

**Southeast Alaska Chinook Salmon Stock Assessment  
(Year 3)  
FINAL REPORT**

*Prepared by*

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## **INTRODUCTION:**

The Southeast Alaska (SEAK) Chinook salmon stock assessment program provides the information necessary to adequately manage and implement Chinook salmon troll, gillnet, and recreational fisheries as directed by the Pacific Salmon Treaty (PST) and the Southeast Alaska King Salmon Management Plan. This program at full implementation in SFY 2007 cost over \$2.2M to execute. The Alaska Department of Fish and Game (ADF&G), Division of Sport Fish oversees the program and the majority of funding is provided through the Dingell-Johnson Act that provides federal funds to the state for the management and restoration of fisheries having a recreational fishing connection. These funds are derived from excise taxes on sport fishing related gear, tackle, and boat fuel among other commodities. The fund source requires a 25% non-federal match which currently is a source that is generated off of the sale of fishing licenses and king salmon stamps. With the recent downturn in the economy, these sources of funds have been impacted significantly, and in SFY 2014 are reduced over 20% from the allocation to this program seen in 2007 at full implementation. The cumulative reductions in the Federal Aid budget and matching funds have resulted in the Chinook salmon stock assessment scaling back operations to function on a budget of less than \$1.4M. Chinook salmon in SEAK are harvested primarily by the U.S. commercial troll fleet and recreational anglers. Chinook salmon are also harvested in U.S. commercial set gillnet, drift gillnet, and purse seine fisheries and in subsistence and personal use fisheries in the region. Harvests in SEAK are managed on an abundance-based approach, with an annual all-gear harvest target provided by the Chinook Technical Committee (CTC) of the Pacific Salmon Commission (PSC), prior to each fishing season. The annual PSC harvest target is based on a preseason forecast of the aggregate abundance of all Chinook salmon stocks that are projected to be present in Southeast Alaska in the upcoming year. The preseason forecast is estimated using a PSC Chinook model operated by the CTC and inputs to the model are from Chinook salmon indicator stocks located throughout the Pacific Northwest that frequent SEAK waters. In SEAK there are eleven Chinook salmon indicator stocks used by the CTC and stock assessment programs are in place on each to monitor stock status on an annual basis and these programs include the use of weirs, foot and aerial survey counts, detailed mark-recapture studies, and age, sex, and length sampling programs. On the Taku and Stikine Rivers, the two largest producers of Chinook salmon in SEAK, all of these methods are used to some extent. The programs in place on these two transboundary rivers are cooperative efforts among the ADF&G, Fisheries and Oceans Canada (DFO), and the First Nations Canada. Escapement goals have been developed for all of the SEAK indicator stocks, and in general, the stock assessment programs in place are prime examples of how to effectively monitor and implement abundance-based management. At this time, the SEAK Chinook salmon indicator stocks are viewed as healthy and have, with very few exceptions, achieved their escapement goals. To counter recent reductions in federal funds, and to provide adequate non-federal matching funds for the Federal Aid, it is proposed that the Northern Fund be used to augment the existing ADF&G Chinook salmon program budget by providing funding for: (1) analysis of data for use in CTC, the Transboundary Technical Committee (TTC) and other relevant PST activities; and (2) analysis of aerial survey, age, sex, and length composition, mark-recapture, smolt, and harvest data for SEAK indicator stocks.

The U.S. section of the CTC developed data standards desirable for stock specific assessments of escapement, terminal runs, and forecasts of abundance against which existing stock assessment programs could be evaluated. The standard for escapement is as follows, "Escapement. Annual age and sex-specific estimates of total escapement should be available. Point estimates should be accompanied by variance estimates, and both should be based on annual sampling data." Providing high-quality escapement data for the SEAK Chinook salmon indicator stocks and ensuring these data meet minimum CTC standards is important for abundance-based management of PSC Chinook fisheries as the CTC uses the CTC Chinook model for coastwide management and evaluation of stock status. Abundance indices in the CTC model are based, in part, on escapement data. High quality escapement data is essential to ensure that both conservation and allocation fishery management objectives are realized. This work is also important for stock-specific abundance-based management regimes. Existing commercial, sport, subsistence, and personal use Chinook salmon fisheries on the Taku and Stikine River stocks of Chinook salmon are managed using information gathered from high quality stock assessment programs. In some years, runs of Chinook salmon to either river are large enough to allow directed Chinook salmon commercial fisheries in District 111 (Juneau area, Taku River) and District 108 (Wrangell/Petersburg area, Stikine River). These fisheries can only be opened if surplus production is identified and the stock assessment programs in place

on both rivers generate the information necessary to identify surplus production on pre-season, in-season, and post-season basis. Goal 1 of the Northern Fund is development of improved information for resource management, including better stock assessment. In particular, the committee encourages projects involving catch accounting, harvest enumeration, and escapement enumeration of stocks harvested in both nations; data needed to estimate optimal escapement; and collection of data necessary to forecast returns.

## **METHODS:**

### *Analysis of Data for Use in the Pacific Salmon Treaty-*

This project provides for salary and contractual funding of personnel whose expertise is needed for various Chinook salmon analyses on data gathered from the SEAK Chinook salmon stock assessment program for use in the CTC, the TTC and other relevant PST activities. Activities include escapement goal analyses and applications both inside and outside of Alaska, participation in meetings and research and analyses regarding Chinook salmon stock status and assessment efforts in the Pacific Northwest and Canada. Successful salmon management depends on establishing and implementing biologically based salmon escapement goals and processes for effective estimation and monitoring of escapement. This project helps ensure that appropriate methods and analyses are used for both stocks originating in SEAK and for stocks from other areas that contribute to SEAK fisheries.

### *Analysis of Aerial Survey, Age, Sex, and Length Composition, Mark-Recapture, Harvest, and Smolt Data for SEAK Indicator Stocks-*

This project provides for salary and contractual funding of personnel whose expertise is needed for various analyses associated with the SEAK Chinook salmon stock assessment program. In this program, aerial counts, age, sex, and length composition, mark-recapture, smolt, and harvest data for the SEAK indicator stocks are gathered annually. Aerial surveys of spawning Chinook salmon take place annually in the Taku, Stikine, Unuk, Chickamin, Blossom, Keta, and King Salmon Rivers and Andrew Creek and counts occur shortly before, during, or just after the peak of spawning. Age, sex, and length composition data are gathered on Chinook salmon sampled in the Situk, Chilkat, Taku, Stikine, Unuk, Chickamin, Blossom, Keta, and King Salmon Rivers and Andrew Creek. Fish are systematically sampled for scales and scales are taken from the preferred side of the fish which is the left side of the fish and 2 rows up from the lateral line on an imaginary line from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Mark-recapture experiments occur each year to estimate the number of Chinook salmon spawning grounds in the Chilkat, Taku, Stikine, and Unuk Rivers. As part of event 1 of a two-event mark-recapture study, personnel capture Chinook salmon in the lower river using a variety of gear types and later recapture fish upriver using a variety of gear. Abundance is most often estimated using a Petersen model with Chapman's modifications, or a stratified model using the methods of Darroch to estimate total abundance past Canyon Island. Separate mark-recapture experiments are performed on smolt in the Chilkat, Taku, Stikine, and Unuk Rivers. Smolt are tagged and marked as the first of two sampling events. Minnow traps and seines are typically used to capture smolt and all Chinook smolt >50 mm FL captured each day are tranquilized, injected with a CWT, and have their adipose fin excised. All fish are then held overnight and checked the next day for overnight mortality. A subsample of these fish is checked to determine tag retention rates. Then, 1 to 5 years later, adult Chinook salmon are inspected for missing adipose fins in each river as the second sampling event for use in smolt abundance estimates. A Petersen model with Chapman's modifications is employed to estimate the abundance, and associated variance, of Chinook and coho salmon smolt abundances. Harvest is also estimated using CWT information and associated harvest statistics gathered in the various marine fisheries in SEAK. Adult Chinook salmon, 1 to 5 years after being injected with CWTs, are inspected for missing adipose fins. ADF&G personnel sample the troll, purse seine, gillnet and sport fisheries in SEAK and the ADF&G Mark, Tag and Age Laboratory in Juneau reports the sampling data and estimated catch by time, area, and fishery for each recovered CWT. Intensive sampling programs are established for the Juneau area sport fishery and District 111 gillnet fishery and the Wrangell/Petersburg sport fishery and District 108 gillnet/troll fisheries, respectively, in response to the Taku and Stikine River stock assessment programs, management, and the PST agreements

governing directed Chinook salmon fisheries in these transboundary rivers. These data are then used to estimate Chinook salmon harvest, distribution and timing in various SEAK fisheries.

## RESULTS:

### Analysis of Data for Use in the Pacific Salmon Treaty-

Personnel funded through this project were involved in various Chinook salmon analyses using data gathered from the SEAK Chinook salmon stock assessment program. Results were used in part to construct the CTC's "Annual Report of Catch and Escapement for 2014" and the "2014 Exploitation Rate Analysis and Model Calibration" manuscripts and were also useful for the TTC's "Salmon Management and Enhancement Plans for the Stikine, Taku and Alsek Rivers, 2014" manuscript. Personnel funded through this endeavor provided oversight, valuable input, and analyses necessary for preseason forecasts, inseason management, and postseason run reconstruction for PST Chinook salmon stocks.

### Estimating Escapement-

In 2014, aerial counts of spawning Chinook salmon occurred in 7 of the region's 11 indicator stocks: the Taku, King Salmon, Unuk, Chickamin, Blossom, Keta, and Andrew Creek (Table 1). Estimates of total escapement occurred in 10 of the 11 indicators (all but the Situk River) and an exact census was obtained through the Situk River weir. In total, 5 stocks, shown in red in Table 1, failed to attain the lower bound of the escapement goal.

**Table 1.-** Chinook salmon escapements in the eleven Pacific Salmon Commission indicator stocks in Southeast Alaska in 2014.

Stock	Peak aerial count	Escapement	Standard error	Lower bound escapement goal	Method
Situk River	NA	475		500	Weir
Alsek River	NA	3,384	1,699	3,500	Weir expansion
Chilkat River	NA	1,529	307	1,750	Mark-recapture
Taku River	11,944	23,532	2,217	19,000	Mark-recapture
King Salmon River	45	68	12	120	Expanded peak aerial count
Stikine River	NA	24,360	4,365	14,000	Mark-recapture
Andrew Creek	647	1,261	291	650	Expanded peak aerial count
Unuk River	1,691	1,691	269	1,800	Expanded peak aerial count
Chickamin River	2,499	2,499	368	2,150	Expanded peak aerial count
Blossom River	171	840	106	580	Expanded peak aerial count
Keta River	439	1,321	246	525	Expanded peak aerial count
NA = Not applicable having no aerial survey program					

Weirs are used to enumerate fish into the Situk and Klukshu (Alsek River drainage) rivers. The count into the Klukshu is expanded further to an estimate of drainage-wide escapement. Mark-recapture studies occur in the Chilkat, Taku, Stikine, and Unuk rivers each year. Aerial surveys occur on 7 of the 11 indicator stocks and in 5 of these systems the peak survey expansion is used to estimate escapement. The SEAK stock assessment program has been in place for nearly half a century and the program is constantly evolving and refining methods to most accurately and

precisely estimate Chinook salmon escapement. This is an ongoing process and the methods are not static and funding sources like the Northern Fund are instrumental in the continued success.

Chinook Salmon Age, Sex, and length Composition-

Chinook salmon sampled in the Situk, Chilkat, Taku, King Salmon River, Stikine, Unuk, Chickamin, Blossom, and Keta Rivers and Andrew Creek were systematically sampled for scales in 2014. Age analysis occurred later in the fall (Table 2). Sex and length composition information was also gathered but results are still preliminary. In the case of the King Salmon River, poor weather impacted the sampling and no samples were gathered. And due to short windows of opportunity to sample these fish during spawning, once the weather finally improved the fish had already spawned and were unavailable for sampling.

**Table 2.-** Chinook salmon scale age analysis results for the eleven Pacific Salmon Commission indicator stocks in Southeast Alaska sampled for age information in 2014.

Stock	Brood year					Total	Comments
	2011	2010	2009	2008	2007		
Situk River	29	16	105	9	0	159	Weir sample
Chilkat River	135	38	21	34	0	228	Lower river and spawning grounds sample
Taku River	17	371	611	129	1	1129	Lower river and spawning grounds sample
King Salmon River	0	0	0	0	0	0	No samples due to poor run size
Stikine River	8	176	644	374	0	1202	Lower river and spawning grounds sample
Andrew Creek	1	24	57	71	0	153	Spawning grounds sample
Unuk River	7	92	219	32	0	350	Lower river and spawning grounds sample
Chickamin River	1	48	109	38	2	198	Spawning grounds sample
Blossom River	0	36	16	11	0	63	Spawning grounds sample
Keta River	1	35	60	20	0	116	Spawning grounds sample
Total	199	836	1,842	718	3	3,598	
Proportion	0.06	0.23	0.51	0.20	0.00	1.00	

Chinook Salmon Smolt abundance-

In the spring of 2015, a total of 22,132 and 20,254 smolt were tagged in the Taku and Stikine Rivers, respectively, representing production from the 2013 brood year. Separate mark-recapture experiments, similar in design, are used to estimate the abundance of Chinook salmon smolt leaving the Taku and Stikine Rivers. Smolt were tagged and marked as the first of two sampling events in the spring of 2015. Returning adults from this release will be sampled from 2016 to 2020.

**SUMMARY:**

The total approved budget for this project was \$160,000 which was allocated \$110,391 to Wages and Salaries and \$29,960 to Contract Services. In total, \$112,029 was spent in Wages and Salaries, \$646 in Travel, and \$24,153 in Contract Services resulting in a balance of \$918 (Table 3).

**Table 3.-** The total State of Alaska FY15 budget allocation, expenditures, and balance for the Northern Fund project Southeast Alaska Chinook Salmon.

<b>Line item</b>	<b>Allocation</b>	<b>Expenditures</b>	<b>Project balance</b>
Wages & Salaries	\$ 110,391	\$ 112,029	\$ (1,638)
Travel		\$ 646	\$ (646)
Contract Services	\$ 29,960	\$ 24,153	\$ 5,807
Administrative Overhead	\$ 140,351	\$ 22,254	\$ 118,097
<b>Total</b>	<b>\$ 160,000</b>	<b>\$ 159,082</b>	<b>\$ 918</b>

Chinook salmon escapement estimates are a critical element in the strategy to improve Chinook salmon stock assessment and abundance-based management as outlined in Annex IV, Chapter 3 of the 2009 Pacific Salmon Treaty (PST). The CTC uses 11 indicator stocks in SEAK, some of which are escapement indicator stocks and model calibration stocks, and escapements are measured annually. Chapter 1 of the PST details harvest sharing arrangements and management programs for two of these stocks (i.e., Taku and Stikine Rivers) in years of surplus abundance. Cumulative reductions in the Federal Aid budget and matching funds over recent years has led to ADF&G scaling back Chinook salmon stock assessment to function on a budget of less than \$1.0M from a previous level of \$2.2M at full implementation. However, this project buffered these effects greatly and the results from this work are instrumental in providing the information necessary to aid staff in the management of the Chinook salmon fisheries vital to Southeast Alaska commercial and recreational fisheries while at the same time providing data for use in Chinook Technical Committee, the Transboundary Technical Committee and other relevant Pacific Salmon Treaty activities.