

# **Southeast Alaska Chinook Salmon Stock Assessment (Year 2)**

*Prepared by*

**ED JONES**

**Alaska Department of Fish and Game**

**Division of Sport fish**

**802 3<sup>rd</sup> Street**

**Douglas, Alaska 99824**

(907) 465-4417

ed.jones@alaska.gov

## **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 and the Southeast Alaska King Salmon Management Plan. This program at full implementation in SFY 2007 cost in excess \$2.2M to execute. The Alaska Department of Fish and Game (ADFG), 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, sport 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.

Chinook salmon in SEAK are harvested primarily by the 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 present in Southeast Alaska for the upcoming year. The preseason forecast is estimated using a PSC Chinook model run by the CTC and inputs to the model are from Chinook salmon indicator stocks in the Pacific Northwest. In SEAK there are eleven Chinook salmon indicator stocks used by the CTC and stock assessment programs are in place annually to monitor stock status 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 in some facet each year. The programs in place on these two transboundary rivers are cooperative efforts among the ADFG, 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 in recent years.

To counter budget reductions, and to provide adequate non-federal matching funds for the Federal Aid, the Northern Fund provided funds to perform: (1) analysis of data for use in CTC, the Transboundary Technical Committee (TTC) and other relevant PST activities; (2) Chinook salmon aerial surveys on the 8 of 11 SEAK indicator stocks (i.e., Taku, Stikine, King Salmon, Unuk, Chickamin, Blossom and Keta Rivers and Andrew Creek); (3) Chinook salmon age, sex, and length sampling programs in 10 of 11 SEAK indicator stocks (i.e., Situk, Chilkat, Taku, Stikine, King Salmon, Unuk, Chickamin, Blossom and Keta Rives and Andrew Creek); and (4) mark-recapture and coded wire tag (CWT) studies in the Taku and Stikine Rivers.

## **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 is dependent upon establishing and implementing biologically based salmon escapement goals and processes for effectively estimating and monitoring escapement. This project will help 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.

### *Estimating Escapement Using Aerial Counts-*

In the SEAK Chinook salmon stock assessment program, large Chinook salmon are considered fish greater than 659 mm mid-eye to fork (MEF) of tail in length. These fish are essentially 3-, 4-, and 5-ocean age fish and comprise the vast majority of spawning females. In aerial counts of Chinook salmon, observers can distinguish between large Chinook salmon and smaller fish that can consist of both Chinook and other species of salmon. For this reason, observer counts of Chinook salmon in SEAK are germane to large Chinook salmon only. Aerial counts 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. Peak spawning times are well defined from previous surveys of these same systems over the last 20 years (Pahlke 2010). Index areas were selected on the basis of their historical importance, size of the population, geographic distribution, historical database, and ease of data collection. Index areas were originally described by landmarks and have recently been further defined by GPS coordinates. These counts will serve as an annual comparable index of the spawning escapement. Surveys will be conducted from a Bell 206 or Hughes 500D helicopter during the peak of spawning. Each index area will be surveyed at least twice. The accuracy of peak escapement counts in predicting total escapement will be evaluated by comparing them with mark-recapture estimates on the Taku, Stikine, and Unuk rivers and at a weir operated by DFO on the Little Tahltan River in the Stikine River drainage.

### *Chinook Salmon Age, Sex, and Length Composition-*

Chinook salmon sampled in the Situk, Chilkat, Taku, Stikine, Unuk, Chickamin, Blossom, Keta, and King Salmon Rivers and Andrew Creek will be systematically sampled for scales. Scales will be 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 (Scarnecchia 1979). Four to 5 scales will be taken from each fish and mounted on gum cards for later impression into acetate cards using a scale press. Ages will be determined from patterns of circuli (Mosher 1968; Olsen 1992) and each fish will also be measured for length (MEF) and sex will be estimated using external morphological sex characteristics or by internal inspection when possible (i.e., carcasses).

### Chinook Salmon Smolt abundance-

Separate mark-recapture experiments, similar in design, will be used to estimate the abundance of Chinook salmon smolt leaving the Taku and Stikine Rivers (Jones et al. 2010; Richards et al. 2008). Smolt will be tagged and marked as the first of two sampling events. About 100-200 baited minnow traps will be fished daily, and during peak outmigration, seines will be used to capture smolt. All Chinook smolt  $\geq 50$  mm FL captured each day will be tranquilized, given a CWT, and have their adipose fin excised. All fish will be held overnight and checked the next day for overnight mortality. A subsample of these fish will then be checked to determine tag retention rates. One to 5 years later, adult Chinook salmon will be inspected for missing adipose fins as the second sampling event for use in smolt abundance estimates. A Petersen model with Chapman's modifications will be employed to estimate the abundance, and associated variance, of Chinook and coho salmon smolt abundances.

### Chinook Salmon Marine Harvest-

Chinook salmon smolt tagged as part of the smolt abundance programs in the Taku and Stikine Rivers will also be injected with a CWT. One to 5 years later, adult Chinook salmon will be inspected for missing adipose fins and subsequent CWTs. ADFG personnel will sample the troll, purse seine, gillnet and sport fisheries in SEAK and the ADFG Mark, Tag and Age Laboratory in Juneau will report the sampling data and estimated catch by time, area, and fishery for each recovered CWT. Intensive sampling programs have been established for the Juneau area sport fishery and District 11 gillnet fishery and the Wrangell/Petersburg sport fishery and District 8 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 will be used to estimate Chinook salmon harvest, distribution and timing in various fisheries (Bernard and Clark 1996; Bernard et al. 1998).

### Chinook Salmon Escapement-

Mark-recapture experiments occur each year to estimate the number of Chinook salmon spawning grounds in the Taku and Stikine Rivers. As part of event 1 of a two-event mark-recapture study, personnel will capture Chinook salmon with two fish wheels and tangle gillnets at Canyon Island in the lower Taku River and using two drift gillnets near Kakwan Point in the lower Stikine River. Chinook salmon captured in this event will be sampled for age, sex, length, and tag information and, if in good condition, are tagged with a solid-core spaghetti tag and given two secondary marks in the form of an upper operculum punch and clipped axillary appendage, and then released. Chinook salmon are later sampled in catches from inriver test and Canadian commercial fisheries and also on the spawning grounds using a variety of gear types as part of event 2 of the mark-recapture study (Jones et al. 2010; Richards et al. 2008). Event 1 lower river tagging and event 2 inriver test and Canadian commercial fishery sampling takes place April through early July. Event 2 spawning grounds sampling takes place from late July through mid-September. Abundance is normally 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.

## 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 2013" and the "2013 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, 2013" 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 2013, 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, 4 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 2013.

Stock	Peak aerial Count	Escapement	Standard error	Lower bound escapement goal	Method
Situk River	NA	912		500	Weir
Alsek River	NA	5,044	1,765	3,500	Weir expansion
Chilkat River	NA	1,730	338	1,750	Mark-recapture
Taku River	17,794	18,002	6,889	19,000	Mark-recapture
Stikine River	NA	16,735	2,871	14,000	Mark-recapture
King Salmon River	62	94	16	120	Expanded peak aerial count
Andrew Creek	472	920	212	650	Expanded peak aerial count
Unuk River	235	1,135	181	1,800	Mark-recapture
Chickamin River	468	2,223	328	2,150	Expanded peak aerial count
Blossom River	255	987	158	580	Expanded peak aerial count
Keta River	493	1,484	276	525	Expanded peak aerial count
NA = Not applicable having no aerial counting 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 2013. 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 2013.

Stock	Brood year					Total	Comments
	2010	2009	2008	2007	2006		
Situk River	12	897	108			1,017	Weir sample
Chilkat River	135	38	21	34		228	Lower river and spawning grounds sample
Taku River	250	429	415	164	2	1,260	Lower river and spawning grounds sample
King Salmon River							No samples due to weather
Stikine River	12	182	329	255	1	779	Lower river and spawning grounds sample
Andrew Creek	5	35	63	48		151	Spawning grounds sample
Unuk River	9	86	147	42		284	Lower river and spawning grounds sample
Chickamin River	1	34	115	42		192	Spawning grounds sample
Keta River	17	72	16			105	Spawning grounds sample
Blossom River		8	29	7		44	Spawning grounds sample
Total	441	1,781	1,243	592	3	4,060	
Proportion	0.11	0.44	0.31	0.15		1.00	

Chinook Salmon Smolt abundance-

In the spring of 2014, a total of 24,221 and 41,778 smolt were tagged in the Taku and Stikine Rivers, respectively, representing production from the 2012 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 2014. Returning adults from this release will be sampled from 2015 to 2019.

**SUMMARY:**

The total approved budget for this project was \$160,000 which was allocated \$93,500 to Wages and Salaries, \$4,000 to Travel, and \$42,817 to Contract Services. In total, \$94,805 was spent in Wages and Salaries, \$650 in Travel, and \$43,949 in Contract Services resulting in a balance of \$199 (Table 3).

**Table 3.-** The total State of Alaska FY14 budget allocation, expenditures, and balance for the Northern Fund project Southeast Alaska Chinook Salmon.

<b>Item</b>	<b>Allocation</b>	<b>Expenditures</b>	<b>Project Balance</b>
Wages & Salaries	\$ 93,534	\$ 94,805	\$ (1,271)
Travel	\$ 4,000	\$ 650	\$ 3,350
Contract Services	\$ 42,817	\$ 43,949	\$ (1,132)
AOH @ 14%	\$ 19,649	\$ 20,397	\$ (748)
Total	\$ 160,000	\$ 159,801	\$ 199

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 for which escapements are measured annually and Chapter 1 of the PST details harvest sharing arrangements and management programs in the 2 of these indicator 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.