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Abundance and Run Timing of Adult Salmon in the Kwethluk River, Yukon Delta National Wildlife Refuge, Alaska, 2000

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Abstract.— From June 22 to September 15, 2000, a resistance board weir was used to collect abundance, run timing, and biological data from Pacific salmon returning to the Kwethluk River, a tributary to the lower Kuskokwim River. This was the first year of a cooperative project initiated under the Federal Subsistence Fishery Management program to provide reliable data necessary for managing Refuge fishery resources that contribute to major subsistence and commercial fisheries.

A total of 11,691 chum *Oncorhynchus keta*, 3,547 chinook *O. tshawytscha*, 1,049 sockeye *O. nerka*, 1,407 pink *O. gorbuscha*, and 25,610 coho *O. kisutch* salmon were counted through the weir. Peak weekly passage occurred: July 9 to 15 for chum and chinook; June 25 to July 1 for sockeye; August 13 to19 for pink; and August 13 to 19 and August 27 to September 2 for coho salmon.

Sex composition of the chum escapement shifted from predominantly males to females at the midpoint of the run. Females constituted 49.1% of the total chum escapement. The proportions of females varied by week for chinook, sockeye, and coho. Females represented 22.1% of the chinook, 49.2% of the sockeye, and 44.9% of the coho salmon escapement.

Dominant age groups for salmon were 0.3 for chum; 1.3 and 1.4 for male and female chinook, respectively; 1.3 for sockeye, and 2.1 for coho. Gill net marks were observed on 2.8% of the chum, 3.9% of the chinook, 2.5% of the sockeye, 1.8% of the pink, and 2.1% of the coho salmon passing through the weir.

Forty-eight Dolly Varden *Salvelinus malma*, 31 rainbow trout *O. mykiss*, 778 whitefish (*Prosopium cylindraceum* and *Coregonus* spp.), and 53 Arctic grayling *Thymallus arcticus* were counted through the weir. Only larger-sized resident species are represented because of picket spacing.

Some chum and sockeye were not identified correctly during the first two weeks of operations; therefore, counts were reapportioned between these two species. A high-water event submerged a portion of the weir from early morning on September 7 through 1630 hours on September 11. Consequently, no counts were conducted from September 8 to 9, and the coho escapement count underrepresents the actual escapement.

Introduction

The Kwethluk River, a lower Kuskokwim River tributary located on the Yukon Delta National Wildlife Refuge (Refuge), provides important spawning and rearing habitat for chum *Oncorhynchus keta*, chinook *O. tshawytscha*, pink *O. gorbuscha*, sockeye *O. nerka*, and coho salmon *O. kisutch* (Figure 1) (Alt 1977; U.S. Fish and Wildlife Service 1992). Adult salmon returning to the Kwethluk River migrate 159 river kilometers (rkms) through the lower Kuskokwim River before reaching the Kwethluk River, and then migrate upstream as many as 160 rkms to reach spawning grounds. In the lower Kuskokwim River, salmon pass through and are harvested in a commercial fishery and in one of Alaska’s most intense subsistence fisheries (Francisco et al. 1995; U.S. Fish and Wildlife Service 1988).

The Alaska National Interest Lands Conservation Act (ANILCA) mandates that salmon populations and their habitats be conserved in their natural diversity within the Refuge; that international treaty obligations be fulfilled; and that subsistence opportunities for local residents be maintained. Salmon escapement studies for lower Kuskokwim River tributaries on the Refuge are ranked as priorities in the Refuge Fishery Management Plan (U.S. Fish and Wildlife Service 1992). Compliance with ANILCA mandates, however, are not ensured when reliable data on Refuge-originating stocks are not available.

Adequate escapements to individual tributaries and main stem spawning areas are required to maintain genetic diversity and sustainable harvests, but management is complicated by the mixed-stock nature of the Kuskokwim River fishery. Managers attempt to distribute catch over time to avoid overharvesting individual stocks, since each may have distinct migratory timing (Mundy 1982). Stocks or species returning in low numbers or early and late portions of runs may be overharvested incidentally during intensive harvesting of abundant stocks. Escapement data are lacking on many of these individual stocks in the Kuskokwim River drainage and are needed for more precise management.

In accordance with ANILCA mandates, the U.S. Fish and Wildlife Service (Service) initiated a three-year study of the Kwethluk River in 1991 to: (1) enumerate adult salmon; (2) describe run timing of chum, chinook, sockeye, pink, and coho salmon returns; (3) estimate the age, sex, and length composition of adult chum, chinook, sockeye, and coho salmon populations; and (4) identify and count other fish species passing through the weir. High water precluded the installation and operation of the weir in 1991, and the weir was operated only in 1992. Resolutions opposing the weir were passed by local residents in September 1992, consequently discontinuing subsequent weir operations. In 1996, the Association of Village Council Presidents (AVCP) initiated a counting tower project which operated through 1999. Complete counts for chum, chinook, and sockeye salmon were obtained only in 1996 and 1997 because high water delayed operations until late July in 1998 and 1999. In all years of the tower project, high water prevented operations beyond mid-August; therefore, few data exist regarding the abundance and run timing of coho and pink salmon for those years. Additionally, sampling for age, sex, and length information was unsuccessful in 1996 and 1997, and sampling was discontinued in successive years (Cappiello and Sundown 1998; Cappiello and Chris 1999). No comprehensive sampling data exist for the years of tower operation.

Study Area

The Kwethluk River is in the lower Kuskokwim River drainage (Figure 1). The region has a subarctic climate characterized by extreme temperatures. Temperatures range from summer highs near 15°C to average winter lows near -12°C (Alt 1977). Average yearly precipitation is approximately 50 cm with the majority falling between June and October. The rivers generally become ice free in the slow-moving sections by early May and freeze-up occurs in late November.

The Kwethluk River originates in the Eek and Crooked mountains, flows northwest approximately 222 km, and drains an area of about 3,367 km^2. Braiding and gravel substrates are found in the middle section of the river where the weir was placed. Below the middle section, the lower 47 km consists of a deeper, muddy-bottomed channel averaging 53 m in width (Alt 1977). Turbid water conditions also characterize this lower river section during the summer, the result of active stream cutting on tundra banks.

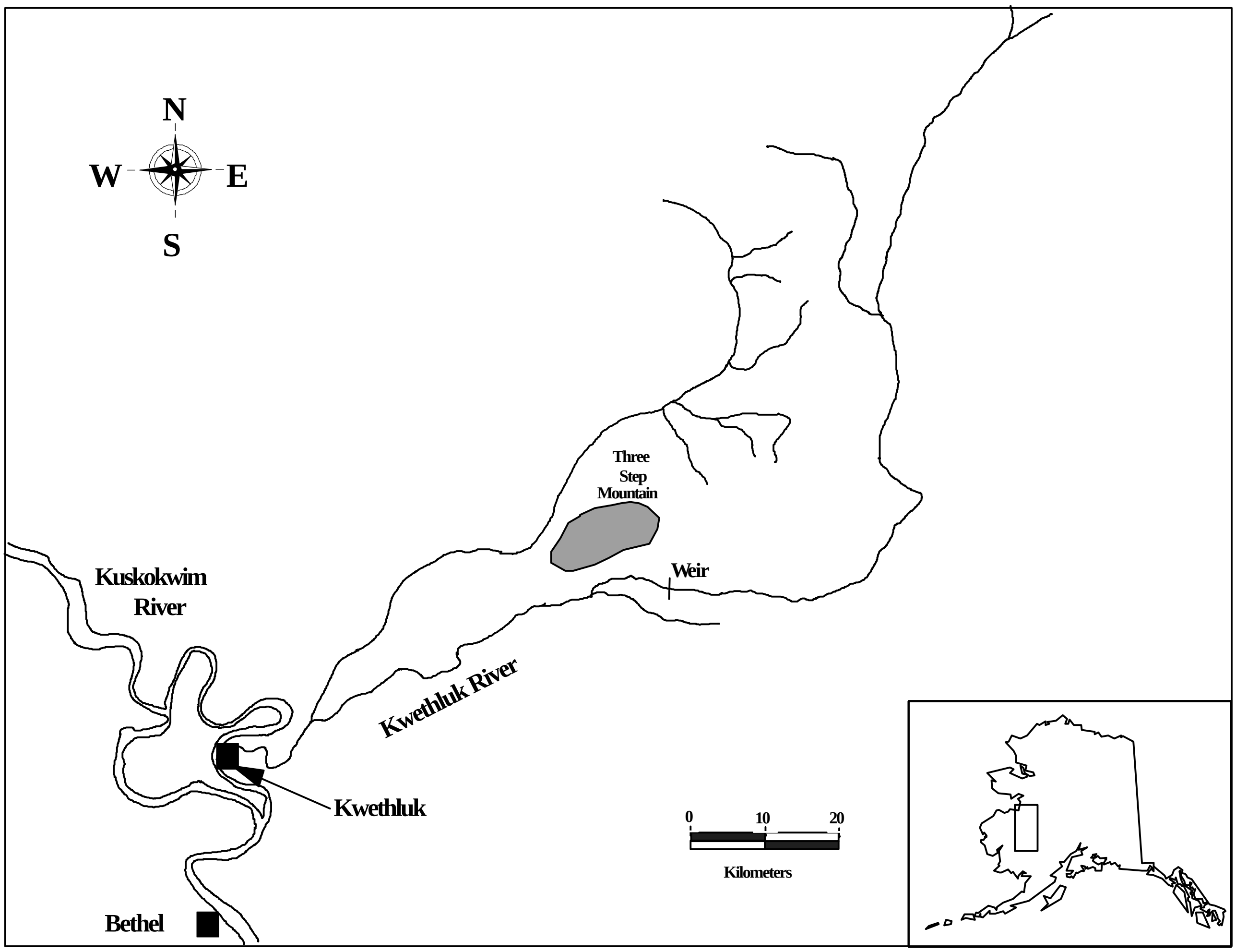

Figure 1. Location of the Kwethluk River weir

Methods

Weir Operation

A resistance board weir (Tobin 1994) spanning 56 m was installed in the Kwethluk River (62°07'N, 162°48'W) approximately 88 rkm upstream from the Kuskokwim River and 43 air-km E from Kwethluk, Alaska (Figure 1). This location is approximately 2.4 rkm downstream from the 1992 weir site described by Harper (1998). The weir was moved downstream to this section of river in 2000 due to a change in channel characteristics at the old location.

A staff gauge was installed upstream of the weir to measure daily water levels. Staff gauge measurements were correlated to correspond with the average water depth across the river channel at the upstream edge of the weir. Water temperatures were generally collected at the site, from May 10 through September 18, twice daily between 0700 and 0900 hours, and again at 1700 hours.

One live trap and one count passage area were installed to facilitate sampling and efficient fish passage during various river stage heights. All fish were enumerated to species as they passed through the live trap (Harper 1998). Salmon and resident fish that did not pass through these areas, but escaped upstream through gaps between pickets were not counted. Picket spacing was 4.8 cm and wider than the 3.5 cm spacing used in 1992. Panels with wider picket intervals were designed to remain functional during higher flows and allow independent passage of smaller pink salmon between pickets. Fish were passed and counted intermittently between 0001 hours and midnight each day. The duration of counting sessions varied depending on the intensity of fish passage through the weir and was recorded to the nearest 0.25 hour at each counting station.

The weir was inspected for holes and cleaned daily. An observer outfitted with snorkeling gear checked weir integrity and substrate conditions. Cleaning consisted of raking debris from the upstream surface of the weir or walking across each panel until it was partially submerged, allowing the current to wash accumulations downstream.

Biological Data

Sample weeks or strata began on a Sunday and ended the following Saturday. However, partial weeks of weir operation shortened the length of the first and last strata. Sampling generally commenced near the beginning of the week, and an effort was made to obtain a weekly quota of 210 chum, 210 chinook, 210 sockeye, and 170 coho salmon in as short a period (1–3 d) as possible to approximate a pulse or snapshot sample (Geiger et al. 1990). All target species within the trap were sampled to prevent bias.

Fish sampling consisted of measuring length, determining sex, collecting scales and then releasing the fish upstream of the weir. Length was measured from mideye to fork of the caudal fin and rounded to the nearest 5 mm. Sex was determined by observing external characteristics, including verifying reproductive organs. Scales were removed from the preferred area for age determination (Koo 1962; Mosher 1968). Three scales were collected from each chum salmon, one scale from each sockeye salmon and four scales from each chinook and coho salmon. Scale impressions were made on cellulose acetate cards using a heated scale press, and examined with a microfiche reader. An Alaska Department of Fish and Game (Department) biologist determined age and reported results according to the European Method (Koo 1962).

Mean lengths of males and females by age were compared using a two-tailed *t* test at $\alpha = 0.05$ (Zar 1984). Age and sex composition were estimated using a stratified sampling design (Cochran 1977). Chi-square contingency table analysis was used to test for differences in age composition between the sexes. Because the standard test only applies to data collected under simple random sampling, adjustments were made to the test statistic, following Rao and Thomas (1989), to account for the impact of our stratified sampling design on the results. The X^2 statistic, hereafter referred to as $X^2(\hat{\delta}.)$, was divided by the mean generalized design effect, $\hat{\delta}$., as a first-order correction to the standard test (Rao and Thomas 1989). Estimated design effects for the cells and marginals are presented in the results. Age and sex specific escapements in a stratum, $\hat{A}_{hij}$, and their variances, $V[\hat{A}_{hij}]$, were estimated as:

$$\hat{A}_{hij} = N_h \, \hat{p}_{hij} \; ; \qquad \textbf{(1)}$$

and

$$\hat{V}\,[\hat{A}_{hij}] = N_h^2 \left(1 - \frac{n_h}{N_h}\right)\left(\frac{\hat{p}_{hij}(1-\hat{p}_{hij})}{n_h - 1}\right) \qquad \textbf{(2)}$$

where

N_h = total escapement of a given species during stratum *h*;

$\hat{p}_{hij}$ = estimated proportion of age *i* and sex *j* fish, of a given species, in the sample in stratum *h*; and

n_h = total number of fish, of a given species, in the sample for stratum *h*.

Abundance estimates and their variances for each stratum were summed to obtain age- and sex-specific escapements for the season as follows:

$$\hat{A}_{ij} = \Sigma \hat{A}_{hij} \; ; \qquad \textbf{(3)}$$

and

$$\hat{V}\,[\hat{A}_{ij}] = \Sigma \hat{V}(\hat{A}_{hij}) \; ; \qquad \textbf{(4)}$$

where

$\hat{A}_{ij}$ = estimated total escapement for age *i* and sex *j* fish of a given species.

Estimates of egg production were derived from fecundity regression equations developed for chinook salmon on the Tanana River (Skaugstad, and McCracken. 1991). Estimated numbers of females for each size group was then multiplied by the average number of eggs produced for that size group and summed for all size groups.

Results

Weir Operation

Weir operations started at 2000 hours on June 22 and continued through September 15, 2000. Prior to this time fish could pass the weir or trap and not be enumerated. Moderate to high stage heights averaging 70.6 cm persisted with minimum and maximum levels reaching 55.5 cm and 112.2 cm (Appendix 1). Water temperatures averaged 9.3°C with minimum and maximum temperatures reaching 6.0 and 14.0°C (Appendix 1).

An exposed permafrost bank approximately 300m above the weir adversely affected water turbidity. This 1.8-2.4 m-high bank was susceptible to melting, subsequently contributing sediment to the river, and to continuous erosion due to high water from seasonal freshets. The weir passed large amounts of debris throughout the course of the summer. Pieces of tundra sod, up to 1 X 3 m, frequently washed onto the weir and into the counting chute during periods of rising water levels. The highest water levels coincided with the greatest debris accumulations.

On August 16, a broken bulkhead retainer created a 10-15 cm gap between the river left bulkhead and the first panel connector picket. This gap was noticed and repaired the morning of August 17. A high-water event caused four to five panels of the weir, including both boat passage panels, to submerge from September 7 to 11, with no counts conducted September 8 or 9. Accumulated debris on the upstream stringers forced the panels down to the substrate for 2.4-3 m behind the rail, submerged the remaining portion of each weir panel over 1 m below the surface. At the same time, this excessive weight stressed the weir creating a 15cm gap along the river left bulkhead by bending the connector picket. No coho salmon were observed escaping over submerged weir panels or along the river left bulkhead.

Biological Data

Five species of Pacific salmon, including 11,691 chum, 3,547 chinook, 1,049 sockeye, 1,407 pink, and 25,610 coho salmon, were counted upstream through the weir (Appendices 2 and 3). Other species counted through the weir include 48 Dolly Varden *Salvelinus malma*, 31 rainbow trout *O. mykiss*, 778 whitefish *Prosopium cylindraceum* and *Coregonus* spp., and 53 Arctic grayling *Thymallus Arcticus* (Appendix 2).

Chum salmon.—A total of 11,691 chum salmon passed through the weir from June 23 to September 11 (Appendix 4). Peak passage (*N* = 3,232) occurred the week of July 9 to15 (Figure 2; Appendix 2), and the median passage date was July 18 (Figure 3; Appendix 3). Counts did not exceed 100 fish per day after August 5.

Gill net marks were observed throughout the season on approximately 2.8% (*N* = 333) of chum salmon passing the weir (Appendix 2), while 3.4% (*N* = 39) of the sampled chum exhibited gill net marks. Gill net marks constituted 2.9% of sampled females, and 3.9% of males.

There was no significant difference in age composition between sexes ($X^2(\hat{\delta}.) = 10.074$, df =3, $P = 0.018$). Females constituted an estimated 49.1% of the chum escapement, and predominated between July 9 and August 13 (Figure 3; Appendix 5). Four age groups were identified from 995 out of 1,059 chum salmon sampled from the weir escapement between June 26 and August 29 (Appendix 5). During this period, 11,616 chum salmon were counted through the weir.

The sampled escapement was composed primarily of age 0.3 (62.2%) and age 0.4 (36.5%) chum salmon (Appendix 5). In sampled fish, the mean length of males was greater than that of same-aged females for all age classes (two-tailed *t* test: age 0.2, $t = 1.44$, df = 10 p= 0.179; 0.3, $t = 17.413$, df = 650, $P < 0.001$; age 0.4, 11.67, df =324, $P < 0.001$; age 0.5 insufficient data,) (Appendix 6).

Chinook salmon.—A total of 3,547 chinook salmon passed through the weir from June 23 to September 6 (Appendix 7). Peak passage (*N* =1,056) occurred the week of July 9 to15 (Figure 2; Appendix 2), and the median passage date was July 13 (Figure 3; Appendix 3). Counts did not exceed 30 fish per day after July 28.

Gill net marks were observed throughout the season on approximately 3.9% (*N* = 137) of chinook salmon passing the weir (Appendix 2), while 8.5% (*N* = 28) of the sampled chinook exhibited gill net marks. Likewise, gill net marks were found on 18.6% of sampled females, but on only 5.7% of males.

Females made up an estimated 22.1% of the chinook escapement, while males predominated every week (Figure 3; Appendix 8). Four age groups were identified from 301 out of 331 chinook salmon sampled from the weir escapement between June 26 and August 1 (Appendix 8). During this period, 3,461 chinook salmon were counted through the weir. Age 1.3 chinook salmon were most abundant (36.3%) followed by age 1.2 (30.0%) and age 1.4 (27.1%) fish (Appendix 8).

An estimated 766 females passed the weir, and produced an estimated 7.22 million eggs (Figure 4). The percent of females in the size groups of 800-899 mm and 900-999 mm dropped by 4% from 1992 levels.

Age composition differed significantly between sexes ($X^2(\hat{\delta}.) = 95.18$, df = 3, $P < 0.001$). Males were primarily age 1.3 (44.1%) followed by age 1.2 (38.6%), and females were predominately age 1.4 (70.4%) followed by age 1.5 (20.5%). In sampled fish, the mean length of age 1.3 and age 1.4 females was greater than that of same-aged males (two-tailed *t* test: Age 1.3, $t = 6.1$, df =108, $P < 0.001$; Age 1.4, $t = 4.4$, df =79, $P = <0.001$; Age 1.5, t = .88, df= 17, p = 0.393) (Appendix 9).

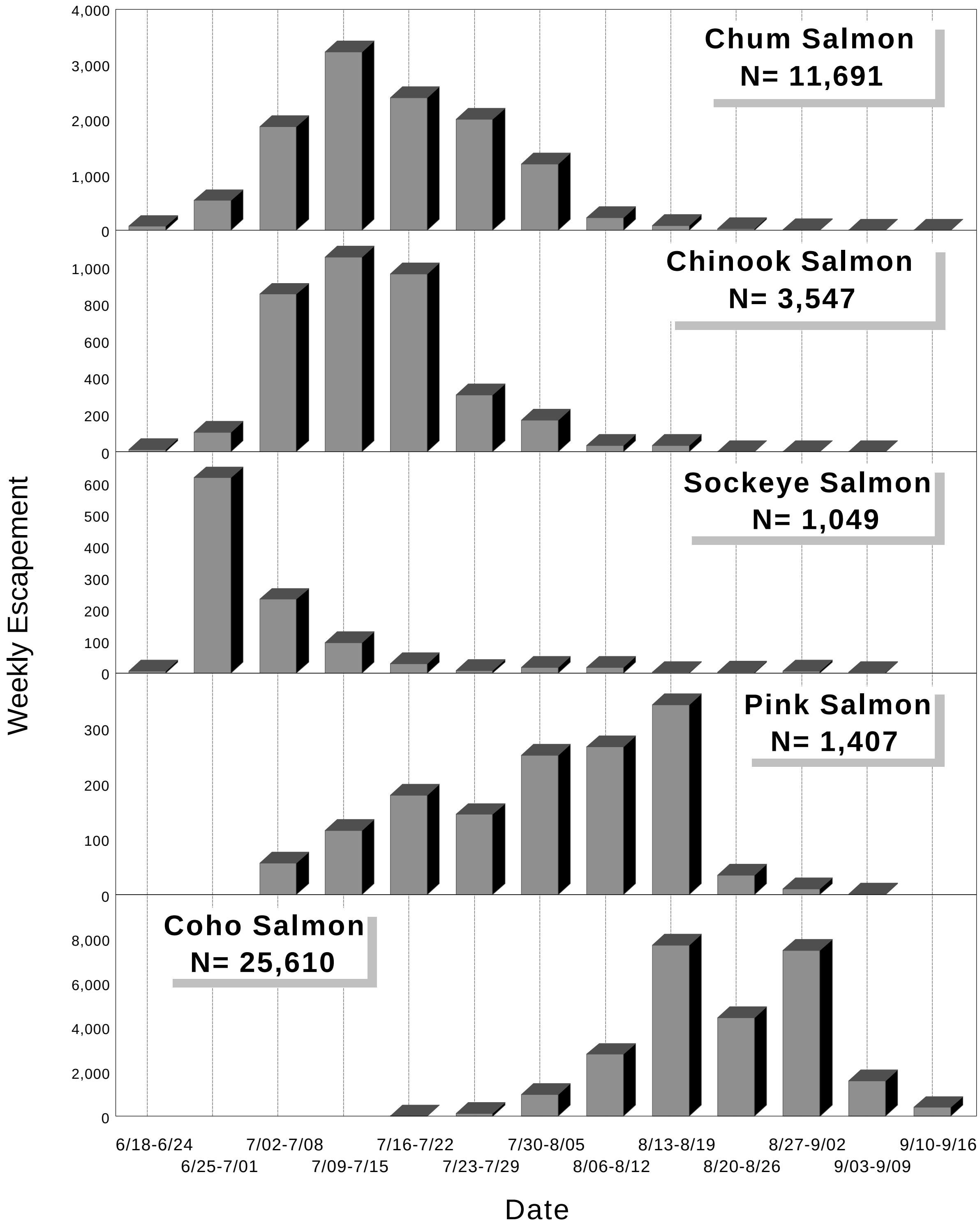

Figure 2- Chum, chinook, sockeye, pink, and coho salmon escapement through the Kwethluk River weir, Alaska, 2000.

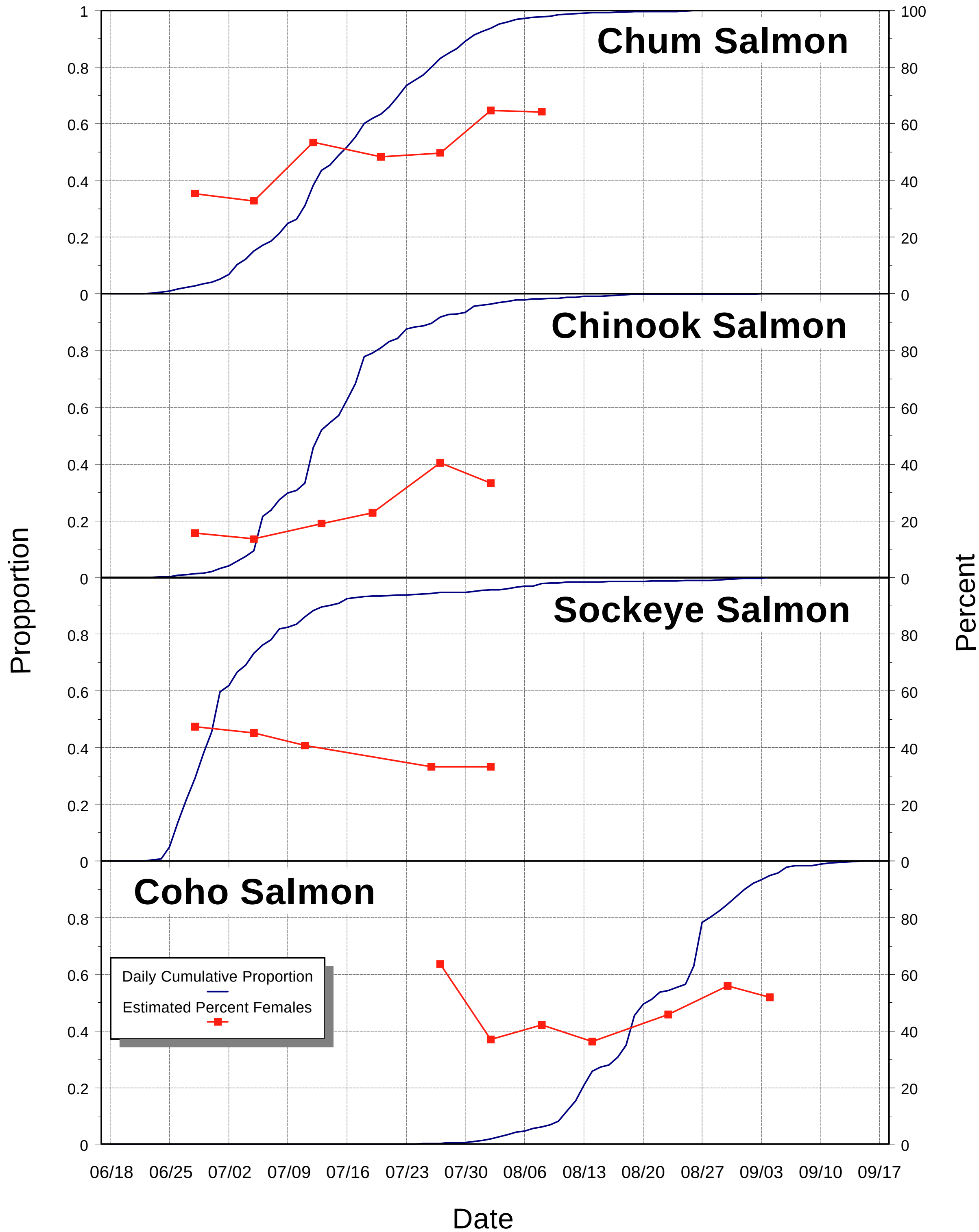

Figure 3- Cumulative proportion and sex composition of chum, chinook, sockeye, and coho salmon escapement through the Kwethluk River weir, Alaska, 2000.

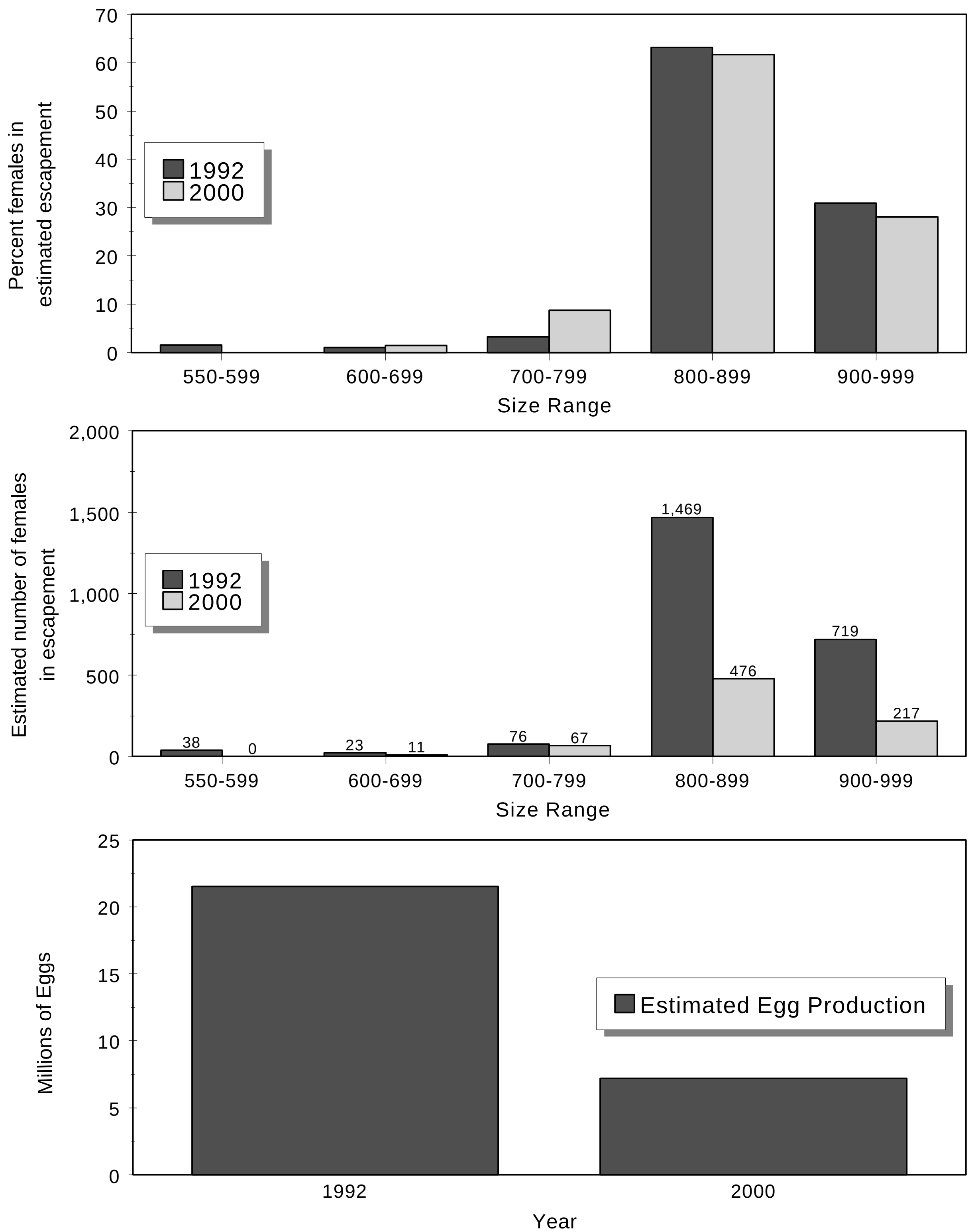

Figure 4- Comparison of size composition in estimated escapement, and estimated egg production for female chinook salmon at the Kwethluk River weir (1992 and 2000), Alaska.

Of the 70 female chinook sampled, 90% were greater than 800 mm, while only one sampled female was less than 700 mm (Figure 4; Appendix 10).

Sockeye salmon.—A total of 1,049 sockeye salmon passed through the weir from June 23 to September 4 (Appendix 10). Peak passage (*N* = 618) occurred the week of June 25 to July 1 (Appendix 3), and the median passage date was July 1 (Figure 3; Appendix 3).

Age composition did not differ between sexes (P>0.05). Females constituted an estimated 49.2% of the escapement (Figure 3; Appendix 11). Five age groups were identified from 117 out of 155 sockeye salmon sampled from the weir escapement between June 26 and July 26 (Appendix 11). During this period 987 sockeye salmon were counted through the weir. Age 1.3 sockeye salmon were most abundant, accounting for 92.8% of all sampled sockeye. There was no significant difference ($P > 0.05$) in the mean lengths of males and same-aged females (Appendix 12).

Pink salmon.—Although some pink salmon are assumed to have passed uncounted between panel pickets, 1,407 pink salmon passed through the weir at counting stations from July 2 to September 3 (Appendix 13). Peak passage (*N* = 343) occurred the week of August 13 to19 (Figure 2; Appendix 2), and the median passage date was August 4 (Figure 3; Appendix 3). Gill net marks were observed on 1.8% (*N*= 26) of pink salmon passing the weir throughout the season (Appendix 2); but pink salmon were not sampled for age, sex, or length.

Coho salmon.—A total of 25,610 coho salmon passed through the weir from July 22 to September 15 (Appendix 14). Two distinct peaks of passage occurred the weeks of August 13 to 19 (*N* = 7,739) and August 27 to September 2 (*N*= 7,498) (Figure 2; Appendix 2). The median passage date was August 21 (Figure 3; Appendix 3).

Gill net marks were observed throughout the season on approximately 2.1% (*N*= 547) of coho salmon passing the weir (Appendix 2), while 2.8% (*N*= 21) of the sampled coho exhibited gill net marks. Likewise, gill net marks made up 3.1% of sampled females, and 2.4% for males.

Age composition did not differ between sexes (P>0.05). Females constituted an estimated 44.9% of the escapement (Figure 3; Appendix 15). Three age groups were identified from 669 out of 761 coho salmon sampled from the weir escapement between July 24 and September 4 (Appendix 15). During this period 24,284 coho salmon were counted through the weir. Age 2.1 coho salmon were most abundant accounting for 93.4% of all sampled coho. There was no significant difference ($P > 0.05$) in the mean lengths of males and same-aged females (Appendix 16).

Discussion

Weir Operation

An unknown number of salmon may have escaped undetected over the weir when a gap formed along the river left bulkhead on August 16 and 17, or during the high-water event which submerged a portion of the weir from September 7 to September 11. No attempt has been made to estimate the uncounted portion of these escapements; therefore, the season total for coho salmon should be considered an incomplete count.

Picket spacing allowed pink salmon and smaller resident fish to pass upstream, yet was effective for the enumeration of other salmon species. Consequently, pink salmon, rainbow trout, Arctic grayling, Dolly Varden, whitefish, and northern pike counts are conservative.

Biological Data

Escapement data and data from the one commercial harvest period indicated chum and chinook salmon returns to the Kuskokwim River drainage were below average in magnitude during 2000. Limited fishing time and below average effort accounts for the record low commercial catch; however, the Bethel test fishery also reported a record low CPUE for District W-1 during the directed chum salmon fishery. Conversely, sockeye and coho salmon harvests were reported as adequate or strong (Alaska Department of Fish and Game 2000). The only commercial period during the directed chum salmon fishery opened July 5 in half of District W-1 for four hours. On July 8, due to chinook salmon conservation needs, the Department and the Federal In-Season Manager restricted the subsistence fishery in the Kuskokwim River drainage. They also closed the chinook salmon sport fishery, limited rod and reel subsistence harvest to one chinook per day, and imposed the use of 6-inch or less mesh gill nets (Alaska Department of Fish and Game 2000).

Kruse (1998) suggests that anomalous conditions that existed in the marine ecosystem during 1997 and 1998 may have adversely affected the growth and survival of salmon in the ocean. Consequently, these unfavorable ocean conditions would have negatively impacted all major age components of the 2000 return.

During the first two weeks of operation, some bright sockeye were incorrectly classified as chum. This problem with speciation was identified through scale pattern analysis, and was only apparent for the first two pulses. The counts between chum and sockeye salmon were reapportioned to reflect these errors during this time period.

Chum salmon.—Chum salmon escapement to the Kwethluk River during 2000 (*N*= 11,691) was poor relative to the 1992 weir escapement of 30,595 and the 1996 tower escapement of 26,049, but slightly greater than the 1997 tower escapement of 10,659 (Appendix 4). Although chum salmon initially appeared late during 2000, the median passage date of July 15 was similar to the 1992 weir and 1997 tower average of July 18, but later than the 1996 tower median passage date of July 7 (Cappiello and Sundown 1998; Harper 1998).

Chum salmon escapement to the Kwethluk River during 1996 was the second largest in magnitude for the years of weir and tower operation (Appendix 4) (Cappiello and Sundown 1998; Harper 1998). Similarly, escapements in 1995 and 1996 were strong throughout the Kuskokwim River drainage (Burkey et al. 1999). This indicated a potentially strong return of age 0.3 fish during 2000.

Gill net marks were observed on 2.7% of chum salmon passing the weir, while 4.7% of the 1992 chum salmon weir escapement had gill net marks (Harper 1998). Additionally, 3.4% of the sampled chum exhibited gill net marks in 2000, which compares to 3% of the sampled chum with gill net marks in 1992 (unpublished notes, Harper 1998). Gill net marks constituted 2.9% of sampled females, and 3.9% of males.

Female chum salmon made up 49.1% of the 2000 chum escapement, which compares to 50.3% of the Tuluksak weir escapement from 1991 to 1994 and 53.1% in the Kuskokwim River commercial harvest from 1984 to 1998 (Molyneaux and DuBois 1999). However, females made up 57.7% of the 1992 weir escapement (Harper 1998). Sex composition of the 2000 chum salmon escapement steadily increased in the percentage of females, from 33 to 65 percent, as the season progressed. This trend has been observed throughout the Kuskokwim drainage for the years that escapement and commercial catch data were collected (Molyneaux and DuBois 1999).

Chinook salmon.—Chinook salmon escapement to the Kwethluk River during 2000 (*N*= 3,547) was smaller in magnitude than the 1992 weir escapement of 9,675, and the 1996 and 1997 tower escapements of 7,415 and 10,395 respectively (Appendix 7). The median passage date of July 13 was later than the 1992 weir and the 1996 and 1997 tower averages of July 6.

Chinook salmon return to the Kwethluk River primarily at ages 1.2, 1.3 and 1.4, and strong parent year escapements in the Kuskokwim River drainage, from 1994 to 1996, suggested good returns from these escapements (Burkey et al. 1999). Chinook salmon escapement at the Tuluksak River weir in 1994 was the highest reported for the four years of operation. Similarly, chinook escapements at the Kogrukluk River weir from 1994 to 1996 were the highest reported between 1984 and 1998 (Molyneaux and DuBois 1999).

Gill net marks were observed on 3.9% of chinook salmon passing the weir which was significantly lower than the 10% observed in the 1992 weir escapement.

Similarly, 8.5% of the sampled chinook exhibited gill net marks in 2000, while 10.8% of the sampled chinook had gill net marks in 1992. Gill net marks constituted 18.6% of sampled females and only 5.7% of males in 2000, and 21.2% of females and only 5.9% of males sampled in 1992 (unpublished notes, Harper 1998).

The proportion of females in the 2000 weir escapement of 22.1% was lower relative to the 1992 weir escapement of 24.8%, but slightly higher than the 1991 through 1994 Tuluksak weir escapement average proportion of 19.4% (Harper 1998; Molyneaux and DuBois 1999). These low proportions of females may be the consequence of two factors. First, the result of a weak parent year escapement or survival for age 1.4 fish, the predominate age class among females. Second, as demonstrated by the number of gill net marks, a high proportion of females may be harvested in the subsistence fishery.

Except for smaller size classes, the size composition of females in 2000 was similar to that reported in 1992 (Figure 4; Appendix 10). It should be noted that gender confirmation for fish less than 700 mm was not established in the 1992 sample. Molyneaux (2000) states that based on commercial catch sampling, chinook salmon less than 700 mm have a 99.7% likelihood of being male. Molyneaux and DuBois (1999) found that more than 98% of age 1.2 chinook salmon were male, and the occurrence of age 1.3 males was approximately 82% when sex was verified. The relatively small size of age 1.2 male chinook is considered to be an external morphological characteristic in sex determination. Additionally, age 1.3 female chinook tend to be in the upper size range for that age class (Molyneaux and DuBois 1999). In 1992, 17 of the 29 sampled females less than 700 mm were age 1.2, and all these fish were 600 mm or less; the remaining 12 fish were age 1.3 (unpublished notes, Harper 1998). Age 1.2 and age 1.3 female chinook made up 6.1% and 4.7% of the 1992 weir escapement for those respective age classes (Harper 1998). If this re-analysis holds true, the numbers and percentage of females in the 1992 escapement would be lower than the 2,325 fish or 24.8% reported.

The estimated number of female chinook salmon in total weir escapement fell from 2,325 in 1992 to 771 in 2000. These numbers differ by a factor of 3.3 (Appendix 10). Likewise, total escapement declined by a factor of 2.7 from 1992 to 2000. Recruitment of female chinook above 800 mm fell dramatically from 1992 to 2000 (Figure 4; Appendix 10). Specifically, in 1992 an estimated 1,469 females between 800 and 899 mm passed the weir, while for the same size range, an estimated 476 females passed in 2000 (Figure 4; Appendix 10). The estimated escapement for females between 900 and 999 mm was 719 in 1992 and 217 in 2000. Overall, female chinook salmon longer than 800 mm accounted for 94.1% and 89.9% of the estimated escapement for females in 1992 and 2000, respectively. The loss of older ages, or larger sizes, may have implications on a population's reproductive success and its ability to overcome periods of poor recruitment (Livingston, 1998).

Estimated egg production for female chinook salmon was 21.52 million eggs in 1992 and 7.22 million eggs in 2000. These estimates of fecundity, at a given length, for chinook salmon are derived from the regression developed from the Tanana River, a tributary of the upper Yukon River (Skaugstad and McCracken 1991). Healey and Heard (1984) suggest that fecundity can vary significantly between populations of chinook salmon, a result of differences in the relationship between length and fecundity- both the number and size of eggs. It has been shown that the distance of freshwater migration affects the average egg size of a particular population (Beacham and Murray 1993). In general, the longer the migration the smaller the average egg size for a population. Beacham and Murray (1993) go on to state that fecundity may compromise egg size, where an increase in egg production will be at the expense of egg size. Consequently, the data on fecundity presented here are only an estimate of egg production, and serve as an index of relative contributions between years and not an absolute indicator of productivity or health.

Sockeye salmon.—Sockeye salmon are harvested incidentally in the Kuskokwim River drainage during the directed chum salmon fishery, but little is known about the population in the Kwethluk River. The Kwethluk River may produce only a small number of sockeye because habitat is limited for juveniles.

The magnitude of sockeye salmon escapements past the weir and tower has been small, ranging from 1,049 in 2000 to 1,801 fish in 1996. The median passage date of July 1, 2000 was similar to the average median passage date of July 5 for years of weir and tower operations. Run magnitude and timing results are believed to reflect the run but may be unreliable because of low sockeye salmon abundances and the potential for misidentification with other species.

Sockeye salmon return to the Kwethluk River primarily as age 1.3, and strong parent year escapements in the Kuskokwim River drainage in 1995 suggested good returns for this escapement (Burkey et al. 1999).

Gill net marks were observed on 2.5% of sockeye salmon passing the weir, which was lower than the 6.1% observed in the 1992 weir escapement. Additionally, 5.2% of the sampled sockeye exhibited gill net marks in 2000, while 9.5% of the sampled sockeye had gill net marks in 1992 (unpublished notes, Harper 1998).

The proportion of females in the 2000 weir escapement of 49.2% was lower relative to the 1992 weir escapement of 59.6%, but similar to the 1991 through 1994 Tuluksak weir escapement average proportion of 51.4% (Harper 1998; Molyneaux and DuBois 1999).

Pink salmon.—Pink salmon escapement to the Kwethluk River during 2000 (*N*=1,407) was approximately 3% of the 1992 escapement of 45,952. Likewise, estimated escapement in 1996 and 1998 was only 6% and 9.6% of the 1992 escapement; however, these years do not represent the complete pink salmon run (Appendix 13).

In 1998, the year with the most complete late-season tower data, the weir was operated from July 24 to August 18. Approximately 4.5% of the pink run passed the weir before July 24, and 12% passed after August 18 in 1992. Similarly, during 2000, 28% of the run passed prior to July 24, while 3.3% passed later than August 18. Run timing during 2000 was similar to previous even-year weir escapements (Cappiello and Sundown 1998; Harper 1998; Cappiello and Chris 1999).

Pink salmon escapement estimates should be compared cautiously, because wider picket intervals were designed to remain functional during higher flows and allow independent passage of smaller pink salmon between pickets. Therefore, weir counts for pink salmon are, at best, an indicator of run timing.

Coho salmon.—Coho salmon escapement to the Kwethluk River during 2000 (*N*= 25,610) was approximately 56% of the 1992 weir escapement of 45,605 (Appendix 14). The coho salmon return appeared to be both early and weak during 2000, even though the coho salmon harvest was the highest since 1996 (Alaska Department of Fish and Game 2000). The median passage date of August 21 was earlier than the 1992 median passage date of August 26 (Harper 1998).

Coho salmon return to the Kwethluk River primarily as age 2.1 fish. Strong escapements throughout the Kuskokwim River drainage in 1996 indicated a potentially strong return of age 2.1 fish during 2000. Information on the total returns to the Kwethluk River in 1996 are absent. By comparison, the return to the Kogrukluk River weir in 1996 was the highest ever recorded and produced a strong return in 2000 (Burkey et al. 1999).

The proportion of gill net marks observed on coho salmon (2.1%) passing the weir was lower than the 3.2% observed in the 1992 weir escapement. Similarly, 2.8% of the sampled coho exhibited gill net marks in 2000, while 3.7% of the sampled coho had gill net marks in 1992. Gill net marks were found on 3.1% of females and 2.4% of males sampled in 2000, and 2.9% of females and 0.8% of males sampled in 1992 (unpublished notes, Harper 1998).

Female coho salmon constituted 44.9% of the 2000 weir escapement, which compares to 42.5% of the 1992 weir escapement. Likewise, the commercial catch averaged 46.1% females from 1984 to 1998, while the proportion of females from the Tuluksak weir, operated in 1991 through 1994, averaged 43.7% (Molyneaux and DuBois 1999).

Due to a high-water event which submerged the weir from September 7 to 11, with no counts conducted

September 8 and 9, the escapement count of 25,610 coho salmon may underrepresent the actual escapement. Approximately 1.4% of the coho escapement passed the weir between September 8 and 9, 1992 (Harper 1998). Daily counts from September 10 through the last day of operations accounted for less than 0.5% of the total 2000 weir escapement per day. Therefore, it is thought that the 2000 weir escapement is a relatively complete estimate of the actual escapement.

Recommendations

The Kwethluk River weir has been an important tool for monitoring refuge-originating salmon stocks and assisting the Department with management of lower Kuskokwim River fisheries. No other existing project in the lower Kuskokwim River drainage can match the accurate, precise, and reliable escapement and biological data provided by the Kwethluk River weir.

Information on the contribution of Kwethluk River salmon to subsistence or commercial fisheries is currently lacking. This piece of information would help with decisions to protect these important runs of salmon in the Kuskokwim River drainage. Gathering genetic samples from both the subsistence and commercial harvest, and the establishment of a genetic baseline, will enable managers to determine these contributions

In response to the poor chum salmon escapements during 1997 and 1998, we recommend developing benchmarks to alert fishery managers when in-season projections indicate undesirable escapement magnitudes in the Kwethluk River.

We also recommend continuing weir operations into mid-September to obtain comprehensive coho salmon escapement data.

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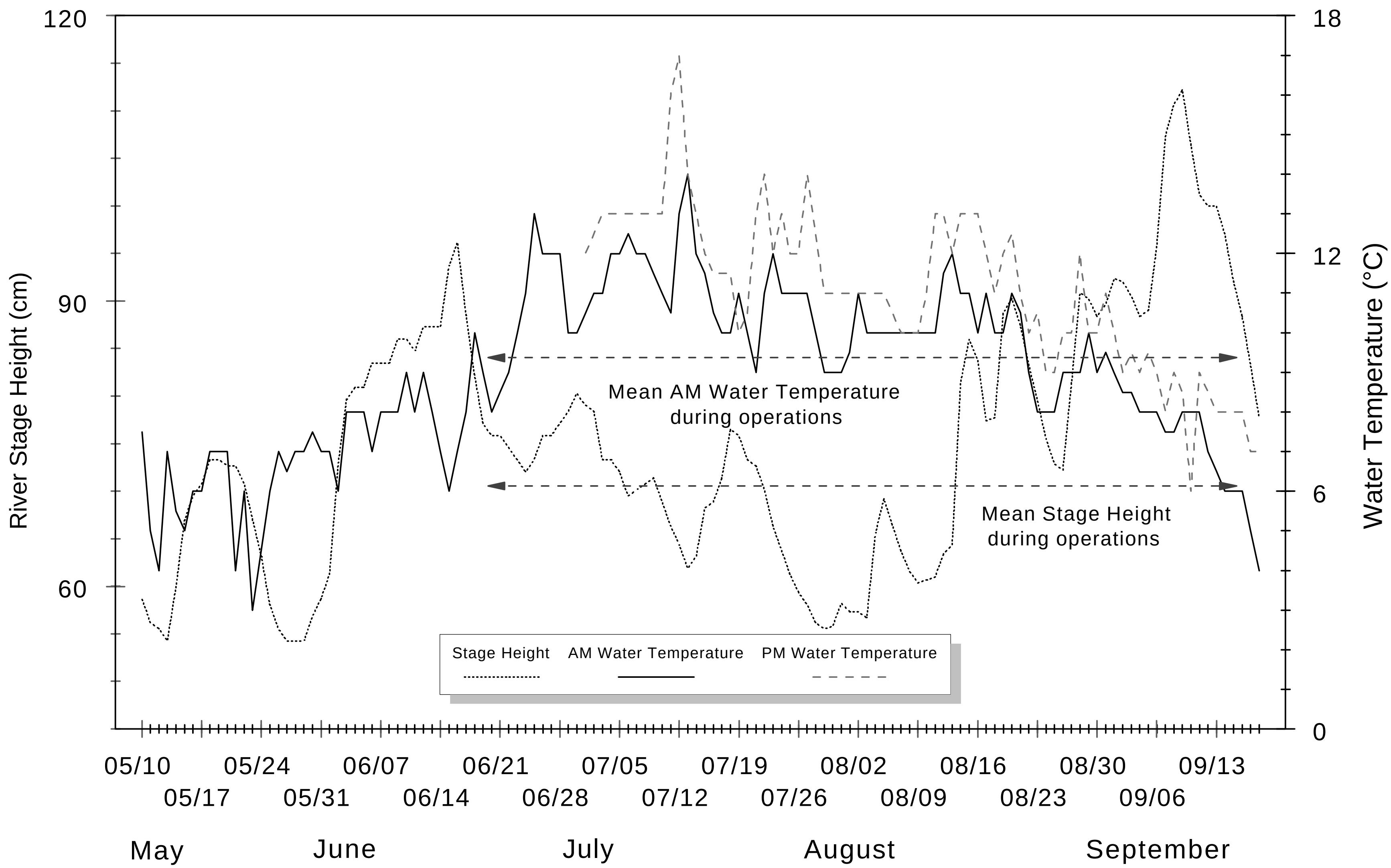


Appendix1- River stage heights and AM and PM water temperatures at the Kwethluk River weir, 2000.

Appendix 2 – Daily escapement and counting effort at the Kwethluk River weir, Alaska 2000.

							Gill Net Marks									
Date	Counting Effort (h)	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
Stratum 1																
6/22	10.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23	13.00	28	4	3	0	0	3	0	0	0	0	0	1	0	0	0
6/24	4.00	44	7	4	0	0	4	1	0	0	0	0	7	0	2	1
Total:	27.00	72	11	7	0	0	7	1	0	0	0	0	8	0	2	1
Stratum 2																
6/25	4.00	39[a]	3	45[a]	0	0	3	0	0	0	0	0	3	0	0	0
6/26	8.75	79[a]	18	90[a]	0	0	9	1	3	0	0	0	8	0	0	0
6/27	7.50	71[a]	3	82[a]	0	0	12	0	4	0	0	0	4	0	0	0
6/28	9.50	72[a]	15	83[a]	0	0	4	5	1	0	0	0	1	0	0	0
6/29	12.00	78[a]	10	89[a]	0	0	4	0	1	0	0	0	0	0	0	0
6/30	13.75	72[a]	16	82[a]	0	0	6	0	0	0	0	0	6	0	0	0
7/1	14.50	128[a]	41	147[a]	0	0	9	0	0	0	0	0	5	0	0	0
Total:	70.00	539[a]	106	618[a]	0	0	47	6	9	0	0	0	27	0	0	0
Stratum 3																
7/2	14.50	195[a]	33	24[a]	3	0	6	2	0	0	0	0	2	0	1	0
7/3	12.25	396[a]	55	50[a]	7	0	15	1	0	0	0	0	3	0	0	1
7/4	11.00	208[a]	56	26[a]	9	0	6	4	0	0	0	0	1	0	0	0
7/5	10.00	348[a]	72	43[a]	8	0	7	0	1	0	0	0	2	0	1	0
7/6	11.75	256[a]	437	32[a]	9	0	5	9	2	0	0	0	2	0	0	0
7/7	10.50	146[a]	75	18[a]	15	0	0	0	1	0	0	0	1	0	1	0
7/8	14.00	327[a]	126	41[a]	6	0	20	4	3	0	0	0	1	0	2	6
Total:	84.00	1,876[a]	854	234[a]	57	0	59	20	7	0	0	0	12	0	5	7
Stratum 4																
7/9	14.50	423	88	6	10	0	10	4	0	1	0	0	1	0	1	2
7/10	12.00	179	33	11	1	0	5	3	0	0	0	2	0	0	0	0
7/11	12.50	537	91	28	8	0	10	4	1	0	0	2	0	0	0	0
7/12	12.50	856	444	22	25	0	20	12	2	0	0	3	6	0	0	0
7/13	13.00	616	222	14	27	0	12	20	1	0	0	7	4	0	11	0
7/14	16.00	207	92	6	15	0	5	2	1	2	0	2	6	0	4	15
7/15	15.25	414	86	9	30	0	9	5	0	0	0	0	9	0	4	0
Total:	95.75	3,232	1,056	96	116	0	71	50	5	3	0	16	26	0	20	17

Continued

[a] Counts reapportioned by species identified through scale pattern analysis.

Appendix 2.– Continued

Date	Counting Effort (h)	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Gill Net Marks: Chum Salmon	Gill Net Marks: Chinook Salmon	Gill Net Marks: Sockeye Salmon	Gill Net Marks: Pink Salmon	Gill Net Marks: Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
Stratum 5																
7/16	17.00	347	196	15	23	0	8	12	0	1	0	2	12	0	11	0
7/17	11.75	395	201	4	26	0	9	3	4	0	0	0	5	0	0	0
7/18	11.50	566	340	5	54	0	16	14	0	1	0	0	6	0	0	0
7/19	9.25	218	41	1	20	0	9	3	0	0	0	0	0	0	0	0
7/20	12.75	173	69	0	17	0	4	5	0	0	0	0	1	0	0	0
7/21	15.00	283	82	3	14	0	7	4	0	0	0	0	12	0	0	0
7/22	14.75	421	35	2	26	9	16	3	0	0	0	0	5	0	2	0
Total:	92.00	2,403	964	30	180	9	69	44	4	2	0	2	41	0	13	0
Stratum 6																
7/23	15.00	468	117	0	41	12	9	4	0	0	1	0	6	0	1	0
7/24	12.25	217	28	2	20	9	5	0	0	0	0	2	1	0	0	0
7/25	11.75	208	15	1	7	14	2	2	0	0	0	1	5	0	2	0
7/26	12.75	331	32	1	16	16	10	2	0	0	2	0	8	0	0	1
7/27	13.50	365	75	4	22	25	15	1	0	0	0	1	4	0	1	2
7/28	12.75	217	30	0	24	33	4	0	0	0	0	0	0	0	0	0
7/29	13.75	201	12	1	15	14	9	0	0	0	0	1	0	0	0	0
Total:	91.75	2,007	309	9	145	123	54	9	0	0	3	5	24	0	4	3
Stratum 7																
7/30	14.75	297	17	0	37	37	3	0	0	0	0	1	0	0	0	0
7/31	10.00	248	77	5	23	96	4	0	0	0	0	0	6	0	0	0
8/1	12.50	155	10	3	39	104	3	0	0	0	0	0	9	0	0	0
8/2	13.25	143	15	1	27	91	2	0	0	0	0	1	5	0	0	0
8/3	15.00	155	19	0	36	227	3	1	0	2	1	0	0	0	0	0
8/4	12.25	97	17	4	46	182	2	2	0	0	0	2	1	0	0	0
8/5	13.00	102	17	6	44	242	2	1	0	1	5	1	4	0	0	0
Total:	90.75	1,197	172	19	252	979	19	4	0	3	6	5	25	0	0	0
Stratum 8																
8/6	14.75	38	5	3	20	86	1	0	0	1	2	2	7	0	0	0
8/7	10.50	48	5	2	22	205	1	0	0	0	9	1	3	0	0	0
8/8	9.75	23	5	9	9	158	0	0	0	0	4	0	2	0	0	0
8/9	14.00	18	4	1	25	204	0	0	0	0	1	0	0	0	0	0
8/10	15.00	58	4	1	44	306	0	1	0	2	5	1	15	0	0	0
8/11	15.50	33	8	3	90	909	0	0	0	2	11	3	14	0	0	0
8/12	15.00	14	3	0	57	933	0	0	0	2	9	0	23	0	0	0
Total:	94.50	232	34	19	267	2,801	2	1	0	7	41	7	64	0	0	0

Continued

Appendix 2.– Continued

							Gill Net Marks									
Date	Counting Effort (h)	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
							Stratum 9									
8/13	15.50	21	8	0	85	1,444	1	2	0	1	21	3	27	0	2	0
8/14	7.25	16	1	0	64	1,270	0	0	0	0	14	2	23	0	0	0
8/15	14.00	9	3	1	61	363	0	0	0	2	13	1	21	0	0	2
8/16	14.00	6	5	1	31	198	0	0	0	1	3	1	23	0	1	0
8/17	15.75	10	7	0	25	665	0	0	0	1	11	0	25	0	1	0
8/18	16.25	15	5	1	35	1,099	0	0	0	1	15	3	20	0	1	0
8/19	14.50	9	7	0	42	2,700	0	0	0	2	61	1	23	0	2	1
Total:	97.25	86	36	3	343	7,739	1	2	0	8	138	11	162	0	7	3
							Stratum 10									
8/20	12.75	4	1	0	13	1,034	0	0	0	0	19	0	23	0	0	0
8/21	14.00	2	1	1	3	400	0	0	0	0	9	0	26	0	0	0
8/22	15.50	4	0	0	6	656	1	0	0	0	13	2	22	0	1	0
8/23	12.75	4	0	1	2	148	0	0	1	0	3	0	17	0	0	0
8/24	15.50	3	0	0	2	307	0	0	0	1	5	0	32	0	0	0
8/25	13.25	2	0	1	1	272	0	0	0	0	3	0	28	0	0	0
8/26	13.00	11	0	1	8	1,639	0	0	0	1	39	0	38	0	0	0
Total:	96.75	30	2	4	35	4,456	1	0	1	2	91	2	186	0	1	0
							Stratum 11									
8/27	13.75	10	0	0	8	3,969	3	0	0	0	89	0	64	0	0	0
8/28	11.75	0	0	0	1	476	0	0	0	0	10	0	14	0	0	0
8/29	11.50	2	1	1	0	528	0	0	0	0	30	0	25	0	0	0
8/30	12.25	0	0	3	0	638	0	0	0	0	11	0	13	0	0	0
8/31	13.00	1	0	2	0	643	0	0	0	0	23	0	9	0	0	0
9/1	13.50	1	0	1	0	674	0	0	0	0	23	0	11	0	0	0
9/2	14.25	0	0	0	2	570	0	0	0	1	28	0	11	0	1	0
Total:	90.00	14	1	7	11	7,498	3	0	0	1	214	0	147	0	1	0
							Stratum 12									
9/3	13.75	1	1	0	1	309	0	0	0	0	14	0	10	0	0	0
9/4	10.75	0	0	3	0	370	0	0	0	0	13	0	5	0	0	0
9/5	12.75	1	0	0	0	273	0	0	0	0	9	0	8	0	0	0
9/6	12.75	0	1	0	0	508	0	0	0	0	8	0	5	0	0	0
9/7	5.75	0	0	0	0	147	0	0	0	0	4	0	0	0	0	0
9/8	[b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/9	[b]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total:	55.75	2	2	3	1	1,607	0	0	0	0	48	0	28	0	0	0

Continued

[b] No counts due to high water

Appendix 2. – Continued

Date	Counting Effort (h)	Chum Salmon	Chinook Salmon	Sockeye Salmon	Pink Salmon	Coho Salmon	Gill Net Marks: Chum Salmon	Gill Net Marks: Chinook Salmon	Gill Net Marks: Sockeye Salmon	Gill Net Marks: Pink Salmon	Gill Net Marks: Coho Salmon	Dolly Varden	Whitefish	N. Pike	Grayling	Rainbow Trout
Stratum 13																
9/10	10.50	0	0	0	0	115	0	0	0	0	2	0	6	0	0	0
9/11	11.00	1	0	0	0	93	0	0	0	0	1	0	4	0	0	0
9/12	11.00	0	0	0	0	54	0	0	0	0	1	0	0	0	0	0
9/13	10.50	0	0	0	0	49	0	0	0	0	2	0	2	0	0	0
9/14	10.75	0	0	0	0	59	0	0	0	0	0	0	16	0	0	0
9/15	5.00	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0
9/16	[c]															
Total:	58.75	1	0	0	0	398	0	0	0	0	6	0	28	0	0	0
Cumulative Totals																
6/22-9/16	1044.25	11,691[a]	3,547	1,049[a]	1,407	25,610	333	137	26	26	547	48	778	0	53	31

[a] Counts reapportioned by species identified through scale pattern analysis.

[c] No counts- weir pulled for season

Appendix 3. – Daily counts, cumulative counts, and cumulative proportion of chum, chinook, sockeye, pink, and coho salmon escapement through the Kwethluk River Weir, Alaska, 2000.

Date	Chum Salmon			Chinook Salmon			Sockeye Salmon			Pink Salmon			Coho Salmon		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
6/22	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000	0	0	0.000
6/23	28	28	0.002	4	4	0.001	3	3	0.003	0	0	0.000	0	0	0.000
6/24	44	72	0.006	7	11	0.003	4	7	0.007	0	0	0.000	0	0	0.000
6/25	39	111	0.009	3	14	0.004	45	52	0.050	0	0	0.000	0	0	0.000
6/26	79	190	0.016	18	32	0.009	90	142	0.135	0	0	0.000	0	0	0.000
6/27	71	261	0.022	3	35	0.010	82	224	0.214	0	0	0.000	0	0	0.000
6/28	72	333	0.028	15	50	0.014	83	307	0.293	0	0	0.000	0	0	0.000
6/29	78	411	0.035	10	60	0.017	89	396	0.378	0	0	0.000	0	0	0.000
6/30	72	483	0.041	16	76	0.021	82	478	0.456	0	0	0.000	0	0	0.000
7/1	128	611	0.052	41	117	0.033	147	625	0.596	0	0	0.000	0	0	0.000
7/2	195	806	0.069	33	150	0.042	24	649	0.619	3	3	0.002	0	0	0.000
7/3	396	1202	0.103	55	205	0.058	50	699	0.666	7	10	0.007	0	0	0.000
7/4	208	1410	0.121	56	261	0.074	26	725	0.691	9	19	0.014	0	0	0.000
7/5	348	1758	0.150	72	333	0.094	43	768	0.732	8	27	0.019	0	0	0.000
7/6	256	2014	0.172	437	770	0.217	32	800	0.763	9	36	0.026	0	0	0.000
7/7	146	2160	0.185	75	845	0.238	18	818	0.780	15	51	0.036	0	0	0.000
7/8	327	2487	0.213	126	971	0.274	41	859	0.819	6	57	0.041	0	0	0.000
7/9	423	2910	0.249	88	1059	0.299	6	865	0.825	10	67	0.048	0	0	0.000
7/10	179	3089	0.264	33	1092	0.308	11	876	0.835	1	68	0.048	0	0	0.000
7/11	537	3626	0.310	91	1183	0.334	28	904	0.862	8	76	0.054	0	0	0.000
7/12	856	4482	0.383	444	1627	0.459	22	926	0.883	25	101	0.072	0	0	0.000
7/13	616	5098	0.436	222	1849	0.521	14	940	0.896	27	128	0.091	0	0	0.000
7/14	207	5305	0.454	92	1941	0.547	6	946	0.902	15	143	0.102	0	0	0.000
7/15	414	5719	0.489	86	2027	0.571	9	955	0.910	30	173	0.123	0	0	0.000
7/16	347	6066	0.519	196	2223	0.627	15	970	0.925	23	196	0.139	0	0	0.000
7/17	395	6461	0.553	201	2424	0.683	4	974	0.929	26	222	0.158	0	0	0.000
7/18	566	7027	0.601	340	2764	0.779	5	979	0.933	54	276	0.196	0	0	0.000
7/19	218	7245	0.620	41	2805	0.791	1	980	0.934	20	296	0.210	0	0	0.000
7/20	173	7418	0.635	69	2874	0.810	0	980	0.934	17	313	0.222	0	0	0.000
7/21	283	7701	0.659	82	2956	0.833	3	983	0.937	14	327	0.232	0	0	0.000
7/22	421	8122	0.695	35	2991	0.843	2	985	0.939	26	353	0.251	9	9	0.000

Boxed areas encompass first quartile, median, and third quartile.

Appendix 3. – Continued

Date	Chum Salmon			Chinook Salmon			Sockeye Salmon			Pink Salmon			Coho Salmon		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
7/23	468	8590	0.735	117	3108	0.876	0	985	0.939	41	394	0.280	12	21	0.001
7/24	217	8807	0.753	28	3136	0.884	2	987	0.941	20	414	0.294	9	30	0.001
7/25	208	9015	0.771	15	3151	0.888	1	988	0.942	7	421	0.299	14	44	0.002
7/26	331	9346	0.799	32	3183	0.897	1	989	0.943	16	437	0.311	16	60	0.002
7/27	365	9711	0.831	75	3258	0.919	4	993	0.947	22	459	0.326	25	85	0.003
7/28	217	9928	0.849	30	3288	0.927	0	993	0.947	24	483	0.343	33	118	0.005
7/29	201	10129	0.866	12	3300	0.930	1	994	0.948	15	498	0.354	14	132	0.005
7/30	297	10426	0.892	17	3317	0.935	0	994	0.948	37	535	0.380	37	169	0.007
7/31	248	10674	0.913	77	3394	0.957	5	999	0.952	23	558	0.397	96	265	0.010
8/1	155	10829	0.926	10	3404	0.960	3	1002	0.955	39	597	0.424	104	369	0.014
8/2	143	10972	0.938	15	3419	0.964	1	1003	0.956	27	624	0.443	91	460	0.018
8/3	155	11127	0.952	19	3438	0.969	0	1003	0.956	36	660	0.469	227	687	0.027
8/4	97	11224	0.960	17	3455	0.974	4	1007	0.960	46	706	0.502	182	869	0.034
8/5	102	11326	0.969	17	3472	0.979	6	1013	0.966	44	750	0.533	242	1111	0.043
8/6	38	11364	0.972	5	3477	0.980	3	1016	0.969	20	770	0.547	86	1197	0.047
8/7	48	11412	0.976	5	3482	0.982	2	1018	0.970	22	792	0.563	205	1402	0.055
8/8	23	11435	0.978	5	3487	0.983	9	1027	0.979	9	801	0.569	158	1560	0.061
8/9	18	11453	0.980	4	3491	0.984	1	1028	0.980	25	826	0.587	204	1764	0.069
8/10	58	11511	0.985	4	3495	0.985	1	1029	0.981	44	870	0.618	306	2070	0.081
8/11	33	11544	0.987	8	3503	0.988	3	1032	0.984	90	960	0.682	909	2979	0.116
8/12	14	11558	0.989	3	3506	0.988	0	1032	0.984	57	1017	0.723	933	3912	0.153
8/13	21	11579	0.990	8	3514	0.991	0	1032	0.984	85	1102	0.783	1444	5356	0.209
8/14	16	11595	0.992	1	3515	0.991	0	1032	0.984	64	1166	0.829	1270	6626	0.259
8/15	9	11604	0.993	3	3518	0.992	1	1033	0.985	61	1227	0.872	363	6989	0.273
8/16	6	11610	0.993	5	3523	0.993	1	1034	0.986	31	1258	0.894	198	7187	0.281
8/17	10	11620	0.994	7	3530	0.995	0	1034	0.986	25	1283	0.912	665	7852	0.307
8/18	15	11635	0.995	5	3535	0.997	1	1035	0.987	35	1318	0.937	1099	8951	0.350
8/19	9	11644	0.996	7	3542	0.999	0	1035	0.987	42	1360	0.967	2700	11651	0.455
8/20	4	11648	0.996	1	3543	0.999	0	1035	0.987	13	1373	0.976	1034	12685	0.495
8/21	2	11650	0.996	1	3544	0.999	1	1036	0.988	3	1376	0.978	400	13085	0.511
8/22	4	11654	0.997	0	3544	0.999	0	1036	0.988	6	1382	0.982	656	13741	0.537
8/23	4	11658	0.997	0	3544	0.999	1	1037	0.989	2	1384	0.984	148	13889	0.542

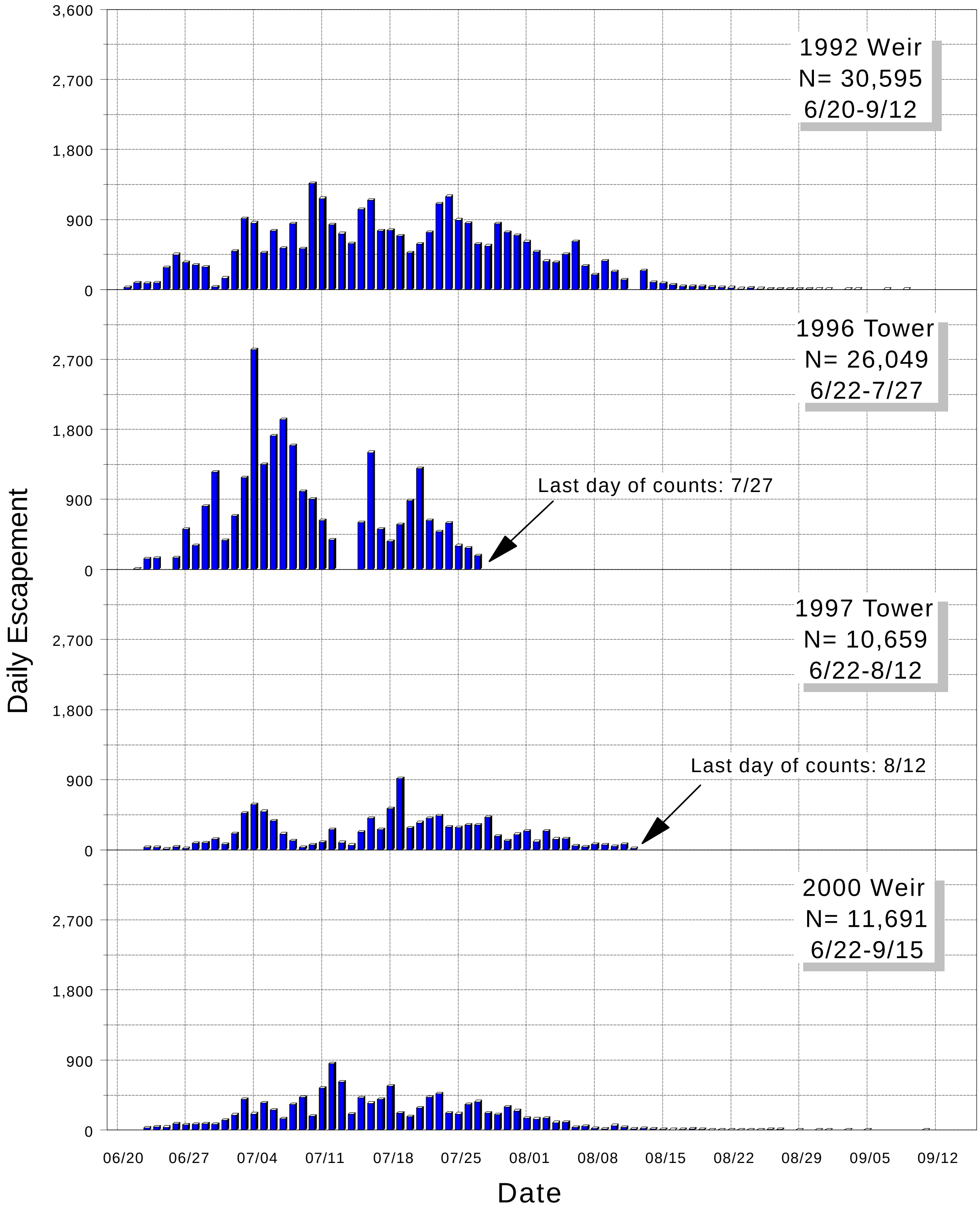
Boxed areas encompass first quartile, median, and third quartile.

Appendix 3. – Continued

Date	Chum Salmon			Chinook Salmon			Sockeye Salmon			Pink Salmon			Coho Salmon		
	Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative		Daily	Cumulative	
	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion	Count	Count	Proportion
8/24	3	11661	0.997	0	3544	0.999	0	1037	0.989	2	1386	0.985	307	14196	0.554
8/25	2	11663	0.998	0	3544	0.999	1	1038	0.990	1	1387	0.986	272	14468	0.565
8/26	11	11674	0.999	0	3544	0.999	1	1039	0.990	8	1395	0.991	1639	16107	0.629
8/27	10	11684	0.999	0	3544	0.999	0	1039	0.990	8	1403	0.997	3969	20076	0.784
8/28	0	11684	0.999	0	3544	0.999	0	1039	0.990	1	1404	0.998	476	20552	0.802
8/29	2	11686	1.000	1	3545	0.999	1	1040	0.991	0	1404	0.998	528	21080	0.823
8/30	0	11686	1.000	0	3545	0.999	3	1043	0.994	0	1404	0.998	638	21718	0.848
8/31	1	11687	1.000	0	3545	0.999	2	1045	0.996	0	1404	0.998	643	22361	0.873
9/1	1	11688	1.000	0	3545	0.999	1	1046	0.997	0	1404	0.998	674	23035	0.899
9/2	0	11688	1.000	0	3545	0.999	0	1046	0.997	2	1406	0.999	570	23605	0.922
9/3	1	11689	1.000	1	3546	1.000	0	1046	0.997	1	1407	1.000	309	23914	0.934
9/4	0	11689	1.000	0	3546	1.000	3	1049	1.000	0	1407	1.000	370	24284	0.948
9/5	1	11690	1.000	0	3546	1.000	0	1049	1.000	0	1407	1.000	273	24557	0.959
9/6	0	11690	1.000	1	3547	1.000	0	1049	1.000	0	1407	1.000	508	25065	0.979
9/7	0	11690	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	147	25212	0.984
9/8	0	11690	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	0	25212	0.984
9/9	0	11690	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	0	25212	0.984
9/10	0	11690	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	115	25327	0.989
9/11	1	11691	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	93	25420	0.993
9/12	0	11691	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	54	25474	0.995
9/13	0	11691	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	49	25523	0.997
9/14	0	11691	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	59	25582	0.999
9/15	0	11691	1.000	0	3547	1.000	0	1049	1.000	0	1407	1.000	28	25610	1.000

Boxed areas encompass first quartile, median, and third quartile.

No counts conducted on 9/8 and 9/9 due to high water which submerged the weir.



Appendix 4 – Daily chum salmon escapement through the Kwethluk River weir (1992 and 2000) and counting tower (1996 and 1997), Alaska..

Appendix 5 – Estimated age and sex composition of weekly chum salmon escapements through the Kwethluk River weir, Alaska, 2000; and estimated design effects of the stratified sampling design.

		Brood Year and Age Class				
		1997	1996	1995	1994	
		0.2	0.3	0.4	0.5	Total
Stratum 1:	06/18-06/24					
No Samples Collected						
Stratum 2:	06/25-07/01					
Sampling Dates: 06/26, 06/27, & 06/28						
Male:	Number in Sample:	0	11	29	2	42
	Estimated % of Escapement:	0.0	16.9	44.6	3.1	64.6
	Estimated Escapement:	0	91	240	17	348
	Standard Error:	0.0	23.7	31.4	10.9	
Female:	Number in Sample:	0	6	17	0	23
	Estimated % of Escapement:	0.0	9.2	26.2	0.0	35.4
	Estimated Escapement:	0	50	141	0	191
	Standard Error:	0.0	18.3	27.8	0.0	
Total:	Number in Sample:	0	17	46	2	65
	Estimated % of Escapement:	0.0	26.2	70.8	3.1	100.0
	Estimated Escapement:	0	141	381	17	539
	Standard Error:	0.0	27.8	28.7	10.9	
Stratum 3:	07/02-07/08					
Sampling Dates: 07/03, 07/04, & 07/05						
Male:	Number in Sample:	0	30	53	1	84
	Estimated % of Escapement:	0.0	24.0	42.4	0.8	67.2
	Estimated Escapement:	0	450	795	15	1,261
	Standard Error:	0.0	69.5	80.4	14.5	
Female:	Number in Sample:	0	10	31	0	41
	Estimated % of Escapement:	0.0	8.0	24.8	0.0	32.8
	Estimated Escapement:	0	150	465	0	615
	Standard Error:	0.0	44.2	70.3	0.0	
Total:	Number in Sample:	0	40	84	1	125
	Estimated % of Escapement:	0.0	32.0	67.2	0.8	100.0
	Estimated Escapement:	0	600	1,261	15	1,876
	Standard Error:	0.0	75.9	76.4	14.5	
Stratum 4:	07/09-07/15					
Sampling Dates: 07/10, 07/11, & 07/12						
Male:	Number in Sample:	0	48	32	1	81
	Estimated % of Escapement:	0.0	27.6	18.4	0.6	46.6
	Estimated Escapement:	0	892	594	19	1,505
	Standard Error:	0.0	106.8	92.6	18.1	
Female:	Number in Sample:	0	58	35	0	93
	Estimated % of Escapement:	0.0	33.3	20.1	0.0	53.4
	Estimated Escapement:	0	1,077	650	0	1,727
	Standard Error:	0.0	112.7	95.8	0.0	
Total:	Number in Sample:	0	106	67	1	174
	Estimated % of Escapement:	0.0	60.9	38.5	0.6	100.0
	Estimated Escapement:	0	1,969	1,245	19	3,232
	Standard Error:	0.0	116.6	116.3	18.1	

Appendix 5 – Continued

		Brood Year and Age Class				
		1997	1996	1995	1994	
		0.2	0.3	0.4	0.5	Total
Stratum 5:	07/16-07/22					
Sampling Dates: 07/17, 07/18, 07/19, & 07/20						
Male:	Number in Sample:	0	61	30	0	91
	Estimated % of Escapement:	0.0	34.7	17.0	0.0	51.7
	Estimated Escapement:	0	833	410	0	1,242
	Standard Error:	0.0	83.2	65.8	0.0	
Female:	Number in Sample:	1	57	27	0	85
	Estimated % of Escapement:	0.6	32.4	15.3	0.0	48.3
	Estimated Escapement:	14	778	369	0	1,161
	Standard Error:	13.1	81.8	63.0	0.0	
Total:	Number in Sample:	1	118	57	0	176
	Estimated % of Escapement:	0.6	67.0	32.4	0.0	100.0
	Estimated Escapement:	14	1,611	778	0	2,403
	Standard Error:	13.1	82.2	81.8	0.0	
Stratum 6:	07/23-07/29					
Sampling Dates: 07/24, 07/25, 07/26, & 07/27						
Male:	Number in Sample:	1	76	21	0	98
	Estimated % of Escapement:	0.5	39.0	10.8	0.0	50.3
	Estimated Escapement:	10	782	216	0	1,009
	Standard Error:	9.8	66.8	42.4	0.0	
Female:	Number in Sample:	0	84	13	0	97
	Estimated % of Escapement:	0.0	43.1	6.7	0.0	49.7
	Estimated Escapement:	0	865	134	0	998
	Standard Error:	0.0	67.8	34.2	0.0	
Total:	Number in Sample:	1	160	34	0	195
	Estimated % of Escapement:	0.5	82.1	17.4	0.0	100.0
	Estimated Escapement:	10	1,647	350	0	2,007
	Standard Error:	9.8	52.5	51.9	0.0	
Stratum 7:	07/30-08/05					
Sampling Dates: 07/31 & 08/01						
Male:	Number in Sample:	3	55	14	1	73
	Estimated % of Escapement:	1.4	26.6	6.8	0.5	35.3
	Estimated Escapement:	17	318	81	6	422
	Standard Error:	9.1	33.5	19.0	5.3	
Female:	Number in Sample:	4	115	14	1	134
	Estimated % of Escapement:	1.9	55.6	6.8	0.5	64.7
	Estimated Escapement:	23	665	81	6	775
	Standard Error:	10.4	37.7	19.0	5.3	
Total:	Number in Sample:	7	170	28	2	207
	Estimated % of Escapement:	3.4	82.1	13.5	1.0	100.0
	Estimated Escapement:	40	983	162	12	1,197
	Standard Error:	13.7	29.1	25.9	7.4	

Appendix 5 – Continued

		Brood Year and Age Class				
		1997	1996	1995	1994	
		0.2	0.3	0.4	0.5	Total
Strata 8-11:	08/06-09/02					
Sampling Dates: 08/07, 08/08, 08/21, 08/23, & 08/29						
Male:	Number in Sample:	0	15	4	0	19
	Estimated % of Escapement:	0.0	28.3	7.5	0.0	35.8
	Estimated Escapement:	0	102	27	0	130
	Standard Error:	0.0	20.9	12.3	0.0	
Female:	Number in Sample:	3	25	6	0	34
	Estimated % of Escapement:	5.7	47.2	11.3	0.0	64.2
	Estimated Escapement:	20	171	41	0	232
	Standard Error:	10.7	23.2	14.7	0.0	
Total:	Number in Sample:	3	40	10	0	53
	Estimated % of Escapement:	5.7	75.5	18.9	0.0	100.0
	Estimated Escapement:	20	273	68	0	362
	Standard Error:	10.7	20.0	18.1	0.0	
Strata 12-13:	09/03-09/16					
No Samples Collected						
Strata 1-13:	06/18-09/16					
Sampling Dates:						
Male:	Number in Sample:	4	296	183	5	488
	% Males in Age Group:	0.5	58.6	40.0	0.9	100.0
	Estimated % of Escapement:	0.2	29.9	20.4	0.5	50.9
	Estimated Escapement:	28	3,469	2,364	56	5,917
	Standard Error:	13.3	172.5	150.6	26.1	
	Estimated Design Effects:	0.637	1.131	1.108	1.136	1.118
Female:	Number in Sample:	8	355	143	1	507
	% Females in Age Group:	1.0	65.9	33.0	0.1	100.0
	Estimated % of Escapement:	0.5	32.3	16.2	0.0	49.1
	Estimated Escapement:	57	3,756	1,881	6	5,699
	Standard Error:	19.9	168.0	143.6	5.3	
	Estimated Design Effects:	0.680	1.029	1.202	0.495	1.118
Total:	Number in Sample:	12	651	326	6	995
	Estimated % of Escapement:	0.7	62.2	36.5	0.5	100.0
	Estimated Escapement:	85	7,224	4,245	62	11,616*
	Standard Error:	23.9	175.8	174.9	26.7	
	Estimated Design Effects:	0.664	1.042	1.045	1.076	

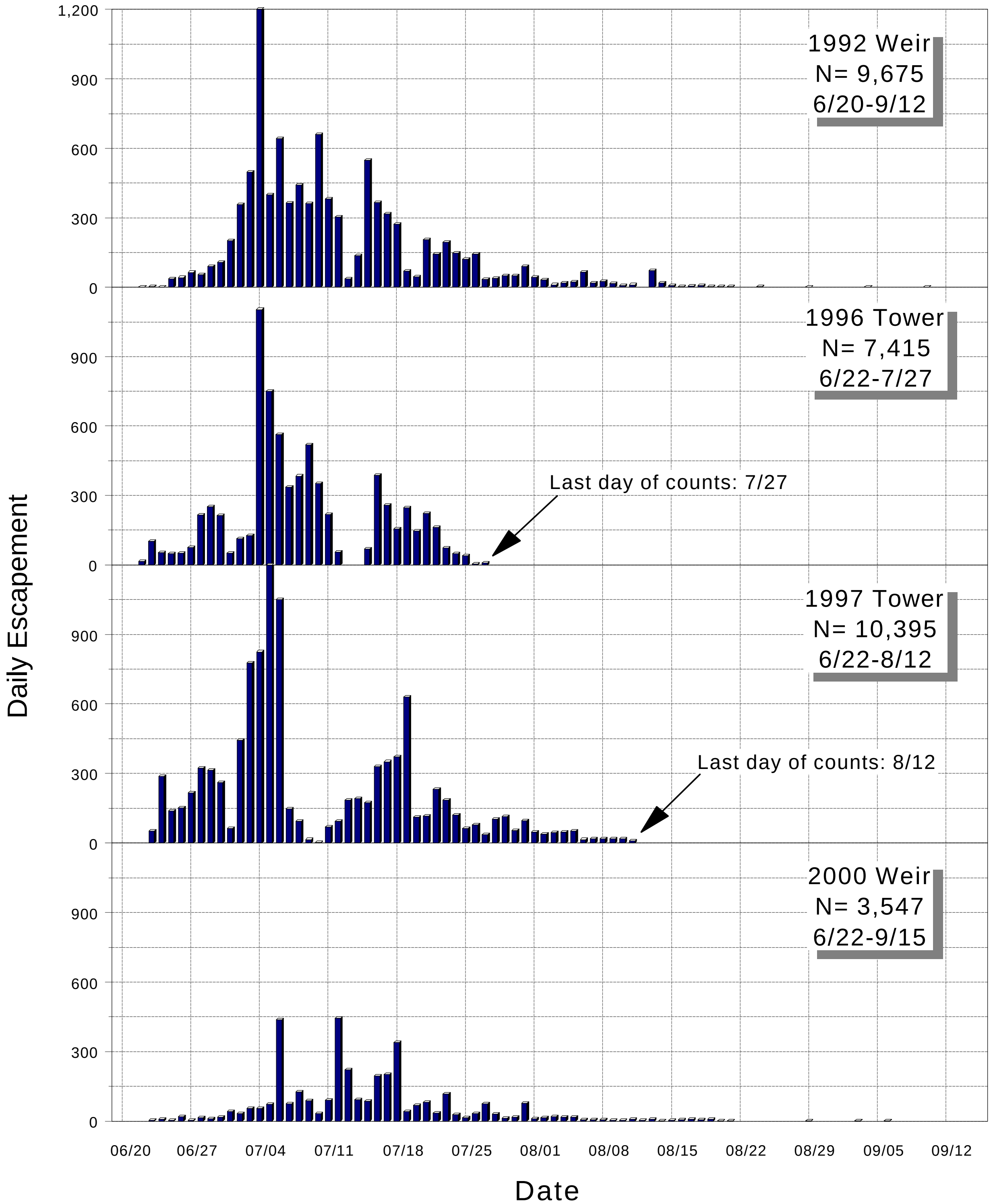
* 75 fish that were counted through the weir during stratum 1 and strata 12-13 are not included in this total.

Appendix 6 – Length (mm) at age for chum salmon, Kwethluk River weir, Alaska, 2000.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class			
			1997	1996	1995	1994
			0.2	0.3	0.4	0.5
6/26, 6/27, & 6/28	Male	Mean Length		594	622	630
(6/25-7/01)		Std. Error		7	6	50
		Range		555- 630	555- 680	580- 680
		Sample Size	0	11	29	2
	Female	Mean Length		574	592	
		Std. Error		12	7	
		Range		540- 620	525- 635	
		Sample Size	0	6	17	0
7/03, 7/04, & 7/05	Male	Mean Length		581	611	610
(7/02-7/08)		Std. Error		5	4	
		Range		525- 625	545- 670	610- 610
		Sample Size	0	30	53	1
	Female	Mean Length		552	569	
		Std. Error		9	4	
		Range		510- 595	510- 610	
		Sample Size	0	10	31	0
7/10, 7/11, & 7/12	Male	Mean Length		585	606	625
(7/09-7/15)		Std. Error		3	4	
		Range		525- 635	555- 640	625- 625
		Sample Size	0	48	32	1
	Female	Mean Length		551	556	
		Std. Error		3	4	
		Range		505- 630	505- 615	
		Sample Size	0	58	35	0
7/17, 7/18, 7/19, & 7/20	Male	Mean Length		585	600	
(7/16-7/22)		Std. Error		4	7	
		Range		465- 660	530- 675	
		Sample Size	0	61	30	0
	Female	Mean Length	535	544	567	
		Std. Error		3	4	
		Range	535- 535	480- 600	515- 595	
		Sample Size	1	57	27	0

Appendix 6 – Continued.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class			
			1997	1996	1995	1994
			0.2	0.3	0.4	0.5
7/24, 7/25, 7/26, & 7/27 (7/23-7/29)	Male	Mean Length	540	579	593	
		Std. Error		3	8	
		Range	540- 540	495- 640	510- 660	
		Sample Size	1	76	21	0
	Female	Mean Length		543	566	
		Std. Error		3	7	
		Range		485- 620	510- 595	
		Sample Size	0	84	13	0
7/31 & 8/01 (7/30-8/05)	Male	Mean Length	552	579	598	590
		Std. Error	19	4	12	
		Range	530- 590	500- 645	540- 675	590- 590
		Sample Size	3	55	14	1
	Female	Mean Length	536	542	569	555
		Std. Error	11	2	8	
		Range	520- 570	460- 595	500- 630	555- 555
		Sample Size	4	115	14	1
8/07, 8/08, 8/20, & 8/29 (8/06-9/02)	Male	Mean Length		565	610	
		Std. Error		8	10	
		Range		520- 615	585- 625	
		Sample Size	0	15	4	0
	Female	Mean Length	512	524	553	
		Std. Error	14	6	12	
		Range	485- 530	465- 595	525- 605	
		Sample Size	3	25	6	0
Seasonal	Male	Mean Length	547	582	607	619
		Std. Error	19	2	2	50
		Range	530- 590	465- 660	510- 680	580- 680
		Sample Size	4	296	183	5
	Female	Mean Length	527	545	565	555
		Std. Error	9	1	2	
		Range	485- 570	460- 630	500- 635	555- 555
		Sample Size	8	355	143	1



Appendix 7– Daily chinook salmon escapement through the Kwethluk River weir (1992 and 2000) and counting tower (1996 and 1997), Alaska..

Appendix 8 – Estimated age and sex composition of weekly chinook salmon escapements through the Kwethluk River weir, Alaska, 2000; and estimated design effects of the stratified sampling design.

		Brood Year and Age Class								
		1997	1996	1995		1994		1993		
		1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	Total
Stratum 1:	06/18-06/24									
No Samples Collected										
Stratum 2:	06/25-07/01									
Sampling Dates: 06/26, 06/27 & 06/28										
Male:	Number in Sample:	0	7	9	0	0	0	0	0	16
	Estimated % of Escapement:	0.0	36.8	47.4	0.0	0.0	0.0	0.0	0.0	84.2
	Estimated Escapement:	0	39	50	0	0	0	0	0	89
	Standard Error:	0.0	10.9	11.3	0.0	0.0	0.0	0.0	0.0	
Female:	Number in Sample:	0	0	0	0	3	0	0	0	3
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	15.8	0.0	0.0	0.0	15.8
	Estimated Escapement:	0	0	0	0	17	0	0	0	17
	Standard Error:	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	
Total:	Number in Sample:	0	7	9	0	3	0	0	0	19
	Estimated % of Escapement:	0.0	36.8	47.4	0.0	15.8	0.0	0.0	0.0	100.0
	Estimated Escapement:	0	39	50	0	17	0	0	0	106
	Standard Error:	0.0	10.9	11.3	0.0	8.3	0.0	0.0	0.0	
Stratum 3:	07/02-07/08									
Sampling Dates: 07/03, 07/04, & 07/05										
Male:	Number in Sample:	0	19	30	0	8	0	0	0	57
	Estimated % of Escapement:	0.0	28.8	45.5	0.0	12.1	0.0	0.0	0.0	86.4
	Estimated Escapement:	0	246	388	0	104	0	0	0	738
	Standard Error:	0.0	46.1	50.7	0.0	33.2	0.0	0.0	0.0	
Female:	Number in Sample:	0	0	1	0	7	0	1	0	9
	Estimated % of Escapement:	0.0	0.0	1.5	0.0	10.6	0.0	1.5	0.0	13.6
	Estimated Escapement:	0	0	13	0	91	0	13	0	116
	Standard Error:	0.0	0.0	12.4	0.0	31.3	0.0	12.4	0.0	
Total:	Number in Sample:	0	19	31	0	15	0	1	0	66
	Estimated % of Escapement:	0.0	28.8	47.0	0.0	22.7	0.0	1.5	0.0	100.0
	Estimated Escapement:	0	246	401	0	194	0	13	0	854
	Standard Error:	0.0	46.1	50.8	0.0	42.6	0.0	12.4	0.0	

Appendix 8 – Continued

		Brood Year and Age Class								
		1997	1996	1995		1994		1993		
		1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	Total
Stratum 4:	07/09-07/15									
Sampling Dates: 07/10, 07/11, 07/12, 07/13										
Male:	Number in Sample:	0	26	29	0	18	0	3	0	76
	Estimated % of Escapement:	0.0	27.7	30.9	0.0	19.1	0.0	3.2	0.0	80.9
	Estimated Escapement:	0	292	326	0	202	0	34	0	854
	Standard Error:	0.0	46.8	48.3	0.0	41.1	0.0	18.4	0.0	
Female:	Number in Sample:	0	0	3	0	14	0	1	0	18
	Estimated % of Escapement:	0.0	0.0	3.2	0.0	14.9	0.0	1.1	0.0	19.1
	Estimated Escapement:	0	0	34	0	157	0	11	0	202
	Standard Error:	0.0	0.0	18.4	0.0	37.2	0.0	10.7	0.0	
Total:	Number in Sample:	0	26	32	0	32	0	4	0	94
	Estimated % of Escapement:	0.0	27.7	34.0	0.0	34.0	0.0	4.3	0.0	100.0
	Estimated Escapement:	0	292	359	0	359	0	45	0	1,056
	Standard Error:	0.0	46.8	49.5	0.0	49.5	0.0	21.1	0.0	
Stratum 5:	07/16-07/22									
Sampling Dates: 07/17, 07/18, & 07/19										
Male:	Number in Sample:	0	26	29	0	7	0	2	0	64
	Estimated % of Escapement:	0.0	31.3	34.9	0.0	8.4	0.0	2.4	0.0	77.1
	Estimated Escapement:	0	302	337	0	81	0	23	0	743
	Standard Error:	0.0	47.2	48.5	0.0	28.3	0.0	15.6	0.0	
Female:	Number in Sample:	0	0	2	0	13	0	4	0	19
	Estimated % of Escapement:	0.0	0.0	2.4	0.0	15.7	0.0	4.8	0.0	22.9
	Estimated Escapement:	0	0	23	0	151	0	46	0	221
	Standard Error:	0.0	0.0	15.6	0.0	37.0	0.0	21.8	0.0	
Total:	Number in Sample:	0	26	31	0	20	0	6	0	83
	Estimated % of Escapement:	0.0	31.3	37.3	0.0	24.1	0.0	7.2	0.0	100.0
	Estimated Escapement:	0	302	360	0	232	0	70	0	964
	Standard Error:	0.0	47.2	49.2	0.0	43.5	0.0	26.4	0.0	

Appendix 8 – Continued

		Brood Year and Age Class								
		1997	1996	1995		1994		1993		
		1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4	Total
Strata 6-7:	07/23-08/05									
Sampling Dates: 07/24-07/27, 07/31, & 08/01										
Male:	Number in Sample:	0	13	7	0	1	0	1	0	22
	Estimated % of Escapement:	0.0	33.3	17.9	0.0	2.6	0.0	2.6	0.0	56.4
	Estimated Escapement:	0	160	86	0	12	0	12	0	271
	Standard Error:	0.0	35.3	28.7	0.0	11.8	0.0	11.8	0.0	
Female:	Number in Sample:	0	0	0	0	10	0	7	0	17
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	25.6	0.0	17.9	0.0	43.6
	Estimated Escapement:	0	0	0	0	123	0	86	0	210
	Standard Error:	0.0	0.0	0.0	0.0	32.7	0.0	28.7	0.0	
Total:	Number in Sample:	0	13	7	0	11	0	8	0	39
	Estimated % of Escapement:	0.0	33.3	17.9	0.0	28.2	0.0	20.5	0.0	100.0
	Estimated Escapement:	0	160	86	0	136	0	99	0	481
	Standard Error:	0.0	35.3	28.7	0.0	33.7	0.0	30.2	0.0	
Strata 8-13:	08/06-09/16									
No Samples Collected										
Strata 1-13:	06/18-09/16									
Sampling Dates: 06/26-08/29										
Male:	Number in Sample:	0	91	104	0	34	0	6	0	235
	% Males in Age Group:	0.0	38.6	44.1	0.0	14.8	0.0	2.6	0.0	100.0
	Estimated % of Escapement:	0.0	30.0	34.3	0.0	11.5	0.0	2.0	0.0	77.9
	Estimated Escapement:	0	1,039	1,187	0	399	0	69	0	2,695
	Standard Error:	0.0	88.9	90.6	0.0	61.1	0.0	26.8	0.0	
	Estimated Design Effects:	0.000	1.029	0.997	0.000	1.001	0.000	1.008	0.000	0.982
Female:	Number in Sample:	0	0	6	0	47	0	13	0	66
	% Females in Age Group:	0.0	0.0	9.1	0.0	70.4	0.0	20.5	0.0	100.0
	Estimated % of Escapement:	0.0	0.0	2.0	0.0	15.6	0.0	4.5	0.0	22.1
	Estimated Escapement:	0	0	70	0	539	0	157	0	766
	Standard Error:	0.0	0.0	27.1	0.0	69.8	0.0	39.6	0.0	
	Estimated Design Effects:	0.000	0.000	1.018	0.000	1.014	0.000	0.989	0.000	0.982
Total:	Number in Sample:	0	91	110	0	81	0	19	0	301
	Estimated % of Escapement:	0.0	30.0	36.3	0.0	27.1	0.0	6.5	0.0	100.0
	Estimated Escapement:	0	1,039	1,257	0	938	0	226	0	3,461*
	Standard Error:	0.0	88.9	91.7	0.0	85.8	0.0	47.0	0.0	
	Estimated Design Effects:	0.000	1.029	0.995	0.000	1.020	0.000	0.987	0.000	

* 86 fish that were counted through the weir during stratum 1 and strata 8-13 are not included in this total.

Appendix 9 – Length (mm) at age for chinook salmon, Kwethluk River weir, Alaska, 2000.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class							
			1997	1996	1995		1994		1993	
			1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4
6/26, 6/27 & 6/28 (6/25-7/01)	Male	Mean Length		518	677					
		Std. Error		20	22					
		Range		415- 565	575- 805					
		Sample Size	0	7	9	0	0	0	0	0
	Female	Mean Length					888			
		Std. Error					24			
		Range					840- 915			
		Sample Size	0	0	0	0	3	0	0	0
7/03, 7/04, & 7/05 (7/02-7/08)	Male	Mean Length		510	664		774			
		Std. Error		11	9		38			
		Range		445- 595	585- 780		650- 955			
		Sample Size	0	19	30	0	8	0	0	0
	Female	Mean Length			825		884		910	
		Std. Error					33			
		Range			825- 825		710- 970		910- 910	
		Sample Size	0	0	1	0	7	0	1	0
7/10, 7/11, 7/12, & 7/13 (7/09-7/15)	Male	Mean Length		518	674		806		900	
		Std. Error		10	11		14		43	
		Range		450- 595	585- 775		740- 970		815- 945	
		Sample Size	0	26	29	0	18	0	3	0
	Female	Mean Length			808		876		820	
		Std. Error			36		9			
		Range			740- 860		825- 945		820- 820	
		Sample Size	0	0	3	0	14	0	1	0
7/17, 7/18, & 7/19 (7/16-7/22)	Male	Mean Length		503	678		851		968	
		Std. Error		8	11		23		18	
		Range		425- 580	580- 805		780- 940		950- 985	
		Sample Size	0	26	29	0	7	0	2	0
	Female	Mean Length			823		867		929	
		Std. Error			68		13		22	
		Range			755- 890		745- 930		890- 970	
		Sample Size	0	0	2	0	13	0	4	0

Appendix 9-Continued.

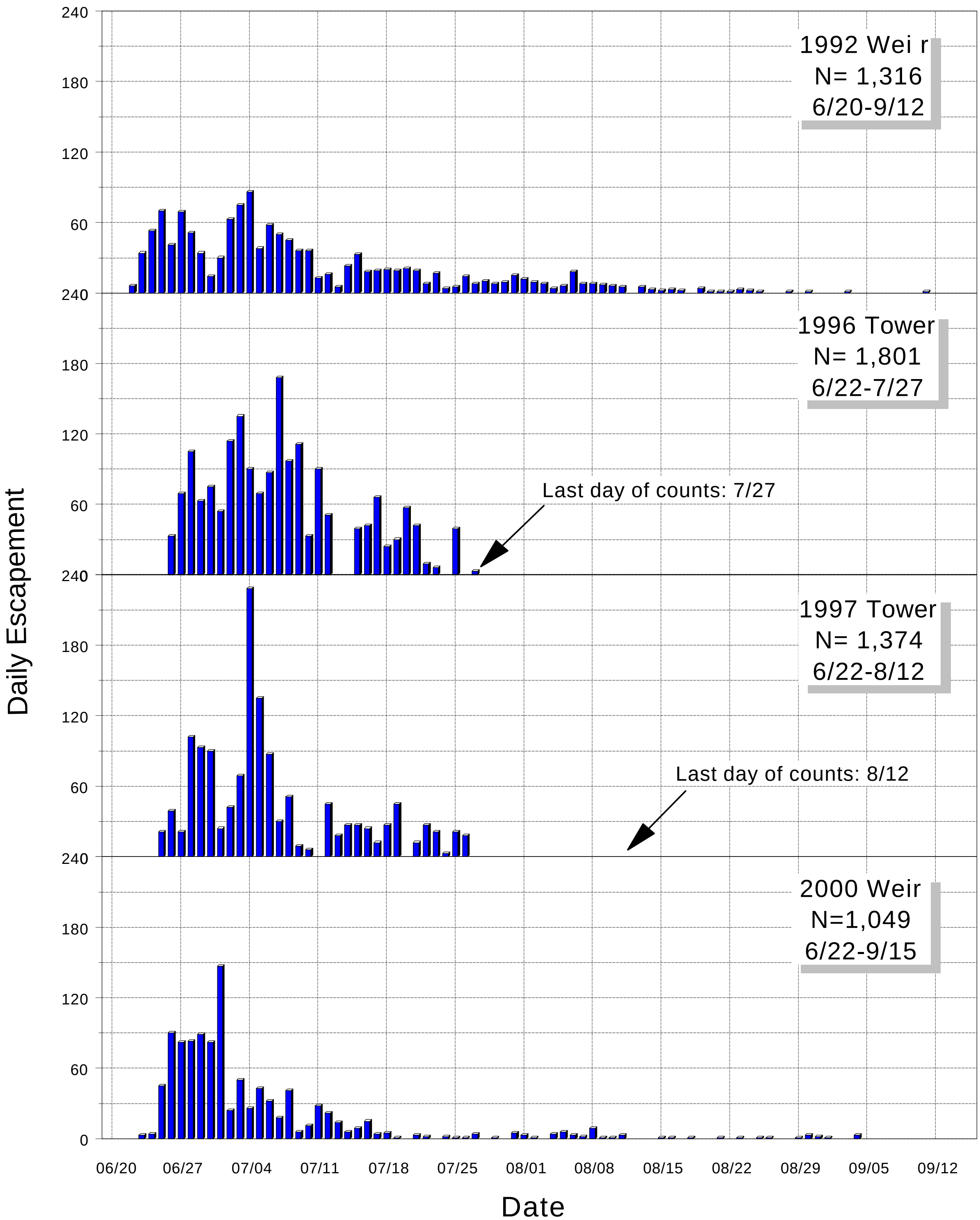
Sampling Dates (Stratum Dates)	Sex		Age Class							
			1997	1996	1995		1994		1993	
			1.1	1.2	1.3	2.2	1.4	2.3	1.5	2.4
7/24-7/27, & 8/01	Male	Mean Length		495	713		855		940	
(7/23-8/05)		Std. Error		16	10					
		Range		400- 595	665- 740		855- 855		940- 940	
		Sample Size	0	13	7	0	1	0	1	0
	Female	Mean Length					855		901	
		Std. Error					14		24	
		Range					760- 925		800- 970	
		Sample Size	0	0	0	0	10	0	7	0
Seasonal	Male	Mean Length		508	675		808		930	
		Std. Error		5	5		14		26	
		Range		400- 595	575- 805		650- 970		815- 985	
		Sample Size	0	91	104	0	34	0	6	0
	Female	Mean Length			816		870		904	
		Std. Error			35		8		17	
		Range			740- 890		710- 970		800- 970	
		Sample Size	0	0	6	0	47	0	13	0

Appendix 10 – Estimated number of females and estimated egg production of chinook salmon in the Kwethluk River, Alaska, 2000.

	Estmated Escapement			Sample Size			Sex Composition	
	1992	**2000**		**1992**	**2000**		**1992**	**2000**
Males:	7,350	2,776	Males:	604	261	Males:	74.8%	78.9%
Females:	2,325	771	Females:	204	70	Females:	25.2%	21.1%
Total:	**9,675**	**3,547**	**Total:**	**808**	**331**			

		1992			**2000**		
Size	Eggs per female[a]	Females in Sample	Number of Females	Egg Production	Females in Sample	Number of Females	Egg Production
550	3,060	1	2	6,908	0	0	0
560	3,260	0	0	0	0	0	0
570	3,460	0	0	0	0	0	0
580	3,660	3	7	24,788	0	0	0
590	3,860	3	29	110,701	0	0	0
600	4,060	1	2	9,166	0	0	0
610	4,260	2	5	19,235	0	0	0
620	4,460	0	0	0	0	0	0
630	4,660	0	0	0	0	0	0
640	4,860	1	2	10,972	0	0	0
650	5,060	2	5	22,847	0	0	0
660	5,260	2	5	28,707	0	0	0
670	5,460	1	2	12,326	0	0	0
680	5,660	0	0	0	0	0	0
690	5,860	1	2	13,229	1	11	62,767
700	6,060	2	25	154,403	0	0	0
710	6,260	0	0	0	1	12	72,244
720	6,460	0	0	0	0	0	0
730	6,660	0	0	0	0	0	0
740	6,860	0	0	0	2	21	143,134
750	7,060	1	3	22,592	1	11	75,620
760	7,260	0	0	0	1	13	93,873
770	7,460	2	25	185,807	1	10	75,748
780	7,660	1	3	24,512	0	0	0
790	7,860	3	20	156,639	0	0	0
800	8,060	1	18	147,210	1	13	104,218
810	8,260	13	194	1,605,075	2	24	195,277
820	8,460	12	131	1,108,965	4	42	355,338
830	8,660	11	124	1,077,428	1	11	92,758
840	8,860	11	113	1,000,403	2	16	141,794
850	9,060	16	167	1,512,934	7	84	757,137
860	9,260	8	125	1,152,936	11	121	1,121,719
870	9,460	16	186	1,763,348	2	21	202,654
880	9,660	21	271	2,614,801	3	34	326,462
890	9,860	14	140	1,383,170	10	110	1,083,363
900	10,060	14	159	1,594,654	3	32	317,655
910	10,260	12	175	1,794,918	5	45	466,750
920	10,460	6	81	845,816	2	23	241,459
930	10,660	14	178	1,896,312	2	24	252,017
940	10,860	3	50	539,121	2	23	250,693
950	11,060	4	55	605,219	2	24	270,647
960	11,260	0	0	0	2	22	250,554
970	11,460	2	21	245,981	2	24	270,930
980	11,660	0	0	0	0	0	0
990	11,860	0	0	0	0	0	0
	Total	204	2,325	21,520,325	70	771	7,224,811

[a] Eggs per female based on regression developed from Tanana River chinook salmon (Skaugstad and McCracken 1991).



Appendix 11 – Daily sockeye salmon escapements through the Kwethluk River weir (1992) and 2000) and counting tower (1996 and 1997), Alaska.

Appendix 12 – Estimated age and sex composition of weekly sockeye salmon escapements through the Kwethluk River weir, Alaska, 2000; and estimated design effects of the stratified sampling design.

		Brood Year and Age Class								
		1997	1996		1995			1994		
		0.2	0.3	1.2	0.4	1.3	2.2	1.4	2.3	Total
Stratum 1:	06/18-06/24									
No Samples Collected										
Stratum 2:	06/25-07/01									
Sampling Dates: 06/26, 06/27, & 06/28										
Male:	Number in Sample:	0	0	0	0	39	0	0	1	40
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	47.6	0.0	0.0	1.2	48.8
	Estimated Escapement:	0	0	0	0	294	0	0	8	301
	Standard Error:	0.0	0.0	0.0	0.0	31.9	0.0	0.0	7.0	
Female:	Number in Sample:	0	2	0	0	39	0	1	0	42
	Estimated % of Escapement:	0.0	2.4	0.0	0.0	47.6	0.0	1.2	0.0	51.2
	Estimated Escapement:	0	15	0	0	294	0	8	0	317
	Standard Error:	0.0	9.9	0.0	0.0	31.9	0.0	7.0	0.0	
Total:	Number in Sample:	0	2	0	0	78	0	1	1	82
	Estimated % of Escapement:	0.0	2.4	0.0	0.0	95.1	0.0	1.2	1.2	100.0
	Estimated Escapement:	0	15	0	0	588	0	8	8	618
	Standard Error:	0.0	9.9	0.0	0.0	13.8	0.0	7.0	7.0	
Stratum 3:	07/02-07/08									
Sampling Dates: 07/04 & 07/05										
Male:	Number in Sample:	0	1	2	0	10	0	0	0	13
	Estimated % of Escapement:	0.0	4.3	8.7	0.0	43.5	0.0	0.0	0.0	56.5
	Estimated Escapement:	0	10	20	0	102	0	0	0	132
	Standard Error:	0.0	9.7	13.3	0.0	23.5	0.0	0.0	0.0	
Female:	Number in Sample:	0	0	1	0	9	0	0	0	10
	Estimated % of Escapement:	0.0	0.0	4.3	0.0	39.1	0.0	0.0	0.0	43.5
	Estimated Escapement:	0	0	10	0	92	0	0	0	102
	Standard Error:	0.0	0.0	9.7	0.0	23.1	0.0	0.0	0.0	
Total:	Number in Sample:	0	1	3	0	19	0	0	0	23
	Estimated % of Escapement:	0.0	4.3	13.0	0.0	82.6	0.0	0.0	0.0	100.0
	Estimated Escapement:	0	10	31	0	193	0	0	0	234
	Standard Error:	0.0	9.7	16.0	0.0	18.0	0.0	0.0	0.0	

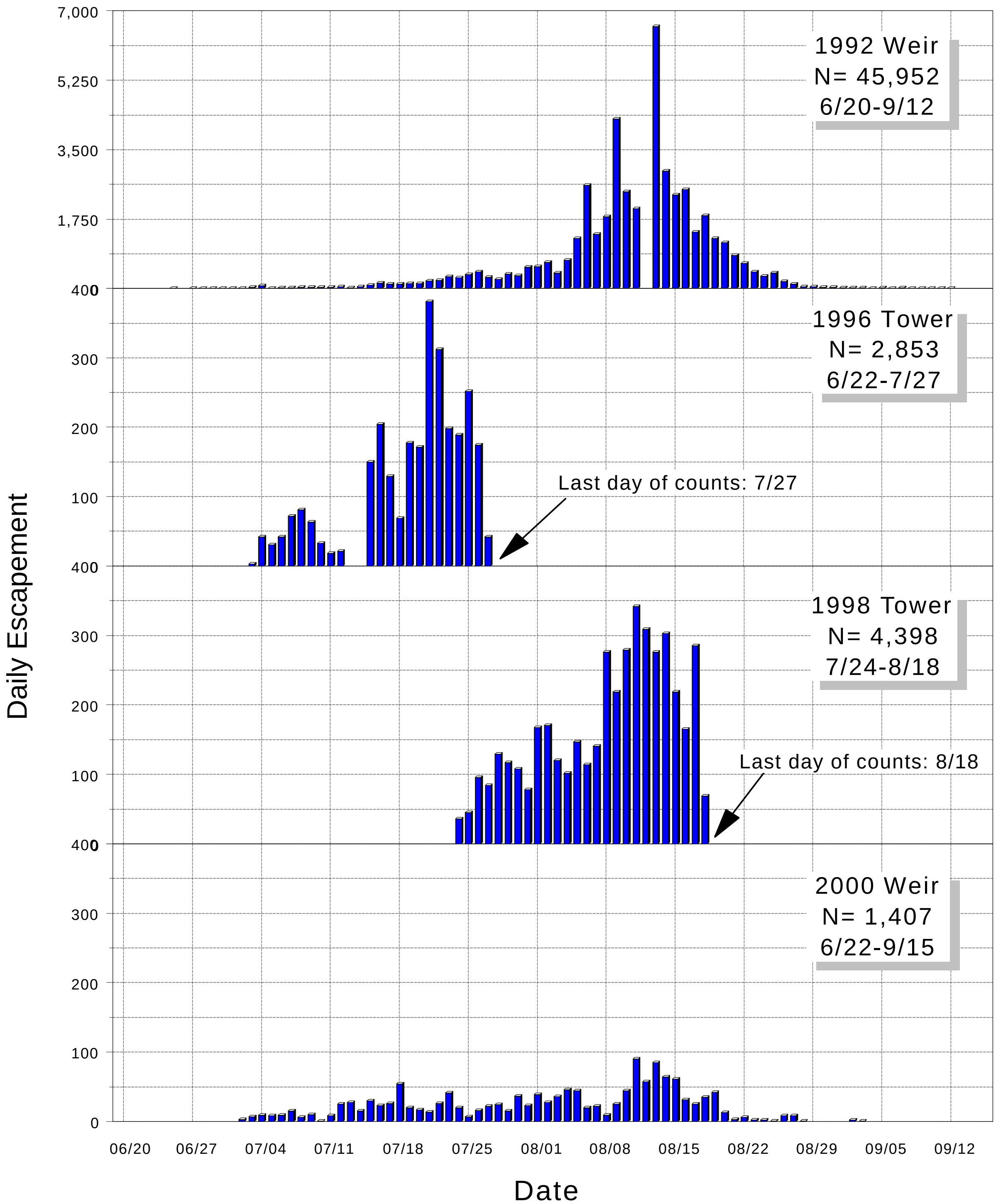
Appendix 12 – Continued

		Brood Year and Age Class								
		1997	1996		1995			1994		
		0.2	0.3	1.2	0.4	1.3	2.2	1.4	2.3	Total
Strata 4-6:	07/09-07/29									
Sampling Dates: 07/10, 07/11, 07/17, 07/19, & 07/24-07/26										
Male:	Number in Sample:	0	0	0	0	6	0	0	0	6
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0
	Estimated Escapement:	0	0	0	0	68	0	0	0	68
	Standard Error:	0.0	0.0	0.0	0.0	19.4	0.0	0.0	0.0	
Female:	Number in Sample:	0	0	0	0	6	0	0	0	6
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0
	Estimated Escapement:	0	0	0	0	68	0	0	0	68
	Standard Error:	0.0	0.0	0.0	0.0	19.4	0.0	0.0	0.0	
Total:	Number in Sample:	0	0	0	0	12	0	0	0	12
	Estimated % of Escapement:	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100.0
	Estimated Escapement:	0	0	0	0	135	0	0	0	135
	Standard Error:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Strata 7-13:	07/30-09/16									
No Samples Collected										
Strata 1-13:	06/18-09/16									
Sampling Dates: 06/26-07/26										
Male:	Number in Sample:	0	1	2	0	55	0	0	1	59
	% Males in Age Group:	0.0	2.0	4.1	0.0	92.4	0.0	0.0	1.5	100.0
	Estimated % of Escapement:	0.0	1.0	2.1	0.0	46.9	0.0	0.0	0.8	50.8
	Estimated Escapement:	0	10	20	0	463	0	0	8	501
	Standard Error:	0.0	9.7	13.3	0.0	44.1	0.0	0.0	7.0	
	Estimated Design Effects:	0.000	1.208	1.165	0.000	1.053	0.000	0.000	0.893	1.050
Female:	Number in Sample:	0	2	1	0	54	0	1	0	58
	% Females in Age Group:	0.0	3.1	2.1	0.0	93.3	0.0	1.6	0.0	100.0
	Estimated % of Escapement:	0.0	1.5	1.0	0.0	45.9	0.0	0.8	0.0	49.2
	Estimated Escapement:	0	15	10	0	453	0	8	0	486
	Standard Error:	0.0	9.9	9.7	0.0	44.0	0.0	7.0	0.0	
	Estimated Design Effects:	0.000	0.888	1.208	0.000	1.047	0.000	0.893	0.000	1.050
Total:	Number in Sample:	0	3	3	0	109	0	1	1	117
	Estimated % of Escapement:	0.0	2.6	3.1	0.0	92.8	0.0	0.8	0.8	100.0
	Estimated Escapement:	0	25	31	0	916	0	8	8	987*
	Standard Error:	0.0	13.8	16.0	0.0	22.6	0.0	7.0	7.0	
	Estimated Design Effects:	0.000	1.030	1.122	0.000	1.030	0.000	0.893	0.893	

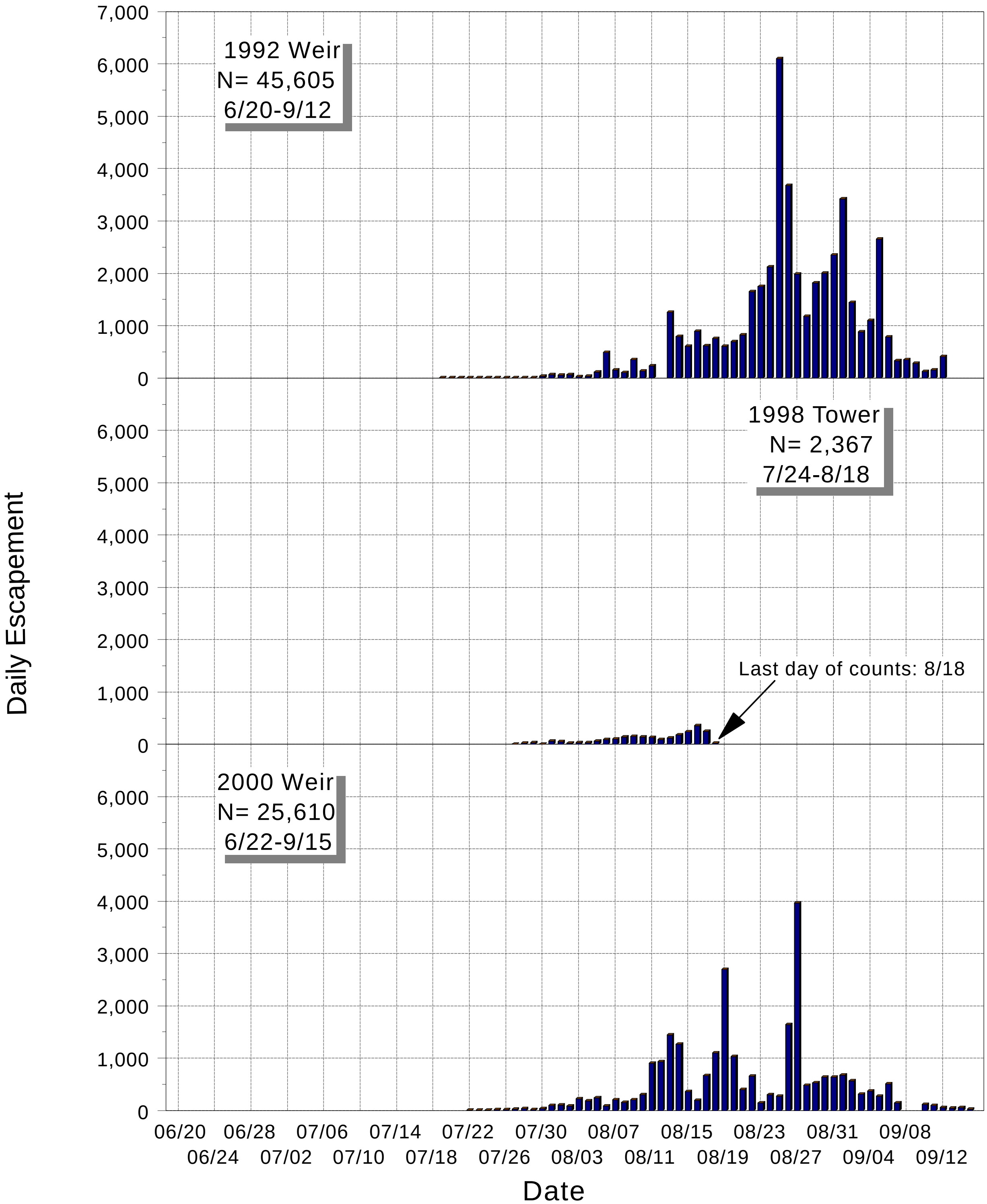
* 62 fish that were counted through the weir during stratum 1 and strata 7-13 are not included in this total.

Appendix 13 – Length (mm) at age for sockeye salmon, Kwethluk River weir, Alaska 2000.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class							
			1997	1996		1995			1994	
			0.2	0.3	1.2	0.4	1.3	2.2	1.4	2.3
6/26, 6/27, & 6/28 (6/25-7/01)	Male	Mean Length					560			520
		Std. Error					5			
		Range					445- 625			520- 520
		Sample Size	0	0	0	0	39	0	0	1
	Female	Mean Length		520			532		535	
		Std. Error					3			
		Range		520- 520			500- 570		535- 535	
		Sample Size	0	2	0	0	39	0	1	0
7/03, 7/04, & 7/05 (7/02-7/08)	Male	Mean Length		585	578		568			
		Std. Error			13		7			
		Range		585- 585	565- 590		530- 600			
		Sample Size	0	1	2	0	10	0	0	0
	Female	Mean Length			500		526			
		Std. Error					8			
		Range			500- 500		495- 560			
		Sample Size	0	0	1	0	9	0	0	0
7/10, 7/11, 7/17, & 7/26 (7/09-7/29)	Male	Mean Length					558			
		Std. Error					23			
		Range					450- 605			
		Sample Size	0	0	0	0	6	0	0	0
	Female	Mean Length					533			
		Std. Error					5			
		Range					515- 550			
		Sample Size	0	0	0	0	6	0	0	0
Seasonal	Male	Mean Length		585	578		561			520
		Std. Error			13		5			
		Range		585- 585	565- 590		445- 625			520- 520
		Sample Size	0	1	2	0	55	0	0	1
	Female	Mean Length		520	500		531		535	
		Std. Error					2			
		Range		520- 520	500- 500		495- 570		535- 535	
		Sample Size	0	2	1	0	54	0	1	0



Appendix 14 – Daily pink salmon escapements through the Kwethluk River weir (1992 and 2000) and counting tower (1996 and 1998), Alaska. (Note different scales)



Appendix 15 – Daily coho salmon escapement through the Kwethluk River weir (1992 and 2000) and counting tower (1998), Alaska.

Appendix 16 – Estimated age and sex composition of weekly coho salmon escapements through the Kwethluk River weir, Alaska, 2000; and estimated design effects of the stratified sampling design.

		Brood Year and Age Class			
		1993	1992	1991	
		1.1	2.1	3.1	Total
Strata 1-5:	06/18-07/22				
No Samples Collected					
Stratum 6:	07/23-07/29				
Sampling Dates: 07/26					
Male:	Number in Sample:	0	3	0	3
	Estimated % of Escapement:	0.0	30.0	0.0	30.0
	Estimated Escapement:	0	40	0	40
	Standard Error:	0.0	19.4	0.0	
Female:	Number in Sample:	0	6	1	7
	Estimated % of Escapement:	0.0	60.0	10.0	70.0
	Estimated Escapement:	0	79	13	92
	Standard Error:	0.0	20.7	12.7	
Total:	Number in Sample:	0	9	1	10
	Estimated % of Escapement:	0.0	90.0	10.0	100.0
	Estimated Escapement:	0	119	13	132
	Standard Error:	0.0	12.7	12.7	
Stratum 7:	07/30-08/05				
Sampling Dates: 08/01 & 08/02					
Male:	Number in Sample:	0	34	0	34
	Estimated % of Escapement:	0.0	63.0	0.0	63.0
	Estimated Escapement:	0	616	0	616
	Standard Error:	0.0	63.1	0.0	
Female:	Number in Sample:	0	20	0	20
	Estimated % of Escapement:	0.0	37.0	0.0	37.0
	Estimated Escapement:	0	363	0	363
	Standard Error:	0.0	63.1	0.0	
Total:	Number in Sample:	0	54	0	54
	Estimated % of Escapement:	0.0	100.0	0.0	100.0
	Estimated Escapement:	0	979	0	979
	Standard Error:	0.0	0.0	0.0	
Stratum 8:	08/06-08/12				
Sampling Dates: 08/07 & 08/08					
Male:	Number in Sample:	2	82	1	85
	Estimated % of Escapement:	1.3	54.7	0.7	56.7
	Estimated Escapement:	37	1,531	19	1,587
	Standard Error:	25.6	111.1	18.2	
Female:	Number in Sample:	2	63	0	65
	Estimated % of Escapement:	1.3	42.0	0.0	43.3
	Estimated Escapement:	37	1,176	0	1,214
	Standard Error:	25.6	110.2	0.0	
Total:	Number in Sample:	4	145	1	150
	Estimated % of Escapement:	2.7	96.7	0.7	100.0
	Estimated Escapement:	75	2,708	19	2,801
	Standard Error:	36.0	40.1	18.2	

Appendix 16 – Continued

		Brood Year and Age Group			
		1993	1992	1991	
		1.1	2.1	3.1	Total
Stratum 9:	08/13-08/19				
Sampling Dates: 08/14					
Male:	Number in Sample:	1	62	0	63
	Estimated % of Escapement:	1.1	66.0	0.0	67.0
	Estimated Escapement:	82	5,104	0	5,187
	Standard Error:	81.8	377.9	0.0	
Female:	Number in Sample:	3	28	0	31
	Estimated % of Escapement:	3.2	29.8	0.0	33.0
	Estimated Escapement:	247	2,305	0	2,552
	Standard Error:	140.2	364.8	0.0	
Total:	Number in Sample:	4	90	0	94
	Estimated % of Escapement:	4.3	95.7	0.0	100.0
	Estimated Escapement:	329	7,410	0	7,739
	Standard Error:	161.0	161.0	0.0	
Stratum 10:	08/20-08/26				
Sampling Dates: 08/20 & 08/23					
Male:	Number in Sample:	4	63	0	67
	Estimated % of Escapement:	3.2	50.8	0.0	54.0
	Estimated Escapement:	144	2,264	0	2,408
	Standard Error:	70.0	198.1	0.0	
Female:	Number in Sample:	6	51	0	57
	Estimated % of Escapement:	4.8	41.1	0.0	46.0
	Estimated Escapement:	216	1,833	0	2,048
	Standard Error:	85.0	194.9	0.0	
Total:	Number in Sample:	10	114	0	124
	Estimated % of Escapement:	8.1	91.9	0.0	100.0
	Estimated Escapement:	359	4,097	0	4,456
	Standard Error:	107.9	107.9	0.0	
Stratum 11:	08/27-09/02				
Sampling Dates: 08/28, 08/29, & 08/30					
Male:	Number in Sample:	8	64	0	72
	Estimated % of Escapement:	5.0	39.8	0.0	44.7
	Estimated Escapement:	373	2,981	0	3,353
	Standard Error:	127.4	287.0	0.0	
Female:	Number in Sample:	6	82	1	89
	Estimated % of Escapement:	3.7	50.9	0.6	55.3
	Estimated Escapement:	279	3,819	47	4,145
	Standard Error:	111.1	293.1	46.1	
Total:	Number in Sample:	14	146	1	161
	Estimated % of Escapement:	8.7	90.7	0.6	100.0
	Estimated Escapement:	652	6,799	47	7,498
	Standard Error:	165.2	170.4	46.1	

Appendix 16 – Continued

		Brood Year and Age Group			
		1993	1992	1991	
		1.1	2.1	3.1	Total
Strata 12-13:	09/03-09/16				
Sampling Dates: 09/04					
Male:	Number in Sample:	3	31	1	35
	Estimated % of Escapement:	3.9	40.8	1.3	46.1
	Estimated Escapement:	79	818	26	923
	Standard Error:	44.2			
Female:	Number in Sample:	2	38	1	41
	Estimated % of Escapement:	2.6	50.0	1.3	53.9
	Estimated Escapement:	53	1,003	26	1,082
	Standard Error:	36.4			
Total:	Number in Sample:	5	69	2	76
	Estimated % of Escapement:	6.6	90.8	2.6	100.0
	Estimated Escapement:	132	1,820	53	2,005
	Standard Error:	56.3	65.7	36.4	
Strata 1-13:	06/18-09/16				
Sampling Dates:					
Male:	Number in Sample:	18	339	2	359
	% Males in Age Group:	5.1	94.6	0.3	100.0
	Estimated % of Escapement:	2.8	52.1	0.2	55.1
	Estimated Escapement:	715	13,354	45	14,114
	Standard Error:	174.5	541.8	31.6	
	Estimated Design Effects:	1.168	1.223	0.606	1.236
Female:	Number in Sample:	19	288	3	310
	% Females in Age Group:	7.2	92.0	0.7	100.0
	Estimated % of Escapement:	3.2	41.3	0.3	44.9
	Estimated Escapement:	832	10,578	86	11,496
	Standard Error:	203.0	535.2	54.3	
	Estimated Design Effects:	1.361	1.229	0.923	1.236
Total:	Number in Sample:	37	627	5	669
	Estimated % of Escapement:	6.0	93.4	0.5	100.0
	Estimated Escapement:	1,547	23,932	131	25,610
	Standard Error:	263.3	269.6	62.7	
	Estimated Design Effects:	1.270	1.235	0.812	

Appendix 17 – Length (mm) at age for coho salmon, Kwethluk River weir, Alaska, 2000.

Sampling Dates (Stratum Dates)	Sex		Brood Year and Age Class		
			1997	1996	1995
			1.1	2.1	3.1
7/26 (7/16-7/29)	Male	Mean Length		557	
		Std. Error		31	
		Range		495- 590	
		Sample Size	0	3	0
	Female	Mean Length		513	510
		Std. Error		6	
		Range		495- 540	510- 510
		Sample Size	0	6	1
8/01 & 8/02 (7/30-8/05)	Male	Mean Length		546	
		Std. Error		6	
		Range		460- 610	
		Sample Size	0	34	0
	Female	Mean Length		554	
		Std. Error		5	
		Range		505- 590	
		Sample Size	0	20	0
8/07 & 8/08 (8/06-8/12)	Male	Mean Length	518	541	625
		Std. Error	8	5	
		Range	510- 525	430- 640	625- 625
		Sample Size	2	82	1
	Female	Mean Length	525	545	
		Std. Error	5	3	
		Range	520- 530	475- 595	
		Sample Size	2	63	0
8/14 (8/13-8/19)	Male	Mean Length	545	550	
		Std. Error		5	
		Range	545- 545	440- 610	
		Sample Size	1	62	0
	Female	Mean Length	538	543	
		Std. Error	9	6	
		Range	520- 550	475- 585	
		Sample Size	3	28	0

Appendix 17 – Continued

Sampling Dates Stratum Dates	Sex		Brood Year and Age Class 1997 1.1	 1996 2.1	 1995 3.1
8/20 & 8/23 (8/20-8/26)	Male	Mean Length	553	563	
		Std. Error	6	5	
		Range	535- 565	475- 650	
		Sample Size	4	63	0
	Female	Mean Length	529	561	
		Std. Error	18	3	
		Range	460- 590	480- 600	
		Sample Size	6	51	0
8/28, 8/29, & 8/30 (8/27-9/02)	Male	Mean Length	559	568	
		Std. Error	13	5	
		Range	490- 590	465- 644	
		Sample Size	8	64	0
	Female	Mean Length	550	567	590
		Std. Error	13	3	
		Range	505- 600	480- 625	590- 590
		Sample Size	6	82	1
9/04 (9/03-9/16)	Male	Mean Length	552	572	565
		Std. Error	8	8	
		Range	535- 560	430- 650	565- 565
		Sample Size	3	31	1
	Female	Mean Length	563	560	540
		Std. Error	3	4	
		Range	560- 565	475- 610	540- 540
		Sample Size	2	38	1
Seasonal	Male	Mean Length	553	556	590
		Std. Error	8	2	
		Range	490- 590	430- 650	565- 625
		Sample Size	18	339	2
	Female	Mean Length	541	557	562
		Std. Error	7	2	
		Range	460- 600	475- 625	510- 590
		Sample Size	19	288	3