

Southeast Alaska Chinook Salmon Stock Assessment

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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 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) Chinook salmon aerial surveys on the 7 of 11 SEAK indicator stocks (i.e., Taku, King Salmon, Unuk, Chickamin, Blossom and Keta Rivers and Andrew Creek); (2) 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); (3) mark-recapture and coded wire tag (CWT) studies in the Taku and Stikine Rivers; and (4) analysis of data for use in Chinook Technical Committee, the Transboundary Technical Committee and other relevant Pacific Salmon Treaty activities.

METHODS:

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, 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 serve as an annual comparable index of the spawning escapement. Surveys were conducted from a Bell 206 or Hughes 500D helicopter during the peak of spawning. Each index area was surveyed at least twice.

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 were systematically sampled for scales. Scales were 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 were taken from each fish and mounted on gum cards for later impression into acetate cards using a scale press. Ages were determined from patterns of circuli (Mosher 1968; Olsen 1992) and each fish was measured for length (MEF) and sex was estimated using external morphological sex characteristics or by internal inspection when possible (i.e., carcasses).

Chinook Salmon Escapement-

Mark-recapture experiments occurred 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 captured Chinook salmon with two fish wheels and tangle gillnets at Canyon Island in the lower Taku River and used two drift gillnets near Kakwan Point in the lower Stikine River. Chinook salmon captured in this event were sampled for age, sex, length, and tag information and, if in good condition, were 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 were 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. Event 1 lower river tagging and event 2 inriver test and Canadian commercial fishery sampling took place April through early July. Event 2 spawning grounds sampling took place from late July through mid-September. Abundance was estimated using a Petersen model with Chapman's modifications.

Chinook Salmon Smolt abundance-

Separate mark-recapture experiments, similar in design, were 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 2013. About 100-200 baited minnow traps were be fished daily, and during peak outmigration, seines were used to capture smolt. All Chinook smolt ≥ 50 mm FL captured each day were tranquilized, given a CWT, and have their adipose fin excised. All fish were held overnight and checked the next day for overnight mortality. A subsample of these fish was then checked to determine tag retention rates. One to 5 years later, adult Chinook salmon were 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 used to estimate the abundance, and associated variance, of Chinook smolt using information on the number of smolt tagged and released and on returning adults from 2014 to 2018.

RESULTS:

Estimating Escapement-

In 2012, aerial counts of spawning Chinook salmon occurred in the Taku, Stikine, Unuk, Chickamin, Blossom, Keta, and King Salmon Rivers and Andrew Creek (Table 1). Of the 11 indicator stocks, 6 failed to attain the lower bound of the escapement goal, an indication of poor production for the region.

Table 1.- Chinook salmon escapements in the eleven Pacific Salmon Commission indicator stocks in Southeast Alaska in 2012.

Stock	Aerial Count	Escapement	Standard error	Method
Situk River	NA	322		Weir
Alek River	NA	2,660	808	Weir expansion (Klukshu
Chilkat River	NA	1,744	267	Mark-recapture
Taku River	3,214	19,429	2,256	Mark-recapture
King Salmon River	102	155	27	Expanded peak count
Stikine River	NA	22,671	3,734	Mark-recapture
Andrew Creek	301	587	136	Expanded peak count
Unuk River	247	956	152	Expanded peak count
Chickamin River	444	444		Peak count
Blossom River	205	793	127	Expanded peak count
Keta River	241	725	135	Expanded peak count
NA=not applicable having no aerial count program.				

Chinook Salmon Age 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 2012. Age analysis occurred later in the fall (Table 2). Sex and length composition information was also gathered but results are still preliminary. In two cases, King Salmon and Blossom Rivers, poor weather impacted the sampling yielding poor results. And due to short windows of opportunity on the spawning grounds, once the weather improved the fish had already spawned and were unavailable.

Table 2.- Chinook salmon scale age analysis results for the eleven Pacific Salmon Commission indicator stocks in Southeast Alaska sampled for age information in 2012.

Stock	Brood Year					Total	Comments
	2009	2008	2007	2006	2005		
Situk River	1	19	12			32	Weir sample
Chilkat River	38	44	347	84		513	Lower river and spawning grounds sample
Taku River	21	138	483	159	2	803	Lower river and spawning grounds sample
King Salmon River							No samples due to weather
Stikine River		21	490	239	3	753	Lower river and spawning grounds sample
Andrew Creek		1	48	26		75	Spawning grounds sample
Unuk River	19	101	147	34		301	Lower river and spawning grounds sample
Chickamin River	5	41	128	34		208	Spawning grounds sample
Blossom River		6	6	4		16	Spawning grounds sample
Keta River	5	30	36	6		77	Spawning grounds sample
Total	89	401	1,697	586	5	2,778	
Proportion	0.03	0.14	0.61	0.21		1.00	

Chinook Salmon Smolt abundance-

In the spring of 2013, a total of 23,971 and 48,447 smolt were tagged in the Taku and Stikine Rivers, respectively, representing production from the 2011 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 2013. Returning adults from this release will be sampled from 2014 to 2018 and information is still being gathered, accordingly.

SUMMARY:

The total approved budget for this project was \$160,000 which was allocated \$100,000 to Wages and Salaries and \$40,351 to Contract Services. In total, \$100,551 was spent in Wages and Salaries and \$39,596 in Contract Services resulting in a balance of \$232 (Table 3).

Table 3.- The total State of Alaska FY13 budget allocation, expenditures, and balance for the Northern Fund project Southeast Alaska Chinook Salmon.

Item	Allocation	Expenditures	Project Balance
Wages & Salaries	\$ 100,000	\$ 100,551	\$ (551)
Contract Services	\$ 40,351	\$ 39,596	\$ 755
Direct	\$ 140,351	\$ 140,148	\$ 203
AOH @ 14%	\$ 19,649	\$ 19,621	\$ 28
Total	\$ 160,000	\$ 159,768	\$ 232

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.