CHILKOOT RIVER WEIR RESULTS, 1998

by

M. Scott Kelley
and
Randall L. Bachman

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AUTHORS

M. Scott Kelley and Randall Bachman are fishery biologists employed by the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 330, Haines, Alaska 99827-0330. E-mail: scottk@fishgame.state.ak.us and randylb@fishgame.state.ak.us.

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ABSTRACT

The Alaska Department of Fish and Game, Division of Commercial Fisheries operated an adult salmon enumeration weir at the Chilkoot River in 1998. The weir was previously operated from 1976 to 1997. A mark-recapture study of adult sockeye salmon *Oncorhynchus nerka* was performed in conjunction with weir operations as was done in 1996 and 1997. The objectives of the mark-recapture program were to validate the accuracy of the weir count or to estimate the total sockeye escapement if fish were suspected to have passed the weir uncounted. In 1998, the visual weir count for sockeye salmon was 12,335 and the abundance estimate from mark-recapture was 28,015 (SE 5,120) (95% C.I. of 17,980 to 38,051). We consider the mark-recapture estimate to be the best estimate of the 1998 Chilkoot Lake sockeye escapement. In addition, 44,001 pink salmon *O. gorbuscha*, 131 coho salmon *O. kisutch*, 368 chum salmon *O. keta*, and 11 chinook salmon *O. tshawytscha*, were enumerated through the weir.

KEY WORDS: enumeration weir, Chilkoot River, sockeye salmon, Oncorhynchus nerka, mark-recapture, abundance estimate

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries has operated a weir on the Chilkoot River to estimate the escapement of sockeye, pink, and chum salmon into Chilkoot Lake from 1976 through 1998 (Bergander 1985, Beesley and Barto unpublished data). The primary species of interest is sockeye salmon; other species are counted incidentally while enumerating the sockeye salmon escapement to Chilkoot Lake. Reliable estimates of the sockeye salmon escapement and changes in escapement trends over time is necessary for responsive management of the District 115 (Figure 1) commercial drift gillnet fishery. Escapement information from this project is used to determine if escapement goals are being attained, assess the effects of various management decisions on the escapement levels, and to provide data needed to reconstruct the run size of Chilkoot Lake (Figure 2) sockeye salmon stocks. Age and sex compositions of the escapements are monitored for any changes over the years that would give insight into the status of these stocks and would allow assessment of management strategies pertaining to these stocks. Run reconstruction conducted over a number of years provides a time series of data useful in the development of spawner-recruit relationships, estimation of maximum sustainable yield, optimum escapement, and forecasting returns.

Historical weir counts have ranged from 7,209 in 1995 to 102,973 in 1982 (Tables 1 and 2; Figure 3). Optimal spawning escapement goals, with desired management ranges, were established for two separate stocks, early and late run, in Chilkoot Lake (McPherson 1990, Tables 3a and 3b). The optimal escapement goals sum to 62,000 with a range of 50,500 to 91,500.

Chilkoot Lake sockeye salmon are traditionally harvested in a commercial drift gillnet fishery in Lynn Canal, a subsistence fishery in Chilkoot Inlet, and by sport fishers in the Chilkoot River and Chilkoot Lake. The commercial sockeye salmon harvest in the Lynn Canal (District 115) fishery is comprised of a mixture of Chilkoot Lake, Chilkat Lake, Chilkat River, and other smaller, local sockeye stocks. Scale pattern analysis (SPA) is used to estimate the contribution of these stocks of sockeye in this fishery each season (McPherson *et al.* 1992, McPherson 1989, McPherson 1987, McPherson and Marshall 1986, McPherson *et al* 1983, Marshall *et al* 1982). Scale samples used for standards for Chilkoot Lake sockeye salmon stocks are collected during this project. Commercial drift gillnet harvests of Chilkoot sockeye salmon have ranged from approximately 2,200 in 1998 to 334,995 in 1987, (Table 4). The estimated average annual subsistence harvest of Chilkoot Lake sockeye salmon is approximately 2,000 to 3,000 fish (Scott Kelley personal communication). The estimated 1977 to 1997 average annual sport fish harvest of Chilkoot Lake sockeye salmon is 989 fish (range 238 to 2,974, Randy Ericksen personal communication).

An enumeration weir is the most applicable method of enumerating the escapement into Chilkoot Lake because the system is very turbid due to glacial influence, there is a very short lag time between the commercial fishery and the weir, and the investment of installing a permanent superstructure to the weir has made weiring this system possible. This turbidity precludes the use of aerial or foot surveys to evaluate the salmon escapement into Chilkoot Lake. Foot surveys are conducted annually in significant inlet spawning streams to assess the spawning abundance and distribution of sockeye salmon to these systems. These surveys are incidental in nature and are not applicable for indexing the total sockeye escapement as a significant proportion of the sockeye salmon spawn along the beaches in Chilkoot Lake.

Because simple weir counts may not give a true representation of total escapement (McGregor and Bergander 1993, Shaul 1994, Kelley and Josephson 1997), mark-recapture experiments were initiated for Chilkoot Lake sockeye salmon beginning in 1996 and were conducted again in 1997 (Beesley and Barto unpublished data). This technique was used to verify the weir counts and to provide an alternative means to estimate escapement abundance of sockeye salmon if the weir ever became inoperable.

GOALS

1. Estimate the total escapement of sockeye salmon returning to Chilkoot Lake with a precision of ±10%, 95% of the time.

2. Estimate the annual age and sex composition of sockeye salmon migrating past the Chilkoot River weir with a precision of ±5%, 95% of the time.

OBJECTIVES

1. Enumerate sockeye, pink, chum, and coho salmon as they are passed through the weir.

2. Mark 10% of the enumerated sockeye salmon as they are passed through the weir.

3. Obtain representative scale, length, and sex data from 635 sockeye salmon throughout the run.

METHODS AND MATERIALS

Study Area Description

Chilkoot Lake (59°21′16" N, 135°35′42" W) is glacially turbid, has a surface area of 7.0 x 10^6 m^2 (1,734 acres), mean depth of 54.5 meters, a maximum depth of 89 meters and a total volume of 382.4 x 10^6 m^3. The lake outlet is at the head of Lutak Inlet located approximately 16 kilometers northeast of the city of Haines, Alaska (Figure 2). Chilkoot Lake is located within the northern temperate rainforest that dominates the Pacific Northwest coast of North America. The climates of this area are characterized by cold winters and cool, wet summers. Average precipitation for the study area is ~ 165 cm/yr (Bugliosi 1988). Sitka spruce, western hemlock and Sitka alder dominates this forested watershed.

Weir Operation and Biological Sampling

Escapement enumeration, marking, and sampling at the Chilkoot River weir began on June 7 and continued through September 13. The installation of the weir involved the placement of pickets in the existing supporting structure and the installation of a weir trap, sampling stations, and a recovery pen. The Chilkoot weir is a 360-foot wide steel structure built in 1976 and supported by 8-inch steel H pilings driven approximately 23 feet into the bottom of the Chilkoot River channel. Schedule 40 black iron pipe, 1 inch O.D., is used for pickets that are placed vertically along the face of the weir at 2 ½" center to center intervals. The maximum spacing of the pickets is designed to be 1 ½". The weir was inspected for gaps at least every other day. Weir personnel donned neoprene stocking-foot waders and walked across the face of the weir feeling for gaps with their feet. When conditions (river level and clarity) permitted, the weir was examined using snorkel gear and dry suits. Any suspected fish sized gaps were blocked using sandbags.

Migrating salmon were enumerated by removing 2 pickets, which simply allowed fish to pass upstream unimpeded. Weir personnel sit above the opening in the weir and tally fish by species as they pass through the weir during daylight hours. Pieces of ¾" CDX plywood that were painted white for contrast were placed on the front of the weir at the bottom of the gap in the weir. With these plywood pieces in place the fish were much easier to enumerate and identify to species. Another method entailed passing fish into a trap where fish were simply dip netted out of the trap, enumerated, and released immediately upstream of the weir. Hookless fishing lures were suspended at the opening of the weir trap to attract salmon into it. Sockeye salmon captured in the trap and dip netted from the opening in the weir were sampled for sex, scales, and mid-eye to fork-of-tail length (MEF in millimeters). This data was used for Lynn Canal sockeye salmon marine stock composition project to develop stock identification standards. Sub-sampling was based primarily on daily abundance. On days of peak fish movement a larger number of fish were sampled to achieve the goal of sampling 635 sockeye salmon for the season.

One scale per fish was taken from the preferred area of the fish (ADF&G 1994). Date of sample, sex, and length, and other data regarding each fish was recorded on mark-sense forms. A daily record of stream height and temperature was taken at approximately 0800. Stream height was measured in centimeters on a stadia rod and temperatures were taken with a mounted thermometer to the nearest degree Celsius.

Mark –Recapture Methods

Sockeye salmon were removed from the trap or dip netted as they passed through the gap in the weir and marked. Marking rates were adjusted on a daily basis based on daily weir counts to ensure that the objective of marking 10% of the sockeye salmon observed at the weir was achieved. All sockeye salmon marked at the weir were marked with a primary adipose clip and a secondary fin clip to allow temporal stratification of the abundance estimate if necessary. Secondary marks were as follows:

Dates	*Statistical Weeks*[a]	*Secondary Mark*
May 31 to July 4	23-27	Dorsal Clip
July 5 to August 1	28-31	Left Ventral Clip
August 2 to September 13	32-end	Left Axillary Clip

[a] Appendix A.

After the marking procedure, sockeye salmon captured in the trap were released into a holding box upstream of the weir. The holding box was a plywood structure with a hole cut into one side. Fish were allowed to recover in the box out of the main current force and exit the box on their own volition.

Recovery efforts were conducted by ADF&G staff at Chilkoot Lake and inlet tributaries (Chilkoot River and Bear Creek) approximately once a week beginning the first week of August. Sockeye salmon were captured using a 10-meter by 2.7-meter beach seine and a 5-m by 2.7-m linen 12-cm gillnet on and near spawning beaches and inlet tributaries. Floating carcasses were also examined. Sockeye salmon were typically concentrated on spawning beaches on the western shore of Chilkoot Lake and at Bear Creek to about 1 km downstream of the confluence of Bear Creek in the Chilkoot River. All sockeye salmon captured were examined first for the presence of a left opercule punch, if absent the fish were examined for the presence of a primary mark (adipose fin), and if absent, the type of secondary mark was noted. All fish examined in the recovery event were marked with a left opercule punch to prevent future sampling of the same fish. Live fish were then gently released.

Statistical Methods

Mark-recapture data was compiled into a matrix summarized by marking and recapture periods. The mark-recapture matrices were then analyzed using a statistical program called "Stratified Population Analysis System" (SPAS; Arnason, A.N., C.W. Kirby, C.J. Swartz, and J.R. Irvine. 1996). This program provides stratified population estimates using maximum likelihood techniques (Plante 1990) and associated variances, s (the number of tagging stratum) and t (number of recovery stratum) are not equal. For cases in which $s=t$, the model provides stratified population estimates based on Chapman and Junge (1956) and Darroch (1961). Stratified methods were used because it allows the probabilities of capture in marking and recovery strata to vary across time. The program also provides results for two tests for appropriateness of pooling the data. If the either of those tests (equal proportions and complete mixing) are not significant then the data may be fully pooled and a Pooled Petersen estimate (PPE) is appropriate.

Assumptions necessary to form consistent stratified mark-recapture estimates in this study include (Arnason, et al. 1996):

1. All fish that pass Chilkoot weir during the period of interest have a non-zero probability of recovery in the commercial fishery and all fish caught by the fishery have a non-zero probability of being marked (i.e., the population is closed).
2. There is no mark-induced mortality, mark misidentification, or non-reporting. Should any of these occur, they are to be estimated and adjusted for.

3. All fish, marked or not, are independently caught with the same probability in any given recovery stratum.
4. All fish, marked or not, move from a given release stratum to the recovery strata independently with the same probability distribution.
5. There are no release strata or recovery strata where no marks are released or found respectively, and there are no rows or columns of the release-recovery matrix, which are linear combinations of other rows or columns respectively.

Scale samples were aged in the Region 1 aging Laboratory in Douglas, Alaska. Length, sex, and age results were recorded on mark-sense data forms (ADF&G 1994). When complete, the forms were then scanned and a computer file was generated and saved onto disk. That file was then analyzed using two (M. Olsen ADF&G Division of Commercial Fisheries, Juneau) computer programs. One program summarized age data by statistical week and sex. The other summarized length information by statistical week and sex.

RESULTS

Weir Counts

A total of 11 chinook, 12,335 sockeye, 131 coho, 44,001 pink, and 368 chum salmon were enumerated at the Chilkoot River weir between June 4 to September 13, 1998 (Appendix B). Due to very high water level events on August 29 and September 1, pickets were removed from the weir for 4 and 7 hours respectively to prevent possible weir and riverbed scour damage from occurring.

The total weir count for the early segment (statistical weeks 23 through 28) of the Chilkoot Lake sockeye return was 2,641 fish, 13% of the 1976 to 1997 average of 20,485 fish (Table 2). The total weir count for the late segment (statistical weeks 29 through the end of the run) of the Chilkoot Lake sockeye return was 9,694 fish, 19% of the 1976 to 1997 average of 51,198 fish (Table 2). The total weir count of 12,335 fish was 17% of the 1976 to 1997 average of 71,557 fish (Table 2; Figure 4). Escapement objectives for the early and late runs of Chilkoot Lake sockeye salmon were not met in 1998 (Figure 5).

The pink salmon count of 44,001, was the highest on record (Table 1). An additional 10,000 to 20,000 pink salmon were observed spawning below the weir.

There is not an endemic run of chinook salmon to the Chilkoot River. Chinook salmon counted at the weir are likely strays from enhancement projects in upper Lynn Canal. The weir counts for coho and chum salmon in 1998 are not representative of the total abundance as the weir was removed prior to the peak of the return for those species.

Mark-Recapture Results

A total of 1,248 sockeye salmon were marked and released at the Chilkoot River weir with an adipose fin clip and secondary mark. The marking fraction represented 10.1% of the total escapement counted through the weir (Table 5a). During recapture efforts at Chilkoot Lake and inlet tributaries, a total of 700 sockeye salmon were examined in the lake and inlet tributaries for marks. Twenty-nine sockeye salmon with missing adipose fins were recovered (Table 5b). The overall percent marked in the lake was 4.1%.

The PPE for the Chilkoot Lake sockeye salmon escapement in 1998 is 28,015 (SE 5,120, 95% CI-17,980 to 38,051, Appendix C). The PPE was used because pooling tests performed by the SPAS program confirmed the validity of pooling the Chilkoot Lake m-r data for the estimate.

If any of the following conditions are met, then the PPE is consistent:

1. The recovery probabilities are constant across strata (i.e., probability of recapture is the same regardless of strata origin).
2. The expected ratio of marked to unmarked fish is constant across all recovery strata.

The test labeled "complete mixing" is a test of the hypothesis that the probability of resighting a released animal is independent of its stratum of origin using a chi-square 2-by-*s* table. The test labeled "equal proportions" at the beginning of the analysis results tests for condition 2 using a 2-by-*t* table.

If either test passes (ie. $P > 0.05$), as it did with the Chilkoot Lake m-r data (Appendix E.), the PPE is the appropriate estimator (Arnason *et al*. 1996).

Age, Length, and Sex Composition

The sockeye samples taken at the Chilkoot weir indicated that age-1.3 fish were most prevalent, 60.5% (1976 to 1997 average 64.5%) of the sockeye salmon return to Chilkoot lake was of this age class. Age-2.3 fish comprised 31.0% (1976 to 1997 average 22.5%), age-1.2, 4.7% (1976- 1997 average 9.5%), and age-2.2, 2.1% (1976 to 1997 average 2.3%) of the run. There were very small numbers of age-0.1, 2.4 and 3.3 fish (Table 6; Appendix D).

Escapement data collected at Chilkoot Lake in 1998 indicated that male sockeye salmon were more prevalent (55.9%) than female sockeye. Length composition information revealed that the average length for males sampled at the weir was 570 mm (MEF) and averaged 563 mm for females (MEF) (Figure 6; Appendix E). Historic average length in millimeters by age class (1982 to 1998) is presented in Table 7.

DISCUSSION

In estimating the abundance of adult sockeye salmon present in Chilkoot Lake we feel comfortable assuming that: (a) Marking of adult sockeye salmon was in proportion to their numbers immigrating over time. (b) No sockeye entered or left the lake between the marking and recovery events or sockeye that make up the population of the capture strata have a non-zero probability of recapture during the recovery event. (c) No mark non-identification and no mark induced mortality occurred. (d) The probability of recovering sockeye salmon is independent of its marked/unmarked status.

Efforts were made to catch and mark fish at the weir in proportion to their abundance (assumption a) by marking 10% of the daily sockeye passage at the weir. The weir was frequently inspected for "leaks" or holes to prevent fish from passing undetected (assumption b). It is likely that some sockeye salmon had entered Chilkoot Lake before the weir was installed. It is also possible that sockeye salmon entered the lake after the weir was removed. It is thought that the numbers of fish entering the lake before or after the weir was operational is very low based on historical run timing. Unobserved sockeye salmon passage through gaps or holes in the weir was thought to be minimal. When pickets were pulled at the counting station for the first time each morning a "spurt" of fish were counted through the gap in the weir. The rate of fish passage dwindled after one to two hours. This suggests that the weir was impeding fish passage and that significant numbers of sockeye salmon were not slipping through the weir uncounted. All marks were easily recognizable at the spawning grounds and a specific crew was responsible for all recovery events at Chilkoot Lake (assumption c).

The adjusted Peterson estimator is valid only if all sockeye have an equal probability of being marked or being recovered (assumption d). Fluctuating water conditions at the weir and spawning areas effect the ease at which sockeye can be enumerated, captured, marked, and inspected for marks. Difference in location, timing, and methods used to recover marked fish may have resulted in different degrees of compliance with the assumption of equal proportions of marking and recovery over time. Factors that may cause inaccurate estimates of sockeye salmon at this project include, difficult visual detection of passing fish during periods of high water and/or poor water clarity. Pickets of the weir had to be removed twice during the season due to very high water level events. Holes or "fish leaks" in the weir structure that would allow fish to escape undetected and failure to mark the migrating sockeye at a constant rate over time would result in a high estimate. An additional factor that would cause the mark-recapture study to reflect an over-abundance is the potential increased mortality of marked fish as a result of handling. A recovery pen was used this year to allow fish more time to recuperate from the marking procedure before being released into the river. Mortality resulting from the capture and marking process is difficult to assess. If handling mortality took place shortly after the marking event it is highly likely that carcasses would have washed up on the face of the weir. We did not observe any prespawning sockeye salmon carcasses on the weir. Holding studies conducted at Canyon Island on the Taku River, however, suggest that short-term mortality due to tagging is negligible (McGregor unpublished data).

The large discrepancy between the Chilkoot visual weir estimation (12,335) and the mark-recapture estimate (28,015, SE-5,120) cannot be explained with any certainty. Any violation of the above assumptions could greatly bias the estimate in either direction. Weir counts themselves can only be biased low, observers can only count the fish they see.

Other indications of Chilkoot River sockeye salmon abundance support the low abundance estimates, both visual and mark-recapture, we obtained at the Chilkoot River weir. Fishery performance indicators for the Lynn Canal commercial drift gillnet fishery indicated a very poor return of Chilkoot Lake sockeye salmon.

The estimated harvest of Chilkoot Lake sockeye salmon in the Lynn Canal drift gillnet fishery was the lowest on record. The sport fishery cannot be used as an "index" of sockeye salmon abundance in 1998 because that fishery was closed to the retention of sockeye salmon on June 26th but based on informal angler interviews the number of sockeye salmon in the Chilkoot River was quite low (based on frequency of sockeye salmon "hook-ups" while fishing for other species). During recovery efforts foot surveys were conducted on smaller Chilkoot Lake inlet spawning tributaries. Very few sockeye salmon were observed in any of those smaller tributaries.

RECOMMENDATIONS

1. Increase the frequency of weir maintenance to ensure that the weir remains "fish tight" throughout the season.

2. Repair any scouring and/or flood damage that may have occurred during the high water events in October 1998.

3. Increase recovery efforts at Bear Creek and upper Chilkoot River areas throughout the season.

4. Construct additional recovery pens along sampling and marking stations to minimize the impacts of stress on sampled fish.

5. Mark a higher proportion, 20% instead of 10%, of the sockeye salmon at the weir to improve the precision of the mark-recapture estimate.

6. Collect sex and size information from fish examined in the second event. Having this data would allow more rigorous testing for possible size and sex selectivity between the marking and recovery events which could yield information on possible bias in the mark-recapture estimates.

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Table 1. Dates of operation and total weir counts by species for Chilkoot River weir, 1976 through 1998.

Year	Dates	Chinook	Sockeye	Coho	Pink	Chum
1976	5/29-11/4	n/a	71,297	991	n/a	241
1977	5/28-9/18	n/a	97,051	42	5,377	193
1978	6/6-11/8	n/a	35,454	1,091	111	382
1979	6/9-11/4	n/a	95,946	899	n/a	253
1980	6/15-10/4	n/a	96,512	628	4,683	719
1981	6/10-10/12	n/a	83,372	1,579	41,222	367
1982	6/3-9/14	1	102,973	5	6,665	507
1983	6/4-11/12	0	80,343	1,844	11,237	501
1984	6/3-9/14	0	100,417	321	5,034	372
1985	6/5-10/28	5	69,026	2,202	33,608	1,031
1986	6/4-10/28	6	88,024	1,966	1,303	454
1987	6/4-11/2	3	95,185	560	6,689	431
1988	6/9-11/12	1	81,274	1,476	5,274	450
1989	6/3-10/30	4	54,900	3,998	2,193	225
1990	6/3-10/30	0	73,324	988	10,398	216
1991	6/7-10/8	0	90,638	4,000	2,588	357
1992	6/2-9/26	1	67,071	1,518	7,836	193
1993	6/3-9/30	204	51,827	322	357	240
1994	6/4-9/24	118	37,416	463	22,472	214
1995	6/5-9/10	7	7,209	95	1,243	99
1996	6/6-9/11	19	50,739	86	2,867	305
1997	6/04-9/09	6	44,254	17	26,197	267
1998	6/04-9/13	11	12,335	131	44,001	368
	Average	23	71,557	1,141	9,868	364
	Minimum	0	7,209	5	111	99
	Maximum	204	102,973	4,000	41,222	1,031

Table 2. Annual escapements of Chilkoot Lake sockeye salmon by week, 1976 to 1998.

Mid-Week Date	Stat Week	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3-Jun	23	124	14	844	3	0	0	0	0	333	8	25	11
10-Jun	24	623	9,572	1,957	8,738	0	25	252	467	3,349	6	101	176
17-Jun	25	241	35,751	1,368	2,730	391	1,108	12,220	2,764	11,100	104	163	198
24-Jun	26	3,579	11,150	274	469	1,157	2,177	9,440	8,860	7,444	4,681	224	16,583
1-Jul	27	735	3,361	6,677	407	1,824	559	2,623	4,062	4,406	783	857	6,879
8-Jul	28	397	6,970	1,311	309	2,241	606	1,981	3,304	9,993	463	3,650	3,365
15-Jul	29	1,752	1,844	2,526	95	5,894	7,346	5,095	4,090	6,738	810	2,328	7,000
22-Jul	30	4,091	1,854	7,650	2,871	9,239	15,951	17,574	21,548	11,917	3,601	5,467	8,134
29-Jul	31	28,061	9,016	3,465	22,765	8,294	9,006	20,806	12,747	9,610	19,778	11,438	8,998
5-Aug	32	13,587	9,561	5,157	31,000	20,860	9,963	13,358	4,507	8,020	9,832	21,563	9,944
12-Aug	33	11,827	6,059	2,316	16,091	21,333	15,631	8,287	3,614	5,522	12,501	12,276	5,899
19-Aug	34	5,205	1,019	1,469	5,140	12,968	10,659	4,938	2,720	11,185	7,013	11,839	16,978
26-Aug	35	346	372	155	3,880	10,669	5,028	2,655	3,016	3,435	4,432	6,348	6,018
2-Sep	36	49	403	56	933	1,077	4,519	1,518	4,366	4,474	2,817	5,416	3,918
9-Sep	37	118	103	106	427	479	794	1,404	2,604	2,891	1,546	5,071	738
16-Sep	38	410	2	83	8	45	0	822	1,070		480	762	217
23-Sep	39	142		12	70	36	0		502		145	409	112
30-Sep	40-42	10		28	10	5	0		102		26	87	17
Yearly Total		71,297	97,051	35,454	95,946	96,512	83,372	102,973	80,343	100,417	69,026	88,024	95,185
Weekly Mean		3,961	6,066	1,970	5,330	6,032	5,955	6,436	4,464	6,694	3,835	4,890	5,288
Early Stock Esc.		6,737	69,268	10,349	13,026	14,196	8,144	29,127	21,545	37,489	9,424	17,210	29,141
Late Stock Esc.		64,560	27,783	25,105	82,920	82,316	75,228	73,846	58,798	62,928	59,602	70,814	66,044

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Table 2. (page 2 of 2)

Mid-Week Date	Stat Week	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1976-97 Mean
3-Jun	23	0	571	328	1	31	65	309	185	0	873	0	169
10-Jun	24	95	4,266	2,060	471	4,744	249	2687	295	129	2317	117	1,935
17-Jun	25	1,082	21,300	2,778	5,599	8,775	2,592	1,117	243	459	6,677	327	5,398
24-Jun	26	1,506	2,466	12,190	3,083	2,310	5,431	4,752	342	1,418	3,433	664	4,680
1-Jul	27	22,846	1,009	1,893	2,097	8,450	2,306	4,170	317	1,956	1,407	857	3,619
8-Jul	28	5,872	913	1,980	2,528	975	5,883	4,241	298	4,393	3,143	676	2,946
15-Jul	29	4,389	2,122	0	5,436	1,222	3,488	1,141	325	2,482	2,440	791	3,117
22-Jul	30	2,554	2,942	4,989	21,990	2,902	5,021	2,123	1,517	12,040	4,805	1,534	7,763
29-Jul	31	5,416	3,614	1,853	17,870	9,488	5,864	5,158	1,731	9,163	3,919	1,687	10,366
5-Aug	32	5,824	4,313	1,995	7,317	7,173	6,807	1,342	417	6,743	3,524	1,924	9,219
12-Aug	33	5,683	2,157	4,255	8,229	10,572	4,298	2,140	545	3,867	2,606	1,352	7,532
19-Aug	34	10,851	2,793	13,553	4,115	2,530	4,857	3,220	237	2,655	4,246	1,217	6,372
26-Aug	35	6,650	3,067	13,734	5,077	3,531	2,222	2,736	270	2,919	2,880	678	4,065
2-Sep	36	4,544	1,840	9,147	3,988	2,549	899	1,656	472	1,081	1,540	261	2,603
9-Sep	37	2,646	876	2,128	1,879	1,200	1,427	624	15	969	444	216	1,295
16-Sep	38	759	232	365	416	346	418	0		465		34	314
23-Sep	39	381	216	5	294	273	0	0					118
30-Sep	40-42	176	203	71	248		0						45
Yearly Total		81,274	54,900	73,324	90,638	67,071	51,827	37,416	7,209	50,739	44,254	12,335	71,557
Weekly Mean		4,781	3,050	4,074	5,035	3,726	2,879	2,459	401	2,819	2,459	685	4,209
Early Stock Esc.		30,765	29,561	21,229	16,497	25,285	16,526	17,276	1,680	8,355	17,850	2,641	20,485
Late Stock Esc.		50,509	25,339	54,870	74,141	41,786	35,301	20,140	5,529	42,384	26,404	9,694	51,198

Table 3a. Escapement goals for Chilkoot sockeye salmon early stock, 1998.

Stat Week	Chilkoot Weekly 1998 Escapement	Observed 1998 Cum	Weekly Goal	Cum. Goal	Cum. Lower Bound	Cum. Upper Bound
23	0	0	450	450	337	644
24	117	117	2,419	2,868	2,151	4,107
25	327	444	5,320	8,189	6,142	11,725
26	664	1,108	6,021	14,209	10,657	20,346
27	857	1,965	4,310	18,519	13,890	26,517
28	676	2,641	2,994	21,514	16,135	30,804
29	791	2,641	486	22,000	16,500	31,500
30	1,534	2,641	0	22,000	16,500	31,500
31	1,687	2,641	0	22,000	16,500	31,500
32	1,924	2,641	0	22,000	16,500	31,500
33	1,352	2,641	0	22,000	16,500	31,500
34	1,217	2,641	0	22,000	16,500	31,500
35	678	2,641	0	22,000	16,500	31,500
36	261	2,641	0	22,000	16,500	31,500
37	216	2,641	0	22,000	16,500	31,500
38	34	2,641	0	22,000	16,500	31,500
39	0	2,641	0	22,000	16,500	31,500
40	0	2,641	0	22,000	16,500	31,500

Total Early Stock Goal	22,000
Upper Mgmt Goal	31,500
Lower Mgmt. Goal	16,500

Table 3b. Escapement goals for Chilkoot sockeye salmon late stock, 1998.

Stat Week	Observed 1998 Cum	Weekly Goal	Cum Goal	Cum. Lower Bound	Cum. Upper Bound
23	0		0	0	0
24	0		0	0	0
25	0		0	0	0
26	0		0	0	0
27	0		0	0	0
28	0		0	0	0
29	791	532	532	452	798
30	2,325	6,308	6,840	5,814	10,260
31	4,012	8,442	15,282	12,990	22,923
32	5,936	8,936	24,218	20,585	36,327
33	7,288	6,302	30,520	25,942	45,780
34	8,505	4,720	35,240	29,954	52,860
35	9,183	2,880	38,120	32,402	57,180
36	9,444	1,280	39,400	33,490	59,100
37	9,660	440	39,840	33,864	59,760
38	9,694	160	40,000	34,000	60,000
39	9,694	0	40,000	34,000	60,000
40	9,694	0	40,000	34,000	60,000

Total Late Stock Goal	40,000	Total Late and Early Stock Goal	62,000
Upper Mgmt. Goal	60,000	Upper Mgmt. Goal	91,500
Lower Mgmt. Goal	34,000	Lower Mgmt. Goal	50,500

Table 4. Annual harvests of Chilkoot Lake sockeye salmon in the District 115 drift gillnet fishery.

Mid-Week Date	Stat Week	Year											
		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
17-Jun	25	242		2,428	2,072	921	2,286	2,217		2,173	526	251	
24-Jun	26	2,891	22,024	733	1,719	322	2,078	3,832	1,315	6,760	2,294	423	4,838
1-Jul	27	2,457	17,624		2,425		1,750	4,349	2,574	7,686	2,589	2,135	16,332
8-Jul	28	2,953	13,860	1,093	11,723		2,740	5,325	3,882	8,885	6,463	1,035	4,660
15-Jul	29	3,087	16,535	2,458	1,002		9,464	5,585	3,839	21,330	2,046	1,697	44,328
22-Jul	30	6,006	8,698	1,523	5,193	945	8,159	11,347	19,770	49,673	4,595	2,342	46,056
29-Jul	31	2,422	11,583	2,883	7,114	1,931	11,679	36,013	49,231	47,278	17,492	2,068	42,042
5-Aug	32	23,153	11,734	971	25,146	6,974	2,165	28,481	40,832	37,997	23,836	7,901	85,999
12-Aug	33	2,424	6,773	1,133	5,786	6,955	1,578	21,656	41,120	20,685	19,764	21,361	41,439
19-Aug	34	2,381	3,803	738	4,879	1,293	952	16,192	22,533	15,902	48,615	37,864	32,383
26-Aug	35	13,008	511	204	1,921	1,302	539	8,310	28,181	9,903	12,833	20,961	13,503
2-Sep	36	808	124	80	446	128	232	754	21,668	2,980	9,550	9,762	2,537
9-Sep	37	419	26	17	207	39	121	461	5,190	367	1,271	2,206	728
16-Sep	38-42	201	18	3	231	36	49	70	1,334	173	451	424	150
Yearly Total		62,452	113,313	14,264	69,864	20,846	43,792	144,592	241,469	231,792	152,325	110,430	334,995
Weekly Mean		4,461	8,716	1,097	4,990	1,895	3,128	10,328	18,575	16,557	10,880	7,888	25,769
Early Stock Catch		8,543	53,508	4,254	17,939	1,243	8,854	15,723	7,771	25,504	11,872	3,844	25,830
Late Stock Catch		53,909	59,805	10,010	51,925	19,603	34,938	128,869	233,698	206,288	140,453	106,586	309,165

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Table 4. (page 2 of 2)

Mid-Week Date	Stat Week	Year											1976-97 Mean
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
17-Jun	25		5,673	2,284	2,701				1,504	1,403	6,934		2,241
24-Jun	26	4,591	12,640	2,546	4,103	7,116	7,692	3,879	1,165	3,971	5,352	159	4,649
1-Jul	27	5,961	12,466	8,019	2,933	12,867	9,424	4,682	1,015	1,618	4,492	112	6,170
8-Jul	28	14,662	27,293	7,958	6,536	9,143	6,134	2,763	1,866	1,594	1,682	233	6,774
15-Jul	29	25,161	43,692	13,233	8,095	14,276	5,786	2,619	744	578	2,322	450	10,851
22-Jul	30	22,721	34,439	41,331	8,141	13,654	3,724	1,228	237	779	3,061	330	13,346
29-Jul	31	48,921	61,509	29,768	35,267	13,496	4,510	2,400	213	3,355	4,293	380	19,794
5-Aug	32	40,664	43,957	34,731	49,985	18,479	2,502	2,609	144	2,983	251	167	22,341
12-Aug	33	43,995	33,639	28,539	36,144	19,574	3,500	2,291	250	1,346	180	117	16,370
19-Aug	34	14,181	8,205		37,354	12,852	3,089	1,298	396	525	159	76	12,647
26-Aug	35	21,734	5,245	4,758	19,334	12,929	2,214	904	232	444	117	134	8,140
2-Sep	36	8,951	2,497	3,068	7,322	4,612	2,131	526	90	145	48	19	3,566
9-Sep	37	1,931	369	2,440	5,089	1,503	583	97	61	87	24	20	1,056
16-Sep	38-42	495	239	189	1,037	218	135	119	29	34	0		256
Yearly Total		253,968	291,863	178,864	224,041	140,719	51,424	25,414	7,946	18,861	28,913	2,198	125,552
Weekly Mean		19,536	20,847	13,759	16,003	10,825	3,956	1,955	568	1,347	2,065	183	9,325
Early Stock Catch		25,214	58,072	20,807	16,273	29,126	23,250	11,323	5,550	8,586	18,459	504	22,403
Late Stock Catch		228,754	233,791	158,057	207,768	111,593	28,174	14,091	2,396	10,275	10,454	1,694	130,406

Table 5a. Weekly passage and marking data from the 1998 Chilkoot River sockeye salmon mark-recapture program.

Stat. Week	Weekly Weir Passage	Cumulative Weekly Weir Passage	Weekly Sockeye Marked	Cumulative Weekly Sockeye Marked	% Weekly Marked	% Cumulative Marked	Total Marked By Stratum[a]	Statistical Weeks	% Marked By Stratum
24	117	117	14	14	12.0	12.0	DC-197	24-27	15.8
25	327	444	32	46	9.8	10.4	LVC-497	28-31	39.8
26	664	1,108	67	113	10.1	10.2	DP-44	32[b]	3.5
27	857	1,965	84	197	9.8	10.0	LAC-510	32-38[c]	40.9
28	676	2,641	94	291	13.9	11.0			
29	791	3,432	80	371	10.1	10.8			
30	1,534	4,966	154	525	10.0	10.6			
31	1,687	6,653	169	694	10.0	10.4			
32	1,924	8,577	182	876	9.5	10.2			
33	1,352	9,929	135	1,011	10.0	10.2			
34	1,217	11,146	122	1,133	10.0	10.2			
35	678	11,824	65	1,198	9.6	10.1			
36	261	12,085	24	1,222	9.2	10.1			
37	216	12,301	22	1,244	10.2	10.1			
38	34	12,335	4	1,248	11.8	10.1			
Total		12,335		1,248	10.1				

[a] DC=Dorsal Clip, LVC=Left Ventral Clip, DP=Dorsal Punch, LAC=Left Axillary Clip.
[b] 44 fish were marked with a Dorsal Punch mark within the third stratum.
[c] Last day of sampling was September 13.

Table 5b. Recovery data collected at the 1998 Chilkoot River mark recapture program.

Date	Location Recovered	Capture Method	Total Sockeye Captured	Previously Sampled Sockeye	Total New Sockeye Captured	Stratum Marks Recovered	% Marked
Aug. 5	Chilkoot Lake	Seine	67	3	64	1-LVC[a]	1.6
Aug. 13	Chilkoot Lake	Seine	74	10	64	1-DC	1.6
Aug. 23	Chilkoot Lake	Seine	85	27	58	1-LVC	1.7
Aug. 26	Chilkoot Lake	Seine	55	39	16	0	0
Sept. 2	Chilkoot Lake	Seine	43	25	18	0	0
Sept. 6	Chilkoot Lake	Seine/CC[b]	41	20	21	2-LVC	9.5
Sept. 13	Chilkoot Lake	Seine	23	12	11	0	0
Sept. 23	Chilkoot Lake	Seine	23	4	19	0	0
Oct. 1	Chilkoot Lake	Seine/CC	59	0	59	2-LVC	3.4
Oct. 5	Chilkoot Lake	Seine	50	3	47	0	0
Oct. 9	Chilkoot Lake	CC	35	2	33	2-LVC, 1-LAC	9.1
Oct. 12	Bear Creek	Seine	123	9	114	1-DP, 9-LAC	8.8
Oct. 12	Chilkoot Lake	CC	89	4	85	6-LVC	7.1
Oct.22, 26	Chilkoot Lake	CC	8	0	8	0	0
Oct. 29	Bear Creek	Gillnet	24	1	23	0	0
Oct. 30	Bear Creek	Gillnet/CC	50	5	45	3-LAC	6.7
Nov. 1	Chilkoot Lake	CC	8	0	8	0	0
Nov. 10	Chilkoot Lake	CC	7	0	7	0	0
Total			864	164	700	29	4.1

[a] DC=Dorsal Clip, LVC=Left Ventral Clip, DP=Dorsal Punch, LAC=Left Axillary Clip.

[b] CC=Carcass Count

Table 6. Historical age composition of the Chilkoot Lake sockeye salmon escapement, 1982 to 1998.

								Year										Average	
AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1982-97	SE
0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0	0.0	0.0
1.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
1.2	19.0	12.0	4.5	12.2	13.2	8.4	4.4	4.5	2.0	12.5	1.8	2.6	1.8	44.1	6.2	2.2	4.7	9.5	0.2
1.3	78.4	60.4	86.7	66.4	67.0	69.2	77.9	54.9	45.4	55.9	62.6	35.6	66.9	30.7	84.2	90.2	60.5	64.5	0.3
1.4	0.9	0.2	0.8	2.4	0.6	0.2	1.4	1.2	1.0	0.4	0.7	0.3	0.6	0.8	0.2	0.1	1.4	0.7	0.1
2.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
2.2	0.5	1.4	0.4	2.6	2.2	2.2	2.7	5.0	1.5	4.9	5.8	1.8	1.6	3.8	0.8	0.4	2.1	2.3	0.1
2.3	0.9	25.8	7.6	15.9	16.8	19.8	13.2	33.5	49.1	25.9	28.3	59.0	28.8	20.0	8.5	7.1	31	22.5	0.2
2.4	0.0	0.0	0.0	0.3	0.1	0.1	0.3	0.4	1.0	0.3	0.5	0.4	0.2	0.7	0.0	0.0	0.1	0.3	0.0
3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
3.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0	0.0	0.0
3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.0

Table 7. Average length (mid-eye to fork in mm) by age category for Chilkoot Lake sockeye salmon, 1982-1998.

AGE	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	AVG	SE
0.3	620	572	0	0	0	0	0	0	0	0	575	0	540	0	635	565	0	582	14.2
1.1	0	377	0	320	410	0	0	0	0	0	0	0	0	0	0	0	0	371	22.9
1.2	466	455	461	471	472	468	496	468	467	481	471	487	471	496	509	508	492	477	0.8
1.3	577	573	571	569	582	583	578	580	579	565	570	575	568	571	589	577	572	576	0.2
1.4	621	595	600	604	611	593	604	604	607	616	596	583	596	594	611	577	574	602	2
2.1	0	420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	420	0
2.2	489	474	470	476	485	472	499	480	497	477	470	506	489	506	514	508	514	484	1.5
2.3	584	567	570	565	581	582	575	576	577	565	571	573	569	573	585	569	570	573	0.3
2.4	0	0	0	608	618	596	590	592	596	583	595	565	582	608	0	0	605	592	3.1
3.1	0	0	0	0	0	0	0	0	0	0	0	550	0	0	0	0	0	550	0
3.2	0	0	0	470	0	0	0	0	490	0	508	0	450	0	490	0	0	489	12.7
3.3	0	0	0	0	565	560	565	569	580	550	565	550	610	0	0	575	595	566	4.6
AVG	556	556	566	554	565	571	572	569	575	551	563	570	565	536	583	575	566	566	
SE	13.6	13.2	13	13.8	12.3	12.2	11.1	11.2	10.9	11.6	12.5	12.6	12.7	22.1	12.9	12.6	18.6	3.1	

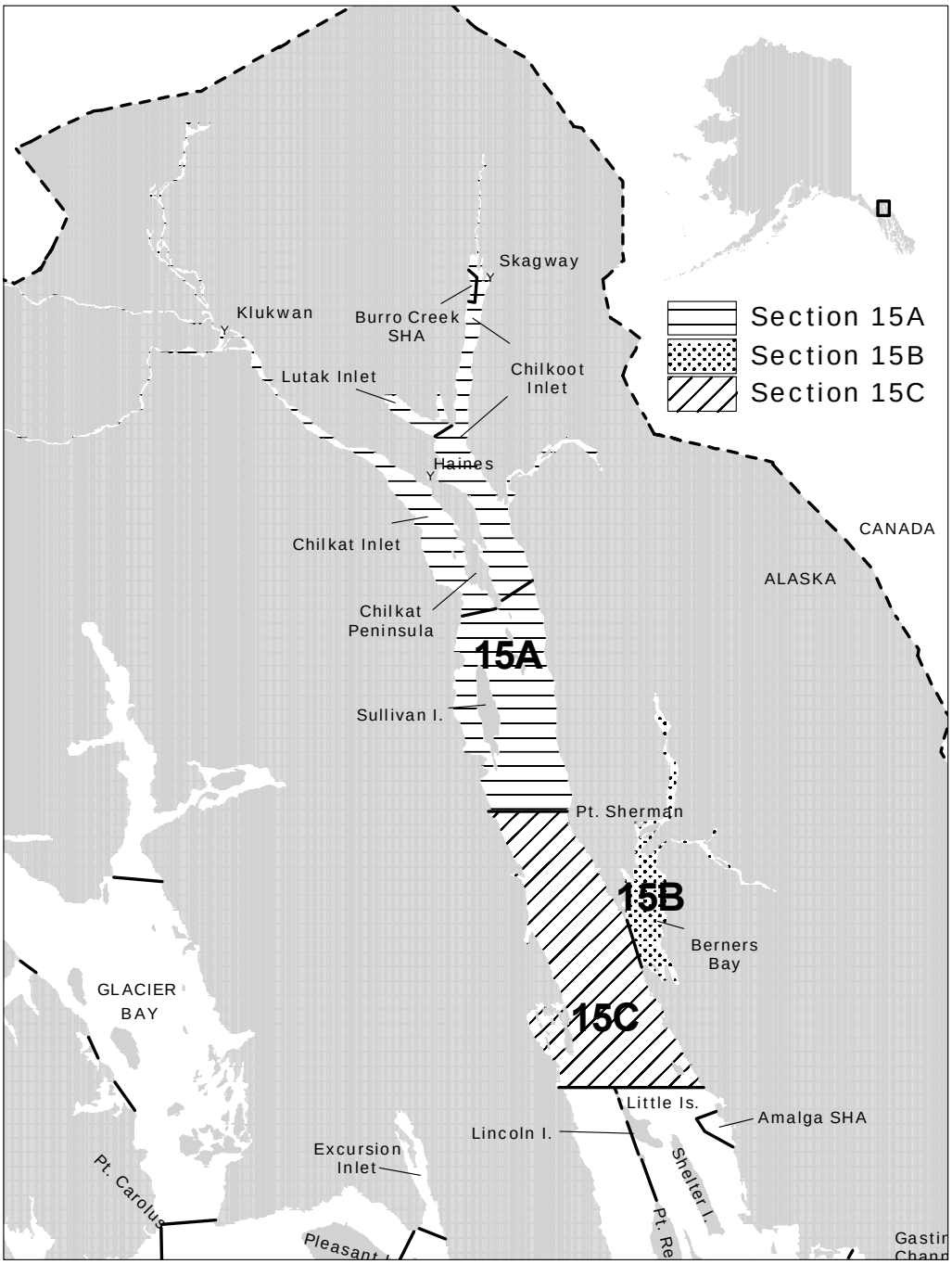


Figure 1. District 115, Lynn Canal, district and section boundaries.

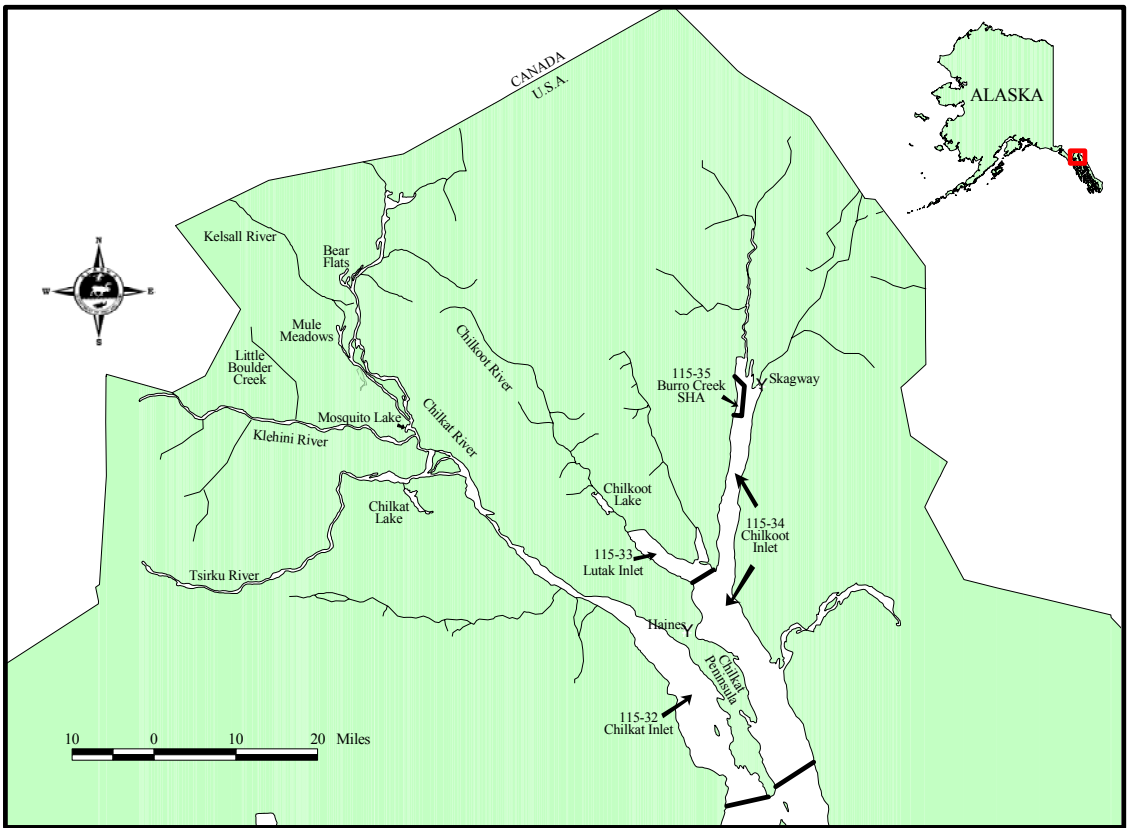


Figure 2. Upper Lynn Canal with adjacent sockeye salmon spawning tributaries.

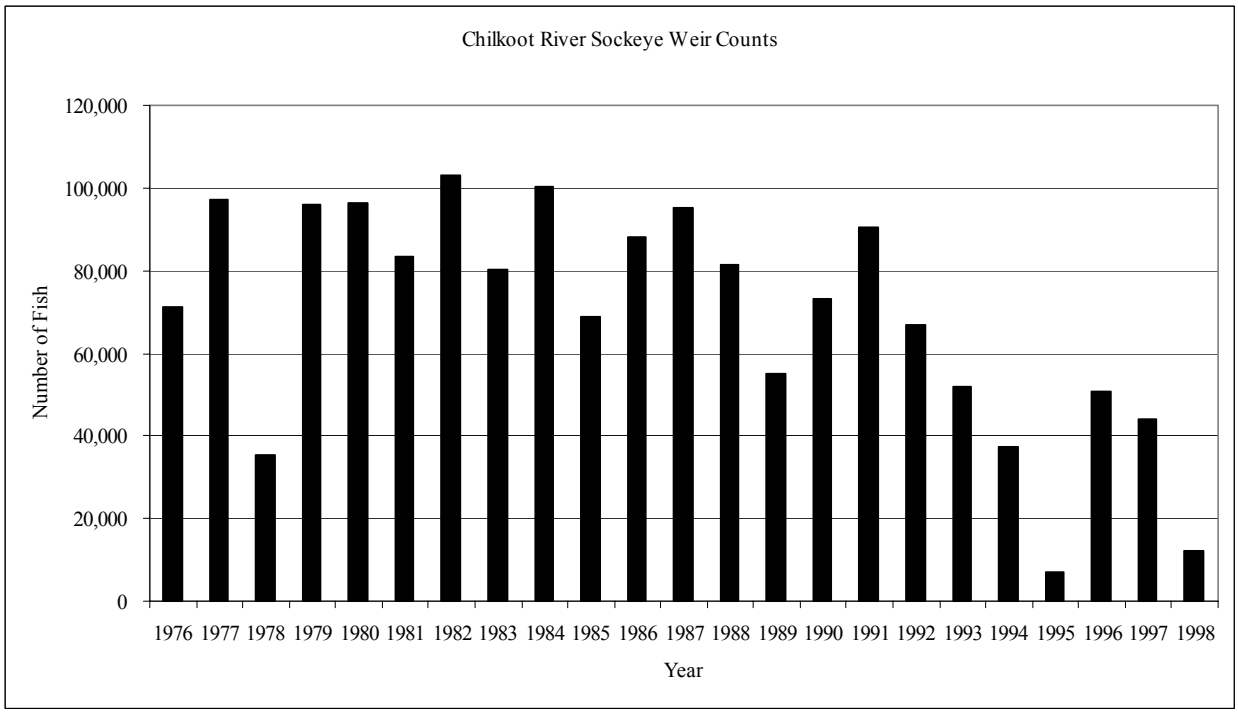
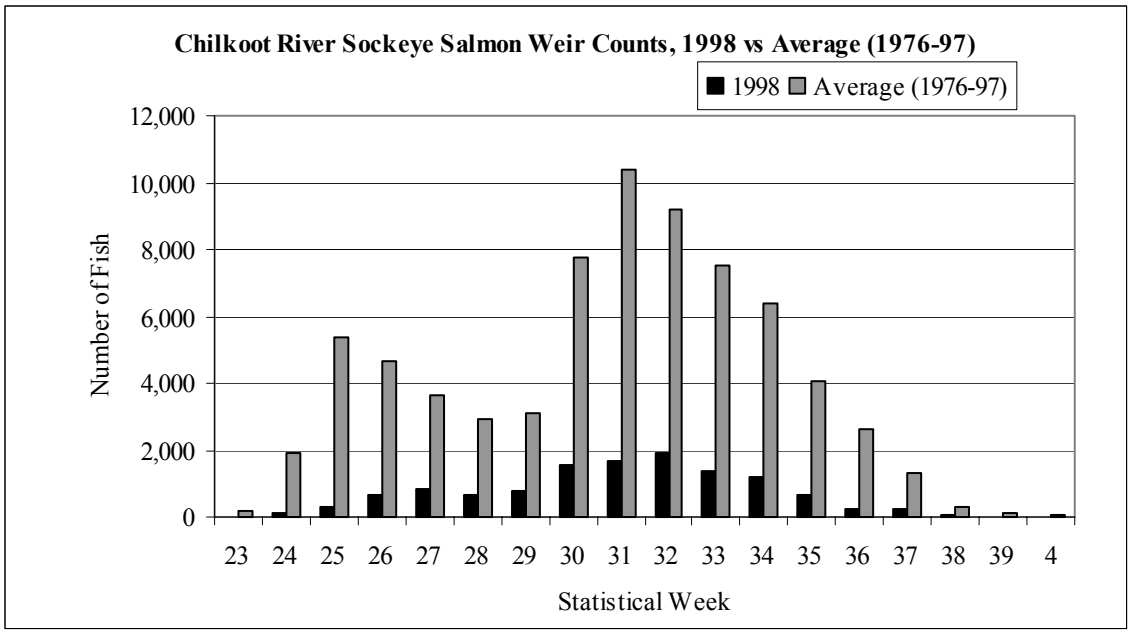


Figure 3. Historical yearly weir counts for Chilkoot River sockeye salmon, 1976-1998.



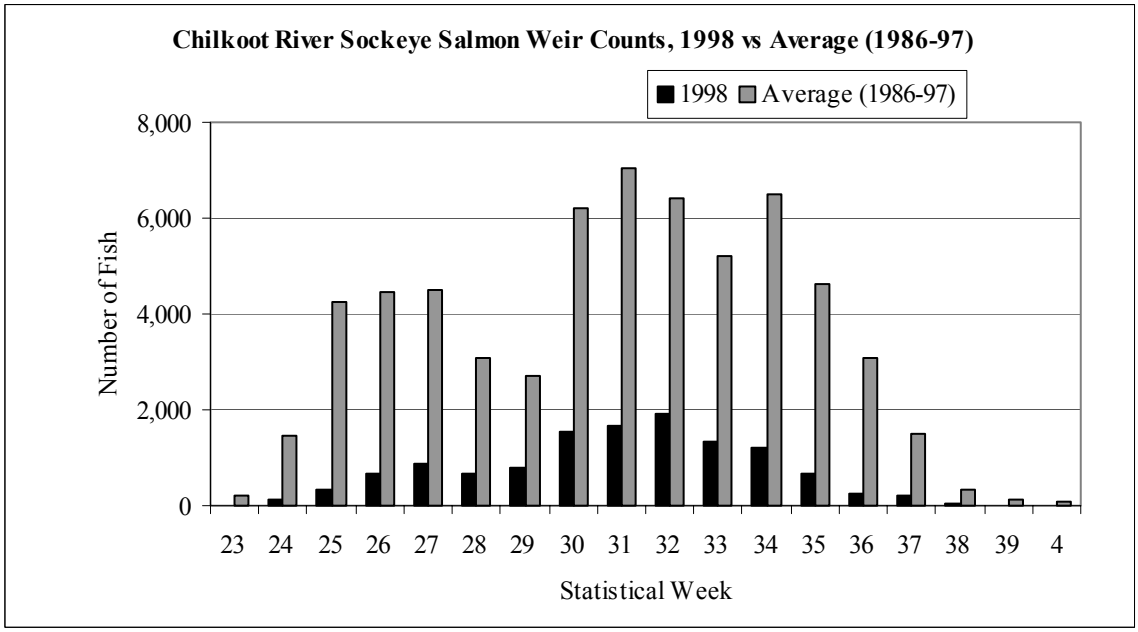
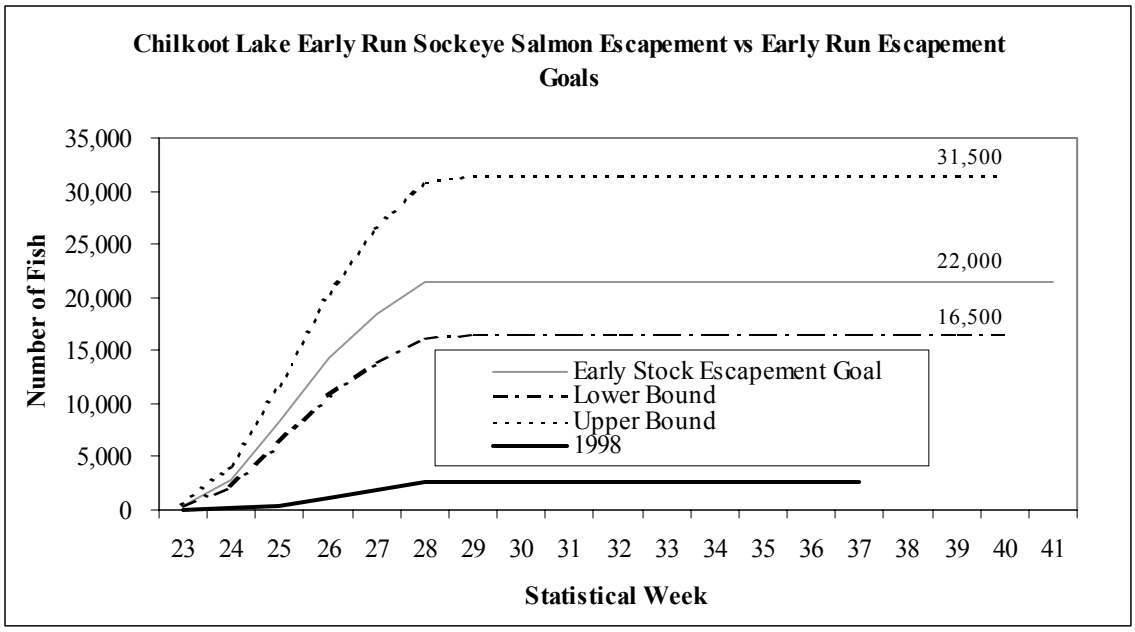


Figure 4. Weekly 1998 Chilkoot River sockeye salmon weir counts vs. 1976 to 1997 and 1986 to 1997 average.



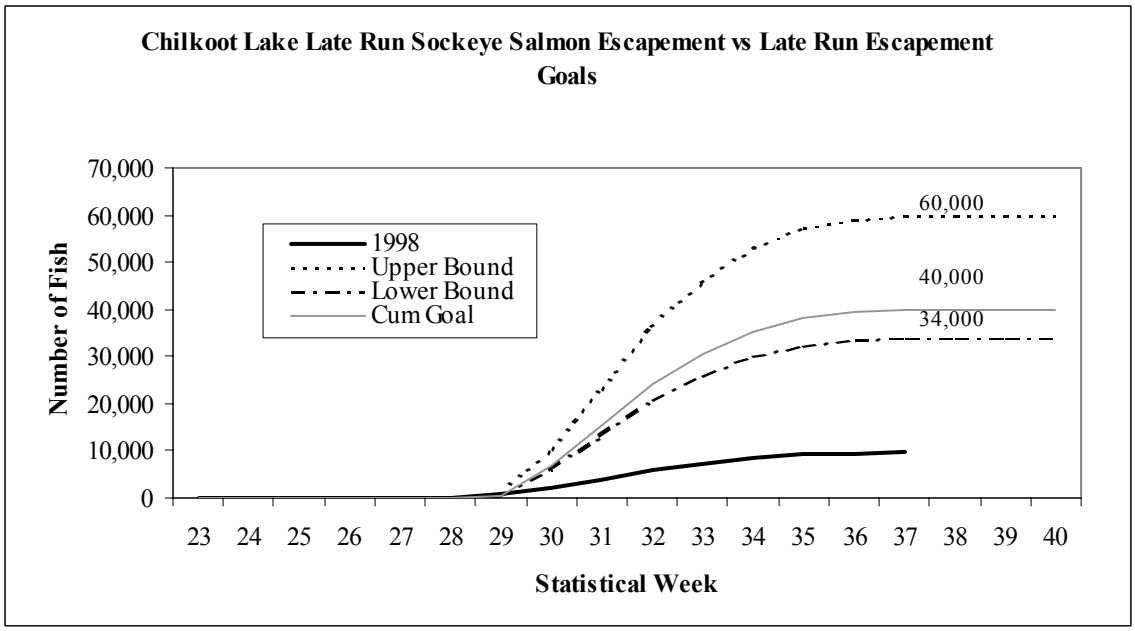


Figure 5. Cumulative weir counts for Chilkoot Lake sockeye salmon by stock related to weekly cumulative upper and lower escapement goals.

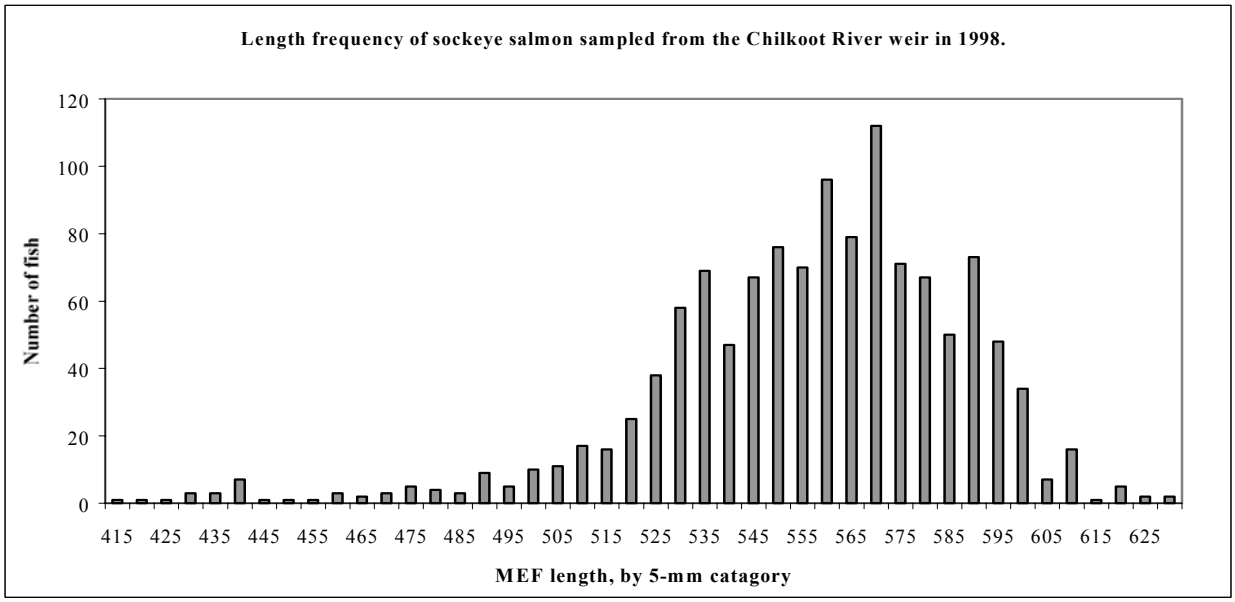


Figure 6. Length frequency of sockeye salmon sampled from the Chilkoot River weir in 1998.

APPENDICES

Appendix A. The numbered calendar weeks for 1998.

Week #	From	Through
1	Jan 1	Jan 3
2	Jan 4	Jan 10
3	Jan 11	Jan 17
4	Jan 18	Jan 24
5	Jan 25	Jan 31
6	Feb 1	Feb 7
7	Feb 8	Feb 14
8	Feb 15	Feb 21
9	Feb 22	Feb 28
10	Mar 1	Mar 7
11	Mar 8	Mar 14
12	Mar 15	Mar 21
13	Mar 22	Mar 28
14	Mar 29	Apr 4
15	Apr 5	Apr 11
16	Apr 12	Apr 18
17	Apr 19	Apr 25
18	Apr 26	May 2
19	May 3	May 9
20	May 10	May 16
21	May 17	May 23
22	May 24	May 30
23	May 31	Jun 6
24	Jun 7	Jun 13
25	Jun 14	Jun 20
26	Jun 21	Jun 27
27	Jun 28	Jul 4
28	Jul 5	Jul 11
29	Jul 12	Jul 18
30	Jul 19	Jul 25
31	Jul 26	Aug 1
32	Aug 2	Aug 8
33	Aug 9	Aug 15
34	Aug 16	Aug 22
35	Aug 23	Aug 29
36	Aug 30	Sep 5
37	Sep 6	Sep 12
38	Sep 13	Sep 19
39	Sep 20	Sep 26
40	Sep 27	Oct 3
41	Oct 4	Oct 10
42	Oct 11	Oct 17
43	Oct 18	Oct 24
44	Oct 25	Oct 31
45	Nov 1	Nov 7
46	Nov 8	Nov 14
47	Nov 15	Nov 21
48	Nov 22	Nov 28
49	Nov 29	Dec 5
50	Dec 6	Dec 12
51	Dec 13	Dec 19
52	Dec 20	Dec 26
53	Dec 27	Dec 31

Appendix B. Daily water temperatures, stream height, and weir counts for Chilkoot Lake, 1998.

		Sockeye		Coho		Chum		Pink		Chinook			Water
Week	Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Temp. (C)	Level (mm)
23	06/04	0	0		0		0		0		0	8.5	113
23	06/05	0	0		0		0		0		0	8	117
23	06/06	0	0		0		0		0		0	8	112
24	06/07	17	17		0		0		0		0	8	110
24	06/08	13	30		0		0		0		0	9	115
24	06/09	3	33		0		0		0		0	9	115
24	06/10	11	44		0		0		0		0	9	110
24	06/11	20	64		0		0		0		0	9	103
24	06/12	27	91		0		0		0		0	8	97
24	06/13	26	117		0		0		0		0	8	92
25	06/14	12	129		0		0		0		0	8	90
25	06/15	24	153		0		0		0		0	N/A	76
25	06/16	0	153		0		0		0		0	8	96
25	06/17	3	156		0		0		0		0	8	95
25	06/18	5	161		0		0		0		0	7	96
25	06/19	89	250		0		0		0		0	8	104
25	06/20	194	444		0		0		0		0	10	105
26	06/21	56	500		0		0		0		0	9	102
26	06/22	125	625		0		0		0		0	9	104
26	06/23	59	684		0		0		0		0	8	103
26	06/24	21	705		0		0		0		0	8	99
26	06/25	14	719		0		0		0		0	8	98
26	06/26	203	922		0		0		0		0	9	103
26	06/27	186	1108		0		0		0		0	10	105
27	06/28	315	1423		0		0		0		0	10	101
27	06/29	139	1562		0		0		0		0	10	102
27	06/30	268	1830		0	1	1		0		0	9	103
27	07/01	12	1842		0	1	2		0		0	10	104
27	07/02	60	1902		0		2		0	1	1	10.5	108
27	07/03	42	1944		0		2	5	5		1	10	109
27	07/04	21	1965		0		2	1	6		1	10	112
28	07/05	46	2011		0		2	1	7		1	10	113
28	07/06	20	2031		0		2	1	8		1	9	112
28	07/07	59	2090		0		2	3	11		1	9	111
28	07/08	132	2222		0		2	12	23		1	10	101
28	07/09	100	2322		0	1	3	16	39		1	10	97
28	07/10	172	2494		0	3	6	34	73		1	10	94
28	07/11	147	2641		0	2	8	42	115		1	10	98
29	07/12	131	2772		0	4	12	51	166	1	2	10	104
29	07/13	105	2877		0	4	16	13	179		2	9	100
29	07/14	90	2967		0	4	20	8	187		2	9	99
29	07/15	106	3073		0	5	25	19	206		2	9	98
29	07/16	106	3179		0	4	29	30	236		2	9	95
29	07/17	142	3321		0	6	35	78	314		2	9	94
29	07/18	111	3432		0	2	37	44	358	1	3	9	89
30	07/19	118	3550		0	4	41	55	413	1	4	9	88

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Appendix B. (page 2 of 3)

		Sockeye		Coho		Chum		Pink		Chinook			Water
Week	Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Temp. (C)	Level (mm)
30	07/20	320	3870		0	3	44	151	564		4	10	90
30	07/21	196	4066		0	2	46	314	878		4	10	90
30	07/22	243	4309		0	7	53	132	1010	1	5	11	99
30	07/23	219	4528		0	2	55	187	1197	1	6	10	101
30	07/24	226	4754		0	7	62	80	1277		6	7	96
30	07/25	212	4966		0	3	65	55	1332		6	10	102
31	07/26	258	5224		0	3	68	95	1427		6	10	99
31	07/27	234	5458		0	6	74	108	1535		6	10	93
31	07/28	212	5670		0	2	76	117	1652		6	10	93
31	07/29	103	5773		0	5	81	96	1748		6	9	93
31	07/30	526	6299		0	6	87	413	2161	1	7	9	90
31	07/31	196	6495		0	3	90	322	2483	1	8	10	88
31	08/01	158	6653		0	7	97	221	2704		8	9	91
32	08/02	338	6991		0	7	104	352	3056		8	9	88
32	08/03	262	7253		0	3	107	243	3299		8	11	86
32	08/04	226	7479		0	5	112	421	3720		8	11	85
32	08/05	402	7881		0	5	117	1927	5647		8	11	86
32	08/06	183	8064		0	9	126	1144	6791		8	11	86
32	08/07	260	8324		0	1	127	662	7453		8	10	88
32	08/08	253	8577		0	2	129	445	7898	1	9	10	105
33	08/09	241	8818		0	3	132	1102	9000		9	10	98
33	08/10	188	9006		0	7	139	771	9771		9	9	92
33	08/11	235	9241		0	1	140	927	10698	1	10	9	84
33	08/12	336	9577		0	1	141	2053	12751		10	10	83
33	08/13	107	9684		0	5	146	1271	14022		10	10	83
33	08/14	132	9816		0	3	149	1856	15878		10	10	81
33	08/15	113	9929		0	4	153	1512	17390		10	10	85
34	08/16	119	10048		0	6	159	2242	19632		10	10	85
34	08/17	167	10215	2	2	3	162	1326	20958		10	9	84
34	08/18	209	10424	2	4	5	167	1135	22093		10	10	87
34	08/19	132	10556		4	2	169	1412	23505		10	10	87
34	08/20	159	10715		4	1	170	2686	26191		10	10	82
34	08/21	122	10837		4	3	173	2216	28407		10	9	79
34	08/22	309	11146	1	5	1	174	2424	30831		10	10	79
35	08/23	227	11373		5	2	176	2065	32896		10	10	81
35	08/24	145	11518		5	5	181	1644	34540		10	9.5	83
35	08/25	83	11601		5	1	182	1070	35610		10	10	95
35	08/26	102	11703		5	7	189	1189	36799		10	9	94
35	08/27	71	11774		5	6	195	1000	37799		10	10	94
35	08/28	36	11810	1	6	2	197	519	38318	1	11	10	94
35	08/29	14	11824		6	1	198	26	38344		11	9	112
36	08/30	36	11860		6	4	202	495	38839		11	9	94
36	08/31	47	11907		6	2	204	1921	40760		11	10	90
36	09/01	5	11912		6		204	33	40793		11	8	118
36	09/02	9	11921	1	7		204	408	41201		11	8	103
36	09/03	53	11974	2	9	5	209	415	41616		11	8	95
36	09/04	63	12037	3	12	7	216	325	41941		11	8	97

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Appendix B. (page 3 of 3)

		Sockeye		Coho		Chum		Pink		Chinook			Water
Week	Date	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Daily	Cum.	Temp. (C)	Level (mm)
36	09/05	48	12085	5	17	10	226	605	42546		11	8	91
37	09/06	60	12145	6	23	30	256	30	42576		11	8	87
37	09/07	8	12153	4	27	13	269	13	42589		11	8	98
37	09/08	7	12160	4	31	7	276	7	42596		11	8	103
37	09/09	42	12202	20	51	18	294	18	42614		11	9	86
37	09/10	66	12268	23	74	40	334	40	42654		11	8	92
37	09/11	21	12289	11	85	14	348	14	42668		11	8	83
37	09/12	12	12301	17	102	14	362	14	42682		11	7	97
38	09/13	34	12335	29	131	6	368	6	42688		11	8	90

Appendix C. Stratified Population Analysis System program results for Chilkoot Lake mark-recapture study, 1998.

1998 Chilkoot Lake m-r data
4 rows x 14 columns

	Marks	D85	D813	D823	D826	D92	D96	D913	D923	D101	D105	D109	D1012	D1O122	D1029	Unseen
DCS	193.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	192.00
LVCS	487.00	1.00	0.00	1.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	2.00	0.00	6.00	0.00	473.00
DP	43.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	42.00
LACS	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	9.00	0.00	0.00	490.00
Unmarked			63.00	63.00	57.00	16.00	18.00	19.00	11.00	19.00	57.00	47.00	30.00	104.00	79.00	8.00
Recovered			64.00	64.00	58.00	16.00	18.00	21.00	11.00	19.00	59.00	47.00	33.00	114.00	85.00	8.00

>>>1998 Chilkoot Lake m-r data - Chi-square Test Statistics

Complete Mixing : 3.76 (3 df)
Significance... 0.29
Equal Proportions: 19.44 (13 df)
Significance... 0.11

> End of Pooling Tests

>> ML Darroch Estimate

Failed to form an estimate

>> Least squares Estimate

Failed to form an estimate

>>Pooled Petersen Estimate
Estimate (std. err) : 28015.00 (5120.15)
95 % normal C I : (17979.50, 38050.50)
95 % transform C I : (19972.27, 41026.44)

Appendix D. Age composition of the Chilkoot River sockeye salmon escapement by sex, 1998.

	Brood Year and Age Class								
	1996	1994	1993	1993	1992	1992	1991	1991	
	0.1	1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Weeks 24-27 (June 7-July 4)									
Male									
Sample Size	1	8	46		1	31	1	1	89
Percent	0.7	5.6	32.4		0.7	21.8	0.7	0.7	62.7
Std. Error	0.7	1.9	3.9		0.7	3.5	0.7	0.7	4.1
Female									
Sample Size		4	28		2	19			53
Percent		2.8	19.7		1.4	13.4			37.3
Std. Error		1.4	3.3		1.0	2.9			4.1
All Fish									
Sample Size	1	12	75		3	51	1	1	144
Percent	0.7	8.3	52.1		2.1	35.4	0.7	0.7	100.0
Std. Error	0.7	2.3	4.2		1.2	4.0	0.7	0.7	
Statistical Weeks 28-29 (July 5-18)									
Male									
Sample Size		5	43	3	1	21			73
Percent		4.0	34.1	2.4	0.8	16.7			57.9
Std. Error		1.7	4.2	1.4	0.8	3.3			4.4
Female									
Sample Size		1	42		1	9			53
Percent		0.8	33.3		0.8	7.1			42.1
Std. Error		0.8	4.2		0.8	2.3			4.4
All Fish									
Sample Size		6	85	3	2	30			126
Percent		4.8	67.5	2.4	1.6	23.8			100.0
Std. Error		1.9	4.2	1.4	1.1	3.8			

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	Brood Year and Age Class								
	1996	1994	1993	1993	1992	1992	1991	1991	
	0.1	1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Week 30 (July 19-25)									
Male									
Sample Size		4	41	5		11			61
Percent		3.4	34.7	4.2		9.3			51.7
Std. Error		1.7	4.4	1.9		2.7			4.6
Female									
Sample Size		1	40	1	2	13			57
Percent		0.8	33.9	0.8	1.7	11.0			48.3
Std. Error		0.8	4.4	0.8	1.2	2.9			4.6
All Fish									
Sample Size		5	81	6	2	24			118
Percent		4.2	68.6	5.1	1.7	20.3			100.0
Std. Error		1.9	4.3	2.0	1.2	3.7			
Statistical Week 31 (July 26-Aug.1)									
Male									
Sample Size		6	44	1		23			74
Percent		4.6	33.8	0.8		17.7			56.9
Std. Error		1.8	4.2	0.8		3.3			4.3
Female									
Sample Size			39			17			56
Percent			30.0			13.1			43.1
Std. Error			4.0			3.0			4.3
All Fish									
Sample Size		6	83	1		40			130
Percent		4.6	63.8	0.8		30.8			100.0
Std. Error		1.8	4.2	0.8		4.1			

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	Brood Year and Age Class								
	1996	1994	1993	1993	1992	1992	1991	1991	
	0.1	1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Week 32 (Aug. 2-8)									
Male									
Sample Size		9	39	4		27			79
Percent		6.6	28.5	2.9		19.7			57.7
Std. Error		2.1	3.9	1.4		3.4			4.2
Female									
Sample Size			43	2	2	11			58
Percent			31.4	1.5	1.5	8.0			42.3
Std. Error			4.0	1.0	1.0	2.3			4.2
All Fish									
Sample Size		9	82	6	2	38			137
Percent		6.6	59.9	4.4	1.5	27.7			100.0
Std. Error		2.1	4.2	1.7	1.0	3.8			
Statistical Week 33 (Aug.9-15)									
Male									
Sample Size		5	30	2		15			52
Percent		5.2	30.9	2.1		15.5			53.6
Std. Error		2.3	4.7	1.4		3.7			5.1
Female									
Sample Size			32			13			45
Percent			33.0			13.4			46.4
Std. Error			4.8			3.5			5.1
All Fish									
Sample Size		5	62	2		28			97
Percent		5.2	63.9	2.1		28.9			100.0
Std. Error		2.3	4.9	1.4		4.6			

-continued-

	Brood Year and Age Class								
	1996	1994	1993	1993	1992	1992	1991	1991	
	0.1	1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Week 34 (Aug. 16-22)									
Male									
Sample Size		2	23	2	1	22			50
Percent		2.1	24.0	2.1	1.0	22.9			52.1
Std. Error		1.5	4.4	1.5	1.0	4.3			5.1
Female									
Sample Size			28			18			46
Percent			29.2			18.8			47.9
Std. Error			4.7			4.0			5.1
All Fish									
Sample Size		2	51	2	1	40			96
Percent		2.1	53.1	2.1	1.0	41.7			100.0
Std. Error		1.5	5.1	1.5	1.0	5.0			
Statistical Weeks 35-38 (Aug. 23-Sept. 19)									
Male									
Sample Size		1	25		1	20			47
Percent		1.1	26.9		1.1	21.5			50.5
Std. Error		1.1	4.6		1.1	4.3			5.2
Female									
Sample Size		1	26		2	17			46
Percent		1.1	28.0		2.2	18.3			49.5
Std. Error		1.1	4.7		1.5	4.0			5.2
All Fish									
Sample Size		2	51		3	37			93
Percent		2.2	54.8		3.2	39.8			100.0
Std. Error		1.5	5.2		1.8	5.1			

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	Brood Year and Age Class								
	1996	1994	1993	1993	1992	1992	1991	1991	
	0.1	1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Combined Periods									
Male									
Sample Size	1	40	291	17	4	170	1	1	525
Percent	0.1	4.1	30.7	1.8	0.5	18.1	0.1	0.1	55.4
Std. Error	0.1	0.6	1.5	0.4	0.2	1.3	0.1	0.1	1.6
Female									
Sample Size		7	278	3	9	117			414
Percent		0.7	29.8	0.3	0.9	12.9			44.6
Std. Error		0.3	1.5	0.2	0.3	1.1			1.6
All Fish									
Sample Size	1	47	570	20	13	288	1	1	941
Percent	0.1	4.7	60.5	2.1	1.4	31.0	0.1	0.1	100.0
Std. Error	0.1	0.7	1.6	0.5	0.4	1.5	0.1	0.1	

Appendix E. Length-at-age composition of Chilkoot River sockeye salmon by sex, 1998.

		Brood year and Age Class							
		1994	1993	1993	1992	1992	1991	1991	
		1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Weeks 24-27 (June 7-July 4)									
Male	Avg. Length	509	575		535	578	605	595	570
	Std. Error	13.7	4.7			5.6			4
	Sample Size	8	46		1	31	1	1	88
Female	Avg. Length	470	561		560	563			555
	Std. Error	25.6	5.3		40.0	8.9			5.7
	Sample Size	4	28		2	19			53
All Fish	Avg. Length	496	570		552	572	605	595	565
	Std. Error	13	3.6		24.6	4.9			3.3
	Sample Size	12	74		3	50	1	1	141
Statistical Weeks 28-29 (July 5-July 18)									
Male	Avg. Length	507	583	533	565	567			571
	Std. Error	16.5	3.5	19.6		3.8			3.6
	Sample Size	5	43	3	1	21			73
Female	Avg. Length	515	566		565	564			565
	Std. Error		3.4			8.4			3.2
	Sample Size	1	42		1	9			53
All Fish	Avg. Length	508	575	533	565	566			569
	Std. Error	13.5	2.6	19.6		3.6			2.5
	Sample Size	6	85	3	2	30			126
Statistical Weeks 30 (July 19-July 25)									
Male	Avg. Length	483	580	504		578			568
	Std. Error	18.8	3.7	18.1		7.9			5.1
	Sample Size	4	41	4		11			60
Female	Avg. Length	485	567	515	570	563			564
	Std. Error		3.3		20.0	7.7			3.3
	Sample Size	1	40	1	2	13			57
All Fish	Avg. Length	483	574	506	570	570			566
	Std. Error	14.5	2.6	14.2	20.0	5.6			3.1
	Sample Size	5	81	5	2	24			117

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		Brood year and Age Class							
		1994	1993	1993	1992	1992	1991	1991	
		1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Weeks 31 (July 26-Aug. 1)									
Male	Avg. Length	476	575	520		563			563
	Std. Error	14.9	3.8			5.1			4.3
	Sample Size	6	44	1		23			74
Female	Avg. Length		560			560			560
	Std. Error		2.9			4.6			2.4
	Sample Size		39			17			56
All Fish	Avg. Length	476	568	520		562			562
	Std. Error	14.9	2.6			3.5			2.7
	Sample Size	6	83	1		40			130
Statistical Weeks 32 (Aug. 2- Aug. 8)									
Male	Avg. Length	500	581	506		585			570
	Std. Error	9.6	4.1	27.9		4.9			4.6
	Sample Size	9	39	4		27			79
Female	Avg. Length		571	528	590	568			570
	Std. Error		3.9	12.5	10.0	5.4			3.3
	Sample Size		42	2	2	11			57
All Fish	Avg. Length	500	576	513	590	580			570
	Std. Error	9.6	2.9	18.5	10.0	4			3
	Sample Size	9	81	6	2	38			136
Statistical Weeks 33 (Aug. 9- Aug. 15)									
Male	Avg. Length	480	579	515		578			567
	Std. Error	8.5	4.9	15.0		4.8			5.4
	Sample Size	5	30	2		15			52
Female	Avg. Length		560			561			561
	Std. Error		3.6			4			2.8
	Sample Size		32			13			45
All Fish	Avg. Length	480	570	515		570			564
	Std. Error	8.5	3.2	15.0		3.5			3.2
	Sample Size	5	62	2		28			97

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		Brood year and Age Class							
		1994	1993	1993	1992	1992	1991	1991	
		1.2	1.3	2.2	1.4	2.3	2.4	3.3	Total
Statistical Weeks 34 (Aug. 16- Aug. 22)									
Male	Avg. Length	490	592	508	570	584			581
	Std. Error	40	4.0	27.5		4.3			4.6
	Sample Size	2	23	2	1	22			50
Female	Avg. Length		574			569			572
	Std. Error		3.7			4.9			3
	Sample Size		28			18			46
All Fish	Avg. Length	490	582	508	570	577			577
	Std. Error	40	3.0	27.5		3.4			2.8
	Sample Size	2	51	2	1	40			96
Statistical Weeks 35 (Aug. 23- Aug. 29)									
Male	Avg. Length	510	571		585	566			568
	Std. Error		5.3			5.5			3.9
	Sample Size	1	25		1	20			47
Female	Avg. Length	470	560		603	559			559
	Std. Error		4.1		2.5	6.3			4
	Sample Size	1	26		2	17			46
All Fish	Avg. Length	490	565		597	562			564
	Std. Error	20	3.4		6.0	4.1			2.8
	Sample Size	2	51		3	37			93
Combined Periods									
Male	Avg. Length	494	580	514	564	575	605	595	570
	Std. Error	5.4	1.5	9.0	10.5	1.9			1.6
	Sample Size	40	291	16	4	170	1	1	523
Female	Avg. Length	485	565	521	578	563			563
	Std. Error	15.1	1.3	8.3	9.6	2.3			1.3
	Sample Size	7	277	3	9	117			413
All Fish	Avg. Length	490	573	516	574	570	605	595	567
	Std. Error	5.1	1.1	7.7	7.4	1.5			1.1
	Sample Size	47	568	19	13	287	1	1	936

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