TECHNICAL FISHERY REPORT 94-15

Alaska Department of Fish and Game
Commercial Fisheries Management
and Development Division
P.O. Box 25526
Juneau, Alaska 99802-5526

June 1994

Upper Cook Inlet Salmon Escapement Studies, 1992

by

Randall Z. Davis

Bruce E. King

and

Kenneth E. Tarbox

State of Alaska Walter J. Hickel, Governor

The Technical Fishery Report Series was established in 1987, replacing the Technical Data Report Series. The scope of this new series has been broadened to include reports that may contain data analysis, although data oriented reports lacking substantial analysis will continue to be included. The new series maintains an emphasis on timely reporting of recently gathered information, and this may sometimes require use of data subject to minor future adjustments. Reports published in this series are generally interim, annual, or iterative rather than final reports summarizing a completed study or project. They are technically oriented and intended for use primarily by fishery professionals and technically oriented fishing industry representatives. Publications in this series have received several editorial reviews and at least one *blind* peer review refereed by the division's editor and have been determined to be consistent with the division's publication policies and standards.

UPPER COOK INLET SALMON ESCAPEMENT STUDIES, 1992

by

Randall Z. Davis

Bruce E. King

and

Kenneth E. Tarbox

Technical Fishery Report No. 94-15

Alaska Department of Fish and Game
Commercial Fisheries Management
and Development Division
P.O. Box 25526
Juneau, Alaska 99802-5526

June 1994

AUTHORS

Randall Z. Davis is a Fishery Biologist for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Region II, Upper Cook Inlet, 34828 Kalifornsky Beach Road Suite B, Soldotna, AK 99669.

Bruce E. King is an Assistant Research Project Leader for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Region II, Upper Cook Inlet, 34828 Kalifornsky Beach Road Suite B, Soldotna, AK 99669.

Kenneth E. Tarbox is the Research Project Leader for the Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Region II, Upper Cook Inlet, 34828 Kalifornsky Beach Road Suite B, Soldotna, AK 99669.

ACKNOWLEDGMENTS

We would like to acknowledge the work of the permanent seasonal staff responsible for collection of data: Kenai River sonar - David Westerman (Crew Leader), Jennifer Brannen, Jim Browning, Jim Cofske, Wayne Lehtinen; Kasilof River Sonar - Bill Glick (Crew Leader), Pako Lehtinen, Phil Morin; Yentna River Sonar - Stanley Walker (Crew Leader), Kerri Derning, Susan DeMillo, Vaslikki Lyras; Crescent River Sonar - Mark Schlenker (Crew Leader), Keith Wible; Susitna River Fish wheel - Jim Lattimer (Crew Leader), Gordon Shuler.

We would also like to acknowledge:

Alaska Department of Fish and Game (ADF&G) Fisheries Rehabilitation, Enhancement, and Development Division personnel, Soldotna, for stream survey counts and escapement counts collected at Bear Creek weir at Tustumena Lake (Kasilof River) and for the use of a fish wheel maintained on the south bank of the Kasilof River; ADF&G Sport Fish Division personnel, Soldotna, for data collected at Russian River (Kenai drainage) weir and ADF&G personnel, Palmer, for stream survey data on coho and chinook salmon collected in the Susitna River drainage; Cook Inlet Aquaculture Association personnel for data collected at Hidden Creek (Kenai River tributary) weir; the United States Department of Agriculture, US Forest Service personnel, Seward, for stream survey data collected on two Kenai River tributaries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES, continued

LIST OF TABLES, continued

LIST OF FIGURES

ABSTRACT

Sockeye salmon *Oncorhynchus nerka* spawning escapements into four river systems of Upper Cook Inlet, Alaska, were estimated using Bendix Corporation side-scanning sonar equipment. Salmon migration was monitored mid-June through July in the Kasilof River, during July in the Crescent River, and July through mid-August in the Kenai and Yentna Rivers. Estimated sockeye salmon escapements were: 994,798 into the Kenai River; 184,178 into the Kasilof River; 58,229 into the Crescent River; and 66,074 into the Yentna River. Indices of escapements of other salmon species into the Yentna River were also obtained by sonar: 239,362 pink *O. gorbuscha*; 30,061 chum *O. keta*; and 29,072 coho *O. kitsutch* salmon. Age composition of sockeye salmon in the Kenai River was primarily distributed within two age classes: 1.3 (79.4%) and 2.3 (11.0%). Age composition was distributed within four age classes in the Kasilof River: 2.2 (35.0%); 1.3 (27.6%); 1.2 (21.2%); and 2.3 (15.9%). Age-2.3 sockeye salmon were the most abundant age class in the Crescent River (61.9%), followed by age class 1.3 (21.7%) and age-2.2 (12.4%). Age composition of sockeye salmon in the Susitna and Yentna Rivers was primarily distributed within four age classes: 1.2 (23.2%), 1.3 (37.5%), 2.2 (25.7%), and 2.3 (13.2%) in the Susitna River and 1.2 (31.1%), 1.3 (29.6%), 2.2 (16.9%), and 2.3 (18.3%) in the Yentna River. Length and sex composition data were collected for sockeye salmon in each river. Migration in all rivers was near shore. Most sockeye salmon migrated during the hours of darkness in the Kenai and Crescent Rivers, during the evening and early morning hours in the Kasilof River, and during the afternoon and evening hours in the Yentna River.

KEY WORDS: Pacific salmon, sockeye salmon, *Oncorhynchus nerka*, Upper Cook Inlet, Kenai River, Kasilof River, Crescent River, Yentna River, Susitna River spawning escapements, hydroacoustic enumeration, biological sampling, migratory behavior

INTRODUCTION

Prior to 1968, sockeye salmon *Oncorhynchus nerka* escapement estimates in Upper Cook Inlet (UCI), Alaska (Figure 1), were based on surveys of clear water spawning areas and provided no information about the escapement that spawned in glacially occluded waters (King and Davis 1989). Fishery management efforts were further hampered by lack of daily and cumulative estimates of total escapement. These constants were resolved by the development of hydroacoustic techniques to enumerate sockeye salmon in the glacial tributaries of UCI. Hydroacoustic enumeration of escapements began on the Kenai and Kasilof Rivers in 1968 and was expanded to the Susitna River in 1978 and to Crescent River in 1980. The Susitna River counting site was abandoned in 1985, and in 1986 counting operations were begun on the Yentna River, the major tributary of the Susitna River. Results of subsequent escapement enumeration studies have been documented by Waltemyer et al. (1980), Tarbox et al. (1983), King and Tarbox (1984, 1986, 1987, 1988, 1989a, 1989b, 1990 and 1991), King (1990) and King and Davis (1992). Supporting data for this report were published in a separate archival report (Davis and King 1992).

The program objectives of UCI escapement projects in 1992 were to estimate (1) the daily and cumulative number of sockeye salmon entering the Kenai, Kasilof, Crescent, and Yentna Rivers (Figure 1), and (2) the age, length, and sex composition of those escapements. Indices of abundance were also obtained for Yentna River pink *O. gorbuscha*, chum *O. keta*, and coho *O. kisutch* salmon.

METHODS

Bendix Corporation[1] side-scanning sonar counters described by King and Tarbox (1989a), Gaudet (1983) and Bendix Corp (1980 and 1984) were used to enumerate salmon escapements. Pulse width was 100 μs and the frequency was 515 Khz. Two- and four-degree transducer elements were multiplexed in an alternating mode. The counting threshold was preset at approximately -38 db at the minimum 35-V power input by the manufacturer. Counting thresholds could be lowered by increasing voltage to the system. Counters were operated without artificial substrates on the north bank of the Kenai River and both banks of the Crescent River. A technical consultant (A. Menin, Hydroacoustic Consulting, Sylmar, CA) tested the counters for proper operation prior to deployment, and reinspected counters when migrating fish densities neared maximum levels in each river system.

Projects were operated from 1 July through 13 August on the Kenai River, 15 June through 2 August on the Kasilof River, 7 July through 11 August on the Yentna River, and 1 July through 2 August on the Crescent River.

---

[1]Use of a company's name does not constitute product endorsement.

Raw hourly output data were edited to account for debris, bottom echoes, or other sources of non-fish counts. At the Kenai, Kasilof, and Yentna River counting sites, a daily average hourly count was calculated for inshore (1–6) and offshore (7–12) sonar sectors by

$$C_a = C_b/N,$$

where:

C_a = average count per sector per hour;
C_b = valid hourly counts for all inshore or offshore sectors; and
N = number of sector per hour units which contained only valid counts.

The average count was then substituted in any sector/hour block where counts were deleted through editing. At Crescent River the daily average hourly count was calculated for each sector by

$$C_a = C_b/N,$$

where:

C_a = average count per sector per hour;
C_b = valid hourly counts per sector; and
N = number of hour units per sector which contained only valid counts.

Temporal and spacial behavior of sockeye salmon at the sonar sites was assessed by examining distribution of fish by sector, hourly passage rate, bank preference, and cumulative proportion of sonar counts by day. The maximum counting distance for each Bendix counter utilizing an artificial substrate was 18.5 m. Counting ranges for Bendix counters operated without artificial substrates were 12.3 m for both banks of the Crescent River and 15.4 m for the north bank of the Kenai River. For calculations of distribution data, maximum counting distances were used in data computations.

Transducer orientation was accomplished manually except on the north banks of the Kenai and Crescent Rivers, where Erin[2] rotators were used. Correct orientation of the acoustic axis was tested periodically by use of an artificial target. An air-tight plastic sphere was weighted and moved through the ensonified area at various distances from the transducer. Simultaneous detection of the target by the counter and visual recognition on an oscilloscope verified correct axis orientation.

Monitoring of counter operations occurred from 0700 through 2400 hours on the Kasilof, Crescent, and Yentna Rivers, and throughout the 24-h period on the Kenai River. In addition to regularly scheduled monitoring, intensified monitoring was conducted during episodic fish passage events. In all cases, visual counts from an oscilloscope were compared to the counts accumulated by the counter during a minimum 10-min period or for a minimum visual count of 100 fish. During periods of low density passage (<500 fish per hour), Kenai and Yentna River operators were required to make oscilloscope/counter observations

[2]Use of a company's name does not constitute product endorsement.

for a minimum of 1 h per bank each day. When passage rates reached 500 fish per hour, minimum observation time increased to 2 h per bank per day. Operators at the Kasilof and Crescent River counting sites were required to monitor counters for a minimum of 2 h per bank per day. When a relative error greater than 20% occurred between targets counted on the oscilloscope and targets recorded by the counter, standard operating procedure required that operators make counter adjustments to reduce the relative error. Operators were also allowed to make adjustments to the counters to accommodate for < 20% relative error and frequently used that option.

Information used to estimate species composition of sonar counts, and age, length, and sex composition of the escapements was obtained from salmon captured in fish wheels in the Kenai (north bank), Kasilof (both banks), and Yentna (both banks) Rivers. A stationary fish trap and drifted gillnets were used to obtain fish for sampling and species composition estimates in Crescent River. Age, length, and sex data were also collected from sockeye salmon captured in a fish wheel located in the upper Susitna River at Sunshine Station (river mile 80) near Talkeetna. Fish wheel catches at the Kenai and Yentna River sites were expanded for each 24-h period based on the hourly catch rate during the hours of operation by

$$F_d = (F_h/H)\ 24\ ,$$

where:

F_d = expanded fish wheel catch for 24 hours;
F_h = fish wheel catch for hours operated; and
H = hours fish wheel operated.

With the exception of the Kasilof River, daily fish wheel, trap and/or gillnet catches were grouped into sample sizes of at least 150 salmon, and attendant species ratios were used to apportion sonar counts to species. Sonar counts recorded in the Kasilof River were not apportioned to species because we believed that the ratio of sockeye salmon to chinook salmon captured in the fish wheel was biased toward chinook salmon. Additionally, the relative number of chinook salmon which pass the site during the time sockeye salmon were being enumerated was not considered to be significant.

Factors influencing the accuracy of escapement estimates for pink, coho, chum, and chinook salmon in the Yentna River were discussed by Tarbox et al. (1981, 1983). Counts apportioned to these species in 1992 were considered to be index counts.

Sample sizes for estimating sockeye salmon age composition were based on methods for estimating multinomial proportions developed by Thompson (1987). Sample sizes were calculated so that the estimated proportion of each major age class was within 5% of the true proportion 90% of the time. The largest sample size calculated in this manner was chosen as a minimum sample size for 1992. The minimum sample size was increased by 10% to account for unreadable scales, and this number was used as the total sample size required per stratum. The sample size per stratum was then multiplied by the number of strata to determine total season sample size. In general, the number of temporal strata was set to detect inseason age composition changes comparable to those seen in previous years (Waltemyer

1992). Two strata were selected for the Crescent and Susitna Rivers, and three strata for the Kenai, Kasilof, and Yentna Rivers.

Sockeye salmon scale samples were collected daily from the Crescent, Yentna, and Susitna Rivers. The number of salmon sampled per day was based on a percentage of the previous day's escapement except at Sunshine Station (Susitna River). These percentages were calculated by dividing the total season sample size by the anticipated total escapement. Sockeye salmon were also sampled at least 1 d each week from the Kenai and Kasilof Rivers to provide scales for the stock identification program. Additional scale samples were collected at all sonar counting sites and at the Susitna River fish wheel site for a genetics project, and from a fish wheel operated on the south bank of the Kasilof River. Scale samples from these sources were combined to produce the data set used for age composition analysis.

Sockeye salmon scales and otoliths were collected from spawning lakes and streams throughout UCI as part of the genetics project. Many of these stocks had not been previously examined, and for archival purposes, their age compositions are included in the supporting data for this document (Davis and King 1992).

A chi-square analysis was performed to determine if statistically significant changes occurred in the proportions of the major (>10%) age classes of the escapements through time. If the null hypothesis was rejected, indicating significant changes in age composition, then chi-square tests were repeated between appropriate sampling strata to determine when changes occurred.

Fork length (mm) and sex were recorded for all sockeye salmon captured. Sex ratios and mean lengths were calculated by grouping all samples together regardless of type or timing of sampling. Age classes that did not compose 10% of the total escapement for a particular river were not included in length composition tables.

Foot surveys of index areas were conducted on Tustumena Lake (Kasilof River) and on Kenai River tributaries. All surveys were conducted between 1 August and 24 September. Index area counts and other survey data referenced in this report are totals of live and dead fish counts. If more than one survey was completed on a system, only the result of the survey having the highest total count was reported.

A weir at Bear Creek (Tustumena Lake) provided an escapement count for that stream. Sockeye salmon located below the Bear Creek weir were not counted in 1992, but were included in total escapement counts for previous years.

Escapements for two Kenai River tributaries (Hidden Creek and Russian River) were enumerated when passing sockeye salmon through weirs.

RESULTS

Kenai River

From 1 July through 13 August, 1,031,661 salmon migrated past the Kenai River sonar site (Table 1). The sockeye salmon count was 994,798 or 96% of the total salmon count (Table 2). Sonar counts attributed to pink (22,541), coho (10,486), and chinook (3,836) salmon accounted for 4% of the total (Table 1). The estimated sockeye salmon spawning escapement (sonar count minus sport harvest above the Soldotna bridge) was 798,422 (Table 3). The desired escapement goal range for this drainage is 400,000–700,000 fish. A total of 32,912 sockeye salmon were counted at the Hidden Lake weir. Late-run escapement of Russian River sockeye salmon totaled 68,458 fish (Table 4).

Eighty percent of the sockeye salmon escapement passed the sonar counters in 25 d (Table 5; mean = 16 d; range for 1979–92 = 6-25 d). The midpoint of the escapement was 25 July. Run timing was not appreciably different by bank (Davis and King 1992), but more sockeye salmon (60%) migrated along the north bank of the river (Table 6). There were two distinct peaks in the daily numbers of fish passing the counters (Figure 2).

Distribution of the salmon migration along the south bank was shore-oriented: 92.9% of the counts were within 7.5 m of the transducer (Table 7, Figure 3). Distribution across the counting range on the north bank was less shore oriented where 87.6% of the counts were within the inshore 10.5 m of the counting range.

A pattern of increased salmon passage in the evening and early morning hours was observed on the south bank (Figure 4). Fish passage measured between 1700 and 0300 hours accounted for 62.2% of the total migration (Davis and King 1992), exceeding the average for a constant hourly passage rate (4.2% per hour) by 16%. On the north bank the temporal passage of fish was equally well defined. The average for a constant hourly passage rate were exceeded from 1600 to 0200 hours, accounting for 51.9% of the bank total.

A total of 5,526 sockeye salmon were captured in the fish wheel (Table 8). Lengths and scale samples were obtained from 1,338 sockeye salmon (Table 9). Age-1.3 and -2.3 fish were the major components of the escapement. The mean length of age-2.3 fish was the smallest recorded in the previous 10 years. Age-1.3 fish were the second smallest on record. The male-to-female ratio was the lowest to appear in the historical record for both age classes. Female spawners comprised 65.5% of the total escapement.

The largest component of the sockeye salmon escapement was age-1.3 fish (79.4%), followed by age-2.3 (11.0%), and -2.2 (6.1%) fish (Table 10). The age-1.2 component accounted for only 2.9% of the escapement. The proportions of the two major age classes changed significantly over time ($\chi^2 = 26.4$, $\alpha = 0.05$, , $P < 0.05$, 3 df). Significant changes in age class proportions also occurred between the second and third time strata (Table 11).

Age-1.3 sockeye salmon were bound primarily for Quartz Creek, the mainstem river, and the shorelines and outlets of Kenai and Skilak Lakes. Sockeye salmon bound for Russian River were predominantly age 2.2 (J. Carlon, ADF&G, Soldotna, personal communication), and those bound for Hidden Lake were predominantly age 1.2 (D. Waltemyer, ADF&G, Soldotna, personal communication).

Kasilof River

A total of 184,178 sockeye salmon were counted at the Kasilof River sonar site from 15 June through 2 August 1992 (Table 12). This escapement estimate was within the desired escapement goal range (150,000–250,000 fish). The estimated number of natural spawners (estimated escapement minus brood stock used for artificial propagation of Tustumena Lake) was 177,628 fish (Table 13). Of the 56,776 sockeye salmon enumerated in the major spawning streams of Tustumena Lake, 34.5% entered Bear Creek (Tables 14, 15).

The midpoint of the sockeye salmon escapement occurred on 12 July, 4 d before the mean for the previous 10 years (range 11–22 July; Table 16). Eighty percent of the escapement occurred in 34 d, 2.5 d greater than the historical mean (1982–91). No differences in timing between the north and south banks were detected (Davis and King 1992).

Fifty-five percent of the salmon counts for the season occurred on the south bank (Table 6), and 71.4% of these fish were within 6 m of the transducer (Figure 5, Table 7). The distribution of fish was more shore oriented on the north bank, where 83.9% of the total counts were within 6.0 m of the transducer.

The seasonal average hourly passage rate on the south bank exceeded the theoretically even passage rate of 4.2% during two periods of the day: 0500 to 1100 hours and 2300 to 0100 hours, although this pattern was not consistent each day (Figure 6). The average hourly passage rate on the north bank exceeded the even passage rate during 1600 to 2300 hours and during 0700 to 0800 hour, but variations from this pattern were observed (Figure 6). There were three major peaks in daily passage of fish passed the counting site (Figure 2).

A total of 2,960 sockeye salmon were captured in the Kasilof River fish wheels (Table 17, 18), of which 1,717 were sampled for age, length, and sex characteristics. Age-2.2 (35.0%), -1.3 (27.6%), -1.2 (21.2%), and -2.3 (15.9%) sockeye salmon were the dominant age classes (Table 19). The proportion of age-.2 sockeye salmon increased, and the proportion of age-.3 sockeye salmon decreased significantly as the season progressed (Table 11; $\chi^2 = 470.08$, $\alpha = 0.05$, $P < 0.05$, 9 df). Mean lengths by age class were within the historical range (Table 20). The male-to-female ratio was similar to that observed in previous years with the exception of age-2.2 fish, which was the lowest recorded in 9 years of observation (0.6:1). Female spawners comprised 54.5% of the escapement.

Crescent River

A total of 66,103 salmon were counted at the Crescent River sonar site from 1 July through 2 August 1992 (Table 21). Sockeye salmon represented approximately 84% of the fish captured in the trap and gillnets (Table 22) resulting in an estimated sockeye salmon escapement of 58,229. The desired sockeye salmon escapement goal for this system is 50,000 to 100,000 fish.

The midpoint of the sockeye salmon escapement occurred on 17 July, the date of the historical mean, and 80% of the escapement passed the site in 23 d (Table 23). The peak in daily passage occurred on 23 July (Figure 2). No difference in run timing was detected between banks, but more fish (56.0%) migrated along the north bank (Table 6).

Spacial distribution of fish was strongly shore oriented; 88.2% of the north bank counts were within 4.0 m of the transducer and 99.5 % of the south bank counts were within 2.0 m of the transducer (Table 7, Figure 7). Three peaks in the migration were observed (Figure 2).

Fish migrated on the north bank at rates that exceeded the hourly constant passage rate (4.2%) during 1600 to 2400 hours (Figure 8). On the south bank the highest hourly passage rates occurred during 1200 to 2400 hours (Davis and King 1992).

A total of 240 sockeye salmon were captured in the fish trap and gillnets, of which 194 were sampled for age, length, and sex data. Age-2.3 (61.9%) fish were the most abundant, with other major components of the escapement represented by age-1.3 (21.7%), and -2.2 (12.4%) fish (Table 24). Average lengths by sex for age-2.3 fish were within the bounds of previous years' observations. Average lengths for age classes 1.3 and 2.2 were the smallest to appear in the 11-year database (Table 25). The ratio of males to females was within historical bounds. Females accounted for 50.5% of the total escapement.

Yentna River

From 7 July through 11 August, 364,676 salmon were counted at the Yentna River sonar site (Table 26), of which 66,074 were sockeye salmon (Table 2). The escapement goal range for the Yentna River is 100,000-150,000 sockeye salmon. Sonar counts apportioned to species other than sockeye salmon included: 239,362 pink salmon; 29,072 coho salmon; and 30,061 chum salmon (Table 26). Estimates of coho and chinook salmon escapements for some tributaries of the Yentna River were made (Table 27).

The midpoint of the sockeye salmon escapement occurred on 26 July (Table 28), 2 d later than the historical mean. Eighty percent of the escapement passed the counters within a 17 d period (Table 28). Nearly all (95%) of the sockeye salmon migrated adjacent to the south bank (Table 6).

Of the salmon counted from the south bank, 85.7% were within 6.0 m of the transducer (Table 7, Figure 9). On the north bank 92.1% of the salmon were counted within 6.0 m of the transducer.

The seasonal hourly passage rate on the north bank met or exceeded the average for a constant hourly passage rate during 1600 to 0300 hours. Counts accumulated during these hours accounted for 67.3% of the total north bank count. The percentage per hour for a constant hourly passage rate was exceeded during 1400 to 1500 hours and 1800 to 0400 hours on the south bank. Counts accumulated during these hours accounted for 55.1% of the total south bank count. There was one distinct peak in the daily numbers of fish passing the counters (Figure 2).

A total of 4,523 sockeye salmon were captured in fish wheels at Yentna Station (Tables 29, 30), of which 1,451 were sampled for age, sex, and length data. The major components of the escapement were ages 1.2 (31.1%), 1.3 (29.6%), 2.3 (18.3%), and 2.2 (16.9%, Table 31). The proportions of the major age classes (> 10% of the total) did not change significantly as the migration progressed (Tables 11, 31; $\alpha = 0.05$, $\chi^2 = 13.66$, $p > 0.05$, 9 df). Mean lengths were smaller than the range of values observed for age-1.3 fish. Mean lengths for ages 1.2 and 2.3 were the second smallest recorded at this site (Table 32). The male-to- female ratios were within historical ranges for age-.3 fish. The age-1.2 component of the escapement had a male-to-female ratio of 3.1:1. Age-2.2 fish composed a major proportion of the escapement for the first time at this site. The male-to-female ratio for age-2.2 fish was 3.4:1 (Table 32). Female spawners composed 37.2% of the total sockeye salmon escapement.

Eighty percent of the pink salmon escapement occurred in 15 d, the mid-point occurring on 27 July (Table 33). Pink salmon run duration (80%) in the Yentna River has ranged from 9 d to 21 d. Migratory timing has been remarkably consistent, with the midpoint occurring between 27 and 30 July in 9 of the previous 10 years. No estimates for pink or chum salmon were available for the Susitna River above its confluence with the Yentna River.

Susitna River, Sunshine Station

A fish wheel was operated at Sunshine Station from 14 July through 6 August. Species composition was 19.6% sockeye, 41.6% pink, 32.1% chum, 6.1% coho, and 0.6% chinook salmon (Table 34). Of the total 7,207 salmon caught, 996 sockeye salmon were sampled for length, age, and sex characteristics. Sockeye salmon were predominantly ages 1.3 (37.5%), 2.2 (25.7%), 1.2 (23.2%), and 2.3 (13.2%; Table 35). The proportion of age-.2 fish and age-2.3 fish increased significantly over time. Age-1.3 fish proportionally decreased as the migration progressed (Tables 11, 35; $\alpha = 0.05$, $\chi^2 = 17.49$, $p < 0.05$, 3 df). Mean lengths for age-1.2 and -1.3 fish were the smallest to appear in the 4-year database (Table 36). The ratio of males-to-females was within recorded values for age-1.2 fish. The ratio of males-to-females for age-1.3 fish was the lowest recorded in the 4-year database. Female spawners composed 58.7% of the sockeye salmon captured in the fish wheel.

DISCUSSION

The 1992 field season and sonar counting operations were similar to past years. Counting conditions on all rivers were thought to be within design and operational tolerances of the Bendix side-scanning sonar system because (1) salmon passage was inshore and near the bottom during the peak of the run, (2) salmon densities were generally adequate for system adjustment, and (3) one species, sockeye salmon, composed most of the run (88%–97%), except in Yentna River (18%).

Counting operations at Crescent River provided an escapement estimate which was lower than the number of fish that actually passed the counting site. Counts recorded on the beginning date (1 July) composed 5% of the total counts. An examination of daily escapement indicated that a peak in passage of fish was underway when the counting operation began. No estimate was made of the number of fish that passed the counting site prior to 1 July.

Most of the counts (99.5%) recorded on the south bank at Crescent River occurred in sectors one and two of the counting range. Printer skips (treated as false counts) regularly occurred in sectors one through six. Hourly averages were calculated for each sector and were substituted for hours where skips occurred or counts were deleted. This deviation from the method used for the treatment of false counts in the other rivers provided a more accurate estimate of daily escapement because it did not place a high hourly average count derived from sector one or two into sectors where very few targets were detected (targets detected in sectors 3 through 6 accounted for 0.4% of the total).

Turbidity was consistently low throughout the counting operation at Crescent River. Fish avoided the fixed trap and nearly all of the samples were collected by drifting sections of gillnet. This method proved to be labor intensive and inefficient, resulting in failure to attain the sample goal of 1,000 fish.

The use of Erin rotators on the north banks of the Crescent and Kenai Rivers increased efficiency, enabling an unassisted operator to reorient the acoustic axis to accommodate for subtle changes in fish behavior.

There were no obvious relationships between measured environmental conditions and the temporal and spatial distribution of fish at each sonar site. Daily fish passage rates at Crescent River peaked during the afternoon and evening hours during the hours following high tides (Figure 11). However, there were variations from this trend on 7 of the 33 ds of the enumeration operation. In past years fluctuations between lower water levels in the morning hours and higher water levels in the afternoon and evening hours were detected. In those years the highest hourly passage rates generally correlated to the time of day when water levels were highest. In 1992, afternoon water levels were equal to or lower than those recorded in the morning on 22 of the 26 ds on which observations were made for both the morning and the evening hours.

King and Tarbox (1990) indicated sockeye and pink salmon exhibited differential migratory behavior in the Yentna River. Sockeye salmon were proportionally higher in the fish wheel catch from 1200 to 2400

hours and pink salmon were more frequently captured from 0600 to 1200 hours. This observation identified a potential source of error in the use of total daily adjusted fish wheel catches to apportion sonar counts. Consequently, in 1991, fish wheel operations at Yentna Station were scheduled to occur throughout the day, and this procedure was continued in 1992. Further investigation of temporal distribution by species in the fish wheel catch was conducted at Yentna Station in 1992, but results are not currently available (B. King, ADF&G, Soldotna, personal communication). In the Kenai and Kasilof Rivers, daily temporal changes appeared to be related to the onset of the main body of the sockeye salmon escapement.

Age composition of the sockeye salmon escapements in the Kasilof and Crescent Rivers was typical of previous years. The percentage of age-1.2 fish in the Kenai River was the lowest recorded since 1978. The low proportion of age-1.2 sockeye salmon returning to the Kenai River in 1992 can be partially attributed to the numbers of age-.1 smolt that migrated out of the river in 1989 and 1990. The 1990 estimate of five million age-.1 sockeye salmon smolt that returned as age-1.2 adults in 1992 was approximately 20% of the 1989 estimate of 24 million age-.1 sockeye salmon smolt which returned as age-1.3 adults in 1992 (King et al. (1990, 91). The Russian River late-run sport harvest and escapement of age-2.2 sockeye salmon was 71,511 fish (D. Nelson, ADF&G, Soldotna, personal communication). Only 61,000 fish were accounted for in the escapement sample at the Kenai River enumeration site. We believe a high proportion of age-2.2 sockeye salmon entering the Kenai River are Russian River stock; however, other Kenai River stocks include an age-2.2 component (D. Waltemyer, ADF&G, Soldotna, personal communication). Factors that may have contributed to the under-estimate of age-2.2 sockeye salmon at the mile 19 site include (1) the small sample size of age-2.2 fish obtained from a relatively large escapement, (2) errors in scale aging, (3) run timing of the age-2.2 component of the escapement (a portion of the age- 2.2 component may have passed the counting site before or after fish wheel operations were conducted), and (4) the escapement estimate is in error. A typical percentage of age-1.2 sockeye salmon were detected in the Yentna River, but the percentage of age-1.3 fish was the lowest and percentages of age classes 2.2 and 2.3 were the highest to appear in the 7-year database. Age-2.2 sockeye salmon became a major (> 10% of total) component of the escapement for the first time in 7 years of observations. In the Susitna River at Sunshine Station, age-2.2 and -2.3 sockeye salmon became major components of the escapement for the first time in 4 years of observations.

Mean lengths of the major age classes of sockeye salmon collected in the Kenai, Yentna, and Susitna Rivers were the smallest or second smallest on record. Age-1.3 and -2.2 sockeye salmon collected in the Crescent River were the smallest on record. In the Kenai River, mean lengths by age may have been effected by disproportionate numbers of males. However, in the Crescent, Yentna, and Susitna Rivers, more males than females appeared in some age classes, yet mean lengths remained small. Mean lengths of sockeye salmon collected in the Kasilof were within historical bounds. This 2-year trend of reduced mean lengths has not been explained.

Age-1.3 (648,780 fish) and age-2.3 (83,024 fish) sockeye salmon that spawned in the mainstem Kenai River each had a male-to-female ratio of 0.5:1, an unusually large escapement of females (482,991).

Run timing, counter limitations, and spawning locations relative to the sonar site made sonar escapement estimates for Kasilof River pink, coho, and chinook salmon impractical. Coho salmon entered the river primarily in August (G. Kyle, ADF&G, Soldotna, personal communication). The proportion of pink salmon spawning below the counting site was not known. Early- and late-run chinook salmon migrated past the sonar site during the time that sockeye were counted, but no counts were apportioned to this species.

Enumeration activities ceased on the Yentna River on 12 August. Migratory timing information could not be calculated for chum and coho salmon because migration continued past that date. In the years 1981 to 1984 a range of 69.8% to 92.0% (mean 78.7%) of the chum salmon escapement and 79.6% to 89.9% (mean 84.8%) of the coho salmon escapement were recorded by 12 August (King and Tarbox 1986).

LITERATURE CITED

Bendix Corporation. 1980. Installation and operation manual for side scan salmon counter (1980 model). Bendix Corporation Oceanics Division Report SP-78-017, Sylmar, California.

Bendix Corporation. 1984. Installation and operation manual — long range side scan herring counter with rock inhibitor. Bendix Corporation Oceanics Division, Sylmar, California.

Bethe, M.L., P.V. Krasnowski, and S.L. Marshall. 1980. Origins of sockeye salmon in the Upper Cook Inlet fishery of 1978 based on scale pattern analysis. Alaska Department of Fish and Game, Division of Commercial Fisheries Informational Leaflet 186, Juneau.

Cross, B.A., D.R. Bernard, and S.L. Marshall. 1983. Recruits-per-spawner ratios for sockeye salmon of Upper Cook Inlet, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries Informational Leaflet 221, Juneau.

Davis, R.Z., and B.E. King. 1993. Supporting data for the 1992 Upper Cook Inlet adult salmon escapement studies. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A93-09.

Fandrei, G. 1991. Hidden Lake sockeye salmon enhancement progress report 1991. Cook Inlet Aquaculture Association, Soldotna, Alaska.

Flagg, L.B. 1986. Central Cook Inlet FRED Division 1986 Annual Report. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development (unpublished manuscript), Anchorage.

Gaudet, D.M. 1983. 1981 Bendix counter manual. Alaska Department of Fish and Game, Division of Commercial Fisheries (unpublished manuscript), Juneau.

LITERATURE CITED, (continued)

King, B.E., and R.Z. Davis. 1992. Supporting data for the 1991 Upper Cook Inlet adult salmon escapement studies. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A92-28. Anchorage.

King, B.E., and K.E. Tarbox. 1990. Upper Cook Inlet salmon studies, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 91-21. Anchorage.

King, B.E. 1990. Upper Cook Inlet salmon escapement studies, 1990: backup data. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S91-4. Anchorage.

King, B.E., Brannian, L., and K.E. Tarbox. 1990. Kenai River sockeye salmon smolt studies, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S90-5. Anchorage.

King, B.E., Brannian, L.K., and Tarbox, K.E. 1991. Kenai River sockeye salmon smolt studies, 1990–91. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S91-8, Anchorage.

King, B.E., and R.Z. Davis. 1989. Summary of Upper Cook Inlet historic salmon spawning information. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S89-2, Anchorage.

King, B.E., and K.E. Tarbox. 1984. Upper Cook Inlet (*Oncorhynchus* spp.)escapement studies, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 122, Juneau.

King, B.E., and K.E. Tarbox. 1986. Upper Cook Inlet (*Oncorhynchus* spp.) escapement studies, 1985. Alaska Department of Fish and Game,Division of Commercial Fisheries, Upper Cook Inlet Data Report 86-8, Anchorage.

King, B.E., and K.E. Tarbox. 1987. Upper Cook Inlet (*Oncorhynchus* spp.) escapement studies, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 201, Juneau.

King, B.E., and K.E. Tarbox. 1988. Upper Cook Inlet salmon escapement studies, 1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 88-04, Juneau.

LITERATURE CITED, (continued)

King, B.E., and K.E. Tarbox. 1989a. Upper Cook Inlet salmon escapement studies, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 89-11, Juneau.

King, B.E., and K.E. Tarbox. 1989b. Upper Cook Inlet salmon escapement studies, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 89-19, Juneau.

King, B.E., and K.E. Tarbox. 1991. Upper Cook Inlet salmon escapement studies, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 91-20, Juneau.

Marsh, L. 1991. Catch and effort statistics for the sockeye salmon sport fishery during the late-run to the Russian River with estimates of escapement, Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series 92-22, Juneau.

Namtvedt, T.B., N.V. Friese, and D.L. Waltemyer. 1979. Cook Inlet sockeye salmon studies. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Report for the period July 1, 1977 to June 30, 1978, Anchorage.

Tarbox, K.E., B.E. King, and D.L. Waltemyer. 1981. Kenai, Kasilof, and Crescent River sonar investigations. Alaska Department of Fish and Game, Division of Commercial Fisheries, Legislative Report, Juneau.

Tarbox, K.E., B.E. King, and D.L. Waltemyer. 1983. Cook Inlet sockeye salmon studies. Alaska Department of Fish and Game, Division of Commercial Fisheries Completion report for period July 1, 1977 to June 30, 1982, Anchorage.

Thompson, S.K. 1987. Sample sizes for estimating multinomial proportions. The American Statistician 41:42–46.

Waltemyer, D.L., T.B. Namtvedt, and B.E. King. 1980. Cook Inlet sockeye salmon studies. Alaska Department of Fish and Game, Division of Commercial Fisheries Technical Report for the period July 1, 1978 to June 30, 1979, Anchorage.

Waltemyer, D.L. 1992. Abundance, age, sex, and length of chinook, sockeye, coho, and chum salmon returning to Upper Cook Inlet, Alaska in 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report 93-02, Juneau.

Table 1. Estimated salmon escapement into the Kenai River, north and south banks combined, 1 July through 13 August 1992. Species composition based on fish wheel catches.

	Sockeye		Pink		Coho		Chinook	
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
7/01	2,782	2,782	18	18	0	0	127	127
7/02	2,256	5,038	14	32	0	0	104	231
7/03	2,957	7,995	20	52	0	0	135	366
7/04	2,163	10,158	14	66	0	0	99	465
7/05	1,204	11,362	28	94	0	0	29	494
7/06	2,511	13,873	61	155	0	0	59	553
7/07	953	14,826	22	177	0	0	23	576
7/08	1,471	16,297	36	213	0	0	35	611
7/09	1,192	17,489	29	242	0	0	28	639
7/10	2,769	20,258	66	308	0	0	66	705
7/11	1,736	21,994	42	350	0	0	41	746
7/12	20,672	42,666	162	512	0	0	82	828
7/13	67,632	110,298	531	1,043	0	0	266	1,094
7/14	64,127	174,425	0	1,043	0	0	0	1,094
7/15	26,795	201,220	0	1,043	0	0	0	1,094
7/16	15,645	216,865	55	1,098	0	0	54	1,148
7/17	11,112	227,977	38	1,136	0	0	39	1,187
7/18	16,882	244,859	0	1,136	0	0	197	1,384
7/19	8,403	253,262	189	1,325	0	0	35	1,419
7/20	29,047	282,309	653	1,978	0	0	123	1,542
7/21	49,662	331,971	1,116	3,094	0	0	209	1,751
7/22	36,142	368,113	255	3,349	0	0	511	2,262
7/23	31,463	399,576	0	3,349	0	0	0	2,262
7/24	49,356	448,932	1,057	4,406	0	0	0	2,262
7/25	83,184	532,116	1,603	6,009	96	396	396	2,658
7/26	76,952	609,068	0	6,009	0	396	0	2,658
7/27	64,922	673,990	605	6,614	0	396	0	2,658
7/28	62,641	736,631	0	6,614	4,176	4,572	0	2,658
7/29	57,354	793,985	244	6,858	245	4,817	428	3,086
7/30	32,174	826,159	0	6,858	0	4,817	0	3,086
7/31	12,484	838,643	359	7,217	967	5,784	0	3,086
8/01	10,958	849,601	80	7,297	0	5,784	0	3,086
8/02	10,097	859,698	0	7,297	446	6,230	0	3,086
8/03	6,344	866,042	0	7,297	134	6,364	0	3,086
8/04	6,231	872,273	0	7,297	304	6,668	0	3,086
8/05	11,435	883,708	112	7,409	57	6,725	57	3,143
8/06	14,787	898,495	5,297	12,706	49	6,774	104	3,247
8/07	12,199	910,694	803	13,509	76	6,850	0	3,247
8/08	14,584	925,278	366	13,875	365	7,215	0	3,247
8/09	11,569	936,847	769	14,644	547	7,762	220	3,467
8/10	13,626	950,473	1,299	15,943	211	7,973	70	3,537
8/11	13,588	964,061	1,750	17,693	721	8,694	0	3,537
8/12	11,866	975,927	2,120	19,813	858	9,552	0	3,537
8/13	18,871	994,798	2,728	22,541	934	10,486	299	3,836

Table 2. Estimated sockeye salmon escapement recorded by side-scanning sonar in the Kenai, Kasilof, Crescent, and Susitna Rivers, 1978-1992.

	System			
Year	Kenai R.[a]	Kasilof R.[b]	Crescent R.	Susitna R.[c]
1978	398,900	116,600	[d]	94,400
1979	285,020	152,179	86,654	156,890
1980	464,038	187,154	90,863	190,866
1981	407,639	256,625	41,213	139,401[e]-340,232
1982	619,831	180,239	58,957	215,856[f]-265,332[g] 113,847[e]
1983	630,340	210,271	92,122	112,314-175,936[g] 104,414[e]
1984	344,571	231,685	118,345	194,480[f]-279,446[g] 149,375[e]
1985	502,820	505,049	128,628	107,124[e]-227,924[g]
1986	501,157	275,963	20,385[h]	92,076[e]
1987	1,596,871	249,250	120,219	66,054[e]
1988	1,021,469	204,000[i]	57,716	52,330[e]
1989	1,599,959	158,206	71,064	96,269[h]
1990	659,520	144,136	52,238	140,290[h]
1991	647,597	238,269	44,578	109,632[h]
1992	994,798	184,178	58,229	66,074[h]

[a] Includes counts after 22 June (1978-87) and after 1 July (1988-92).
[b] Includes counts or estimates from designated early period (prior to 15 June).
[c] Sonar counts from Susitna Station unless otherwise indicated.
[d] No counts conducted.
[e] Sonar counts from Yentna Station and Susitna Station east bank.
[f] Sonar counts from Yentna Station and mark-recapture estimate from Sunshine Station.
[g] Counts through 16 July only.
[h] Counts from Yentna Station only (1986-92).
[i] Combined counts from wiers on Bear and Glacier Flat Creeks and surveys of remaining spawning streams.

Table 3. Late-run Kenai River sockeye salmon escapement summary, 1968-1992.

Year	Estimated Escapement at Sonar Site[a]	Russian River Sport Harvest[b]	Kenai River Mainstem Sport Harvest[b]	Estimated Total Harvest Above Sonar Site[c]	Sonar Count Less Sport Harvest[d]
1968	88,000	5,820			
1969	53,000	1,150			
1970	73,000	600			
1971	300,000	10,730			
1972	318,000	16,050			
1973	367,000	8,930			
1974	161,000	8,500	8,030	16,530[e]	144,470
1975	142,000	8,390	5,110	13,500	128,500
1976	380,000	13,700	13,140	26,840	353,160
1977	708,000	27,440	16,933	44,373	663,627
1978	398,900	24,530	24,542	49,072	349,828
1979	285,020	26,840	12,328	39,158	245,862
1980	464,038	33,500	18,592	52,082	411,956
1981	407,639	23,720	14,450	38,171	369,468
1982	619,831	10,320	38,400	48,718	571,113
1983	630,340	16,000	48,310	64,306	566,034
1984	344,571	21,970	11,160	33,250	311,321
1985	502,820	58,410	40,440	98,850	403,970
1986	501,157	30,810	47,920	78,730	422,427
1987	1,596,871	40,580	148,300	188,880	1,407,991
1988	1,021,469	19,540	91,770	111,310	910,159
1989	1,599,959	55,210	165,340	220,550	1,379,409
1990	659,520	52,984	87,575	140,559	518,961
1991	647,597	31,450	108,271	216,781[f]	430,816
1992	994,798	29,646[g]	166,730[g]	196,376	798,422

[a] Bendix Corp. multiple transducer sonar 1968-1977, side-scanning sonar 1978-1992.
[b] Data from Sport Fish Division Statewide Harvest estimate. Mainstem harvest above the Soldotna bridge (and sonar site) only.
[c] Combined Russian River and mainstem (above bridge) harvests.
[d] Considered estimate of spawners above sonar site.
[e] Cross et al. (1983): 1974-1980.
[f] Includes 77,060 harvest at Hidden Creek weir: Fandrei 1991.
[g] Preliminary estimate: Sport Fish Division Statewide Harvest estimate.

Table 4. Late-run sockeye salmon escapement counts in eight index areas, Kenai River drainage, 1969-1992.

Year	Railroad Creek[b]	Johnson Creek[b]	Carter-Moose Creek[b]	Ptarmigan Creek[b]	Tern (Mud) Lake[b]	Quartz Creek	Hidden Lake[c]	Russian River[a] Above Weir	Russian River[a] Below Weir	Total Index Area Escapement
1969	100	75	598	5	487	487	500	28,920	1,100	32,272
1970	99	118	348	7	561	200	323	28,200	220	30,076
1971	194	160	3,201	45	1,370	808	1,958	54,430	10,000	72,166
1972	700	150	3,400		1,200		4,956	79,000	6,000	95,406
1973	521	1,714	660	1,041	1,731	3,173	690	24,970	6,690	41,190
1974		46	939	558		255	1,150	24,650	2,210	29,808
1975	522	105	1,278	186	1,214	1,068	1,375	31,970	630	38,348
1976	1,032		5,558		1,548	3,372	4,860	31,950	3,470	51,790
1977	1,262	450	6,515	1,513	2,230	3,037	1,055	21,410	17,090	54,562
1978	1,749	780	1,933	3,529	1,126	10,627	4,647	32,760	18,330	75,481
1979		588	3,986	523	1,693	277	5,762	87,920	3,920	104,669
1980	1,259	253	4,879	5,752	2,575	7,982	27,448	83,980	3,220	137,348
1981	1,276	142	4,370	1,421	3,402	5,998	15,939	44,530	4,160	81,238
1982	2,518	498	4,752	7,525	4,300	70,540[d]	8,648	30,790	45,000	174,571
1983	1,289	338	1,819	9,709		73,345	11,297	34,040	44,000	175,837
1984	2,090	939	5,927	18,000	2,728	37,659	27,792	92,660	3,000	190,795
1985	2,884	151	5,928	26,879			24,784	136,970	8,650	206,246
1986	600	245	1,659				17,530	40,420	6,022	66,476
1987	736	74	625	14,187		45,400	43,487	53,930	76,732	235,171
1988	1,990	1,243	1,607	31,696			50,907	42,480	28,840	158,763
1989	4,959	2,276	5,958	3,484			7,770	138,320	28,480	191,247
1990			2,306	3,230			77,959	83,336	11,760	178,591
1991			750[e]	2,764[e]	1,750[f]		35,676	78,175	22,267	141,382
1992			1,106[e]	3,147[e]	970[f]		32,912	63,478[g]	4,980[g]	106,593

[a] 1969-75, ADF&G archives, Division of Sport Fish, Anchorage. 1976-91, Marsh, L. 1991.
[b] United States Department of Agriculture, Forest Service, Seward, Alaska (1984-92).
[c] Weir count: 1971, 1973, 1976-89 (FRED Division); 1990-92 (Cook Inlet Aquaculture Assoc.).
[d] FRED Division weir count (1982-83).
[e] Ptarmigan Creek survey conducted on lower 1.5 miles, Moose Creek survey conducted on lower 1.0 mile.
[f] Survey conducted on an unnamed stream at eastern end of Tern (Mud) Lake.
[g] D. Nelson, ADF&G, Soldotna, personal communication.

Table 5. Cumulative proportion by date of late-run sockeye salmon counts recorded in the Kenai River, 1983-1992.

	Cumulative Proportion[a,b]									
Date	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
22-Jun	0.001	0.003	0.001	0.001	0.001					
23-Jun	0.001	0.007	0.002	0.002	0.002					
24-Jun	0.002	0.010	0.003	0.003	0.002					
25-Jun	0.003	0.012	0.004	0.004	0.002					
26-Jun	0.004	0.013	0.005	0.004	0.003					
27-Jun	0.005	0.015	0.006	0.005	0.004					
28-Jun	0.006	0.017	0.007	0.006	0.005					
29-Jun	0.006	0.018	0.009	0.007	0.006					
30-Jun	0.007	0.021	0.010	0.008	0.007					
01-Jul	0.007	0.023	0.014	0.009	0.007	0.000	0.000	0.001	0.001	0.003
02-Jul	0.008	0.024	0.016	0.010	0.008	0.000	0.001	0.001	0.003	0.005
03-Jul	0.008	0.025	0.017	0.011	0.008	0.001	0.001	0.003	0.004	0.008
04-Jul	0.009	0.027	0.019	0.012	0.008	0.001	0.001	0.010	0.005	0.010
05-Jul	0.009	0.029	0.021	0.013	0.009	0.001	0.002	0.019	0.012	0.011
06-Jul	0.009	0.031	0.024	0.014	0.009	0.002	0.006	0.029	0.018	0.014
07-Jul	0.010	0.032	0.026	0.016	0.009	0.003	0.011	0.036	0.019	0.015
08-Jul	0.010	0.036	0.030	0.016	0.010	0.003	0.014	0.044	0.020	0.016
09-Jul	0.011	0.044	0.032	0.016	0.010	0.003	0.017	0.049	0.022	0.018
10-Jul	0.013	0.054	0.033	0.017	0.010	0.011	0.021	0.050	0.024	0.020
11-Jul	0.017	0.063	0.036	0.017	0.011	0.063	0.024	0.052	0.028	0.022
12-Jul	0.021	0.067	0.038	0.018	0.011	0.088	0.046	0.054	0.034	0.043
13-Jul	0.041	0.071	0.039	0.020	0.015	0.141	0.100	0.057	0.037	0.111
14-Jul	0.085	0.073	0.048	0.044	0.018	0.185	0.162	0.060	0.038	0.175
15-Jul	0.174	0.076	0.066	0.057	0.033	0.222	0.211	0.064	0.041	0.202
16-Jul	0.242	0.112	0.104	0.068	0.044	0.274	0.242	0.068	0.046	0.218
17-Jul	0.297	0.173	0.111	0.081	0.052	0.303	0.290	0.138	0.058	0.229
18-Jul	0.437	0.307	0.114	0.095	0.058	0.340	0.347	0.279	0.086	0.246
19-Jul	0.566	0.363	0.115	0.114	0.070	0.375	0.367	0.344	0.136	0.225
20-Jul	0.695	0.406	0.116	0.126	0.142	0.409	0.421	0.400	0.194	0.284
21-Jul	0.766	0.464	0.120	0.194	0.237	0.464	0.500	0.457	0.225	0.334
22-Jul	0.796	0.555	0.178	0.300	0.322	0.569	0.566	0.473	0.261	0.370
23-Jul	0.813	0.652	0.291	0.359	0.409	0.679	0.639	0.518	0.308	0.402
24-Jul	0.833	0.720	0.463	0.426	0.493	0.744	0.679	0.576	0.376	0.451
25-Jul	0.844	0.781	0.574	0.525	0.575	0.785	0.698	0.675	0.424	0.535
26-Jul	0.861	0.833	0.693	0.689	0.646	0.812	0.729	0.719	0.477	0.612
27-Jul	0.865	0.867	0.753	0.814	0.700	0.827	0.774	0.729	0.546	0.678
28-Jul	0.872	0.897	0.822	0.874	0.747	0.836	0.806	0.744	0.637	0.740
29-Jul	0.878	0.913	0.864	0.910	0.774	0.844	0.831	0.796	0.711	0.798
30-Jul	0.882	0.921	0.897	0.961	0.797	0.847	0.846	0.846	0.772	0.830
31-Jul	0.891	0.928	0.911	1.000	0.839	0.850	0.856	0.867	0.838	0.843
01-Aug	0.906	0.933	0.919		0.879	0.854	0.875	0.879	0.885	0.854
02-Aug	0.916	0.937	0.922		0.907	0.859	0.888	0.896	0.912	0.864
03-Aug	0.920	0.943	0.925		0.925	0.863	0.899	0.932	0.927	0.871
04-Aug	0.934	0.948	0.929		0.939	0.873	0.908	0.963	0.934	0.877
05-Aug	0.964	0.956	0.931		0.952	0.894	0.916	0.978	0.939	0.888
06-Aug	0.977	0.960	0.935		0.962	0.914	0.930	0.991	0.946	0.903

- Continued -

Table 5. (p. 2 of 2)

	Cumulative Proportion[a,b]									
Date	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
07-Aug	0.983	0.963	0.938		0.970	0.933	0.949	1.000	0.953	0.915
08-Aug	0.989	0.969	0.943		0.976	0.944	0.960		0.967	0.930
09-Aug	0.993	1.000	0.947		0.981	0.953	0.966		0.979	0.942
10-Aug	0.966		0.953		0.988	1.000	0.974		0.988	0.955
11-Aug	0.999		0.960		0.994		0.985		0.995	0.969
12-Aug	1.000		1.000		0.998		0.990		1.000	0.981
13-Aug					1.000		0.994			1.000
14-Aug							0.998			
15-Aug							1.000			
Midpoint	7/19	7/22	7/25	7/25	7/25	7/22	7/21	7/23	7/27	7/25
No. days for 80%[c]	18	14	16	12	14	25	23	18	15	25

[a] Number of days for 80% of the escapment for years not included in table: 1979-12; 1980-6; 1981-18: and 1982-12.

[b] Proportion accrued on last day (1981, 1982, 1984-1986, 1988) represents that portion of the escapement estimated after termination of enumeration activities.

[c] Inclusive dates: date proportion of escapement reached 10% through date proportion of escapement reached 90%.

Table 6. Distribution of sockeye salmon escapement by bank recorded by side-scanning sonar in the Kenai, Kasilof, Crescent, and Yentna Rivers, 1979-1992.

	Percentage of Total Fish Targets							
	Kenai River		Kasilof River		Crescent River		Yentna River	
Year	North Bank	South Bank	North Bank	South Bank	North Bank	South Bank	North Bank	South Bank
1979	72	28	53	47				
1980	61	39	52	48	49	51		
1981	72	28	69	31	57	43		
1982	39	61	73	27	54	46		
1983	42	58	51	49	39	61		
1984	65	35	56	44	71	29		
1985	54	46	70	30	70	30	9	91
1986	62	38	57	43	84	16	32	68
1987	48	52	55	45	64	34	10	90
1988	47	53	32	68	53	47	8	92
1989	57	43	39	61	52	48	12	88
1990	62	38	29	71	44	56	2	98
1991	73	27	39	61	33	67	8	92
1992	60	40	45	55	56	44	5	95

Table 7. Summary of sonar counts by sector from the Kenai, Kasilof, Crescent, and Yentna Rivers, 1992.

River	Bank	Dates	Sector[a] 1	2	3	4	5	6	7	8	9	10	11	12	Total Counts
Kenai	north	7/01-7/12	8.2	11.1	3.9	15.6	12.7	8.6	6.2	8.7	9.1	3.6	3.8	8.5	28,436
		7/13-8/05[b]	3.8	13.7	8.6	21.2	21.6	12.1	6.8	5.4	3.2	2.2	1.1	0.4	525,683
		8/06-8/13	23.6	35.7	13.1	9.1	9.0	2.9	2.1	2.0	0.9	0.8	0.8	0.0	61,792
		all	6.0	15.8	8.8	19.8	19.9	11.0	6.3	5.2	3.2	2.1	1.2	0.8	615,911
Kenai	south	7/01-7/13	16.0	22.1	22.3	22.7	8.2	4.8	0.4	0.3	0.3	0.5	0.7	1.7	39,506
		7/14-8/09[b]	15.0	25.4	22.0	20.0	10.0	5.0	0.2	0.1	0.1	0.5	0.5	1.0	339,949
		8/10-8/13	79.5	17.3	1.2	0.8	0.3	0.1	0.0	0.1	0.1	0.2	0.2	0.2	36,295
		all	20.7	24.4	20.2	18.6	9.0	4.5	0.2	0.1	0.2	0.5	0.5	1.0	415,750
Kasilof	north	6/15-6/22	12.3	18.1	15.8	13.8	11.7	7.0	2.9	5.3	3.4	3.3	2.5	3.9	6,456
		6/23-7/25[b]	40.5	32.9	8.3	4.3	3.1	2.5	1.0	1.3	1.1	1.5	1.6	2.0	62,451
		7/26-8/02	37.9	41.8	7.6	2.5	1.5	1.5	0.6	1.1	0.9	1.2	1.4	2.1	12,647
		all	37.8	33.1	8.8	4.8	3.5	2.7	1.1	1.6	1.3	1.6	1.6	2.2	81,554
Kasilof	south	6/15-6/23	4.8	9.7	9.5	7.2	2.5	1.5	5.3	6.5	7.2	10.7	14.7	20.5	9,376
		6/24-7/25[b]	24.5	18.3	21.5	11.4	3.4	1.1	3.1	2.5	1.9	2.9	3.6	5.7	84,549
		7/26-8/02	26.6	18.9	14.3	11.8	4.7	2.7	2.2	2.3	2.6	3.4	4.0	6.5	7,703
		all	22.9	17.6	19.9	11.0	3.4	1.2	3.2	2.8	2.5	3.7	4.7	7.1	101,628
Crescent	north	all	9.1	43.2	28.9	7.0	4.9	3.2	1.9	1.0	0.3	0.3	0.1	0.1	37,083
Crescent	south	all	90.9	8.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28,533
Yentna	north	7/07-7/22	17.7	28.3	25.3	8.1	2.8	1.0	1.9	2.1	1.0	1.9	3.8	6.0	4,016
		7/23-8/09[b]	29.3	40.5	17.4	6.8	2.2	1.1	0.4	0.2	0.2	0.3	0.5	0.9	36,263
		7/10-7/11	38.4	39.2	10.7	5.3	1.9	0.9	0.4	0.4	0.1	0.3	1.1	1.2	2,488
		all	28.2	39.2	17.8	6.9	2.3	1.1	0.6	0.5	0.3	0.5	1.0	1.5	46,191
Yentna	south	7/07-7/21	12.2	28.0	20.4	10.7	3.9	1.2	4.2	3.4	3.2	4.2	3.5	5.1	23,512
		7/22-8/03[b]	19.9	38.3	18.3	9.7	4.0	1.8	1.7	1.4	1.2	1.4	1.2	1.0	263,276
		8/04-8/11	26.8	43.8	15.2	7.0	3.0	1.3	0.9	0.5	0.3	0.3	0.2	0.6	31,697
		all	20.0	38.0	18.2	9.5	3.9	1.7	1.8	1.4	1.3	1.5	1.3	1.3	318,485

[a] Counts by sector and hour by day from Davis and King (1993).
[b] Dates during which 80% of total counts occurred (10% - 90%).

Table 8. Daily adjusted fish wheel catch by species for the Kenai River, 1 July through 13 August 1992.

Date	Hours open[a]	Sockeye		Pink		Coho		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
01-Jul	19.5	49	49	0	0	0	0	0	0
02-Jul	24.0	37	86	0	0	0	0	0	0
03-Jul	24.0	67	153	1	1	0	0	0	0
04-Jul	21.5	12	165	0	1	0	0	5	5
05-Jul	24.5	29	194	0	1	0	0	2	7
06-Jul	6.0	16	210	0	1	0	0	0	7
07-Jul	23.0	10	220	0	1	0	0	0	7
08-Jul		10	220		1		0		7
09-Jul	22.3	16	236	0	1	0	0	0	7
10-Jul	25.8	1	237	0	1	0	0	4	11
11-Jul	6.0	84	321	4	5	0	0	5	16
12-Jul	25.5	69	390	1	6	0	0	0	16
13-Jul	5.0	1,205	1595	9	15	0	0	0	16
14-Jul	0.5	6,960	8555	0	15	0	0	0	16
15-Jul	0.5	4,608	13,163	0	15	0	0	3	19
16-Jul			13,163		15		0		19
17-Jul	8.3	867	14,030	3	18	0	0	2	21
18-Jul	14.0	171	14,201	0	18	0	0	0	21
19-Jul	14.5	38	14,239	0	18	0	0	3	24
20-Jul	16.3	66	14,305	0	18	0	0	0	24
21-Jul	9.0	608	14,913	16	34	0	0	14	38
22-Jul	7.0	991	15,904	7	41	0	0	38	10
23-Jul	8.0	707	16,611	0	41	0	0	38	11
24-Jul	1.0	3,360	19,971	72	113	0	0	19	57
25-Jul	1.3	3,994	23,965	77	190	19	19	0	57
26-Jul	2.8	2,889	26,854	0	190	0	19	0	57
27-Jul	1.0	7,728	34,582	72	262	0	19	0	57
28-Jul	1.0	1,440	36,022	0	262	96	115	7	64
29-Jul	6.8	938	36,960	4	266	4	119	0	64
30-Jul	1.8	4,155	41,115	0	266	0	119	0	64
31-Jul	3.8	659	41,774	19	285	51	170	0	64
01-Aug	2.5	1,373	43,147	10	295	0	170	0	64
02-Aug	6.3	453	43,600	0	295	20	190	0	64
03-Aug	2.5	1,804	45,404	0	295	38	228	0	64
04-Aug	4.0	246	45,650	0	295	12	240	6	70
05-Aug	4.0	1,212	46,862	12	307	6	246	19	89
06-Aug	2.8	2,705	49,567	969	1,276	9	255	0	89
07-Aug	4.5	805	50,372	53	1,329	5	260	0	89
08-Aug	4.0	479	50,851	12	1,341	12	272	4	93
09-Aug	5.0	211	51,062	14	1,355	10	282	2	95
10-Aug	11.0	388	51,450	37	1,392	6	288	0	95
11-Aug	5.0	264	51,714	34	1,426	14	302	0	95
12-Aug	8.8	263	51,977	47	1,473	19	321	8	103
13-Aug	8.5	505	52,482	73	1,546	25	346	0	103

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Total catch by species: 5,526 sockeye salmon; 224 pink salmon; 96 coho salmon; 33 chinook salmon.

Table 9. Length composition of the major age classes of sockeye salmon collected in the Kenai River, 1980-1992. Length measured from mid-eye to fork-of-tail.

		Male			Female			Total			
Year	Age Class	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ratio Male-Female
1980	1.2	482	4	168	494	4	100	486		268	1.7:1
1981		493	6	85	513	6	73	502		158	1.2:1
1982		483	9	70	505	13	32	490	10	63	2.2:1
1983		524	9	25	520	6	30	522	5	55	0.8:1
1984		474	3	280	473	4	196	474	2	476	1.4:1
1985		492	3	184	490	3	186	491	2	370	1.0:1
1986		488	4	155	492	6	96	489	4	251	1.6:1
1987		514	8	39	503	5	56	507	5	95	0.7:1
1988		522	8	79	511	4	84	516	4	163	0.9:1
1989		493	6	114	494	4	92	493	4	206	1.2:1
1990		474	0	168	478	0	127	476	0	295	1.3:1
1991		488	2	613	497	13	577	492	6	1,190	1.1:1
1980	1.3	580	3	180	561	2	192	570		372	0.9:1
1981		590	2	290	569	1	430	577		720	0.7:1
1982		596	2	723	572	1	841	583	2	1,564	0.9:1
1983		598	2	215	577	1	269	586	1	484	0.8:1
1984		582	2	385	559	1	395	571	1	780	1.0:1
1985		575	2	496	552	1	824	560	1	1,320	0.6:1
1986		584	3	112	564	2	200	571	2	312	0.6:1
1987		605	2	183	586	1	401	592	1	584	0.5:1
1988		598	1	428	572	2	624	583	1	1,052	0.7:1
1989		600	1	831	575	1	881	587	1	1,712	0.9:1
1990		586	0	358	559	0	318	574	0	676	1.1:1
1991		561	2	357	539	1	441	549	1	798	0.8:1
1992		572	2	370	547	1	714	556	1	1,084	0.5:1
1984	2.2	505	4	116	508	3	159	507	2	275	0.7:1
1985		513	4	132	513	3	196	513	2	328	0.7:1
1980	2.3	589	3	67	579	3	80	584		147	0.8:1
1982		598	5	46	580	8	21	592	6	67	2.2:1
1983		595	4	25	582	4	36	587	3	61	0.7:1
1984		570	2	210	557	2	192	564	2	402	1.1:1
1985		570	3	106	555	2	129	562	2	235	0.8:1
1986		585	5	52	568	3	89	575	3	142	0.6:1
1988		596	3	53	577	3	92	584	2	145	0.6:1
1989		600	3	112	579	2	108	589	2	220	1.0:1
1990		589	0	177	568	0	132	580	0	309	1.3:1
1991		572	2	153	543	3	139	558	2	292	1.1:1
1992		569	4	46	546	2	88	554	2	134	0.5:1

Table 10. Age composition of sockeye salmon collected in the Kenai River, 1970-1992.

Sample Period	Percentage Composition by Age Class[a]								Sample Size
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	Other	
7/01-7/16	0.0	2.5	89.0	0.2	0.0	3.2	4.9	0.2	473
7/17-7/26	0.0	4.4	84.4	0.2	0.2	5.6	5.1	0.0	430
7/27-8/13	0.0	1.6	69.0	0.2	0.5	8.3	20.5	0.0	435
Seasonal Summary									
1970	tr	10.0	17.0	tr	26.0	25.0	15.0	6.0	225
1971	0.0	8.0	39.0	1.0	3.0	38.0	11.0	0.0	168
1972	0.0	21.0	34.0	0.0	0.0	23.0	20.0	0.0	403
1973	0.0	5.0	68.0	1.0	1.0	8.0	16.0	0.0	632
1974	2.0	18.0	46.0	0.0	3.0	18.0	12.0	0.0	295
1975	2.0	10.0	36.0	2.0	4.0	31.0	14.0	1.0	162
1976	1.0	46.0	20.0	0.0	2.0	22.0	8.0	1.0	948
1977	0.0	6.0	76.0	1.0	tr	7.0	10.0	0.0	1,265
1978	0.0	2.5	86.7	0.0	0.0	4.9	5.4	tr	811
1979	tr	20.2	61.1	0.0	0.0	11.8	6.2	tr	601
1980	0.0	27.7	45.1	0.0	0.0	16.2	10.1	tr	715
1981	0.0	16.2	70.9	0.0	0.0	8.1	4.8	0.0	1,757
1982	0.1	5.8	87.5	tr	0.0	2.9	3.7	0.0	1,787
1983	0.4	8.2	79.1	0.2	0.5	2.2	8.9	0.4	1,765
1984	0.2	23.4	38.2	3.5	0.6	12.8	19.2	2.2	2,364
1985	0.1	15.9	56.4	0.3	0.1	14.7	11.4	1.1	2,201
1986	0.0	31.8	39.5	0.7	0.3	8.2	18.0	1.5	789
1987	0.0	12.8	78.4	0.1	0.0	3.2	5.2	0.3	745
1988	0.3	11.6	74.2	0.4	0.2	3.1	10.2	0.1	1,420
1989	0.1	9.1	75.3	1.0	0.5	4.1	9.7	0.2	2,275
1990	0.6	21.6	41.4	0.6	0.3	13.7	21.1	0.8	1,513
1991	0.2	48.2	31.6	0.1	0.5	5.7	11.4	2.7	2,504
1992	0.0	2.9	79.4	tr	tr	6.1	11.0	tr	1,338

[a] Percentages weighted by total numbers in the escapement: 1978 (Bethe et al. 1980), 1979-1982, 1984-1992.

Table 11. Summary of chi-square analysis of temporal change in sockeye salmon age composition in the Kenai, Kasilof, Yentna, and Susitna Rivers, 1992.

River	Number of Periods	Dates	Age Classes	Chi-square Value			Hypothesis[b]
				Calculated	DF	Tabled Value[a]	
Kenai	3	7/01-8/13	1.3, 2.3	26.36	3	7.81	reject
Kenai	2	7/01-7/26	1.3, 2.3	0.12	1	3.84	accept
Kenai	2	7/17-8/13	1.3, 2.3	40.41	1	3.84	reject
Kasilof	4	6/15-8/02	1.2, 1.3, 2.2, 2.3	470.08	9	16.92	reject
Kasilof	2	6/15-7/15	1.2, 1.3, 2.2, 2.3	191.05	3	7.81	reject
Kasilof	2	7/01-7/22	1.2, 1.3, 2.2, 2.3	131.84	3	7.81	reject
Kasilof	2	7/16-8/02	1.2, 1.3, 2.2, 2.3	5.80	3	7.81	accept
Yentna	4	7/07-8/11	1.2, 1.3, 2.2, 2.3	13.66	9	16.92	accept
Susitna	2	7/15-8/04	1.2, 1.3, 2.2, 2.3	17.49	3	7.81	reject

[a] $\alpha \geq 0.050$, the probability (P) of a $\chi^2 \geq$ the tabled value is 0.050 (5%).
[b] Hypothesis: Age class proportions do not change over time.

Table 12. Estimated salmon escapement into the Kasilof River, north and south banks combined, 15 June through 2 August 1992.

Date	Daily	Cumulative	Date	Daily	Cumulative
6/15	707	707	7/09	1,930	80,780
6/16	1,885	2,592	7/10	2,624	83,404
6/17	1,136	3,728	7/11	1,778	85,182
6/18	1,952	5,680	7/12	10,901	96,083
6/19	1,380	7,060	7/13	11,838	107,921
6/20	2,088	9,148	7/14	2,300	110,221
6/21	2,631	11,779	7/15	1,695	111,916
6/22	3,237	15,016	7/16	1,633	113,549
6/23	3,569	18,585	7/17	2,241	115,790
6/24	4,395	22,980	7/18	3,066	118,856
6/25	3,977	26,957	7/19	3,657	122,513
6/26	5,073	32,030	7/20	7,384	129,897
6/27	7,477	39,507	7/21	3,639	133,536
6/28	6,476	45,983	7/22	2,750	136,286
6/29	7,455	53,438	7/23	5,605	141,891
6/30	6,073	59,511	7/24	13,584	155,475
7/01	2,694	62,205	7/25	8,355	163,830
7/02	2,072	64,277	7/26	7,991	171,821
7/03	4,222	68,499	7/27	5,346	177,167
7/04	994	69,493	7/28	1,670	178,837
7/05	3,162	72,655	7/29	1,193	180,030
7/06	3,529	76,184	7/30	947	180,977
7/07	969	77,153	7/31	1,178	182,155
7/08	1,697	78,850	8/01	947	183,102
			8/02	1,076	184,178

Table 13. Kasilof River sockeye salmon escapement summary, 1968-1992.

Year	Escapement Estimated by Sonar Count[a]	Fish used for Artificial Propogation of Tustumena Lake[b]	Sonar Count Less Egg Take[c]
1968	89,000		
1969	46,000		
1970	38,000		
1971	--		
1972	113,000		
1973	40,000		
1974	70,000	205	69,795
1975	48,000	3,365	44,635
1976	139,000	5,463	133,537
1977	155,300	1,794	153,506
1978	116,600	6,681	109,919
1979	152,179	3,024	149,155
1980	187,154	6,030	181,124
1981	256,625	9,700	246,925
1982	180,239	11,571	168,668
1983	210,271	9,903	200,368
1984	231,685	11,141	220,544
1985	505,049	11,280	493,769
1986	275,963	11,952	264,011
1987	249,246	9,865	239,381
1988	204,000[d]	9,387	195,000
1989	158,206	7,367	150,839
1990	144,136	6,831	137,305
1991	238,269	8,850	229,419
1992	184,178	6,550	177,628

[a] Multiple transducer sonar counts rounded to the nearest thousand (1968-78) from Namtvedt et al. (1979).
[b] From Cross et al. (1983): 1974-1980, FRED Div., Soldotna, Alaska files: 1981-92.
[c] Considered estimate of natural spawners above sonar site.
[d] Combined counts from weirs on Bear and Glacier Flat Creeks and surveys of remaining spawning streams.

Table 14. Distribution (percentage of total index counts) of sockeye salmon in the major tributary systems of Tustumena Lake, 1975-1992.

Year	Nikolai Creek	Moose Creek	Bear Creek	Glacier Flat Creek	Other
1975	10.2	5.9	49.9	25.9	8.1
1976	13.8	16.2	59.8	8.2	2.0
1977	25.8	14.7	51.5	5.1	2.9
1978	34.3	15.9	43.5	4.7	1.6
1979	27.1	11.5	51.0	7.9	2.5
1980	5.8	9.1	73.1	9.0	3.0
1981	21.0	7.6	43.8	23.3	4.3
1982	15.8	12.6	48.2	16.3	7.1
1983	12.0	13.5	43.4	27.1	4.0
1984	5.1	8.7	33.6	47.1	5.5
1985	6.0	3.0	43.0	44.0	4.0
1986	5.9	10.4	50.8	29.9	3.0
1987	5.3	10.4	42.2	36.2	5.9
1988	5.3	8.7	62.5	19.6	3.8
1989	4.5	15.9	58.6	18.8	2.3
1990	8.4	21.1	51.9	16.1	2.6
1991	17.4	14.6	55.6	9.7	2.6
1992	17.5	26.3	34.5[a]	15.8	5.9

[a] No counts were conducted below the weir.

Table 15. Peak sockeye salmon escapement counts in seven index areas, Kasilof River drainage, 1975-1992.

Year	Nikolai Creek[a]	Crystal Creek[a]	Clear Creek[a]	Glacier Flat Creek[b]	Seepage Creek[a]	Moose Creek[a]	Bear Creek[b]	Total Index Count[c]
1975	5,700	400	300	14,400	3,700	3,300	27,700	55,500
1976	12,000	800	300	7,100	800	14,000	51,800	86,800
1977	29,100	600	1,800	5,800	800	16,600	58,000	112,700
1978	34,200	200	200	4,700	1,100	15,900	43,400	99,700
1979	19,100	500	400	5,600	800	8,100	35,900	70,400
1980	10,000	1,000	2,100	15,500	1,800	15,600	125,000	171,000
1981	36,000	860	2,978	40,071	3,376	12,968	75,117	171,370
1982	16,800	1,785	4,183	17,348	1,638	13,400	51,350	106,504
1983	17,100	1,657	860	38,776	3,305	19,245	61,957	142,900
1984	8,270	141	2,619	76,217	6,250	13,999	54,328	161,824
1985[d]	17,500	800	3,500	121,400	5,700	9,200	120,400	278,500
1986[d]	11,900	1,400	2,700	60,600	2,000	21,200	102,900	202,700
1987	9,002	1,385	7,704	61,000	791	17,601	71,250	168,733
1988	10,841	593	5,809	40,015	1,387	17,727	127,532	203,904
1989	4,818	1,033	559	20,156	940	17,058	62,941	107,505
1990	7,474	879	220	14,355	1,217	18,800	46,300	89,245
1991	21,582	391	1,223	12,068	1,661	18,105	68,880	123,910
1992	10,145	724	1,179	9,144	349	15,235	20,000[e]	56,776

[a] Commercial Fisheries Division stream survey counts (1975-85); FRED Division stream survey counts (1986-92).
[b] FRED Division weir count, 1980-90, 1992, 1991 count is result of foot survey.
[c] Counts standardized to common unit for years when entire stream not surveyed. Relative abundance per section (when entire system was surveyed) was used to extrapolate for years when only a portion of the stream was surveyed (1975-1980). Numbers rounded to nearest hundred fish.
[d] Flagg (1986). Numbers rounded to nearest hundred fish.
[e] Fish below the weir not counted.

Table 16. Cumulative proportion by date of sockeye salmon counts recorded in the Kasilof River, 1982-1992.

Date	Cumulative Proportion[a,b]										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
09-Jun			0.007								
10-Jun	0.001	0.045	0.008								
11-Jun	0.003	0.046	0.009								
12-Jun	0.005	0.048	0.011	0.002	0.037	0.044					
13-Jun	0.007	0.050	0.012	0.003	0.041	0.051					
14-Jun	0.008	0.051	0.013	0.003	0.045	0.062	0.009				
15-Jun	0.010	0.053	0.015	0.004	0.048	0.073	0.014	0.001	0.002		0.004
16-Jun	0.011	0.056	0.018	0.004	0.053	0.091	0.018	0.002	0.004	0.009	0.014
17-Jun	0.013	0.058	0.020	0.005	0.059	0.106	0.021	0.004	0.006	0.015	0.020
18-Jun	0.015	0.060	0.022	0.005	0.062	0.120	0.025	0.006	0.008	0.019	0.031
19-Jun	0.027	0.063	0.025	0.006	0.066	0.146	0.028	0.007	0.009	0.026	0.038
20-Jun	0.035	0.065	0.031	0.007	0.068	0.171	0.032	0.011	0.010	0.033	0.050
21-Jun	0.040	0.068	0.039	0.007	0.071	0.190	0.038	0.014	0.012	0.044	0.064
22-Jun	0.043	0.070	0.048	0.008	0.073	0.198	0.046	0.016	0.014	0.056	0.082
23-Jun	0.045	0.074	0.058	0.009	0.074	0.201	0.053	0.019	0.015	0.070	0.101
24-Jun	0.049	0.076	0.069	0.012	0.075	0.206	0.065	0.021	0.017	0.085	0.125
25-Jun	0.053	0.078	0.075	0.015	0.077	0.212	0.077	0.024	0.019	0.096	0.146
26-Jun	0.055	0.080	0.080	0.017	0.079	0.218	0.089	0.031	0.022	0.110	0.174
27-Jun	0.058	0.082	0.089	0.019	0.082	0.222	0.105	0.037	0.025	0.135	0.215
28-Jun	0.061	0.085	0.099	0.022	0.085	0.227	0.133	0.046	0.030	0.171	0.250
29-Jun	0.064	0.090	0.111	0.025	0.095	0.238	0.157	0.057	0.037	0.204	0.290
30-Jun	0.069	0.110	0.123	0.029	0.121	0.249	0.173	0.074	0.051	0.238	0.323
01-Jul	0.078	0.153	0.136	0.035	0.153	0.267	0.184	0.098	0.065	0.259	0.338
02-Jul	0.091	0.165	0.150	0.039	0.180	0.297	0.189	0.153	0.076	0.275	0.349
03-Jul	0.104	0.188	0.157	0.044	0.198	0.317	0.196	0.178	0.091	0.293	0.372
04-Jul	0.115	0.212	0.178	0.056	0.215	0.334	0.224	0.183	0.120	0.338	0.377
05-Jul	0.122	0.221	0.217	0.066	0.228	0.357	0.235	0.225	0.158	0.385	0.394
06-Jul	0.129	0.231	0.243	0.071	0.245	0.385	0.255	0.277	0.193	0.400	0.414
07-Jul	0.136	0.240	0.263	0.078	0.257	0.403	0.306	0.321	0.209	0.406	0.419
08-Jul	0.145	0.247	0.304	0.095	0.261	0.422	0.329	0.346	0.235	0.417	0.428
09-Jul	0.156	0.263	0.358	0.103	0.269	0.438	0.382	0.378	0.254	0.431	0.493
10-Jul	0.164	0.294	0.391	0.114	0.289	0.450	0.457	0.404	0.258	0.450	0.453
11-Jul	0.177	0.315	0.411	0.119	0.323	0.456	0.507	0.431	0.267	0.477	0.462
12-Jul	0.197	0.344	0.416	0.126	0.337	0.481	0.567	0.488	0.281	0.488	0.522
13-Jul	0.217	0.395	0.427	0.148	0.430	0.508	0.600	0.500	0.294	0.490	0.586
14-Jul	0.247	0.465	0.445	0.208	0.501	0.520	0.614	0.514	0.303	0.492	0.598
15-Jul	0.293	0.514	0.484	0.267	0.513	0.587	0.659	0.532	0.317	0.508	0.608
16-Jul	0.358	0.547	0.543	0.382	0.528	0.600	0.676	0.566	0.350	0.523	0.617
17-Jul	0.404	0.663	0.590	0.418	0.544	0.608	0.691	0.615	0.498	0.546	0.629
18-Jul	0.491	0.759	0.636	0.432	0.562	0.619	0.703	0.629	0.602	0.615	0.645
19-Jul	0.577	0.775	0.693	0.436	0.575	0.699	0.723	0.648	0.623	0.649	0.665
20-Jul	0.642	0.785	0.739	0.439	0.586	0.731	0.770	0.711	0.664	0.661	0.705
21-Jul	0.702	0.804	0.778	0.464	0.601	0.765	0.857	0.747	0.676	0.679	0.725
22-Jul	0.744	0.822	0.810	0.551	0.611	0.809	0.921	0.768	0.687	0.710	0.740
23-Jul	0.759	0.833	0.832	0.609	0.618	0.851	0.929	0.806	0.706	0.751	0.770
24-Jul	0.769	0.842	0.864	0.649	0.627	0.873	0.935	0.816	0.723	0.781	0.844
25-Jul	0.784	0.849	0.888	0.683	0.717	0.888	0.939	0.824	0.754	0.813	0.890
26-Jul	0.800	0.854	0.910	0.733	0.795	0.897	0.943	0.840	0.776	0.849	0.933
27-Jul	0.818	0.858	0.918	0.791	0.806	0.906	0.948	0.850	0.790	0.881	0.962
28-Jul	0.836	0.862	0.926	0.826	0.812	0.916	0.953	0.860	0.808	0.914	0.971
29-Jul	0.847	0.867	0.933	0.842	0.829	0.925	0.958	0.869	0.836	0.935	0.977
30-Jul	0.857	0.874	0.939	0.853	0.888	0.939	0.961	0.877	0.856	0.947	0.983
31-Jul	0.866	0.889	0.943	0.865	0.917	0.962	0.965	0.885	0.872	0.956	0.989
01-Aug	0.876	1.000	1.000	0.875	1.000	0.975	0.969	0.892	0.885	0.960	0.994
02-Aug	0.886			0.881		0.982	0.973	0.898	0.901	0.966	1.000
03-Aug	0.895			0.890		0.986	0.977	0.905	0.916	0.973	
04-Aug	1.000			0.898		0.990	0.983	0.916	0.924	0.978	
05-Aug				0.904		0.994	0.990	0.927	0.933	0.981	

- Continued -

Table 16. (p. 2 of 2)

	Cumulative Proportion[a,b]										
Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
06-Aug				0.909		0.997	0.993	0.943	0.941	0.987	
07-Aug				0.917		1.000	0.997	0.958	0.946	0.994	
08-Aug				0.927			1.000	0.963	0.953	1.000	
09-Aug				0.938				0.969	0.963		
10-Aug				0.945				0.976	0.972		
11-Aug				0.949				0.982	0.977		
12-Aug				1.000				0.986	0.984		
13-Aug								0.990	0.989		
14-Aug								0.996	0.995		
15-Aug								1.000	1.000		
Midpoint	7/19	7/15	7/16	7/22	7/14	7/13	7/11	7/14	7/18	7/15	7/12
No. days for 80%[c]	32	33	28	28	32	41	26	33	29	33	34

[a] Number of days for 80% for years not included in table: 1979-32; 1980-34; and 1981-29.

[b] Proportion accrued on first day (1983-1988) and last day (1981-1986) represents that portion of the escapement estimated before and after enumeration activities.

[c] Inclusive dates: date proportion of escapement reached 10% through date proportion of escapement reached 90%.

Table 17. Daily adjusted fish wheel catch by species for the north bank of the Kasilof River, 26 June through 30 July 1992.

Date	Hours open[a]	Sockeye		Pink		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
26-Jun	13.0	214	214	2	2	6	6
27-Jun	14.0	171	385	2	4	2	8
28-Jun	23.6	203	588	1	5	0	8
29-Jun	7.7	131	719	0	5	0	8
30-Jun			719		5		8
01-Jul	22.5	128	847	1	6	0	8
02-Jul	33.0	58	905	1	7	1	9
03-Jul	26.4	95	1,000	2	9	1	10
04-Jul	26.1	31	1,031	1	10	0	10
05-Jul	13.5	37	1,068	0	10	2	12
06-Jul	22.0	88	1,156	1	11	1	13
07-Jul	23.3	161	1,317	1	12	5	18
08-Jul	23.7	51	1,368	0	12	3	21
09-Jul	22.1	26	1,394	0	12	2	23
10-Jul	24.9	54	1,448	2	14	2	25
11-Jul	32.3	14	1,462	2	16	2	27
12-Jul	24.5	125	1,587	1	17	9	36
13-Jul	19.3	110	1,697	1	18	4	40
14-Jul	19.0	29	1,726	1	19	11	51
15-Jul	20.1	73	1,799	4	23	4	55
16-Jul	26.5	59	1,858	3	26	2	57
17-Jul			1,858		26		57
18-Jul	43.8	45	1,903	3	29	3	60
19-Jul	24.0	33	1,936	1	30	3	63
20-Jul	28.8	60	1,996	0	30	1	64
21-Jul			1,996		30		64
22-Jul	49.3	123	2,119	2	32	3	67
23-Jul	17.8	75	2,194	0	32	0	67
24-Jul	25.6	57	2,251	1	33	1	68
25-Jul			2,251		33		68
26-Jul	12.3	304	2,555	4	37	10	78
27-Jul			2,555		37		78
28-Jul	39.0	51	2,606	2	39	4	82
29-Jul	21.0	13	2,619	0	39	5	87
30-Jul	24.8	6	2,625	3	42	1	88

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Actual total catch by species: 2,380 sockeye salmon; 40 pink salmon; 2 coho salmon; 82 chinook salmon.

Table 18. Daily adjusted fish wheel catch by species for the south bank of the Kasilof River, 3 July through 22 July 1992.

Date	Hours open[a]	Sockeye		Pink		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
03-Jul	9.4	184	184	0	0	0	0
04-Jul	24.3	40	224	2	2	0	0
05-Jul	13.6	232	456	0	2	0	0
06-Jul	21.8	82	835	0	2	0	0
07-Jul	24.2	21	559	0	2	0	0
08-Jul	23.8	11	570	1	3	2	2
09-Jul	23.8	15	585	0	3	0	2
10-Jul	24.5	18	603	0	3	0	2
11-Jul	32.3	10	613	0	3	0	2
12-Jul	23.5	15	628	0	3	6	8
13-Jul	13.3	11	639	0	3	2	10
14-Jul	24.0	9	648	0	3	1	11
15-Jul	26.3	32	680	1	4	2	13
16-Jul	26.5	44	724	0	4	5	18
17-Jul			724		4		18
18-Jul	42.8	25	749	1	5	0	18
19-Jul	24.3	22	771	0	5	5	23
20-Jul	29.0	36	807	2	7	0	23
21-Jul			807		7		23
22-Jul	46.0	39	846	3	10	3	26

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Actual total catch by species: 580 sockeye salmon; 14 pink salmon; and 30 chinook salmon.

Table 19. Age composition of sockeye salmon collected in the Kasilof River, 1969-1992.

Sample Period	Percentage Composition by Age Class[a]								Sample Size
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	Other	
6/15-6/30	0.0	10.5	53.6	0.0	0.0	7.6	28.3	0.0	531
7/01-7/15	0.0	20.4	24.3	0.0	0.0	37.9	17.5	0.0	497
7/16-7/22	0.0	29.7	6.5	0.0	0.2	59.1	4.4	0.0	553
7/23-8/02	0.0	31.0	9.9	0.0	0.8	53.4	5.0	0.0	525
Seasonal Summary									
1969	0.0	14.0	39.0	1.0	0.0	30.0	16.0	0.0	399
1970	tr	32.0	37.0	2.0	0.0	16.0	11.0	2.0	297
1971	0.0	6.0	69.0	0.0	0.0	8.0	16.0	1.0	153
1972	tr	42.0	36.0	1.0	tr	3.0	18.0	0.0	668
1973	0.0	20.0	57.0	0.0	0.0	19.0	4.0	0.0	374
1974	0.0	35.0	59.0	0.0	tr	4.0	2.0	0.0	254
1975	1.0	29.0	7.0	0.0	0.0	58.0	4.0	1.0	931
1976	tr	32.0	20.0	0.0	tr	35.0	12.0	1.0	755
1977	tr	30.0	30.0	0.0	1.0	28.0	11.0	0.0	1,209
1978	0.0	42.0	35.0	0.0	0.0	14.0	9.0	0.0	967
1979	0.0	52.2	37.2	0.0	tr	8.4	1.7	0.5	590
1980	0.0	58.7	27.8	0.0	0.0	8.0	4.5	1.0	899
1981	0.0	30.2	62.2	0.0	0.0	6.0	1.6	0.0	1,479
1982	1.0	34.0	49.5	0.0	0.1	10.7	4.7	0.0	1,518
1983	0.0	48.4	34.3	0.0	0.0	12.8	4.5	0.0	1,997
1984	0.0	50.5	24.8	tr	0.2	17.9	6.6	0.0	2,269
1985	0.2	57.3	21.8	0.1	0.1	17.8	2.6	0.1	3,063
1986	0.0	40.9	42.0	0.3	0.1	11.9	4.6	0.2	1,660
1987		43.4	27.4	0.0	0.1	22.4	6.4	0.3	1,248
1988	0.9	37.5	32.9	0.1	0.1	18.6	10.6	0.2	2,282
1989	0.2	44.0	46.3	0.2	0.0	5.2	4.2	0.0	1,216
1990	0.4	32.9	20.7	0.3	0.0	33.2	12.4	0.3	762
1991	0.0	31.5	33.4	0.1	0.1	29.0	5.8	0.1	2,106
1992	0.0	21.2	27.6	0.0	0.2	35.0	15.9	0.0	1,717

[a] Percentages weighted by total numbers in the escapement: 1979-1992.

Table 20. Length composition of the major age classes of sockeye salmon collected in the Kasilof River, 1980-1992. Length measured from mid-eye to fork-of-tail.

		Male			Female			Total			
Year	Age Class	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ratio Male-Female
1980	1.2	474	2	189	464	1	376	467		565	0.5:1
1981		503	2	241	492	3	146	499		387	1.7:1
1982		481	2	285	466	2	235	474	2	475	1.2:1
1983		493	2	113	491	3	78	492	2	191	1.4:1
1984		480	1	544	478	1	428	479	1	972	2.6:1
1985		474	1	723	472	1	897	473	1	1,620	0.8:1
1986		482	2	266	482	1	368	482	1	634	0.7:1
1987		472	2	282	470	2	257	471	1	539	1.1:1
1988		480	1	353	477	1	480	478	1	833	0.7:1
1989		481	2	245	480	2	290	480	1	535	0.8:1
1990		462	0	139	458	0	91	460	0	230	1.5:1
1991		467	2	326	461	2	305	464	1	631	1.1:1
1992		467	2	184	466	2	212	466	1	396	0.9:1
1980	1.3	531	7	35	516	2	115	520		150	0.3:1
1981		566	1	422	558	1	369	562		791	1.1:1
1982		549	1	377	542	1	428	545	1	805	0.9:1
1983		558	2	170	547	2	187	552	1	357	0.9:1
1984		539	1	304	533	1	383	535	1	687	0.8:1
1985		531	2	341	527	1	433	529	1	774	0.8:1
1986		550	2	342	543	1	405	546	1	747	0.8:1
1987		553	2	191	552	2	154	552	2	345	1.2:1
1988		550	1	311	543	1	382	546	1	693	0.8:1
1989		550	2	266	542	2	296	546	1	562	0.9:1
1990		518	0	81	523	0	106	521	0	187	0.8:1
1991		531	1	418	518	1	335	525	1	753	1.3:1
1992		536	2	195	527	2	197	531	1	392	1.0:1
1982	2.2	479	3	65	472	3	81	475	3	146	0.8:1
1984		484	2	202	482	1	223	483	1	425	0.9:1
1985		482	2	248	476	1	319	479	1	567	0.8:1
1986		492	4	78	489	2	115	490	2	193	0.7:1
1987		478	2	137	475	2	141	476	2	278	1.0:1
1988		486	2	173	479	1	220	482	1	393	0.8:1
1990		453	0	104	457	0	111	455	0	215	0.9:1
1991		471	2	289	480	11	301	475	5	590	1.0:1
1992		464	2	264	464	1	427	464	1	691	0.6:1
1982	2.3	548	4	41	543	4	40	546	4	86	1.0:1
1984		533	3	102	526	3	80	530	2	182	1.3:1
1988		544	2	104	543	2	115	543	2	219	0.9:1
1990		514	0	63	529	0	61	522	0	124	1.0:1
1991		516	4	61	514	3	64	515	2	125	1.0:1
1992		534	3	112	532	2	122	533	2	234	0.9:1

Table 21. Estimated salmon escapement into the Crescent River, north and south banks combined, 1 July through 2 August 1992. Species composition based on trap catches.

	Sockeye		Pink		Chum		Coho		Chinook	
Date	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
7/01	2,604	2,604	0	0	33	33	0	0	16	16
7/02	1,595	4,199	0	0	20	53	0	0	11	27
7/03	1,397	5,596	0	0	17	70	0	0	9	36
7/04	1,076	6,672	0	0	14	84	0	0	7	43
7/05	1,382	8,054	0	0	17	101	0	0	9	52
7/06	860	8,914	0	0	11	112	0	0	6	58
7/07	357	9,271	0	0	5	117	0	0	2	60
7/08	791	10,062	0	0	10	127	0	0	5	65
7/09	1,116	11,178	0	0	14	141	0	0	7	72
7/10	1,192	12,370	0	0	16	157	0	0	7	79
7/11	1,790	14,160	0	0	23	180	0	0	11	90
7/12	2,782	16,942	0	0	36	216	0	0	18	108
7/13	2,438	19,380	0	0	31	247	0	0	16	124
7/14	2,425	21,805	0	0	32	279	0	0	15	139
7/15	2,627	24,432	0	0	34	313	0	0	16	155
7/16	2,269	26,701	0	0	28	341	0	0	15	170
7/17	2,872	29,573	78	78	137	478	0	0	0	170
7/18	1,597	31,170	44	122	76	554	0	0	0	170
7/19	1,977	33,147	54	176	94	648	0	0	0	170
7/20	2,114	35,261	57	233	101	749	0	0	0	170
7/21	2,526	37,787	69	302	120	869	0	0	0	170
7/22	2,806	40,593	76	378	134	1,003	0	0	0	170
7/23	4,160	44,753	113	491	198	1,201	0	0	0	170
7/24	3,412	48,165	94	585	162	1,363	0	0	0	170
7/25	2,714	50,879	74	659	129	1,492	0	0	0	170
7/26	2,046	52,925	55	714	98	1,590	0	0	0	170
7/27	744	53,669	0	714	717	2,307	41	41	0	170
7/28	789	54,458	0	714	759	3,066	43	84	0	170
7/29	1,045	55,503	0	714	1,008	4,074	57	141	0	170
7/30	629	56,132	0	714	606	4,680	34	175	0	170
7/31	767	56,899	0	714	739	5,419	42	217	0	170
8/01	631	57,530	0	714	608	6,027	34	251	0	170
8/02	699	58,229	0	714	674	6,701	38	289	0	170

Table 22. Daily fish trap and gillnet catch by species for the Crescent River, 2 July through 2 August 1992.

	Sockeye		Pink		Chum		Coho	
Date	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
02-Jul	10	10	0	0	0	0	0	0
03-Jul	0	10	0	0	0	0	0	0
04-Jul	2	12	0	0	0	0	0	0
05-Jul	5	17	0	0	0	0	0	0
06-Jul	0	17	0	0	0	0	0	0
07-Jul	0	17	0	0	0	0	0	0
08-Jul	13	30	0	0	0	0	0	0
09-Jul	38	68	0	0	0	0	0	0
10-Jul	22	90	0	0	0	0	0	0
11-Jul	13	103	0	0	0	0	0	0
12-Jul[a]	11	114	0	0	0	0	0	0
13-Jul	10	124	0	0	0	0	0	0
14-Jul	7	131	0	0	1	1	0	0
15-Jul	10	141	0	0	1	2	0	0
16-Jul	16	157	0	0	0	2	0	0
17-Jul	11	168	0	0	0	2	0	0
18-Jul	8	176	0	0	0	2	0	0
19-Jul	18	194	0	0	1	3	0	0
20-Jul	27	221	2	2	0	3	0	0
21-Jul	11	232	0	2	1	4	0	0
22-Jul	18	250	1	3	1	5	0	0
23-Jul	10	260	1	4	2	7	0	0
24-Jul	13	273	0	4	0	7	0	0
25-Jul	15	288	0	4	1	8	0	0
26-Jul	16	304	0	4	1	9	0	0
27-Jul	4	308	0	4	5	14	0	0
28-Jul	13	321	0	4	6	20	0	0
29-Jul	11	332	0	4	9	29	0	0
30-Jul	11	343	0	4	5	34	0	0
31-Jul	3	346	0	4	11	45	0	0
01-Aug	3	349	0	4	9	54	3	3
02-Aug	10	359	0	4	8	62	0	3

[a] One chinook salmon was captured on 12 July.

Table 23. Cumulative proportion by date of sockeye salmon counts recorded in the Crescent River, 1983-1992.

	Cumulative Proportion[a,b]									
Date	1983	1984[c]	1985	1986[d]	1987	1988	1989	1990	1991	1992
15-Jun		0.000	0.000							
16-Jun		0.001	0.000							
17-Jun		0.002	0.000							
18-Jun		0.003	0.000							
19-Jun		0.003	0.000							
20-Jun		0.005	0.001							
21-Jun		0.008	0.001							
22-Jun		0.012	0.001							
23-Jun		0.017	0.001							
24-Jun		0.020	0.001							
25-Jun		0.024	0.001	0.000						
26-Jun		0.027	0.001	0.000				0.003	0.002	
27-Jun		0.036	0.002	0.000				0.007	0.004	
28-Jun		0.041	0.002	0.001				0.013	0.005	
29-Jun		0.049	0.005	0.005				0.021	0.010	
30-Jun		0.069	0.007	0.008				0.025	0.013	
01-Jul	0.000	0.081	0.008	0.017	0.012	0.008	0.008	0.034	0.017	0.045
02-Jul	0.000	0.100	0.012	0.031	0.016	0.038	0.020	0.055	0.031	0.072
03-Jul	0.001	0.118	0.016	0.054	0.020	0.149	0.043	0.065	0.033	0.096
04-Jul	0.002	0.140	0.057	0.077	0.023	0.223	0.096	0.077	0.040	0.115
05-Jul	0.019	0.156	0.138	0.084	0.027	0.269	0.129	0.098	0.061	0.138
06-Jul	0.041	0.170	0.188	0.094	0.058	0.338	0.181	0.128	0.063	0.153
07-Jul	0.068	0.184	0.196	0.110	0.084	0.404	0.231	0.141	0.064	0.159
08-Jul	0.098	0.225	0.226	0.126	0.112	0.488	0.293	0.155	0.079	0.173
09-Jul	0.118	0.268	0.251	0.134	0.160	0.554	0.334	0.184	0.090	0.192
10-Jul	0.137	0.322	0.274	0.144	0.193	0.581	0.369	0.207	0.092	0.212
11-Jul	0.167	0.360	0.293	0.154	0.243	0.598	0.412	0.264	0.100	0.243
12-Jul	0.207	0.387	0.319	0.165	0.269	0.625	0.463	0.286	0.131	0.291
13-Jul	0.266	0.409	0.364	0.184	0.305	0.655	0.502	0.299	0.143	0.333
14-Jul	0.338	0.425	0.388	0.197	0.333	0.688	0.502	0.321	0.188	0.374
15-Jul	0.392	0.454	0.415	0.204	0.370	0.692	0.518	0.345	0.245	0.420
16-Jul	0.431	0.499	0.445	0.213	0.386	0.697	0.611	0.393	0.292	0.459
17-Jul	0.457	0.548	0.480		0.406	0.717	0.674	0.472	0.355	0.508
18-Jul	0.499	0.599	0.506		0.448	0.748	0.691	0.540	0.425	0.535
19-Jul	0.559	0.639	0.525		0.513	0.771	0.710	0.574	0.461	0.569
20-Jul	0.617	0.684	0.546		0.548	0.781	0.750	0.610	0.497	0.606
21-Jul	0.667	0.721	0.573		0.593	0.808	0.776	0.653	0.524	0.649
22-Jul	0.702	0.743	0.596		0.671	0.828	0.804	0.705	0.582	0.697
23-Jul	0.732	0.783	0.632		0.773	0.853	0.829	0.742	0.649	0.769
24-Jul	0.764	0.802	0.665		0.819	0.885	0.855	0.762	0.688	0.827
25-Jul	0.787	0.813	0.698		0.856	0.917	0.884	0.801	0.718	0.874
26-Jul	0.813	0.824	0.729		0.877	0.941	0.907	0.839	0.753	0.909
27-Jul	0.839	0.838	0.756		0.893	0.959	0.930	0.864	0.801	0.922
28-Jul	0.858	0.852	0.775		0.905	0.965	0.958	0.880	0.836	0.935
29-Jul	0.881	0.870	0.794		0.915	0.976	0.968	0.896	0.866	0.953
30-Jul	0.915	0.882	0.821		0.920	0.989	0.978	0.933	0.885	0.964
31-Jul	0.945	0.893	1.000		0.938	1.000	0.994	0.956	0.916	0.977
01-Aug	1.000	1.000			0.960		1.000	0.973	0.966	0.988
02-Aug					0.975			0.986	0.978	1.000
03-Aug					0.985			0.993	0.984	
04-Aug					0.994			1.000	0.987	
05-Aug					0.996				0.992	
06-Aug					1.000				0.996	
07-Aug									1.000	

- Continued -

Table 23. (p. 2 of 2)

	Cumulative Proportiona[a,b]									
Date	1983	1984[c]	1985	1986[d]	1987	1988	1989	1990	1991	1992
Midpoint	7/19	7/17	7/18		7/19	7/09	7/15	7/18	7/21	7/17
No. days[e] for 80%	22+	31+	26+		21	23	22	25	21	23

[a] Number of days for 80% for years not included in table: 1979-23; 1980-23; 1981-29, and 1982-21+.
[b] Proportion accrued on last day (1981-1985) represents that portion of the escapement estimated after enumeration activities.
[c] The enumeration site was moved from the outlet of Crescent Lake to approximately 2 miles above the terminus of the river at Cook Inlet in 1984.
[d] Enumeration activities terminated on 16 July 1986. Estimated proportions from King and Tarbox (1988).
[e] Inclusive dates: date proportion of escapement reached 10% through date proportion of escapement reached 90%.

Table 24. Age composition of sockeye salmon collected in the Crescent River, 1979-1992.

	Percentage Composition by Age Class[a]								
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	Other	Sample Size
Seasonal Summary									
1979	tr	27.8	70.1	0.0	0.0	tr	tr	tr	643
1980	0.0	6.5	86.9	0.0	0.0	2.9	1.6	2.1	511
1981	0.0	8.2	32.1	0.0	0.0	9.6	49.9	tr	1,117
1982	0.0	12.9	79.2	0.1	0.0	0.8	7.0	0.0	711
1983	0.0	10.9	42.2	0.2	0.7	27.4	18.6	0.0	731
1984	0.0	3.5	16.9	0.0	0.0	20.0	59.4	tr	780
1985	0.2	4.7	31.3	0.0	0.3	20.5	43.0	0.0	594
1986	0.0	6.5	15.8	0.0	0.0	13.0	64.0	0.7	139
1987	0.0	2.6	47.7	0.0	0.0	4.2	45.0	0.5	191
1988	0.0	10.4	44.9	0.5	0.1	17.8	26.1	0.1	741
1989	0.0	2.6	84.2	0.6	0.0	0.6	15.0	0.1	728
1990	0.0	3.7	48.5	0.4	0.1	3.5	43.2	0.5	591
1991	0.0	14.9	50.4	0.3	0.0	16.8	16.5	1.1	357
1992	0.0	2.6	21.7	0.0	0.0	12.4	61.9	1.6	194

[a] Percentages weighted by total numbers in the escapement: 1979-1981, 1986-1992.

Table 25. Length composition of the major age classes of sockeye salmon collected in the Crescent River, 1980-1992. Length measured from mid-eye to fork-of-tail.

		Male			Female			Total			
Year	Age Class	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ratio Male-Female
1980	1.2	472	6	47	471	7	31	472		78	1.5:1
1981		522	9	59	491	9	33	511	9	92	1.8:1
1982		467	6	47	487	7	25	474	5	72	1.9:1
1991		517	6	36	490	8	17	509	5	53	2.1:1
1980	1.3	568	2	167	549	2	223	557		390	0.7:1
1981		576	3	121	555	3	172	564		293	0.7:1
1982		586	1	303	556	1	259	572	1	562	1.2:1
1983		570	2	111	542	2	169	553	1	280	0.7:1
1984		574	5	60	552	2	72	562	3	132	0.8:1
1985		565	4	75	551	2	111	557	2	186	0.7:1
1987		601	3	54	573	3	37	590	2	91	1.5:1
1988		581	2	195	550	2	138	567	1	333	1.4:1
1989		593	1	320	561	2	271	578	1	591	1.2:1
1990		592	3	184	571	0	120	584	0	304	1.5:1
1991		560	3	105	543	3	75	553	2	180	1.4:1
1992		555	9	24	535	5	18	546	6	42	1.3:1
1981	2.2	487	6	40	519	5	57	506		97	0.7:1
1983		494	4	93	488	3	89	491	3	182	1.0:1
1984		499	4	81	507	4	75	503	3	156	1.1:1
1985		496	5	75	490	4	47	494	4	122	1.6:1
1988		487	5	72	496	4	60	491	3	132	1.2:1
1991		515	5	42	498	6	18	510	4	60	2.3:1
1992		486	12	10	492	5	14	490	6	24	0.7:1
1980	2.3	584	2	158	554	2	237	566		395	0.7:1
1983		569	4	43	550	2	80	556	2	123	0.5:1
1984		581	2	261	553	2	202	569	1	463	1.3:1
1985		568	4	94	551	2	161	557	2	255	0.6:1
1986		573	5	44	556	3	45	564	3	89	1.0:1
1987		595	4	49	573	3	37	586	3	86	1.3:1
1988		585	3	110	556	2	83	572	2	193	1.3:1
1989		594	3	72	568	3	37	586	2	109	1.9:1
1990		601	0	165	571	0	72	592	0	237	2.3:1
1991		558	4	36	537	4	23	550	3	59	1.6:1
1992		572	4	58	547	3	62	559	2	120	0.9:1

Table 26. Estimated salmon escapement into the Yentna River, north and south banks combined, 7 July through 11 August 1992. Species composition of daily sonar counts based on fish wheel catches.

	Sockeye		Pink		Chum		Coho		Chinook	
Date	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
7/07	150	150	71	71	21	21	17	17	8	8
7/08	76	226	33	104	11	32	8	25	4	12
7/09	126	352	36	140	12	44	12	37	6	18
7/10	118	470	41	181	12	56	13	50	5	23
7/11	83	553	20	201	7	63	7	57	4	27
7/12	110	663	31	232	10	73	11	68	5	32
7/13	136	799	43	275	13	86	14	82	6	38
7/14	286	1,085	86	361	28	114	27	109	14	52
7/15	387	1,472	149	510	32	146	25	134	8	60
7/16	870	2,342	288	798	59	205	49	183	14	74
7/17	1,734	4,076	511	1,309	102	307	221	404	1	75
7/18	1,574	5,650	931	2,240	126	433	248	652	1	76
7/19	2,246	7,896	1,723	3,963	110	543	269	921	2	78
7/20	1,894	9,790	2,734	6,697	246	789	418	1,339	2	80
7/21	2,351	12,141	5,255	11,952	198	987	421	1,760	0	80
7/22	3,016	15,157	6,617	18,569	243	1,230	520	2,280	0	80
7/23	4,417	19,574	11,489	30,058	555	1,785	799	3,079	1	81
7/24	5,049	24,623	20,714	50,772	506	2,291	1,913	4,992	0	81
7/25	4,944	29,567	26,180	76,952	1,024	3,315	2,711	7,703	0	81
7/26	4,748	34,315	32,841	109,793	2,009	5,324	2,267	9,970	0	81
7/27	5,737	40,052	24,555	134,348	2,124	7,448	1,523	11,493	0	81
7/28	4,477	44,529	25,428	159,776	987	8,435	1,936	13,429	0	81
7/29	3,973	48,502	19,890	179,666	854	9,289	1,425	14,854	0	81
7/30	3,964	52,466	15,438	195,104	1,062	10,351	1,701	16,555	0	81
7/31	2,066	54,532	11,259	206,363	1,043	11,394	1,694	18,249	2	83
8/01	2,140	56,672	8,748	215,111	2,240	13,634	1,872	20,121	0	83
8/02	1,555	58,227	6,026	221,137	2,447	16,081	1,333	21,454	17	100
8/03	994	59,221	4,044	225,181	1,299	17,380	897	22,351	0	100
8/04	919	60,140	3,122	228,303	1,083	18,463	656	23,007	0	100
8/05	310	60,450	1,654	229,957	915	19,378	647	23,654	0	100
8/06	446	60,896	1,390	231,347	937	20,315	437	24,091	0	100
8/07	476	61,372	1,171	232,518	709	21,024	405	24,496	0	100
8/08	821	62,193	1,808	234,326	1,389	22,413	674	25,170	7	107
8/09	1,654	63,847	2,734	237,060	2,890	25,303	1,389	26,559	0	107
8/10	1,169	65,016	1,495	238,555	2,975	28,278	1,608	28,167	0	107
8/11	1,058	66,074	807	239,362	1,783	30,061	905	29,072	0	107

Table 27. Salmon escapement observations in Susitna River tributaries, 1992.

			Number of Fish Observed or Estimated				
	Method	Source	Sockeye	Pink	Chum	Coho	Chinook
Chelatna Lake	mark/recap	[a]	20,000				
Deception Creek		[b]					983
Rabideux Creek		[b]					
Birch Creek		[b]				167	
Question Creek		[b]				227	
Answer Creek		[b]				181	
Goose Creek		[b]					369
Little Willow Creek		[b]					673
Montana Creek		[b]					1,560
Prairie Creek		[b]					4,453
Sheep Creek		[b]					
Willow Creek		[b]					1,660
Alexander Creek		[b]					3,710
Deshka River		[b]					7,736
Lake Creek		[b]					2,322
Peters Creek		[b]					851

[a] Cook Inlet Aquaculture Association records, Soldotna. Chelatna Lake count is preliminary estimate, personal communication, Gary Fandrei, Cook Inlet Aquaculture Association, Soldotna.

[b] Sport Fish Division records, Alaska Department of Fish and Game, Palmer.

Table 28. Cumulative proportion by date of sockeye salmon counts recorded in the Yentna River, 1983-1992.

	Cumulative Proportion[a,b]									
Date	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
29-Jun				0.001						
30-Jun	0.000			0.002						
01-Jul	0.001	0.001	0.000	0.002	0.000					
02-Jul	0.001	0.001	0.001	0.003	0.001					
03-Jul	0.002	0.002	0.001	0.003	0.001					
04-Jul	0.003	0.003	0.001	0.004	0.002					
05-Jul	0.003	0.004	0.001	0.005	0.002					
06-Jul	0.004	0.004	0.002	0.005	0.003					
07-Jul	0.004	0.005	0.003	0.006	0.003	0.004	0.003	0.002	0.000	0.002
08-Jul	0.004	0.005	0.003	0.006	0.004	0.008	0.006	0.005	0.001	0.003
09-Jul	0.005	0.006	0.004	0.007	0.004	0.012	0.009	0.008	0.001	0.005
10-Jul	0.005	0.007	0.005	0.008	0.005	0.016	0.012	0.010	0.002	0.007
11-Jul	0.006	0.009	0.006	0.009	0.005	0.019	0.014	0.013	0.002	0.008
12-Jul	0.008	0.011	0.007	0.010	0.005	0.022	0.015	0.014	0.002	0.010
13-Jul	0.011	0.012	0.008	0.011	0.006	0.025	0.016	0.016	0.003	0.012
14-Jul	0.034	0.015	0.009	0.011	0.007	0.029	0.019	0.017	0.003	0.016
15-Jul	0.059	0.017	0.010	0.014	0.008	0.034	0.023	0.019	0.004	0.022
16-Jul	0.096	0.023	0.010	0.022	0.010	0.039	0.026	0.020	0.005	0.035
17-Jul	0.131	0.142	0.011	0.027	0.014	0.043	0.051	0.022	0.005	0.062
18-Jul	0.179	0.232	0.012	0.036	0.020	0.046	0.103	0.025	0.009	0.086
19-Jul	0.351	0.345	0.013	0.041	0.027	0.091	0.161	0.105	0.028	0.120
20-Jul	0.567	0.458	0.014	0.042	0.034	0.197	0.202	0.217	0.100	0.148
21-Jul	0.693	0.554	0.014	0.043	0.047	0.270	0.234	0.284	0.193	0.184
22-Jul	0.722	0.626	0.016	0.052	0.059	0.304	0.280	0.327	0.302	0.229
23-Jul	0.758	0.681	0.019	0.162	0.107	0.375	0.359	0.383	0.378	0.296
24-Jul	0.786	0.755	0.145	0.193	0.218	0.484	0.453	0.452	0.425	0.373
25-Jul	0.824	0.785	0.359	0.253	0.331	0.630	0.532	0.505	0.451	0.447
26-Jul	0.867	0.808	0.507	0.371	0.442	0.771	0.646	0.573	0.505	0.519
27-Jul	0.894	0.836	0.636	0.491	0.528	0.821	0.749	0.667	0.575	0.606
28-Jul	0.905	0.855	0.782	0.606	0.587	0.858	0.799	0.734	0.637	0.674
29-Jul	0.913	0.866	0.903	0.752	0.625	0.886	0.854	0.769	0.674	0.734
30-Jul	0.921	0.874	0.942	0.831	0.655	0.916	0.864	0.796	0.720	0.794
31-Jul	0.925	0.885	0.960	0.861	0.686	0.937	0.868	0.825	0.754	0.825
01-Aug	0.929	0.893	0.970	0.882	0.709	0.947	0.873	0.859	0.779	0.858
02-Aug	0.937	0.901	0.978	0.908	0.750	0.960	0.879	0.907	0.806	0.881
03-Aug	0.941	0.909	0.983	0.917	0.789	0.969	0.889	0.947	0.850	0.896
04-Aug	0.945	0.920	0.987	0.924	0.825	0.975	0.907	0.962	0.891	0.910
05-Aug	0.949	0.926	0.990	0.935	0.857	0.981	0.923	0.971	0.930	0.915
06-Aug	0.953	0.934	0.994	0.940	0.875	0.984	0.936	0.978	0.942	0.922
07-Aug	0.955	0.939	0.997	1.000	0.889	0.989	0.944	0.985	0.959	0.929
08-Aug	0.958	0.944	1.000		0.900	0.992	0.949	0.990	0.975	0.941
09-Aug	0.959	0.949			0.932	0.994	0.954	0.994	0.986	0.966
10-Aug	0.959	0.954			0.962	0.996	0.958	0.995	0.994	0.984
11-Aug	0.962	0.958			0.986	1.000	0.962	0.998	0.999	1.000
12-Aug	0.968	0.962			0.996		0.966	1.000	1.000	
13-Aug	0.974	0.965			1.000		0.975			
14-Aug	0.977	0.968					0.985			
15-Aug	0.979	0.970					0.992			
16-Aug	0.982	0.973					0.995			
17-Aug	0.985	0.975					0.997			
18-Aug	0.987	0.977					0.998			
19-Aug	0.988	0.979					0.999			

-Continued-

Table 28. (p. 2 of 2)

Date	Cumulative Proportion[a,b] 1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
20-Aug	0.990	0.980					1.000			
21-Aug	0.991	0.981								
22-Aug	0.992	0.984								
23-Aug	0.993	0.987								
24-Aug	0.994	0.989								
25-Aug	0.994	0.992								
26-Aug	0.995	0.994								
27-Aug	0.996	0.996								
28-Aug	0.997	0.996								
29-Aug	0.998	0.998								
30-Aug	0.998	0.999								
31-Aug	0.999	0.999								
01-Sep	0.999	1.000								
02-Sep	0.999	1.000								
03-Sep	0.999	1.000								
04-Sep	1.000	1.000								
Midpoint	7/20	7/21	7/26	7/28	7/27	7/25	7/25	7/25	7/26	7/26
No. days for 80%[c]	12	17	6	11+	17	11	18	15	17	17

[a] Number of days for 80% for 1981-14; and 1982-14.
[b] Proportion accrued on last day (1986) represents that portion of the escapement estimated after termination of enumeration activities.
[c] Inclusive dates: date proportion of escapement reached 10% through date proportion of escapement reached 90%.

Table 29. Daily adjusted fish wheel catch by species for the north bank of the Yentna River, 8 July through 11 August 1992.

Date	Hours open[a]	Sockeye		Pink		Chum		Coho		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
08-Jul	5.25	0	0	0	0	0	0	0	0	0	0
09-Jul	22.42	3	3	1	1	0	0	0	0	1	1
10-Jul	20.67	0	3	2	3	0	0	0	0	0	1
11-Jul	17.33	3	6	0	3	0	0	1	1	0	1
12-Jul	24.25	1	7	1	4	1	1	0	1	2	3
13-Jul	23.17	3	10	4	8	1	2	1	2	0	3
14-Jul	24.83	7	17	4	12	4	6	2	4	1	4
15-Jul	32.70	24	41	23	35	14	20	2	6	0	4
16-Jul	15.77	38	79	76	111	11	31	11	17	2	6
17-Jul	24.08	25	104	22	133	8	39	2	19	0	6
18-Jul	22.92	21	125	57	190	8	47	5	24	0	6
19-Jul	22.83	33	158	82	272	16	63	15	39	1	7
20-Jul	21.54	32	190	224	496	32	95	22	61	1	8
21-Jul	15.25	39	229	381	877	28	123	28	89	0	8
22-Jul	17.97	21	250	346	1,223	20	143	20	109	0	8
23-Jul	20.09	47	297	710	1,933	37	180	47	156	1	9
24-Jul	12.45	71	368	999	2,932	50	230	46	202	0	9
25-Jul	5.25	87	455	1422	4,354	73	303	81	283	0	9
26-Jul	6.49	59	514	1087	5,441	63	366	29	312	0	9
27-Jul	6.17	109	623	1393	6,834	152	518	66	378	0	9
28-Jul	4.75	71	694	1445	8,279	172	690	51	429	0	9
29-Jul	7.88	18	712	1075	9,354	43	733	37	466	0	9
30-Jul	10.17	50	762	776	10,130	158	891	30	496	0	9
31-Jul	9.24	47	809	1062	11,192	119	1,010	52	548	3	12
01-Aug	7.95	30	839	827	12,019	166	1,176	85	633	0	12
02-Aug	10.41	21	860	618	12,637	194	1,370	65	698	0	12
03-Aug	12.87	18	878	296	12,933	76	1,446	42	740	0	12
04-Aug	17.42	22	900	247	13,180	72	1,518	10	750	0	12
05-Aug	15.62	12	912	94	13,274	37	1,555	9	759	0	12
06-Aug	8.86	32	944	97	13,371	83	1,638	21	780	0	12
07-Aug	23.00	33	977	91	13,462	80	1,718	18	798	0	12
08-Aug	25.09	51	1,028	193	13,655	153	1,871	39	837	2	14
09-Aug	22.16	54	1,082	143	13,798	168	2,039	34	871	0	14
10-Aug	21.89	41	1,123	39	13,837	186	2,225	53	924	0	14
11-Aug	22.92	40	1,163	32	13,869	85	2,310	36	960	0	14

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Actual catch: 636 sockeye salmon; 5,867 pink salmon; 1,345 chum salmon; 509 coho salmon; 13 chinook salmon.

Table 30. Daily adjusted fish wheel catch by species for the south bank of the Yentna River, 7 July through 11 August 1992.

Date	Hours open[a]	Sockeye		Pink		Chum		Coho		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
07-Jul	13.13	4	4	0	0	0	0	0	0	0	0
08-Jul	22.75	6	10	0	0	0	0	0	0	0	0
09-Jul	25.30	11	21	5	5	1	1	0	0	2	2
10-Jul	23.24	5	26	1	6	0	1	3	3	0	2
11-Jul	22.25	9	35	0	6	0	1	3	6	2	4
12-Jul	23.66	3	38	3	9	2	3	3	9	1	5
13-Jul	23.19	7	45	2	11	0	3	0	9	1	6
14-Jul	22.00	84	129	7	18	4	7	1	10	0	6
15-Jul	21.82	95	224	19	37	4	11	0	10	0	6
16-Jul	22.33	92	316	25	62	3	14	8	18	2	8
17-Jul	22.99	182	498	40	102	8	22	22	40	0	8
18-Jul	21.42	174	672	86	188	10	32	26	66	0	8
19-Jul	21.58	237	909	162	350	6	38	26	92	0	8
20-Jul	18.92	291	1200	370	720	30	68	60	152	0	8
21-Jul	12.13	419	1619	851	1,571	28	96	69	221	0	8
22-Jul	10.17	463	2082	946	2,517	33	129	76	297	0	8
23-Jul	10.27	339	2421	832	3,349	40	169	58	355	0	8
24-Jul	10.56	332	2753	1,259	4,608	27	196	123	478	0	8
25-Jul	10.58	286	3039	1,318	5,926	48	244	150	628	0	8
26-Jul	9.64	319	3358	1,939	7,865	120	364	152	780	0	8
27-Jul	7.90	692	4050	2,545	10,410	206	570	167	947	0	8
28-Jul	8.16	461	4511	2,347	12,757	61	631	194	1,141	0	8
29-Jul	7.83	603	5114	2,752	15,509	119	750	208	1,349	0	8
30-Jul	8.14	465	5579	1,769	17,278	114	864	199	1,548	0	8
31-Jul	8.91	277	5856	1,435	18,713	131	995	226	1,774	0	8
01-Aug	12.87	179	6035	641	19,354	170	1,165	149	1,923	0	8
02-Aug	13.21	183	6218	596	19,950	254	1,419	147	2,070	2	10
03-Aug	15.48	158	6376	586	20,536	193	1,612	136	2,206	0	10
04-Aug	18.34	130	6506	407	20,943	144	1,756	94	2,300	0	10
05-Aug	21.43	48	6554	243	21,186	141	1,897	107	2,407	0	10
06-Aug	21.88	94	6648	295	21,481	185	2,082	100	2,507	0	10
07-Aug	17.51	89	6737	213	21,694	114	2,196	82	2,589	0	10
08-Aug	24.84	80	6817	142	21,836	107	2,303	67	2,656	0	10
09-Aug	21.50	175	6992	242	22,078	241	2,544	157	2,813	0	10
10-Aug	15.50	142	7134	192	22,270	297	2,841	198	3,011	0	10
11-Aug	20.16	118	7252	89	22,359	189	3,030	100	3,111	0	10

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Actual catch: 3,887 sockeye salmon; 9,966 pink salmon; 1,940 chum salmon; 1,737 coho salmon; 9 chinook salmon.

Table 31. Age composition of sockeye salmon collected in the Yentna River, 1986-1992.

Sample Period	Percentage Composition by Age Class[a]											Sample Size
	0.2	0.3	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.2	
7/07-7/18	0.5	0.3	0.3	36.6	29.4	0.0	0.0	15.0	17.8	0.3	0.0	388
7/19-7/24	0.9	0.3	0.0	32.2	23.9	0.0	0.3	21.1	21.1	0.0	0.3	351
7/25-7/29	0.3	0.0	0.0	26.3	31.1	0.0	0.0	18.0	24.0	0.0	0.3	312
7/30-8/11	4.5	2.0	3.5	34.5	33.7	0.3	1.3	11.5	7.8	0.3	0.8	400
Seasonal Summary												
1986	0.0	2.1	1.9	22.7	56.5	0.2	0.6	5.9	10.0	0.1		492
1987	1.3	2.4	0.9	23.3	50.6	1.0	0.0	8.6	11.7	0.0		1,089
1988	2.7	2.4	0.4	33.5	41.9	0.2	1.7	6.5	10.4	0.1		1,727
1989	0.2	0.2	1.3	27.2	63.5	0.4	0.2	3.0	4.0	0.0		1,362
1990	0.8	2.4	0.3	29.9	47.6	0.7	0.1	9.8	8.2	0.1		1,710
1991	2.0	10.1	0.1	25.2	44.1	0.1	0.1	7.0	11.1	0.1		1,509
1992	1.6	0.6	1.0	31.1	29.6	0.1	0.4	16.9	18.3	0.1	0.4	1,451

[a] Percentages weighted by total numbers in the escapement.

Table 32. Length composition of the major age classes of sockeye salmon collected in the Yentna River, 1986-1992. Length measured from mid-eye to fork-of-tail.

		Male			Female			Total			
Year	Age Class	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ratio Male-Female
1991	0.3	572	5	59	550	2	100	558	2	159	0.6:1
1986	1.2	455	3	104	472	5	52	461	3	156	2.0:1
1987		484	3	158	477	2	156	480	2	314	1.0:1
1988		461	2	408	486	3	170	469	2	578	2.4:1
1989		463	4	246	485	4	122	471	3	368	2.0:1
1990		446	0	305	446	0	238	446	0	543	1.3:1
1991		460	3	253	484	2	130	468	2	383	2.0:1
1992		443	2	360	469	3	115	449	2	475	3.1:1
1986	1.3	579	3	172	563	2	216	570	2	388	0.8:1
1987		591	2	246	565	2	222	580	1	468	1.1:1
1988		580	2	365	552	1	359	567	1	724	1.0:1
1989		575	3	390	553	1	474	563	1	864	0.8:1
1990		573	0	400	552	0	526	561	0	926	0.7:1
1991		562	2	301	542	1	356	551	1	657	0.9:1
1992		546	4	188	543	2	242	545	2	430	0.8:1
1992	2.2	451	3	181	471	6	53	455	3	234	3.4:1
1986	2.3	588	5	25	555	4	44	567	3	69	0.6:1
1987		583	4	62	566	3	52	577	3	114	1.2:1
1988		585	4	92	554	3	87	570	2	179	1.1:1
1990		574	0	73	542	0	96	555	0	169	0.8:1
1991		561	4	78	536	3	86	547	2	164	0.9:1
1992		564	3	123	538	4	126	552	2	249	1.0:1

Table 33. Cumulative proportion by date of pink salmon counts recorded in the Yentna River, 1982-1992.

	Cumulative proportion										
Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
27-Jun	0.000										
28-Jun	0.000										
29-Jun	0.000				0.000	0.000					
30-Jun	0.000	0.000			0.000	0.000					
01-Jul	0.000	0.001	0.000	0.001	0.000	0.002					
02-Jul	0.000	0.001	0.000	0.002	0.000	0.004					
03-Jul	0.000	0.001	0.000	0.003	0.000	0.008					
04-Jul	0.000	0.002	0.000	0.003	0.000	0.011					
05-Jul	0.000	0.003	0.000	0.005	0.001	0.015					
06-Jul	0.000	0.003	0.000	0.007	0.001	0.018					
07-Jul	0.000	0.003	0.000	0.011	0.001	0.022	0.000	0.003	0.000	0.002	0.000
08-Jul	0.000	0.003	0.000	0.012	0.001	0.025	0.000	0.008	0.000	0.005	0.000
09-Jul	0.000	0.004	0.000	0.015	0.001	0.029	0.000	0.013	0.000	0.006	0.001
10-Jul	0.000	0.004	0.000	0.018	0.001	0.031	0.000	0.018	0.000	0.007	0.001
11-Jul	0.000	0.005	0.001	0.021	0.001	0.035	0.000	0.026	0.000	0.009	0.001
12-Jul	0.000	0.006	0.001	0.025	0.001	0.041	0.000	0.034	0.000	0.010	0.001
13-Jul	0.000	0.009	0.001	0.030	0.001	0.047	0.000	0.043	0.001	0.012	0.001
14-Jul	0.000	0.030	0.001	0.033	0.002	0.051	0.000	0.052	0.001	0.014	0.002
15-Jul	0.000	0.039	0.001	0.038	0.003	0.056	0.001	0.058	0.001	0.016	0.002
16-Jul	0.000	0.056	0.001	0.042	0.007	0.065	0.001	0.060	0.001	0.018	0.003
17-Jul	0.001	0.098	0.003	0.046	0.011	0.075	0.001	0.071	0.002	0.019	0.005
18-Jul	0.002	0.171	0.008	0.050	0.014	0.088	0.001	0.105	0.002	0.027	0.009
19-Jul	0.010	0.288	0.023	0.053	0.015	0.099	0.002	0.158	0.014	0.063	0.017
20-Jul	0.021	0.400	0.067	0.056	0.016	0.110	0.005	0.196	0.030	0.092	0.028
21-Jul	0.040	0.511	0.126	0.060	0.017	0.135	0.013	0.224	0.050	0.120	0.050
22-Jul	0.056	0.565	0.190	0.064	0.021	0.156	0.019	0.255	0.084	0.151	0.078
23-Jul	0.078	0.638	0.277	0.078	0.059	0.180	0.032	0.287	0.132	0.180	0.126
24-Jul	0.126	0.704	0.365	0.135	0.125	0.222	0.061	0.349	0.190	0.216	0.212
25-Jul	0.162	0.743	0.420	0.226	0.222	0.307	0.129	0.420	0.263	0.257	0.322
26-Jul	0.192	0.791	0.466	0.329	0.369	0.407	0.231	0.493	0.342	0.308	0.459
27-Jul	0.237	0.820	0.510	0.475	0.535	0.537	0.338	0.570	0.433	0.361	0.561
28-Jul	0.330	0.843	0.578	0.636	0.695	0.624	0.459	0.638	0.514	0.441	0.668
29-Jul	0.447	0.855	0.669	0.763	0.830	0.668	0.589	0.691	0.580	0.499	0.751
30-Jul	0.562	0.864	0.728	0.833	0.894	0.701	0.662	0.730	0.640	0.567	0.815
31-Jul	0.654	0.871	0.784	0.877	0.924	0.729	0.722	0.748	0.722	0.640	0.862
01-Aug	0.735	0.879	0.837	0.903	0.957	0.741	0.768	0.759	0.815	0.677	0.899
02-Aug	0.824	0.903	0.873	0.926	0.979	0.767	0.826	0.770	0.884	0.703	0.924
03-Aug	0.896	0.908	0.903	0.942	0.991	0.799	0.878	0.781	0.927	0.751	0.941
04-Aug	0.934	0.912	0.925	0.956	0.996	0.838	0.909	0.812	0.947	0.804	0.954
05-Aug	0.953	0.918	0.943	0.966	0.999	0.870	0.931	0.850	0.964	0.870	0.961
06-Aug	0.962	0.924	0.956	0.978	1.000	0.887	0.951	0.883	0.976	0.911	0.967
07-Aug	0.969	0.931	0.962	0.991		0.895	0.969	0.912	0.984	0.951	0.971
08-Aug	0.978	0.936	0.969	1.000		0.901	0.982	0.924	0.990	0.971	0.979
09-Aug	0.984	0.937	0.975			0.921	0.990	0.938	0.994	0.985	0.990
10-Aug	0.989	0.938	0.982			0.950	0.995	0.943	0.997	0.995	0.997
11-Aug	0.991	0.943	0.986			0.975	1.000	0.948	0.998	0.999	1.000
12-Aug	0.994	0.951	0.988			0.989		0.952	1.000	1.000	
13-Aug	0.996	0.958	0.991			0.996		0.963			
14-Aug	0.997	0.966	0.992			1.000		0.974			
15-Aug	0.998	0.971	0.994					0.989			
16-Aug	0.998	0.978	0.994					0.994			
17-Aug	0.999	0.984	0.995					0.997			
18-Aug	0.999	0.988	0.996					0.998			
19-Aug	0.999	0.990	0.997					0.999			

- Continued -

Table 33. (p. 2 of 2)

	Cumulative Proportion										
Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
20-Aug	0.999	0.992	0.997					1.000			
21-Aug	0.999	0.993	0.997								
22-Aug	1.000	0.993	0.998								
23-Aug	1.000	0.994	0.998								
24-Aug	1.000	0.995	0.998								
25-Aug	1.000	0.996	0.999								
26-Aug	1.000	0.996	0.999								
27-Aug	1.000	0.997	0.999								
28-Aug	1.000	0.998	0.999								
29-Aug	1.000	0.998	0.999								
30-Aug	1.000	0.999	1.000								
31-Aug	1.000	0.999									
01-Sep	1.000	0.999									
02-Sep	1.000	0.999									
03-Sep	1.000	1.000									
04-Sep	1.000										
05-Sep	1.000										
Midpoint	7/30	7/21	7/27	7/28	7/27	7/27	7/29	7/27	7/28	7/30	7/27
No. days for 80%[a]	12	16	14	9	8+	20	11	21	12	17	11

[a] Inclusive dates: dates proportion of escapment reached 10% through date proportion of escapement reached 90%.

Table 34. Daily adjusted fish wheel catch by species for the east bank of the Susitna River at Sunshine Station, 14 July through 6 August 1992.

Date	Hours open[a]	Sockeye		Pink		Chum		Coho		Chinook	
		Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]	Daily	Cum[b]
14-Jul	22.00	1	1	0	0	2	2	0	0	1	1
15-Jul	26.00	0	1	1	1	0	2	0	0	1	2
16-Jul	23.00	15	16	0	1	1	3	0	0	4	6
17-Jul	24.00	31	47	1	2	1	4	0	0	3	9
18-Jul	24.75	32	79	1	3	2	6	0	0	5	14
19-Jul	23.25	25	104	6	9	5	11	0	0	4	18
20-Jul	25.75	21	125	9	18	8	19	0	0	2	20
21-Jul	21.75	73	198	13	31	4	23	1	1	6	26
22-Jul	25.50	72	270	11	42	16	39	5	6	2	28
23-Jul	23.50	129	399	31	73	43	82	1	7	1	29
24-Jul	16.25	98	497	56	129	72	154	3	10	3	32
25-Jul	15.50	113	610	110	239	104	258	3	13	2	34
26-Jul	17.25	178	788	212	451	45	303	8	21	4	38
27-Jul	11.25	139	927	293	744	111	414	17	38	0	38
28-Jul	13.50	151	1,078	329	1,073	92	506	21	59	2	40
29-Jul	20.00	129	1,207	446	1,519	116	622	38	97	2	42
30-Jul	20.25	115	1,322	418	1,937	101	723	42	139	2	44
31-Jul	19.00	91	1,413	475	2,412	190	913	23	162	1	43
01-Aug	20.50	86	1,499	393	2,805	315	1,228	63	225	0	43
02-Aug	19.50	48	1,547	161	2,966	143	1,371	25	250	0	45
03-Aug	26.00	69	1,616	259	3,225	467	1,838	68	318	2	47
04-Aug	19.50	49	1,665	227	3,452	143	1,981	94	412	1	48
05-Aug	15.50	79	1,744	229	3,681	420	2,401	88	500	0	48
06-Aug	16.00	39	1,783	197	3,878	300	2,701	60	560	2	50

[a] Fish wheel catch adjusted for 24 h: (daily catch * 24 h) / hours open.
[b] Actual catch: 1,410 sockeye salmon; 2,996 pink salmon; 2,315 chum salmon; 441 coho salmon; 45 chinook salmon.

Table 35. Age composition of sockeye salmon collected in the Susitna River at Sunshine Station, 1989-1992.

Sample Period	Percentage Composition by Age Class								Sample Size
	1.1	0.3	1.2	2.1	1.3	2.2	2.3	Other	
7/15-7/27	0.0	0.0	20.1	0.0	43.9	23.4	12.2	0.4	551
7/28-8/04	0.2	0.2	26.3	0.0	31.1	27.9	14.1	0.2	445
Seasonal Summary									
1989	0.4	0.2	28.7	0.0	66.0	3.3	1.5		1,169
1990	0.2	0.8	35.3	0.0	49.5	7.0	6.9	0.5	1,093
1991	0.1	0.6	21.1	0.1	68.3	4.0	6.0	0.0	1,564
1992	0.1	0.1	23.2	0.0	37.5	25.7	13.2	0.3	996

Table 36. Length composition of the major age classes of sockeye salmon collected in the Susitna River at Sunshine Station, 1989-1992. Length measured from mid-eye to fork-of-tail.

		Male			Female			Total			
Year	Age Class	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ave Length (mm)	Stndrd Error	Sample Size	Ratio Male-Female
1989	1.2	512	4	212	507	2	123	510	3	335	1.7:1
1990		511	0	140	476	0	251	489	0	391	0.6:1
1991		488	0	182	480	2	149	485	2	331	1.2:1
1992		470	5	103	481	2	125	476	2	228	0.8:1
1989	1.3	589	2	317	564	1	454	574	1	771	0.7:1
1990		596	0	208	561	0	329	574	0	573	0.6:1
1991		571	1	520	534	1	546	552	1	1,066	1.0:1
1992		555	3	131	537	2	249	543	2	380	0.5:1
1992	2.2	477	4	122	482	2	131	479	2	253	0.9:1
1992	2.3	559	5	53	537	3	77	546	3	130	0.7:1

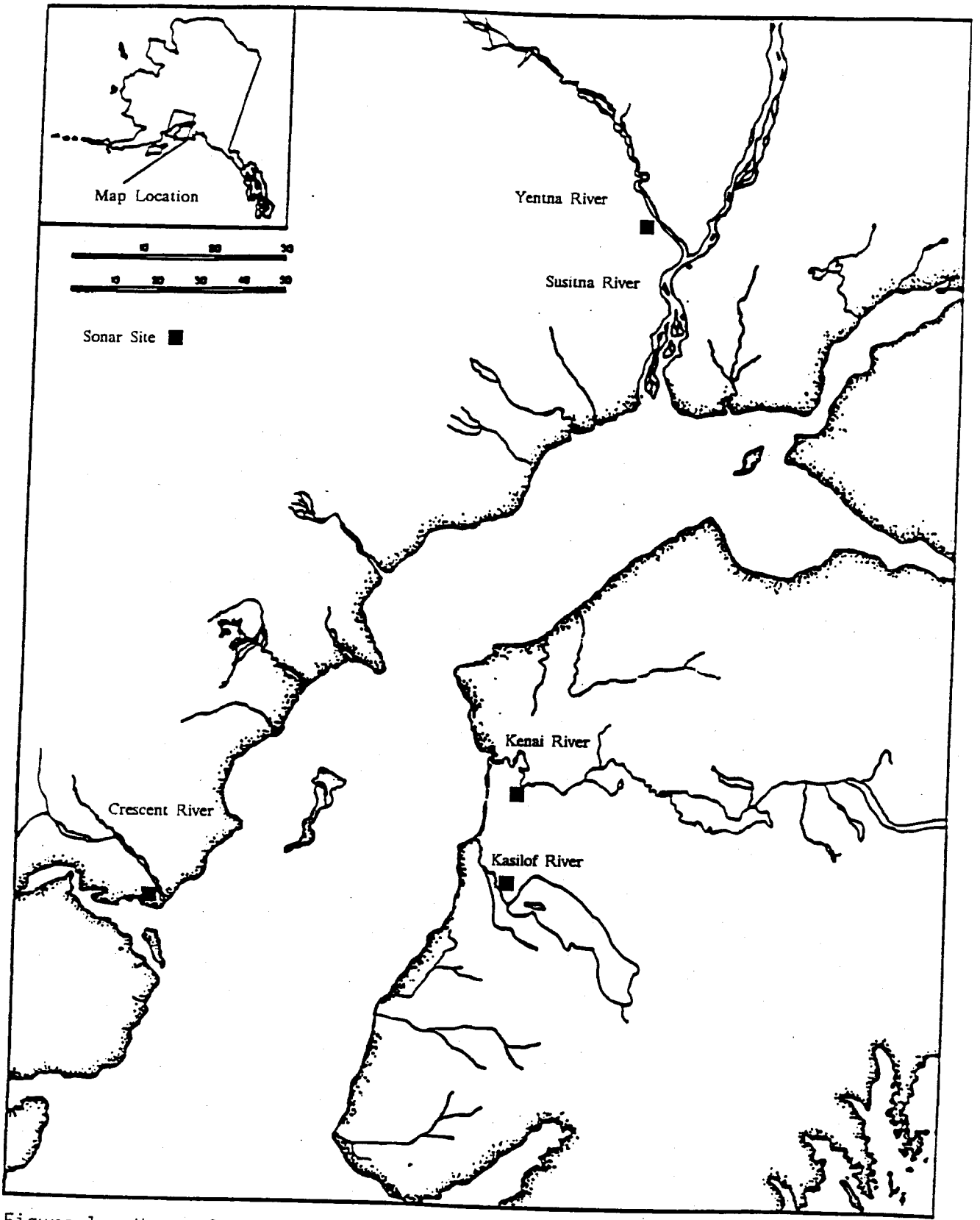

Figure 1. Upper Cook Inlet, Alaska, and sites where sockeye salmon escapement was monitored with side-scanning sonar.

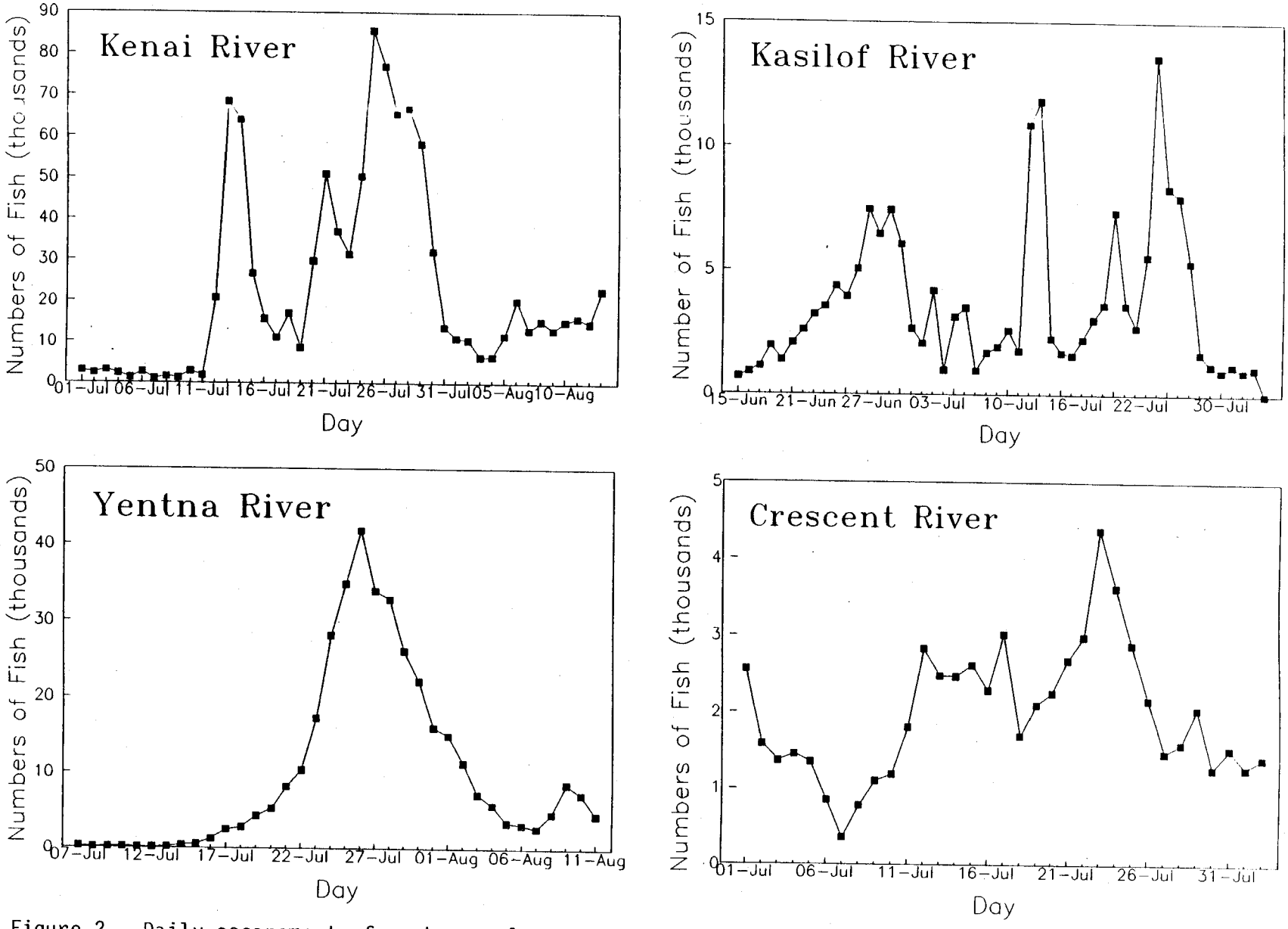

Figure 2. Daily escapement of sockeye salmon into the Kenai, Kasilof, Crescent and Yentna Rivers, 1992.

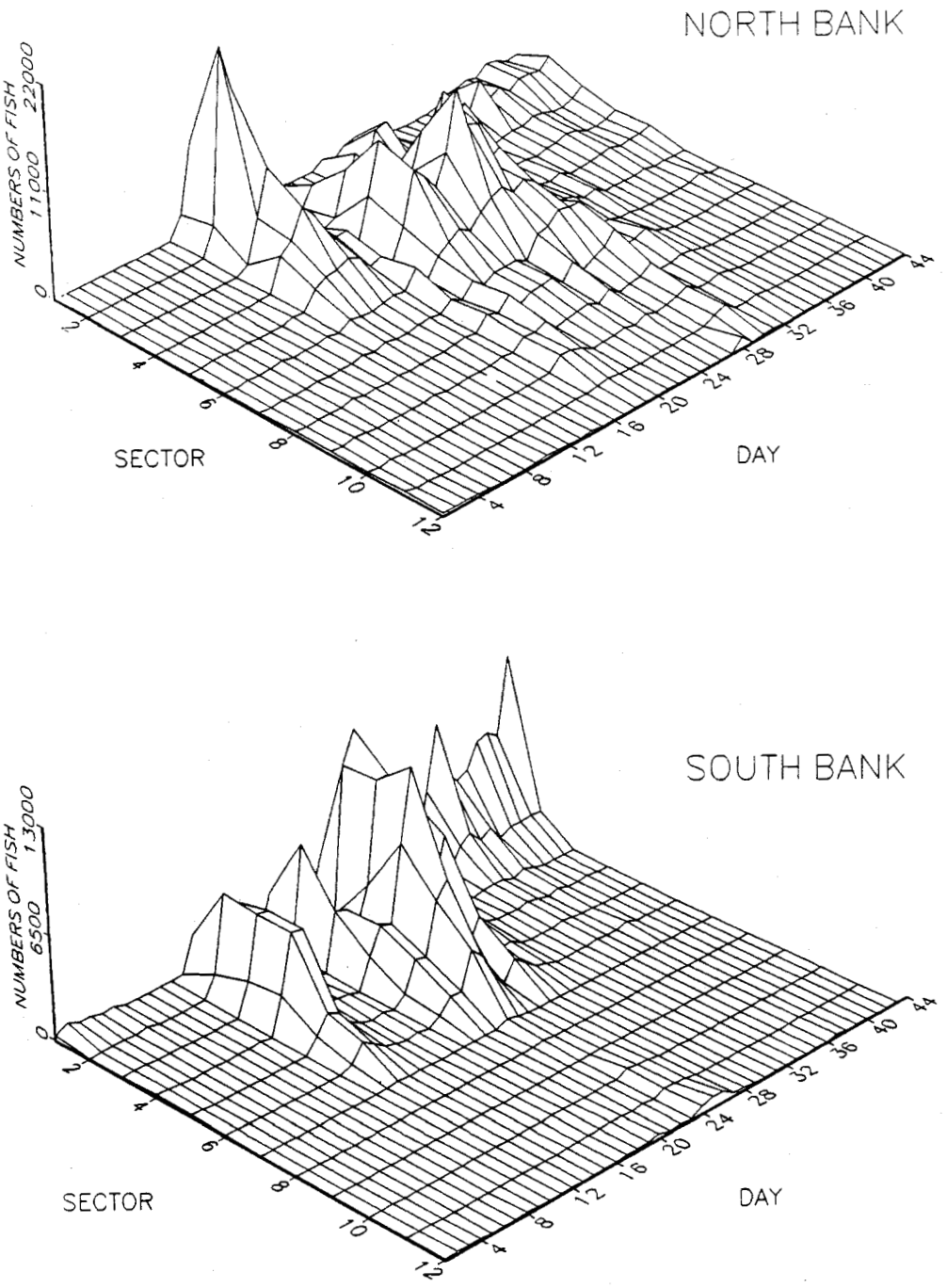

Figure 3. Distribution of salmon sonar counts by sector in the Kenai River, 1992.

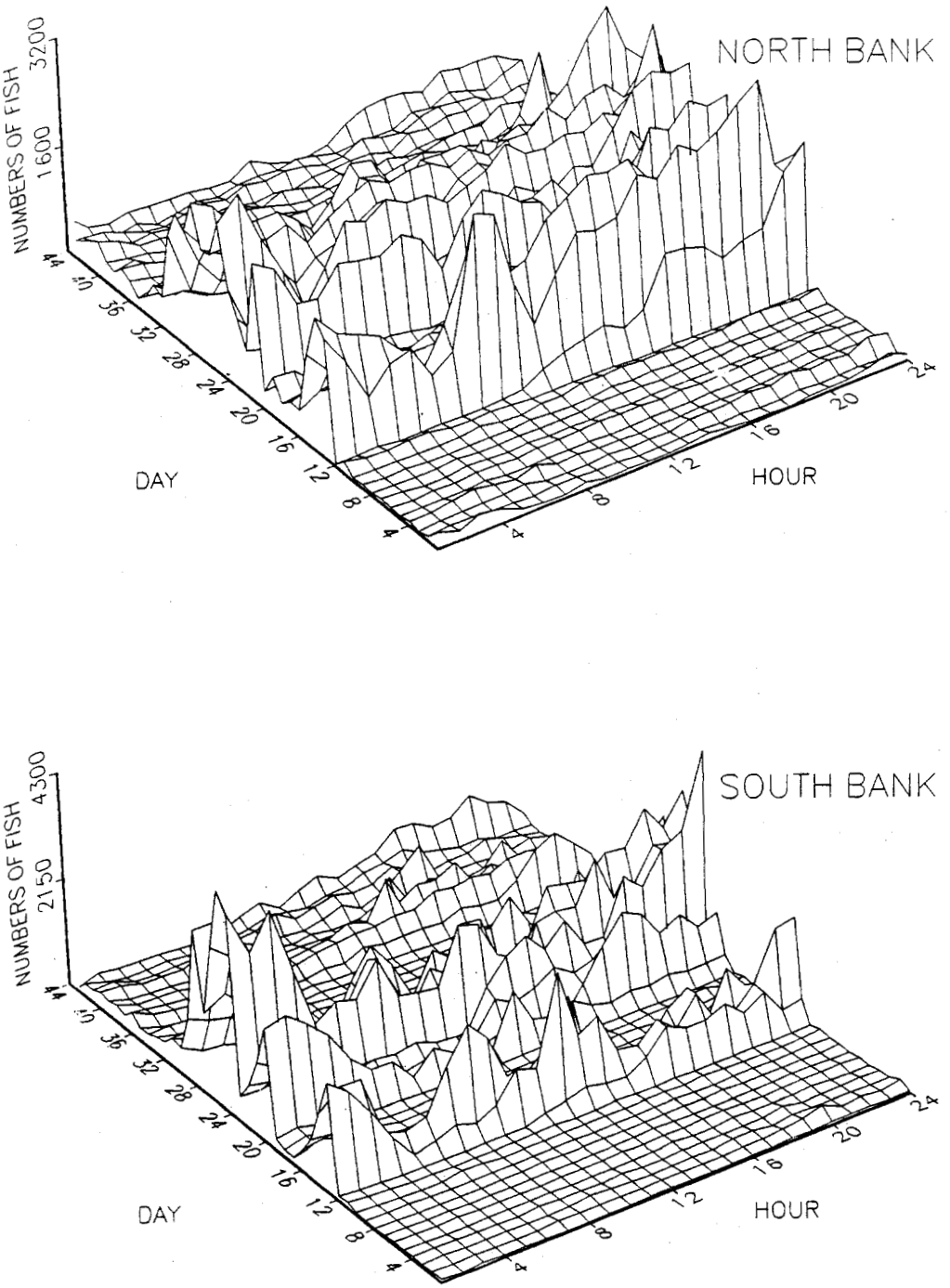

Figure 4. Hourly distribution of salmon migrating past the Kenai River sonar counters, 1992.

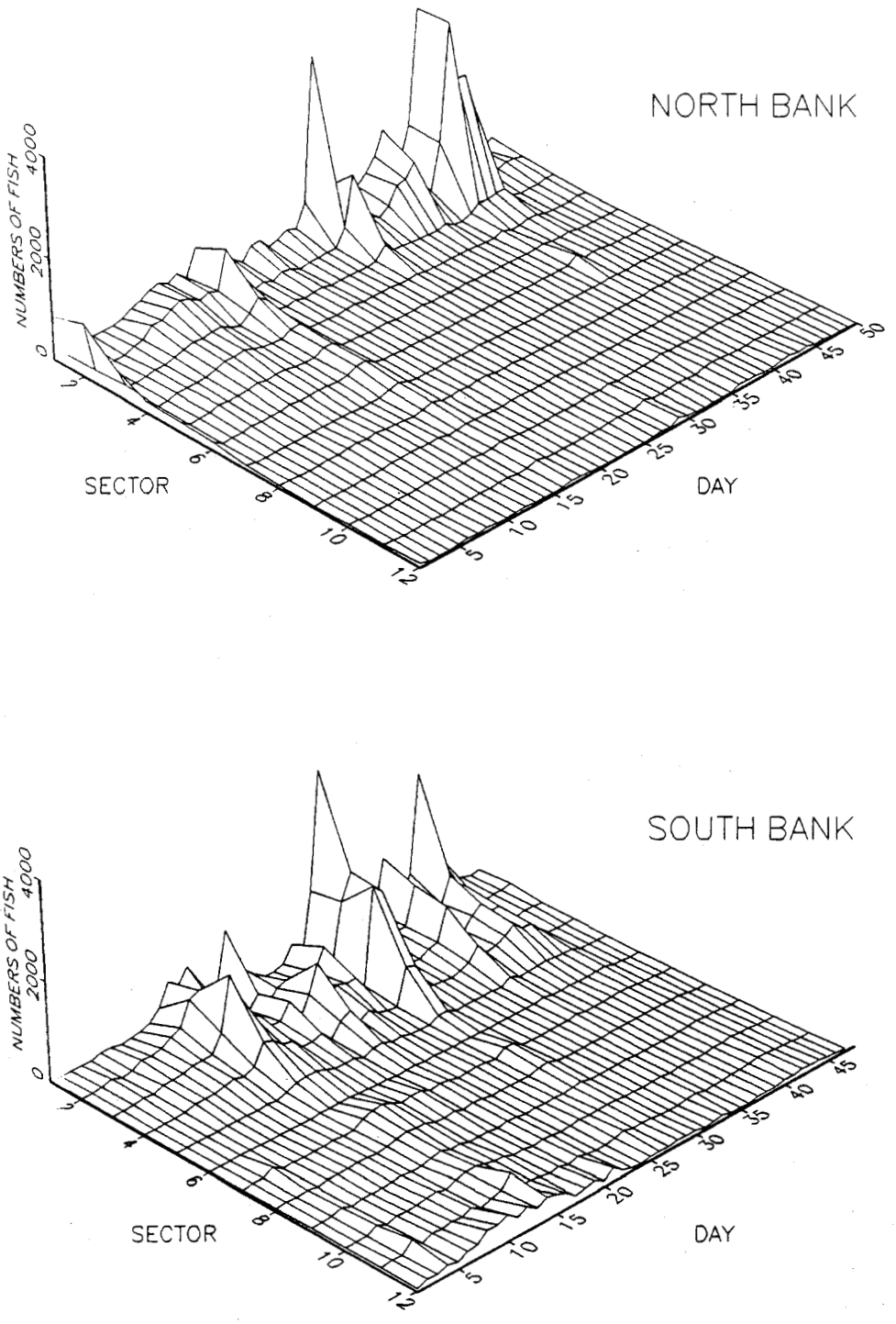

Figure 5. Distribution of salmon sonar counts by sector in the Kasilof River, 1992.

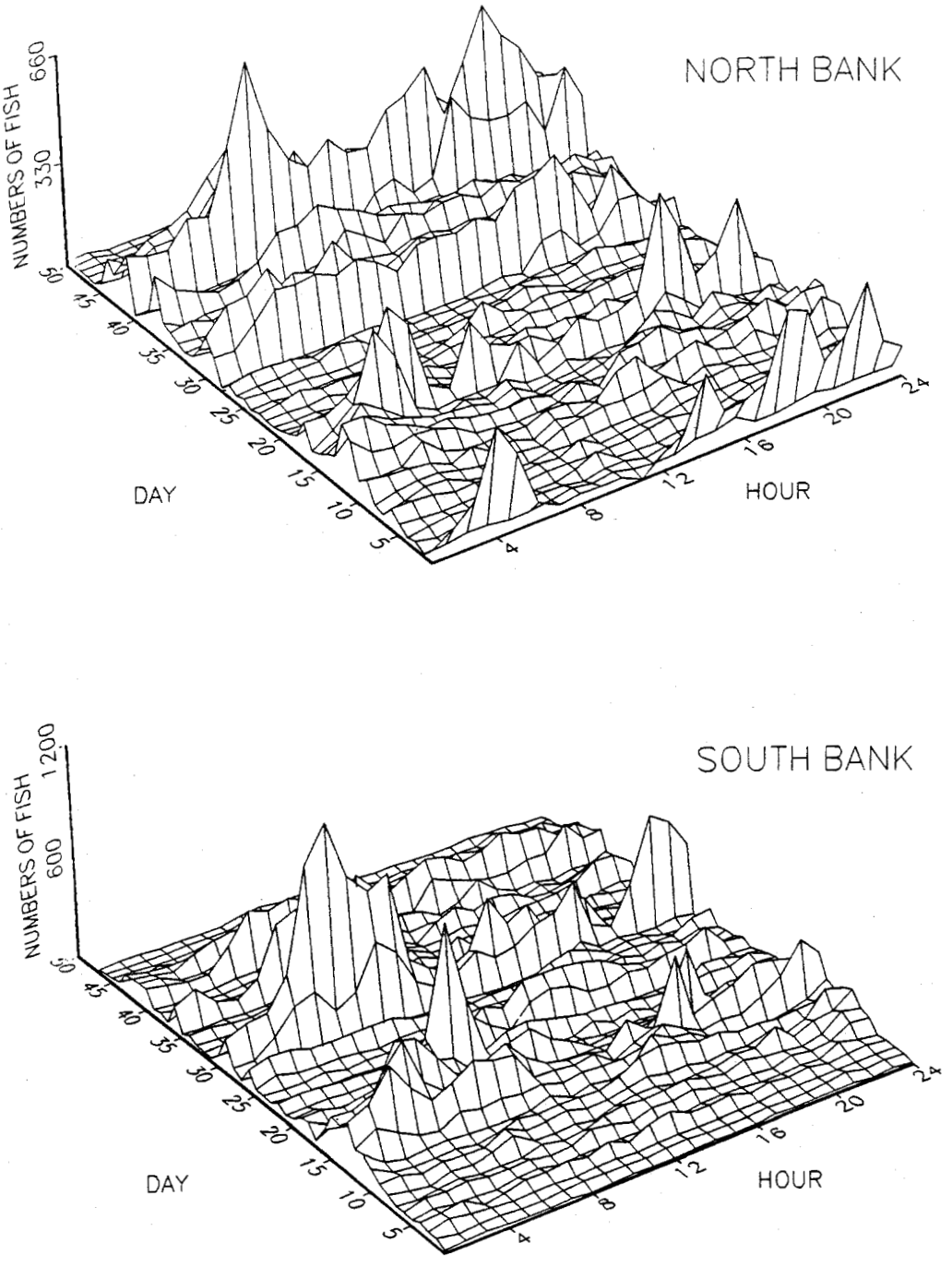

Figure 6. Hourly distribution of salmon migrating past the Kasilof River sonar counters, 1992.

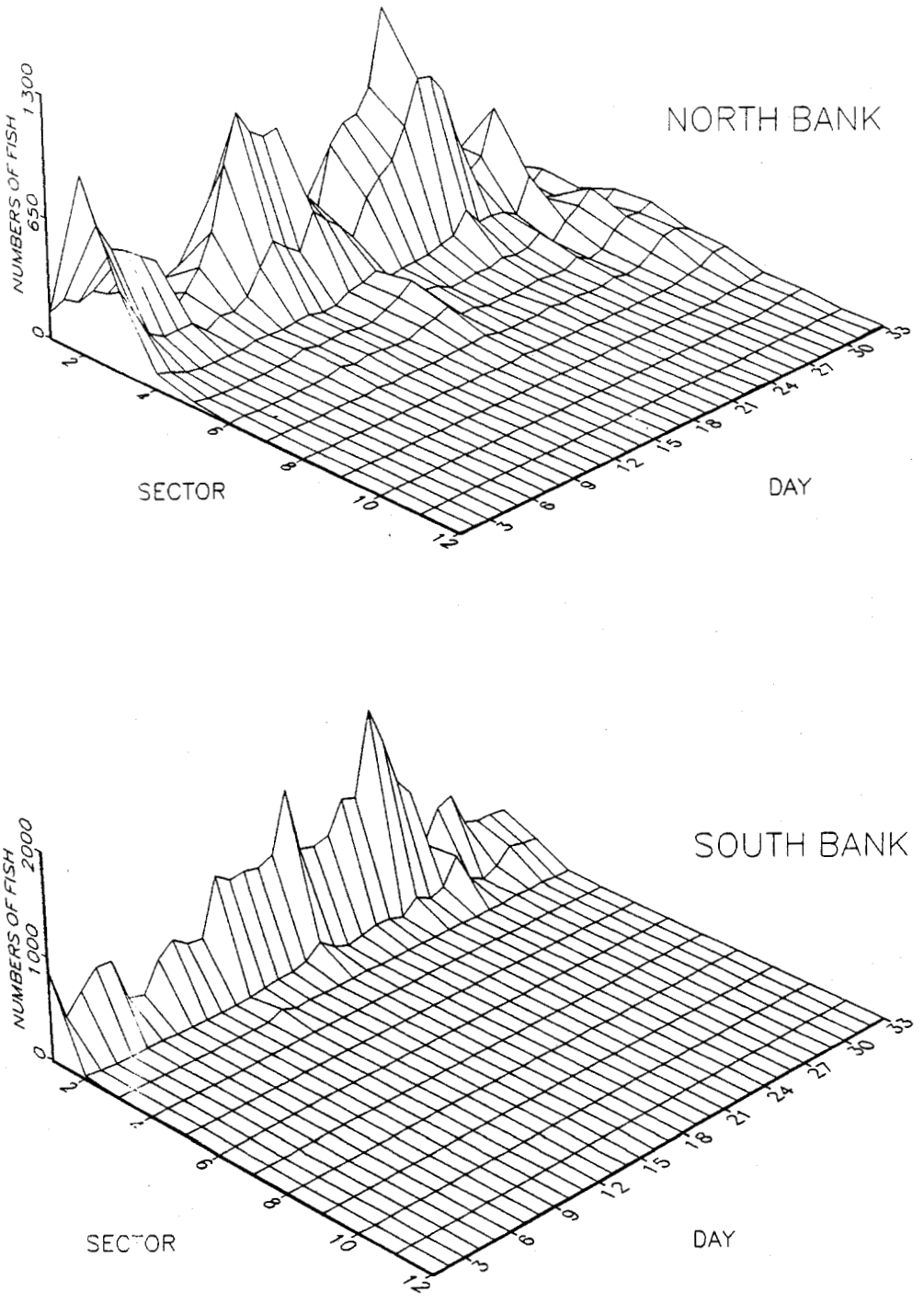

Figure 7. Distribution of salmon sonar counts by sector in the Crescent River, 1992.

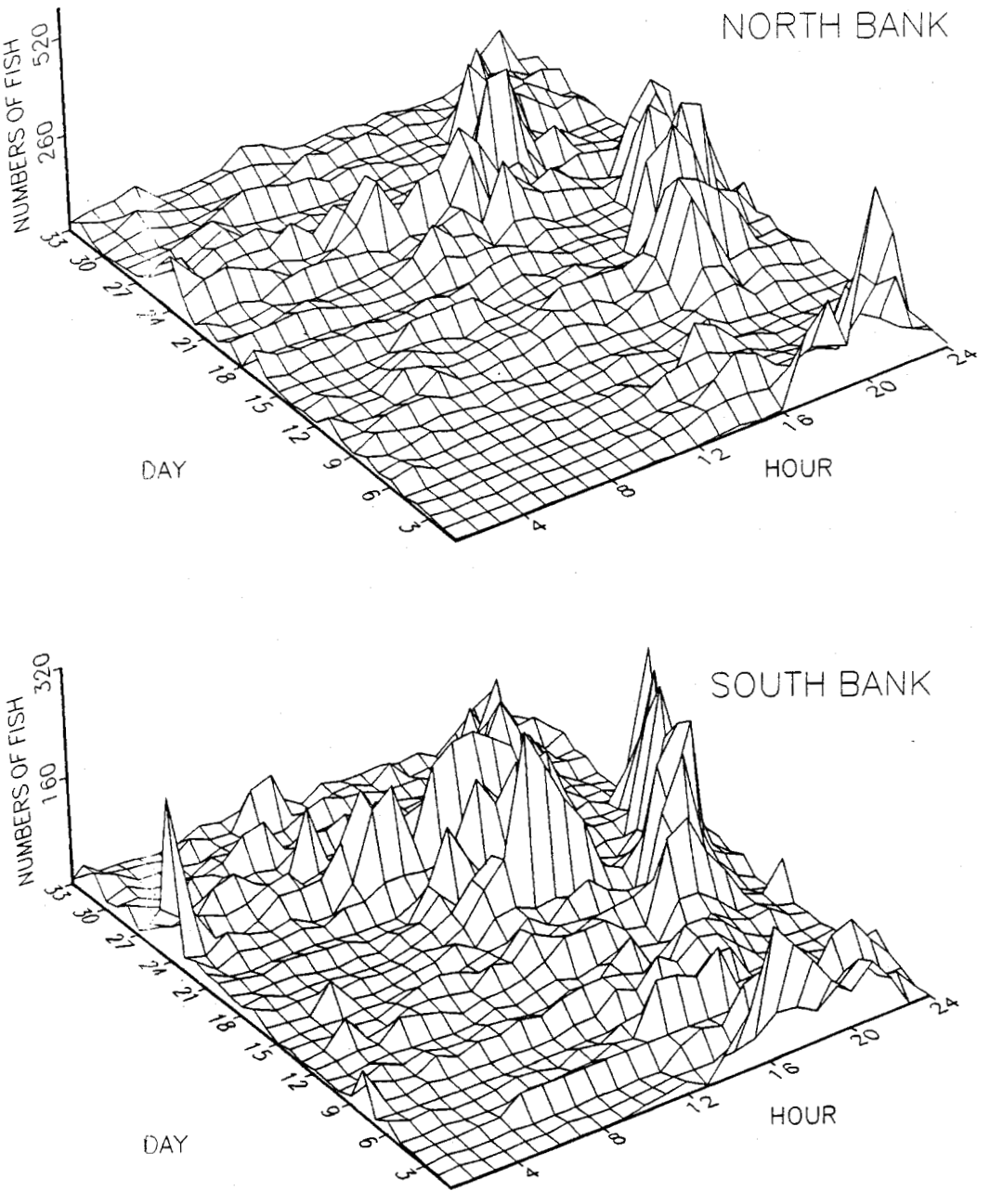

Figure 8. Hourly distribution of salmon migrating past the Crescent River sonar counters, 1992.

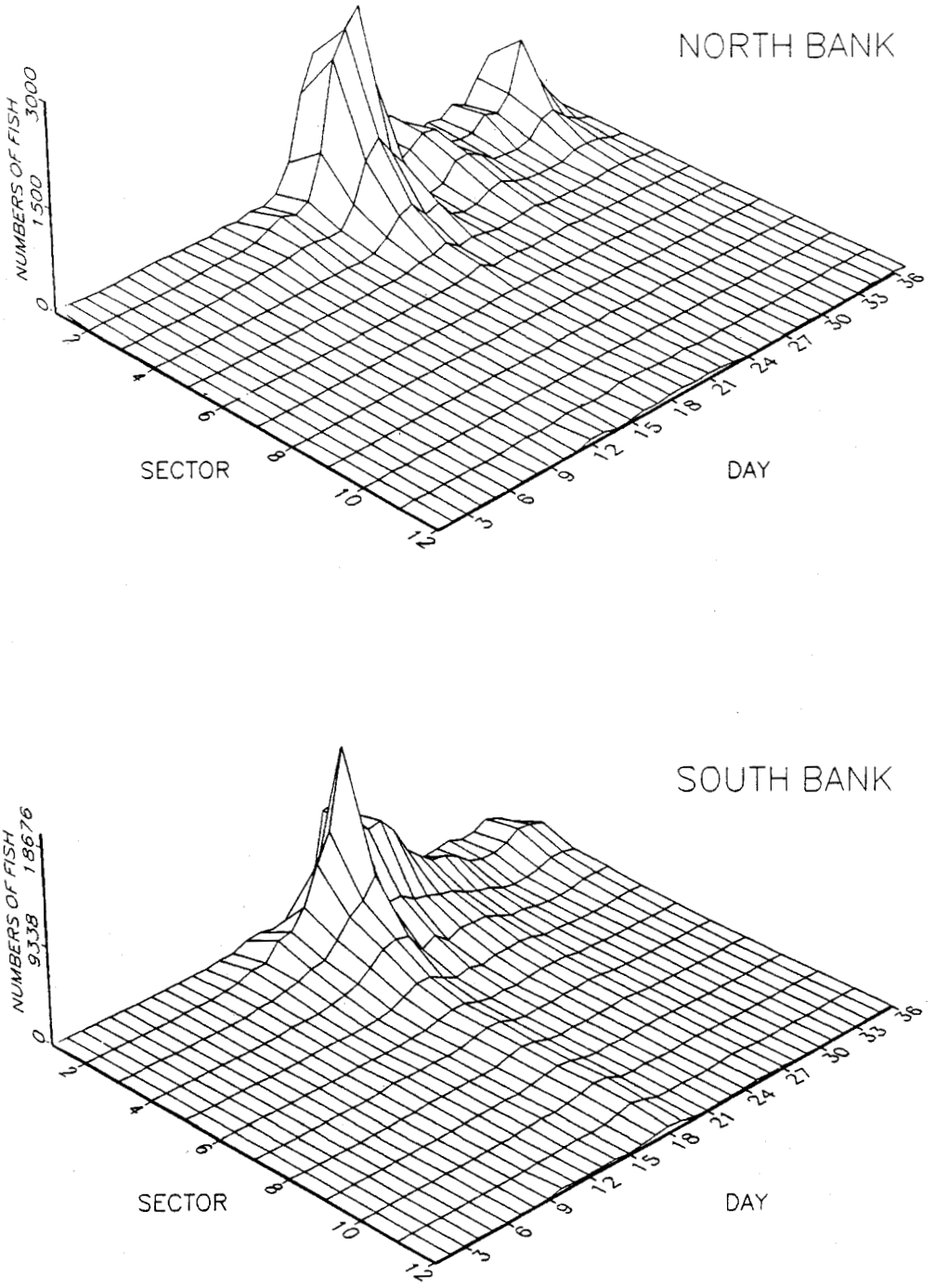

Figure 9. Distribution of salmon sonar counts by sector in the Yentna River, 1992.

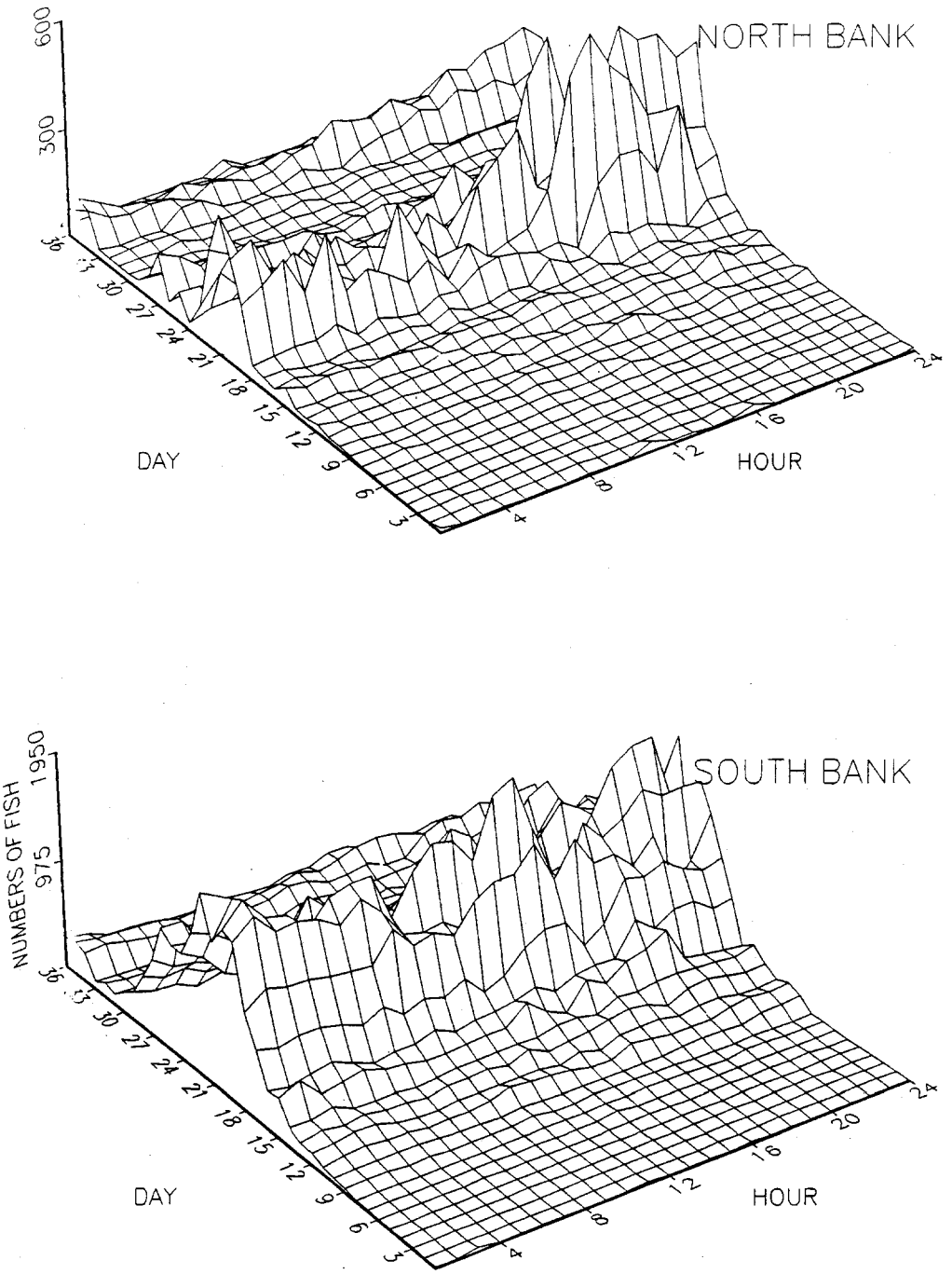

Figure 10. Hourly distribution of salmon migrating past the Yentna River sonar counters, 1992.

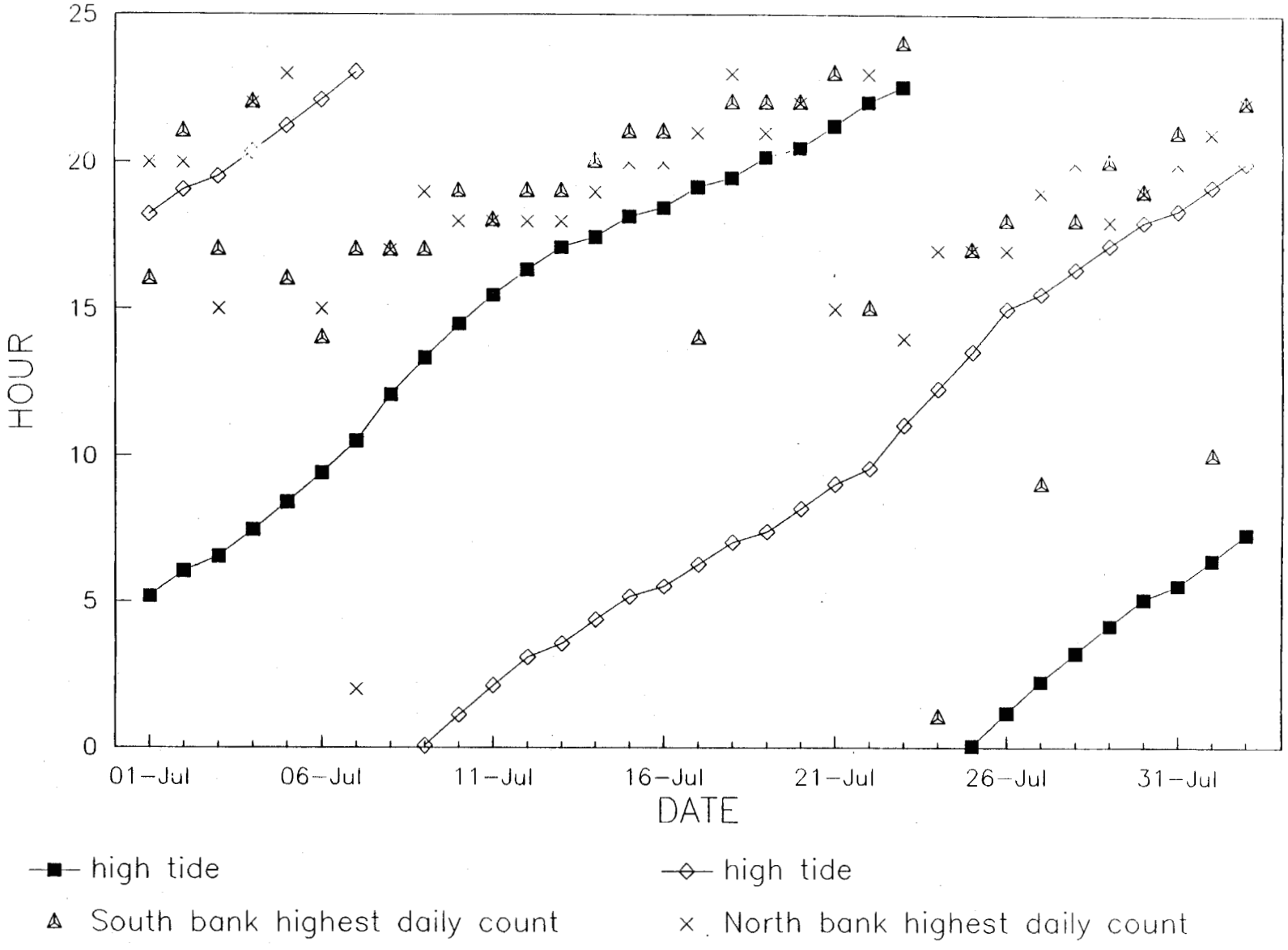

Figure 11. Peak daily sonar counts and daily high tides at Crescent River, 1992.