

STOCK ASSESSMENT STUDIES OF CHILKAT RIVER

ADULT SALMON STOCKS IN 1998



By

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and
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ABSTRACT

Mark-recapture studies of adult Chilkat River sockeye *Oncorhynchus nerka*, chinook *O. tshawytscha*, and coho *O. kisutch* salmon stocks were conducted by the Alaska Department of Fish and Game (ADF&G) and the Northern Southeastern Regional Aquaculture Association (NSRAA) in 1998. Detailed results for chinook and coho salmon portions of the program will be described in other reports. The objective of the sockeye salmon study was to provide estimates of escapement of sockeye salmon stocks to Chilkat Lake and the Chilkat River. Salmon were captured, marked and released at two fish wheels located on the lower Chilkat River. The total fish wheel catch by species was 5,747 sockeye salmon, 138 chinook, 1,071 coho, 1,738 pink, and 1,947 chum salmon. Of the 5,747 sockeye salmon captured, 5,614 were marked with a primary adipose fin clip and a secondary mark that varied according to timing strata. Of the 5,614 marked sockeye salmon it was determined using scale pattern analysis that 5,021 were of Chilkat Lake origin and 593 were of Chilkat River mainstem area origin. A total of 24,431 sockeye salmon were examined for marks during recovery efforts in Chilkat Lake. Of that number, a total of 305 had been marked at the fish wheels. A total of 517 sockeye salmon were examined for marks during recovery efforts in mainstem spawning areas. Of that number, a total of 22 had been marked at the fish wheels. Tagging and recovery data were pooled to develop estimates of the total inriver abundance of sockeye salmon returning to the Chilkat River. The drainage wide sockeye salmon inriver abundance estimate at the time of tagging was 236,073 (SE 22,373, 95% confidence interval 192,222-279,924) fish. The abundance estimate by stock for Chilkat Lake and mainstem spawning areas was 211,114 and 24,959 fish respectively.

KEY WORDS: mark-recapture, stratified population estimations, escapement estimation, scale pattern analysis, Chilkat River, Chilkat Lake, salmon, fish wheel, age, length and sex composition

INTRODUCTION

Mark-recapture studies have been conducted since 1994 to assess the productivity, run timing, and exploitation patterns of Chilkat River salmon stocks and to monitor trends and changes in inriver abundance (Bergander unpublished data, Beesley and Barto unpublished data). The primary focus of this project is to provide fishery managers with an assessment of sockeye escapement to the Chilkat River and Chilkat Lake (Figure 1) and allow for timely fishing time and area adjustments to the District 115 drift gillnet fishery (Figure 2). Sockeye salmon escapement studies had been conducted at Chilkat Lake from 1967 to 1995 using an enumeration weir (Table 1). Due to the approximate 30-day delay in migratory timing between the marine commercial fishery and the weir the Chilkat River fish wheel program was initiated to provide abundance information on a more timely, inseason basis. In addition, the fish wheel program also provides valuable information about sockeye salmon spawning in mainstem areas in the Chilkat River. Chinook, coho, chum, and pink salmon spawning within the Chilkat River drainage can also be assessed using the fish wheels. The Chilkat River fish wheel program was conducted by the Alaska Department of Fish and Game (ADF&G) in 1977, 1978, 1982, and 1983 and again in 1990 to assess, primarily, chum but also coho salmon escapements in the Chilkat River (Table 2). In 1991 the fish wheel program was modified to assess chinook and sockeye salmon escapement in the Chilkat River, but the program was terminated early due to funding cuts. Since 1994 ADF&G and the Northern Southeastern Aquaculture Association (NSRAA) have worked cooperatively to assess Chilkat River sockeye salmon stocks using fish wheels in the lower river. In 1994 and 1995 the Chilkat Lake weir was operated in conjunction with the fish wheels. Sockeye salmon were captured at the weir and examined for marks applied at the fish wheels. Results of the 1994-95 weir work revealed that Chilkat weir counts were not producing reliable estimates of the sockeye salmon escapement into Chilkat Lake, presumably due to increased openings of the weirs boat gate as well as reversals in water flow in the weired outlet stream. This study also showed that a mark recovery program with marks applied at the lower river fish wheels could provide improved estimates of escapement. As a result, the operation of the weir for escapement purposes was discontinued in 1996 (Bergander unpublished data).

The commercial sockeye salmon harvest in the Lynn Canal (District 115) fishery is comprised of a mixture of Chilkat Lake, Chilkat River, Chilkoot Lake, Berners Bay rivers, 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 pattern analysis can be used inseason and postseason to identify Chilkat Lake, Chilkoot Lake, and "other" (an amalgamation of Chilkat River mainstem, Berners Bay, and other local stocks) sockeye salmon stocks in the Lynn Canal fishery. Scale samples used for SPA standards for Chilkat Lake and mainstem area sockeye salmon stocks are collected by this project.

Sockeye salmon originating in Chilkat Lake and Chilkat River contribute significantly to the Lynn Canal (District 115) commercial drift gillnet fishery. Chilkat Lake has produced annual commercial sockeye salmon harvests as high as 168,361 in 1986, with mean harvests of 96,179 fish for the years 1976 through 1997 (Table 3). Annual harvests of "other" sockeye stocks, which includes Chilkat River mainstem spawning fish, have been as high as 33,429 in 1992 with a mean harvest of 15,515 fish for the years 1976 through 1997 (Table 3). In addition to the commercial harvest, sockeye salmon from Chilkat Lake and the Chilkat River are harvested in the Haines area subsistence fishery. Reported harvests for that fishery for the period 1990 through 1997 averaged approximately 2,800 sockeye salmon (ADF&G unpublished data). In 1998 the preseason projection was for a strong return of Chilkat Lake sockeye salmon (Kelley 1998). The Lynn Canal drift gillnet fishery was managed to target those fish while protecting other stocks present in lesser abundance. Lynn Canal drift gillnet fishery openings and catch by statistical week are summarized in Table 4.

Spawning escapement goals have been established for two separate stocks of sockeye salmon in Chilkat Lake (McPherson 1990). The escapement goal for the early run is 17,500 (range 14,000 to 28,000) fish and the goal for the late run 47,500 (range 52,000 to 106,000) fish. The optimal total escapement goal is the sum of the individual stock goals. No formal escapement goals have been derived for sockeye salmon stocks that spawn in the Chilkat River mainstem. The escapement to mainstem areas is currently monitored through foot surveys. The desired peak foot survey count is 500 to 2,000 fish.

Sockeye salmon escapements to Chilkat Lake have averaged 105,758 annually for the period 1976 through 1997 with a range of 23,947 to 262,852 fish (Table 5). Escapement estimates of sockeye salmon to the Chilkat mainstem areas are available since 1994 and have averaged 30,084 fish from 1994 through 1997 with a high of 53,369 fish in 1996 (Table 6).

Mark-recapture methods were used in 1998 to estimate sockeye salmon escapements to the Chilkat River and Chilkat Lake. Two fish wheels were operated in the lower Chilkat River adjacent to the Haines Highway between 9 and 9.5 miles from downtown Haines, Alaska to capture fish for marking. Marking data and ratios of marked to unmarked fish collected in the mainstem and Chilkat Lake areas were used to develop escapement estimates for sockeye salmon. Trends in fish wheel catches were used inseason to provide a general idea of inriver abundance which allowed managers to adjust commercial fishing effort accordingly. Daily fish wheel catches of all fish species were recorded, and age, length, and sex data were collected from sockeye salmon from fish caught in the Chilkat River fish wheels.

OBJECTIVES

The primary goals of the Chilkat River fish wheel program in 1998 were to obtain information on sockeye salmon escapement to Chilkat Lake and Chilkat River mainstem spawning areas, general distribution of sockeye salmon to these areas, and age-sex-size composition of sockeye salmon stocks in the Chilkat River drainage.

The specific objectives of this project are as follows:

1. Estimate, on a postseason basis, the number of adult sockeye escaping into Chilkat Lake with a precision of $\pm 10\%$, 95% of the time.
2. Estimate the number of sockeye salmon escaping into the mainstem Chilkat River spawning areas with a precision of $\pm 20\%$, 90% of the time.
3. Estimate the age, sex, and length composition of sockeye salmon captured in the Chilkat River fish wheels on a weekly basis with a precision of $\pm 5\%$, 95% of the time.
4. Estimate the annual age, sex, and length composition of the sockeye salmon spawning escapement in Chilkat Lake and the Chilkat River with a precision of $\pm 5\%$, 95% of the time.

5. Estimate the number of Chilkat Lake, Chilkoot Lake and "other" sockeye salmon harvested in the Lynn Canal drift gillnet fishery.

Additional objectives for estimating chinook and coho salmon inriver abundance are presented in project operational plans and reports authored by Randy Ericksen of ADF&G, Sport Fish Division.

METHODS

Study Area Descriptions

The Chilkat River basin, at the head of Lynn Canal in northern southeast Alaska (Figure 1), is bordered by the Takhinsha Mountains and Glacier Bay National Park and Preserve to the south and by the Takshanuk Mountains to the east. The northern and western parts of the basin lie within British Columbia, Canada. The Chilkat River is a large glacial system that originates in Yukon, Canada, and has its terminus near Haines, Alaska. The mainstem and major tributaries (Tsirku, Klehini, Kelsall, and Tahini Rivers) comprise approximately 220 miles of river channel in a watershed covering about 1,000 square miles. The river system originates from many glaciers and flows through rugged mountainous terrain, converging to a turbid, braided river system. This turbidity precludes complete enumeration of salmon escapements in many areas by aerial or foot surveys. Chilkat River stream flow originates as runoff from rain, melting snow, ice, and ground water discharge to the streams from springs and seeps along or in riverbeds. Runoff from melting glacier snow and ice augments stream flow during summer months.

Chilkat Lake (59°19'34" N, 135°53'33" W) is a relatively large clear water lake with a surface area of $9.8 \times 10^6 \text{ m}^2$ (2,432 acres), mean depth of 32.5 m, a maximum depth of 57 m, and a volume of $319 \times 10^6 \text{ m}^3$. The outlet of the lake is located approximately 30 km northwest of the city of Haines, Alaska. Chilkat Lake drains into the Chilkat River by way of the Tsirku River. It is located approximately 27 river miles upstream from the town of Haines near the northern terminus of Lynn Canal (Figure 1). Average precipitation for this area is approximately 165 cm/yr. (Bugliosi 1988). Resident fish include sockeye *O. nerka*, coho *O. kisutch*, pink *O. gorbuscha*, and chum *O. keta* salmon, dolly varden *Salvelinus malma*, cutthroat trout *Salmo clarki*, threespine stickleback *Gasterosteus aculeatus*, and sculpin *Cottus sp.*, with sockeye salmon being the most abundant (Anonymous 1987).

Fish Wheel Operation

Migrating adult salmon were captured with two three-basket fish wheels operated in the Chilkat River near mile 9 and 9.5 Haines Highway from June 8 through October 13 (Statistical Weeks 23-42, Appendix A). They were located approximately 18 miles downstream from Chilkat Lake. Each fish wheel consisted of

two aluminum pontoons, measuring approximately 12 m in length and 6 m in width and filled with closed-cell Styrofoam for flotation. The pontoons supported a framework consisting of an adjustable axle, three catch baskets, and wooden slides and chutes along with two liveboxes per wheel designed to hold live fish prior to sampling. The three catch baskets were rotated about the axle by the force of the water and were adjusted vertically in the water column by moving the axle up or down within tower support channels. As the fish wheel baskets rotated, migrating salmon were captured when they swam under the structure. V-shaped wooden slides bolted to the rib mid-section of each basket directed fish (by gravity through wooden chutes) to aluminum liveboxes bolted to the outer sides of each pontoon.

The aluminum baskets measured 3.1 m (width) by 3.7 m (depth), were covered with nylon seine mesh (5.1 x 5.1 cm openings), and were bolted to a metal axle which spun in a pillow-block bearing assembly. The aluminum baskets fished to a maximum depth of approximately 3.45 m and were adjusted using a raised tower, which rested on the aluminum pontoons. Minimum fishing depth for the aluminum baskets was approximately 1 m but at this depth the baskets lacked the needed contact with the water current and did not spin properly. Several designs for paddles were used to increase the surface area in contact with the water in an attempt to increase revolution speed. Although some improvements were noted, most of the attempts to increase wheel revolutions per minute (rpm) by attaching various paddles to the baskets decreased overall performance of the fish wheels. The depth at which the fish wheels operated in depended primarily upon water velocity. An average river depth of at least 1 meter is required to maintain revolutions adequate to capture migrating salmon (approximately 1.5-4 rpm).

The fish wheels were positioned between 9 and 9.5 mile Haines Highway on the east riverbank, approximately 200-m apart. The fish wheels were secured in position by anchoring to the highway guardrail with 0.95-cm steel cable along with a 1-inch diameter polyethylene rope bridle and were held out from, and parallel to, the shoreline by an adjustable boom log system. The Chilkat River channel at this location is conducive for fish wheel operation, however, seasonal fluctuations in water flow velocities (particularly from late August through early October), required minor changes in fishing location necessary to maintain fish wheel rpm at an acceptable rate. The fish wheels rotated between 0-4 rpm throughout the season, depending on the water velocity and depth in which the wheels fished. When water levels subsided, the fish wheels were moved farther out from shore into faster water currents or moved to an alternate location to maintain a speed of basket rotation adequate to catch fish.

Fish wheel deployment is accomplished by hoisting the fish wheels into the river with a crane and then drifting each wheel down stream into position at chosen sites. At the end of the season, each fish wheel is crane-hoisted onto flat bed trailers and then transported and stored near milepost 10 Haines Highway.

Marking, Tagging, and Sampling Procedures

Data collected and recorded at the fish wheels included daily catch and number of marked and tagged fish by species. In addition, fish wheel effort (hours fish wheels were operational in a 24-hour period), water level, temperature, and weather data were recorded on a daily basis.

All sockeye salmon captured in the fish wheels were sampled for sex and mid-eye to fork of tail (MEF) length. A sub-sample of 260 sockeye salmon per week was sampled for scales which were used for age determination, stock differentiation, and assignment of marked fish to Chilkat Lake and Chilkat River mark groups. All healthy chinook salmon equal to or greater than 440mm MEF were tagged with

uniquely numbered spaghetti tags and sampled for sex, scales, and MEF lengths. Also, every tagged chinook salmon was given a upper left operculum punch used to verify tag loss during recovery. The total sampling goal for chum salmon was 634 fish. To meet that goal, every second chum salmon captured in the fish wheels was sampled for sex, scales, and MEF length. All coho salmon were sampled for sex and MEF length and received a uniquely numbered spaghetti tag. Every second coho was sampled for scales. All tagged coho salmon were also given a primary fin clip mark (dorsal clip) to verify tag loss and a tertiary fin clip according to strata timing. For pink salmon, 25 fish were sampled daily for MEF length and sex only.

All uninjured sockeye salmon were marked with a primary adipose clip and a secondary mark based on timing strata. Marked fish less than or equal to 360 mm MEF (jacks) were subsequently removed from the mark-recapture analysis. Each release or timing strata was established to correspond to approximately 25% of the sockeye run captured in the fish wheels. This was determined by identifying the week that 25%, 50%, 75%, and 100% of the historic (1994-97) Chilkat sockeye stocks were captured in the fish wheels. Strata marks for the 1998 season were as follows:

<i>Statistical Weeks¹</i>	<i>Secondary Mark</i>	<i>Dates</i>
24-31	Left Axillary Clip	June 7 to August 1
32-35	Dorsal Clip	August 2 to August 29
36-37	Left Ventral Clip	August 30 to September 12
38-39	Right Ventral Clip	September 13 to September 26
40-end	Right Axillary Clip	September 27 to October 13

¹Appendix A.

All salmon with serious wounds (most often thought to be seal inflicted) or lethargic in behavior were immediately released and were not marked, tagged, or sampled.

Salmon were dipnetted from the fish wheel liveboxes and placed into a tagging/marking trough partially filled with river water. Fin clip marks were applied to sockeye salmon as follows: one person held the fish in the trough while a second person removed the adipose fin and applied a secondary mark according to what time strata the fish was captured in. Chinook and coho salmon were tagged by insertion of a 15-cm applicator needle and attached spaghetti tag through the musculature immediately below the dorsal fin. The two ends of the tag were passed through a small metal sleeve, which secured the tag when crimped with pliers. Biological sampling was also conducted during application of the marks/tags. Date of sample, sex, and length measurements along with other information about each fish were recorded on mark-sense forms and scale samples were taken from the preferred area of all chinook, sub-samples of sockeye, chum, and coho salmon caught (ADF&G 1994). The tagging and sampling procedures took from 20 to 40 seconds per fish to complete. The fish were then immediately returned to the river.

Fish wheel catches were sampled in the morning (0800-1200 hrs) and late afternoon (1430-1630 hrs) with more frequent checks during periods of peak fish movement.

Mark Recovery

The ADF&G fish wheel crew performed all of the sockeye salmon mark recovery efforts in Chilkat River mainstem areas. Jet drive powered riverboats were used to transport the crew and sampling gear to capture sites. Beach seines and linen gillnets were used to capture the fish. Because a relatively small number of fish were recovered at Chilkat River mainstem locations, every fish captured was sampled for scales, MEF length, and sex. Every captured sockeye salmon was physically handled to determine presence or absence of an adipose fin and if an adipose fin was absent the fish was examined for a secondary mark. Every fish handled for mark recovery was given a lower left opercle punch to allow it to be identified during subsequent sampling trips as previously sampled. Fish were released after sampling. All data was recorded on established data forms.

NSRAA crews conducted mark recovery activities in Chilkat Lake. Sockeye salmon were captured using beach seines and were examined in the same manner as in mainstem areas. Due to relatively large numbers of sockeye captured by NSRAA recovery crews at Chilkat Lake, a sub-sample of 100 fish per week was sampled for scales, MEF length, and sex.

Recovery efforts were conducted once or twice per week beginning July 29 at Chilkat Lake and July 21 at Chilkat mainstem spawning areas. Scheduling of recovery sampling efforts varied based on the percentage of recaptures in a given area to avoid unnecessary handling of fish near spawning areas. Data was exchanged weekly between the NSRAA and ADF&G offices in Haines.

Marking and mark recovery data were organized by ADF&G statistical week for analysis. Statistical weeks begin at 00:01 AM Sunday and end the following Saturday at midnight, with weeks being numbered sequentially beginning with the week encompassing the first Saturday in January. Inclusive dates for 1998 statistical weeks are shown in Appendix A.

Lynn Canal Drift Gillnet Harvest

Estimates of sockeye stock contribution in the Lynn Canal drift gillnet fishery were derived from SPA for scale samples collected each week from the commercial catch. Catches are tabulated during and after each fishery opening using fish ticket information collected from processors and fishing vessels. Commercial catch was reported by fishing period and assigned to a statistical week. ADF&G employees collected sockeye salmon scales from fishing vessels and tenders on the grounds during open fishing periods and at the port of Excursion Inlet at the time of delivery. Scales were obtained from the preferred area of the left side of the fish as shown in ADF&G 1994. Scale samples collected from each fishing period were sent to the ADF&G scale lab at the Region 1 ADF&G office in Douglas for analysis.

Based on the analysis, sockeye salmon harvested in Lynn Canal were assigned to one of three different stock groupings. These groups were Chilkat Lake, Chilkoot Lake, and "others." The "others" group is comprised primarily of Chilkat River mainstem and Berners Bay rivers sockeye salmon but also includes other smaller local stocks. These stock proportions were applied to the total weekly commercial harvest of sockeye salmon. Estimates of the total catch by stock group and ages class were made by applying each age and stock proportion to the catch during each fishing period and summing the estimates across periods.

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 for cases where 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 they allow 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 either of the tests (equal proportions and complete mixing) are not significant ($P>0.05$) then the data may be fully pooled and a Pooled Petersen estimate (PPE) is appropriate.

Assumptions necessary to form consistent (i.e., approaching unbiased as sample size increases) stratified mark-recapture estimates in this study include (Arnason, et al. 1996):

1. All fish that pass the lower Chilkat River fish wheels during the period of interest have a non-zero probability of recovery at the spawning grounds and all fish caught during recovery efforts have a non-zero probability of being marked (i.e., the population is closed).
2. There is no mark loss, mark induced mortality, mark misidentification, or non-reporting of marks. 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 that are linear combinations of other rows or columns respectively.

The drainage-wide sockeye salmon abundance estimate was determined for the time of tagging. The estimate was derived for all mark and recovery data combined. Sockeye salmon that were less than or equal to 360 mm MEF (“jacks”) were subtracted from the number of marks out by week. Sockeye salmon of that size class were also removed from the second event recovery data. Estimates of weekly abundance were determined by multiplying the proportion of the fish wheel sockeye salmon CPUE for each weekly period by the total abundance estimate. The weekly estimates of Chilkat River mainstem and Chilkat Lake sockeye were then determined by multiplying the weekly abundance estimate by the proportion of mainstem and lake fish as determined by SPA.

Sockeye, chinook, chum, and coho 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 (Olsen unpublished data) computer programs. One program summarized age data by statistical week and sex. The other summarized length information by statistical week and sex.

RESULTS

Fish Wheel Operation

In 1998, fish wheels were operated on the Chilkat River from June 8 through October 13. The fish wheel located furthest downstream (FWII), was installed in a three-aluminum basket configuration on June 8 and fished until October 2. The fish wheel located furthest upstream (FWI), was fished in a three-aluminum basket configuration from June 9 through October 13. Fish wheel I was inoperable on September 17 through 18 due to low water flows. It was relocated into a swifter current and was operable through the end of the season. Fish wheel II stopped fishing on October 2 due to lack of sufficient water flow. An attempt to locate a suitable alternate area to fish this wheel after October 2 was unsuccessful. Fish wheel effort (hours of operation per day), rpm, and river physical parameters are summarized in Appendix B. In 1998, the daily water level measurements were near the 1994-97 average for the majority of the season (Figure 3).

Fish Wheel Catches

Dates of operation, daily and cumulative catches, total effort, and catch per unit of fish wheel effort (CPUE) of chinook, sockeye, coho, pink, and chum salmon and Dolly Varden charr *Salvelinus malma* in the Chilkat River fish wheels are listed in Appendices C.1. to C.6. Dates of operation and the total fish wheel catch by species for the 1977, 1978, 1982, 1983, 1990, 1991, and 1994 to 1998 seasons are presented in Table 2. Graphs of the fish wheel CPUE for sockeye, coho, chinook, pink, and chum salmon are provided in Figure 4.

The total catch of 138 chinook salmon in 1998 was the second lowest on record for the period of 1994 to 1998 (Table 2). The 1998 catch of chinook salmon is almost 92% of the historic 1994-1997 average of 150 fish. The daily catch peaked on July 1, 2, and 3, when 5, 10, and 7 fish were captured respectively (Appendix C.1).

The total catch of sockeye salmon in 1998 was 5,747 fish (Appendix C.2). This catch is 1.5 times higher than the 1994 to 1997 average of 3,799 fish and the highest catch on record. Catches occurred from June 10 through October 13. A total of 720 sockeye salmon were captured after September 20, which is the average date of wheel removal for the years 1994 to 1997. In 1998, as in past years, the daily catches fluctuated dramatically. The effects of the drift gillnet commercial fishery in Lynn Canal were observable in the fish wheel catch where net marks and dramatic weekly fluctuations of abundance were noted. Fish wheel catches declined to their lowest weekly levels between Thursday and Saturday indicating an average travel time of three to four days between Lynn Canal and the lower Chilkat fish wheel sites. Catches of sockeye salmon continued through the very end of the season with 51 fish captured in the last seven days of fish wheel operations.

The total 1998 coho salmon catch in the Chilkat River fish wheels was 1,071 fish. The 1990 and 1997 average coho catch was 2,372 fish; 1990 and 1997 were the only other recent years of comparison due to removal of the fish wheels prior to the completion of coho salmon migration (Table 2). Two peaks in fish wheel CPUE and catch occurred, from September 17 to 19 and September 27 to 29 (Appendix C.3).

The 1998 pink salmon fish wheel catch was 1,738 (highest on record, Appendix C.4). This catch was 1.96 times the 1990 and 1994 to 1997 average of 886 fish. This catch was similar to the 1997 catch of 1,657 pink salmon.

The fish wheel catch of chum salmon was 1,947 fish, well below the 1990 and 1997 average of 2,371 fish. The peak daily catch of 137 occurred on September 27 (Appendix C.5).

In 1998 the total Dolly Varden catch in the fish wheels at Chilkat River was 313. Currently, fish wheel catch information is the only information collected for this species (Appendix C.6).

Sockeye Salmon Inriver Abundance

Escapement estimates were derived for sockeye salmon only. Analysis of chinook and coho mark recapture data and results are reported elsewhere (Ericksen, 1999 and 1999b).

Of the 5,747 sockeye salmon captured in the Chilkat River fish wheels during the period from June 19 through October 13 in 1998, 5,614 were marked and released (Table 7). After 148 marked fish less than or equal to 360 mm MEF were removed from consideration, a total of 5,466 marked sockeye salmon were included in the analysis. A total of 329 marked fish were recovered at the mainstem and Chilkat Lake recovery areas. Of that total, 93% (305) were recovered in Chilkat Lake and 7% (22) in mainstem areas.

Tagging and recovery data were pooled into two marking strata and thirteen recovery strata (Table 8). Analysis of this data set resulted in an escapement estimate of 236,073 (SE=22,373, 95% C.I. 192,221 to 279,924) sockeye salmon for the entire Chilkat River drainage (Appendix D).

A necessary assumption of the population estimation technique we used is that all fish in a particular recovery stratum, whether tagged or untagged, have the same capture probability. One factor that could violate this assumption is that tagging and recapture gear are selective for different sized fish. Based on the compared cumulative distribution functions between sockeye salmon marked at the fish wheels and sockeye salmon recovered at Chilkat Lake, it is clear the fish wheels tended to capture a higher proportion of larger fish in 1998 (Figure 5).

Another factor that could lead to substantial bias in the abundance estimate is there were very few late marked fish recovered at Chilkat Lake at the end of the season. Only two fish out of 1,049 fish that were marked in the last two marking strata from the fish wheels were recovered at Chilkat Lake. Recovery crews were unable to capture spawning sockeye at Chilkat Lake beyond November 9 due to low water and ice conditions on the lake. Scales collected from the Chilkat River fish wheel project were analyzed for stock of origin and proportions by stock of the weekly fish wheel catch were developed. The abundance estimate was then multiplied by the weekly stock proportion to generate the weekly passage of sockeye salmon by stock group through the lower Chilkat River (Table 9). The estimated abundance of Chilkat

Lake sockeye salmon is 211,114 fish. This estimate is almost two times the historical 1976-97 average of 105,758 fish (Table 5). The estimated escapement of Chilkat River sockeye salmon is 24,949 fish. This escapement estimate is 83% of the 1994-1997 average of 30,084 fish (Table 6).

Sockeye Salmon Stock Timing

The timing of individual stock groups of sockeye salmon past the Chilkat River fish wheels in 1998 was determined using scale pattern analysis of samples collected at the fish wheels by statistical week (Table 9). Predominant age 1.X proportions of fish from Statistical Weeks 24 through 32 are characteristic of the Chilkat Lake early run. Age 0.X fish (predominantly Chilkat mainstem stocks) have a timing window from Statistical Week 24 through 32 similar to the Chilkat early run. Age 2.X fish (predominantly Chilkat Lake late run) exhibit a greater proportion of the fish wheel catch from Statistical Week 33 through the end of the season (Figure 7).

Age, Length, and Sex Composition

Historical age composition and length-at-age data for Chilkat River salmon stocks along with size and sex ratios of pink salmon sampled in the Chilkat fish wheels is summarized in Tables 10 through 22 by species.

Historical age composition data for sockeye salmon captured in the Chilkat River fish wheels is presented in Table 10. In 1998 age-2.2 fish were most prevalent (35.8%) with age-2.3 fish comprising 26.8%, age-1.3 (25.5%), and age-1.2 (3.9 %), and very small numbers of age-0.1, 0.2, 0.3, 1.1, 2.1, 2.4, 3.2, and 3.3 fish. A historical summary of lengths (MEF mm) at age for sockeye salmon captured in the Chilkat River fish wheels is presented in Table 11. The average length-at-age for the most prevalent age classes of fish sampled at the fish wheels was smaller than the 1989-1991 and 1996-1997 average. For example, the average length for age-1.3 sockeye salmon was 558 mm in 1998 and the historical average is 570 mm.

Historical age and length-at-age data for Chilkat Lake sockeye salmon is summarized in Tables 12 and 13. In 1998 the percentage of age-1.3 sockeye salmon was the highest on record (69.4%) and well above the average of 32.2%. The percentage of age-2.3 fish was well below average, 6.0% compared to a historical average of 35.5%. There were small proportions of age-1.2, 2.1, and 2.4 fish in the sample. The average length-at-age data for sockeye salmon sampled in Chilkat Lake was consistent with the data collected in the fish wheels. The average length in 1998 for a given age class was smaller than the historical average.

Historical age and length-at-age data for Chilkat River mainstem sockeye salmon is summarized in Tables 14 and 15. In 1998 the percentage of age-0.3 sockeye salmon was the highest on record (42.0%) and well above the average of 14.8%. The percentage of age-1.3 fish was well below average, 19.6% compared to a historical average of 26.2%. The proportion of age-0.2 fish was also the highest on record, 28.0% compared to the historical average of 5.2%. There were small proportions of age-0.1, 1.1, and 1.2

fish in the sample. The average length-at-age data for sockeye salmon sampled in the Chilkat River was consistent with the data collected in the fish wheels. The average length in 1998 for a given age class was slightly smaller than the historical average.

For chinook salmon, age 1.1 fish were most prevalent (39.4%) with age 1.4 fish comprising 23.9%, age 1.3 (17.4%), age 1.2 (13.8%) and small numbers of age 1.5 (5.5%) fish (Table 16). Historical length-at-age data for chinook salmon captured in the Chilkat fish wheels is summarized in Table 17.

Two full seasons of age and length data have been collected from adult migrations of coho salmon in the Chilkat River with fish wheels. Age-1.1 fish were the most abundant (61.9%) with age-2.1 fish comprising 23.5% of the sample. Small numbers of 2.0 (12.8%) and 1.0 (1.9%) were also present in the fish wheel catch in 1998 (Table 18). The only other year data was collected from coho salmon was during 1990. Length-at-age data for 1990 and 1998 Chilkat River coho salmon is summarized in Table 19.

Fish wheel catches of chum salmon were comprised mostly of age 0.3 (64.5%) and age 0.4 (29.2%) fish (Table 20). The average length at age for chum salmon captured in the Chilkat River fish wheels was 608, 629, 663, and 660 mm for age 0.2, 0.3, 0.4, and 0.5 fish, respectively (Table 21).

Pink salmon length and sex ratio data was first collected from the Chilkat River fish wheel project in 1998. Pink salmon sex ratios were collected and tabulated weekly to provide insight to the status and timing of the return. The pink salmon return in 1998 peaked in week 33 (Table 22). The percent males in the weekly fish wheel samples peaked in the first week of samples (week 28) and generally declined through the remainder of the season.

Lynn Canal Drift Gillnet Harvest

The Lynn Canal drift gillnet fishery targets stocks of sockeye, chum, and coho salmon. Chinook and pink salmon are harvested incidentally in the fishery. In general, sockeye and summer chum salmon are harvested in the early to late summer periods of the fishery and coho and chum salmon are harvested in the late summer and fall periods (Figure 8).

The annual total Lynn Canal commercial gillnet harvests of sockeye salmon between 1960 and 1997 have ranged between 18,388 and 471,914 fish and averaged 234,938 fish (Table 3). Annual harvests during the most recent five-year period prior to 1998 (1993-1997) averaged 122,955 fish. The 1998 harvest of 134,576 ranked twentieth highest since 1960. The 1998 harvest of sockeye salmon in Lynn Canal occurred over a 14-week period (Table 4). Strategies to manage harvest selectively to protect stocks of sockeye, chinook, coho, and/or chum salmon, while targeting abundant Chilkat Lake sockeye stocks, resulted in substantial variation in the time and locations open to fishing each week (Table 4).

In 1998, sockeye aged 1.3 dominated the catch (49.2%), followed by fish aged 2.3 (31.1%), and 2.2 (15.4%); fish of all other age classes accounted for <3% of the catch (Table 23). Average length-at-age for sockeye salmon harvested in the fishery is summarized in Table 24.

The stock composition of the 134,576 harvested sockeye salmon was estimated to be 120,644 Chilkat Lake fish (89.4%), 2,217 Chilkoot Lake fish (1.6%), and 11,715 fish (8.7%) from "other" stocks (Table 3, Appendix E). Contributions from Chilkat Lake were greater than 60% in all weeks during the

commercial fishing season (Appendix E). Contributions from Chilkoot Lake were not higher than 4% the entire season. "Other" sockeye stocks fish were present in sizable numbers only during the first five weeks of the season and contributed an average of 16% of the catch in those weeks. Historical harvests by week of Chilkat Lake and "other" sockeye salmon in the Lynn Canal drift gillnet fishery are presented in Tables 25 and 26.

The 1998 catch of 120,644 Chilkat Lake sockeye salmon was 1.2 times the 1976 through 1997 average catch of 96,179 fish (Table 3). The 1998 harvest of 11,715 "other" sockeye salmon was 75% of the 1976 through 1997 average of 15,515 fish.

The Chilkat Lake sockeye salmon run was exploited by the Lynn Canal drift gillnet fishery at an estimated rate of 36.4%, compared to a 1976-1997 average of 50.0%. The estimated total run (escapement + harvest) of Chilkat Lake sockeye salmon in 1998 was estimated to be 331,758 fish, 1.6 times the 1976 through 1997 average of 201,937 fish (Figure 9). Total return and exploitation rate information for the Chilkat mainstem sockeye stock could not be determined as it is not possible to differentiate Chilkat River mainstem sockeye salmon from Berners Bay rivers fish in the commercial drift gillnet harvests.

DISCUSSION

The accuracy of mark-recapture studies in providing estimates of abundance is dependent on the degree to which the underlying assumptions of the analytical methods used are satisfied. In estimating the abundance of adult sockeye salmon present in Chilkat Lake and mainstem areas we assumed: (a) marking of adult sockeye salmon was in proportion to their numbers immigrating over time, (b) no sockeye entered or left the system 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, and (d) the probability of recovering sockeye salmon is independent of its marked/unmarked status.

Assumption (a) is addressed by the fact that Chilkat River fish wheels are used in a consistent manner throughout the season and recovery efforts at Chilkat Lake and mainstem areas are conducted weekly. Both of the fish wheels were strictly maintained and adjusted throughout the bulk of the sockeye run. Fluctuating river conditions affect the fishing efficiencies of both wheels and recovery gear used in spawning locations. We are able to work around this variation in gear efficiency for sockeye salmon by using the Darroch stratified estimator for the Chilkat Lake and mainstem abundance estimate, which allows the probabilities of capture in tagging and recovery strata to vary across time but not within these strata. We assume that mark mis-identification and marking induced mortality were negligible.

Kelley et al. (1997) concluded that tagging and handling procedures could effect fish behavior and survival (assumptions c and d). Their study conducted on the Taku River on the Canyon Island fish wheel project found that effects can be species-specific. It was found that tagged chinook salmon recaptured in the fish wheels had been delayed for a much longer period (mean 12.3 days) than either sockeye (mean 3.6 days) or coho (mean 4.3 days) salmon; these results are similar to those seen in 1988 (McGregor and Clark 1989). It is assumed that these fish dropped back or held in the vicinity of the capture site. The effects of the length of holding time, the time that fish are held in the fish wheel liveboxes before being tagged or marked, was examined for chinook, sockeye, and coho salmon in 1996. No significant differences in elapsed days from

release to recovery in the inriver commercial fishery were apparent between the long holding time groups and short holding time groups for all chinook, sockeye, and coho salmon. There were also no substantial differences in tag recovery rate for a given species for the two holding times similar to observations of McGregor and Clark (1989) for chinook salmon in 1988.

All marks were easily recognizable at the spawning grounds and a specific well-trained crew was responsible for all recovery events at Chilkat Lake and mainstem areas. Estimates could be improved by accurate knowledge of the number of marks removed through mortality by subsistence fisheries and fish wheel sampling and marking (assumption c).

It is likely that assumption (b) was violated in this experiment. Of a total of 1,838 sockeye salmon marked at the fish wheels during the period August 30 through October 13 only 10 were recovered in subsequent recovery efforts. The probable cause for this low recovery rate is the lag time between when the fish were captured in the fish wheels and when they were available for capture in beach seines in Chilkat Lake. The lake recovery crew had to cease recovery efforts in early November due to lake accessibility considerations and icing on the lake. This problem could be addressed by using a weir at the outlet of Chilkat Lake as a recovery platform. Based on historical run timing from weir data collected from 1976 to 1995, the bulk of the sockeye salmon return to the lake passed the weir site by late September or early October.

In addition, there is a significant difference in the cumulative distribution frequencies for length between fish sampled at the fish wheel site and in the lake. The proportion of smaller fish was significantly higher in the lake and mainstem areas than in the fish wheels indicating that the fish wheels were biased for larger fish or, alternatively, those lake and mainstem recoveries were biased towards smaller fish (Figure 5). This phenomenon could be minimized by a) completely removing smaller (jack) sockeye salmon from the experiment and (b) stratifying abundance estimates by size if the data were available.

Closer examination of length frequency and age composition data from the fish wheels and from samples collected during recovery efforts in Chilkat Lake and Chilkat River mainstem indicate that it is likely that inlake sampling may not have been representative of the entire return (Figure 6). For example, the age composition for age-1.3, age-2.2, and age 2.3 sockeye salmon was 25.5, 35.8, and 26.8 percent respectively (Table 10). The age composition in Chilkat Lake for age-1.3, age-2.2, and age-2.3 fish was 69.4, 19.0, and 6.0 percent respectively (Table 12). It is likely that because samples were not collected in Chilkat Lake after October 5 due to difficulty in accessing the lake age-2.X fish, that have a generally later return timing (Figure 6) were not present on the spawning beaches where crews conducted seining operations. The results of the length-at-age data also provide further insight related to size differences between fish captured in the fish wheels and fish captured in the lake. The average length-at-age for age-2.3 and age-2.2 fish sampled in the wheels was 504 and 568 mm MEF respectively. For fish sampled in the lake, the average length-at-age for age-2.2 and age-2.3 fish was 475 and 542 respectively (Tables 11 and 13).

Sampling bias for the Chilkat Lake recovery portion of the project could be greatly reduced if sockeye salmon were sampled at a weir in the outlet stream instead of on the spawning beaches. Based on historical weir data (Figure 10) approximately 99% of the Chilkat Lake sockeye salmon are past the weir by October 31.

Abundance estimates for the Chilkat Lake and Chilkat River mainstem components of the escapement were based on weekly fish wheel CPUE. It is known that fish wheel efficiency changes as river level fluctuates. It is also known that the Chilkat River sockeye salmon stock composition changes through time. These factors may induce bias in the total and weekly estimates of abundance for different components of the return. Any such bias could be minimized if we had the ability to generate separate estimates of abundance directly from the mark-recapture experiment.

Aluminum fish wheels were used for the second year in 1998 at Chilkat River. The basic goals we had in modifying the design modifications for aluminum fish wheels were to build a salmon sampling device that would: (1) deploy, transport, and adjust more easily than the wooden wheel types of previous years, (2) be resistant to damage from impacts with river born debris, and (3) have a longer service life thus reducing costs overall by minimizing labor incurred during assembly and routine maintenance. The aluminum liveboxes and catch baskets will undoubtedly have a longer service life than the previous wooden designs, thus saving crew labor time and material costs. The wheels performed very well this season and minimal repair and maintenance was needed to maintain operations throughout the salmon migration period. Similar to 1997, seasonal changes in river flow often inhibited the fish wheels in maintaining adequate rpm necessary to effectively capture salmon. This necessitated relocating the fish wheels to areas of faster and deeper water. A mechanical boom log system similar in design developed for the Taku River fish wheel project was installed onto the Chilkat River fish wheels in 1998. This improvement allowed each fish wheel to be positioned away from the riverbank to a desired distance by use of a cable hoist attached to a 15 foot limbed log. The log with a diameter not greater than 15 cm is guided through a series of steel rings bolted to the front walkway of the fish wheel. As tension is applied to the cable hoist, the log is forced through the steel rings and against the riverbank extending the fish wheel away from the bank. As the cable hoist is shortened the boom log retracts and the fish wheel pulls in closer to the bank.

Improvements for 1999 include replacing an aluminum axle on one of the fish wheels with a new steel axle similar to those used on the Taku fish wheel project. A new design for chutes used to “funnel” fish from the basket slides to the live boxes was devised for deployment during the 1999 season. This new design is similar to the older design except it has a plastic or canvas tube or slide extension that allows fish to be guided directly into the live box. New hoist cables will be installed on all ends of the fish wheel pontoons to maintain safety when fish wheels are hoisted into the air for deployment and retrieval. Modifications will be performed to allow use of chain hoists to raise and lower the basket assembly vertically in the water column.

ADF&G managers use abundance and stock composition data from this program together with fishery performance data from the drift gillnet fishery in Lynn Canal to adjust fishing times, catches, and escapements in order to meet escapement goal requirements (Kelley 1998). Information from this project is used to determine if escapement goals are being attained, to assess the effects of various management decisions on the escapement levels, and to provide data needed to reconstruct the run size of Chilkat Lake and mainstem 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.

RECOMMENDATIONS

- 1) Operate the weir at the outlet of Chilkat Lake as a mark-recovery platform in 1999 and all subsequent years.
- 2) Discontinue marking sockeye salmon less than 360 mm MEF in the fish wheels and do not include fish of this size in recovery data.

- 3) Generate distinct estimates of escapement for Chilkat Lake and Chilkat River mainstem sockeye salmon using mark-recapture methods.
- 4) Make necessary safety and fish handling modifications to the fish wheels.

LITERATURE CITED

- ADF&G. 1994. Length, sex, and sampling procedures for sampling using the ADF&G adult salmon age-length mark sense form, version 3.0. Region I Informational Report 1J94-06, Juneau.
- Anonymous. 1987. Catalog of waters important for spawning, rearing, or mitigation of anadromous fishes. Alaska Department of Fish and Game, Habitat Division, Juneau, Alaska.
- Arnason, A. N., C. W. Kirby, C. J. Schwarz, and J. R. Irvine. 1996. Computer analysis of data from stratified mark-recovery experiments for estimation of salmon escapements and other populations. Canadian Technical Report of Fisheries and Aquatic Sciences. 2106.
- Bugliosi, E. F. 1988. Hydrologic reconnaissance of the Chilkat River Basin, southeast Alaska. U.S. Geological Survey, Water-Resources Investigations Report 88-4023.
- Chapman, D. G. and C. O. Junge. 1956. The estimation of the size of a stratified animal population. *Annals of Mathematical Statistics*. 27.
- Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and sampling are stratified. *Biometrika*. 48.
- Ericksen, R. P. 1999. Abundance of coho salmon in the Chilkat River in 1998. Alaska Department of Fish and Game, Division of Sport Fish. Fishery Data Series No. 99.29.
- Ericksen, R. P. 1999b. Sport fishing effort, catch, and harvest, fishery contributions, and inriver abundance of Chilkat River chinook salmon near Haines, Alaska, in 1998. Alaska Department of Fish and Game, Division of Sport Fish. Fishery Data Series No. 99.19.
- Kelley, M. S., P. Milligan, and A. J. McGregor. 1997. Adult mark-recapture studies of Taku River adult salmon stocks in 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 1J97-01. Juneau.
- Kelley, M. S. 1998. Fishery Management Plan for the Lynn Canal (District 15) Drift Gillnet Fishery 1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 1J98-22. Juneau.
- Marshall, S. L., S. A. McPherson, and S. Sharr. 1982. Origins of sockeye salmon (*Oncorhynchus nerka*) in the Lynn Canal drift gillnet fishery of 1981 based on scale pattern analysis. Alaska Department of Fish and Game, Technical Data Report No. 75.
- McGregor, A. J. and J. E. Clark. 1989. Migratory timing and escapement of Taku River salmon stocks in 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 1J89-40, Juneau.
- McPherson, S. A., F. E. Bergander, M. A. Olsen, and R. R. Riffe. 1992. Contribution, exploitation, and migratory timing of Lynn Canal sockeye salmon runs in 1989 based on analysis of scale patterns. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report No. 92-21.
- McPherson, S. A. 1989. Contribution, exploitation, and migratory timing of Lynn Canal sockeye salmon runs in 1987 based on analysis of scale patterns. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J89-18.
- McPherson, S. A. 1987. Contribution, exploitation, and migratory timing of sockeye salmon (*Oncorhynchus nerka* Walbaum) stocks to Lynn Canal in 1985 based on analysis of scale patterns. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 217, Juneau.

LITERATURE CITED (Continued)

- McPherson, S. A., and S. Marshall. 1986. Contribution, exploitation, and migratory timing of Chilkat and Chilkoot River runs of sockeye salmon (*Oncorhynchus nerka* Walbaum) in the Lynn Canal drift gill net fishery of 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 165, Juneau.
- McPherson, S. A., A. J. McGregor, and S. L. Marshall. 1983. Origins of Sockeye salmon *Oncorhynchus nerka* in the Lynn Canal drift gillnet fishery of 1982 based on scale pattern analysis. Alaska Department of Fish and Game, Technical Data Report No. 87.
- McPherson, S. A. 1990. An in-season management system for sockeye salmon returns to Lynn Canal, southeast Alaska. Masters of Science Thesis.
- McGregor, A. J., P. A. Milligan, and J. E. Clark. 1991. Adult mark-recapture studies of Taku River salmon stocks in 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 91-05, Juneau.
- Plante, N. 1990. Estimation de la taille d'une population animale à l'aide d'une modèle de capture recapture avec stratification. M. Sc. thesis, Université Laval, Quebec.

Table 1. Chilkat Lake weir dates of operation and catches of sockeye, coho, pink, and chum salmon, 1967 to 1995.

Year	Dates of Operation	Sockeye	Coho	Pink	Chum
1967	6/13-9/02	20,111	n/a	n/a	n/a
1968	6/08-9/12	41,246	168 ^a	4 ^a	n/a
1969	6/04-9/16	44,555	n/a	n/a	n/a
1970	5/29-9/17	41,085	n/a	n/a	n/a
1971	5/31-10/28	49,342	1,063 ^a	n/a	n/a
1972	6/03-10/12	51,850	518 ^a	n/a	n/a
1973	6/11-10/15	50,527	167 ^a	n/a	n/a
1974	5/30-9/28	82,811	161 ^a	n/a	n/a
1975	6/04-11/06	41,520	644 ^a	n/a	n/a
1976	6/03-10/21	69,723	204 ^a	n/a	n/a
1977	6/03-9/27	41,044	n/a	n/a	n/a
1978	6/05-11/05	67,520	390 ^a	n/a	n/a
1979	6/09-11/11	80,589	965 ^a	n/a	n/a
1980	6/15-10/8	87,847	n/a	n/a	n/a
1981	6/11-10/22	82,597	n/a	n/a	n/a
1982	6/24-10/06	80,208	n/a	n/a	n/a
1983	6/22-11/12	134,022	n/a	n/a	n/a
1984	6/09-10/07	115,269	n/a	n/a	n/a
1985	6/23-10/22	57,724	n/a	n/a	n/a
1986	6/16-11/14	23,947	n/a	n/a	n/a
1987	6/19-11/20	48,593	n/a	n/a	n/a
1988	6/18-11/14	27,575	n/a	n/a	n/a
1989	6/05-10/28	140,475	n/a	n/a	n/a
1990	6/06-11/13	53,780	n/a	n/a	n/a
1991	7/10-10/24	47,436	n/a	n/a	n/a
1992	6/08-10/15	94,278	1,052	2	41
1993	6/13-10/14	210,257	595	0	5
1994	5/20-10/05	80,788	797	0	0
1995	6/08-10/09	59,698	797	0	0

All counts acquired from Alaska Department of Fish and Game Alexander database except:

^a Numbers were taken from Bergander 1982, Sockeye Stock Assessment and Evaluation – S. E. Alaska. Project No. AFC-60-4. Anadromous Fish Conservation Act.

Table 2. Chilkat fish wheels dates of operation and catches of chinook, sockeye, coho, pink, and chum salmon, 1977, 1978, 1982, 1983, 1990, 1991, 1994 to 1998.

Year	Dates of Operation	Chinook	Sockeye	Coho	Pink	Chum	Wheel Type and Number of Baskets
1977	8/21-10/21	0	108	729	0	604	N/A
1978	8/14-11/9	0	119	369	14	1,586	N/A
1982	10/5-26	0	10	78	0	254	One wooden two-basket wheel
1983	8/9-10/3	0	299	190	67	176	One wooden two-basket wheel
1990	8/14-10/25	0	2,984	3,686	1,140	3,025	Two wooden four – basket wheels
1991	6/10-7/20	382	1,385	0	578	8	Two wooden four – basket wheels
1994	6/18-9/11	214	3,865	140	532	196	Two wooden four – basket wheels
1995	6/16-9/16	139	3,231	1,353	609	2,288	Two wooden four – basket wheels
1996	6/22-9/16	68	3,118	546	494	430	Two wooden four – basket wheels
1997	6/11-10/9	179	5,016	1,057	1,657	1,315	Two aluminum three-basket wheels
1998	6/8-10/13	138	5,747	1,071	1,738	1,947	Two aluminum three-basket wheels

Table 3. Catches, escapements, annual total runs, and exploitation rates of Lynn Canal (District 115) sockeye salmon stocks, 1960-1998.

Year	Sockeye Stock										"Other" Total Sockeye		
	% Total Chilkat Lake			% Total Lynn Canal			% Total Chilkoot Lake			% Total Lynn Canal			
	Catch	Esc.	Total Run	Catch	Expl. Rate	Catch	Esc.	Total Run	Catch	Expl. Rate	Catch	Esc. ^a	Lynn Canal Catch
1960													59,604
1961													67,860
1962													103,696
1963													57,518
1964													68,200
1965													89,046
1966													108,086
1967		20,111	20,111										66,621
1968		41,246	41,246										80,004
1969		44,555	44,555										127,869
1970		41,085	41,085										79,115
1971		49,342	49,342										75,147
1972		51,850	51,850										81,010
1973		50,527	50,527										193,701
1974		82,811	82,811										152,014
1975		41,520	41,520										18,338
1976	59,328	69,729	129,057	46.9	0.46	62,452	71,297	133,749	49.3	0.47	4,842		126,622
1977	41,389	41,044	82,433	25.9	0.50	113,313	97,051	210,364	70.8	0.54	5,377		160,079
1978	89,558	67,528	157,086	82.6	0.57	14,264	35,454	49,718	13.1	0.29	4,658		108,480
1979	115,994	80,589	196,583	60.1	0.59	69,864	95,946	165,810	36.2	0.42	7,116		192,974
1980	30,681	95,347	126,028	57.8	0.24	20,846	96,512	117,358	39.3	0.18	1,558		53,085
1981	48,460	84,089	132,549	51.9	0.37	43,792	83,372	127,164	46.9	0.34	1,071 ^b		93,323
1982	127,036	80,221	207,257	46.4	0.61	144,592	102,973	247,565	52.9	0.58	1,908 ^b		273,536
1983	123,888	134,207	258,095	33.5	0.48	241,469	80,343	321,812	65.4	0.75	3,955 ^b		369,312
1984	98,231	115,269	213,500	29.4	0.46	231,792	100,417	332,209	69.3	0.70	4,350 ^b		334,373
1985	135,503	57,724	193,227	44.6	0.70	152,325	69,026	221,351	50.1	0.69	16,178		304,006
1986	168,361	23,947	192,308	58.0	0.88	110,430	88,024	198,454	38.1	0.56	11,414		290,205
1987	70,069	48,593	118,662	16.9	0.59	334,995	95,185	430,180	80.6	0.78	10,751		415,815
1988	76,473	27,593	104,066	21.8	0.73	253,968	81,274	335,242	72.2	0.76	21,110		351,551
1989	159,446	140,475	299,921	33.8	0.53	291,863	54,900	346,763	61.8	0.84	20,625		471,934
1990	147,056	60,231	207,287	41.2	0.71	178,864	73,324	252,188	50.1	0.71	31,044		356,964
1991	59,806	52,889	112,695	19.4	0.53	224,041	90,638	314,679	72.8	0.71	23,964		307,811
1992	111,887	97,740	209,627	39.1	0.53	140,719	67,071	207,790	49.2	0.68	33,429		286,035
1993	100,717	209,730	310,447	58.9	0.32	51,424	51,827	103,251	30.1	0.50	18,985		171,126
1994	122,212	153,540 ^a	275,752	73.2	0.44	25,414	37,416	62,830	15.2	0.40	19,252	26,186 ^c	166,878
1995	63,396	184,541 ^a	247,937	79.5	0.26	7,946	7,209	15,155	10.0	0.52	8,430	26,080 ^c	79,772
1996	96,380	262,852 ^a	359,232	66.9	0.27	18,861	50,739	69,600	13.1	0.27	28,893	53,369 ^c	144,134
1997	70,056	238,803 ^a	308,859	63.3	0.23	28,913	44,254	73,167	26.1	0.40	11,642	14,699 ^c	110,611
1998	120,644	211,114 ^a	331,758	89.6	0.36	2,217	12,335	14,541	1.6	0.15	11,715	24,959 ^c	134,576
1976-1997													
Mean	96,179	82,608	201,937	47.8	0.50	125,552	71,557	197,109	46.0	0.55	15,515	30,084	234,938
Min	30,681	23,947	82,433	16.9	0.23	2,206	7,209	14,541	1.6	0.15	1,558	13,196	53,987
Max	168,361	262,852	430,106	91.5	0.88	334,995	102,973	430,180	80.7	0.84	33,429	53,369	471,914

^a Escapement derived from mark-recapture estimates.

^b Catch broken out for age-0. fish only.

^c Estimates of escapement is for Chilkat Mainstem sockeye only, mark-recapture estimates.

Table 4. Fishery openings, effort and harvest of salmon in Lynn Canal (District 115) by statistical week, 1998.

Week	Catch					Dollar Value	Boats	Hours Open	No. Landings
	Chinook	Sockeye	Coho	Pink	Chum				
26 ^a	125	4,310	33	21	7,510	\$37,907	64	48	90
27 ^b	124	8,820	47	1,812	6,100	\$36,224	36	72	82
28 ^c	102	15,746	80	3,273	42,537	\$94,151	63	120	145
29 ^d	96	21,199	114	3,618	36,530	\$145,131	60	120	201
30 ^e	83	15,845	93	3,886	33,399	\$120,636	64	120	184
31 ^f	43	15,111	38	4,688	10,439	\$109,959	60	96	166
32 ^g	78	19,216	134	7,321	3,221	\$151,944	62	120	205
33 ^h	17	13,262	198	4,301	1,694	\$117,019	60	96	156
34 ⁱ	5	9,916	555	1,598	1,689	\$91,973	47	72	106
35 ^j	3	5,046	3,112	1,198	2,487	\$57,175	56	48	80
36 ^k	1	2,713	3,830	633	2,423	\$38,366	51	48	76
37 ^l	2	2,238	6,006	2	4,443	\$53,187	56	48	79
38 ^m	3	1,127	6,046	0	5,195	\$46,138	51	48	82
39 ⁿ	0	388	5,832	0	3,002	\$35,154	41	72	62
Total	682	134,937	26,118	32,351	160,669	\$1,134,964	771	1,128	1,714

Notes to openings:

^a Week 26. Section 15-A: open from 12:01 p.m., Sunday, June 21 through 12:00 noon Tuesday, June 23 with the following restrictions: Chilkat and Chilkoot Inlets: closed north of the latitude of Seduction Point.

Section 15-C: open from 12:01 p.m., Sunday, June 21 through 12:00 noon Tuesday, June 23, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance Point to a point 2.4 miles north of Point Whidbey.

^b Week 27. Section 15-A: open from 12:01 p.m., Sunday, June 28 through 12:00 noon Wednesday, July 1, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: closed north of the latitude of Seduction Point.

Section 15-C: (Boat Harbor Area): open from 12:01 p.m., Sunday, June 28 through 12:00 noon Wednesday, July 1, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance Point to a point 2.4 miles north of Point Whidbey.

^c Week 28. Section 15-A: open from 12:01 p.m., Sunday, July 5 through 12:00 noon Friday, July 10, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: closed north of the latitude of Glacier Point.

Section 15-C: open from 12:01 p.m., Sunday, July 5 through 12:00 noon Tuesday, July 7, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance

Point and in all remaining waters of Section 15-C south of the latitude of Point Bridget with the following restriction: Gillnet Mesh Restriction in Section 15-C with the exception of the Boat Harbor area: from 12:01 p.m. Sunday, July 5 through 12:00 noon Tuesday, July 7, gillnets fished in Section 15-C (with the exception of the Boat Harbor area) must have a minimum mesh size of six inches.

Section 15-C: (Boat Harbor Area): open until further notice in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey with no mesh size restriction.

- ^d Week 29. Section 15-A: open from 12:01 p.m., Sunday, July 12 through 12:00 noon Friday, July 17, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: closed north of the latitude of the northernmost tip of Kochu Island.

Section 15-C: open from 12:01 p.m., Sunday, July 12 through 12:00 noon Tuesday, July 14, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance Point and in all remaining waters of Section 15-C south of the latitude of Point Bridget with the following restriction: Gillnet Mesh Restriction in Section 15-C with the exception of the Boat Harbor area: from 12:01 p.m. Sunday, July 12 through 12:00 noon Tuesday, July 14, gillnets fished in Section 15-C (with the exception of the Boat Harbor area) must have a minimum mesh size of six inches. Section 15-C: (Boat Harbor Area): open until further notice in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey with no mesh size restriction.

- ^e Week 30. Section 15-A: open from 12:01 p.m., Sunday, July 19 through 12:00 noon Friday, July 24, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: open to the mouth of the Chilkat River.

Section 15-C: open from 12:01 p.m., Sunday, July 19 through 12:00 noon Tuesday, July 21, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance Point and in all remaining waters of Section 15-C south of the latitude of Point Bridget with the following restriction: Gillnet Mesh Restriction in Section 15-C with the exception of the Boat Harbor area: from 12:01 p.m. Sunday, July 19 through 12:00 noon Tuesday, July 21, gillnets fished in Section 15-C (with the exception of the Boat Harbor area) must have a minimum mesh size of six inches. Section 15-C: (Boat Harbor Area): open until further notice in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey with no mesh size restriction.

- ^f Week 31. Section 15-A: open from 12:01 p.m., Sunday, July 26 through 12:00 noon Thursday, July 30, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: open to the mouth of the Chilkat River.

Section 15-C: open from 12:01 p.m., Sunday, July 26 through 12:00 noon Tuesday, July 28, in those waters within two nautical miles of the western shoreline of Lynn Canal south of the latitude of Lance

Point and in all remaining waters of Section 15-C south of the latitude of Point Bridget with the following restriction: Gillnet Mesh Restriction in Section 15-C with the exception of the Boat Harbor area: from 12:01 p.m. Sunday, July 26 through 12:00 noon Tuesday, July 28, gillnets fished in Section 15-C (with the exception of the Boat Harbor area) must have a minimum mesh size of six inches. Section 15-C: (Boat Harbor Area): open until further notice in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey with no mesh size restriction.

- ^g Week 32. Section 15-A: open from 12:01 p.m., Sunday, August 2 through 12:00 noon Friday, August 7, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: open to the mouth of the Chilkat River.

Section 15-C: open until further notice only in the Boat Harbor area in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey.

- ^h Week 33. Section 15-A: open from 12:01 p.m., Sunday, August 9 through 12:00 noon Thursday, August 13, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: open to the mouth of the Chilkat River.

Section 15-C: open until further notice only in those waters within two nautical miles of the western shoreline of Lynn Canal from the latitude of Lance Point south to a point 2.4 miles north of Point Whidbey. The remaining waters of Section 15-C are closed.

- ⁱ Week 34. Section 15-A: open from 12:01 p.m., Sunday, August 16 through 12:00 noon Wednesday, August 20, 1998, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: closed north of the latitude of Letnikof Point (normal markers).

Section 15-C: closed.

- ^j Week 35. Section 15-A: open from 12:01 p.m., Monday, August 24 through 12:00 noon Wednesday, August 26, in the waters of Lynn Canal west of a line beginning at a point within two nautical miles of the western shoreline of Lynn Canal at the latitude of Point Sherman, to Sullivan Rock Light, to Eldred Rock Light, to the southernmost tip of Talsani Island, to the northernmost tip of Talsani Island to Seduction Point, with the following restriction: Chilkat Inlet: closed north of the latitude of Glacier Point.

Section 15-C: will open from 12:01 p.m., Monday, August 24 through 12:00 noon Wednesday, August 26.

- ^k Week 36. Section 15-A: open from 12:01 p.m., Sunday, August 30 through 12:00 noon Tuesday, September 1, in the waters of Lynn Canal south of the latitude of Seduction Point.

Section 15-C: open from 12:01 p.m., Sunday, August 30 through 12:00 noon Tuesday, September 1.

- ^l Week 37. Section 15-A: open from 12:01 p.m., Sunday, September 13 through 12:00 noon Tuesday, September 15, in the waters of Lynn Canal south of the latitude of the northernmost tip of Sullivan Island.

Section 15-C: open from 12:01 p.m., Sunday, September 13 through 12:00 noon Tuesday, September 15.

- ^m Week 38. Section 15-A: open from 12:01 p.m., Sunday, September 13 through 12:00 noon Tuesday, September 15, in the waters of Lynn Canal south of the latitude of the northernmost tip of Sullivan Island.

Section 15-C: open from 12:01 p.m., Sunday, September 13 through 12:00 noon Tuesday, September 15.

- ⁿ Week 39. Section 15-A: closed.

Section 15-C: open from 12:01 p.m., Sunday, September 20 through 12:00 noon Wednesday, September 23.

Table 5. Historical estimated escapements of Chilkat Lake sockeye salmon by week, 1976 to 1998^a.

Mid-Week	Stat.												
Date	Week	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
3-Jun	23	0	0	0	0	0	0	0	0	0	0	0	0
10-Jun	24	1	0	22	6	0	0	0	0	0	0	0	0
17-Jun	25	0	214	476	44	72	3	0	0	302	0	0	0
24-Jun	26	433	305	1,302	698	887	0	31	368	1,441	7	4	88
1-Jul	27	944	572	8,622	6,930	1,152	5	532	1,248	5,436	98	2	1,777
8-Jul	28	2,437	773	2,751	2,081	3,560	141	605	11,144	623	1,317	602	2,197
15-Jul	29	1,140	207	11,816	8,576	4,355	549	461	15,284	3,280	1,141	139	5,601
22-Jul	30	2,055	542	1,310	4,068	4,575	1,071	2,515	8,935	6,011	334	20	2,542
29-Jul	31	2,816	711	1,814	1,413	2,100	1,002	1,743	10,750	929	812	24	1
5-Aug	32	310	1,184	40	2,056	2,100	266	3,496	6,865	141	2,029	1	123
12-Aug	33	2,740	725	1,078	5,895	2,100	729	509	4,254	2,971	157	3	1,776
19-Aug	34	9,810	968	1,634	7,288	5,666	1,450	4,073	5,589	1,417	1,555	138	1,875
26-Aug	35	4,283	1,269	1,246	11,212	6,910	767	5,151	1,433	14,899	4,434	736	6,193
2-Sep	36	6,799	18,711	5,670	3,639	10,351	4,967	1,575	5,475	18,015	3,271	1,006	1,618
9-Sep	37	17,483	8,664	6,106	19,464	29,613	18,652	6,091	10,526	18,512	3,372	5,364	27
16-Sep	38	9,655	144	7,747	12	10,739	1,113	20,378	21,097	21,106	12,639	6,943	259
23-Sep	39	5,584	5,821	9,469	2,353	7,015	6,134	25,516	9,455	17,510	17,688	3,796	18,033
30-Sep	40	0	234	6,334	1,413	3,374	32,516	7,467	9,398	2,252	5,258	3,762	6,165
7-Oct	41	3,001	0	91	2,125	778	10,222	78	7,305	424	2,009	831	0
14-Oct	42	238			1,316		4,502		5,081		1,603	576	318
Yearly Total		69,729	41,044	67,528	80,589	95,347	84,089	80,221	134,207	115,269	57,724	23,947	48,593
Weekly Mean		3,486	2,160	3,554	4,029	5,609	4,672	5,014	7,895	6,067	3,396	1,330	2,700
Early Stock		17,582	9,437	17,924	30,433	10,253	10,617	9,640	47,885	28,193	7,449	2,536	13,345
Late Stock		52,147	31,607	49,604	50,156	85,094	73,472	70,581	86,322	87,076	50,275	21,411	35,248

^a Escapement estimates based on weir counts in 1976 to 1993 and on mark-recapture estimates from fish wheel program in 1994 to 1998.

-continued-

Table 5. (page 2 of 2)

Mid-Week	Stat.												76-97
Date	Week	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Mean
3-Jun	23	0	62	0	1	0	0	0	0	0	0	0	3
10-Jun	24	0	689	202	44	10	0	0	57	0	476	395	69
17-Jun	25	0	5,802	639	305	53	75	0	2,232	0	1,857	2,562	549
24-Jun	26	59	10,690	3,615	901	1,016	1,745	1,510	5,323	2,720	3,618	6,382	1,671
1-Jul	27	2,015	7,845	1,660	1,600	1,653	3,557	3,456	8,471	11,051	11,759	12,307	3,654
8-Jul	28	496	2,295	4,353	1,971	1,762	4,240	8,223	9,674	32,814	5,951	10,495	4,546
15-Jul	29	9	8,126	9,566	503	6,529	3,552	5,125	9,387	28,393	5,713	12,343	5,884
22-Jul	30	722	15,810	2,380	2,812	5,034	7,615	8,025	18,775	28,308	13,187	9,500	6,211
29-Jul	31	1,969	3,161	1,449	2,234	2,263	5,336	8,184	17,172	26,778	16,044	10,900	4,941
5-Aug	32	1,965	4,340	1,925	3,724	3,579	6,490	9,375	17,973	42,335	22,138	15,897	6,021
12-Aug	33	200	11	380	1,821	1,197	14,537	34,085	15,054	22,358	11,283	17,350	5,630
19-Aug	34	566	3,207	2,948	4,295	5,768	6,643	17,559	25,643	17,767	9,617	16,221	6,158
26-Aug	35	280	7,582	7,167	10,732	10,357	23,593	16,367	21,007	21,848	14,521	19,738	8,727
2-Sep	36	469	8,379	9,647	5,380	13,172	19,677	19,346	13,394	13,942	18,044	12,723	9,207
9-Sep	37	7,973	15,019	259	2,260	6,014	1,251	18,274	20,377	14,112	27,518	19,149	11,679
16-Sep	38	2,254	34,155	664	3,264	8,779	61,222	4,012		425	42,800	12,857	12,829
23-Sep	39	2,747	2,713	4,465	1,873	22,150	32,323				9,474	18,121	10,743
30-Sep	40	4,551	2,936	3,552	1,091	6,171	297				21,328	10,598	6,216
7-Oct	41	655	3,053	4,456	1,427	1,891	2,947				3,475	3,163	2,356
14-Oct	42	663	4,600	904	6,651	342	14,630				0	411	2,959
Yearly Total		27,593	140,475	60,231	52,889	97,740	209,730	153,540	184,541	262,852	238,803	211,114	105,758
Weekly Mean		1,533	7,024	3,170	2,644	5,144	10,487	9,596	13,182	16,428	11,940	11,111	5,957
Early Stock		7,512	54,090	25,792	15,916	23,096	47,147	43,897	89,065	172,401	80,744	80,782	34,771
Late Stock		20,081	86,385	34,439	36,973	74,644	162,583	109,643	95,476	90,451	158,059	130,331	70,988

^a Escapement estimates based on weir counts in 1976 to 1993 and on mark-recapture estimates from fish wheel program in 1994 to 1998.

Table 6. Weekly and yearly escapement of Chilkat River sockeye salmon from 1994 to 1998^a.

Mid-Week Date	Stat Week						1994-97		
		1994	1995	1996	1997	1998	Mean	Minimum	Maximum
3-Jun	23							0	0
10-Jun	24		27		69	56	48	27	69
17-Jun	25		1,410		270	724	840	270	1,410
24-Jun	26	137	2,867	585	162	2,614	938	137	2,867
1-Jul	27	1,061	3,700	4,428	1,189	4,412	2,595	1,061	4,428
8-Jul	28	3,427	3,529	12,508	1,059	2,527	5,131	1,059	12,508
15-Jul	29	1,434	3,116	10,239	1,433	2,774	4,055	1,433	10,239
22-Jul	30	2,242	4,283	11,416	3,277	3,850	5,305	2,242	11,416
29-Jul	31	2,720	3,140	6,615	2,845	3,518	3,830	2,720	6,615
5-Aug	32	3,170	1,588	5,207	2,222	1,766	3,047	1,588	5,207
12-Aug	33	8,431	1,229	1,036	613	929	2,827	613	8,431
19-Aug	34	1,882	449	661	371	579	841	371	1,882
26-Aug	35	886	740	398	430	596	614	398	886
2-Sep	36	691		217	140	217	349	140	691
9-Sep	37	105		59	377	322	180	59	377
16-Sep	38				180	0	180	180	180
23-Sep	39					76		0	0
30-Sep	40-42					0		0	0
Yearly Total		26,186	26,080	53,369	14,699	24,959	30,084	14,699	53,369
Weekly Mean		2,182	2,173	4,447	976	0	2,052		

^a Based on mark-recapture estimates from apportionment of fish wheel captured sockeye by stock through scale pattern analysis.

Table 7. Tagging and recovery data from the 1998 Chilkat River sockeye salmon mark-recapture program.

Tagging Dates	Mark Applied ^a	Date of Recovery																Marks Recovered	Marks Released	Percent Recovered
		July 21,28,29	August 4	August 10,14	August 17,19	August 24,25,26	August 31	September 1,3,7	September 12,14	September 20	September 21,24,27,28	October 2,5	October 12	October 21	October 28	November 2	November 9			
6/10-8/01	LA	5	17	29	26	58	56	45	21	2	15	0	2	0	0	2	0	278	1,970	14.1%
8/02-8/29	DC	0	0	0	1	0	5	4	1	5	4	2	4	3	1	4	3	37	1,720	2.2%
8/30-9/12	LV	0	0	0	0	0	0	2	0	0	0	0	2	0	1	4	1	10	714	1.4%
9/12-9/26	RV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	728	0.1%
9/27-10/13	RA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	334	0.3%
Total Recovered		5	17	29	27	58	61	51	22	7	19	2	9	3	2	10	5	327	5,466	6.0%
Total Examined		815	1,573	1,943	2,809	5,215	5,211	2,755	1,619	68	1,151	269	421	172	170	428	329	24,948		

^a All sockeye marked had the adipose fin removed as a primary mark. Secondary marks were left axillary appendage clip (LA), dorsal last four rays clip (DC), left ventral clip (LV), right ventral clip (RV), and right axillary appendage clip (RA).

Table 8. Pooled-strata tagging and recovery data used to calculate mark-recapture estimates of Chilkat Lake and River sockeye salmon run past the Chilkat River fish wheels, 1998.

Statistical Week of Marking	Chilkat Lake and Mainstem Combined													Total Marks Recovered	Total Marks Applied
	Statistical Week of Recovery														
	30-31	32	33	34	35	36	38	38	39	40	41	42	43		
24-31	5	17	29	26	58	56	45	21	17	0	2	0	2	278	1,970
32-42				1		5	6	1	9	2	10	2	13	49	3,496
Total	5	17	29	27	58	61	51	22	26	2	12	2	15	327	5,466
Examined	815	1,573	1,943	2,809	5,215	5,211	2,755	1,619	1,219	269	593	170	757	24,948	

Table 9. Weekly abundance, fresh water age class, and stock group for sockeye salmon captured in the Chilkat River fish wheels, 1998.

Stat Week	Mid-Week Date	Weekly Proportion	Weekly Abundance	Chilkat Lake	Chilkat Mainstem	Lake Age 1	Lake Age 2	Lake Age 3	Mainstem Age 0	Mainstem Age 1	Total
24	10-Jun	0.0019	452	395	56	75.00%	12.50%	0.00%	12.50%	0.00%	100.00%
25	17-Jun	0.0139	3,286	2,562	724	57.63%	20.34%	0.00%	6.78%	15.25%	100.00%
26	24-Jun	0.0381	8,996	6,382	2,614	47.97%	22.97%	0.00%	12.84%	16.22%	100.00%
27	1-Jul	0.0708	16,719	12,307	4,412	36.81%	36.81%	0.00%	7.64%	18.75%	100.00%
28	8-Jul	0.0552	13,022	10,495	2,527	52.24%	28.36%	0.00%	9.95%	9.45%	100.00%
29	15-Jul	0.0640	15,117	12,343	2,774	49.54%	32.11%	0.00%	10.55%	7.80%	100.00%
30	22-Jul	0.0566	13,350	9,500	3,850	36.28%	34.88%	0.00%	16.74%	12.09%	100.00%
31	29-Jul	0.0611	14,418	10,900	3,518	35.60%	40.00%	0.00%	11.20%	13.20%	100.00%
32	5-Aug	0.0748	17,663	15,897	1,766	25.00%	64.58%	0.42%	6.25%	3.75%	100.00%
33	12-Aug	0.0774	18,280	17,350	929	21.19%	73.31%	0.42%	1.69%	3.39%	100.00%
34	19-Aug	0.0712	16,801	16,221	579	10.78%	84.91%	0.86%	1.29%	2.16%	100.00%
35	26-Aug	0.0861	20,333	19,738	596	9.62%	87.45%	0.00%	2.09%	0.84%	100.00%
36	2-Sep	0.0548	12,939	12,723	217	7.95%	89.12%	1.26%	0.00%	1.67%	100.00%
37	9-Sep	0.0825	19,471	19,149	322	4.13%	93.80%	0.41%	0.41%	1.24%	100.00%
38	16-Sep	0.0545	12,857	12,857	0	5.56%	93.59%	0.85%	0.00%	0.00%	100.00%
39	23-Sep	0.0771	18,197	18,121	76	3.77%	94.98%	0.84%	0.00%	0.42%	100.00%
40	30-Sep	0.0449	10,598	10,598	0	6.00%	92.00%	2.00%	0.00%	0.00%	100.00%
41	7-Oct	0.0134	3,163	3,163	0	10.00%	90.00%	0.00%	0.00%	0.00%	100.00%
42	14-Oct	0.0017	411	411	0	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
Total			236,073	211,114	24,959						

Table 10. Historical age compositions for sockeye salmon captured in the Chilkat River fish wheels.

Year	Sample	Percent By Age Class														
	Size	0.1	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3	4.2
1989	30	0.0	0.0	0.0	0.0	3.3	3.3	3.3	0.0	0.0	66.7	23.3	0.0	0.0	0.0	0.0
1990	755	0.0	0.7	2.6	0.0	0.7	2.3	4.5	0.0	3.0	62.4	23.0	0.0	0.8	0.0	0.0
1991	111	0.0	3.6	17.1	0.0	0.0	20.7	46.8	0.0	0.0	3.6	8.1	0.0	0.0	0.0	0.0
1994	1,963	0.2	2.4	6.1	0.0	1.9	4.2	32.1	0.1	1.7	26.4	23.2	0.1	0.1	1.4	0.1
1995	1,971	0.1	4.8	6.7	0.2	1.8	8.5	18.0	0.1	3.9	29.6	26.1	0.1	0.1	0.0	0.0
1996	1,910	0.0	3.9	14.9	0.0	0.0	4.6	26.2	0.0	0.5	27.7	22.1	0.0	0.1	0.0	0.0
1997	2,573	0.1	2.2	8.5	0.0	1.2	8.7	14.0	0.0	2.8	24.6	37.5	0.1	0.1	0.0	0.0
1998	3,534	0.3	2.4	2.2	0.0	1.0	3.9	25.5	0.0	1.6	35.8	26.8	0.1	0.3	0.2	0.0
Average	1,606	0.2	2.9	6.8	0.0	1.1	5.7	22.1	0.0	2.1	31.3	27.2	0.1	0.2	0.3	0.0
SE		0.1	1.6	6.1	0.1	1.1	6.0	14.5	0.0	1.5	20.7	8.0	0.1	0.3	0.5	0.0
CV		56.3%	55.4%	89.4%	-	99.7%	105.2%	65.8%	-	69.6%	66.2%	29.6%	53.5%	132.1%	163.3%	-

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Table 11. Historical length-at-age data for sockeye salmon captured in the Chilkat River fish wheels.

Year	Average Length at Age															Average	SE
	0.1	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3			
1989	0	0	0	0	370	0	580	0	0	526	600	0	0	0	541	10	
1990	0	444	566	0	312	486	577	0	352	517	589	0	506	0	530	19.5	
1991	0	468	531	0	0	440	552	0	0	490	532	0	0	0	518	56.6	
1996	0	476	587	0	0	509	587	0	377	530	589	0	480	0	563	13	
1997	336	466	582	0	340	486	580	530	358	518	575	582	538	545	543	10.8	
1998	320	450	563	570	326	474	558	540	350	504	568	537	536	555	529	9	
Average	323	463	580	570	332	485	570	535	355	514	576	560	524	554	540	5.8	
SE	4.1	2.8	1.4	0	2.4	1.9	0.8	5	1.7	0.7	0.7	13.7	7.7	7.6			

Table 12. Historical age compositions for sockeye salmon escapements to Chilkat Lake.

Year	Sample Size	Percent by Age Class															
		0.2	0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.2	4.3
1982	1,630	0.1	0.1	0.4	2.3	12.9	0.0	2.6	45.3	34.8	0.0	0.0	0.0	1.3	0.1	0.0	0.0
1983	2,848	0.0	0.0	0.7	3.2	38.0	0.0	2.7	27.9	27.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1984	2,728	0.0	0.0	0.1	1.5	22.8	0.0	1.5	53.6	20.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0
1985	1,333	0.0	0.0	0.6	0.7	9.2	0.2	3.3	39.7	45.7	0.0	0.0	0.2	0.5	0.0	0.0	0.0
1986	940	0.0	0.0	0.0	1.7	1.6	0.0	0.5	20.6	73.1	0.0	0.0	0.0	1.9	0.5	0.0	0.0
1987	1,461	0.0	0.0	0.9	1.8	24.5	0.0	2.7	34.2	35.0	0.1	0.0	0.0	0.5	0.2	0.0	0.0
1988	1,918	0.0	0.1	0.0	0.8	47.3	0.2	0.0	7.9	43.4	0.1	0.0	0.0	0.1	0.1	0.0	0.0
1989	3,874	0.0	0.0	0.0	0.7	42.8	0.1	0.0	28.9	27.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1990	2,635	0.0	0.1	0.0	1.8	14.0	0.5	0.0	24.8	58.0	0.1	0.0	0.0	0.8	0.0	0.0	0.0
1991	1,602	0.0	0.0	0.0	2.1	36.1	0.1	0.0	21.8	39.5	0.2	0.0	0.0	0.0	0.2	0.0	0.0
1992	2,505	0.0	0.1	0.0	1.1	40.8	0.2	0.0	16.9	40.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1993	2,367	0.0	0.1	0.0	6.4	15.0	0.0	0.0	36.2	38.7	0.0	0.0	0.0	3.6	0.0	0.1	0.0
1994	2,187	0.0	0.0	0.0	2.6	58.6	0.1	0.0	11.4	26.6	0.0	0.0	0.0	0.1	0.6	0.0	0.0
1995	2,691	0.0	0.0	0.0	5.5	27.1	0.9	0.0	17.7	48.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0
1996 ^a	308	0.0	0.0	0.0	10.4	67.5	0.0	0.0	8.8	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997 ^a	750	0.0	0.0	0.4	38.8	19.9	0.0	1.3	14.0	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998 ^a	1,198	0.0	0.0	0.1	4.9	69.4	0.0	0.3	19.0	6.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Average	1,940	0.0	0.0	0.2	5.1	32.2	0.1	0.9	25.2	35.5	0.0	0.0	0.0	0.5	0.1	0.0	0.0
SE(82-98)		0.0	0.0	0.3	9.1	20.3	0.2	1.2	13.0	16.2	0.1	0.0	0.0	1.0	0.2	0.0	0.0
CV(82-98)		4.1	1.6	1.6	1.8	0.6	1.8	1.4	0.5	0.5	1.7	0.0	4.1	1.8	1.6	4.1	0.0

^a Scale samples collected from beach seining operations at Chilkat Lake.

Table 13. Historical length-at-age for escapements of Chilkat Lake sockeye salmon.

Year	Average Length by Age Class																AVG	SE
	0.2	0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	4.2	4.3		
1982	0	555	356	518	607	0	365	540	616	0	0	0	565	637	0	0	570	14.2
1983	0	0	330	503	596	615	357	541	601	630	0	0	562	601	0	0	571	10.8
1984	0	560	332	513	595	630	355	521	594	600	0	0	552	610	0	0	550	10.6
1985	0	0	357	504	597	633	372	518	596	0	0	405	515	0	0	0	555	15.3
1986	0	0	0	490	602	0	363	547	612	0	0	0	563	619	0	0	594	19.5
1987	0	0	338	508	598	0	346	534	599	565	0	0	526	616	0	0	565	14.9
1988	0	600	0	540	620	620	0	563	625	580	0	0	572	670	0	0	617	14.1
1989	0	0	0	536	598	570	0	543	590	0	0	0	480	575	0	600	580	9.3
1990	0	580	0	512	581	590	0	530	579	640	0	0	534	605	0	0	566	11.1
1991	0	0	0	519	584	600	0	528	583	565	0	0	0	581	0	0	570	14.3
1992	450	533	0	514	584	575	0	526	585	600	645	0	510	617	0	0	574	11.5
1993	0	557	0	508	574	0	0	521	574	0	0	0	525	0	540	0	549	11.3
1994	0	0	0	544	575	575	0	538	575	0	0	0	518	560	0	0	570	12.2
1995	0	510	0	513	573	582	0	521	572	605	0	0	560	605	0	0	560	10.8
1996	0	0	0	526	587	0	0	514	577	0	0	0	0	0	0	0	573	32.2
1997	0	0	400	479	575	0	367	519	572	0	0	0	0	0	0	0	526	19.5
1998	0	0	385	477	543	0	406	475	542	512	0	0	0	0	0	0	526	15.2
Average(82-98)	450	556	357	512	588	599	366	528	588	589	645	405	537	608	540	600	567	3.1
SE(82-98)	0	8.8	3.7	1.3	0.4	4.9	1.6	0.4	0.3	12	0	15.5	2.6	7.1	20	0		

Table 14. Historical age compositions for sockeye escapements to the Chilkat River (Bear Flats).

Year	Sample Size	Percent by Age Class														
		0.1	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3	4.2
1983	150	0.0	2.0	40.0	0.0	0.7	14.0	41.3	0.0	0.0	0.7	1.3	0.0	0.0	0.0	0.0
1989	165	0.0	0.0	0.0	0.0	0.6	0.6	24.2	0.0	0.6	53.3	20.6	0.0	0.0	0.0	0.0
1990	755	0.0	0.7	2.6	0.0	0.7	2.3	4.5	0.0	3.0	62.4	23.0	0.0	0.8	0.0	0.0
1991	164	0.0	2.4	12.2	0.0	0.0	15.9	48.2	0.0	0.0	6.1	15.2	0.0	0.0	0.0	0.0
1994	1,963	0.2	2.4	6.1	0.0	1.9	4.2	32.1	0.1	1.7	26.4	23.2	0.1	0.1	1.4	0.1
1995	1,971	0.1	4.8	6.7	0.2	1.8	8.5	18.0	0.1	3.9	29.6	26.1	0.1	0.1	0.0	0.0
1996	1,910	0.1	3.9	14.9	0.0	0.0	4.6	26.2	0.0	0.5	27.7	22.1	0.0	0.1	0.0	0.0
1997	2,573	0.1	2.2	8.5	0.0	1.2	6.5	21.4	0.1	2.2	29.4	26.9	0.1	0.1	0.3	0.0
1998	429	1.2	28.0	42.0	0.0	1.9	7.5	19.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	1,120	0.2	5.2	14.8	0.0	1.0	7.1	26.2	0.0	1.3	26.2	17.6	0.0	0.1	0.2	0.0
SD		0.4	8.7	15.5	0.1	0.8	5.1	13.0	0.1	1.4	21.8	10.2	0.1	0.3	0.5	0.0
CV		2.0	1.7	1.1	3.0	0.8	0.7	0.5	1.5	1.1	0.8	0.6	1.5	1.9	2.5	3.0

Table 15. Historical length-at-age data for sockeye salmon escapements to the Chilkat River (Bear Flats).

Year	Average Length at Age											AVG	SE
	0.1	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.2	2.3	2.4		
1984	0	435	560	0	325	445	568	0	0	0	0	553	43.1
1985	0	448	559	0	0	0	567	0	520	560	0	540	63.2
1986	0	466	579	600	0	449	570	600	0	585	605	551	54.4
1987	0	441	583	0	0	437	580	0	0	585	0	561	7.5
1988	390	427	553	0	385	452	549	0	0	0	0	479	6.8
1989	0	442	566	0	0	420	582	0	0	0	0	550	7.4
1990	0	433	577	0	0	400	590	0	0	0	0	520	17.7
1991	342	436	563	0	328	429	568	0	0	0	0	520	31.7
1992	295	429	572	613	342	446	581	0	0	0	0	540	27.4
1996	0	460	596	0	350	464	596	0	0	0	0	569	25.2
1997	410	468	586	0	0	464	586	0	0	0	0	560	27.3
1998	307	444	570	0	341	448	567	0	0	0	0	517	24.8
Average	331	446	578	608	342	449	579	600	520	576	605	543	10.7
SE	15.1	1.4	1	12.9	4.7	2.4	1.2	0	0	8.3	0		

Table 16. Historical age composition for chinook salmon captured in the Chilkat River fish wheels.

Year	Sample Size	Percent by Age Class							
		0.1	1.1	1.2	1.3	1.4	1.5	2.1	2.3
1991	383	0.5	36.3	11.7	27.2	21.7	1	1.6	0
1994	74	0	2.7	1.4	41.9	54.1	0	0	0
1995	77	0	2.6	42.9	9.1	44.2	0	0	1.3
1996	61	0	8.2	16.4	67.2	8.2	0	0	0
1997	139	0	10.8	11.5	18.7	59	0	0	0
1998	109	0	39.4	13.8	17.4	23.9	5.5	0	0
Average		0.1	16.7	16.3	30.3	35.2	1.1	0.3	0.2
SD		0.2	16.7	14.0	21.2	20.2	2.2	0.7	0.5

Table 17. Historical length-at-age composition for chinook salmon captured in the Chilkat River fish wheels.

Year	Sample Size	Average Length at Age								SD
		0.1	1.1	1.2	1.3	1.4	1.5	2.1	2.3	
1991	381	425	346	545	743	870	901	404	0	32.7
1994	74	0	405	550	765	872	0	0	0	4.4
1995	77	0	420	582	695	913	0	0	630	99.7
1996	61	0	348	547	778	890	0	0	0	21.5
1997	139	0	332	542	762	850	0	0	0	58.9
1998	218	0	388	539	759	885	885	0	0	43.5
Average		425	361	553	755	872	889	404	630	22.5
SD		15	2.7	5.9	4.9	3.9	11.7	14.1	0	

Table 18. Historical age composition for coho salmon captured in the Chilkat River fish wheels.

Year	Sample Size	Percent by Age Class						
		1.0	1.1	2.0	2.1	3.0	3.1	4.1
1990	1,025	0	45.8	0.1	48.3	0.2	5.6	0.1
1998	485	1.9	61.9	12.8	23.5	0	0	0
Average		1.0	53.9	6.5	35.9	0.1	2.8	0.1
SD		1.3	11.4	9.0	17.5	0.1	4.0	0.1

Table 19. Historical length-at-age composition for coho salmon captured in the Chilkat River fish wheels.

Year	Sample Size	Average Length at Age						
		1.0	1.1	2.0	2.1	3.0	3.1	4.1
1990	590	0	573	360	605	350	611	640
1998	579	317	615	339	633	0	0	0
Average		158.5	594.0	349.5	619.0	175.0	305.5	320.0
SD		224.2	29.7	14.8	19.8	247.5	432.0	452.5

Table 20. Historical age composition of chum salmon captured in the Chilkat River fish wheels.

Year	Sample Size	Percent Age Class			
		0.2	0.3	0.4	0.5
1990	1,783	0.4	72.9	26.4	0.3
1997	104	5.7	65.7	28.6	0.0
1998	608	5.3	64.5	29.2	1.0
Average		1.8	70.6	27.2	0.4
SE		0.3	0.9	0.9	0.1

Table 21. Historical average length-at-age for chum salmon captured in the Chilkat River fish wheels.

Year	Average Length at Age			
	0.2	0.3	0.4	0.5
1990	554	630	669	653
1997	634	660	669	-
1998	608	629	663	660
Average	602	631	667	656
SE	6.7	0.9	1.4	11.2

Table 22. Sex ratios (by statistical week) and average lengths of pink salmon captured in the Chilkat River fish wheels, 1998.

Statistical Week	Total Weekly Catch	Total Weekly		Percent Males	Cumulative Catch	Cumulative Proportion
		Males	Females			
28	32	23	9	71.9%	32	0.002
29	209	124	85	59.3%	241	0.015
30	1,244	796	448	64.0%	1,485	0.095
31	3,277	1,762	1,515	53.8%	4,762	0.303
32	2,551	1,283	1,268	50.3%	7,313	0.466
33	3,730	1,588	2,142	42.6%	11,043	0.703
34	2,399	809	1,590	33.7%	13,442	0.856
35	905	299	606	33.0%	14,347	0.914
36	816	290	526	35.5%	15,163	0.966
37	381	103	278	27.0%	15,544	0.990
38	103	41	62	39.8%	15,647	0.996
39	56	22	34	39.3%	15,703	1.000
Total	15,703	7,140	8,563	45.5%		
Ave. Length (mm)	450	445	455			
SE (length)	1.11	1.82	1.23			

Table 23. Historical age composition for sockeye salmon captured in the commercial Lynn Canal drift gillnet fishery.

Year	Sample Size	Percent by Age Class													
		0.1	0.2	0.3	0.4	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	3.3
1982	5,350	0	0	0.5	0.1	0	3.9	55.3	0.1	0	12.4	27.1	0	0.3	0.2
1983	10,620	0	0	1.1	0	0	2.2	55	0.3	0	7.4	33.7	0	0.1	0
1984	11,867	0	0	1.7	0	0	1.5	68.3	0.2	0	9.8	18.4	0.1	0	0
1985	10,616	0	0.2	1.4	0	0	2.4	53.3	1.2	0	6.9	34.2	0.1	0.1	0
1986	10,549	0	0.3	4.7	0	0	4.7	35.4	0.2	0	16.8	36.5	0.1	1	0.2
1987	11,500	0	0	2.3	0	0	4.2	58.9	0.1	0	6.3	27.8	0.1	0.1	0.2
1988	11,061	0	0	1.6	0	0	5.2	62.7	0.3	0	6.9	22.9	0.1	0.1	0.1
1989	6,734	0	0	1.5	0	0	2.2	45	0.2	0	15.5	35.2	0	0	0.4
1990	7,820	0	0.1	4.5	0	0	3	31.5	0.4	0	15.9	43.9	0.3	0.3	0.1
1991	7,477	0	0.3	5.8	0	0	5.3	53	0.2	0	4.2	30.8	0.1	0	0.1
1992	7,854	0	0.2	4	0	0	1.8	48.5	0.4	0	9.1	35.7	0.1	0.1	0.1
1993	7,948	0	0.1	6	0	0	2	27.8	0.2	0	12.1	50.2	0.1	1.4	0.1
1994	8,330	0	0	3	0	0.1	1.3	51.3	0.1	0	8.7	34.1	0.1	0.1	1.2
1995	6,051	0	1.3	7.9	0.1	0	9.6	32.1	0.4	0	11.8	36.4	0.1	0	0.1
1996	6,996	0	0.4	7.8	0	0	3.9	51.7	0.1	0	11.8	24.2	0	0.1	0
1997	5,488	0	0.6	5.8	0	0	4.1	43.2	0.1	0	9.7	36.5	0	0	0.1
1998	4,874	0	0.2	1.8	0	0	1.9	49.2	0.1	0	15.4	31.1	0	0.1	0.1
Average		0	0.2	3.6	0.0	0.0	3.5	48.4	0.3	0.0	10.6	32.9	0.1	0.2	0.2
SD		0	0.3	2.4	0.0	0.0	2.1	11.3	0.3	0.0	3.8	7.6	0.1	0.4	0.3

Table 24. Historical length-at-age composition for sockeye salmon captured in the commercial Lynn Canal drift gillnet fishery.

Year	Sample	Average Length at Age												
	Size	0.2	0.3	0.4	1.1	1.2	1.2	1.4	2.1	2.2	2.3	2.4	3.2	3.3
1982	5,347	0	584	582	0	513	585	614	0	565	612	0	579	617
1983	10,586	0	581	645	346	520	586	597	0	559	597	606	559	633
1984	11,790	550	578	0	0	509	581	609	0	546	598	604	551	609
1985	10,511	490	571	574	308	506	577	605	370	540	594	605	555	585
1986	3,244	498	577	632	0	514	586	609	0	562	604	605	557	598
1987	2,867	545	595	600	0	507	591	607	0	557	596	0	566	628
1988	4,167	0	584	612	0	518	588	605	0	548	607	586	576	590
1989	2,084	0	582	655	370	497	590	625	350	544	588	648	0	571
1990	2,428	0	574	0	0	505	582	606	0	550	589	596	582	608
1991	1,898	521	566	629	0	511	575	579	0	530	581	569	439	599
1992	2,171	496	571	623	329	516	574	589	0	539	585	0	555	604
1993	2,399	0	572	0	0	524	579	554	0	548	586	585	556	582
1994	2,376	0	580	0	383	522	580	592	0	542	588	640	531	584
1995	923	481	573	607	0	524	580	589	0	538	581	0	0	556
1996	1,230	502	599	0	0	535	597	529	0	557	600	0	0	592
1997	698	522	602	0	0	547	602	615	0	551	607	0	0	634
1998	697	455	575	0	0	536	584	0	0	538	589	0	545	0
Average		298	580	362	102	518	585	560	42	548	594	356	421	564
SD		29.1	10.2	26.1	30.3	12.7	7.5	25.1	14.1	9.7	9.5	24.1	36.2	21.9

Table 25. Annual harvests of Chilkat Lake sockeye salmon by week, 1976 to 1998.

Mid-Week Date	Statistical Week	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
17-Jun	25	384		4,385	1,512	603	1,539	469		2,248	408	88	
24-Jun	26	4,605	5,041	1,343	3,243	166	1,960	2,139	1,084	4,907	1,725	357	1,880
1-Jul	27	4,624	9,089		25		1,821	3,529	1,868	5,696	1,633	1,302	3,530
8-Jul	28	4,146	1,577	1,048	4,936		1,494	2,919	5,603	4,790	5,139	625	1,516
15-Jul	29	897	2,205	1,832	5,512		2,504	2,626	4,457	9,051	4,318	1,858	6,810
22-Jul	30	1,740	1,044	3,218	13,220	2,110	5,100	1,103	7,382	8,136	3,137	2,209	5,038
29-Jul	31	1,459	1,130	20,294	18,107	1,301	2,121	11,392	8,243	8,366	9,150	2,242	6,072
5-Aug	32	9,420	3,318	18,939	28,212	3,450	5,668	27,126	17,604	12,062	9,676	10,774	15,278
12-Aug	33	11,682	4,625	22,490	15,870	8,237	1,017	30,199	18,777	18,396	11,336	30,803	9,454
19-Aug	34	11,496	5,217	11,334	16,101	6,844	1,980	14,475	11,718	6,390	26,250	45,502	8,166
26-Aug	35	7,997	6,123	3,138	6,339	6,889	18,720	16,202	20,923	6,528	35,316	14,617	6,456
2-Sep	36	497	1,482	1,233	1,471	681	3,130	10,675	19,799	4,898	16,834	44,362	2,494
9-Sep	37	257	318	256	685	207	1,000	1,913	5,148	3,997	7,808	7,719	1,825
16-Sep	38-42	124	220	48	761	193	406	2,269	1,282	2,766	2,773	5,903	1,550
Yearly Total		59,328	41,389	89,558	115,994	30,681	48,460	127,036	123,888	98,231	135,503	168,361	70,069
Weekly Mean		4,238	3,184	6,889	8,285	2,789	3,461	9,074	9,530	7,017	9,679	12,026	5,390
Early Stock Catch		9,514	13,064	8,023	29,065	1,984	12,885	26,257	32,908	43,208	23,540	15,333	24,571
Late Stock Catch		49,814	28,325	81,535	86,929	28,697	35,575	100,779	90,980	55,023	111,963	153,028	45,498

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Table 25 (page 2 of 2)

Mid-Week Date	Statistical Week	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1976-98 Mean
17-Jun	25		7,596	1,719	1,211		2,283	0	2,283	987	3,146		2,403
24-Jun	26	2,379	8,490	2,406	1,826	2,436	1,141	4,752	1,698	3,234	2,950	2,841	3,003
1-Jul	27	3,482	10,439	6,306	1,557	4,627	2,563	6,768	2,002	929	3,398	7,888	4,457
8-Jul	28	4,920	11,161	4,405	1,931	3,548	5,547	7,677	4,884	1,597	2,387	14,463	5,336
15-Jul	29	7,598	12,833	3,688	2,389	5,687	5,865	11,756	1,971	2,512	2,756	16,274	6,678
22-Jul	30	3,405	9,805	10,257	2,116	5,647	2,926	6,452	2,082	2,869	2,588	14,006	5,599
29-Jul	31	8,507	12,833	9,923	4,060	5,562	3,981	9,597	2,611	8,008	7,596	13,211	7,663
5-Aug	32	6,497	30,913	25,025	6,478	11,688	7,123	11,775	4,543	16,233	9,590	18,128	13,606
12-Aug	33	13,369	18,492	35,214	6,049	24,426	11,967	12,141	5,764	17,426	6,066	12,852	14,435
19-Aug	34	6,771	18,034		10,037	9,648	26,518	11,760	18,943	19,743	11,031	9,738	13,672
26-Aug	35	6,728	13,465	29,780	8,691	26,558	14,515	18,913	7,195	9,872	11,544	4,875	13,216
2-Sep	36	6,637	3,833	14,282	6,056	9,517	10,273	12,759	4,375	6,742	4,627	2,687	7,023
9-Sep	37	3,518	1,231	3,761	5,466	2,220	4,650	7,863	2,996	3,977	2,378	2,197	3,507
16-Sep	38-42	2,662	321	290	1,939	323	1,365	0	2,048	2,251	0	1,485	1,186
Yearly Total		76,473	159,446	147,056	59,806	111,887	100,717	122,212	63,396	96,380	70,056	120,644	99,845
Weekly Mean		5,883	11,389	11,312	4,272	8,607	7,194	8,729	4,528	6,884	5,004	9,280	7,373
Early Stock Catch		25,500	60,963	2,972	11,030	21,945	20,325	37,404	14,920	12,129	17,225	55,472	25,371
Late Stock Catch		50,973	98,483	144,084	48,776	89,942	80,392	84,808	48,476	84,251	52,831	65,172	74,474

Table 26. Annual harvests of "other"^a sockeye salmon in the Lynn Canal drift gillnet fishery by week, 1976 to 1998.

Mid-Week Date	Stat Week	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
17-Jun	25	60	0	548	504	381	143	44	0	355	134	16	0	0
24-Jun	26	694	2,653	1,759	1,328	56	101	210	49	514	1,688	599	734	968
1-Jul	27	963	1,330	207	0	725	145	145	255	491	5,173	1,233	6,958	6,611
8-Jul	28	1,194	332	386	494	158	150	155	294	383	6,691	4,365	983	4,889
15-Jul	29	375	848	316	501	73	181	175	105	309	273	738	872	5,100
22-Jul	30	735	116	577	1,414	0	116	172	268	561	522	897	263	1,057
29-Jul	31	204	0	486	1,942	76	154	549	1,204	706	746	597	330	1,316
5-Aug	32	227	0	0	0	75	67	128	740	536	448	903	350	442
12-Aug	33	151	0	269	165	8	0	329	663	244	377	948	111	348
19-Aug	34	132	98	74	492	3	14	0	256	73	68	825	121	101
26-Aug	35	76	0	29	195	3	0	0	78	130	48	206	22	100
2-Sep	36	8	0	6	35		0	0	42	48	0	87	0	122
9-Sep	37	0	0	1	14		0	0	1	0	10	0	7	23
16-Sep	38-42	23	0		32		0	1	0	0	0	0	0	33
Yearly Total		4,842	5,377	4,658	7,116	1,558	1,071	1,908	3,955	4,350	16,178	11,414	10,751	21,110
Weekly Mean		346	384	333	508	111	77	136	283	311	1,156	815	768	1,508

^a Includes Berners Bay River systems and other local stocks.

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Table 26. (page 2 of 2)

Mid-Week Date	Stat Week	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1976-98 Mean
17-Jun	25	3,214	1,823	2,213	0	0		1,282	1,828	1,466		667
24-Jun	26	3,381	1,783	6,782	4,926	2,321	1,178	1,165	3,309	1,441	1,309	1,711
1-Jul	27	2,440	6,998	4,097	8,241	4,258	2,418	976	1,245	2,070	820	2,590
8-Jul	28	1,742	2,221	2,470	5,650	3,296	2,135	1,696	1,743	1,046	1,050	1,931
15-Jul	29	2,030	1,054	3,451	4,275	3,012	2,619	744	2,311	1,133	4,122	1,386
22-Jul	30	1,725	4,601	1,012	3,327	2,757	1,323	799	2,660	1,447	1,509	1,198
29-Jul	31	2,922	4,669	1,729	2,488	1,738	2,400	457	5,535	1,495	1,520	1,443
5-Aug	32	1,956	4,251	1,138	2,356	879	2,236	385	5,695	769	921	1,072
12-Aug	33	366	3,088	224	1,422	433	2,291	250	2,916	168	293	671
19-Aug	34	494	0	151	280	246	1,623	396	1,051	278	102	308
26-Aug	35	233	297	635	280	33	723	100	333	210	31	170
2-Sep	36	98	216	0	184	12	263	90	145	95	6	69
9-Sep	37	19	40	38	0	0	32	61	87	24	21	17
16-Sep	38-42	5	3	24	0	0	11	29	34	0	0	10
Yearly Total		20,625	31,044	23,964	33,429	18,985	19,252	8,430	28,893	11,642	11,715	13,281
Weekly Mean		1,473	2,217	1,712	2,388	1,356	1,481	602	2,064	832	900	948

^a Includes Berners Bay River systems and other local stocks.

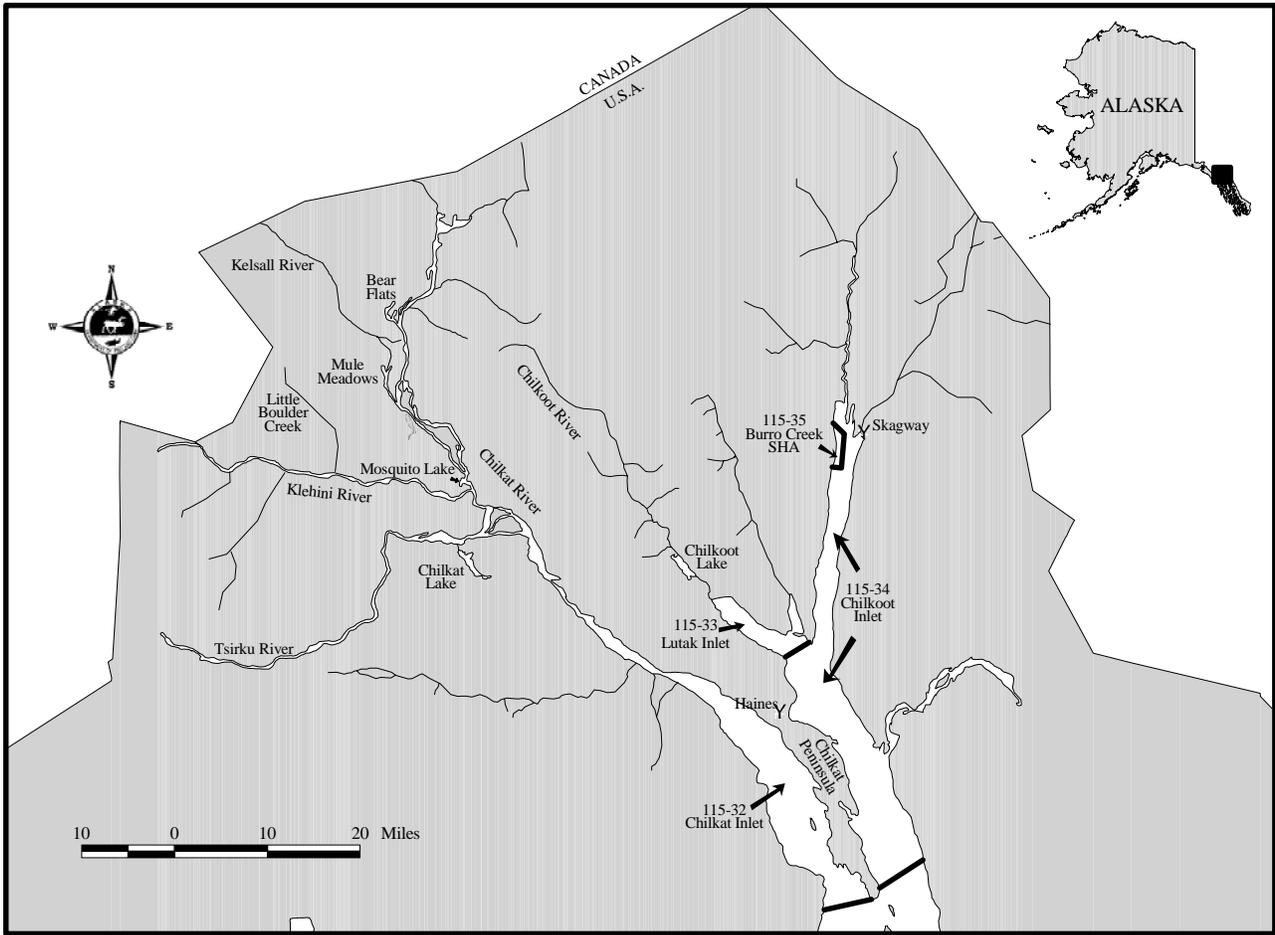


Figure 1. Chilkat Lake and adjacent marine areas.

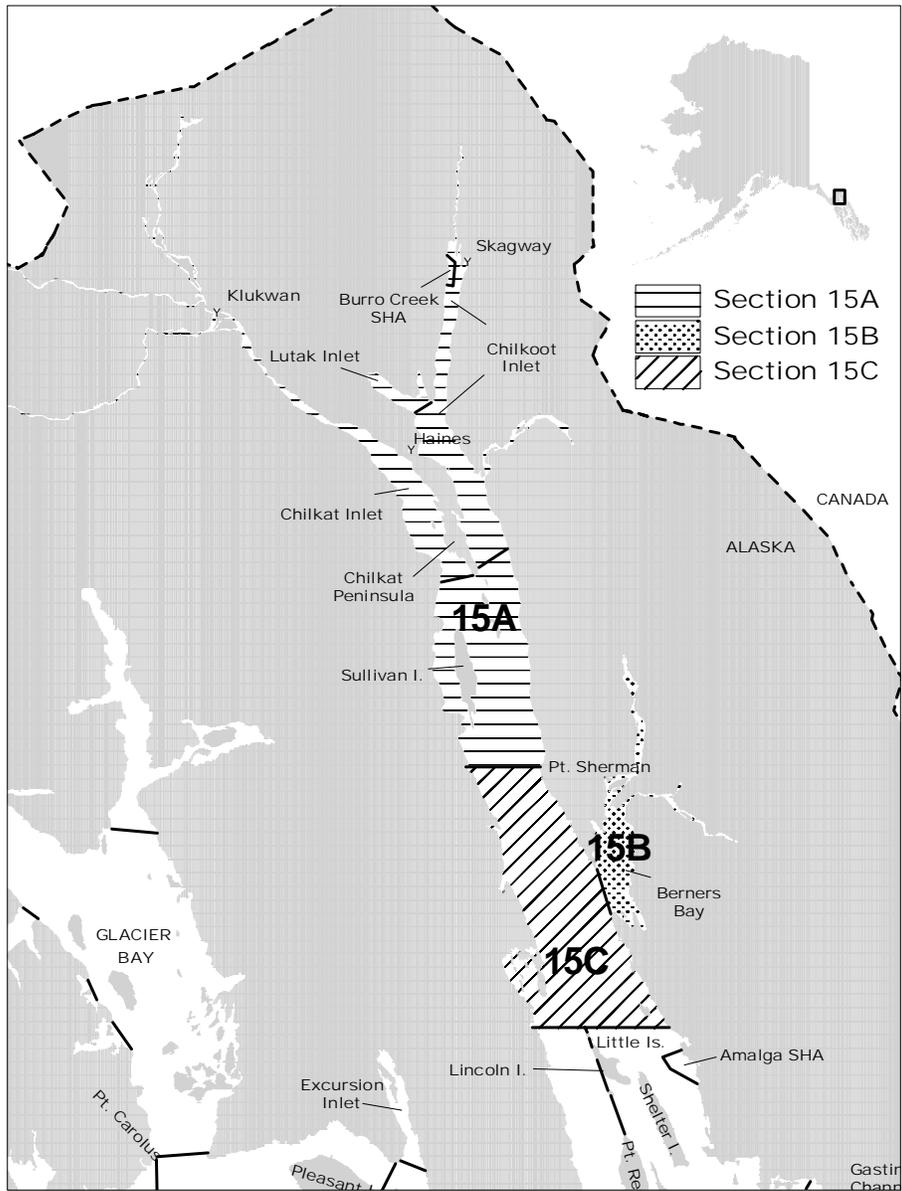


Figure 2. Lynn Canal with primary fishing areas.

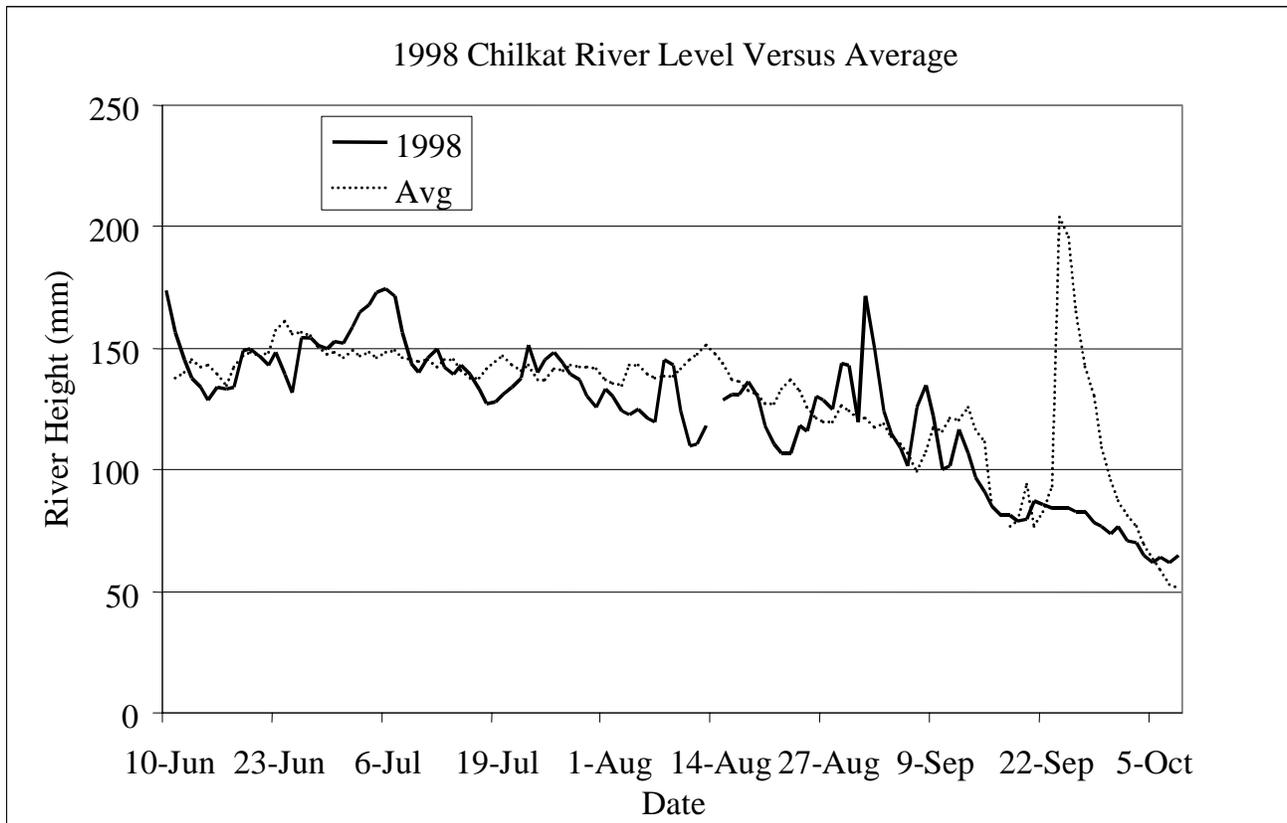


Figure 3. Water levels for the Chilkat River, 1998.

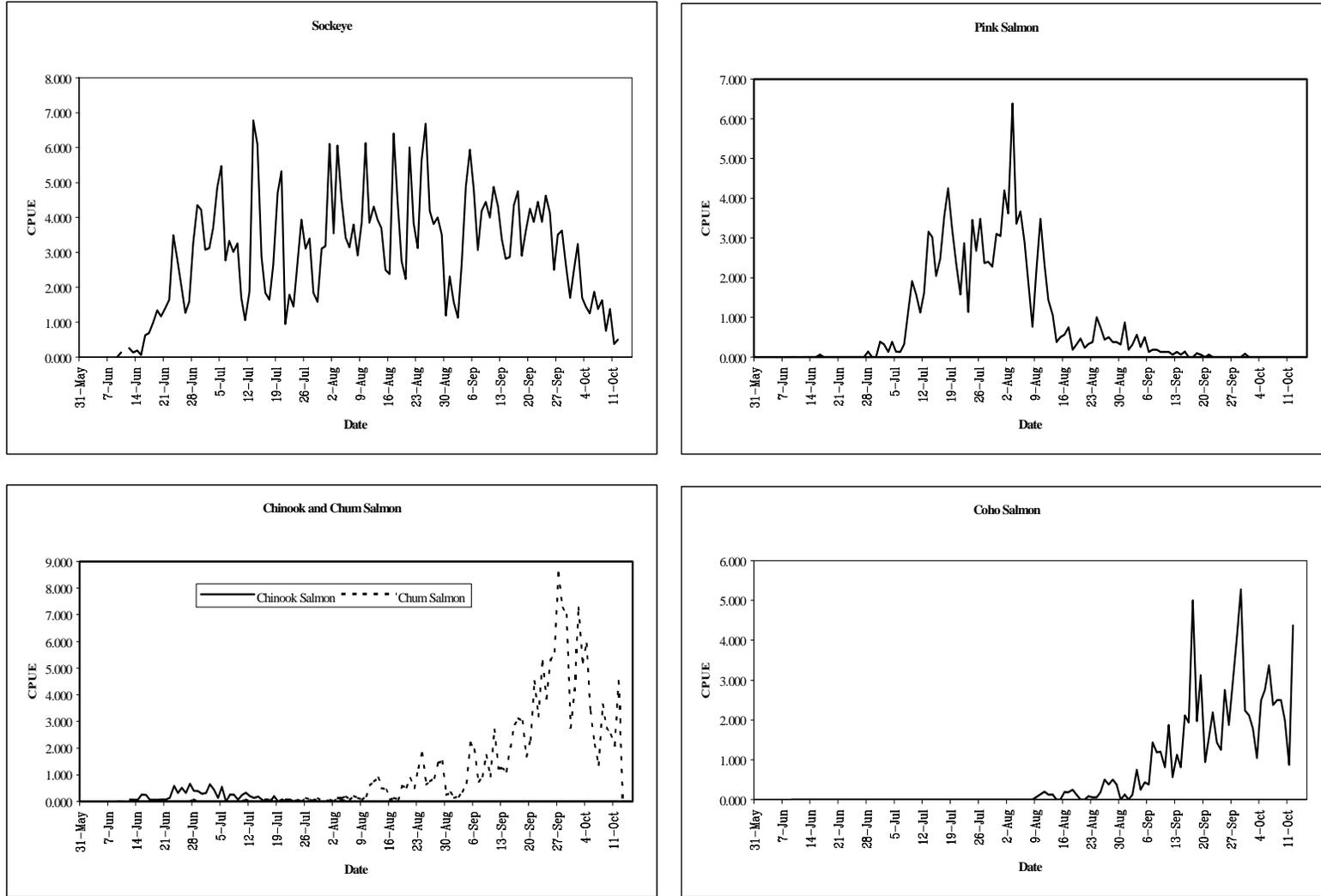


Figure 4. Fish wheel CPUE for five Pacific salmon species in the Chilkat River, 1998. Gaps in the lines are periods when the fish wheels were not operational.

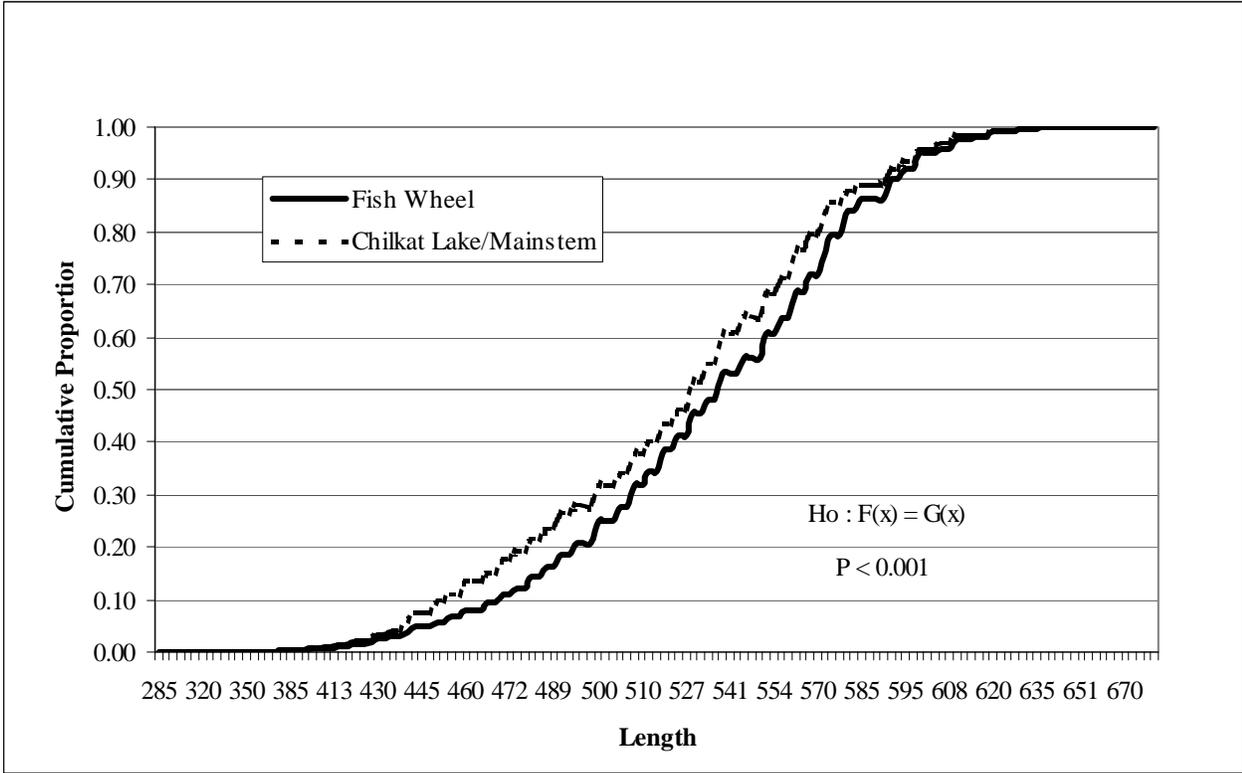


Figure 5. Cumulative distribution function (CDF) of MEF lengths of sockeye salmon captured in the Chilkat River fish wheels versus lengths of fish recaptured on spawning grounds at Chilkat Lake and Bear Flats (Chilkat Mainstem).

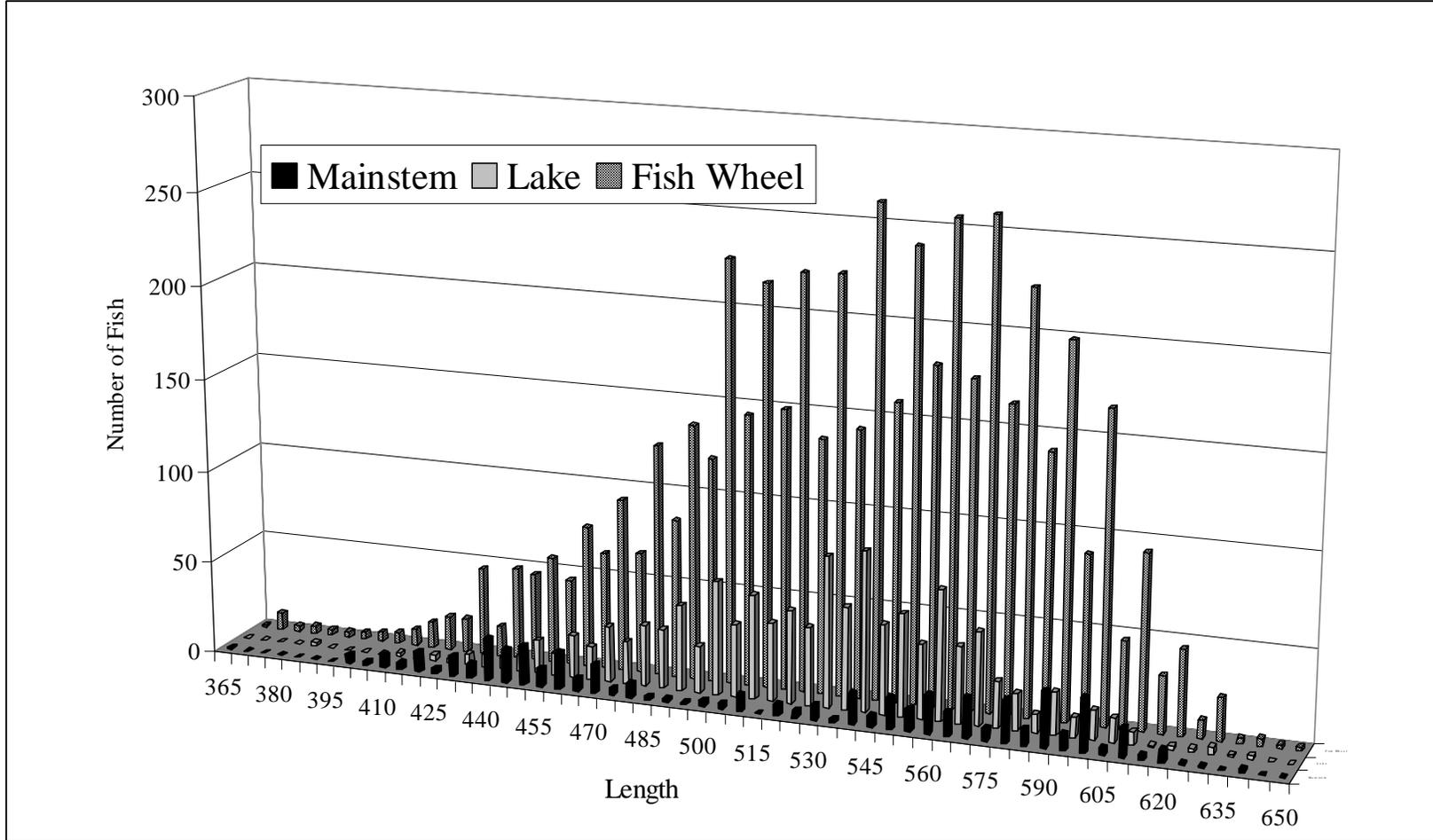


Figure 6. Length frequency distribution for sockeye salmon captured in the Chilkat River fish wheels and during recovery sampling in the Chilkat River mainstem and Chilkat Lake, 1998.

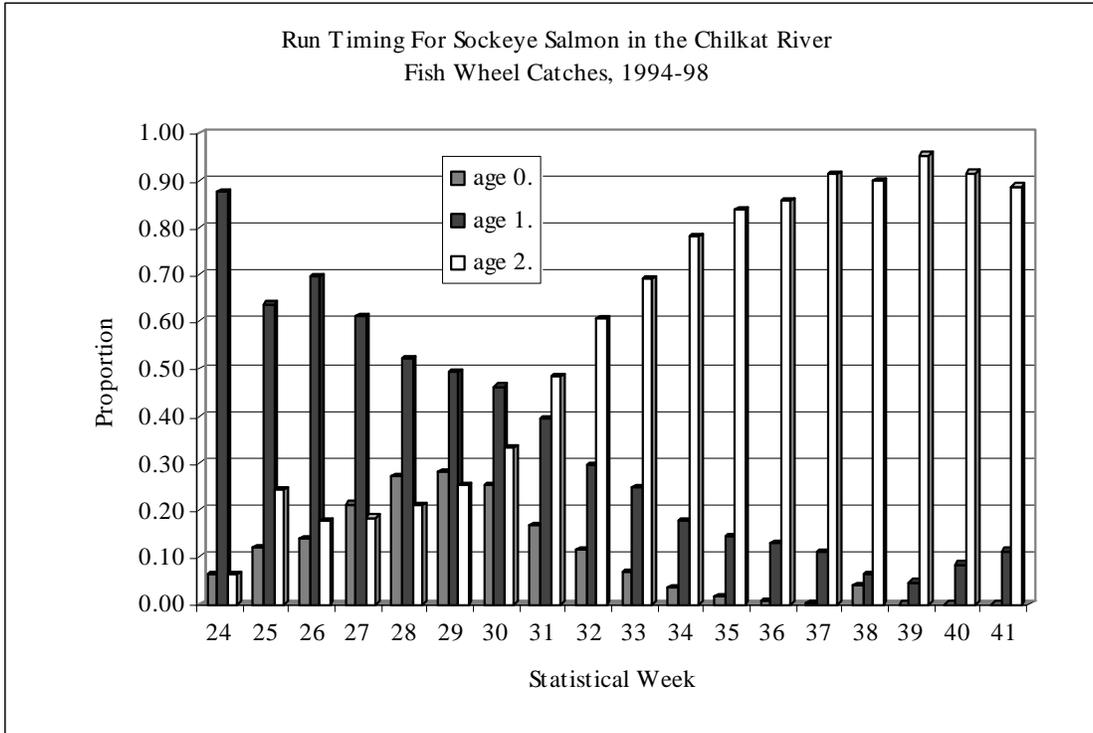


Figure 7. Run timing of three sockeye salmon stock groups passing the Chilkat River fish wheels, 1998. Based on scale pattern analysis.

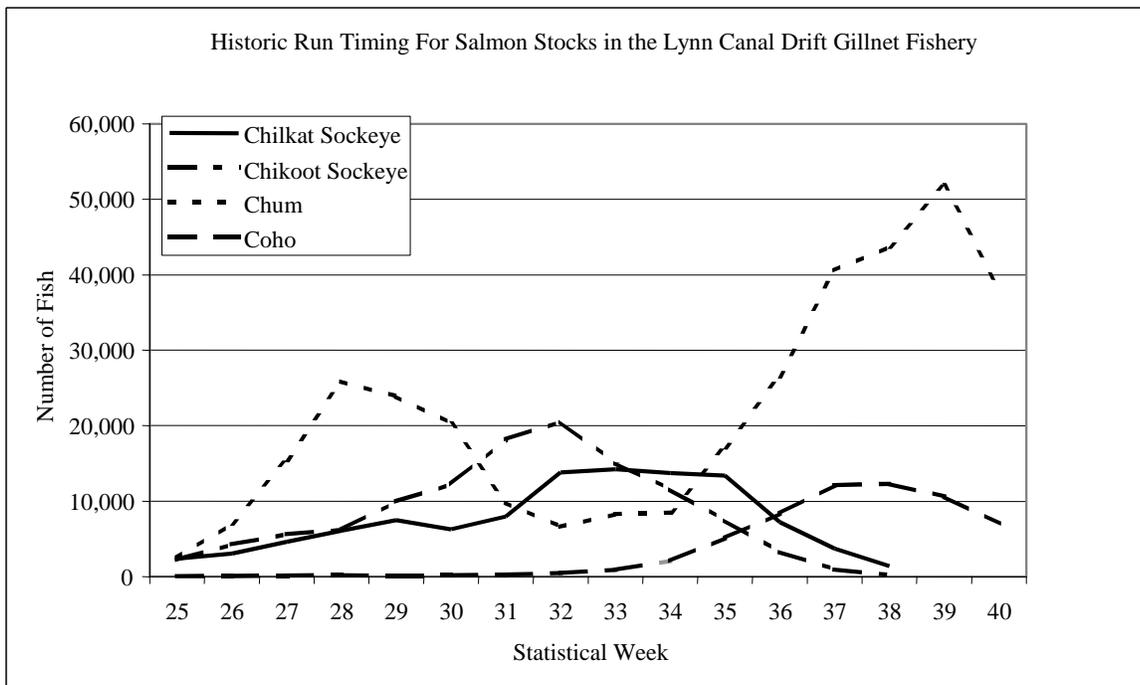


Figure 8. Historic run timing for salmon stocks in the Lynn Canal drift gillnet fishery.

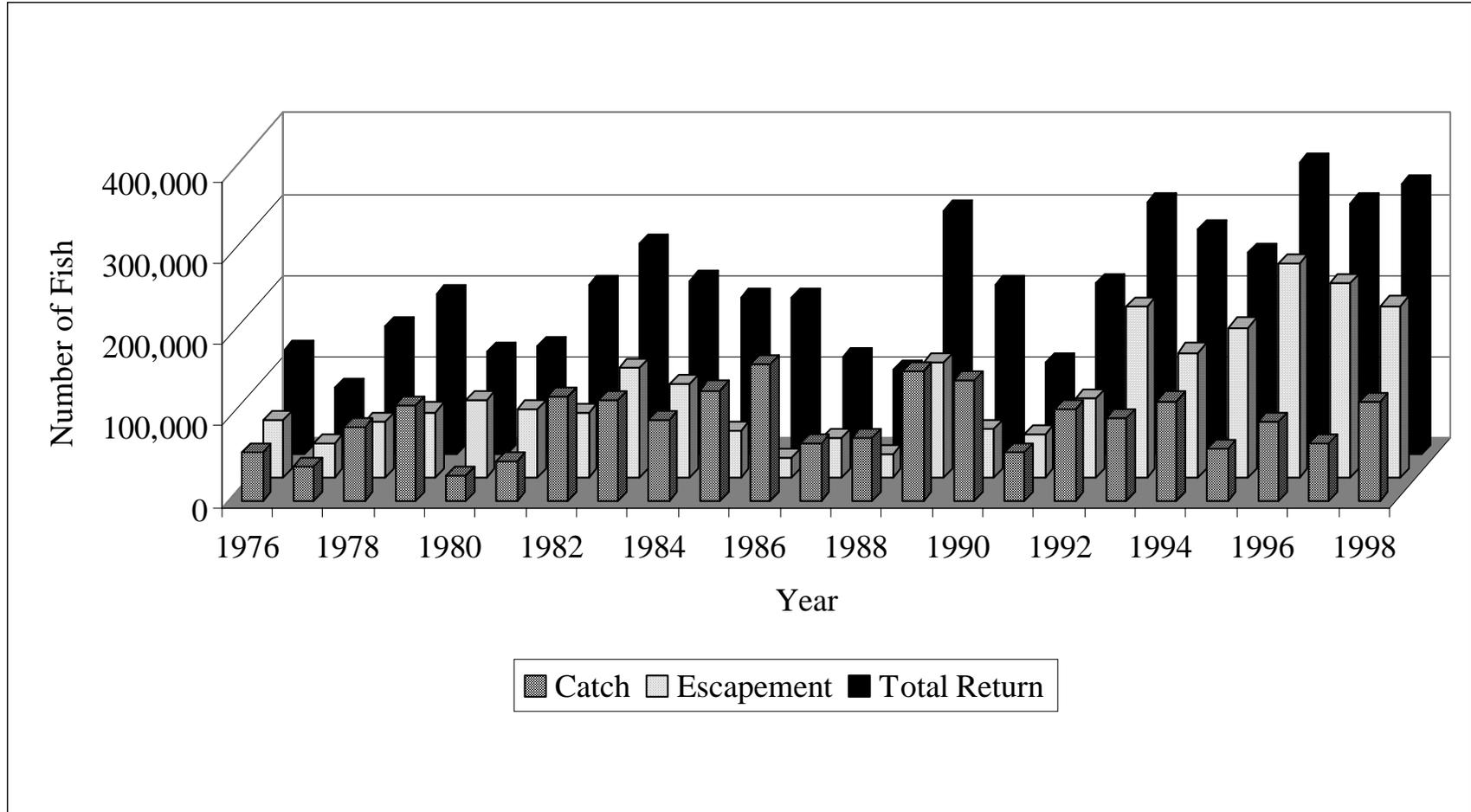


Figure 9. Historical escapement, harvest and total run of Chilkat Lake sockeye salmon.

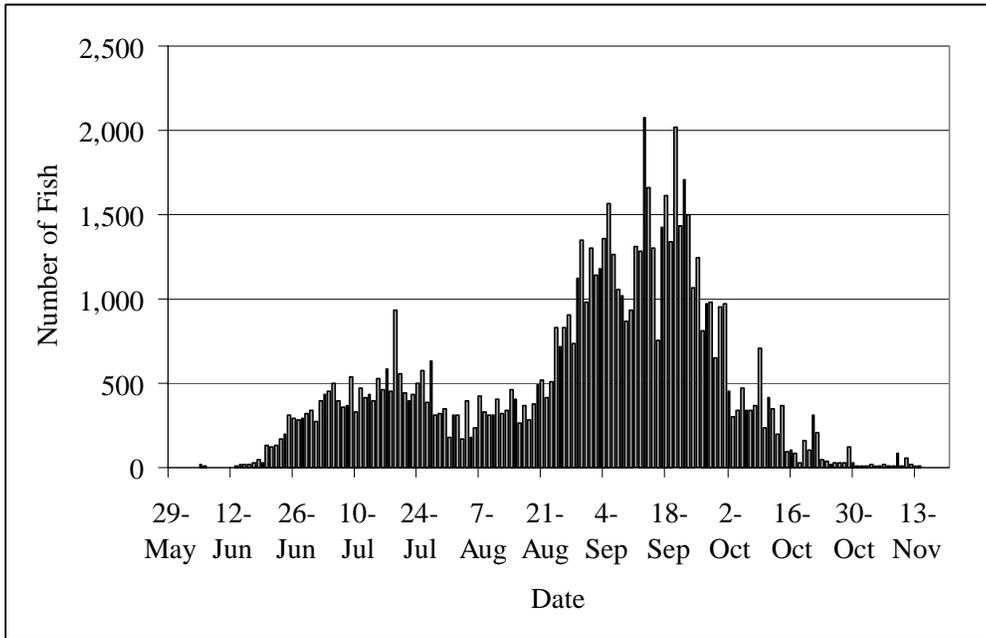


Figure 10. Average Chilkat Lake daily weir counts, 1970 through 1995.

APPENDICES

Appendix A. Calendar dates for statistical weeks in 1998.

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

Appendix B. Chilkat River daily water level, temperature, fish wheel rpm, and fish wheel effort data, 1998.

Stat Week	Date	Daily Water Level	Daily Water Temp.(C)	Fish Wheel I RPM	Fish Wheel II RPM	Fish Wheel I Effort	Fish Wheel II Effort
24	10-Jun	174	7.5	3.8	2.0	0.00	23.00
24	11-Jun	157	7	4.0	2.0	22.50	23.84
24	12-Jun	145	7.5	3.6	2.0	22.50	23.84
24	13-Jun	138	7.5	3.9	2.5	24.00	23.92
25	14-Jun	134	7.5	3.6	2.0	24.00	23.50
25	15-Jun	129	10	3.8	2.0	24.00	23.50
25	16-Jun	134	8.5	3.6	2.5	24.00	23.77
25	17-Jun	133	7	3.6	2.6	24.00	23.84
25	18-Jun	134	8.2	3.5	2.1	24.00	23.58
25	19-Jun	149	9.1	3.6	2.3	24.00	23.25
25	20-Jun	150	8.4	3.5	2.3	23.00	23.58
26	21-Jun	147	9	3.1	2.3	18.00	22.56
26	22-Jun	143	7.5	3.3	2.6	24.00	23.32
26	23-Jun	148	8.7	3.2	2.3	24.00	22.48
26	24-Jun	139	7.5	3.1	2.0	24.00	22.72
26	25-Jun	132	8.5	3.2	2.1	24.00	22.67
26	26-Jun	154	9.2	3.3	2.3	23.50	23.73
26	27-Jun	154	8.5	3.4	2.3	22.00	23.65
27	28-Jun	151	8.4	3.2	2.3	24.00	21.84
27	29-Jun	150	8.4	3.6	2.2	24.00	22.84
27	30-Jun	153	8.4	3.5	2.1	18.39	22.84
27	1-Jul	152	8.4	3.4	2.0	24.00	22.84
27	2-Jul	159	9.5	3.3	2.2	24.00	23.00
27	3-Jul	165	9.4	3.4	1.8	24.00	22.92
27	4-Jul	168	9.5	3.4	1.9	24.00	22.92
28	5-Jul	173	10.2	3.4	1.9	21.00	22.84
28	6-Jul	175	8.7	3.5	1.8	24.00	23.67
28	7-Jul	172	8	3.5	2.1	24.00	22.84
28	8-Jul	157	7.7	3.4	2.3	23.92	22.92
28	9-Jul	144	6.9	3.5	2.2	24.00	23.08
28	10-Jul	140	7.1	3.4	2.3	24.00	23.77
28	11-Jul	146	7.9	3.3	2.0	24.00	21.56
29	12-Jul	150	8.4	3.3	2.1	24.00	22.25
29	13-Jul	142	8.4	3.6	1.9	23.42	22.16
29	14-Jul	139	7.2	3.4	1.8	24.00	22.75
29	15-Jul	143	7.2	3.5	1.8	24.00	23.00
29	16-Jul	139	7.4	3.3	1.7	24.00	23.42

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Stat Week	Date	Daily Water Level	Daily Water Temp.(C)	Fish Wheel Wheel I RPM	Fish Wheel Wheel II RPM	Fish Wheel Wheel I Effort	Fish Wheel Wheel II Effort
29	17-Jul	133	7	3.4	1.8	24.00	23.33
29	18-Jul	127	8.2	3.3	1.9	23.42	23.15
30	19-Jul	128	8.1	3.4	1.7	23.50	23.17
30	20-Jul	131	9	3.3	1.8	24.00	22.25
30	21-Jul	134	7.6	3.5	1.7	24.00	23.67
30	22-Jul	138	7.9	3.4	2.1	24.00	23.08
30	23-Jul	151	7.5	3.4	1.7	24.00	23.50
30	24-Jul	140	6.9	3.4	1.8	24.00	23.77
30	25-Jul	145	7.2	3.5	2.0	24.00	23.17
31	26-Jul	148	7.9	3.3	2.1	24.00	23.33
31	27-Jul	144	6.2	3.2	2.1	23.92	22.92
31	28-Jul	139	8.5	3.2	2.1	24.00	23.42
31	29-Jul	137	8.3	3.1	2.3	24.00	23.50
31	30-Jul	130	8.2	3.2	2.0	24.00	23.33
31	31-Jul	126	8	3.2	2.1	24.00	23.25
31	1-Aug	133	9.7	3.1	2.2	24.00	23.17
32	2-Aug	130	6.3	3.0	1.7	24.00	23.33
32	3-Aug	124	7.8	2.9	1.6	24.00	23.00
32	4-Aug	123	7.7	2.7	1.6	24.00	23.33
32	5-Aug	125	7.8	2.8	1.8	24.00	23.42
32	6-Aug	121	8.7	2.7	1.6	24.00	22.75
32	7-Aug	120	8.2	2.9	1.8	24.00	22.67
32	8-Aug	145	7.3	2.8	2.1	24.00	23.33
33	9-Aug	143	6.7	3.0	1.6	24.00	23.33
33	10-Aug	124	7.2	2.7	1.4	24.00	22.50
33	11-Aug	110	7.2	2.6	1.2	24.00	21.17
33	12-Aug	111	7.7	2.7	1.5	24.00	24.00
33	13-Aug	118	8.4	2.7	1.5	24.00	24.00
33	14-Aug	N/A	N/A	2.5	1.6	24.00	24.00
33	15-Aug	129	8.5	2.5	1.8	24.00	24.00
34	16-Aug	131	7.8	2.9	1.8	24.00	24.00
34	17-Aug	131	8.3	3.0	1.5	24.00	23.84
34	18-Aug	136	7.4	2.9	1.6	24.00	24.00
34	19-Aug	130	6.7	3.2	1.0	24.00	24.00
34	20-Aug	118	7.2	3.0	1.1	24.00	15.00
34	21-Aug	111	7.5	2.9	1.0	24.00	15.00

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Stat Week	Date	Daily Water Level	Daily Water Temp.(C)	Fish Wheel Wheel I RPM	Fish Wheel Wheel II RPM	Fish Wheel Wheel I Effort	Fish Wheel Wheel II Effort
34	22-Aug	107	7.2	2.9	1.5	24.00	12.00
35	23-Aug	107	6.7	2.8	1.7	24.00	24.00
35	24-Aug	118	8.1	3.0	2.5	24.00	24.00
35	25-Aug	116	7.2	3.0	2.6	24.00	24.00
35	26-Aug	130	7.7	3.0	2.7	24.00	24.00
35	27-Aug	129	6.4	2.6	2.6	24.00	24.00
35	28-Aug	125	6.2	2.7	2.4	24.00	24.00
35	29-Aug	144	9.3	2.5	2.9	24.00	24.00
36	30-Aug	143	5.8	2.9	2.7	24.00	24.00
36	31-Aug	120	9.6	2.7	2.5	24.00	24.00
36	1-Sep	172	7.6	2.9	2.6	24.00	24.00
36	2-Sep	150	6.4	2.6	2.5	24.00	24.00
36	3-Sep	124	6.6	2.3	2.3	24.00	24.00
36	4-Sep	115	6.8	2.3	2.0	24.00	24.00
36	5-Sep	109	6.2	2.1	1.8	24.00	24.00
37	6-Sep	102	7.8	2.3	2.0	24.00	24.00
37	7-Sep	126	N/A	2.6	2.8	24.00	24.00
37	8-Sep	135	N/A	2.2	2.2	24.00	24.00
37	9-Sep	122	6	2.0	1.6	24.00	23.25
37	10-Sep	100	6.5	1.9	1.6	24.00	24.00
37	11-Sep	102	7	2.3	2.2	24.00	24.00
37	12-Sep	117	6.8	2.4	2.3	24.00	24.00
38	13-Sep	107	6.8	2.2	1.7	24.00	24.00
38	14-Sep	97	7.5	1.9	1.6	24.00	24.00
38	15-Sep	91	6.5	1.3	1.2	24.00	20.00
38	16-Sep	85	6	1.3	n/a	24.00	7.00
38	17-Sep	81	5	1.2	n/a	24.00	0.00
38	18-Sep	81	5.4	1.8	3.0	24.00	8.00
38	19-Sep	79	7.5	1.7	3.0	24.00	24.00
39	20-Sep	80	7.5	2.1	3.1	24.00	24.00
39	21-Sep	87	7	2.1	3.1	24.00	24.00
39	22-Sep	86	6.5	2.1	2.9	24.00	23.92
39	23-Sep	84	7	2.4	2.4	24.00	24.00
39	24-Sep	84	7	2.3	2.6	24.00	24.00
39	25-Sep	84	7.5	2.2	2.2	24.00	24.00
39	26-Sep	83	7.5	2.2	2.3	24.00	24.00
40	27-Sep	83	7	2.3	2.1	24.00	24.00

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Stat Week	Date	Daily Water Level	Daily Water Temp.(C)	Fish Wheel Wheel I RPM	Fish Wheel Wheel II RPM	Fish Wheel Wheel I Effort	Fish Wheel Wheel II Effort
40	28-Sep	78	7	2.0	1.5	24.00	24.00
40	29-Sep	77	5	1.6	1.1	23.67	23.50
40	30-Sep	74	5	1.6	1.2	22.92	16.00
40	1-Oct	77	5.9	1.7	1.3	23.42	23.42
40	2-Oct	71	6	1.6	1.0	22.84	4.00
40	3-Oct	70	5	1.5	n/a	23.00	0.00
41	4-Oct	65	4.9	1.5	n/a	22.84	0.00
41	5-Oct	62	4.9	1.7	n/a	24.00	0.00
41	6-Oct	64	4.9	2.0	n/a	24.00	0.00
41	7-Oct	62	5	1.8	n/a	24.00	0.00
41	8-Oct	65	5	1.7	n/a	24.00	0.00
41	9-Oct	60	5	1.6	n/a	24.00	0.00
41	10-Oct	58	5	1.5	n/a	24.00	0.00
42	11-Oct	57	4	1.3	n/a	24.00	0.00
42	12-Oct	55	3.5	1.2	n/a	24.00	0.00
42	13-Oct	53	2.5	n/a	n/a	2.00	0.00

Appendix C.1. Catches, number tagged, and CPUE of chinook salmon captured in the Chilkat River fish wheels, 1998.

Date	Daily Chinook Catch	Cumul. Chinook Catch	Daily Chinook Tagged	Cumul. Chinook Tagged	Daily CPUE	Cumul. Proport. CPUE
9-Jun		0		0	0.000	0.000
10-Jun		0		0	0.000	0.000
11-Jun	1	1	1	1	0.000	0.000
12-Jun	1	2	1	2	0.065	0.007
13-Jun	1	3	1	3	0.063	0.014
14-Jun	1	4	1	4	0.063	0.021
15-Jun	4	8	4	8	0.253	0.050
16-Jun	4	12	4	12	0.251	0.078
17-Jun	1	13	1	13	0.063	0.085
18-Jun	1	14	0	13	0.063	0.092
19-Jun	1	15	1	14	0.063	0.100
20-Jun	1	16	0	14	0.064	0.107
21-Jun	1	17	1	15	0.074	0.115
22-Jun	2	19	1	16	0.127	0.129
23-Jun	9	28	6	22	0.581	0.195
24-Jun	5	33	4	26	0.321	0.231
25-Jun	8	41	4	30	0.514	0.289
26-Jun	5	46	4	34	0.318	0.325
27-Jun	10	56	6	40	0.657	0.399
28-Jun	6	62	6	46	0.393	0.443
29-Jun	6	68	2	48	0.384	0.486
30-Jun	4	72	2	50	0.291	0.519
1-Jul	5	77	3	53	0.320	0.555
2-Jul	10	87	9	62	0.638	0.627
3-Jul	7	94	3	65	0.448	0.677
4-Jul	2	96	0	65	0.128	0.692
5-Jul	8	104	3	68	0.547	0.754
6-Jul	0	104	0	68	0.000	0.754
7-Jul	4	108	1	69	0.256	0.782
8-Jul	4	112	1	70	0.256	0.811
9-Jul	1	113	1	71	0.064	0.818
10-Jul	4	117	0	71	0.251	0.847
11-Jul	5	122	5	76	0.329	0.884
12-Jul	3	125	1	77	0.195	0.906
13-Jul	2	127	2	79	0.132	0.921
14-Jul	3	130	2	81	0.193	0.942
15-Jul	1	131	0	81	0.064	0.949
16-Jul	0	131	0	81	0.000	0.949
17-Jul	0	131	0	81	0.000	0.949
18-Jul	3	134	2	83	0.193	0.971
19-Jul	0	134	0	83	0.000	0.971
20-Jul	1	135	1	84	0.065	0.979

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Date	Daily Chinook Catch	Cumul. Chinook Catch	Daily Chinook Tagged	Cumul. Chinook Tagged	Daily CPUE	Cumul. Proport. CPUE
21-Jul	0	135	0	84	0.000	0.979
22-Jul	1	136	1	85	0.064	0.986
23-Jul	0	136	0	85	0.000	0.986
24-Jul	0	136	0	85	0.000	0.986
25-Jul	0	136	0	85	0.000	0.986
26-Jul	0	136	0	85	0.000	0.986
27-Jul	0	136	0	85	0.000	0.986
28-Jul	1	137	1	86	0.063	0.993
29-Jul	0	137	0	86	0.000	0.993
30-Jul	0	137	0	86	0.000	0.993
31-Jul	0	137	0	86	0.000	0.993
1-Aug	0	137	0	86	0.000	0.993
2-Aug	0	137	0	86	0.000	0.993
3-Aug	0	137	0	86	0.000	0.993
4-Aug	1	138	1	87	0.063	1.000

Appendix C.2. Catches, number marked, and CPUE of sockeye salmon captured in the Chilkat River fish wheels, 1998.

Date	Daily Sockeye Catch	Cumul. Sockeye Catch	Daily Sockeye Marked	Cumul. Sockeye Marked	Daily CPUE	Cumul. Proport. CPUE
9-Jun		0		0	0.000	0.000
10-Jun	1	1	1	1	0.130	0.000
11-Jun	4	5	4	5		0.000
12-Jun	4	9	4	9	0.259	0.001
13-Jun	2	11	2	11	0.125	0.001
14-Jun	3	14	3	14	0.189	0.002
15-Jun	1	15	1	15	0.063	0.002
16-Jun	10	25	10	25	0.628	0.004
17-Jun	11	36	10	35	0.690	0.005
18-Jun	16	52	16	51	1.009	0.008
19-Jun	21	73	21	72	1.333	0.012
20-Jun	18	91	17	89	1.159	0.015
21-Jun	19	110	19	108	1.405	0.018
22-Jun	26	136	26	134	1.648	0.022
23-Jun	54	190	52	186	3.485	0.032
24-Jun	44	234	42	228	2.825	0.039
25-Jun	32	266	31	259	2.057	0.044
26-Jun	20	286	20	279	1.270	0.048
27-Jun	24	310	24	303	1.577	0.052
28-Jun	50	360	48	351	3.272	0.060
29-Jun	68	428	63	414	4.355	0.072
30-Jun	58	486	58	472	4.220	0.083
1-Jul	48	534	47	519	3.074	0.091
2-Jul	49	583	47	566	3.128	0.099
3-Jul	58	641	56	622	3.708	0.108
4-Jul	76	717	72	694	4.859	0.121
5-Jul	80	797	79	773	5.474	0.135
6-Jul	44	841	43	816	2.769	0.142
7-Jul	52	893	51	867	3.330	0.151
8-Jul	47	940	45	912	3.010	0.159
9-Jul	51	991	51	963	3.250	0.167
10-Jul	27	1,018	26	989	1.696	0.172
11-Jul	16	1,034	16	1,005	1.054	0.175
12-Jul	29	1,063	29	1,034	1.881	0.179
13-Jul	103	1,166	100	1,134	6.779	0.197
14-Jul	95	1,261	94	1,228	6.096	0.213
15-Jul	45	1,306	44	1,272	2.872	0.220
16-Jul	29	1,335	29	1,301	1.835	0.225
17-Jul	26	1,361	24	1,325	1.648	0.229
18-Jul	41	1,402	38	1,363	2.641	0.236
19-Jul	73	1,475	70	1,433	4.693	0.249
20-Jul	82	1,557	80	1,513	5.319	0.262

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Date	Daily Sockeye Catch	Cumul. Sockeye Catch	Daily Sockeye Marked	Cumul. Sockeye Marked	Daily CPUE	Cumul. Proport. CPUE
21-Jul	15	1,572	15	1,528	0.944	0.265
22-Jul	28	1,600	27	1,555	1.784	0.269
23-Jul	23	1,623	23	1,578	1.453	0.273
24-Jul	42	1,665	41	1,619	2.638	0.280
25-Jul	62	1,727	62	1,681	3.943	0.290
26-Jul	49	1,776	49	1,730	3.106	0.298
27-Jul	53	1,829	53	1,783	3.395	0.307
28-Jul	29	1,858	28	1,811	1.835	0.312
29-Jul	25	1,883	24	1,835	1.579	0.316
30-Jul	49	1,932	49	1,884	3.106	0.324
31-Jul	50	1,982	49	1,933	3.175	0.333
1-Aug	96	2,078	96	2,029	6.106	0.348
2-Aug	56	2,134	54	2,083	3.550	0.358
3-Aug	95	2,229	95	2,178	6.064	0.373
4-Aug	71	2,300	71	2,249	4.500	0.385
5-Aug	54	2,354	54	2,303	3.416	0.394
6-Aug	49	2,403	48	2,351	3.144	0.402
7-Aug	59	2,462	55	2,406	3.793	0.412
8-Aug	46	2,508	45	2,451	2.916	0.420
9-Aug	61	2,569	60	2,511	3.866	0.430
10-Aug	95	2,664	89	2,600	6.129	0.446
11-Aug	58	2,722	57	2,657	3.852	0.456
12-Aug	69	2,791	67	2,724	4.313	0.467
13-Aug	63	2,854	61	2,785	3.938	0.477
14-Aug	59	2,913	58	2,843	3.688	0.487
15-Aug	40	2,953	38	2,881	2.500	0.493
16-Aug	38	2,991	37	2,918	2.375	0.499
17-Aug	102	3,093	96	3,014	6.396	0.516
18-Aug	72	3,165	71	3,085	4.500	0.528
19-Aug	44	3,209	43	3,128	2.750	0.535
20-Aug	29	3,238	29	3,157	2.231	0.541
21-Aug	78	3,316	76	3,233	6.000	0.556
22-Aug	46	3,362	44	3,277	3.833	0.566
23-Aug	50	3,412	50	3,327	3.125	0.574
24-Aug	90	3,502	88	3,415	5.625	0.589
25-Aug	107	3,609	105	3,520	6.688	0.607
26-Aug	67	3,676	65	3,585	4.188	0.617
27-Aug	61	3,737	60	3,645	3.813	0.627
28-Aug	64	3,801	62	3,707	4.000	0.638
29-Aug	56	3,857	54	3,761	3.500	0.647
30-Aug	19	3,876	18	3,779	1.188	0.650
31-Aug	37	3,913	37	3,816	2.313	0.656

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Date	Daily Sockeye Catch	Cumul. Sockeye Catch	Daily Sockeye Marked	Cumul. Sockeye Marked	Daily CPUE	Cumul. Proport. CPUE
1-Sep	25	3,938	24	3,840	1.563	0.660
2-Sep	18	3,956	18	3,858	1.125	0.663
3-Sep	43	3,999	43	3,901	2.688	0.670
4-Sep	78	4,077	77	3,978	4.875	0.683
5-Sep	95	4,172	94	4,072	5.938	0.698
6-Sep	77	4,249	75	4,147	4.813	0.711
7-Sep	49	4,298	48	4,195	3.063	0.719
8-Sep	67	4,365	63	4,258	4.188	0.729
9-Sep	70	4,435	69	4,327	4.444	0.741
10-Sep	64	4,499	63	4,390	4.000	0.751
11-Sep	78	4,577	74	4,464	4.875	0.764
12-Sep	69	4,646	67	4,531	4.313	0.775
13-Sep	54	4,700	54	4,585	3.375	0.784
14-Sep	45	4,745	45	4,630	2.813	0.791
15-Sep	42	4,787	41	4,671	2.864	0.799
16-Sep	45	4,832	45	4,716	4.355	0.810
17-Sep	38	4,870	38	4,754	4.750	0.823
18-Sep	31	4,901	30	4,784	2.906	0.830
19-Sep	58	4,959	56	4,840	3.625	0.840
20-Sep	68	5,027	67	4,907	4.250	0.851
21-Sep	62	5,089	60	4,967	3.875	0.861
22-Sep	71	5,160	70	5,037	4.445	0.872
23-Sep	62	5,222	60	5,097	3.875	0.882
24-Sep	74	5,296	73	5,170	4.625	0.894
25-Sep	66	5,362	66	5,236	4.125	0.905
26-Sep	40	5,402	38	5,274	2.500	0.912
27-Sep	56	5,458	55	5,329	3.500	0.921
28-Sep	58	5,516	56	5,385	3.625	0.930
29-Sep	41	5,557	41	5,426	2.608	0.937
30-Sep	22	5,579	22	5,448	1.696	0.941
1-Oct	39	5,618	38	5,486	2.498	0.948
2-Oct	29	5,647	28	5,514	3.241	0.956
3-Oct	13	5,660	13	5,527	1.696	0.961
4-Oct	11	5,671	11	5,538	1.445	0.965
5-Oct	10	5,681	10	5,548	1.250	0.968
6-Oct	15	5,696	15	5,563	1.875	0.973
7-Oct	11	5,707	11	5,574	1.375	0.976
8-Oct	13	5,720	13	5,587	1.625	0.980
9-Oct	6	5,726	6	5,593	0.750	0.982
10-Oct	11	5,737	11	5,604	1.375	0.986
11-Oct	3	5,740	3	5,607	0.375	0.987
12-Oct	4	5,744	4	5,611	0.500	0.988
13-Oct	3	5,747	3	5,614	4.500	1.000

Appendix C.3. Catches, number tagged, and CPUE of coho salmon captured in the Chilkat River fish wheels, 1998.

Date	Daily Coho Catch	Cumul. Coho Catch	Daily Coho Tagged	Cumul. Coho Tagged	Daily CPUE	Cumul. Proport. CPUE
9-Aug	1	1	1	1	0.063	0.001
10-Aug	2	3	2	3	0.129	0.002
11-Aug	3	6	2	5	0.199	0.004
12-Aug	2	8	1	6	0.125	0.005
13-Aug	2	10	2	8	0.125	0.006
14-Aug	0	10	0	8	0.000	0.006
15-Aug	0	10	0	8	0.000	0.006
16-Aug	3	13	3	11	0.188	0.008
17-Aug	3	16	3	14	0.188	0.009
18-Aug	4	20	4	18	0.250	0.012
19-Aug	2	22	1	19	0.125	0.013
20-Aug	0	22	0	19	0.000	0.013
21-Aug	0	22	0	19	0.000	0.013
22-Aug	1	23	1	20	0.083	0.014
23-Aug	1	24	1	21	0.063	0.014
24-Aug	1	25	1	22	0.063	0.015
25-Aug	3	28	3	25	0.188	0.017
26-Aug	8	36	8	33	0.500	0.021
27-Aug	6	42	5	38	0.375	0.025
28-Aug	8	50	6	44	0.500	0.029
29-Aug	6	56	5	49	0.375	0.033
30-Aug	0	56	0	49	0.000	0.033
31-Aug	2	58	2	51	0.125	0.034
1-Sep	0	58	0	51	0.000	0.034
2-Sep	2	60	2	53	0.125	0.035
3-Sep	12	72	12	65	0.750	0.042
4-Sep	4	76	4	69	0.250	0.045
5-Sep	7	83	7	76	0.438	0.049
6-Sep	6	89	6	82	0.375	0.052
7-Sep	23	112	23	105	1.438	0.065
8-Sep	19	131	18	123	1.188	0.076
9-Sep	19	150	18	141	1.206	0.088
10-Sep	13	163	13	154	0.813	0.095
11-Sep	30	193	30	184	1.875	0.113
12-Sep	9	202	9	193	0.563	0.118
13-Sep	18	220	18	211	1.125	0.128
14-Sep	13	233	11	222	0.813	0.136
15-Sep	31	264	30	252	2.114	0.156
16-Sep	20	284	20	272	1.935	0.174
17-Sep	40	324	40	312	5.000	0.220
18-Sep	21	345	19	331	1.969	0.238

-continued-

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Date	Daily Coho Catch	Cumul. Coho Catch	Daily Coho Tagged	Cumul. Coho Tagged	Daily CPUE	Cumul. Proport. CPUE
19-Sep	50	395	47	378	3.125	0.267
20-Sep	15	410	15	393	0.938	0.276
21-Sep	25	435	24	417	1.563	0.291
22-Sep	35	470	35	452	2.191	0.311
23-Sep	23	493	22	474	1.438	0.324
24-Sep	20	513	19	493	1.250	0.336
25-Sep	44	557	41	534	2.750	0.361
26-Sep	30	587	29	563	1.875	0.379
27-Sep	48	635	47	610	3.000	0.407
28-Sep	66	701	64	674	4.125	0.445
29-Sep	83	784	83	757	5.279	0.494
30-Sep	29	813	29	786	2.235	0.515
1-Oct	33	846	30	816	2.114	0.535
2-Oct	16	862	16	832	1.788	0.551
3-Oct	8	870	7	839	1.043	0.561
4-Oct	19	889	18	857	2.496	0.584
5-Oct	22	911	22	879	2.750	0.610
6-Oct	27	938	27	906	3.375	0.641
7-Oct	19	957	19	925	2.375	0.663
8-Oct	20	977	20	945	2.500	0.686
9-Oct	20	997	20	965	2.500	0.710
10-Oct	16	1,013	16	981	2.000	0.728
11-Oct	7	1,020	6	987	0.875	0.736
12-Oct	35	1,055	35	1,022	4.375	0.777
13-Oct	16	1,071	16	1,038	24.000	1.000

Appendix C.4. Catches and CPUE of pink salmon captured in the Chilkat River fish wheels, 1998.

Date	Daily Pink Catch	Cumul. Pink Catch	Daily CPUE	Cumul. Proport. CPUE
16-Jun	1	1	0.063	0.001
17-Jun	0	1	0.000	0.001
18-Jun	0	1	0.000	0.001
19-Jun	0	1	0.000	0.001
20-Jun	0	1	0.000	0.001
21-Jun	0	1	0.000	0.001
22-Jun	0	1	0.000	0.001
23-Jun	0	1	0.000	0.001
24-Jun	0	1	0.000	0.001
25-Jun	0	1	0.000	0.001
26-Jun	0	1	0.000	0.001
27-Jun	0	1	0.000	0.001
28-Jun	2	3	0.131	0.002
29-Jun	0	3	0.000	0.002
30-Jun	0	3	0.000	0.002
1-Jul	6	9	0.384	0.005
2-Jul	5	14	0.319	0.008
3-Jul	2	16	0.128	0.009
4-Jul	6	22	0.384	0.013
5-Jul	2	24	0.137	0.014
6-Jul	2	26	0.126	0.015
7-Jul	5	31	0.320	0.018
8-Jul	18	49	1.153	0.028
9-Jul	30	79	1.912	0.046
10-Jul	25	104	1.570	0.060
11-Jul	17	121	1.119	0.070
12-Jul	25	146	1.622	0.084
13-Jul	48	194	3.159	0.113
14-Jul	47	241	3.016	0.140
15-Jul	32	273	2.043	0.159
16-Jul	39	312	2.467	0.181
17-Jul	56	368	3.550	0.213
18-Jul	66	434	4.252	0.251
19-Jul	50	484	3.214	0.280
20-Jul	36	520	2.335	0.301
21-Jul	25	545	1.573	0.315
22-Jul	45	590	2.867	0.341
23-Jul	18	608	1.137	0.351
24-Jul	55	663	3.454	0.382
25-Jul	42	705	2.671	0.407
26-Jul	55	760	3.486	0.438

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Date	Daily Pink Catch	Cumul. Pink Catch	Daily CPUE	Cumul. Proport. CPUE
27-Jul	37	797	2.370	0.459
28-Jul	38	835	2.404	0.481
29-Jul	36	871	2.274	0.502
30-Jul	49	920	3.106	0.530
31-Jul	48	968	3.048	0.557
1-Aug	66	1,034	4.198	0.595
2-Aug	57	1,091	3.613	0.627
3-Aug	100	1,191	6.383	0.685
4-Aug	53	1,244	3.359	0.715
5-Aug	58	1,302	3.669	0.748
6-Aug	45	1,347	2.888	0.774
7-Aug	29	1,376	1.864	0.791
8-Aug	12	1,388	0.761	0.798
9-Aug	34	1,422	2.155	0.817
10-Aug	54	1,476	3.484	0.849
11-Aug	35	1,511	2.325	0.870
12-Aug	23	1,534	1.438	0.883
13-Aug	17	1,551	1.063	0.892
14-Aug	6	1,557	0.375	0.896
15-Aug	8	1,565	0.500	0.900
16-Aug	9	1,574	0.563	0.905
17-Aug	12	1,586	0.753	0.912
18-Aug	3	1,589	0.188	0.914
19-Aug	5	1,594	0.313	0.917
20-Aug	6	1,600	0.462	0.921
21-Aug	3	1,603	0.231	0.923
22-Aug	4	1,607	0.333	0.926
23-Aug	6	1,613	0.375	0.929
24-Aug	16	1,629	1.000	0.938
25-Aug	12	1,641	0.750	0.945
26-Aug	7	1,648	0.438	0.949
27-Aug	8	1,656	0.500	0.953
28-Aug	6	1,662	0.375	0.957
29-Aug	6	1,668	0.375	0.960
30-Aug	4	1,672	0.250	0.962
31-Aug	14	1,686	0.875	0.970
1-Sep	3	1,689	0.188	0.972
2-Sep	5	1,694	0.313	0.975
3-Sep	9	1,703	0.563	0.980
4-Sep	4	1,707	0.250	0.982
5-Sep	8	1,715	0.500	0.987

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Date	Daily Pink Catch	Cumul. Pink Catch	Daily CPUE	Cumul. Proport. CPUE
6-Sep	2	1,717	0.125	0.988
7-Sep	3	1,720	0.188	0.989
8-Sep	2	1,722	0.125	0.991
9-Sep	2	1,724	0.127	0.992
10-Sep	2	1,726	0.125	0.993
11-Sep	2	1,728	0.125	0.994
12-Sep	1	1,729	0.063	0.995
13-Sep	2	1,731	0.125	0.996
14-Sep	1	1,732	0.063	0.996
15-Sep	2	1,734	0.136	0.997
16-Sep	0	1,734	0.000	0.997
17-Sep	0	1,734	0.000	0.997
18-Sep	1	1,735	0.094	0.998
19-Sep	1	1,736	0.063	0.999
20-Sep	0	1,736	0.000	0.999
21-Sep	1	1,737	0.063	0.999
22-Sep	0	1,737	0.000	0.999
23-Sep	0	1,737	0.000	0.999
24-Sep	0	1,737	0.000	0.999
25-Sep	0	1,737	0.000	0.999
26-Sep	0	1,737	0.000	0.999
27-Sep	0	1,737	0.000	0.999
28-Sep	0	1,737	0.000	0.999
29-Sep	0	1,737	0.000	0.999
30-Sep	0	1,737	0.000	0.999
1-Oct	1	1,738	0.064	1.000

Appendix C.5. Catches and CPUE of chum salmon captured in the Chilkat River fish wheels, 1998.

Date	Daily Chum Catch	Cumul. Chum Catch	Daily CPUE	Cumul. Proport. CPUE
28-Jun	1	1	0.065	0.000
29-Jun	0	1	0.000	0.000
30-Jun	0	1	0.000	0.000
1-Jul	0	1	0.000	0.000
2-Jul	0	1	0.000	0.000
3-Jul	0	1	0.000	0.000
4-Jul	0	1	0.000	0.000
5-Jul	0	1	0.000	0.000
6-Jul	0	1	0.000	0.000
7-Jul	0	1	0.000	0.000
8-Jul	0	1	0.000	0.000
9-Jul	0	1	0.000	0.000
10-Jul	0	1	0.000	0.000
11-Jul	1	2	0.066	0.001
12-Jul	0	2	0.000	0.001
13-Jul	0	2	0.000	0.001
14-Jul	0	2	0.000	0.001
15-Jul	0	2	0.000	0.001
16-Jul	1	3	0.063	0.001
17-Jul	1	4	0.063	0.002
18-Jul	0	4	0.000	0.002
19-Jul	0	4	0.000	0.002
20-Jul	0	4	0.000	0.002
21-Jul	1	5	0.063	0.002
22-Jul	1	6	0.064	0.002
23-Jul	0	6	0.000	0.002
24-Jul	1	7	0.063	0.003
25-Jul	0	7	0.000	0.003
26-Jul	2	9	0.127	0.003
27-Jul	1	10	0.064	0.004
28-Jul	0	10	0.000	0.004
29-Jul	2	12	0.126	0.005
30-Jul	0	12	0.000	0.005
31-Jul	0	12	0.000	0.005
1-Aug	1	13	0.064	0.005
2-Aug	0	13	0.000	0.005
3-Aug	2	15	0.128	0.006
4-Aug	2	17	0.127	0.007
5-Aug	3	20	0.190	0.008
6-Aug	1	21	0.064	0.008
7-Aug	3	24	0.193	0.009

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Date	Daily Chum Catch	Cumul. Chum Catch	Daily CPUE	Cumul. Proport. CPUE
8-Aug	2	26	0.127	0.010
9-Aug	1	27	0.063	0.010
10-Aug	3	30	0.194	0.012
11-Aug	9	39	0.598	0.015
12-Aug	12	51	0.750	0.020
13-Aug	14	65	0.875	0.025
14-Aug	8	73	0.500	0.028
15-Aug	7	80	0.438	0.031
16-Aug	1	81	0.063	0.031
17-Aug	2	83	0.125	0.032
18-Aug	1	84	0.063	0.032
19-Aug	9	93	0.563	0.036
20-Aug	7	100	0.538	0.039
21-Aug	11	111	0.846	0.044
22-Aug	6	117	0.500	0.047
23-Aug	20	137	1.250	0.054
24-Aug	29	166	1.813	0.065
25-Aug	10	176	0.625	0.069
26-Aug	12	188	0.750	0.074
27-Aug	14	202	0.875	0.079
28-Aug	23	225	1.438	0.088
29-Aug	24	249	1.500	0.097
30-Aug	4	253	0.250	0.098
31-Aug	5	258	0.313	0.100
1-Sep	2	260	0.125	0.101
2-Sep	3	263	0.188	0.102
3-Sep	6	269	0.375	0.104
4-Sep	11	280	0.688	0.108
5-Sep	35	315	2.188	0.122
6-Sep	31	346	1.938	0.133
7-Sep	12	358	0.750	0.138
8-Sep	15	373	0.938	0.144
9-Sep	27	400	1.714	0.154
10-Sep	15	415	0.938	0.160
11-Sep	43	458	2.688	0.176
12-Sep	20	478	1.250	0.183
13-Sep	20	498	1.250	0.191
14-Sep	18	516	1.125	0.198
15-Sep	30	546	2.045	0.210
16-Sep	30	576	2.903	0.228
17-Sep	25	601	3.125	0.246

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Date	Daily Chum Catch	Cumul. Chum Catch	Daily CPUE	Cumul. Proport. CPUE
18-Sep	32	633	3.000	0.265
19-Sep	27	660	1.688	0.275
20-Sep	37	697	2.313	0.289
21-Sep	72	769	4.500	0.316
22-Sep	51	820	3.193	0.335
23-Sep	84	904	5.250	0.367
24-Sep	62	966	3.875	0.390
25-Sep	85	1,051	5.313	0.422
26-Sep	90	1,141	5.625	0.456
27-Sep	137	1,278	8.563	0.508
28-Sep	116	1,394	7.250	0.552
29-Sep	110	1,504	6.996	0.594
30-Sep	36	1,540	2.775	0.611
1-Oct	65	1,605	4.163	0.636
2-Oct	65	1,670	7.265	0.680
3-Oct	40	1,710	5.217	0.711
4-Oct	45	1,755	5.911	0.747
5-Oct	27	1,782	3.375	0.767
6-Oct	17	1,799	2.125	0.780
7-Oct	11	1,810	1.375	0.789
8-Oct	29	1,839	3.625	0.811
9-Oct	22	1,861	2.750	0.827
10-Oct	20	1,881	2.500	0.842
11-Oct	17	1,898	2.125	0.855
12-Oct	36	1,934	4.500	0.882
13-Oct	13	1,947	19.50	1.000

Appendix C.6. Catches of Dolly Varden char in the Chilkat River fish wheels, 1998.

Date	Daily Dolly Varden Catch	Cumul. Dolly Varden Catch
15-Jun	1	1
16-Jun	0	1
17-Jun	0	1
18-Jun	1	2
19-Jun	0	2
20-Jun	0	2
21-Jun	0	2
22-Jun	0	2
23-Jun	0	2
24-Jun	0	2
25-Jun	0	2
26-Jun	0	2
27-Jun	0	2
28-Jun	1	3
29-Jun	1	4
30-Jun	0	4
1-Jul	1	5
2-Jul	0	5
3-Jul	0	5
4-Jul	4	9
5-Jul	5	14
6-Jul	0	14
7-Jul	3	17
8-Jul	1	18
9-Jul	6	24
10-Jul	2	26
11-Jul	4	30
12-Jul	4	34
13-Jul	10	44
14-Jul	15	59
15-Jul	7	66
16-Jul	8	74
17-Jul	10	84
18-Jul	33	117
19-Jul	13	130
20-Jul	19	149
21-Jul	7	156
22-Jul	9	165
23-Jul	4	169
24-Jul	5	174
25-Jul	4	178
26-Jul	10	188

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Date	Daily Dolly Varden Catch	Cumul. Dolly Varden Catch
27-Jul	3	191
28-Jul	9	200
29-Jul	6	206
30-Jul	6	212
31-Jul	6	218
1-Aug	4	222
2-Aug	0	222
3-Aug	2	224
4-Aug	4	228
5-Aug	2	230
6-Aug	1	231
7-Aug	1	232
8-Aug	2	234
9-Aug	0	234
10-Aug	2	236
11-Aug	3	239
12-Aug	2	241
13-Aug	3	244
14-Aug	0	244
15-Aug	0	244
16-Aug	0	244
17-Aug	1	245
18-Aug	1	246
19-Aug	0	246
20-Aug	0	246
21-Aug	0	246
22-Aug	0	246
23-Aug	0	246
24-Aug	8	254
25-Aug	0	254
26-Aug	1	255
27-Aug	1	256
28-Aug	2	258
29-Aug	1	259
30-Aug	0	259
31-Aug	1	260
1-Sep	0	260
2-Sep	0	260
3-Sep	0	260
4-Sep	0	260
5-Sep	1	261

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Date	Daily Dolly Varden Catch	Cumul. Dolly Varden Catch
6-Sep	1	262
7-Sep	0	262
8-Sep	1	263
9-Sep	0	263
10-Sep	0	263
11-Sep	0	263
12-Sep	0	263
13-Sep	0	263
14-Sep	0	263
15-Sep	0	263
16-Sep	0	263
17-Sep	0	263
18-Sep	4	267
19-Sep	11	278
20-Sep	5	283
21-Sep	0	283
22-Sep	0	283
23-Sep	1	284
24-Sep	0	284
25-Sep	0	284
26-Sep	1	285
27-Sep	1	286
28-Sep	1	287
29-Sep	2	289
30-Sep	5	294
1-Oct	2	296
2-Oct	4	300
3-Oct	4	304
4-Oct	9	313

Appendix D. Mark-recovery output for Chilkat Lake and mainstem sockeye salmon, 1998.

1998 Chilkat All sockeye M-R data - Chi-square Test Statistics

```
Complete Mixing : 361.89 (1 df)
  Significance... 0.00
Equal Proportions: 27.51 (12 df)
  Significance... 0.01
End of Pooling Tests
ML Darroch Estimate
```

```
Total Number of iterations is 1 (Max iterations is 25 )
Estimate (std. err) : 236072.88 ( 22373.02)
Log likelihood : 169050.79
```

```
95 % normal C I : ( 192221.76, 279924.00)
G-square : 4048.56 (11 df)
  Significance : 0.00
Chi-square : 3326.38 (11 df)
  Significance... 0.00
```

Table of Stratum Estimates & Predicted counts N(cap), m(cap,rec), u(rec)

	Stratum Si	S.E.(Size)	P(Capture)	S.E.(P(Cap	D72129	D84	D81014	D81619
LA	163280.69	9931.69	0.0121	0.0007	5.00	17.00	29.00	26.00
DCLVRVRA	71893.49	22250.96	0.0486	0.0151	0.00	0.00	0.00	1.00
Unmarked					409.42	1392.02	2374.62	2148.54

	D82128	D831	D917	D91214	D9202128	D1025	D101221	D1028	D1129
LA	58.00	56.00	45.00	21.00	17.00	0.00	2.00	0.00	2.00
DCLVRVRA	0.00	5.00	6.00	1.00	9.00	2.00	10.00	2.00	13.00
Unmarked	4749.25	4683.30	3802.15	1739.12	1568.10	39.13	359.41	39.13	418.11

End of Table

Least squares Estimate

```
Estimate (std. err) : 236072.88 ( -1.00)
G-square : 4069.60 (11 df)
  Significance... 0.00
Chi-square : 3327.70 (11 df)
  Significance... 0.00
```

Table of Stratum Estimates & Predicted counts N(cap), m(cap,rec), u(rec)

	Stratum Si	P(Capture)	D72129	D84	D81014	D81619	D82128
LA	163280.69	0.0121	10.15	20.05	25.28	34.69	66.59
DCLVRVRA	71893.49	0.0486	0.00	0.00	0.00	1.08	0.00
Unmarked			409.42	1392.02	2374.62	2148.54	4749.25

	D831	D917	D91214	D9202128	D1025	D101221	D1028	D1129
LA	62.24	31.22	20.04	8.59	0.00	-0.31	0.00	-0.53
DCLVRVRA	5.13	5.56	0.99	7.94	8.41	7.24	3.59	9.07
Unmarked	4683.30	3802.15	1739.12	1568.10	39.13	359.41	39.13	418.11

End of Table

Appendix E. Weekly sample size and contributions by stock group and age class of sockeye salmon in the Lynn Canal (District 115) sockeye salmon catch by statistical week for 1998.

Week	Stock	Age Class									Total	
		0.3	1.2	1.3	2.2	2.3	1.4	3.2	3.3	2.4	Sample	%
26	Chilkoot			5							5	0.04
	Chilkat		4	75	4	6					89	0.66
	Other	8	4	29							41	0.30
											135	
27	Chilkoot			6							6	0.01
	Chilkat		4	372	36	11					423	0.89
	Other	12		32							44	0.09
											473	
28	Chilkoot			5		1					6	0.02
	Chilkat		7	179	21	10					217	0.87
	Other	7		20							27	0.11
											250	
29	Chilkoot		1	13	1						15	0.04
	Chilkat		6	224	34	40					304	0.77
	Other	12	6	59							77	0.19
											396	
30	Chilkoot			7							7	0.02
	Chilkat		7	204	33	53					297	0.88
	Other	8	3	21							32	0.10
											336	
31	Chilkoot			7	1	5					13	0.03
	Chilkat		13	265	39	133	2				452	0.87
	Other	19	3	30							52	0.10
											517	
32	Chilkoot		2	1	1						4	0.01
	Chilkat		1	148	87	196	1				433	0.94
	Other	11		11							22	0.05
											459	
33	Chilkoot			3		1					4	0.01
	Chilkat		2	95	108	234					439	0.97
	Other	4	2	4							10	0.02
											453	
34	Chilkoot			3							3	0.01
	Chilkat		2	50	100	229		2		1	384	0.98
	Other	3	1								4	0.01
											391	

-continued-

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Week	Stock	Age Class									Total	
		0.3	1.2	1.3	2.2	2.3	1.4	3.2	3.3	2.4	Sample	%
35	Chilkoot			6		3					9	0.03
	Chilkat		2	34	94	183		1	1		315	0.97
	Other			2							2	0.01
											326	
36	Chilkoot		1	2							3	0.01
	Chilkat			40	111	268			2		421	0.99
	Other	1									1	0.00
											425	
37	Chilkoot					1					1	0.01
	Chilkat		1	5	27	73					106	0.98
	Other			1							1	0.01
											108	
38	Chilkoot										0	0.00
	Chilkat		1	5	22	72					100	1.00
	Other										0	0.00
											100	
39	Chilkoot					1					1	0.03
	Chilkat			2	8	24					34	0.94
	Other			1							1	0.03
											36	

Total Sample Size by Stock Group and Age Class

Age Class	0.3	1.2	1.3	2.2	2.3	1.4	3.2	3.3	2.4	Total
Chilkoot	0	4	58	3	12	0	0	0	0	77
Chilkat	0	50	1,698	724	1,532	3	3	3	1	4,014
Other	85	19	210	0	0	0	0	0	0	314
										4,405

Total Proportion by Stock Group and Age Class

System	0.3	1.2	1.3	2.2	2.3	1.4	3.2	3.3	2.4	Total
Chilkoot	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Chilkat	0.00	0.01	0.37	0.16	0.35	0.00	0.00	0.00	0.00	0.89
Other	0.02	0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Total	0.02	0.02	0.45	0.17	0.35	0.00	0.00	0.00	0.00	

Total Commercial Catch by Stock Group and Age Class

System	0.3	1.2	1.3	2.2	2.3	1.4	3.2	3.3	2.4	Total
Chilkoot	0	135	1,579	92	405	0	0	0	0	2,217
Chilkat	0	1,532	49,792	22,178	46,830	92	92	92	31	120,644
Other	2,834	810	8,096	0	0	0	0	0	0	11,715
										134,937

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