# TECHNICAL FISHERY REPORT 94-02

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

March 1994

## Anvik River Salmon Escapement Study, 1992

by

Gene J. Sandone

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.

# ANVIK RIVER SALMON ESCAPEMENT STUDY, 1992

By

Gene J. Sandone

Technical Fishery Report No. 94-02

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

March 1994

## AUTHOR

Gene J. Sandone is the Lower Yukon Area Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

## ACKNOWLEDGMENTS

The author wishes to acknowledge John Buchanan, Alden Walker, and Konrad Mittelstadt for the work completed at the Anvik River sonar site in conjunction with this project. Critical review of this report was provided by Larry Buklis.

## TABLE OF CONTENTS

**TABLE OF CONTENTS** (Continued)

Page

## LIST OF TABLES

## LIST OF FIGURES

LIST OF FIGURES (continued)

## LIST OF APPENDICES

**ABSTRACT**

Since 1979 the Anvik River sonar project has estimated daily passage of summer chum salmon *Oncorhynchus keta* using side-scanning sonar counters. During the period 21 June through 25 July 1992, an estimated 775,626 summer chum salmon passed the sonar site on the Anvik River. This estimate is 55% above the minimum escapement objective of 500,000 salmon. The 1992 summer chum salmon run started very late, was very compressed, and had the highest daily passage proportions during the first two quartiles of the run. Timing of the 1992 run was mixed in relation to the long-term mean (1979–1990 excluding 1986) timing statistics of the run. Although the first quartile passage day of the run was 2 d later than the long-term first quartile day, the median and third quartile passage day indicated a run of average timing. Female chum salmon composed an estimated 56.6% of the summer chum salmon passage. Age-5 fish composed an estimated 69.0% of the passage; age-4 fish accounted for 26.5%. Older-age salmon dominated the first two sampling strata: 29 June to 7 July and 8 to 15 July. Female salmon dominated the first and final stratum. A total of 931 chinook salmon *O. tshawytscha* were enumerated on an aerial survey of the index area within Anvik River drainage. This count is 86% above the minimal escapement objective of 500 chinook salmon for this index area. Age-6 salmon accounted for 50.8% of the escapement; age-5 salmon accounted for 38.1% based on carcass samples. Male chinook salmon dominated the escapement, accounting for 58.7% of the sample.

## INTRODUCTION

Two distinct runs of chum salmon, summer and fall, spawn in the Yukon River drainage. The Anvik River (Figure 1) is the largest producer of summer chum salmon in the Yukon River drainage. Buklis (1982a) estimated that the Anvik River alone accounts for 35% of the total production. Other known major spawning populations occur in the Andreafsky, Rodo, Nulato, Gisasa, Hogatza, Melozitna, Tozitna, Chena, and Salcha Rivers (Figure 1). Summer chum salmon spawn in lesser numbers in other tributaries of the Yukon River. Chinook *O. tshawytscha* and pink *O. gorbuscha* salmon occur in the Anvik River coincidentally with summer chum salmon. Coho salmon *O. kisutch* spawn in the Anvik River drainage during the fall.

### *Harvest of Anvik River Salmon*

Commercial and subsistence harvests of Anvik River summer chum salmon occur throughout the mainstem Yukon River from the coast of the delta to the mouth of this tributary stream at river kilometer (rkm) 513. This section of river includes Districts 1, 2, 3 in total and the extreme lower portion of District 4 (Figure 1). Set and drift gillnets are the legal fishing gear in Districts 1, 2, and 3; set gillnets and fish wheels are used in District 4. Most of the effort and harvest on the Anvik River stock occurs in Districts 1 and 2 and in the extreme lower portion of District 4 below the confluence of the Anvik and Yukon Rivers. Fish taken commercially in the lower three districts are sold in the round; District 4 is primarily a roe fishery because of poor flesh quality and distance from market. Subsistence fisheries in Districts 1, 2, and 3 take summer chum salmon primarily for human consumption. Subsistence harvest of summer chum salmon in District 4 is primarily for sled dog food. Commercial and subsistence summer chum salmon fisheries in the remainder of District 4 and in District 6 are supported by stocks other than the Anvik River stock. Very few summer chum salmon are harvested in District 5 because of the lack of spawning populations in that portion of the drainage.

In the lower portion of the Yukon River (Districts 1, 2, 3), run timing of chinook and summer chum salmon greatly overlap from river-ice breakup through June or early July. During this period, management of the lower Yukon River has traditionally been directed at chinook salmon. The District 4 commercial fishery has been directed primarily at chum salmon. In the Lower Yukon Area, large-mesh gillnets (stretch mesh greater than 6 in) were employed to harvest chinook salmon. Although these were very efficient for chinook salmon, the associated harvest of summer chum salmon through 1984 was small in relation to the size of the run. Therefore, prior to the 1985 season, the Alaska Board of Fisheries, in an attempt to increase the harvest of summer chum salmon in the lower river, directed that special small-mesh (stretch mesh maximum of 6 in) fishing periods be allowed during the chinook salmon season provided that (1) the summer chum salmon run was of sufficient size to support the additional exploitation, and (2) the incidental harvest of chinook salmon during these small-mesh fishing periods did not adversely affect conservation of that species.

A poor summer chum salmon run to the Yukon River in 1987 prompted fishery managers to consider the summer chum salmon fishery as fully developed (Sandone 1991). However, strong runs during the next 2 years resulted in record commercial harvests of 1,620,269 summer chum salmon in 1988 and

1,456,928 in 1989 (Bergstrom et al. 1992). Distribution of the summer chum salmon catch among districts reflected stock distribution, market demand, and scheduled fishing time. Without harvest guidelines, increased market demand prompted allocation disputes between district fishermen. Additionally, fishery managers were perceived by some of the public as making resource-allocation decisions by scheduling fishing time. To address these problems the Alaska Board of Fisheries, in February 1990, established a river-wide guideline harvest range of 400,000 to 1,200,000 summer chum salmon (ADF&G 1990). This overall guideline was distributed by district and subdistrict based on the previous 15-year average harvests.

Based on evaluation of brood year escapements and assuming average survival, it was expected that the Anvik River summer chum salmon run in 1992 would be average to above average in magnitude. However, other stocks of Yukon River summer chum salmon were expected to be below average. As a result, the total Yukon River summer chum salmon run for 1992 was expected to be below average to average, as was the primary contributor, the Anvik River stock (ADF&G 1992). Accordingly, the river-wide commercial harvest was expected to be between 600,000 to 800,000 summer chum salmon (ADF&G 1992).

### *Stock Identification Studies*

Two stock identification studies have been conducted on Yukon River chum salmon stocks. Initially, a small-scale stock identification investigation using scale pattern analysis was conducted by the Alaska Department of Fish and Game (ADF&G). Results of this pilot study indicated that separation of chum salmon stocks by scale pattern analysis was probably not feasible (Wilcock 1988). A more recent stock identification study (Wilmot et al. 1992) reported success in separating Yukon River chum salmon stocks using protein electrophoresis techniques. This study was initiated in 1987 by the United States Fish and Wildlife Service (USFWS) and continued through the 1991 season. Preliminary results indicated that among all represented chum salmon stocks of the Yukon River, two major groups were apparent, a summer-run group and a fall-run group. These investigators also reported that within the summer-run group, two major subdivisions were apparent, those of the lower river below rkm 800 and those of the mid river (rkm 800–1,150). Wilmot et al. reported that estimated stock compositions of samples collected from District 1 commercial and test net fisheries during 1987 to 1990 indicated that the lower river summer-run chum salmon stocks contributed 75–100% to the catch until mid-July.

During the 1987 and 1988 field season, chum salmon genetic stock identification (GSI) collections were obtained at the mainstem Anvik River sonar site. Interestingly, these two collections were significantly different genetically (Wilmot et al. 1992). Although the collection obtained in 1987 was genetically similar to the lower river summer-run group, the collection obtained in 1988 was reported to be a separate group within the summer-run group and genetically distinct from the lower and mid-river groups (Wilmot et al. 1992). These investigators speculated that because the Anvik River is a large, productive river system that probably supports numerous spawning stocks, the mainstem collections at the sonar site in 1987 and 1988 most likely included different combinations of upriver, genetically distinct stocks. This apparent under-representation of Anvik River subpopulations in the genetic baseline data set was identified as one of the limitations of the study (Wilmot et al. 1992). Future studies will attempt to sample tributary populations of chum salmon within the Anvik River drainage in order to expand the chum salmon baseline.

### *Escapement Assessment*

Accurate salmon escapement counts on Yukon River tributaries are important for regulating fishery harvests, determining escapement objectives, evaluating the effectiveness of management programs, and providing information for use in projecting subsequent returns. However, because of the vast size of the Yukon River drainage, 853,000 km$^2$, enumerating escapements to more than a few tributaries is economically infeasible. Consequently, most escapements are instead assessed using low-level aerial surveys conducted from single-engine, fixed-wing aircraft. These aerial surveys are subject to counting errors and year-to-year variability associated with weather, stream conditions, timing of the survey relative to spawning stage, and observer subjectivity and experience. The counts obtained are only indices of abundance because the entire escapement is not present on the day of the survey and not all the fish present are seen and counted. Attempts to standardize the conditions under which these indices are conducted improves their usefulness in monitoring the relative abundance of spawning escapements.

Chinook salmon escapements to the major spawning areas in the Yukon River drainage have been estimated by aerial survey from fixed-wing aircraft on a consistent basis since the early 1960s, and chum salmon *O. keta* escapements since the early 1970s. Escapement objectives based on aerial surveys have been established for both chinook and chum salmon in selected tributary streams for which there is a sufficient historical database (Bergstrom et al. 1991).

Comprehensive escapement enumeration studies have been conducted on only a few selected spawning streams for each run of chum salmon in the Yukon River drainage. The Anvik River was chosen for summer chum salmon research studies in 1972 and the Andreafsky and Melozitna Rivers (Figure 1) in 1981. However, because of budget restrictions, the Melozitna River project was discontinued in 1984, and the Andreafsky River project was discontinued in 1989.

#### **Study Area**

The Anvik River originates at an elevation of 400 m and flows in a southerly direction approximately 200 km to its mouth at rkm 513 of the Yukon River. It is a narrow runoff stream with a substrate mainly of gravel and cobble. However, bedrock is exposed in some of the upper reaches. The Yellow River (Figure 2), a major tributary of the Anvik, is located approximately 100 km upstream from the mouth of the Anvik River. Downstream of the confluence of the Yellow and Anvik Rivers, the Anvik River changes from a moderate gradient system to a low gradient system meandering through a much broader flood plain. Turbid waters from the Yellow River also greatly reduce the water clarity of the Anvik River below this confluence. Numerous oxbows, old channel, cutoffs and sloughs are found throughout the lower river.

Anvik River salmon escapement was enumerated from two counting tower sites from 1972 to 1979 above the confluence of the Anvik and Yellow Rivers (Figure 2). A site 9 km above the Yellow River on the mainstem Anvik River was used from 1972 to 1975 (Lebida 1973; Trasky 1974, 1976; Mauney 1977). From 1976 to 1979 a site on the mainstem Anvik River near the confluence of Robinhood Creek and the Anvik River was used (Figure 2; Mauney 1979, 1980; Mauney and Geiger 1977). Other than 1974, aerial surveys were flown each year in fixed-wing aircraft to estimate salmon abundance below the tower site. High and turbid water often affected the accuracy of visual salmon enumeration from counting towers, as well as from aircraft on the Anvik River.

The Electrodynamics Division of the Bendix Corporation[1] developed a side-scanning sonar counter during the 1970s capable of detecting and counting salmon migrating along the banks of streams. A pilot study using side-scanning sonar to estimate chum salmon escapement to the Anvik River was conducted in 1979. Results of this study indicated that sonar enumeration of chum salmon escapements to the Anvik River was superior to the counting tower method (Mauney and Buklis 1980). Therefore, in 1980, sonar enumeration replaced the tower counting method for estimating summer chum salmon escapement.

The Anvik River sonar site is located approximately 76 km upstream of the confluence of the Anvik and Yukon Rivers (Figure 2). Project results for escapement studies using sonar technology on the Anvik River from 1979 to 1990 have been reported by Mauney and Buklis (1980), Buklis (1981, 1982b, 1983, 1984a, 1984b, 1985, 1986, 1987), and Sandone (1989, 1990a, 1990b, 1992). This report presents results of the Anvik River summer chum salmon escapement study for the 1992 field season.

**Objectives**

Because the majority of the subsistence harvest and some of the commercial summer chum salmon harvest occur in the Yukon River drainage above the mouth of the Anvik River, it is important to accurately assess the strength of the upriver run so that escapement and harvest needs can be met. The information derived from this project, in conjunction with Yukon River sonar passage estimates and subsistence and commercial catch rates, has been used to assess the strength of the Yukon River summer chum salmon run above the mouth of the Anvik. The timely and accurate reporting of information from the Anvik River sonar project is a critical component of Yukon River summer chum salmon management. The primary purpose of this study is to monitor the escapement of summer chum salmon to the Anvik River. The two primary objectives of this study are to:

1. estimate the daily summer chum salmon escapement passing the Anvik River sonar site; and

2. estimate the age and sex composition of the summer chum and chinook salmon spawning escapements.

---

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

## METHODS

### *Sonar Deployment and Operation*

A sonar counter has been installed and operated on each bank of the Anvik River near Theodore Creek (Figure 2) each year since 1979. The sonar counter operates by transmitting a sonic beam along an 18-m aluminum tube, or substrate. Echoes from salmon passing through the beam are reflected back to the transducer. The system electronics interpret the strength and number of the echoes, and tally salmon counts. Criteria for strength and frequency of the echoes are designed to count salmon and minimize non-salmon counts (i.e., debris or other fish species). Aerial survey data indicate that virtually all summer chum salmon spawning activity is located upstream of this site.

During the 1992 season, a 1981-model sonar counter was deployed and operated according to guidelines described by Bendix Corporation (1981) on each bank of the Anvik River to enumerate summer chum salmon passage. Sonar counters were operated without the prescribed artificial aluminum substrate tubes throughout the season. This practice of operation without an artificial substrate has been in effect since 1986. The east and west bank sites used in previous years were probed to locate uniform river bottom gradients that would provide optimum surfaces for ensonification. Each sonar transducer was mounted on a rectangular aluminum frame. Two steel pipes were set into the river bottom on each side of the river, onto which the transducer frames were guided by side-mounted steel sleeves. Sandbags were placed on top of the transducer housing to ensure stability. Sonic beams emitted from each transducer were aimed perpendicular to shore; transducers were offset to prevent interference between units. To prevent fish passage inshore of the transducer, weirs constructed of T-stakes and rectangular mesh fencing were installed perpendicular from the shoreline and downstream of the transducer; they extended from the shore to approximately 1 m beyond the transducer. Counting towers of aluminum scaffolding material approximately 3 m in height were placed near the transducers on each bank for visual observation of salmon when water conditions permitted. As required by fluctuating water levels, transducers were moved inshore or offshore. Consequently, depth at the transducer varied throughout the season. Transducers were aimed and counting range lengths were adjusted so that echoes resulting from the stream bottom or surface interface did not register as counts by the sonar electronics.

The 1981-model counters used on the Anvik River sonar project divided the counting range, or ensonified zone, into 16 sectors of equal length. Sector length was dependent on the length of the counting range. Sectors were consecutively numbered from the west (right) to east (left) bank. Therefore, sectors 1–16 were associated with the west bank counter, and sectors 17–32 were associated with the east bank counter. Sector number 1 and 32 corresponded to the nearest sectors to each bank.

The east bank transducer was located along a cutbank approximately 60 m above the field camp site. Initial placement of the east bank transducer was approximately 1.0 m offshore and at a depth of 1 m. The west bank transducer was located along a gradually sloping gravel bar, approximately 3 m downstream of the east bank transducer. Initial placement of the west bank transducer was approximately 9.0 m offshore and was also in water about 1 m deep.

### *Sonar Calibration and Sampling*

Each sonar counter was usually calibrated four times daily by observing fish passage using an oscilloscope. Salmon passing through the sonar beam produce a distinctive oscilloscope trace or spike. During each calibration period counts of salmon enumerated by the observer using the oscilloscope were compared to counts recorded by the sonar electronics. The fish velocity control setting on the sonar counter was adjusted immediately after a calibration if the oscilloscope:sonar counts ratio varied from 1.0 by 15% or more. The existing fish velocity setting was multiplied by this ratio to obtain the correct new setting. If adjustments were made to the sonar unit an additional calibration was made to ensure that the oscilloscope:sonar count ratio was within accepted limits, ±15%, and to initialize the counting period. Each calibration lasted for at least 15 min or until 30 salmon were counted by the observer, whichever was less.

Attempts were also made to visually enumerate fish passage from 3-m counting towers during sonar calibration times as a further check on sonar accuracy and to train operators in oscilloscope monitoring. Observers wore polarizing sunglasses to reduce water surface glare. Attempts to visually enumerate salmon during calibration times were discontinued from the west bank when it became apparent that the presence of the observer on the tower interfered with the normal passage of salmon past the sonar site. Salmon passed farther offshore when the observer was on the tower.

Four daily calibration times were deemed adequate to monitor the diel timing pattern of the salmon migration. Calibrations were normally conducted during 0600, 1200, 1800, and 2400 hours. However, during the initial and last days of the project when fish passage was low, calibrations were conducted during 0800, 1300, 1800, and 2400 hours.

Bank-specific calibration periods were defined by the time between individual calibrations on each bank. An associated adjustment factor, specific to each calibration period and to each bank was derived from the following formula:

$$A_{b,n}=\frac{(OC_{b,ts}+OC_{b,te})}{(SC_{b,ts}+SC_{b,te})}, \quad \ldots$$

where A = periodic adjustment factor,
b = west or east bank,
n = calibration period,
ts = time at start of calibration period ,
te = time at end of calibration period,
OC = oscilloscope counts, and
SC = sonar counts.

The periodic adjustment factor was applied to the unadjusted sonar counts for each hour within the associated calibration period for each bank. The resulting corrected sonar counts for each hour within a day were summed, yielding the estimated summer chum salmon passage for that day for that bank. Corrected hourly counts were calculated and totalled for each day and bank using a portable computer. The daily passage of salmon was determined by summing the daily bank estimates. Daily adjustment or correction factors for each bank and for both banks combined were calculated by dividing the daily corrected counts by the raw sonar counts. Raw sector counts for each day were corrected by using the overall daily correction factor. Corrected hourly and sector counts were used to determine the temporal and spatial distribution of the summer chum salmon run.

Sonar counters do not distinguish between species of salmon. However, a separate escapement estimate for chinook salmon was obtained by aerial survey. This count was not subtracted from the chum salmon sonar count because we assumed that most chinook salmon were not counted by the sonar counters. This assumption was based on tower observations which indicated that most chinook salmon migrated up the middle of the stream channel beyond the ensonified zones. Additionally, the relative small numbers of chinook salmon observed during aerial survey flights have averaged less than 0.2% of the estimated sonar counts of summer chum salmon escapement from 1979–1992. Therefore, the small numbers of chinook salmon that may have been counted as summer chum salmon during 1992 were considered insignificant.

During the 1992 season pink salmon were observed from the observation tower, but they were not captured in beach seine samples for age, sex, and size sampling. Accordingly, pink salmon passage was estimated from corrected sonar counts based on the mean percentage of pink salmon observed during tower observations on each bank for each day. Tower observations were usually conducted in association with calibration periods on the east bank and immediately after calibration periods on the west bank. Observation of salmon passage on each bank was hampered by glare, which resulted from overcast skies and reflection of the sun off the water. Usually, only a few observations were possible from each observation tower site. On overcast days observation of salmon passage was not possible. When observations were possible, percentages were based on counts of at least 100 salmon on each bank. When counting was not conducted for a full day, the percent passage of pink salmon was estimated as the mean of the percentages for the day before and after. Pink salmon count estimates were used to correct the adjusted sonar counts to reflect only chum salmon passage estimates.

Missing hourly sector counts not recorded as a result of debris or printer malfunction were estimated by averaging the counts in the same sector for the hour before and after the count in question. When salmon were not counted for a large portion of a day, or a large portion of the counting range within a day, the corrected daily count total for that day was estimated by dividing the corrected partial daily count by the mean proportion of corrected counts for the corresponding hours or sectors for the first day before and after having full 24-hr counts. The estimated counts for the sectors or hours for which counts were not recorded were distributed by sector or hour based on the mean count-distribution pattern of the corresponding sectors or hours on the day before and day after. When counting was not conducted for a full day, the salmon passage for that day was estimated as the mean of the salmon passage for the day before and after. The estimated daily counts were distributed by hour and sector based on the mean distribution pattern of corrected counts for the day before and after the missing count.

### *Age-Sex-Size Sampling*

Season strata used for the comparison of hourly and sector passage data were defined by the early, early middle, late middle and late strata for age-sex-size sampling goals. Each terminal stratum was initially defined by an approximate 2-week interval with the two middle strata defined by a 1-week period. These strata were determined preseason based on historical run timing data; they represent an attempt to sample the escapement for age-sex-size information in relative proportion to the total run. During 1992, the early and late strata were adjusted inseason. Initiation of the early stratum was delayed until salmon passed the sonar site; the final stratum ended with the termination of sonar enumeration. Chum salmon were first observed and counted on 29 June. Because no salmon were sampled for age, sex, and size during the first stratum, and because salmon passage during 29 and 30 June accounted for <1% of the total passage estimate, the previously defined first and second strata were combined. Therefore, for 1992 the number of sampling strata was reduced to three: 29 June – 7 July; 8–15 July; and 16–26 July.

A beach seine (31 m long, 66 meshes deep, 6.35-cm mesh) was set approximately 100 m above the sonar site to capture chum and chinook salmon for age, sex, and size measurements. Chum and chinook salmon were placed in a holding pen, identified by sex, and measured in millimeters from mid-eye to fork-of-tail. One scale was taken for age determination from chum salmon. Scales were removed from an area posterior to the base of the dorsal fin and above the lateral line on the left side of the fish (Clutter and Whitesel 1956). The adipose fin was clipped on each fish before release to prevent resampling. Additionally, chinook salmon carcasses were sampled in August to supplement the beach seine sample. Three scales were taken from each chinook salmon sampled for determination of age and stock origin.

Scale samples were later pressed on acetate cards and the resulting impressions viewed on a microfiche reader for age determination. Sample size goals for each species were based on 95% precision with a 10% accuracy for each time stratum. A sample size of 152 fish per stratum (early, early middle, late middle, and late) was needed to describe the age composition of the chum salmon escapement by stratum (J. Bromaghin, Alaska Department of Fish and Game, Anchorage, personal communication). This sample size is related to number of expected age classes and accounts for a 10% unageable rate. A maximum sample size of 198 per stratum was needed to describe the age and sex composition of the chinook salmon escapement based on the number of expected age classes and an assumed 10% unageable rate (J. Bromaghin, Alaska Department of Fish and Game, Anchorage, personal communication). However, a sample size of 400 chinook salmon was deemed necessary for the scale pattern analysis baseline for the Anvik River chinook salmon stock.

### *Hydrological and Climatological Sampling*

A water depth profile was measured at 3-m intervals from established headpins across the width of the river by probing with a pole marked in 1-cm increments. Because the east bank sonar site was situated approximately 3 m upriver from the west bank site, one transect situated between the sites served to describe profile. Transect profile data were collected twice during the season.

Climatological data were collected at approximately 1800 hours each day at the campsite. Relative river depth was monitored by staff gauge marked in 0.01-ft increments. Change in water depth was converted to centimeters and presented as negative or positive increments from the initial reading of 0.0 cm. Water temperature was measured in degrees centigrade near shore at a depth of about 0.5 m. Daily maximum and minimum air temperatures were recorded in degrees centigrade. Subjective notes were kept by the crew describing wind speed and direction, cloud cover, and precipitation.

### *Run Timing*

Since 1986 run timing of summer chum salmon within the Yukon River drainage was monitored at three locations: the lower Yukon River test fishery (rkm 32), Yukon sonar site (rkm 197), and Anvik River sonar site, located approximately 589 km from the mouth of the Yukon River (Figure 1). During 1991, a problem with sonar beam attenuation was identified as a potentially significant problem affecting the accuracy of the salmon counts (Fleischman et al. 1992) at the mainstem Yukon sonar site (Figure 1). New equipment, purchased during 1992 and designed to alleviate the attenuation problem was tested during the 1992 field season. Consequently, salmon passage estimates were unavailable from Yukon sonar during 1992.

Run timing statistics, quartile days, were calculated for chum salmon passage at the lower Yukon test fish and Anvik sonar site and compared. Because the Anvik River is the major producer of summer chum salmon in the Yukon River drainage, comparison of run timing statistics allowed a calculation of estimated migratory rate of the salmon between the two sites.

## RESULTS AND DISCUSSION

### *Sonar Enumeration*

Two sonar counters were operated on the Anvik River from 21 June through 25 July at the same sites used in previous years. Only a small portion, approximately 16 m, of the central river channel was not ensonified on 20 June (Figure 3). Because of decreasing river water level (Figure 4) and, consequently, cross-sectional area throughout the season, the central river channel not ensonified on 9 July decreased to 9 m. Similar river ensonification was achieved during the initial placement of the transducers on 21 June and throughout the season. Because sonar beam width and height increased with distance from the transducer, the ensonified zone also encompassed most of the vertical water column within the counting range.

The escapement count for the period 21 June through 25 July was 775,626 summer chum salmon (Table 1). In 1992 the Anvik River summer chum salmon run started on 29 June. Since inception of the project in 1979, only the 1985 run started later. In 1992, the 7-d period, 3–9 July, which included the first quartile-day of passage, 5 July, and the median-day of passage, 8 July, accounted for 55% of the total season salmon passage, or 429,153 salmon (Figure 5). Highest daily passage proportion, 0.10, occurred on the first quartile day of passage, 5 July (Table 1). The initiation of the run was the latest on record, except for 1985, and first quartile-day of passage, 5 July, was 2 d later than the overall mean; however, the median day of passage, 8 July, and the third quartile passage day, 12 July, indicated that the run was of average timing (Table 2). This mixed timing information was the result of the 1992 summer chum salmon run having started very late, being very compressed, and having the highest daily passage proportions occur during the first two quartiles of the run (Figure 6).

Buklis (1982a) expanded the season escapement estimates for 1972 through 1978, making it possible to more directly compare visual count estimates to more recent annual sonar count estimates (Figure 7). Assuming an average brood year contribution of 4% age-3, 64% age-4, 31% age-5, and 1% age-6 summer chum salmon, the 1992 escapement estimate of 775,626 summer chum salmon was 14% less than the weighted parent-year escapement from years 1986–1989 of 898,981 fish, but was 20% greater than the long term (1972–1991) average of 644,691 fish.

A total of 24.28 h of sonar calibration were conducted over a 34-d period at the west bank site. West bank sonar accuracy (sonar count/oscilloscope count) averaged 1.03 (Table 3). Sonar accuracy averaged 1.04 for 25.80 h of oscilloscope calibration at the east bank site for the same period (Table 3).

Buklis (1982b) first noticed a distinct diurnal salmon migration pattern during the 1981 season with a higher proportion of the salmon migration past the sonar site during the evening hours. A similar pattern was observed during the years 1985 through 1991 by Buklis (1985, 1986, 1987) and Sandone (1989, 1990a, 1990b, 1992). In 1992 temporal distribution of the west (Appendix A) and east (Appendix B) bank adjusted sonar counts by hour also indicated a distinct diel pattern of salmon passage (Figure 8). Based upon adjusted counts, salmon passage was lowest from 0700 to 2100 hours (averaging 3.6% of total daily passage per hour) and greatest from 2200-0600 (averaging 5.1% of total daily passage per hour). This pattern was relatively consistent throughout the season (Figure 9) and similar to the historical temporal distribution pattern of the migration.

In all years that sonar was used to estimate Anvik River summer chum salmon escapement, a majority of the escapement passage has been associated with the west bank (Mauney and Buklis 1980; Buklis 1981, 1982b, 1983, 1984a, 1984b, 1985, 1986, 1987; Sandone 1989, 1990a, 1990b, 1992). In 1992, however, only 43% of the total adjusted counts were observed on the west bank. This percentage is very dissimilar to the 1986–91 average percent counts on the west bank of 74% (SE = 10%). The appearance of a shallow bar downstream of the east bank sonar site, which extended approximately 10 m from shore, appeared to alter the spatial salmon migration pattern in 1992.

In previous years, most of the salmon migrated close to shore on both banks. During those years it was assumed that very few chum salmon migrated past the sonar site beyond the ensonified zone. In 1992, however, most of the salmon migrated offshore of the east bank (Figure 8). Because we were concerned about the possibility of salmon passing beyond the ensonified zone and not being counted, we compared tower observations of salmon passage in conjunction with oscilloscope observations within the ensonified zone. From the tower, salmon migrating along shore downstream of the transducer were observed to move off shore when the shallow water over the bar was encountered. By comparing visual counts with oscilloscope counts we determined that chum salmon were not migrating past the sonar site beyond the ensonified zone. Additionally, as the season progressed decreasing water depth and river width resulted in a larger portion of the river being ensonified. Therefore, as in previous years, we assumed that only a very small portion of the total summer chum salmon passage was not counted during the operational period.

Salmon passage along the west bank (Figure 8) was greatest in near-shore sector 2, 7.0%, and decreased in sectors farther offshore (Appendix C). Sectors 2 through 8 accounted for 36.1% of the total chum salmon passage. This distribution of salmon passage along the west bank was very similar to previous years. However, chum salmon passage along the east bank (Figure 8) differed substantially from previous years. Usually, in previous years, near-shore sectors accounted for the majority of the passage along the east bank. Although east bank near-shore sector 32 accounted for 7.1% of the total 1992 chum salmon passage, off shore east bank sectors accounted for the greatest portion of salmon passage (Appendix D). Sectors 18 through 24 accounted for 43.6% of the total season chum salmon passage (Figure 8). The remaining 13.2% of the counts were distributed across the other 16 sonar counting sectors. The sonar sector nearest the shoreline of the west bank, sonar sector 1, was low probably due to the salmon avoiding the nearby weir and transducer. Throughout the season, salmon passage along the east bank was primarily offshore, whereas passage along the west bank changed from predominantly near shore during the first two sampling stratum, to offshore during the third sampling stratum. This shift in migration pattern was probably due to continued decreasing water levels during that time (Figure 4).

Salmon passage associated with each bank changed throughout the season from a dominant east-bank migration to a west-bank migration. East-bank salmon passage dominated the first sampling stratum, 29 June – 7 July, accounting for 68% of the stratum passage. Passage was equally divided between banks during the second stratum, 8–15 July. West-bank passage dominated the final stratum, 16–25 July, accounting for 65% of the stratum passage (Figure 10). We are uncertain as to why these changes occurred, but speculate that they were at least partially the result of decreasing water levels.

Lower Yukon test net CPUE indicated that the 1992 Yukon River summer chum salmon run was below average in abundance. Because of this and the desire to protect the Andreafsky River and other less abundant upriver summer chum salmon stocks, fishing in the Lower Yukon Area was concluded on 9 July. Four restricted mesh size fishing periods were scheduled in District 1, four in District 2, and three in District 3. The 1992 harvest of summer chum salmon in the lower Yukon River fisheries at 324,523 was below the 15%-point of the combined Lower Yukon Area guideline harvest range of 257,000 to 774,000 salmon.

Inseason Anvik River passage estimates played a very minor role in the management of the Lower Yukon Area fisheries in 1992 because of the late and compressed run timing. However, they did play an important role in limiting the District 4 summer chum salmon fishery. The inseason indication of a below-average summer chum salmon run from lower Yukon test fish data, combined with the relatively high passage numbers of salmon to the Anvik River, indicated that the Yukon River summer chum salmon run above the Anvik River was below average. The summer chum salmon harvest in District 4 (Figure 1) was limited to an estimated 199,348 summer chum salmon, which is slightly above the quarter point of the guideline harvest level of 129,000 to 385,000 for this district. However, summer chum salmon escapement to most tributaries, other than the Anvik River, was poor (Table 4).

## *Age and Sex Composition*

### Summer Chum Salmon

Beach seine sets were made from 5 to 21 July on 9 individual days. A total of 458 chum salmon were captured (Appendix E). Stratum sampling sizes were 149, 152, and 157 for the three sampling strata. The sampling goal of 138 ageable scales per stratum was achieved for all strata. Of the 458 chum salmon sampled for age-sex-size data, 424 (93%) had ageable scales. Age of the escapement passing the sonar site varied through time (Figure 11). Age-5 chum salmon dominated the first two sampling stratum, whereas age-4 salmon dominated the final stratum. Age composition of the escapement weighted by strata escapement counts was 0.3% age 3, 26.5% age 4, 69.0% age 5, and 4.2% age 6 (Appendix F). Age-5 chum salmon dominated the escapement in 1972, 1976, 1981, 1986, 1989, 1991 and 1992, but in all other years since 1972 the 4-year-olds dominated (Figure 12). The contribution of age-4 salmon, 26.5%, was the lowest contribution for that age class in a run since 1976. Conversely, the contribution of age-5 was the highest since 1976 and the contribution of age-6 was the highest on record (Appendix F). Because of very good summer chum salmon escapement (1,125,499) to the Anvik River in 1988, the 1992 run was anticipated to be above average and dominated by age 4. However, because age-4 salmon contributed only 26.5% to the Anvik River escapement and only 23.0% to the Lower Yukon Area commercial harvest, it appears that relatively few salmon returned as 4-year-old fish from the 1988 brood year.

Overall, female chum salmon accounted for 56.6% of the 1992 escapement to the Anvik River. Females have contributed > 50% to the escapement sample of summer chum salmon in 17 of the 20 years of record (Appendix F). Overall, the range of female contribution has ranged from 39.1% in 1974 to 69.4% in 1982. In 1989, 1990, and 1991 (Sandone 1990a, 1990b, 1992), male chum salmon dominated during the first sampling stratum. In contrast, in 1992 female salmon dominated the first sampling stratum (Figure 11). However, similar to 1989, 1990, and 1991 (Sandone 1990a, 1990b, 1992), female salmon dominated, at least, the final stratum.

Except for 1990, age class compositions of both the Anvik River escapement and the District 1 summer chum salmon commercial harvest have been very similar (Figure 13). In 1992 both escapement and harvest samples contained few age-3 salmon, few age-6 salmon, and were dominated by the age-5 component. Estimated age composition of the Anvik River escapement was 0.3% age 3, 26.5% age 4, 69.0% age 5, and 4.2% age 6 (Appendix F). Similarly, the preliminary age-class composition estimate of the total District 1 summer chum salmon harvest was 0.0% age 3, 23.0% age 4, 73.1% age 5, and 3.9% age 6 (D. Schneiderhan, Alaska Department of Fish and Game, Anchorage, personal communication). Also, similar to previous years, the sex composition of the 1992 Anvik River summer chum salmon escapement was dominated by females, whereas male salmon composed the majority of the District 1 commercial catch in every year since 1982, except for 1983 (Figure 14). Male chum salmon accounted for 56.6% of the District 1 harvest (D.Schneiderhan, Alaska Department of Fish and Game, Anchorage, personal communication) but accounted for only 43.4% of the Anvik River escapement. The difference in sex composition between District 1 harvest and Anvik River escapement is thought to have occurred because of size selectivity of gillnets used in the lower river fisheries.

**Chinook and Pink Salmon**

No chinook or pink salmon were captured by beach seine. However, 396 chinook salmon carcass samples were collected by boat survey in August. Of the Anvik River chinook salmon sampled for age-sex-size data, 315 (80%) provided ageable scales. Age composition was 9.5% age 4, 38.1% age 5, 50.8% age 6, and 1.6% age 7 (Figure 15). Females accounted for 41.3% of the sample (Appendix G), slightly greater than the 40.2% long-term average (1972–1991, excluding 1974 when no samples were obtained).

Age composition of the District 1 commercial harvest was approximately 3.9% age 4, 15.6% age 5, 76.7% age 6, 3.7% age 7, and 0.0% age 8. Female chinook salmon accounted for 52.8% of the harvest (D. Schneiderhan, Alaska Department of Fish and Game, Anchorage, personal communication). The District 1 commercial catch and Anvik River escapement age composition samples of chinook salmon are usually quite dissimilar (Figure 16). The Anvik River escapement has been usually composed of younger-age salmon than the District 1 commercial harvest (Figure 16). This difference is most likely due to the differences in age compositions and run strengths of the various chinook stocks present in the lower river during the harvest period and secondarily to the size-selective nature of the commercial gillnets.

An aerial survey of the Anvik River drainage,including Beaver Creek, Swift River, Canyon Creek, Otter Creek, and McDonald River, was flown on 24 July under good survey conditions. A total of 1,536 chinook salmon were enumerated. The count of 931 chinook salmon in the mainstem Anvik River between the Yellow River and McDonald Creek (Figure 2) met the aerial survey count objective of at least 500 chinook salmon for this index area. Although pink salmon were observed on this survey, counts were not conducted.

### *Hydrologic and Climatological Sampling*

River transect data collected on and 20 June and 9 July indicates that the bottom gradient was relatively smooth on both banks and free of major obstructions to the sonar beam (Figure 3). River width data collected in conjunction with the transect profiles varied from a high of approximately 70 m on 20 June to a low of 60 m on 24 July. Maximum depth and probably maximum river width, during project operations, occurred on the first full day of field operations, 19 June (Appendix H). River water level dropped approximately 57 cm between 19 June and 26 July (Figure 4). River level generally dropped in a consistent and regular manner throughout the season. This general trend in decreasing river level was only slightly interrupted a few times during the season (Figure 4).

Instantaneous water temperature ranged from a low of 12° C recorded on 21, 22, 30 June, and 21 July to a high of 18° C recorded on 9 and 25 July. Instantaneous air temperature ranged from a low daily minimum of 2° C on 20 June and 15 July to a high daily maximum of 27° C observed on 4 June (Figure 4).

### *Run Timing*

Similar to the 1985 and 1986 runs, number of days between the first and third quartile passage days, the mid-50% of the run passage, were very low in 1992 (Table 2), indicating a very compressed run. Although the 1992 run started late, similar to the 1985 run, it was more compressed prior to the median day of passage than the 1985 run, but similar to the 1986 run (Figure 5). However, the 1986 run was the earliest run on record (Table 2). Even when the 1986 run was expanded by Buklis (1986) to account for the early termination of the project, the numbers of salmon added to the final quartile did not change the median passage day, 2 July. The 1992 run was mainly composed of age-5 salmon, similar to the 1986 run, but different than the 1985 run, which was mainly composed of age-4 salmon (Appendix F). Because older-age chum salmon generally tend to arriver earlier within a run, as evidenced in 1989, 1990, and 1991 runs (Sandone 1990a, 1990b, 1992), and because the 1992 run was composed mainly of age-5 salmon, the very late starting salmon run appeared average in timing because of the very compressed nature of the first two quartiles (Figure 6). It appears that age composition probably was a major factor in determining the temporal distribution of the 1992 run.

Summer chum salmon run timing at the lower Yukon River set gillnet test fishery (rkm 32), and at the Anvik River sonar site located 589 km from the mouth of the Yukon River (Figure 1), were compared to provide a qualitative assessment of summer chum salmon migration through the lower river fisheries (Figure 17). Problems associated with sonar beam attenuation and salmon migrating beyond the ensonified zone at the mainstem Yukon sonar site (Figure 1) during previous years (Fleischman et al. 1992) prompted the installation of new, low frequency transducers. During 1992, these new transducers were tested at the Yukon sonar site. Therefore, counts of summer chum salmon passing the mainstem sonar site for run timing comparisons were unavailable.

Although there is a major spawning tributary between the lower Yukon River test fishery and the mainstem Anvik River sonar site, the Andreafsky River (Figure 1), it has been assumed that most of the unharvested salmon migrating past the lower Yukon River test fishing sites also pass the Anvik River sonar site. This assumption was probably met because of the difference in magnitude between the Andreafsky and Anvik River summer chum runs. During the years 1981–1988, excluding 1985 when sonar or tower counts of summer chum salmon escapement were available for the East Fork Andreafsky River (Table 4), escapement to the Anvik River was, on the average, approximately 9 times greater than the East Fork Andreafsky River escapement (range = 2.5 – 16.3). Because aerial survey escapement objectives for the East (109,000 salmon) and West (116,000 salmon) Fork Andreafsky River are very similar (Table 4), it was also assumed that a substantial portion, up to 50%, of the Andreafsky River escapement was represented by the East Fork for these years. Therefore, during this time, summer chum salmon escapement to the Anvik River probably averaged more than 4 times the Andreafsky River escapement. The 1992 escapement to the Andreafsky River was considered poor; escapement to the Anvik River was very good. Therefore, we believe that in 1992 most of the unharvested salmon migrating past the lower Yukon test fishing sites also passed the Anvik River sonar site.

Because we assume that a majority of the summer chum salmon pass both sites, we can subjectively assess run timing of the summer chum salmon run between these sites. The median date of the 1992 summer chum salmon passage was 23 June at the lower river test fishing sites, and 8 July at the Anvik River sonar site. Based on these data, the difference, or lag time, between the lower river test fishery and the Anvik River sonar site in 1992 was 15 d (1986–91 average = 15.0 d, SE=3.7). Based on distance and time between median days of passage, the calculated swimming speed of summer chum salmon in 1992 was approximately 37 km/d from the lower river test fishery to the Anvik River sonar site. Similarly, the 1986–91 average swimming speed, based on similar calculations, between the lower Yukon River test fishing sites and the Anvik River sonar site was 39 km/d (SE =9.8). These calculations, however, may be affected by incorrect determination of timing statistics because of fluctuations in test net efficiency, sonar accuracy, and varying run strengths and run timing differences of the various summer chum salmon stocks of the Yukon River drainage.

Inspection of the daily test fishing catch per unit effort in the lower river test fishery and the Anvik River sonar counts indicates that a pulse of fish passed this test fishery during 16–18 June but was not apparent in the Anvik River sonar counts (Figure 17). Two explanations are possible for this. The pulse of fish which appeared to pass the lower river test fishery during this time was other than Anvik River fish, or the lower test fish CPUE index overestimated the front portion of the summer chum run and indicated an earlier and larger pulse of fish than what was actually there. There is little evidence to support either scenario.

## LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1990. Arctic-Yukon-Kuskokwim Region commercial and subsistence fishing regulations, salmon and miscellaneous finfish, 1990–1991 edition. Division of Commercial Fisheries, Juneau.

ADF&G (Alaska Department of Fish and Game). 1992. Yukon Area commercial and subsistence salmon fisheries 1992 management plan. Division of Commercial Fisheries, Regional Information Report 3A92-10, Anchorage.

Bendix Corporation. 1981. Installation and operation manual, side-scan sonar counter. Electrodynamics Division, Division Report FISH-81-010. Report to the Alaska Department of Fish and Game, Anchorage, Alaska.

Bergstrom, D. J., and 7 co-authors. 1991. Annual management report Yukon Area, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A91-14, Anchorage.

Bergstrom, D. J., and 7 co-authors. 1992. Annual management report Yukon Area, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A92-17, Anchorage.

Buklis, L. S. 1981. Yukon River salmon studies. Anadromous Fish Conservation Act completion report for period July 1, 1977 to June 30, 1981. Alaska Department of Fish and Game, Juneau.

Buklis, L. S. 1982a. Anvik River summer chum salmon stock biology. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 204, Juneau.

Buklis, L. S. 1982b. Anvik, Andreafsky and Tanana River salmon escapement studies, 1981. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 15, Anchorage.

Buklis, L. S. 1983. Anvik and Andreafsky River salmon studies, 1982. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 20, Anchorage.

Buklis, L. S. 1984a. Anvik and Andreafsky River salmon studies, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 23, Anchorage.

Buklis, L. S. 1984b. Anvik and Andreafsky River salmon studies, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 24, Anchorage.

Buklis, L. S. 1985. Anvik and Andreafsky River salmon studies, 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 26, Anchorage.

Buklis, L. S. 1986. Anvik and Andreafsky River salmon studies, 1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 30, Anchorage.

Buklis, L. S. 1987. Anvik and Andreafsky River salmon studies, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Yukon Salmon Escapement Report 34, Anchorage.

Clutter, R.I., and L.W. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin of the International Pacific Salmon Fisheries Commission 9, Vancouver, British Columbia.

Fleischman, S., D. C. Mesiar, and P. Skvorc. 1992. Yukon River sonar escapement estimate 1991. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A92-08, Anchorage.

Lebida, R.C. 1973. Yukon River anadromous fish investigations. Alaska Department of Fish and Game (unpublished Commercial Fisheries Division Region III report), Juneau.

Mauney, J.L. 1977. Yukon River king and chum salmon escapement studies. Anadromous Fish Conservation Act Technical Report for Period July 1, 1975 to June 30, 1976. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Mauney, J.L. 1979. Yukon River salmon studies. Anadromous Fish Conservation Act Technical Report for Period July 1, 1977 to June 30, 1978. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Mauney, J.L. 1980. Yukon River salmon studies. Anadromous Fish Conservation Act Technical Report for Period July 1, 1978 to June 30, 1979. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Mauney, J.L., and L.S. Buklis 1980. Yukon River salmon studies. Anadromous Fish Conservation Act Technical Report for Period July 1, 1979 to June 30, 1980. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Mauney, J.L., and M.F. Geiger. 1977. Yukon River anadromous fish investigations. Anadromous Fish Conservation Act Completion Report for Period July 1, 1974 to June 30, 1977. Alaska Department of Fish and Game, Commercial Fisheries Division, Juneau.

Sandone, G.J. 1989. Anvik and Andreafsky River salmon studies, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A89-03, Anchorage.

Sandone, G.J. 1990a. Anvik River salmon studies, 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A90-26, Anchorage.

Sandone, G.J. 1990b. Anvik River salmon studies, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A90-35, Anchorage.

Sandone, G.J. 1991. An improved procedure to estimate summer chum salmon harvests in District 4 of the Yukon River, Alaska, as applied to the 1989 fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Fishery Research Bulletin 91-02, Juneau.

Sandone, G.J. 1993. Anvik River salmon escapement study, 1991. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report 93-08, Juneau.

**LITERATURE CITED** (Continued)

Trasky, L.L. 1974. Yukon River anadromous fish investigations. Anadromous Fish Conservation Act Technical Report for Period July 1, 1973 to June 30, 1974. Alaska Department of Fish and Game, Commercial Fisheries Division, Juneau.

Trasky, L.L. 1976. Yukon River king and chum salmon escapement studies. Anadromous Fish Conservation Act Technical Report for Period July 1, 1974 to June 30, 1975. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.

Wilcock, J.A. 1988. Feasibility of using scale pattern analysis to identify the origin of chum salmon in Yukon River fisheries, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A88-03, Anchorage.

Wilmot, R. L., and 3 co-authors. 1992. Genetic stock identification of Yukon River chum and chinook salmon 1987 to 1990. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, Fisheries Management Services, Progress Report, Anchorage.

Table 1. Anvik River summer chum salmon sonar counts by date, 1992.

| | West Bank | | | | East Bank | | | | Entire River | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Raw Daily Count | Adjust Factor[a] | Corrected Daily Count | Percentage of Daily Total | Raw Daily Count | Adjust Factor[a] | Corrected Daily Count | Percentage of Daily Total | Raw Daily Count | Corrected Daily Count | Corrected Season Count | Daily Prop. | Season Prop. |
| 21-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 22-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 23-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 24-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 25-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 26-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 27-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 28-Jun | 0 | – | 0 | – | 0 | – | 0 | – | 0 | 0 | 0 | 0.00 | 0.00 |
| 29-Jun | 97 | 1.00 | 97 | 80.2 | 24 | 1.00 | 24 | 19.8 | 121 | 121 | 121 | 0.00 | 0.00 |
| 30-Jun | 2,607 | 1.00 | 2,607 | 54.2 | 2,200 | 1.00 | 2,200 | 45.8 | 4,807 | 4,807 | 4,928 | 0.01 | 0.01 |
| 01-Jul | 12,785 | 1.03 | 13,133 | 65.5 | 7,094 | 0.98 | 6,926 | 34.5 | 19,879 | 20,059 | 24,987 | 0.03 | 0.03 |
| 02-Jul | 10,660 | 0.95 | 10,179 | 24.3 | 31,955 | 0.99 | 31,761 | 75.7 | 42,615 | 41,940 | 66,927 | 0.05 | 0.09 |
| 03-Jul | 16,502 | 0.89 | 14,718 | 25.8 | 42,552 | 0.99 | 42,254 | 74.2 | 59,054 | 56,972 | 123,899 | 0.07 | 0.16 |
| 04-Jul | 11,419 | 0.97 | 11,060 | 18.2 | 50,126 | 0.99 | 49,841 | 81.8 | 61,545 | 60,901 | 184,800 | 0.08 | 0.24 |
| 05-Jul | 18,342 | 1.00 | 18,258 | 22.5 | 71,667 | 0.88 | 62,867 | 77.5 | 90,009 | 81,125 | 265,925 | 0.10 | 0.34 |
| 06-Jul | 26,707 | 0.94 | 25,181 | 41.3 | 37,961 | 0.94 | 35,778 | 58.7 | 64,668 | 60,959 | 326,884 | 0.08 | 0.42 |
| 07-Jul | 27,234 | 0.95 | 25,905 | 49.5 | 27,171 | 0.97 | 26,409 | 50.5 | 54,405 | 52,314 | 379,198 | 0.07 | 0.49 |
| 08-Jul | 26,536 | 0.98 | 25,881 | 45.3 | 32,787 | 0.95 | 31,257 | 54.7 | 59,323 | 57,138 | 436,336 | 0.07 | 0.56 |
| 09-Jul | 23,077 | 0.97 | 22,276 | 37.3 | 38,622 | 0.97 | 37,468 | 62.7 | 61,699 | 59,744 | 496,080 | 0.08 | 0.64 |
| 10-Jul | 20,052 | 0.96 | 19,187 | 46.1 | 22,977 | 0.98 | 22,406 | 53.9 | 43,029 | 41,593 | 537,673 | 0.05 | 0.69 |
| 11-Jul | 15,663 | 0.98 | 15,410 | 49.9 | 16,206 | 0.96 | 15,482 | 50.1 | 31,869 | 30,892 | 568,565 | 0.04 | 0.73 |
| 12-Jul | 20,103 | 0.99 | 19,902 | 70.9 | 8,367 | 0.98 | 8,163 | 29.1 | 28,470 | 28,065 | 596,630 | 0.04 | 0.77 |
| 13-Jul | 16,830 | 0.98 | 16,464 | 62.5 | 9,875 | 1.00 | 9,894 | 37.5 | 26,705 | 26,358 | 622,988 | 0.03 | 0.80 |
| 14-Jul | 9,092 | 0.96 | 8,728 | 44.9 | 11,292 | 0.95 | 10,730 | 55.1 | 20,384 | 19,458 | 642,446 | 0.03 | 0.83 |
| 15-Jul | 9,629 | 1.00 | 9,614 | 54.1 | 8,248 | 0.99 | 8,141 | 45.9 | 17,877 | 17,755 | 660,201 | 0.02 | 0.85 |
| 16-Jul | 9,344 | 0.97 | 9,108 | 57.4 | 7,007 | 0.97 | 6,765 | 42.6 | 16,351 | 15,873 | 676,074 | 0.02 | 0.87 |
| 17-Jul | 10,239 | 0.99 | 10,102 | 48.6 | 11,259 | 0.95 | 10,663 | 51.4 | 21,498 | 20,765 | 696,839 | 0.03 | 0.90 |
| 18-Jul | 7,268 | 1.01 | 7,321 | 60.9 | 4,394 | 1.07 | 4,704 | 39.1 | 11,662 | 12,025 | 708,864 | 0.02 | 0.91 |
| 19-Jul | 7,713 | 1.01 | 7,758 | 78.7 | 1,784 | 1.17 | 2,096 | 21.3 | 9,497 | 9,854 | 718,718 | 0.01 | 0.93 |
| 20-Jul | 5,576 | 0.99 | 5,544 | 76.1 | 1,776 | 0.98 | 1,738 | 23.9 | 7,352 | 7,282 | 726,000 | 0.01 | 0.94 |
| 21-Jul | 7,514 | 0.99 | 7,435 | 64.3 | 4,276 | 0.97 | 4,128 | 35.7 | 11,790 | 11,563 | 737,563 | 0.01 | 0.95 |
| 22-Jul | 9,179 | 0.95 | 8,756 | 88.2 | 1,177 | 1.00 | 1,172 | 11.8 | 10,356 | 9,928 | 747,491 | 0.01 | 0.96 |
| 23-Jul | 7,650 | 0.96 | 7,315 | 64.7 | 4,232 | 0.94 | 3,999 | 35.3 | 11,882 | 11,314 | 758,805 | 0.01 | 0.98 |
| 24-Jul | 6,833 | 0.96 | 6,551 | 72.8 | 2,644 | 0.93 | 2,451 | 27.2 | 9,477 | 9,002 | 767,807 | 0.01 | 0.99 |
| 25-Jul | 5,167 | 0.98 | 5,067 | 64.8 | 2,766 | 0.99 | 2,752 | 35.2 | 7,933 | 7,819 | 775,626 | 0.01 | 1.00 |
| Total | 343,818 | | 333,557 | | 460,439 | | 442,069 | | 804,257 | 775,626 | | | |
| Mean | | 0.98 | | 54.4 | | 0.98 | | 45.6 | | | | | |
| Season adjust. factor[b] | | 0.97 | | | | 0.96 | | | 0.96 | | | | |

[a] Adjustment factor is the proportion of corrected daily sonar counts to the raw sonar counts.
[b] Season adjustment factor is the proportion of corrected season sonar counts to the unadjusted sonar counts.

Table 2. Annual Anvik River sonar passage estimates and associated passage timing statistics of the summer chum salmon run, 1979–1992.

| Year | Sonar Passage Esitmate | First Quartile Day | Median Day | Third Quartile Day | Days Between Quartile Days: First & Median | Median & Third | First & Third |
|---|---|---|---|---|---|---|---|
| 1979 | 277,712 | 02–Jul | 08–Jul | 12–Jul | 6 | 4 | 10 |
| 1980 | 482,181 | 06–Jul | 11–Jul | 16–Jul | 5 | 5 | 10 |
| 1981 | 1,479,582 | 27–Jun | 02–Jul | 07–Jul | 5 | 5 | 10 |
| 1982 | 444,581 | 07–Jul | 11–Jul | 14–Jul | 4 | 3 | 7 |
| 1983 | 362,912 | 30–Jun | 07–Jul | 12–Jul | 7 | 5 | 12 |
| 1984 | 891,028 | 05–Jul | 09–Jul | 13–Jul | 4 | 4 | 8 |
| 1985 | 1,080,243 | 10–Jul | 13–Jul | 16–Jul | 3 | 3 | 6 |
| 1986 | 1,085,750 | 29–Jun | 02–Jul | 06–Jul | 3 | 4 | 7 |
| 1987 | 455,876 | 05–Jul | 12–Jul | 16–Jul | 7 | 4 | 11 |
| 1988 | 1,125,449 | 01–Jul | 04–Jul | 09–Jul | 3 | 5 | 8 |
| 1989 | 636,906 | 01–Jul | 07–Jul | 15–Jul | 6 | 8 | 14 |
| 1990 | 403,627 | 02–Jul | 07–Jul | 15–Jul | 5 | 8 | 13 |
| 1991 | 847,772 | 02–Jul | 10–Jul | 16–Jul | 8 | 6 | 14 |
| 1992 | 775,626 | 05–Jul | 08–Jul | 12–Jul | 3 | 4 | 7 |
| Mean[a] | | 03–Jul | 08–Jul | 13–Jul | 5.3 | 5.0 | 10.3 |
| SE[a] | | 3.5 | 3.3 | 3.0 | 1.6 | 1.7 | 2.7 |

[a] Calculation of mean and SE includes estimates from years 1979–1985 and 1987–1992. In 1986 sonar passage counting was terminated early, probably resulting in the incorrect calculation of the quartile days. Therefore, 1986 run timing statistics were excluded from the calculation of the overall mean and SE.

Table 3. Sonar and corresponding oscilloscope counts of salmon at the Anvik River east and west bank sites, 1992.

| | West Bank Sonar Site | | | | East Bank Sonar Site | | | |
|---|---|---|---|---|---|---|---|---|
| Date[a] | Hours | Sonar Count | Scope Count | Sonar/ Scope | Hours | Sonar Count | Scope Count | Sonar/ Scope |
| 30-Jun | 0.97 | 105 | 101 | 1.04 | 1.00 | 28 | 35 | 0.80 |
| 01-Jul | 1.15 | 312 | 320 | 0.98 | 1.72 | 469 | 457 | 1.03 |
| 02-Jul | 1.15 | 324 | 324 | 1.00 | 1.20 | 946 | 941 | 1.01 |
| 03-Jul | 1.12 | 758 | 640 | 1.18 | 1.17 | 674 | 661 | 1.02 |
| 04-Jul | 0.92 | 418 | 410 | 1.02 | 1.03 | 563 | 582 | 0.97 |
| 05-Jul | 0.92 | 591 | 591 | 1.00 | 0.67 | 970 | 842 | 1.15 |
| 06-Jul | 0.73 | 414 | 384 | 1.08 | 1.00 | 386 | 363 | 1.06 |
| 07-Jul | 0.52 | 433 | 414 | 1.05 | 1.02 | 604 | 581 | 1.04 |
| 08-Jul | 0.68 | 729 | 709 | 1.03 | 0.80 | 439 | 419 | 1.05 |
| 09-Jul | 0.95 | 695 | 678 | 1.03 | 0.37 | 295 | 281 | 1.05 |
| 10-Jul | 0.77 | 507 | 478 | 1.06 | 1.23 | 585 | 566 | 1.03 |
| 11-Jul | 0.73 | 284 | 282 | 1.01 | 0.83 | 87 | 82 | 1.06 |
| 12-Jul | 0.65 | 423 | 419 | 1.01 | 1.12 | 404 | 391 | 1.03 |
| 13-Jul | 0.97 | 541 | 529 | 1.02 | 0.97 | 345 | 343 | 1.01 |
| 14-Jul | 0.88 | 395 | 380 | 1.04 | 0.60 | 268 | 254 | 1.06 |
| 15-Jul | 0.95 | 348 | 349 | 1.00 | 0.93 | 270 | 263 | 1.03 |
| 16-Jul | 0.83 | 291 | 282 | 1.03 | 1.02 | 251 | 248 | 1.01 |
| 17-Jul | 1.02 | 246 | 245 | 1.00 | 1.02 | 468 | 430 | 1.09 |
| 18-Jul | 1.38 | 451 | 455 | 0.99 | 1.02 | 79 | 87 | 0.91 |
| 19-Jul | 0.80 | 390 | 391 | 1.00 | 1.00 | 81 | 94 | 0.86 |
| 20-Jul | 1.00 | 299 | 300 | 1.00 | 1.25 | 148 | 142 | 1.04 |
| 21-Jul | 1.25 | 486 | 462 | 1.05 | 1.00 | 55 | 52 | 1.06 |
| 22-Jul | 1.25 | 486 | 462 | 1.05 | 1.00 | 38 | 40 | 0.95 |
| 23-Jul | 0.87 | 420 | 400 | 1.05 | 1.00 | 200 | 191 | 1.05 |
| 24-Jul | 1.00 | 395 | 381 | 1.04 | 1.02 | 245 | 228 | 1.07 |
| 25-Jul | 0.83 | 255 | 249 | 1.02 | 0.83 | 92 | 92 | 1.00 |
| Total | 24.28 | 10,996 | 10,635 | 1.03 | 25.80 | 8,990 | 8,665 | 1.04 |

[a] Although sonar counters and oscilloscopes were monintored during the peiod 21–29 June, no fish were observed. During this period observation times were not recorded but probably varied between 0.50 and 1.00 h per day.

Table 4. Summer chum salmon escapement counts for selected spawning areas in the Yukon River drainage, 1973–1992.

| | Andreafsky River | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | East Fork | | | Anvik River | | Nulato River[a] | | | Hogatza River[a] | | |
| Year | Aerial | Sonar or Tower | West Fork[a] | Tower & Aerial[b] | Sonar | South Fork | North Fork[c] | Gisasa River[a] | (Clear and Caribou Crs) | Chena River[a] | Salcha River[a] |
| 1973 | 10,149 [d] | – | 51,835 | 86,665 [d] | – | – | – | – | – | 79 [d] | – |
| 1974 | 3,215 [d] | – | 33,578 | 201,277 | – | 29,016 | 29,334 | 22,022 | – | 4,349 | 3,510 |
| 1975 | 223,485 | – | 235,954 | 845,485 | – | 51,215 | 87,280 | 56,904 | 22,355 | 1,670 | 7,573 |
| 1976 | 105,347 | – | 118,420 | 406,166 | – | 9,230 [d] | 30,771 | 21,342 | 20,744 | 685 | 6,474 |
| 1977 | 112,722 | – | 63,120 | 262,854 | – | 11,385 | 58,275 | 2,204 [d] | 10,734 | 610 | 677 [d] |
| 1978 | 127,050 | – | 57,321 | 251,339 | – | 12,821 | 41,659 | 9,280 [d] | 5,102 | 1,609 | 5,405 |
| 1979 | 66,471 | – | 43,391 | 81,830 [d] | 280,537 | 1,506 | 35,598 | 10,962 | 14,221 | 1,025 [d] | 3,060 |
| 1980 | 36,823 [d] | – | 114,759 | – | 492,676 | 3,702 [d] | 11,244 [d] | 10,388 | 19,786 | 338 | 4,140 |
| 1981 | 81,555 | 147,312 [e] | – | – | 1,486,182 | 14,348 | – | – | – | 3,500 | 8,500 |
| 1982 | 7,501 [d] | 181,352 [e] | 7,267 [d] | – | 444,581 | – | – | 334 [d] | 4,984 [d] | 1,509 | 3,756 |
| 1983 | – | 110,608 [e] | – | – | 362,912 | 1,263 [d] | 19,749 | 2,356 [d] | 28,141 | 1,097 | 716 [d] |
| 1984 | 95,200 [d] | 70,125 [e] | 238,565 | – | 891,028 | – | – | – | – | 1,861 | 9,810 |
| 1985 | 66,146 | – | 52,750 | – | 1,080,243 | 10,494 | 19,344 | 13,232 | 22,566 | 1,005 | 3,178 |
| 1986 | 83,931 | 167,614 [f] | 99,373 | – | 1,189,602 | 16,848 | 47,417 | 12,114 | – | 1,509 | 8,028 |
| 1987 | 6,687 [d] | 45,221 [f] | 35,535 | – | 455,876 | 4,094 | 7,163 | 2,123 | 5,669 [d] | 333 | 3,657 |
| 1988 | 43,056 | 68,937 [f] | 45,432 | – | 1,125,449 | 15,132 | 26,951 | 9,284 | 6,890 | 432 | 2,889 [d] |
| 1989 | 21,460 [d] | – | – | – | 636,906 | – | – | – | – | 714 [d] | 1,574 [d] |
| 1990 | 11,519 [d] | – | 20,426 [d] | – | 403,627 | 3,196 [d,g] | 1,419 [d] | 450 [d] | 2,177 [d] | 100 [d] | 450 [d] |
| 1991 | 31,886 | – | 46,657 | – | 847,772 | 13,150 | 12,491 | 7,003 | 9,947 | 10 [d] | 154 [d] |
| 1992 | 11,308 [d] | – | 37,808 [d] | – | 775,626 | 5,322 | 12,358 | 9,300 | 2,986 | 848 [d] | 3,222 |
| E.O.[h] | >109,000 | – | >116,000 | – | >500,000 [j] | – | >53,000 [k] | – | >17,000 [m] | – | >3,500 |

[a] Data obtained by aerial survey unless otherwise noted. Only peak counts are listed. Latest table revision November 18, 1992.
[b] From 1972–1979, counting tower operated; mainstem aerial survey counts below the tower were added to tower counts.
[c] Includes mainstem counts below the confluence of the North and South Forks, unless otherwise noted.
[d] Incomplete survey and/or poor survey timing or conditions resulted in minimal or inaccurate count.
[e] Sonar count.
[f] Tower count.
[g] Mainstem counts below the confluence of the North and South Forks Nulato River included in the South Fork counts.
[h] Interim escapement objective.
[j] The Anvik River escapement objective was rounded upward to 500,000 from 487,000 in March, 1992.
[k] Interim escapement objective for North Fork Nulato River only.
[m] Consists of Clear and Caribou Creeks interim escapement objectives of 9,000 and 8,000, respectively.

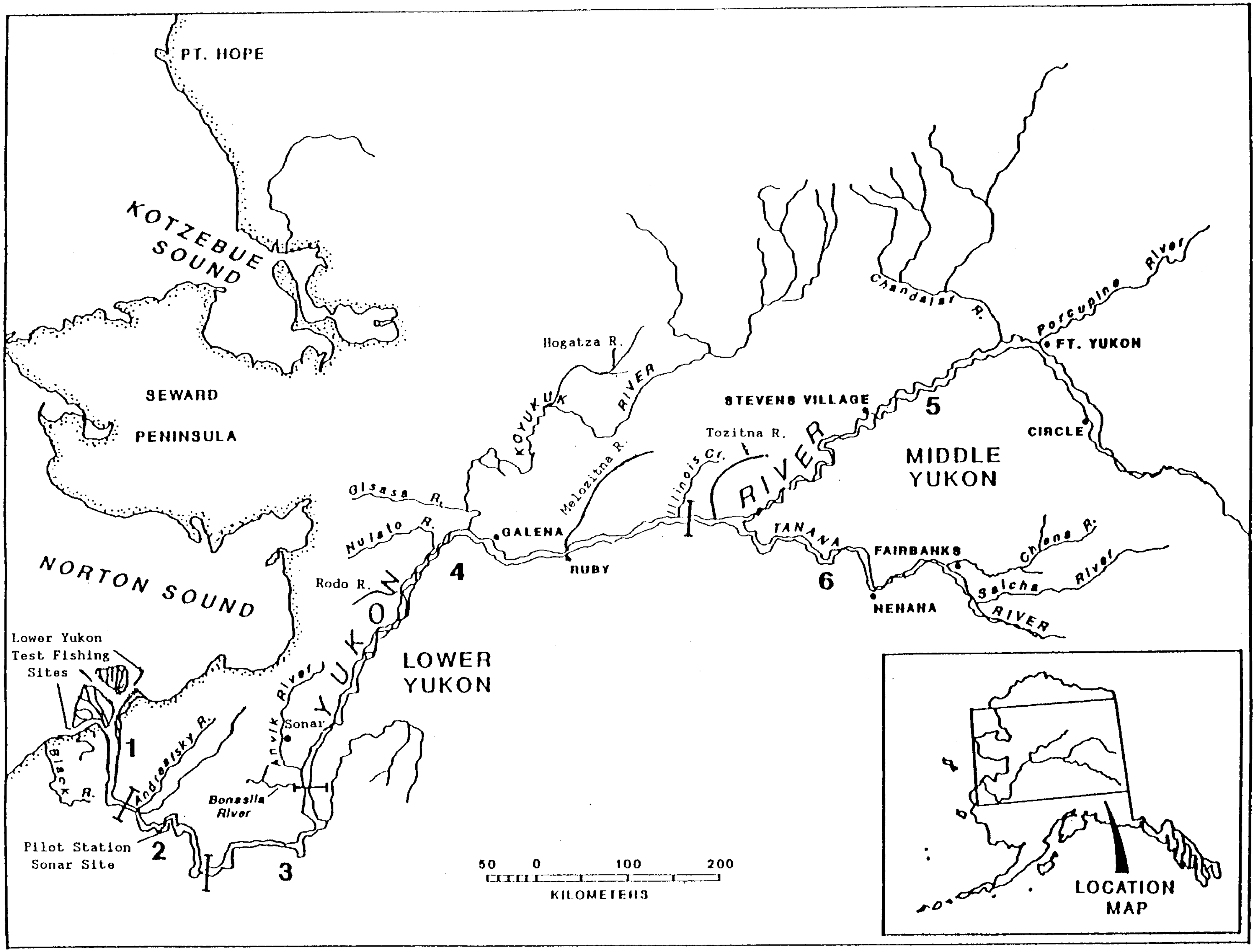


Figure 1. Alaskan portion of the Yukon River showing fishing district boundaries.

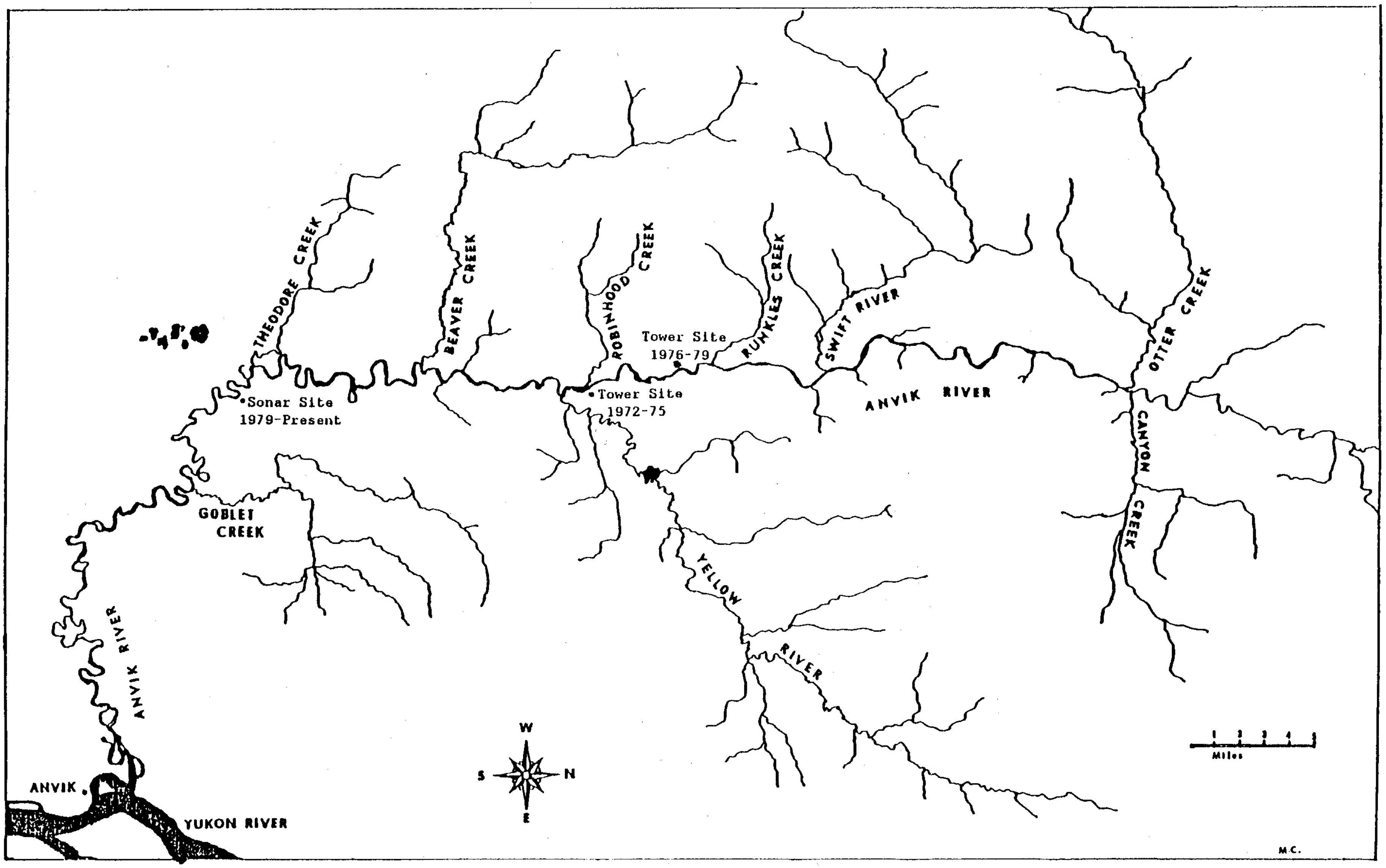


Figure 2. The Anvik River drainage showing sonar and counting tower sites.

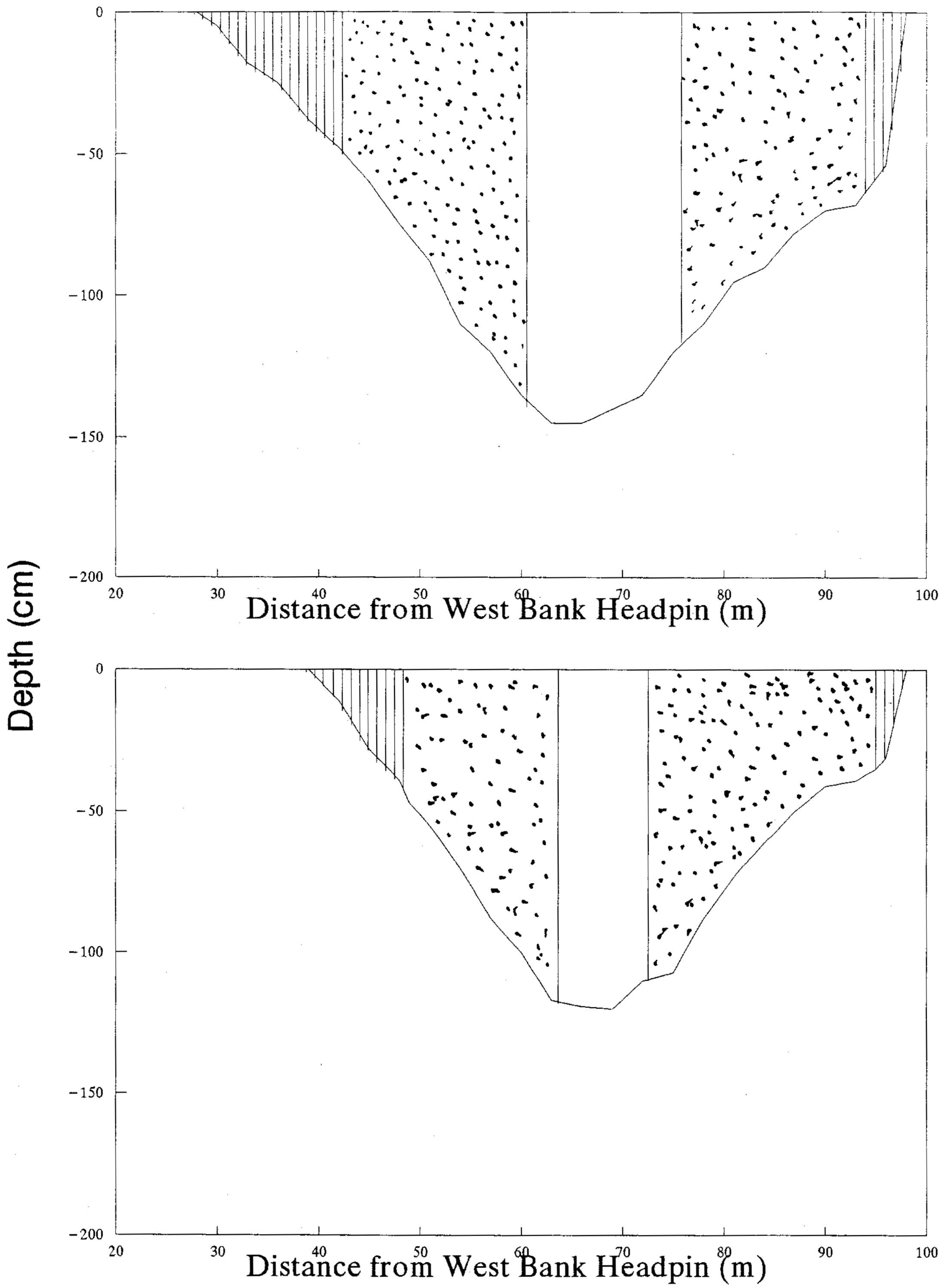


Figure 3. Anvik River depth profiles, 20 June (top) and 9 July (bottom), 1992. Stippled areas are approximate insonification zones; weired areas are indicated by vertical lines.

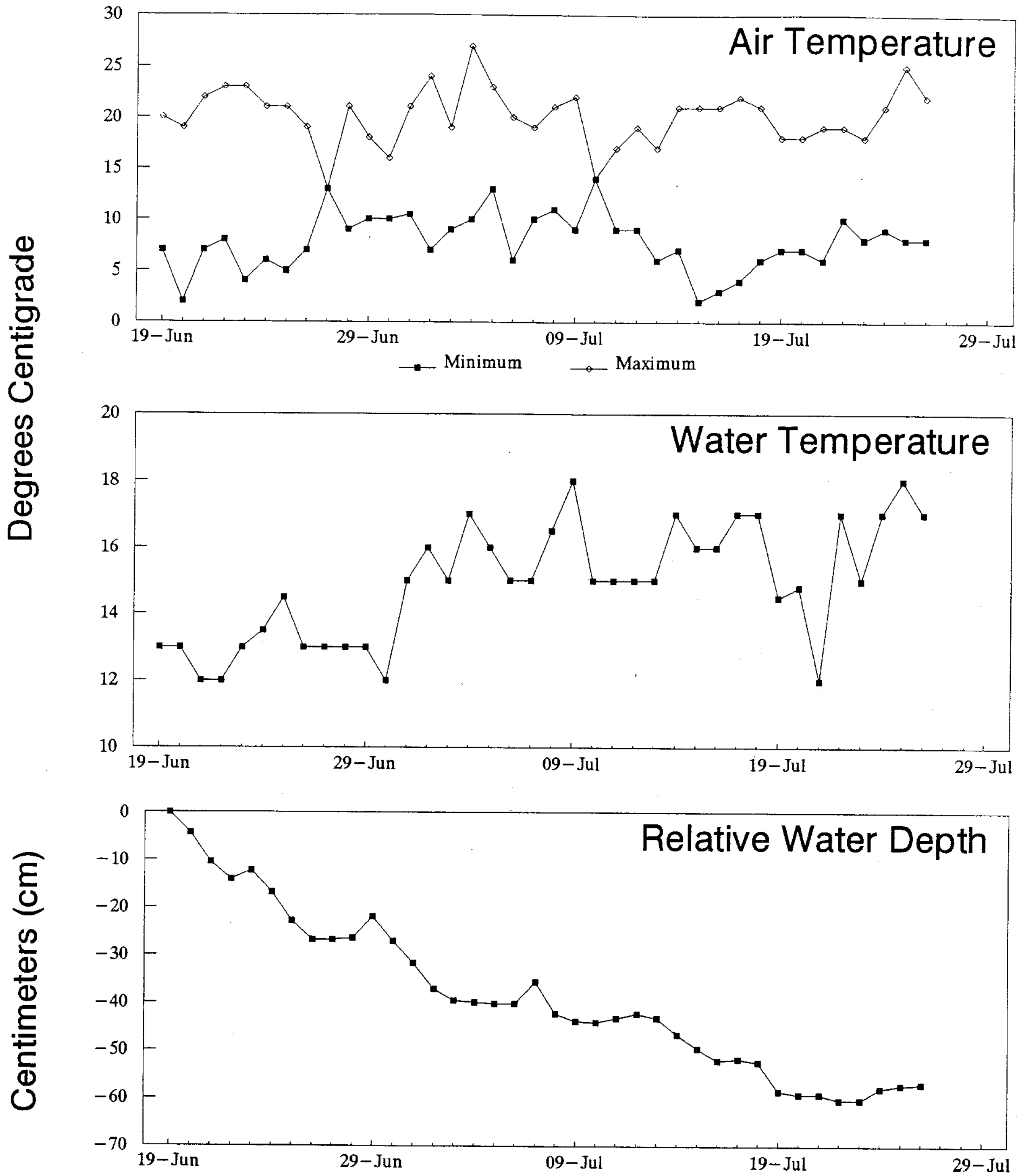


Figure 4. Daily minimum and maximum air temperatures, instantaneous water temperature, and relative water depth measured at approximately 1800 hours at the Anvik River sonar site, 1992.

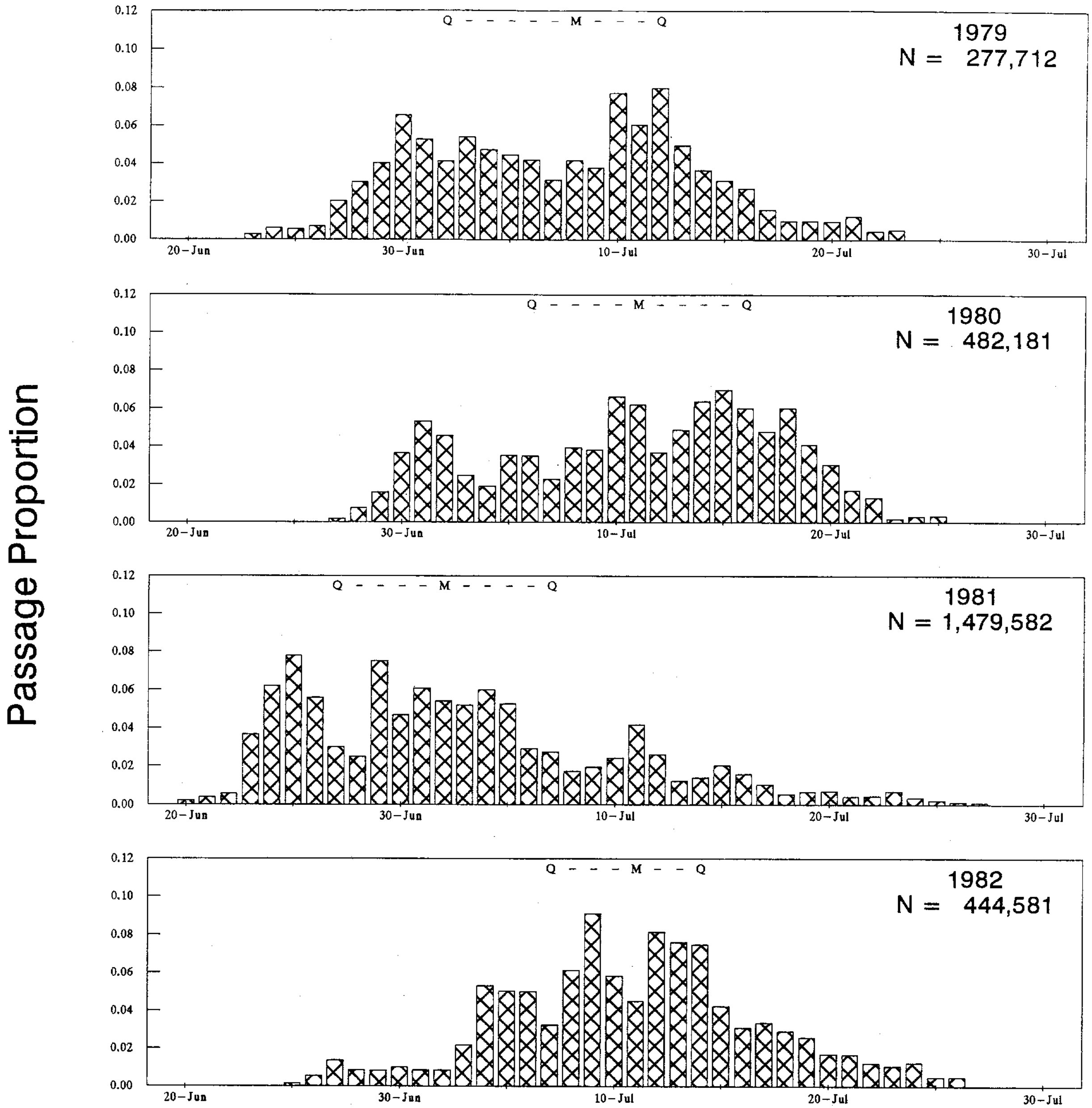


Figure 5. Daily proportion of corrected Anvik River sonar counts of summer chum salmon passage by day, 1979–1992 (N = total number of corrected counts). The first and third quartile passage days are indicated by the "Q"s, while the median day of passage is indicated by the "M".

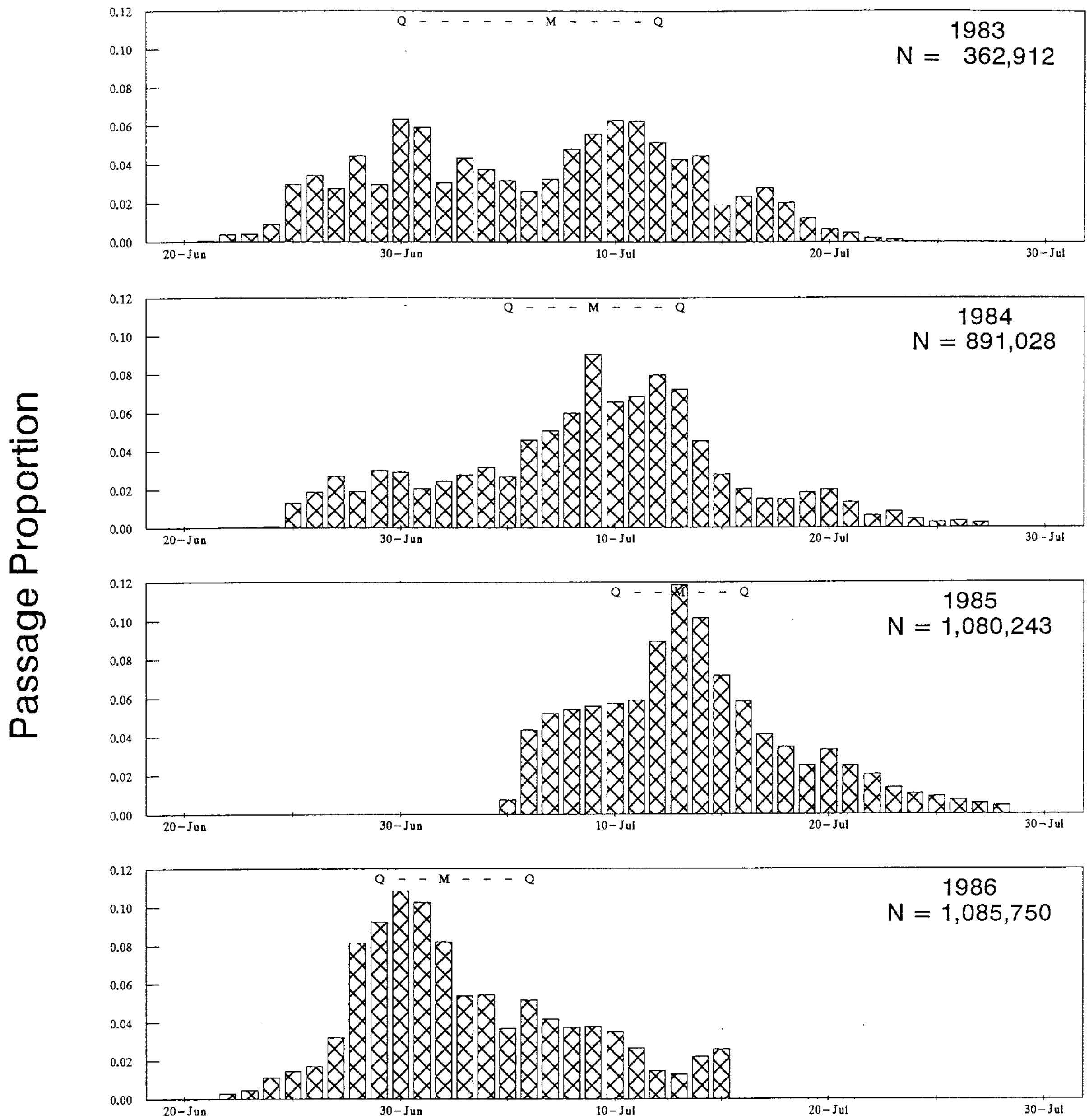


Figure 5. (page 2 of 4).

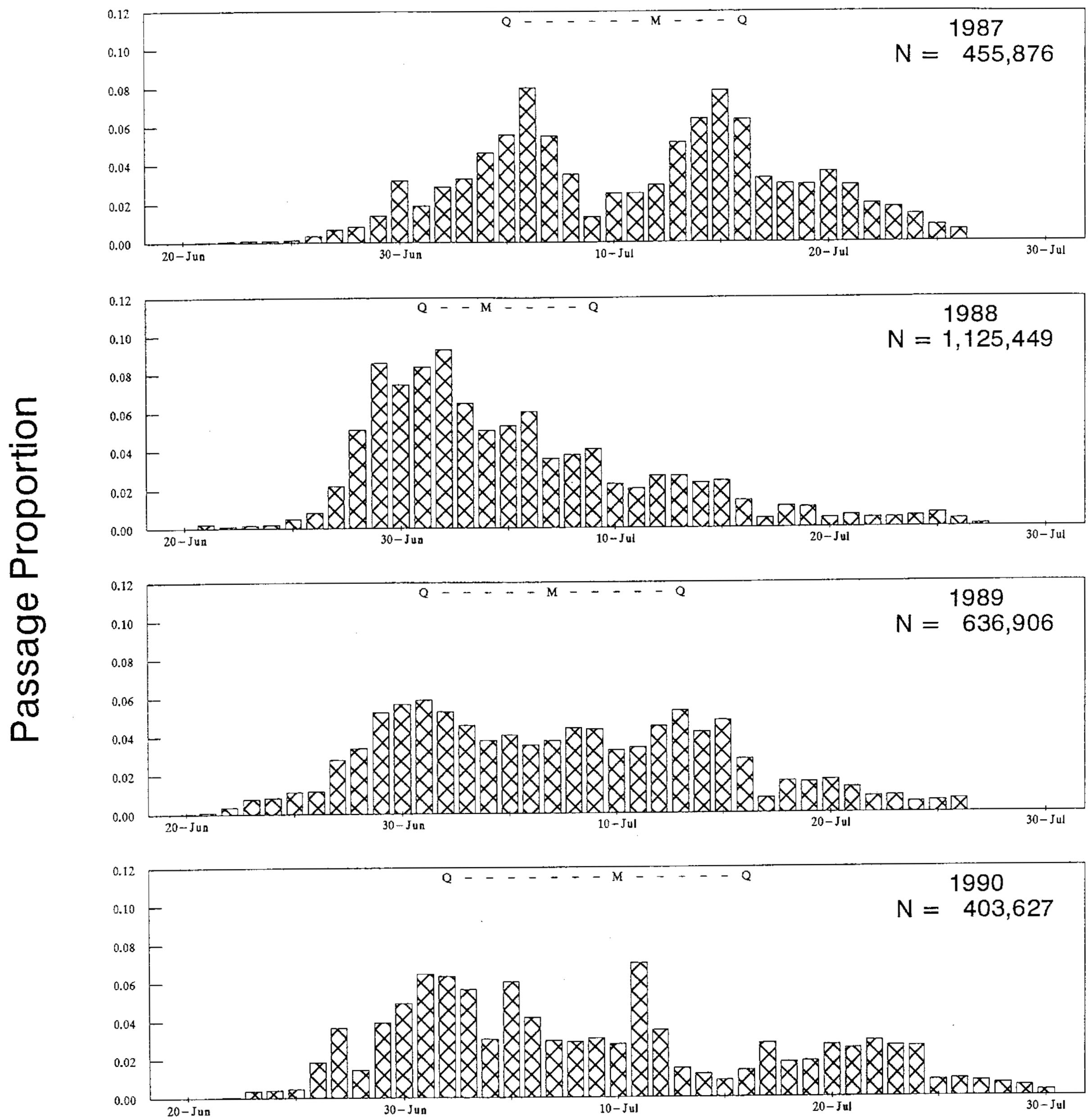


Figure 5. (page 3 of 4).

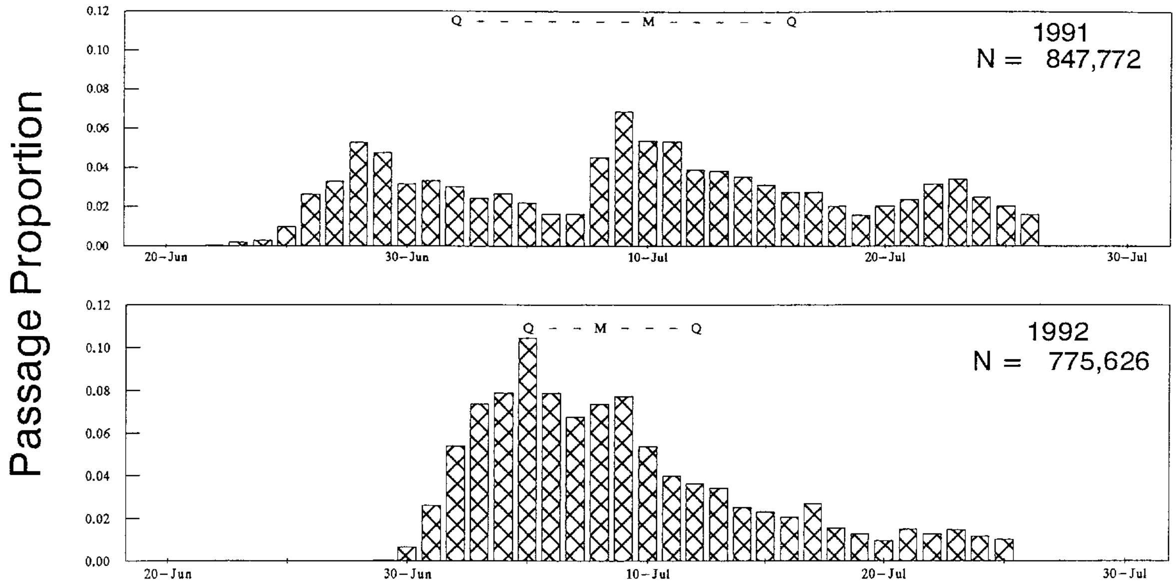


Figure 5. (page 4 of 4).

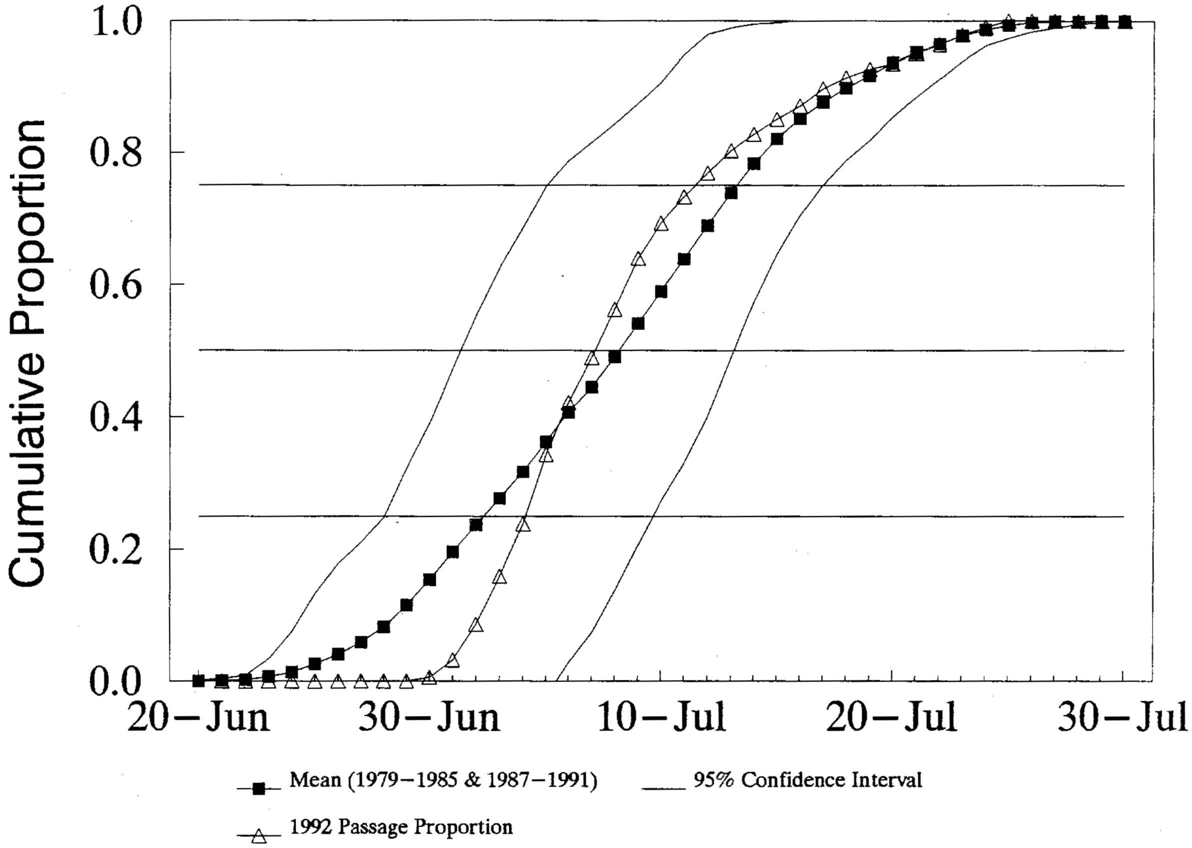


Figure 6. Mean (1979−1985 & 1987−1991) and the 1992 run timing curves for Anvik River summer chum salmon. Horizontal lines indicate the quartile proportions.

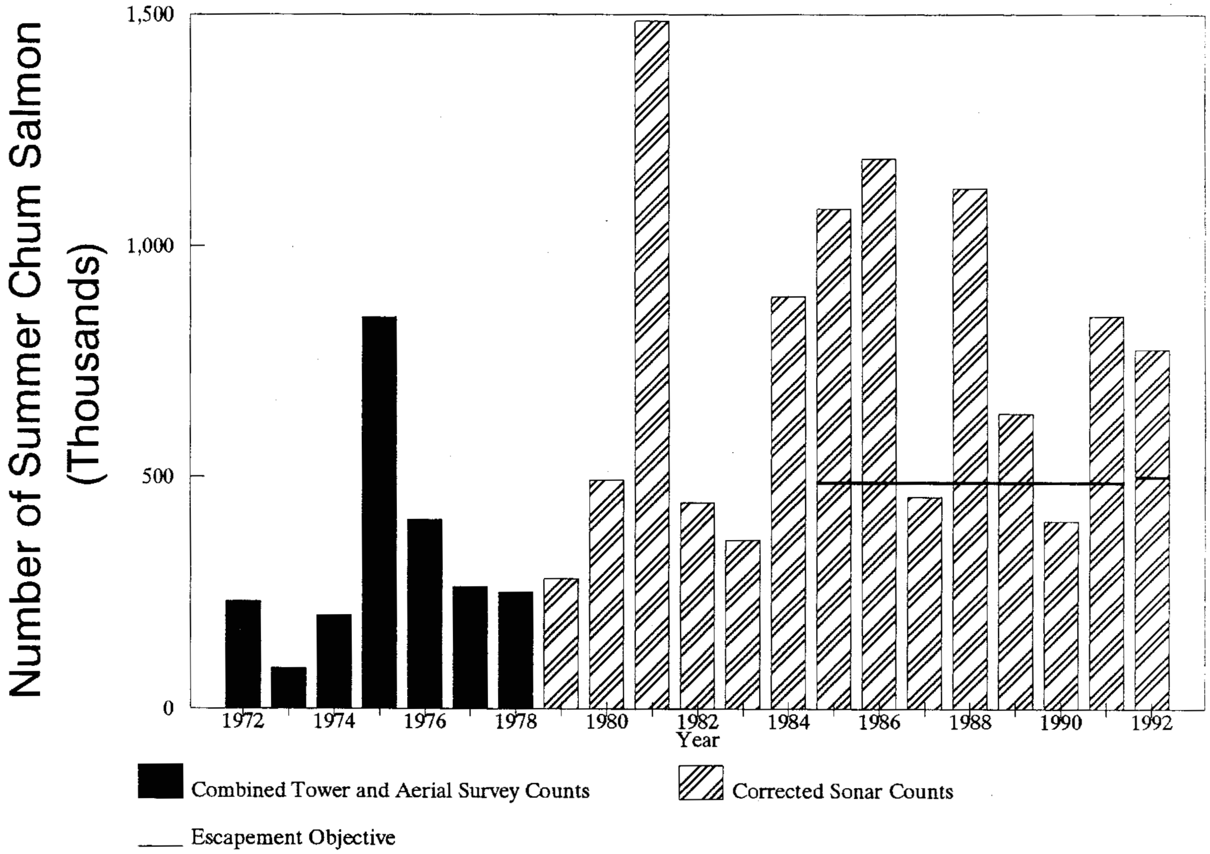


Figure 7. Anvik River summer chum salmon escapement estimated by combined tower and aerial survey count, 1972–1978, and by side–scanning sonar, 1979–1992. Sonar count escapement objective of 487,000 salmon, effective from 1985 to 1991, and the present escapement objective of 500,000 salmon are indicated by the horizontal lines.

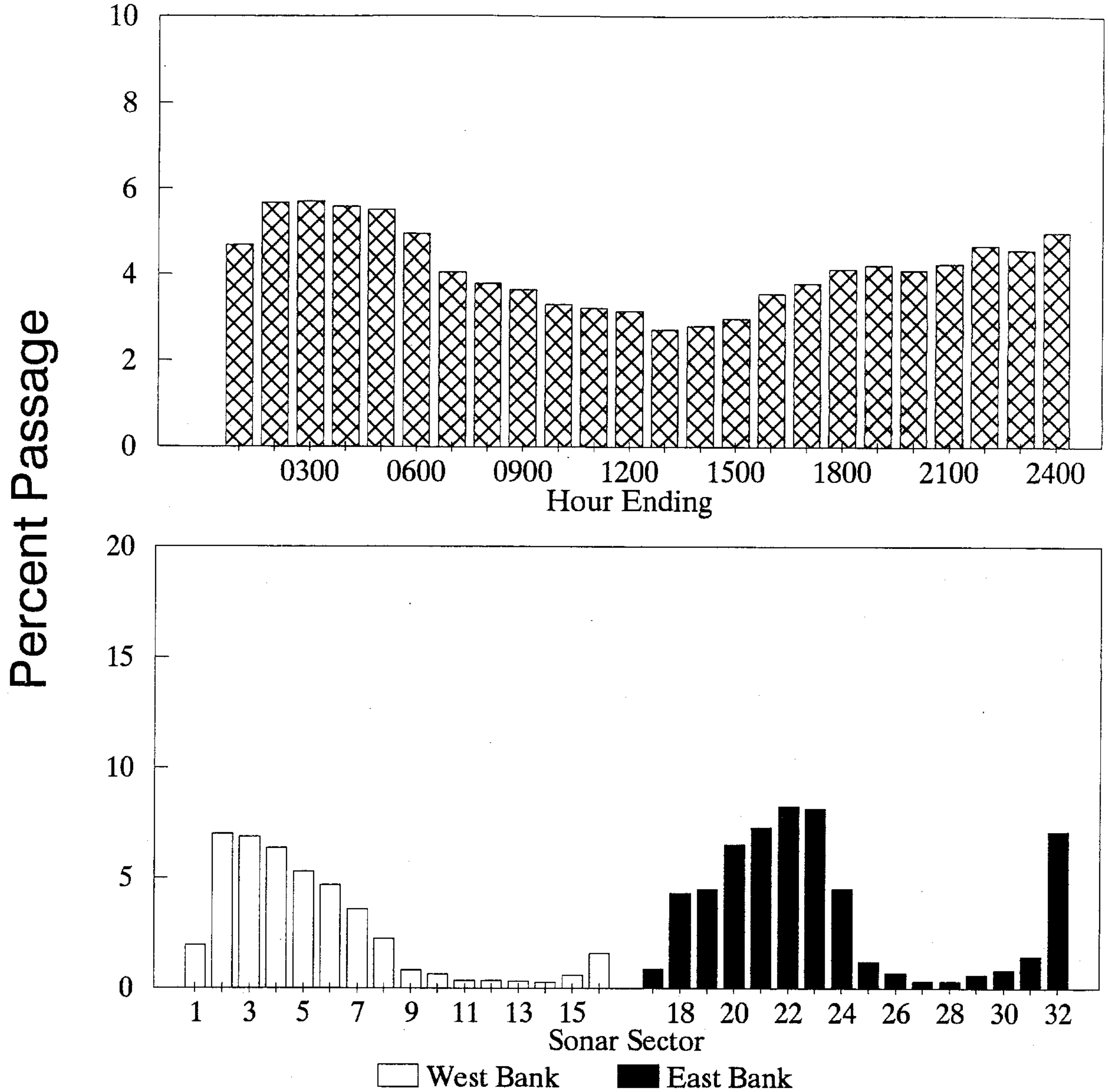


Figure 8. Estimated percent of the total summer chum salmon passage, 775,626 salmon, in relation to hour of the day (above) and sonar sector (below), Anvik River sonar site, 21 June – 25 July, 1992.

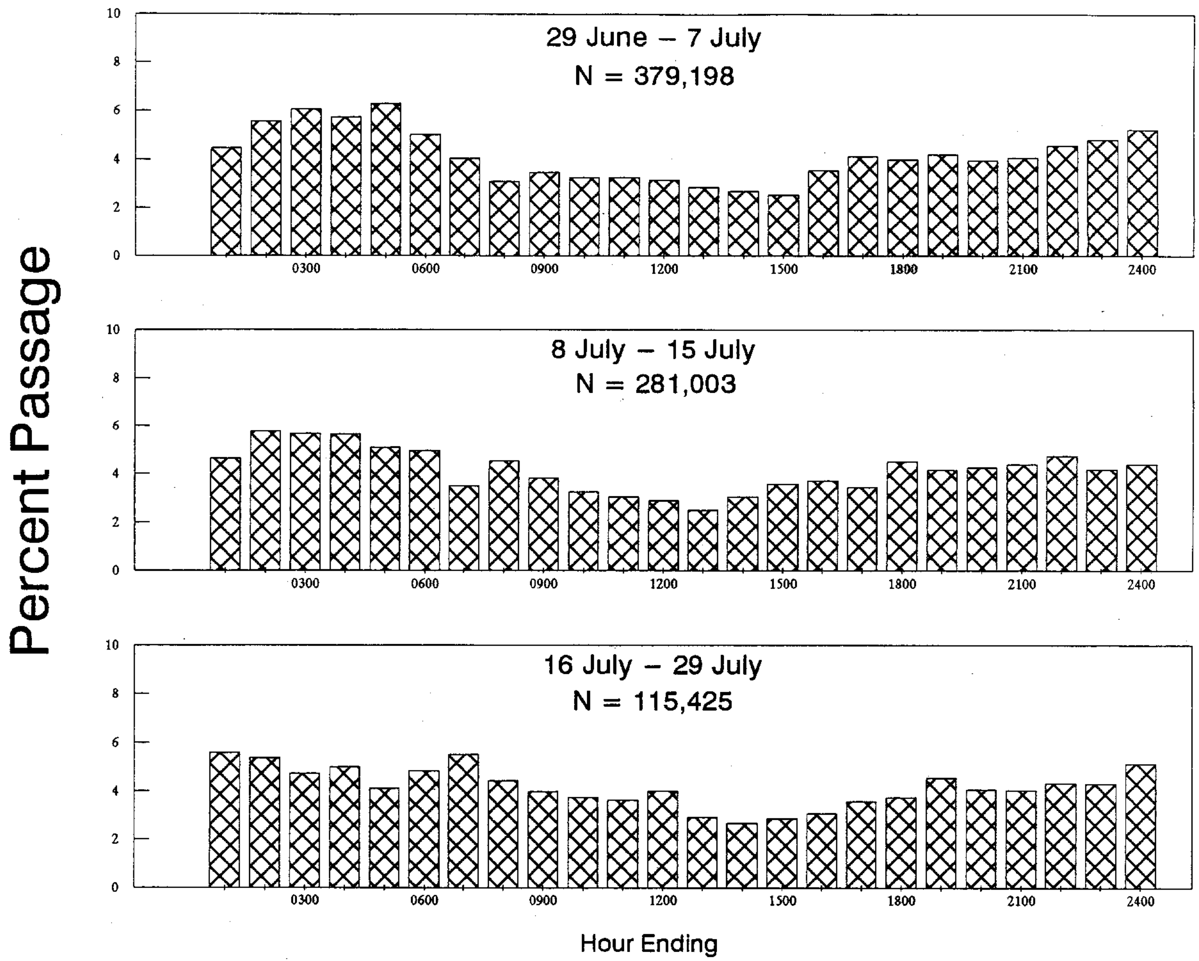


Figure 9. Estimated percent of summer chum salmon passage by sampling stratum and hour of the day, Anvik River, 1992.

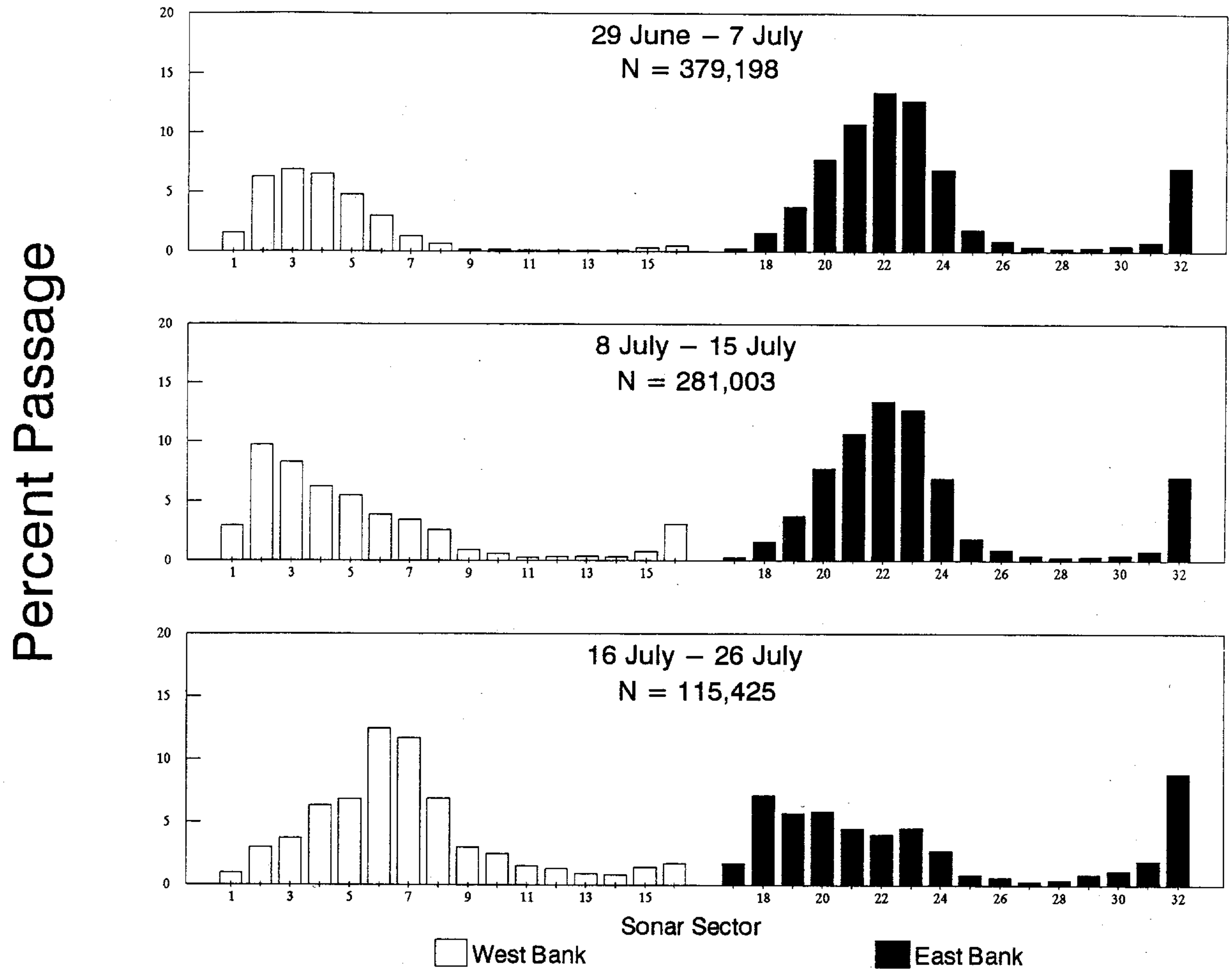


Figure 10. Estimated percent of summer chum salmon passage by sampling stratum and sonar sector, Anvik River, 1992.

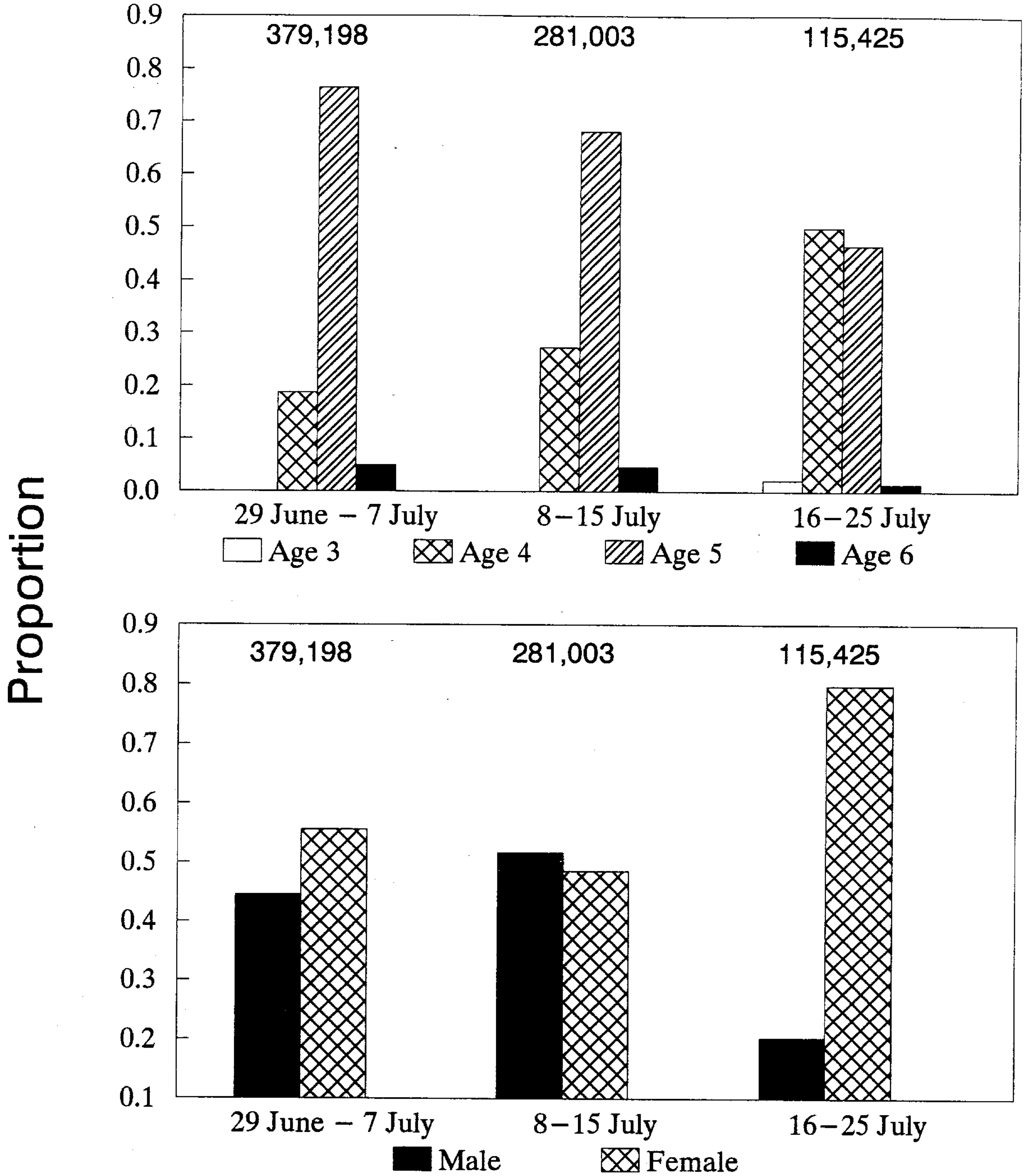


Figure 11. Age and sex compositon of sampled Anvik River summer chum salmon by sampling stratum, 1992. Numbers above bars indicate estimated passage during that stratum.

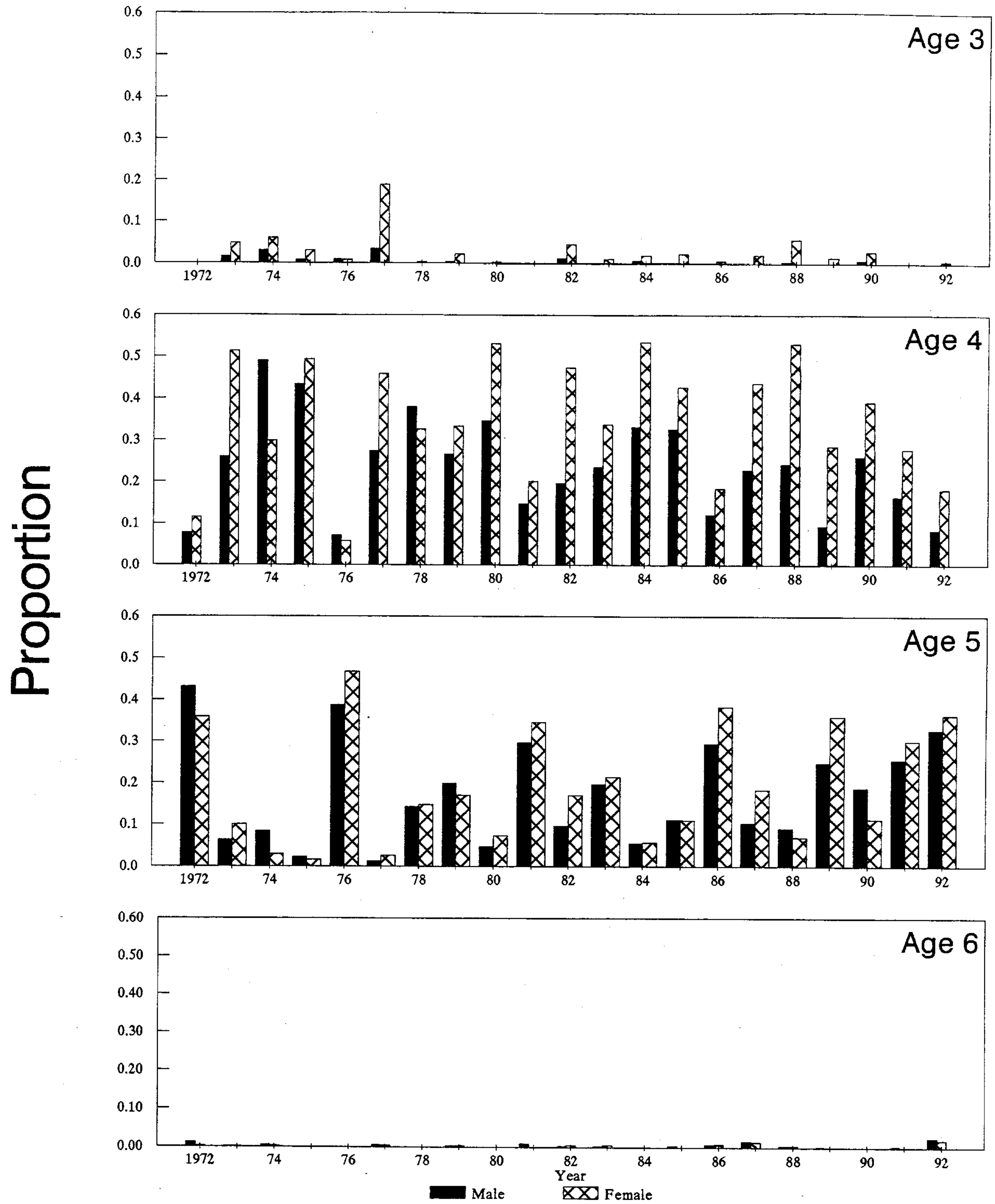


Figure 12. Estimated age and sex compostion of the Anvik River summer chum salmon escapement, 1972–1992.

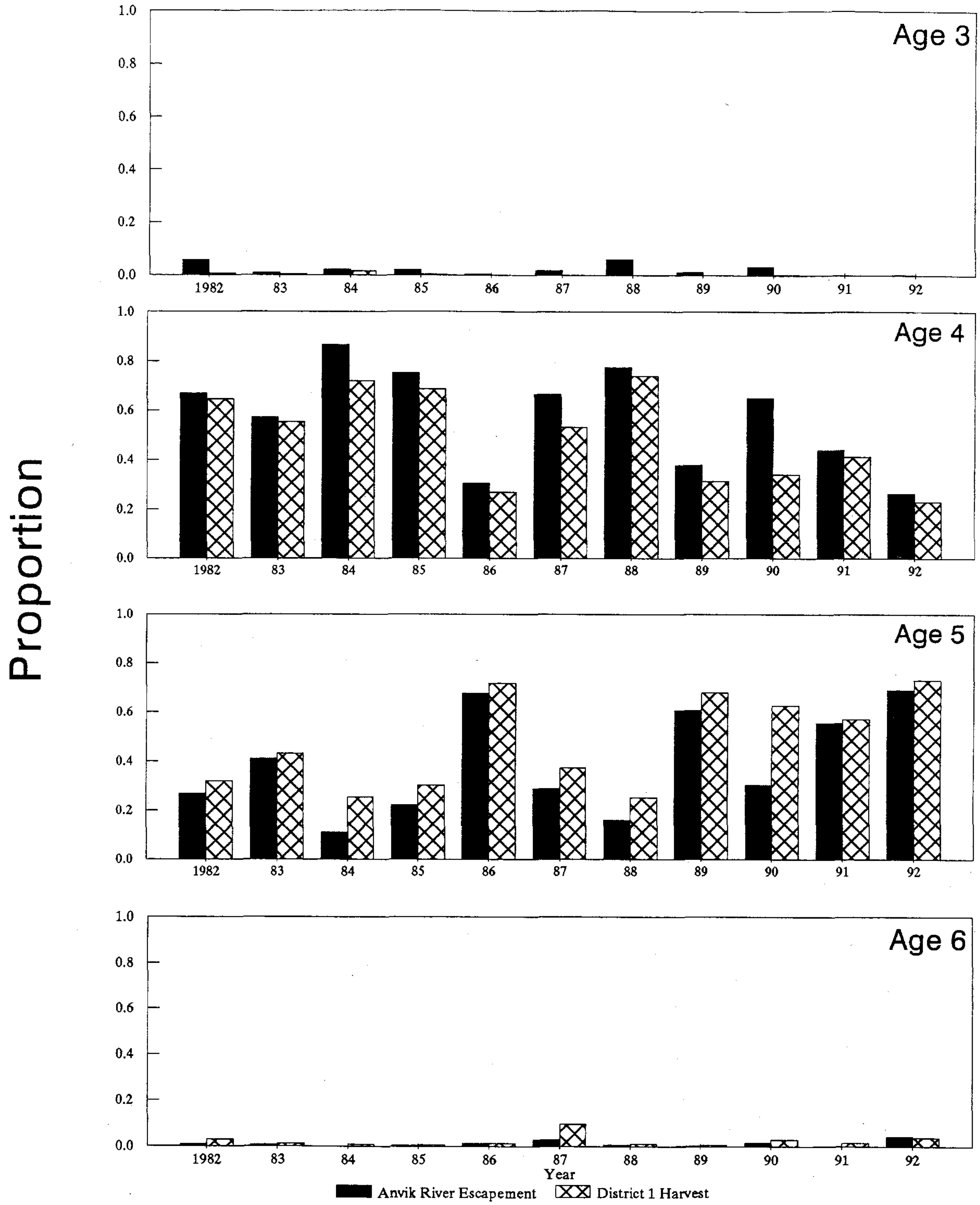


Figure 13. Estimated age compostion of the Anvik River summer chum salmon escapement and District 1 commercial harvest, 1982–1992.

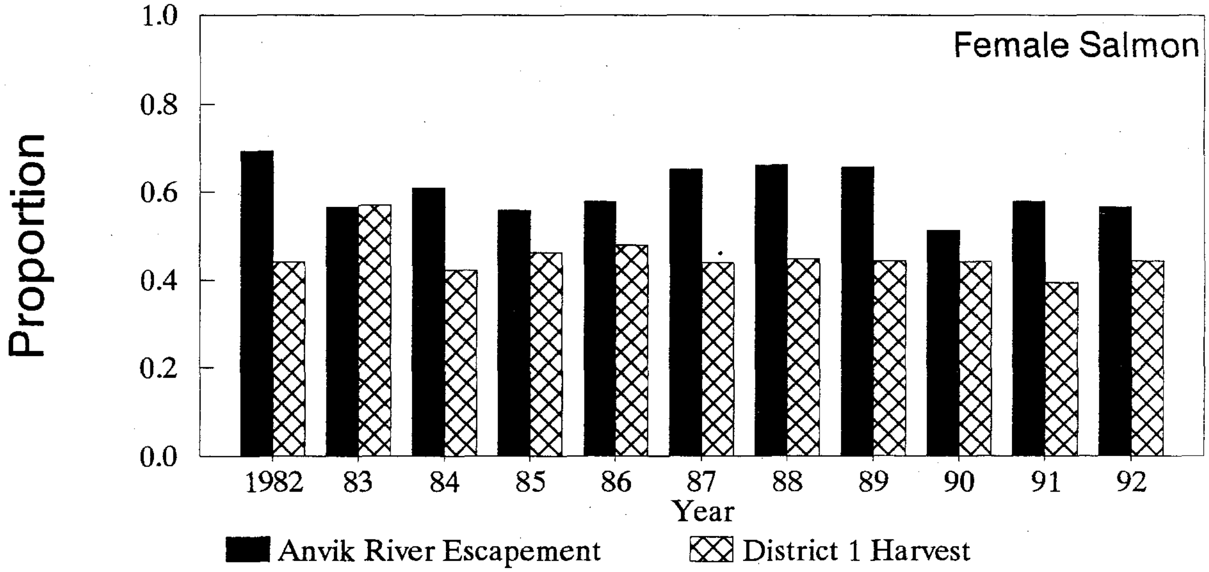


Figure 14. Estimated proporiton of female chum salmon in the Anvik River escapement and the District 1 commercial harvest, 1982–1992.

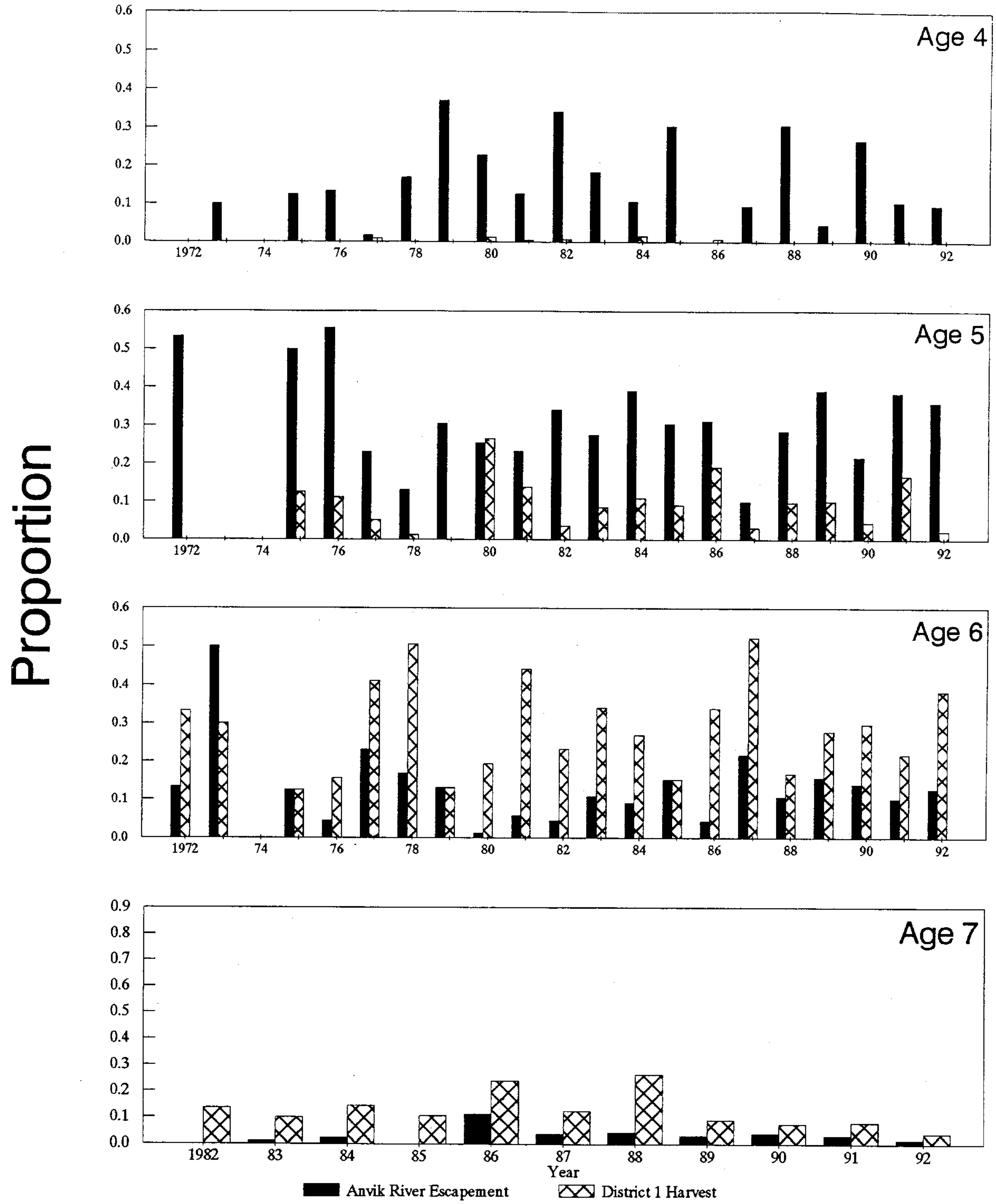


Figure 15. Estimated age and sex compostion of the Anvik River chinook salmon escapement, 1972–1992.

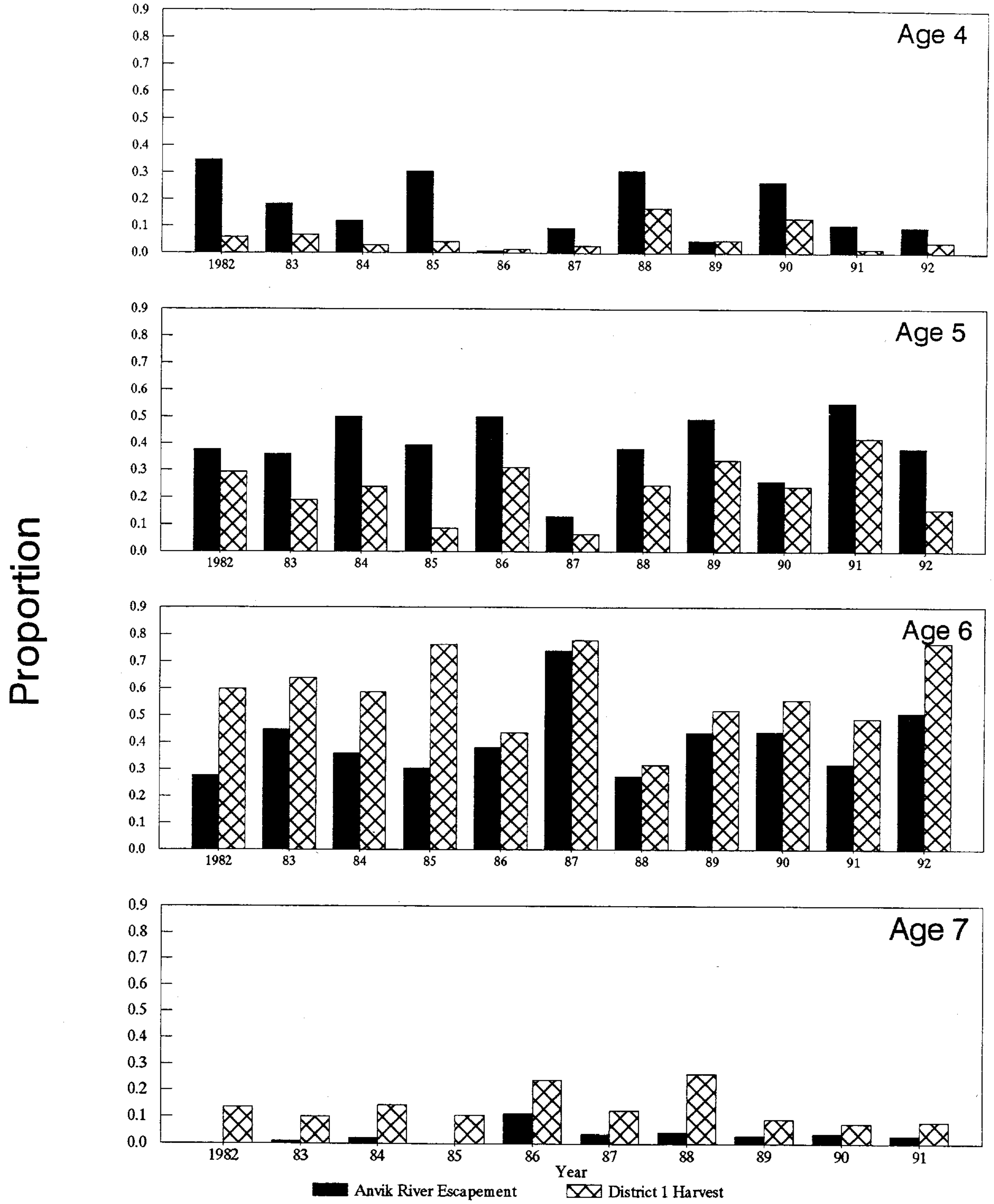


Figure 16. Estimated age composition of the Anvik River chinook salmon escapement and the District 1 harvest, Yukon River, 1982–1992.

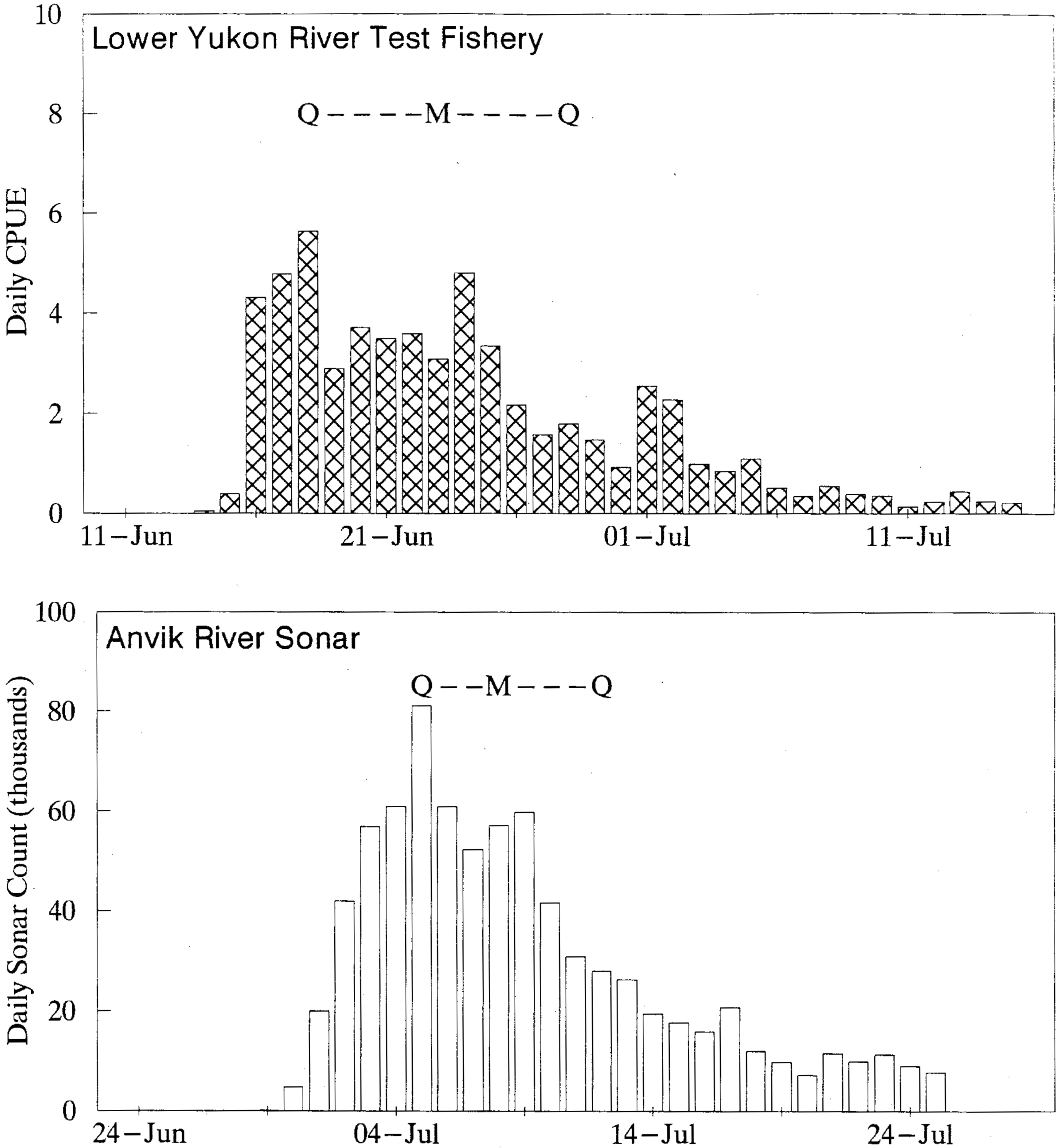


Figure 17. Run timing of Yukon River summer chum salmon in 1992 as indicated by Lower Yukon test fish CPUE and Anvik River sonar counts. First and third quartile passage days are indicated by the "Q"s, while the median day of passage is indicated by the "M ."

# APPENDIX

Appendix A. West bank Anvik River corrected sonar counts by hour and date, 21 June – 25 July, 1992.

| Hour Ending | 28–Jun[a] | 29–Jun | 30–Jun | 01–Jul | 02–Jul | 03–Jul | 04–Jul | 05–Jul | 06–Jul | 07–Jul | 08–Jul | 09–Jul | 10–Jul | 11–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0100 | 0 | 0 | 0 | 794 | 803 | 1,540 | 799 | 632 | 648 | 861 | 677 | 1,120 | 1,559 | 330 |
| 0200 | 0 | 0 | 0 | 1,123 | 899 | 776 | 703 | 748 | 873 | 1,160 | 1,063 | 1,204 | 1,512 | 784 |
| 0300 | 0 | 0 | 0 | 1,436 | 797 | 771 | 747 | 911 | 1,132 | 1,503 | 1,462 | 1,319 | 1,214 | 667 |
| 0400 | 0 | 0 | 0 | 1,134 | 727 | 877 | 720 | 808 | 1,121 | 1,488 | 1,585 | 1,452 | 1,463 | 472 |
| 0500 | 0 | 0 | 0 | 843 | 561 | 829 | 612 | 816 | 1,045 | 1,387 | 1,386 | 1,211 | 1,129 | 672 |
| 0600 | 0 | 0 | 0 | 764 | 309 | 614 | 307 | 478 | 558 | 741 | 679 | 976 | 1,410 | 721 |
| 0700 | 0 | 0 | 0 | 429 | 238 | 564 | 298 | 676 | 608 | 807 | 514 | 221 | 968 | 608 |
| 0800 | 0 | 0 | 0 | 395 | 238 | 597 | 327 | 1,204 | 744 | 334 | 878 | 869 | 622 | 479 |
| 0900 | 0 | 0 | 0 | 729 | 230 | 568 | 158 | 1,173 | 643 | 638 | 1,245 | 507 | 503 | 360 |
| 1000 | 0 | 0 | 0 | 496 | 163 | 180 | 191 | 1,022 | 972 | 614 | 685 | 524 | 490 | 544 |
| 1100 | 0 | 0 | 0 | 561 | 106 | 154 | 196 | 851 | 1,436 | 505 | 702 | 785 | 570 | 370 |
| 1200 | 0 | 0 | 0 | 295 | 138 | 222 | 272 | 1,530 | 1,750 | 608 | 586 | 1,057 | 569 | 473 |
| 1300 | 0 | 0 | 41 | 400 | 315 | 328 | 437 | 1,583 | 1,248 | 744 | 549 | 640 | 588 | 602 |
| 1400 | 0 | 0 | 31 | 269 | 336 | 329 | 634 | 902 | 1,316 | 857 | 850 | 677 | 470 | 572 |
| 1500 | 0 | 0 | 51 | 269 | 415 | 220 | 409 | 647 | 1,185 | 1,508 | 830 | 836 | 710 | 1,238 |
| 1600 | 0 | 0 | 59 | 131 | 245 | 129 | 343 | 349 | 1,189 | 1,711 | 1,482 | 728 | 775 | 537 |
| 1700 | 0 | 0 | 0 | 144 | 201 | 140 | 548 | 495 | 1,004 | 1,637 | 1,001 | 774 | 596 | 663 |
| 1800 | 0 | 0 | 0 | 158 | 240 | 471 | 503 | 334 | 963 | 1,445 | 1,257 | 843 | 478 | 766 |
| 1900 | 0 | 9 | 0 | 354 | 371 | 1,130 | 500 | 347 | 1,173 | 1,119 | 1,771 | 950 | 698 | 670 |
| 2000 | 0 | 3 | 210 | 515 | 855 | 1,136 | 505 | 746 | 1,110 | 1,331 | 1,100 | 850 | 521 | 594 |
| 2100 | 0 | 13 | 509 | 519 | 687 | 1,094 | 856 | 647 | 1,226 | 1,020 | 1,093 | 931 | 593 | 704 |
| 2200 | 0 | 16 | 486 | 438 | 513 | 974 | 371 | 296 | 1,057 | 976 | 1,844 | 1,518 | 544 | 888 |
| 2300 | 0 | 27 | 572 | 281 | 690 | 561 | 263 | 462 | 1,149 | 1,396 | 1,005 | 1,152 | 677 | 755 |
| 2400 | 0 | 29 | 648 | 656 | 102 | 514 | 361 | 601 | 1,032 | 1,516 | 1,637 | 1,132 | 528 | 941 |
| Total | 0 | 97 | 2,607 | 13,133 | 10,179 | 14,718 | 11,060 | 18,258 | 25,182 | 25,906 | 25,881 | 22,276 | 19,187 | 15,410 |

Appendix A. (p 2 of 2).

| Hour Ending | 12-Jul | 13-Jul | 14-Jul | 15-Jul | 16-Jul | 17-Jul | 18-Jul | 19-Jul | 20-Jul | 21-Jul | 22-Jul | 23-Jul | 24-Jul | 25-Jul | 26-Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0100 | 983 | 784 | 606 | 457 | 516 | 502 | 498 | 232 | 272 | 384 | 343 | 354 | 331 | 247 | |
| 0200 | 1,668 | 965 | 582 | 527 | 640 | 676 | 399 | 317 | 244 | 275 | 392 | 308 | 321 | 227 | |
| 0300 | 1,505 | 1,064 | 492 | 493 | 547 | 465 | 224 | 270 | 258 | 252 | 391 | 311 | 245 | 169 | |
| 0400 | 1,490 | 977 | 589 | 417 | 587 | 543 | 242 | 256 | 218 | 277 | 330 | 352 | 223 | 191 | |
| 0500 | 1,475 | 896 | 513 | 419 | 512 | 498 | 298 | 307 | 194 | 278 | 355 | 314 | 223 | 220 | |
| 0600 | 1,196 | 810 | 415 | 378 | 469 | 542 | 356 | 263 | 277 | 347 | 502 | 334 | 347 | 225 | |
| 0700 | 918 | 648 | 314 | 398 | 501 | 498 | 364 | 376 | 310 | 472 | 585 | 354 | 348 | 225 | |
| 0800 | 619 | 716 | 424 | 349 | 408 | 471 | 244 | 244 | 207 | 273 | 402 | 303 | 284 | 248 | |
| 0900 | 738 | 620 | 336 | 271 | 344 | 421 | 243 | 252 | 184 | 284 | 472 | 470 | 306 | 241 | |
| 1000 | 723 | 415 | 305 | 256 | 250 | 386 | 187 | 265 | 245 | 302 | 523 | 348 | 244 | 202 | |
| 1100 | 625 | 434 | 325 | 389 | 227 | 374 | 208 | 255 | 165 | 348 | 411 | 330 | 218 | 185 | |
| 1200 | 766 | 129 | 298 | 397 | 263 | 377 | 260 | 226 | 201 | 207 | 381 | 319 | 281 | 185 | |
| 1300 | 551 | 503 | 296 | 283 | 227 | 279 | 220 | 190 | 199 | 168 | 345 | 320 | 207 | 220 | |
| 1400 | 570 | 576 | 258 | 257 | 298 | 247 | 217 | 193 | 207 | 194 | 288 | 286 | 232 | 172 | |
| 1500 | 624 | 856 | 338 | 363 | 236 | 349 | 243 | 254 | 199 | 273 | 303 | 321 | 172 | 164 | |
| 1600 | 531 | 674 | 372 | 343 | 310 | 349 | 309 | 246 | 216 | 276 | 297 | 212 | 298 | 196 | |
| 1700 | 530 | 695 | 314 | 297 | 296 | 356 | 331 | 377 | 273 | 287 | 276 | 237 | 301 | 201 | |
| 1800 | 784 | 607 | 303 | 358 | 298 | 363 | 385 | 377 | 167 | 314 | 20 | 278 | 310 | 199 | |
| 1900 | 517 | 728 | 345 | 459 | 352 | 364 | 316 | 482 | 221 | 376 | 368 | 380 | 343 | 273 | |
| 2000 | 594 | 662 | 338 | 594 | 428 | 375 | 343 | 380 | 292 | 329 | 343 | 293 | 346 | 201 | |
| 2100 | 602 | 605 | 333 | 494 | 365 | 405 | 341 | 413 | 254 | 410 | 329 | 236 | 311 | 110 | |
| 2200 | 545 | 749 | 294 | 406 | 357 | 348 | 332 | 455 | 248 | 334 | 382 | 273 | 259 | 210 | |
| 2300 | 483 | 595 | 333 | 488 | 281 | 365 | 365 | 645 | 241 | 390 | 359 | 270 | 208 | 227 | |
| 2400 | 865 | 756 | 5 | 521 | 396 | 549 | 396 | 483 | 252 | 385 | 359 | 112 | 193 | 329 | |
| Total | 19,902 | 16,464 | 8,728 | 9,614 | 9,108 | 10,102 | 7,321 | 7,758 | 5,544 | 7,435 | 8,756 | 7,315 | 6,551 | 5,067 | |

[a] No salmon were observed during the period 21 – 27 June.

Appendix B. East bank Anvik River corrected sonar counts by hour and date, 21 June – 25 July, 1992.

| Hour Ending | 28–Jun[a] | 29–Jun | 30–Jun | 01–Jul | 02–Jul | 03–Jul | 04–Jul | 05–Jul | 06–Jul | 07–Jul | 08–Jul | 09–Jul | 10–Jul | 11–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0100 | 0 | 0 | 129 | 94 | 739 | 1,662 | 2,619 | 2,644 | 2,136 | 733 | 1,984 | 1,747 | 967 | 369 |
| 0200 | 0 | 0 | 570 | 164 | 747 | 2,941 | 3,040 | 3,092 | 3,111 | 1,422 | 2,125 | 2,043 | 1,170 | 799 |
| 0300 | 0 | 0 | 91 | 140 | 1,054 | 3,116 | 3,051 | 3,054 | 3,345 | 1,587 | 1,807 | 2,343 | 1,157 | 880 |
| 0400 | 0 | 0 | 67 | 126 | 1,218 | 3,121 | 2,914 | 3,402 | 2,598 | 1,240 | 1,826 | 1,852 | 1,349 | 1,022 |
| 0500 | 0 | 0 | 70 | 310 | 1,560 | 2,676 | 3,463 | 4,031 | 3,599 | 1,847 | 1,676 | 1,892 | 876 | 539 |
| 0600 | 0 | 0 | 51 | 405 | 1,501 | 1,644 | 2,289 | 3,540 | 4,025 | 1,656 | 1,839 | 2,395 | 801 | 533 |
| 0700 | 0 | 0 | 118 | 88 | 933 | 1,535 | 2,036 | 3,059 | 2,526 | 1,324 | 1,383 | 358 | 1,222 | 705 |
| 0800 | 0 | 0 | 0 | 303 | 893 | 1,208 | 205 | 2,695 | 1,862 | 570 | 1,508 | 1,918 | 2,009 | 683 |
| 0900 | 0 | 0 | 1 | 262 | 944 | 1,256 | 2,491 | 2,119 | 1,603 | 116 | 1,494 | 1,351 | 1,149 | 606 |
| 1000 | 0 | 0 | 34 | 140 | 387 | 1,332 | 2,539 | 1,986 | 1,205 | 940 | 1,040 | 1,031 | 1,128 | 493 |
| 1100 | 0 | 0 | 7 | 28 | 455 | 1,580 | 2,267 | 3,003 | 304 | 721 | 758 | 973 | 552 | 857 |
| 1200 | 0 | 0 | 16 | 264 | 501 | 1,324 | 1,855 | 1,724 | 458 | 826 | 760 | 341 | 516 | 475 |
| 1300 | 0 | 0 | 9 | 152 | 314 | 1,312 | 1,268 | 678 | 703 | 1,185 | 902 | 377 | 682 | 100 |
| 1400 | 0 | 0 | 16 | 171 | 157 | 1,086 | 485 | 1,962 | 392 | 1,152 | 923 | 979 | 1,088 | 93 |
| 1500 | 0 | 0 | 87 | 198 | 459 | 1,024 | 670 | 1,569 | 352 | 584 | 851 | 1,576 | 823 | 184 |
| 1600 | 0 | 0 | 215 | 115 | 1,341 | 2,191 | 1,618 | 2,058 | 1,031 | 826 | 808 | 1,212 | 504 | 1,582 |
| 1700 | 0 | 0 | 226 | 26 | 2,102 | 2,925 | 2,008 | 2,432 | 1,070 | 735 | 903 | 1,240 | 469 | 1,291 |
| 1800 | 0 | 0 | 89 | 201 | 2,801 | 1,140 | 1,779 | 3,084 | 787 | 1,045 | 1,185 | 2,462 | 738 | 1,561 |
| 1900 | 0 | 0 | 52 | 129 | 1,861 | 546 | 2,536 | 3,818 | 682 | 1,179 | 906 | 1,888 | 496 | 394 |
| 2000 | 0 | 7 | 41 | 424 | 1,132 | 1,024 | 1,756 | 2,376 | 686 | 1,198 | 1,134 | 3,057 | 434 | 251 |
| 2100 | 0 | 1 | 132 | 484 | 2,253 | 553 | 1,237 | 2,825 | 707 | 1,147 | 1,402 | 2,576 | 731 | 453 |
| 2200 | 0 | 6 | 158 | 1,036 | 2,680 | 1,473 | 2,327 | 2,593 | 661 | 1,765 | 1,154 | 1,362 | 1,088 | 1,001 |
| 2300 | 0 | 7 | 7 | 981 | 2,626 | 2,217 | 2,642 | 2,447 | 800 | 1,487 | 1,543 | 1,377 | 1,154 | 265 |
| 2400 | 0 | 3 | 14 | 685 | 3,103 | 3,368 | 2,746 | 2,676 | 1,135 | 1,124 | 1,346 | 1,118 | 1,303 | 346 |
| Total | 0 | 24 | 2,200 | 6,926 | 31,761 | 42,254 | 49,841 | 62,867 | 35,778 | 26,409 | 31,257 | 37,468 | 22,406 | 15,482 |

Appendix B. (page 2 of 2).

| Hour Ending | 12–Jul | 13–Jul | 14–Jul | 15–Jul | 16–Jul | 17–Jul | 18–Jul | 19–Jul | 20–Jul | 21–Jul | 22–Jul | 23–Jul | 24–Jul | 25–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0100 | 230 | 310 | 702 | 232 | 321 | 981 | 379 | 181 | 123 | 190 | 7 | 162 | 167 | 227 |
| 0200 | 276 | 316 | 632 | 606 | 367 | 538 | 367 | 113 | 135 | 306 | 15 | 230 | 140 | 177 |
| 0300 | 179 | 329 | 515 | 564 | 422 | 588 | 271 | 95 | 122 | 250 | 16 | 206 | 144 | 201 |
| 0400 | 215 | 295 | 542 | 365 | 428 | 748 | 283 | 64 | 111 | 245 | 20 | 209 | 168 | 248 |
| 0500 | 150 | 235 | 569 | 657 | 262 | 299 | 189 | 24 | 90 | 163 | 14 | 195 | 167 | 144 |
| 0600 | 253 | 133 | 707 | 697 | 361 | 340 | 362 | 65 | 81 | 103 | 9 | 267 | 204 | 109 |
| 0700 | 288 | 377 | 272 | 690 | 407 | 780 | 173 | 71 | 105 | 193 | 14 | 223 | 256 | 84 |
| 0800 | 321 | 328 | 677 | 383 | 330 | 976 | 173 | 71 | 58 | 162 | 11 | 76 | 74 | 94 |
| 0900 | 378 | 315 | 585 | 272 | 229 | 568 | 110 | 45 | 125 | 102 | 8 | 49 | 53 | 87 |
| 1000 | 338 | 403 | 540 | 241 | 240 | 438 | 107 | 60 | 82 | 120 | 6 | 42 | 123 | 133 |
| 1100 | 391 | 277 | 336 | 234 | 265 | 623 | 121 | 75 | 31 | 93 | 14 | 58 | 80 | 115 |
| 1200 | 877 | 278 | 376 | 209 | 242 | 1,172 | 74 | 77 | 61 | 93 | 14 | 30 | 54 | 108 |
| 1300 | 233 | 263 | 262 | 188 | 112 | 359 | 198 | 70 | 28 | 64 | 13 | 68 | 21 | 43 |
| 1400 | 253 | 497 | 333 | 178 | 115 | 128 | 37 | 65 | 15 | 43 | 13 | 281 | 14 | 30 |
| 1500 | 272 | 265 | 232 | 92 | 91 | 123 | 45 | 118 | 17 | 47 | 17 | 176 | 122 | 27 |
| 1600 | 277 | 276 | 239 | 132 | 107 | 152 | 44 | 133 | 24 | 101 | 5 | 222 | 22 | 31 |
| 1700 | 217 | 275 | 320 | 132 | 141 | 179 | 48 | 107 | 27 | 437 | 52 | 119 | 13 | 56 |
| 1800 | 215 | 674 | 270 | 163 | 129 | 165 | 89 | 107 | 51 | 670 | 52 | 298 | 13 | 39 |
| 1900 | 670 | 707 | 352 | 175 | 219 | 211 | 233 | 73 | 59 | 626 | 88 | 189 | 26 | 48 |
| 2000 | 608 | 641 | 381 | 285 | 260 | 226 | 100 | 84 | 54 | 0 | 121 | 242 | 124 | 142 |
| 2100 | 365 | 664 | 445 | 390 | 436 | 170 | 187 | 106 | 60 | 0 | 180 | 150 | 65 | 136 |
| 2200 | 405 | 697 | 468 | 420 | 383 | 212 | 366 | 151 | 95 | 119 | 157 | 62 | 122 | 124 |
| 2300 | 378 | 598 | 587 | 438 | 463 | 188 | 349 | 47 | 66 | 0 | 151 | 81 | 114 | 153 |
| 2400 | 374 | 741 | 388 | 398 | 435 | 499 | 399 | 94 | 118 | 1 | 175 | 364 | 165 | 196 |
| Total | 8,163 | 9,894 | 10,730 | 8,141 | 6,765 | 10,663 | 4,704 | 2,096 | 1,738 | 4,128 | 1,172 | 3,999 | 2,451 | 2,752 |

[a] No salmon were observed during the period 21 – 27 June.

Appendix C. West bank Anvik River corrected sonar counts by sector, 21 June – 25 July, 1992.

| West Bank Sector | 28–Jun[a] | 29–Jun | 30–Jun | 01–Jul | 02–Jul | 03–Jul | 04–Jul | 05–Jul | 06–Jul | 07–Jul | 08–Jul | 09–Jul | 10–Jul | 11–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 5 | 18 | 400 | 46 | 12 | 39 | 962 | 1,325 | 3,065 | 322 | 1,386 | 1,692 | 896 |
| 2 | 0 | 10 | 100 | 1,348 | 508 | 111 | 302 | 3,230 | 6,943 | 10,963 | 667 | 4,460 | 5,447 | 3,962 |
| 3 | 0 | 2 | 965 | 4,845 | 1,989 | 1,222 | 1,292 | 3,274 | 5,513 | 6,686 | 941 | 4,095 | 4,734 | 3,241 |
| 4 | 0 | 0 | 1,203 | 4,533 | 2,890 | 2,687 | 2,362 | 3,371 | 4,771 | 2,627 | 1,595 | 3,347 | 2,816 | 2,158 |
| 5 | 0 | 0 | 198 | 1,111 | 1,989 | 2,669 | 2,662 | 4,244 | 3,615 | 1,337 | 2,808 | 3,257 | 1,837 | 1,371 |
| 6 | 0 | 0 | 21 | 289 | 1,079 | 3,906 | 2,270 | 1,713 | 1,534 | 360 | 3,322 | 1,873 | 835 | 700 |
| 7 | 0 | 0 | 15 | 147 | 455 | 2,245 | 799 | 556 | 415 | 123 | 6,362 | 997 | 301 | 287 |
| 8 | 0 | 0 | 6 | 70 | 173 | 946 | 337 | 369 | 298 | 79 | 5,130 | 837 | 184 | 183 |
| 9 | 0 | 0 | 1 | 4 | 31 | 235 | 105 | 95 | 79 | 47 | 1,506 | 234 | 93 | 99 |
| 10 | 0 | 0 | 0 | 10 | 31 | 159 | 127 | 62 | 81 | 42 | 603 | 233 | 116 | 112 |
| 11 | 0 | 0 | 0 | 11 | 33 | 104 | 115 | 40 | 33 | 49 | 75 | 109 | 74 | 76 |
| 12 | 0 | 0 | 0 | 22 | 38 | 66 | 100 | 59 | 53 | 69 | 117 | 155 | 110 | 124 |
| 13 | 0 | 0 | 0 | 13 | 29 | 87 | 95 | 34 | 77 | 52 | 181 | 148 | 142 | 148 |
| 14 | 0 | 0 | 1 | 21 | 42 | 76 | 99 | 46 | 61 | 42 | 151 | 171 | 68 | 96 |
| 15 | 0 | 2 | 7 | 125 | 419 | 69 | 117 | 70 | 99 | 165 | 212 | 273 | 273 | 282 |
| 16 | 0 | 78 | 72 | 218 | 428 | 123 | 239 | 133 | 285 | 201 | 1,890 | 703 | 438 | 1,676 |
| Total | 0 | 97 | 2,607 | 13,167 | 10,180 | 14,717 | 11,060 | 18,258 | 25,182 | 25,907 | 25,882 | 22,278 | 19,160 | 15,411 |

Appendix C. (p 2 of 2).

| West Bank Sector | 12–Jul | 13–Jul | 14–Jul | 15–Jul | 16–Jul | 17–Jul | 18–Jul | 19–Jul | 20–Jul | 21–Jul | 22–Jul | 23–Jul | 24–Jul | 25–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 872 | 1,552 | 1,132 | 345 | 558 | 193 | 96 | 70 | 51 | 47 | 29 | 17 | 39 | 27 |
| 2 | 4,621 | 5,033 | 2,011 | 1,170 | 1,267 | 906 | 322 | 275 | 187 | 110 | 93 | 73 | 108 | 112 |
| 3 | 3,922 | 3,756 | 1,302 | 1,337 | 999 | 1,133 | 432 | 341 | 292 | 223 | 218 | 186 | 226 | 253 |
| 4 | 2,812 | 2,278 | 1,105 | 1,449 | 1,230 | 1,620 | 611 | 647 | 629 | 523 | 490 | 473 | 519 | 526 |
| 5 | 1,908 | 1,342 | 1,123 | 1,689 | 1,421 | 1,615 | 1,112 | 692 | 438 | 297 | 430 | 514 | 713 | 667 |
| 6 | 1,208 | 487 | 786 | 1,587 | 1,533 | 1,862 | 1,730 | 1,621 | 1,000 | 1,425 | 1,644 | 1,450 | 1,554 | 538 |
| 7 | 592 | 122 | 303 | 712 | 708 | 883 | 1,165 | 1,842 | 1,134 | 1,857 | 2,443 | 1,692 | 1,342 | 414 |
| 8 | 251 | 158 | 186 | 298 | 394 | 346 | 531 | 992 | 664 | 1,049 | 1,439 | 1,009 | 646 | 835 |
| 9 | 116 | 102 | 107 | 262 | 235 | 319 | 250 | 308 | 210 | 474 | 527 | 451 | 321 | 361 |
| 10 | 99 | 100 | 120 | 193 | 184 | 218 | 398 | 207 | 191 | 367 | 394 | 332 | 266 | 299 |
| 11 | 70 | 94 | 51 | 69 | 87 | 99 | 151 | 140 | 157 | 232 | 224 | 235 | 240 | 180 |
| 12 | 115 | 107 | 72 | 61 | 80 | 87 | 70 | 90 | 139 | 230 | 184 | 225 | 212 | 171 |
| 13 | 115 | 124 | 76 | 87 | 92 | 146 | 69 | 91 | 68 | 135 | 127 | 148 | 105 | 86 |
| 14 | 106 | 96 | 70 | 95 | 88 | 149 | 66 | 89 | 67 | 110 | 97 | 88 | 90 | 99 |
| 15 | 514 | 228 | 104 | 103 | 125 | 282 | 208 | 171 | 151 | 134 | 140 | 140 | 135 | 135 |
| 16 | 2,580 | 883 | 180 | 158 | 108 | 245 | 107 | 184 | 165 | 223 | 276 | 284 | 42 | 365 |
| Total | 19,901 | 16,462 | 8,728 | 9,615 | 9,109 | 10,103 | 7,318 | 7,760 | 5,543 | 7,436 | 8,755 | 7,317 | 6,558 | 5,068 |

[a] No salmon were observed during the period 21 – 27 June.

Appendix D. East bank Anvik River corrected sonar counts by sector, 21 June – 25 July, 1992.

| East Bank Sector | 28–Jun[a] | 29–Jun | 30–Jun | 01–Jul | 02–Jul | 03–Jul | 04–Jul | 05–Jul | 06–Jul | 07–Jul | 08–Jul | 09–Jul | 10–Jul | 11–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 0 | 0 | 2 | 13 | 50 | 139 | 195 | 239 | 142 | 199 | 2,920 | 260 | 195 | 261 |
| 18 | 0 | 1 | 1 | 194 | 940 | 793 | 1,452 | 1,289 | 541 | 562 | 11,459 | 745 | 3,009 | 2,258 |
| 19 | 0 | 2 | 11 | 143 | 1,303 | 2,209 | 3,358 | 4,221 | 1,638 | 1,236 | 8,628 | 1,694 | 1,009 | 2,765 |
| 20 | 0 | 3 | 46 | 150 | 3,033 | 4,804 | 6,436 | 9,354 | 2,976 | 2,113 | 3,514 | 3,171 | 1,081 | 4,587 |
| 21 | 0 | 0 | 21 | 366 | 5,716 | 7,930 | 7,239 | 10,793 | 4,860 | 3,234 | 2,381 | 4,601 | 1,422 | 654 |
| 22 | 0 | 1 | 92 | 769 | 7,834 | 9,794 | 12,009 | 11,571 | 4,380 | 3,660 | 1,032 | 5,059 | 1,104 | 602 |
| 23 | 0 | 2 | 135 | 1,262 | 6,893 | 8,376 | 9,417 | 9,784 | 5,351 | 6,263 | 324 | 6,808 | 1,613 | 911 |
| 24 | 0 | 1 | 195 | 1,145 | 3,339 | 3,999 | 4,657 | 3,854 | 4,531 | 4,142 | 276 | 3,902 | 1,241 | 628 |
| 25 | 0 | 1 | 239 | 711 | 754 | 851 | 1,465 | 1,017 | 633 | 1,030 | 86 | 997 | 577 | 257 |
| 26 | 0 | 6 | 313 | 759 | 254 | 290 | 533 | 360 | 526 | 366 | 56 | 459 | 545 | 224 |
| 27 | 0 | 7 | 290 | 741 | 43 | 128 | 120 | 94 | 74 | 76 | 50 | 68 | 249 | 116 |
| 28 | 0 | 0 | 153 | 390 | 12 | 95 | 81 | 139 | 7 | 52 | 57 | 53 | 193 | 182 |
| 29 | 0 | 0 | 58 | 146 | 10 | 87 | 177 | 89 | 345 | 262 | 36 | 86 | 737 | 238 |
| 30 | 0 | 0 | 19 | 30 | 12 | 179 | 249 | 396 | 280 | 490 | 85 | 355 | 1,091 | 244 |
| 31 | 0 | 0 | 143 | 8 | 15 | 314 | 405 | 1,058 | 730 | 208 | 129 | 1,037 | 1,922 | 285 |
| 32 | 0 | 0 | 482 | 126 | 1,553 | 2,266 | 2,048 | 8,612 | 8,765 | 2,513 | 224 | 8,174 | 6,416 | 1,271 |
| Total | 0 | 24 | 2,200 | 6,953 | 31,761 | 42,254 | 49,841 | 62,870 | 35,779 | 26,406 | 31,257 | 37,469 | 22,404 | 15,483 |

Appendix D. (p 2 of 2).

| East Bank Sector | 12–Jul | 13–Jul | 14–Jul | 15–Jul | 16–Jul | 17–Jul | 18–Jul | 19–Jul | 20–Jul | 21–Jul | 22–Jul | 23–Jul | 24–Jul |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 508 | 358 | 182 | 175 | 194 | 60 | 73 | 26 | 45 | 125 | 167 | 240 | 27 |
| 18 | 569 | 740 | 760 | 491 | 266 | 3,594 | 210 | 128 | 245 | 394 | 240 | 1,129 | 628 |
| 19 | 543 | 764 | 399 | 268 | 308 | 586 | 376 | 222 | 428 | 427 | 239 | 563 | 678 |
| 20 | 971 | 1,595 | 845 | 679 | 707 | 1,089 | 1,152 | 319 | 293 | 215 | 102 | 314 | 475 |
| 21 | 917 | 1,048 | 711 | 778 | 942 | 1,189 | 835 | 305 | 128 | 71 | 37 | 108 | 121 |
| 22 | 935 | 1,163 | 808 | 651 | 644 | 758 | 602 | 298 | 145 | 41 | 16 | 29 | 36 |
| 23 | 767 | 776 | 772 | 767 | 937 | 993 | 664 | 353 | 56 | 16 | 3 | 7 | 19 |
| 24 | 348 | 451 | 387 | 415 | 402 | 451 | 300 | 173 | 12 | 10 | 0 | 5 | 2 |
| 25 | 41 | 68 | 106 | 119 | 144 | 155 | 105 | 33 | 1 | 3 | 2 | 2 | 0 |
| 26 | 89 | 38 | 191 | 109 | 108 | 115 | 74 | 12 | 2 | 8 | 3 | 32 | 0 |
| 27 | 111 | 13 | 177 | 100 | 70 | 39 | 15 | 13 | 2 | 8 | 0 | 5 | 0 |
| 28 | 145 | 12 | 321 | 188 | 100 | 106 | 16 | 13 | 2 | 180 | 2 | 29 | 0 |
| 29 | 262 | 38 | 532 | 442 | 316 | 301 | 12 | 32 | 11 | 324 | 49 | 183 | 18 |
| 30 | 304 | 76 | 547 | 525 | 466 | 217 | 18 | 37 | 46 | 335 | 117 | 346 | 31 |
| 31 | 359 | 251 | 695 | 672 | 522 | 366 | 44 | 31 | 134 | 1,074 | 125 | 440 | 166 |
| 32 | 1,293 | 2,501 | 3,297 | 1,759 | 638 | 643 | 207 | 101 | 190 | 897 | 70 | 568 | 249 |
| Total | 8,162 | 9,892 | 10,730 | 8,138 | 6,764 | 10,662 | 4,703 | 2,096 | 1,740 | 4,128 | 1,172 | 4,000 | 2,450 |

[a] No salmon were observed during the period 21 – 27 June.

Appendix E. Anvik River salmon beach seine catch by species, sex, and date, 1992.

| Date | Chum Salmon | | | Chinook Salmon | | | Pink Salmon | | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 25–Jun | | | | | | | | | |
| 26–Jun | | | | | | | | | |
| 27–Jun | | | | | | | | | |
| 28–Jun | | | | | | | | | |
| 29–Jun | | | | | | | | | |
| 30–Jun | | | | | | | | | |
| 01–Jul | | | | | | | | | |
| 02–Jul | | | | | | | | | |
| 03–Jul | | | | | | | | | |
| 04–Jul | | | | | | | | | |
| 05–Jul | 12 | 18 | 30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06–Jul | 26 | 35 | 61 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07–Jul | 25 | 33 | 58 | 0 | 0 | 0 | 0 | 0 | 0 |
| 08–Jul | | | | | | | | | |
| 09–Jul | 13 | 19 | 32 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10–Jul | 45 | 35 | 80 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11–Jul | | | | | | | | | |
| 12–Jul | 20 | 20 | 40 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13–Jul | | | | | | | | | |
| 14–Jul | | | | | | | | | |
| 15–Jul | | | | | | | | | |
| 16–Jul | 17 | 62 | 79 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17–Jul | | | | | | | | | |
| 18–Jul | 7 | 30 | 37 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19–Jul | | | | | | | | | |
| 20–Jul | | | | | | | | | |
| 21–Jul | 7 | 34 | 41 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22–Jul | | | | | | | | | |
| 23–Jul | | | | | | | | | |
| 24–Jul | | | | | | | | | |
| 25–Jul | | | | | | | | | |
| 26–Jul | | | | | | | | | |
| Total | 172 | 286 | 458 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix F. Age and sex composition of Anvik River summer chum salmon, 1972 – 1992.

| | Number of Fish[a] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Sample | | | Age 0.2 | | | Age 0.3 | | | Age 0.4 | | | Age 0.5 | | |
| Year | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 1972 | 167 | 153 | 320 | 0 | 0 | 0 | 25 | 37 | 62 | 138 | 115 | 253 | 4 | 1 | 5 |
| 1973 | 265 | 518 | 783 | 11 | 37 | 48 | 204 | 401 | 605 | 49 | 79 | 128 | 1 | 1 | 2 |
| 1974 | 245 | 157 | 402 | 12 | 24 | 36 | 197 | 120 | 317 | 34 | 12 | 46 | 2 | 1 | 3 |
| 1975 | 270 | 314 | 584 | 4 | 17 | 21 | 253 | 288 | 541 | 13 | 9 | 22 | 0 | 0 | 0 |
| 1976 | 281 | 320 | 601 | 5 | 4 | 9 | 43 | 35 | 78 | 233 | 281 | 514 | 0 | 0 | 0 |
| 1977 | 191 | 398 | 589 | 20 | 111 | 131 | 161 | 270 | 431 | 7 | 15 | 22 | 3 | 2 | 5 |
| 1978 | 289 | 263 | 552 | 0 | 1 | 1 | 210 | 180 | 390 | 79 | 82 | 161 | 0 | 0 | 0 |
| 1979 | 273 | 306 | 579 | 2 | 12 | 14 | 154 | 193 | 347 | 115 | 99 | 214 | 2 | 2 | 4 |
| 1980 | 167 | 258 | 425 | 0 | 1 | 1 | 147 | 226 | 373 | 20 | 31 | 51 | 0 | 0 | 0 |
| 1981 | 151 | 182 | 333 | 0 | 0 | 0 | 49 | 67 | 116 | 99 | 115 | 214 | 3 | 0 | 3 |
| 1982 | 117 | 265 | 382 | 4 | 17 | 21 | 75 | 181 | 256 | 37 | 65 | 102 | 1 | 2 | 3 |
| 1983 | 183 | 238 | 421 | 0 | 4 | 4 | 99 | 142 | 241 | 83 | 90 | 173 | 1 | 2 | 3 |
| 1984 | 138 | 215 | 353 | 2 | 6 | 8 | 117 | 189 | 306 | 19 | 20 | 39 | 0 | 0 | 0 |
| 1985 | 233 | 294 | 527 | 0 | 11 | 11 | 172 | 225 | 397 | 59 | 58 | 117 | 2 | 0 | 2 |
| 1986 | 205 | 281 | 486 | 0 | 2 | 2 | 59 | 89 | 148 | 143 | 186 | 329 | 3 | 4 | 7 |
| 1987 | 190 | 355 | 545 | 0 | 10 | 10 | 125 | 238 | 363 | 56 | 100 | 156 | 9 | 7 | 16 |
| 1988 | 180 | 351 | 531 | 1 | 30 | 31 | 129 | 282 | 411 | 48 | 37 | 85 | 2 | 2 | 4 |
| 1989 | 199 | 389 | 588 | 0 | 9 | 9 | 55 | 179 | 234 | 143 | 201 | 344 | 1 | 0 | 1 |
| 1990 | 172 | 227 | 399 | 3 | 12 | 15 | 98 | 169 | 267 | 67 | 45 | 112 | 4 | 1 | 5 |
| 1991 | 239 | 313 | 552 | 0 | 0 | 0 | 96 | 153 | 249 | 141 | 160 | 301 | 2 | 0 | 2 |
| 1992 | 162 | 262 | 424 | 0 | 3 | 3 | 39 | 98 | 137 | 115 | 154 | 269 | 8 | 7 | 15 |

–continued–

Appendix F. (page 2 of 2).

| | Percent of Sample[b] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Sample | | | Age 0.2 | | | Age 0.3 | | | Age 0.4 | | | Age 0.5 | | |
| Year | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 1972 | 52.2 | 47.8 | 100.0 | 0.0 | 0.0 | 0.0 | 7.8 | 11.6 | 19.4 | 43.1 | 35.9 | 79.1 | 1.3 | 0.3 | 1.6 |
| 1973 | 33.8 | 66.2 | 100.0 | 1.4 | 4.7 | 6.1 | 26.1 | 51.2 | 77.3 | 6.3 | 10.1 | 16.3 | 0.1 | 0.1 | 0.3 |
| 1974 | 60.9 | 39.1 | 100.0 | 3.0 | 6.0 | 9.0 | 49.0 | 29.9 | 78.9 | 8.5 | 3.0 | 11.4 | 0.5 | 0.2 | 0.7 |
| 1975 | 46.2 | 53.8 | 100.0 | 0.7 | 2.9 | 3.6 | 43.3 | 49.3 | 92.6 | 2.2 | 1.5 | 3.8 | 0.0 | 0.0 | 0.0 |
| 1976 | 46.8 | 53.2 | 100.0 | 0.8 | 0.7 | 1.5 | 7.2 | 5.8 | 13.0 | 38.8 | 46.8 | 85.5 | 0.0 | 0.0 | 0.0 |
| 1977 | 32.4 | 67.6 | 100.0 | 3.4 | 18.8 | 22.2 | 27.3 | 45.8 | 73.2 | 1.2 | 2.5 | 3.7 | 0.5 | 0.3 | 0.8 |
| 1978 | 52.4 | 47.6 | 100.0 | 0.0 | 0.2 | 0.2 | 38.0 | 32.6 | 70.7 | 14.3 | 14.9 | 29.2 | 0.0 | 0.0 | 0.0 |
| 1979 | 47.2 | 52.8 | 100.0 | 0.3 | 2.1 | 2.4 | 26.6 | 33.3 | 59.9 | 19.9 | 17.1 | 37.0 | 0.3 | 0.3 | 0.7 |
| 1980 | 39.3 | 60.7 | 100.0 | 0.0 | 0.2 | 0.2 | 34.6 | 53.2 | 87.8 | 4.7 | 7.3 | 12.0 | 0.0 | 0.0 | 0.0 |
| 1981 | 45.3 | 54.7 | 100.0 | 0.0 | 0.0 | 0.0 | 14.7 | 20.1 | 34.8 | 29.7 | 34.5 | 64.3 | 0.9 | 0.0 | 0.9 |
| 1982 | 30.6 | 69.4 | 100.0 | 1.0 | 4.5 | 5.5 | 19.6 | 47.4 | 67.0 | 9.7 | 17.0 | 26.7 | 0.3 | 0.5 | 0.8 |
| 1983 | 43.5 | 56.5 | 100.0 | 0.0 | 1.0 | 1.0 | 23.5 | 33.7 | 57.2 | 19.7 | 21.4 | 41.1 | 0.2 | 0.5 | 0.7 |
| 1984 | 39.1 | 60.9 | 100.0 | 0.6 | 1.7 | 2.3 | 33.1 | 53.5 | 86.7 | 5.4 | 5.7 | 11.0 | 0.0 | 0.0 | 0.0 |
| 1985 | 44.2 | 55.8 | 100.0 | 0.0 | 2.1 | 2.1 | 32.6 | 42.7 | 75.3 | 11.2 | 11.0 | 22.2 | 0.4 | 0.0 | 0.4 |
| 1986 | 42.2 | 57.8 | 100.0 | 0.0 | 0.4 | 0.4 | 12.1 | 18.3 | 30.5 | 29.4 | 38.3 | 67.7 | 0.6 | 0.8 | 1.4 |
| 1987 | 34.9 | 65.1 | 100.0 | 0.0 | 1.8 | 1.8 | 22.9 | 43.7 | 66.6 | 10.3 | 18.3 | 28.6 | 1.7 | 1.3 | 2.9 |
| 1988 | 33.9 | 66.1 | 100.0 | 0.2 | 5.6 | 5.8 | 24.3 | 53.1 | 77.4 | 9.0 | 7.0 | 16.0 | 0.4 | 0.4 | 0.8 |
| 1989[c] | 34.4 | 65.6 | 100.0 | 0.0 | 1.2 | 1.2 | 9.4 | 28.5 | 37.9 | 24.8 | 35.9 | 60.7 | 0.1 | 0.0 | 0.1 |
| 1990[c] | 48.7 | 51.3 | 100.0 | 0.6 | 2.5 | 3.2 | 26.0 | 39.1 | 65.1 | 18.8 | 11.3 | 30.1 | 1.2 | 0.4 | 1.6 |
| 1991[c] | 42.1 | 57.9 | 100.0 | 0.0 | 0.0 | 0.0 | 16.4 | 27.8 | 44.2 | 25.6 | 30.1 | 55.6 | 0.2 | 0.0 | 0.2 |
| 1992[c] | 43.4 | 56.6 | 100.0 | 0.0 | 0.3 | 0.3 | 8.4 | 18.1 | 26.5 | 32.6 | 36.3 | 69.0 | 2.4 | 1.8 | 4.2 |

[a] Samples collected by carcass survey 1972–1981, by beach seine 1983–1992, and by both methods combined in 1982.
[b] Sample percentages not weighted by time period or escapement counts unless otherwise noted.
[c] Sample percentages weighted by time period and escapement counts.

Appendix G. Age and sex composition of Anvik River chinook salmon escapement samples, 1972–1992.

| | Number of Chinook Salmon[a] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample | | | Age 4 | | | Age 5 | | | Age 6 | | | Age 7 | | |
| Year | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 1972 | 10 | 5 | 15 | 0 | 0 | 0 | 8 | 0 | 8 | 2 | 5 | 7 | 0 | 0 | 0 |
| 1973 | 6 | 4 | 10 | 1 | 0 | 1 | 0 | 0 | 0 | 5 | 3 | 8 | 0 | 1 | 1 |
| 1974 | 0 | 0 | 0 | – | – | – | – | – | – | – | – | – | – | – | – |
| 1975 | 6 | 2 | 8 | 1 | 0 | 1 | 4 | 1 | 5 | 1 | 1 | 2 | 0 | 0 | 0 |
| 1976 | 33 | 12 | 45 | 6 | 0 | 6 | 25 | 5 | 30 | 2 | 7 | 9 | 0 | 0 | 0 |
| 1977 | 58 | 59 | 117 | 2 | 1 | 3 | 27 | 6 | 33 | 27 | 48 | 75 | 2 | 4 | 6 |
| 1978 | 36 | 41 | 77 | 13 | 0 | 13 | 10 | 1 | 11 | 13 | 39 | 52 | 0 | 1 | 1 |
| 1979 | 37 | 9 | 46 | 17 | 0 | 17 | 14 | 0 | 14 | 6 | 6 | 12 | 0 | 3 | 3 |
| 1980 | 41 | 42 | 83 | 19 | 1 | 20 | 21 | 22 | 43 | 1 | 16 | 17 | 0 | 3 | 3 |
| 1981 | 109 | 154 | 263 | 33 | 1 | 34 | 61 | 36 | 97 | 15 | 116 | 131 | 0 | 1 | 1 |
| 1982 | 100 | 38 | 138 | 47 | 1 | 48 | 47 | 5 | 52 | 6 | 32 | 38 | 0 | 0 | 0 |
| 1983 | 173 | 133 | 306 | 56 [b] | 0 | 56 | 84 | 26 | 110 | 33 | 104 | 137 | 0 | 3 | 3 |
| 1984 | 162 | 114 | 276 | 29 | 4 | 33 | 108 | 30 | 138 | 25 | 74 | 99 | 0 | 6 | 6 |
| 1985 | 25 | 8 | 33 | 10 | 0 | 10 | 10 | 3 | 13 | 5 | 5 | 10 | 0 | 0 | 0 |
| 1986 | 53 | 89 | 142 | 0 | 1 | 1 | 44 | 27 | 71 | 6 | 48 | 54 | 3 | 13 | 16 |
| 1987 | 92 | 130 | 222 | 21 | 0 | 21 | 22 | 7 | 29 | 48 | 116 | 164 | 1 | 7 | 8 |
| 1988 | 173 | 73 | 246 | 75 | 0 | 75 | 70 | 24 | 94 | 26 | 41 | 67 | 2 | 8 | 10 |
| 1989 | 226 | 155 | 381 | 17 [b] | 0 | 17 | 149 | 38 | 187 | 60 | 106 | 166 | 0 | 11 | 11 |
| 1990 | 252 | 148 | 400 | 106 [b] | 0 | 106 | 86 | 18 | 104 | 56 | 119 | 175 | 4 | 11 | 15 |
| 1991 | 223 | 155 | 378 | 39 | 0 | 39 | 145 | 63 | 208 | 38 | 82 | 120 | 1 | 10 | 11 |
| 1992 | 185 | 130 | 315 | 30 | 0 | 30 | 113 | 7 | 120 | 40 | 120 | 160 | 2 | 3 | 5 |

–Continued–

| | Percent of Total Sample[c] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample | | | Age 4 | | | Age 5 | | | Age 6 | | | Age 7 | | |
| Year | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| 1972 | 66.7 | 33.3 | 100.0 | 0.0 | 0.0 | 0.0 | 53.3 | 0.0 | 53.3 | 13.3 | 33.3 | 46.7 | 0.0 | 0.0 | 0.0 |
| 1973 | 60.0 | 40.0 | 100.0 | 10.0 | 0.0 | 10.0 | 0.0 | 0.0 | 0.0 | 50.0 | 30.0 | 80.0 | 0.0 | 10.0 | 10.0 |
| 1974 | 0.0 | 0.0 | 0.0 | – | – | – | – | – | – | – | – | – | – | – | – |
| 1975 | 75.0 | 25.0 | 100.0 | 12.5 | 0.0 | 12.5 | 50.0 | 12.5 | 62.5 | 12.5 | 12.5 | 25.0 | 0.0 | 0.0 | 0.0 |
| 1976 | 73.3 | 26.7 | 100.0 | 13.3 | 0.0 | 13.3 | 55.6 | 11.1 | 66.7 | 4.4 | 15.6 | 20.0 | 0.0 | 0.0 | 0.0 |
| 1977 | 49.6 | 50.4 | 100.0 | 1.7 | 0.9 | 2.6 | 23.1 | 5.1 | 28.2 | 23.1 | 41.0 | 64.1 | 1.7 | 3.4 | 5.1 |
| 1978 | 46.8 | 53.2 | 100.0 | 16.9 | 0.0 | 16.9 | 13.0 | 1.3 | 14.3 | 16.9 | 50.6 | 67.5 | 0.0 | 1.3 | 1.3 |
| 1979 | 80.4 | 19.6 | 100.0 | 37.0 | 0.0 | 37.0 | 30.4 | 0.0 | 30.4 | 13.0 | 13.0 | 26.1 | 0.0 | 6.5 | 6.5 |
| 1980 | 49.4 | 50.6 | 100.0 | 22.9 | 1.2 | 24.1 | 25.3 | 26.5 | 51.8 | 1.2 | 19.3 | 20.5 | 0.0 | 3.6 | 3.6 |
| 1981 | 41.4 | 58.6 | 100.0 | 12.5 | 0.4 | 12.9 | 23.2 | 13.7 | 36.9 | 5.7 | 44.1 | 49.8 | 0.0 | 0.4 | 0.4 |
| 1982 | 72.5 | 27.5 | 100.0 | 34.1 | 0.7 | 34.8 | 34.1 | 3.6 | 37.7 | 4.3 | 23.2 | 27.5 | 0.0 | 0.0 | 0.0 |
| 1983 | 56.5 | 43.5 | 100.0 | 18.3 | 0.0 | 18.3 | 27.5 | 8.5 | 35.9 | 10.8 | 34.0 | 44.8 | 0.0 | 1.0 | 1.0 |
| 1984 | 58.7 | 41.3 | 100.0 | 10.5 | 1.4 | 12.0 | 39.1 | 10.9 | 50.0 | 9.1 | 26.8 | 35.9 | 0.0 | 2.2 | 2.2 |
| 1985 | 75.8 | 24.2 | 100.0 | 30.3 | 0.0 | 30.3 | 30.3 | 9.1 | 39.4 | 15.2 | 15.2 | 30.3 | 0.0 | 0.0 | 0.0 |
| 1986 | 37.3 | 62.7 | 100.0 | 0.0 | 0.7 | 0.7 | 31.0 | 19.0 | 50.0 | 4.2 | 33.8 | 38.0 | 2.1 | 9.2 | 11.3 |
| 1987 | 41.4 | 58.6 | 100.0 | 9.5 | 0.0 | 9.5 | 9.9 | 3.2 | 13.1 | 21.6 | 52.3 | 73.9 | 0.5 | 3.2 | 3.6 |
| 1988 | 70.3 | 29.7 | 100.0 | 30.5 | 0.0 | 30.5 | 28.5 | 9.8 | 38.2 | 10.6 | 16.7 | 27.2 | 0.8 | 3.3 | 4.1 |
| 1989 | 59.3 | 40.7 | 100.0 | 4.5 | 0.0 | 4.5 | 39.1 | 10.0 | 49.1 | 15.7 | 27.8 | 43.6 | 0.0 | 2.9 | 2.9 |
| 1990 | 63.0 | 37.0 | 100.0 | 26.5 | 0.0 | 26.5 | 21.5 | 4.5 | 26.0 | 14.0 | 29.8 | 43.8 | 1.0 | 2.8 | 3.8 |
| 1991 | 59.0 | 41.0 | 100.0 | 10.3 | 0.0 | 10.3 | 38.4 | 16.7 | 55.0 | 10.1 | 21.7 | 31.7 | 0.3 | 2.6 | 2.9 |
| 1992 | 58.7 | 41.3 | 100.0 | 9.5 | 0.0 | 9.5 | 35.9 | 2.2 | 38.1 | 12.7 | 38.1 | 50.8 | 0.6 | 1.0 | 1.6 |

[a] Samples collected mainly by carcass survey. In some years a very few fish were also collected by beach seine or hook and line.
[b] Includes one age−3 male.
[c] Sample percentages not weighted by time period or escapement counts.

Appendix H. Climatological and hydrological observations, Anvik River sonar site, 1992.

| Date | Time | Precip. (Code)[a] | Wind (Direction and Velocity) | Cloud Cover (Code)[b] | Temperature Air Min. °C | Temperature Air Max. °C | Temperature Water °C | Water Gauge Actual (ft.) | Water Gauge Relative (ft.) | Water Gauge Relative (cm) | Water Color (code)[c] | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19-Jun | 18:00 | A | calm | 0 | 7 | 20 | 13 | 2.38 | 0.00 | 0.0 | 3 | light showers |
| 20-Jun | 18:00 | A | Var 2 | 2 | 2 | 19 | 13 | 2.24 | -0.14 | -4.3 | 3 | light rain in early AM |
| 21-Jun | 18:05 | A | Var | 2 | 7 | 22 | 12 | 2.04 | -0.34 | -10.4 | 3 | overcast in AM with rain; partly sunny in PM |
| 22-Jun | 18:00 | A | Var 5 | 3 | 8 | 23 | 12 | 1.92 | -0.46 | -14.0 | 3 | rain late PM & AM |
| 23-Jun | 18:00 | N | S 5 | 2 | 4 | 23 | 13 | 1.98 | -0.40 | -12.2 | 2 | |
| 24-Jun | 18:20 | N | NW 15-20 | 2 | 6 | 21 | 14 | 1.83 | -0.55 | -16.8 | 2 | clear & sunny for most of day |
| 25-Jun | 18:00 | N | SW 15-20 | 1 | 5 | 21 | 15 | 1.63 | -0.75 | -22.9 | 2 | clear, hot, sunny, windy |
| 26-Jun | 18:00 | A | S 5 | 4 | 7 | 19 | 13 | 1.50 | -0.88 | -26.8 | 2 | cloudy |
| 27-Jun | 18:00 | A | E 20-25 | 4 | 13 | 13 | 13 | 1.50 | -0.88 | -26.8 | 2 | overcast all day with periodic rain |
| 28-Jun | 18:00 | A | Var 10 | 3 | 9 | 21 | 13 | 1.51 | -0.87 | -26.5 | 2 | rain in early AM; clearing by 1800 |
| 29-Jun | 18:00 | A | calm | 0 | 10 | 18 | 13 | 1.66 | -0.72 | -21.9 | 2 | |
| 30-Jun | 18:00 | N | S 10-15 | 4 | 10 | 16 | 12 | 1.49 | -0.89 | -27.1 | 2 | cold day |
| 01-Jul | 18:00 | N | NW 5-10 | 1 | 11 | 21 | 15 | 1.34 | -1.04 | -31.7 | 2 | overcast thru late eve; clear by 0700 |
| 02-Jul | 19:00 | N | S 10-15 | 2 | 7 | 24 | 16 | 3.16 | -1.22 | -37.2 | 2 | moved water gauge 1.25 = 3.25 |
| 03-Jul | 17:16 | N | Var | 1 | 9 | 19 | 15 | 3.08 | -1.30 | -39.6 | 2 | |
| 04-Jul | 18:15 | N | Var 2 | 2 | 10 | 27 | 17 | 3.07 | -1.31 | -39.9 | 2 | |
| 05-Jul | 16:15 | N | S 10-15 | 3 | 13 | 23 | 16 | 3.06 | -1.32 | -40.2 | 2 | |
| 06-Jul | 16:00 | N | calm | 3 | 6 | 20 | 15 | 3.06 | -1.32 | -40.2 | 2 | |
| 07-Jul | 17:49 | N | calm | 2 | 10 | 19 | 15 | 3.21 | -1.17 | -35.7 | 2 | |
| 08-Jul | 17:55 | N | calm | 3 | 11 | 21 | 17 | 2.99 | -1.39 | -42.4 | 2 | |
| 09-Jul | 18:07 | N | E 10 | 2 | 9 | 22 | 18 | 2.94 | -1.44 | -43.9 | 2 | |
| 10-Jul | 18:00 | A | E 10 | 4 | 14 | 14 | 15 | 2.93 | -1.45 | -44.2 | 2 | |
| 11-Jul | 18:10 | A | calm | 3 | 9 | 17 | 15 | 2.96 | -1.42 | -43.3 | 2 | rain through early AM; clear by 0600 |
| 12-Jul | 18:00 | A | E 2 | 4 | 9 | 19 | 15 | 2.99 | -1.39 | -42.4 | 2 | |
| 13-Jul | 18:00 | N | calm | 3 | 6 | 17 | 15 | 2.96 | -1.42 | -43.3 | 2 | |
| 14-Jul | 18:00 | N | | 2 | 7 | 21 | 17 | 2.85 | -1.53 | -46.6 | 2 | |
| 15-Jul | 18:00 | N | S 5-10 | 1 | 2 | 21 | 16 | 2.75 | -1.63 | -49.7 | 2 | |
| 16-Jul | 18:00 | N | S 5-10 | 1 | 3 | 21 | 16 | 2.67 | -1.71 | -52.1 | 2 | |
| 17-Jul | 18:30 | N | calm | 3 | 4 | 22 | 17 | 2.68 | -1.70 | -51.8 | 2 | |
| 18-Jul | 18:00 | N | S 5-10 | 1 | 6 | 21 | 17 | 2.66 | -1.72 | -52.4 | 2 | |
| 19-Jul | 18:10 | N | calm | 4 | 7 | 18 | 15 | 2.46 | -1.92 | -58.5 | 2 | |
| 20-Jul | 17:33 | N | calm | 3 | 7 | 18 | 15 | 2.44 | -1.94 | -59.1 | 2 | |
| 21-Jul | 22:33 | A | | 4 | 6 | 19 | 12 | 2.44 | -1.94 | -59.1 | 2 | |
| 22-Jul | 18:25 | N | S 5 | 2 | 10 | 19 | 17 | 2.40 | -1.98 | -60.4 | 2 | |
| 23-Jul | 17:55 | A | calm | 3 | 8 | 18 | 15 | 2.40 | -1.98 | -60.4 | 2 | |
| 24-Jul | 18:05 | A | calm | 3 | 9 | 21 | 17 | 2.48 | -1.90 | -57.9 | 2 | rain throughout early AM |
| 25-Jul | 18:06 | N | SE 10-15 | 1 | 8 | 25 | 18 | 2.50 | -1.88 | -57.3 | 2 | hot & humid with thunderstorms |
| 26-Jul | 18:00 | A | SE 5-10 | 2 | 8 | 22 | 17 | 2.51 | -1.87 | -57.0 | 2 | hot & humid with thunderstorms |

[a] Precipitation code for the preceding 24-h period: N = No precipitaion; A = Intermittent rain; B = Continuous rain; C = Snow; D = Snow and rain mixed; and E = Hail.

[b] Instanteous cloud cover code: 0 = No observation; 1 = Clear sky, cloud cover not more than 10% of sky; 2 = Cloud cover not more than 50% of sky; 3 = Cloud cover more than 50% but less than 100% of sky; 4 = Completely overcast; and 5 = Fog or thick haze.

[c] Instanteous water color code: 1 = Clear; 2 = Light brown; 3 = Dark brown; and 4 = Murky or glacial.