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Alaska Department of Fish and Game
Commercial Fisheries Management
and Development Division
333 Raspberry Road
Anchorage, Alaska 99518

June 1998

Salmon Escapement Assessment In the Toklat River, 1995 and 1996

by

Louis H. Barton

State of Alaska — Tony Knowles, Governor

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ABSTRACT

In 1995 and 1996 two user non-configurable, sonar salmon counters were operated from opposite banks to estimate salmon passage in the Toklat River upstream of Barton Creek from approximately mid-August through early October. Estimated passage was 110,867 fish in 1995 and 90,044 fish in 1996. The median day of passage was 14 September in 1995 and 16 September 1996. Sonar counting range was considered adequate for the detection of the majority of fish passing the sonar site each year as most were near-shore oriented, passing within 3-4 m of the shoreline. However, passage was greatest along the left bank in both years, representing 81% of the estimate in 1995 and 66% in 1996. Daily passage was greatest during periods of darkness in both years, with the greatest movement occurring on the average between 2100 and 0100 hours.

Apportionment of sonar counts was based upon species composition observed during subsequent ground surveys made of the major spawning area at Toklat Springs in mid-October each year. Approximately, 99% of the sonar estimate in both years was apportioned to fall-run chum salmon *Oncorhynchus keta* (110,201 in 1995; 88,513 in 1996), with the remainder considered to be coho salmon *O. kisutch*. The resulting estimates of chum salmon were substantially greater than subsequent ground survey estimates made at Toklat Springs each year. The Toklat Springs total abundance estimate in 1995 was 54,513 chum salmon and revealed the escapement goal was achieved in that year. However, the total abundance estimate in 1996 was only 18,264 chum salmon, well below the minimum escapement goal of 33,000 fish. Although an additional 1,293 chum and 194 coho salmon passed Barton Creek weir from mid-August through early October in 1995, only a single chum and no coho salmon passed the weir in 1996.

Variations in Toklat River water levels and velocities, together with migration behavior of upstream migrant salmon affected the ability of the hydroacoustic equipment to accurately estimate salmon passage in both 1995 and 1996. Positive and negative biases in fish passage from sonar counter ping-rate settings were accounted for by comparing sonar counter output to visual observations on an oscilloscope. However, multiple counts as a result of salmon swimming upstream through the acoustic beam more than once was considered to have been the greatest non-quantifiable source of error in both years. Several other factors potentially contributing to the disparity between the two independent estimates of chum salmon abundance in both years are discussed.

KEY WORDS: Chum salmon, Coho salmon, *Oncorhynchus keta, O. Kisutch*, hydroacoustics, sonar, escapement, Yukon River, Tanana River, Kantishna River, Toklat River

INTRODUCTION

Although five species of Pacific salmon *Oncorhynchus* are found in the Yukon River drainage, chum salmon *O. keta* are the most abundant and occur in genetically distinct summer and fall runs (Wilmot et al. 1992; Seeb et al. 1995). Fall chum salmon are larger, spawn later, and are less abundant than their summer chum counterpart. They primarily spawn in the upper portion of the drainage in streams that are spring fed, usually remaining ice-free during the winter (Buklis and Barton 1984). Major fall chum salmon spawning areas include the Tanana, Chandalar, and Porcupine River systems, as well as portions of the upper Yukon River in Canada (Figure 1). Within the Tanana River important fall chum salmon spawning stocks include those utilizing numerous spring areas of the upper mainstem river itself between approximately Little Delta River and Delta Clearwater River (Barton 1992), the lower Delta River, as well as the Toklat River in the Kantishna River drainage (Figure 2).

The Toklat River heads in the glacial ice fields of the Alaska Range near Mount Pendleton in Denali National Park, draining an area of approximately 3,300 sq. km on the north side of the Alaska Range. It is a typical Alaskan glacial river with turbid, silt-laden water and broad, braided, gravel-bedded channels, flowing north approximately 140 km to its terminus on the Kantishna River some 90 km upstream of the Tanana River (Figure 3). Excluding the East Fork, all other tributaries are clear water, the largest of which is the Clearwater Fork. Though detailed studies have not been made, discontinuous permafrost is known to underlie much of the basin lowlands (USNPS 1985 as cited in Karle 1989). While most of the surface flow volume is from snow and glacier melt, which gradually diminishes as freezeup approaches, upwelling ground water composes a significant proportion of the river flow volume during the winter months. These up-welling spring areas provide important spawning habitat for fall chum and coho salmon.

Charles Sheldon (1930) first reported finding dead salmon in open water channels along the Toklat River in 1908. Apart from Sheldon's documentation, no information on chum salmon spawning abundance or distribution in the Toklat River was available prior to the early 1970s. Throughout the next decade however, observations on Toklat River chum salmon escapement were made by the Alaska Department of Fish and Game (department) and consisted of limited aerial and ground surveys conducted during periods of anticipated peak spawning (Barton 1984a). Beginning in 1980, a special effort was made to conduct a thorough ground survey each year of the major fall chum spawning area at Toklat Springs during periods of anticipated peak spawning. In 1985 surveyors began to document the distribution of spawners throughout the floodplain sloughs.

The existing historic escapement database for Toklat River chum salmon consists of estimates of total spawning abundance dating back to 1974 (Barton 1997). Estimates were derived from expanded aerial or ground survey counts of the major spawning area at Toklat Springs, using streamlife and migratory time-density data collected from the Delta River fall chum stock. Based upon the historical database, the department established a minimum fall chum salmon biological escapement goal (BEG) for the Toklat River of 33,000 spawners.

Between 1980 and 1989, Toklat River fall chum salmon escapements were consistently less than the BEG, despite numerous management actions taken by the department and the Alaska Board of Fisheries (BOF), not only for that stock but for Canadian stocks as well. Such actions included reductions in commercial fishing time throughout the Alaska portion of the drainage to both commercial and subsistence fishing closures/restrictions. At the spring 1990 BOF meeting, the Toklat River fall chum salmon stock was identified as a conservation concern. Subsequently, the BOF issued a "charge" to the Yukon River Drainage Fisheries Association (YRDFA) in the spring of 1992, to work with the department in developing a rebuilding management plan for Toklat River fall chum salmon. Based upon a YRDFA proposal presented to the BOF in the spring of 1993, the BOF adopted the *1993 Toklat River Fall Chum Salmon Rebuilding Management Plan*. Similar rebuilding plans, with only slight modifications, were adopted by the BOF for the 1994 fishing season and the 1995 through 1997 fishing seasons.

Due to the elevated concern over Toklat River fall chum salmon, the department initiated a hydroacoustic feasibility study in 1994 to obtain a more comprehensive assessment of fall chum salmon escapement into the river. The expectation was that daily sonar passage estimates could be used for inseason assessment of Toklat River chum salmon escapement. Intensive ground surveys of Toklat Springs were continued, providing for historical consistency. The sonar-estimated escapement (75,000) and subsequent ground survey population estimate (76,000) of fall chum salmon in 1994 were very similar (Barton 1997). As a result of that work, a recommendation was made to continue hydroacoustic assessment to further evaluate the two independent annual abundance estimates (sonar versus expanded ground surveys) over years with differing run sizes. This report presents results of studies conducted in 1995 and 1996.

Objectives

The main goal of 1995 and 1996 studies included continued evaluation of the feasibility of using hydroacoustic techniques to monitor timing and magnitude of fall chum salmon escapement in the Toklat River. Depending upon project success, a secondary goal was to compare the sonar-estimated escapements to independent total abundance estimates obtained from subsequent ground surveys of Toklat Springs during peak spawning. Like 1994, design of the 1995/96 studies was predicated upon two major assumptions. First, while the extent of mainstem spawning is not known with certainty, based upon historic information, it was presumed that little to no chum salmon spawning occurs upstream of Toklat Springs with only limited spawning below that region in most years. Second, it was presumed that species apportionment of mainriver sonar counts upstream of Barton Creek can reasonably be based upon species composition subsequently observed at Toklat Springs during peak of spawning. Given these assumptions, the following specific objectives were identified:

- document timing and magnitude of salmon escapement in the mainstem Toklat River upstream of Barton Creek using hydroacoustic techniques,

- apportion sonar counts to salmon species based upon subsequent ground surveys of Toklat Springs during the period of peak spawning,

- document timing and magnitude of salmon escapement by species in Barton Creek using a counting fence (weir), and

- monitor selected climatological and hydrologic parameters daily at the project site for use as baseline data.

METHODS

Hydroacoustic Equipment and Site Selection

The 1995/1996 sonar project site for assessing the salmon run in the Toklat River was located near the terminus of Barton Creek where it debouches onto the Toklat River floodplain (Figure 4). Camp facilities were established on the eastern side (right bank) of the floodplain between Barton Creek and the main channel of the Toklat River, which allowed a single two-person crew to monitor salmon passage in both the Toklat River and in Barton Creek. Several canvas wall tents, framed with spruce poles, were assembled for mess and sleeping quarters as well as to house sonar electronics.

Two, fixed-location hydroacoustic fish counters developed by the Hydrodynamics Division of Bendix Corporation[2] were used to monitor salmon passage in the mainstem Toklat River: a 1978 model counter and a 1979 model counter. Bendix side-looking transducers have co-axial, circular cross-section narrow (2°) and wide (4°) beam dimensions. Sampling ranges for the narrow and wide beams are variable and maximum at 18.3 m and 9.2 m, respectively. Each counter can be operated on either the narrow or wide beam independently, or by alternating acoustic pulse transmissions between the two beams. In the latter mode fish passage in the outer half and inner half of the sampling range are monitored by the narrow and wide beams, respectively.

Each counter maintained a record of the spatial distribution of fish counts based upon distance of the acoustic target from the transducer. Fish counts were tallied and stored into dynamic memory by 12 electronic range intervals (sectors). A tape printout showing the number of counts by sector was obtained each hour. Each counter was designed to assume that any time 24 counts occur in any one of the 12 electronic sectors in a 35-second period, they are not likely fish. Under such conditions, the system operator was alerted by the presence of a "debris" code appearing on the printout tape next to the suspect counts for the sector and hour in which they occurred. Examples of factors that can result in "debris counts" appearing on printout tapes include: passage of floating or suspended debris through the insonified water column, driving rain, snowfall, mis-angled beam, high density of fish passage, and holding or spawning fish.

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[2]Use of company names in this report does not constitute endorsement.

Other operating characteristics of Bendix counters as well as installation and operational procedures can be found in Bendix Corporation (1978) and Ehrenberg (undated).

Actual location of sonar transducers in 1995 and 1996 were based upon the best of several river bottom profiles made of the Toklat River main channel shortly after arrival at the project site in each year. Profiles of the river bottom were obtained by stretching a rope across the river and measuring water depth with a pole every 3 m.

In both years, the left-bank sonar counter was operated from the right bank. This counter was not housed on the left bank point bar due to increased risk of loss from sudden, unexpected high water events. The right-bank counter was housed in a separate wall tent on the right bank. Wood burning stoves were operated in each sonar tent to prevent printer malfunction during periods of dampness and cold weather. Access between banks was provided by means of a 5 m rubber raft. Personnel pulled themselves across the river in the raft by means of a 1.6 cm rope that had been strung across the river for that purpose. A safety line from the boat was secured to the rope while crossing. A bipod was used to elevate the rope high enough above the river when not in use, so as to avoid floating debris or boat traffic.

The modular aluminum substrates designed for use with Bendix counters were not used in either year. Transducers were mounted on housings made of galvanized steel water pipe (Barton 1997). The pods were designed to permit raising and lowering of the acoustic beam during aiming, by using the two riser pipes that extended above the water. Fine adjustments were made with the knurled knobs that attached the transducer plate to the pod. Transducer pods were secured in place with sandbags. The left-bank transducer cable, supported by a 1.6 cm rope, was elevated across the river to the sonar counter using nylon tie straps spaced about one meter apart and in such a manner so as to eliminate tension on the cable ends. The rope and transducer cable were suspended high enough above the river to avoid floating debris and boat traffic. Right-bank transducers were deployed from the adjacent bank a few meters upstream of the left-bank transducer in both years. Transducers were deployed in water ranging from approximately 0.5 to 1.0 m in depth and aimed perpendicular to the current, along the natural gravel substrate. An attempt was made to insure transducers were deployed at locations where minimum surface water velocities did not fall below approximately 30-45 cm/s.

The system operator used an artificial acoustic target during deployment to insure the aim of each transducer was low enough to prevent salmon from passing undetected beneath the acoustic beam. The target, an airtight, 250 ml weighted plastic bottle, was allowed to drift downstream along the river bottom and through the acoustic beam. Several drifts were made with the target in an attempt to pass it through each electronic sector of the counting range. When a transducer was properly aimed, the target appeared as a vertical deflection (spike) on an oscilloscope screen as it transected the acoustic beam at any given distance. The target may or may not have simultaneously registered a count (or multiple counts) on the sonar counter, depending upon the length of time it remained in the acoustic beam as it drifted downstream along the river bottom.

A fish lead was constructed shoreward from each transducer to prevent upstream salmon passage inshore of the transducers. Each lead was constructed using 5 cm x 5 cm by 1.2 m high Tuflink fencing and 2.5 m metal "T" stakes. Leads were constructed so as to include the nearfield "dead range" of each sonar transducer. Whenever a transducer was relocated because of rising or falling water level, the inshore lead was shortened or lengthened as appropriate, and the artificial target used to insure proper re-aiming.

Sonar Calibrations and Count Adjustments

Daily comparisons (calibrations) were made between oscilloscope observations and automated counter output to determine if the number of fish registered by the sonar counter equaled the number of fish observed passing through the sonar beam. A minimum of six, 15- to 30-minute calibrations was initially scheduled daily for each sonar counter within the following time periods: 0001-0100; 0600-0700; 1100-1200; 1600-1700; 2100-2200; and 2300-2400 hours. The 0001-0100 hour calibration was subsequently shifted to 0300-0400 hours. Duration of calibrations was based upon the following criteria: 1) stop calibration at 15 minutes if less than 10 fish are observed; and, 2) extend 15-minute calibration to 30 minutes if 10 or more fish are observed in the first 15 minutes.

Bank-specific calibration results were used to adjust passage estimates for each sonar counter on a daily basis. Hourly blocks of a day's count included in an adjustment (adjustment period) were defined by the time between individual bank-specific calibrations. An associated adjustment factor (A), specific to each adjustment period (i) was calculated as follows:

$$A_i = \frac{OC}{SC} \tag{1}$$

where:

OC = oscilloscope count; and,
SC = sonar count.

Adjustment factors were applied to the unadjusted sonar counts for each hour within the associated adjustment period for each bank. The resulting corrected sonar counts for each hour within a day for a given bank were summed, yielding the estimated daily passage ($\hat{D}$) of salmon, and is represented by

$$\hat{D} = \sum (A_i \text{x} SC_i) \tag{2}$$

Counts identified as "debris" on printout tapes counts were deleted and replaced by interpolated values prior to making adjustments. Interpolation was also used for missing sector counts as a result of occasional printer malfunction. All interpolated values for a given electronic sector were based upon registered counts for that sector in the preceding and following hour. Daily passage of salmon was determined by summing the daily bank estimates. Sonar counts caused by fish other than salmon were assumed to be insignificant. Whereas the adjusted (corrected) hourly counts were used to determine temporal distribution of salmon passing the sonar site, spatial distribution was estimated from the unadjusted (raw) sector counts.

Adjusting the pulse repetition rate (PRR) or ping rate of each counter as needed minimized over-counting or under-counting. Over- and under-counting primarily results from changes in salmon swimming speeds which may be related to fluctuations in water level and velocity, photoperiod, or fish densities (Barton 1985, 1986, 1987, 1995). Although a few occasions arose when the counter's ping rate was subjectively changed based upon a qualitative evaluation of fish passage rates, the ping rate was generally changed at the end of any calibration if the oscilloscope count was in excess of 59 per hour and differed by more than 15% from the sonar count. The new ping rate was calculated as follows: (sonar count / oscilloscope count) x current PRR setting. If passage rates during calibrations for a given counter on a given day never exceeded 59 fish per hour, the ping rate was changed at 2400 hours on that particular day. However, this change was made only if the sum of sonar counts during all of the day's calibrations differed from the sum of oscilloscope counts from all calibrations by more than 15%.

Barton Creek Weir

A weir was installed in Barton Creek where it debouches onto the Toklat River floodplain approximately 0.5 km upstream from its confluence with the Toklat River (see Figure 4). Actual location of the weir in 1995 and 1996 was approximately 30 m farther upstream from its location in 1994. Barton Creek was approximately 20 m wide at this location and water depth about one meter at the deepest point. A 4.5-m span of the weir consisted of six, 75 cm panels butted together and positioned where water was the deepest and current the most swift. Each panel consisted of twenty-five 1.5 cm diameter by 3 m long metal conduit, spaced on 3 cm centers in angle iron supports. These panels were held in place by large tripods constructed from spruce poles and secured with sandbags. Outer wings of the weir were constructed of 5 cm x 5 cm by 1.2 m high Tuflink fencing and 2.5 m metal "T" stakes. Fencing was secured to "T" stakes with nylon tie straps and sand-bagged along the stream bottom.

A holding pen was constructed in the weir with additional fencing material and provided entry for upstream bound salmon through a fyke opening. The holding pen was checked a minimum of two to four times daily, but frequency of checks increased with increasing numbers of salmon. Adult salmon were dip-netted from the holding pen, counted by species, sexed, and released upstream. Additional daily inspections of the weir were made as needed to remove beaver cuttings and accumulation of autumn foliage to prevent the weir from washing out. Salmon carcasses washed downstream were removed from the weir and the number of salmon retained in the holding pen held to a minimum to minimize fish mortality and bear problems.

Climatological and Hydrologic Observations

A gauge was installed in the main channel of the Toklat River and changes in water level monitored to the nearest centimeter. Surface water temperature was measured with a pocket thermometer to the nearest degree Centigrade (C). Other observations included recording the occurrence of precipitation, estimated wind velocity and direction, and percent cloud cover. All climatological and hydrologic observations were recorded twice daily at approximately 1200 and 2200 hours.

Spawning Ground Surveys and Population Estimate

Intensive ground surveys of the spawning area at Toklat Springs were conducted in mid-October in both 1995 and 1996. Updated maps of floodplain channels were prepared, and salmon distribution documented. Individual channel locations and wetted areas were estimated from several aerial photographs collected each year, and the number of live and dead chum and coho salmon were recorded by location. The chum salmon ground count made each year was subsequently expanded based upon the percentage of live chum salmon actually observed, using an estimated streamlife curve (SLC) and a migratory time-density curve (MTDC) developed for Toklat Springs (Barton 1997).

RESULTS

River Conditions and Sonar Abundance Estimation

Similar to 1994, water flow in the Toklat River at the project site in 1995 and 1996 was primarily confined to a single channel that traversed the floodplain from west to east, leaving exposed a large gravel-bedded point bar on the western side (left bank) (Figure 5). A much smaller channel with restricted flow cut behind the point bar. Water flow in this channel fluctuated in response to that of the main river throughout the 1995 and 1996 seasons. During high water periods the smaller channel behind the gravel bar was frequently of sufficient depth to permit passage of salmon. However, none were observed in this slough based upon occasional ground surveys made during periods of high water in both years. Water level in this channel at other times was generally too low to allow salmon passage. Actual placement of sonar transducers in the main river channel was based upon the best of several river bottom profiles made shortly after arrival at the project site in each year.

1995

A bottom profile of the main channel was made on 21 August 1995 where the left-bank transducer was deployed for operation. It approximated the same location used in 1994. The river measured 50 m wide, with the river bottom sloping gently from the point bar to the thalweg (a distance of 40 m) at a rate of approximately 4-5 cm/m for a bottom slope of 2° to 3° (Figure 6). River bottom from the thalweg to the right bank was steeper, rising approximately 20 cm/m for a slope of 11°.

Prevailing high water conditions at the project site hampered sonar operations in 1995. Although minimum and maximum water level differed by 57 cm between 14 August and 3 October, no less than three high water events were observed (Figure 7; Appendix A.1). High water was responsible for partially or totally suspending sonar counting for 11 days from 24 August to 7 September and 4 days from 21-24 September. For these days, salmon passage was estimated by extrapolation or interpolation (Appendix B.1). On 3 October, water level was only 16 cm lower than recorded on 14 August.

Attempts to initiate sonar counting from the left bank occurred on 13 August. Although salmon were observed passing the left-bank site on that date, electrical problems associated with transducer cables prevented passage estimates from being made prior to 21 August. Unfortunately, the left-bank transducer was removed from the river on the evening of 24 August as a result of rising river water. The transducer was re-deployed on 27 August and operated through 31 August when high water again necessitated its removal. The right-bank transducer was deployed the evening of 1 September across from, and slightly upstream of the left-bank transducer that was reinstalled on 2 September. High water required that both units be removed on 3 September. Right- and left-bank transducers were re-deployed on 5 and 6 September, respectively. Although water levels remained fairly high throughout much of September, both sonar counting units remained in operation until 21 September, when high water once again required their removal for 2-3 days.

Owing to the bottom profile and adequate water depths, salmon passage in 1995 was estimated along each bank by operating each sonar counter in the "alternate" mode, i.e., alternate triggering of the 2° and 4° acoustic beams. The passage estimate consists of adjusted daily counts for each counter based upon oscilloscope calibration data collected throughout the season. A total of 212 calibrations averaging 25 min in duration were made to the left-bank counter during the period 23 August through 3 October (Appendix C.1). For the right-bank counter, 192 calibrations averaging 15 min in duration were made between 1 September and 3 October (Appendix C.2). Total effort exceeded 133 h for both counters combined, and an attempt was made to weight calibrations to periods of the day when upstream migration was heaviest (Figure 8). The sonar fish passage estimate for the Toklat River upstream of Barton Creek in 1995 was 110,867 for the 44-day period 21 August through 3 October (Table 1). This estimate includes expansions for those days only partially monitored by either counter, as well as those days when counting was suspended during periods of high water (see Appendix B.1).

1996

In 1996, the Toklat River was insonified approximately 105 m farther upstream from the 1995 site; a location where the thalweg was more central to the main channel. Two profiles at that location were made on 12 August and river width approximated 53-54 m (see Figure 6). The left-bank transducer was deployed and aimed across transect AB, while aim of the right-bank transducer was across transect CA. At transect AB, the left-bank bottom sloped gently from the point bar to the thalweg (a distance of 35 m) at a rate of approximately 5 cm/m for a slope of approximately 3°.

The right-bank bottom across transect CA was slightly steeper, sloping to the thalweg (a distance of 24 m) at a rate of approximately 7 cm/m (4° slope). Location of the right-bank transducer was approximately 5-6 m upstream of the left-bank transducer.

The Toklat River experienced only moderate fluctuations in water level in 1996 at the project site (Appendix A.2). Minimum and maximum water level differed by 84 cm between 7 August and 1 October, and apart from two high water events of relatively short duration occurring on 11 and 17 August, the overall trend was a decline in water level throughout duration of the project (see Figure 7). High water was responsible for suspending sonar operations on the left bank for nearly 3 days between 16 and 19 August. A decline in water level was observed subsequent to 19 August, and by the end of September it was 52 cm lower than recorded on 7 August. Right-bank counting operations were not interrupted from high water in 1996.

Owing to a prevailing decline in water level for most of the 1996 season, as well as a favorable bottom profile, both the left and right-bank counters were primarily operated on the narrow (2°) acoustic beam. Acoustic noise and background scattering were encountered when operating from the 4° or "alternate" mode. The sonar-estimated escapement in 1996 consists of adjusted daily counts made for each counter based upon oscilloscope calibration data collected throughout the season. A total of 292 calibrations averaging 19 min in duration were made to the left bank counter from 14 August through 1 October (Appendix C.3), while 289 calibrations averaging 17 min in duration were made to the right-bank counter (Appendix C.4). Total effort amounted to 172 h of calibration time for both counters combined, and an attempt was made to weight calibration effort to periods of the day when migration rates were heaviest (see Figure 8). The sonar passage estimate in 1996 was 90,044 fish for the 49-day period 14 August through 1 October (Table 2). This estimate includes expansions for those days only partially monitored by either counter, as well as those days when counting was suspended on the left bank as a result of high water (see Appendix B.1).

Temporal and Spatial Distribution

Entry of salmon in the Toklat River subsequent to mid-August continued for at least 1.5 months in both 1995 and 1996 based upon hydroacoustic assessment (Figure 9).

1995

Salmon were observed to have been present at least as early as 13 August in 1995. Although no passage estimates were made prior to 21 August due to electrical problems associated with transducer cables, few salmon were judged to have passed the project site as evidenced by a passage rate over the next three days of less than 200 per day. Estimated total passage through the end of August was approximately 15,000 salmon or 14% of the run, with an average passage rate of 1,400 fish per day. The central half of the run was estimated to have passed the project site during the 14-d period 7 through 20 September, at an average rate of approximately 4,300 fish per day. The median day of passage occurred on 14 September, while peak daily passage (6,078 fish) was observed on 15 September. Salmon were still passing the project site at a rate of about 200 fish/d, upon termination of operations on 3 October.

An estimated 89,482 salmon, or 81% of the total sonar-estimated escapement in 1995 was observed on the left bank, with the remaining 19% (21,385 salmon) observed on the right bank. Spatial distribution of sonar counts by electronic sector indicates that most of the salmon passed near shore, although some counts were observed in all sectors of each acoustic beam (Figure 10). For example, not only did the majority of salmon move upstream along the left-bank point bar, but 97% of *those* passed through the first three near-shore sectors. The average width of each sector was 1.5 m based upon an average counting range of 18.3 m for the left-bank counter. This results in more than 86,000 salmon passing within 2 m of the left-bank transducer. Similarly, 91% of the right-bank passage estimate was confined to the first five sectors, each of which averaged less than 0.5 m in width based upon an average counting range of 4.3 m for that counter.

The proportion of the river insonified varied throughout the season depending upon the counting range of acoustic beams and actual placement of transducers as necessitated by fluctuations in river water level. The uninsonified portion of the river was greatest prior to 31 August when only one unit was operating from the left-bank point bar. However, less than 15% of the total passage estimate for the season was made during this period, including an estimate for fish passing along the right bank. The right-bank estimate during this period was based upon the average daily proportion right-bank counts comprised (~16%) of the combined daily total when both sonar counters operated 24 h/d over the next two-week period. Once both counters became functional 24 h/d in early September, an uninsonified area averaging 4 m in width existed between the outer ends of the two acoustic beams. No attempt was made to estimate salmon passage for this area but it is believed to have been negligible based upon a review of the spatial distribution of fish by electronic sector.

Distribution of sonar counts by hour revealed a distinct diel pattern in passage along both banks in 1995 (Appendix D.1 and D.2). More fish moved upstream during periods of darkness or hours of suppressed light (Figure 11). Peak passage along the left bank occurred between 2200 and 2300 hours while peak hourly passage along the right bank was between 2100 and 2200 hours. Nighttime passage along each bank gradually subsided with the ensuing hours of daylight and remained low until twilight approached.

1996

In 1996, approximately 13,000 salmon or 14 % of the run, was estimated passing the sonar site from 14 through 31 August, with an average passage rate of approximately 720 fish per day. The central half of the run was estimated to have passed during the 17-d period 5 through 21 September at an average rate of approximately 2,700 fish per day. Median day of passage was 16 September, while peak daily passage (6,158 fish) was observed on 18 September. Approximately 1,400 salmon were estimated to have passed the project site on 1 October, the last day of operation in 1996.

An estimated 55,719 salmon, or 62% of the total sonar-estimated escapement in 1996 was observed on the left bank, while the remaining 38% (34,325 salmon) was observed on the right bank. Like

1995, spatial distribution of sonar counts by electronic sector indicated most of the salmon were near-shore oriented, although some counts were registered in all sectors of each acoustic beam (Figure 12). For example, 66% of fish on the left bank passed through the first four sectors. The average width of each sector was 0.9 m based upon an average total counting range of 10.4 m for the left-bank counter. This results in more than 36,500 salmon passing within 3.4 m of the left-bank transducer. Similarly, 79% of the right-bank passage estimate was confined to the first five sectors, each of which averaged 0.7 m in width based upon an average total counting range of 8.5 m for that counter.

The average uninsonified area between the outer ends of the two acoustic beams was 2 m in 1996, ranging from zero to 10 m throughout the season. No attempt was made to estimate salmon passage for this area but it is believed to have been negligible based upon a review of the spatial distribution of fish by electronic sector.

Distribution of sonar counts by hour revealed a distinct diel pattern in passage along both banks in 1996 (Appendix D.3 and D.4), with more fish moving upstream during periods of darkness or hours of suppressed light (Figure 13). Peak hourly passage along both banks occurred between 2400 and 0100 hours. Nighttime passage along each bank gradually subsided with the ensuing hours of daylight, and remained low until twilight approached.

Weir Passage

1995

A total of 1,293 chum (391 male, 576 female, 326 unsexed) and 194 coho salmon (67 male, 38 female, 89 unsexed) were passed through the weir in Barton Creek between 26 August and 3 October 1995 (Figure 14; Appendix E.1). Although the first chum salmon was passed on 27 August, 85% (1,100 fish) were passed between 22 and 28 September. The first coho salmon was passed on 12 September with peak passage (68 fish) observed on 22 September. Due to the tremendous load of autumn foliage carried downstream and resulting leaf accumulation, the weir had to be removed on 16 September, but was fish-proof again by 1030 hours on 18 September. Although five chum salmon were passed on 16 September, few salmon are believed to have passed the weir site during the time it was inoperable.

Other fish species observed at the Barton Creek weir in 1995 included Arctic grayling (*Thymallus arcticus*), rainbow trout (*O. mykiss*) and round whitefish (*Prosopium cylindraceum*). All of these species were of the size that allowed them to pass unharmed through the fencing portion of the weir.

1996

In 1996, the weir was installed on 9 August and remained in operation for the next three days until high water required its removal. During this period, one chinook salmon was observed well below the weir on 11 August. The weir was removed on 12 August and reinstalled on the 18th. Based upon the presence of 4 chum salmon upstream of the weir on 19 August, an unknown, but likely small number of salmon may have passed during this period. The weir remained in operation until 5 September, when excessive accumulation of deciduous foliage necessitated its removal. Although only a single chum salmon was captured in the holding pen, two chum salmon were seen below the weir on 25 August and two chum and one chinook salmon were observed below the weir on 2 September.

The weir remained inoperable from 5 through 20 September, but based upon daily ground surveys of that portion of Barton Creek below the weir site to its mouth, few salmon (if any) are believed to have passed. Only one chum and two coho salmon were seen during this entire period, and those were observed immediately at the confluence of Barton Creek on the Toklat River. The weir was once again operational between 20 and 30 September, but no salmon were passed (Appendix E.2). The only other species observed (through casual observation) at the weir site in 1996 included Arctic grayling and round whitefish.

Spawning Ground Surveys - Toklat Springs

1995

Intensive ground surveys of the Toklat Springs index area were conducted during the period 20-23 October 1995. Foot surveys of Geiger Creek, Sushana River, and clearwater floodplain slough index areas were successfully completed (Appendix F.1). There was little snow cover (5-7 cm) to impede travel or conceal salmon carcasses, and with exception of observations made in Wolf Slough, all other survey observations were rated either "good" or "fair". However, timing of the ground surveys was delayed more than a week in 1995 due to unseasonably warm weather that characterized September and early October. The warmer weather resulted in the main Toklat River channels remaining high and turbid for a longer period than usual. When the surveys were conducted, spawning was judged to be well past peak and survey timing late relative to most other years. For this reason, together with turbidity problems in the main river channel(s), survey results should be considered conservative. The total count for Toklat Springs was 52,520 chum salmon of which 58% were carcasses. A total of 299 coho salmon were also counted, representing less than 1% of the total number of salmon counted at Toklat Springs. Updated maps of floodplain channels and salmon distribution were prepared (Figures 15 and 16). The chum salmon ground count was subsequently expanded to a total abundance estimate of 54,513 fish and it, too, should be considered a conservative estimate. The coho salmon count was not expanded.

A reconnaissance flight to locate chum and coho salmon spawning areas on selected streams in Denali National Park and Preserve was flown 19 October 1995 (D. Miller, Caribou Air Service, Fairbanks, AK, personal communication). Portions of the Toklat River were included in that survey and the following documentation of salmon made. Although no salmon nor anecdotal evidence of their presence was observed in a survey of the approximate lower 12 km of the East Fork Toklat River, approximately 10-15 chum salmon were observed in a small clearwater slough located near the terminus of Wigand Creek. Additionally, three chum salmon carcasses were observed in

Wigand Creek approximately 1.5-2 km upstream. More than 200 chum salmon were estimated in a slough of the mainstem Toklat River located approximately 20 km upstream of Toklat Springs.

A more comprehensive aerial survey was flown of the Toklat River on 27 October. The survey was rated as "poor" for several reasons: 1) it was flown late, well after peak of spawning, 2) the main river channel was slightly turbid, and 3) a fresh snowfall the previous day contributed to a minimal carcass count. Salmon observations on this survey, excluding the Toklat Springs study area, included 60 chum salmon approximately 15 km farther upstream. Downstream of the study area to the confluence of Barton Creek the main river channel was slightly turbid and often characterized with ice floe and frazil ice. A minimal estimate of 1,271 chum and 75 coho salmon was made for this stretch of river. Fish were seen in relatively small groups throughout the entire distance. The Toklat River was frozen below Barton Creek.

1996

In 1996, intensive ground surveys of Toklat Springs were conducted during the period 15-19 October 1995. Foot surveys of Geiger Creek, Sushana River, and floodplain slough and channel index areas were successfully completed (Appendix F.2). About 18-22 cm of snow cover was present which concealed some salmon carcasses. From this standpoint, survey observations should be considered on the conservative side, even though all of the surveys were rated as either "good" or "fair". Timing of ground surveys appeared to be at peak to slightly past peak of spawning. The total count for Toklat Springs was 16,206 chum salmon of which nearly 30% were carcasses. A total of 276 coho salmon were also counted, representing approximately 2% of the total number of salmon counted at Toklat Springs. Updated maps of floodplain channels and salmon distribution were prepared (Figures 17 and 18). The chum salmon ground count was subsequently expanded to a total abundance estimate of 18,264 fish. The coho salmon count was not expanded.

A helicopter survey was flown of the Toklat River on 19 October between the Toklat Springs index area and the sonar project site. Within approximately the first 10 km downstream of Toklat Springs, the main river channel was mostly frozen over with only limited open water zones present. No fish were seen. Salmon were first observed from that point to approximately 15 km farther downstream in several open water sections of the main channel and side sloughs. A total of 5,170 chum and 358 coho salmon were estimated in three or four concentrated areas of spawning. This is considered a very conservative number of salmon present due to turbidity levels and occurrence of pan/frazil ice throughout this section of the river. The count includes only 12 salmon carcasses. Limited areas of open water were encountered within the next approximate 10 km of the river (down to the sonar site), and no fish were seen.

DISCUSSION

I concluded that the use of sonar was a feasible method of monitoring salmon escapement in the Toklat River in 1994 (Barton 1997). Results from that work also suggested that past estimates of fall chum salmon escapement in the Toklat River were likely reasonable, since the sonar-estimated escapement of chum salmon (~76,000) was remarkably similar to a subsequent expanded ground survey estimate of chum salmon (~75,000). However, unlike 1994, sonar-estimated escapement of chum salmon in 1995 and 1996 greatly exceeded subsequent expanded ground survey estimates of Toklat Springs in each year.

In-season, it was assessed that daily fish passage estimates at the Toklat River sonar site in 1995 were greater than observed in 1994, suggesting the chum salmon escapement goal would be achieved, and by a much higher margin than is believed to have occurred the previous year. Similarly, chum salmon passage in Barton Creek was correspondingly greater than observed in 1994. These factors, together with the tremendous return of chum salmon that was being observed throughout the entire Yukon River drainage (Bergstrom et al. 1997a), suggested a large run was materializing in the Toklat River. Although counting challenges were certainly encountered in 1995, there did not appear to be reason, in-season, to suspect adjusted daily passage estimates. It was considered that over-counting as a result of slow swimming or holding fish was being compensated for by the application of calibration results. Further, there was anecdotal evidence to suggest that the manifestation of sub-threshold spikes on the oscilloscope was likely resulting from the presence of a different and smaller fish species. For example, a whitefish carcass was found in shallow water immediately upstream of the left-bank fish lead on 16 September, and an increase in the number of whitefish present at Barton Creek weir was observed during mid-September. None-the-less, the final 1995 sonar-estimated passage of chum salmon was 110,201 fish, based upon species apportionment from subsequent surveys at Toklat Springs (99.4% chum and 0.6% coho salmon). This was 102% greater than the estimate of 54,513 chum salmon made at Toklat Springs. Although chum and coho spawning was documented between Toklat Springs and the sonar site in 1995, it was particularly disappointing to see an expanded ground-survey estimate that was markedly lower than obtained in 1994, especially since the 1995 sonar-passage estimate was in excess of 100,000 chum salmon. However, the ground survey estimate did indicate that the escapement goal was achieved in 1995.

In 1996, daily fish passage estimates at the sonar site were comparatively low with those of 1995, but passage was steady and on a pace that suggested another good Toklat River chum salmon run. This was consistent with other in-river indicators in 1996 which revealed the overall fall chum salmon run to be strong, particularly the non-Tanana River component (Bergstrom et al, 1997b). However, it was somewhat inconsistent with the south-bank Tanana River test wheel and Tanana River tagging wheel which indicated the Tanana River fall chum component to be comparatively weaker (Cappiello and Bruden 1997). None-the-less, daily estimates of salmon passage at the Toklat River sonar site were indicating another strong run and that the minimum escapement goal of 33,000 chum salmon would likely be achieved. However, another large disparity was manifest between the two Toklat River estimates of chum salmon abundance in 1996. Based upon an apportionment of 98.5% chum and 1.5% coho salmon observed at Toklat Springs, the sonar-passage estimate of chum salmon was 88,513 fish, or 385% greater than the Toklat Springs estimate (18,264). The Toklat Springs estimate was well below the chum salmon escapement goal.

Reasons for the higher sonar estimates of abundance in 1995 and 1996 are not clearly understood, and may have been a function of one or more of several factors. First, the difference between the two independent estimates of abundance in each year may be correct, at least to some degree. If so, this would suggest substantial spawning by either chum or coho salmon, or both species, occurred in areas of the drainage upstream of Barton Creek, in addition to Toklat Springs. In both 1995 and 1996, aerial surveillance documented both chum and coho salmon spawning, the magnitude of which is unknown, in the mainstem-river between the sonar site and Toklat Springs. Species apportionment of sonar counts based upon results obtained from subsequent ground surveys at Toklat Springs could bias sonar-estimated escapements depending upon the extent of additional spawning. Further, such a situation would lessen the usefulness of daily passage estimates inseason to evaluate whether or not the existing escapement goal will be achieved in a given year. If substantial spawning occurs in other areas apart from Toklat Springs in most years, achievement of the existing goal that is predicated upon expanded ground survey observations could only be evaluated on a post-season basis. Further, a need would then exist to develop a chum salmon escapement goal based upon run timing and abundance estimates obtained with sonar.

Late timing of ground surveys at Toklat Springs with respect to peak of spawning and low dead salmon counts resulting from carcasses being concealed by snow cover, or absent due to washout-rates, would negatively bias population estimates made from ground surveys. In 1995, snow cover was not considered to have been a factor in concealing salmon carcasses during ground surveys conducted at Toklat Springs. However, surveys were delayed in that year due to unseasonably warm weather, contributing to a conservative population estimate. By comparison, timing of ground surveys in 1996 was good, but snow cover was a factor in concealing carcasses. Thus, the 1996 population estimate of chum salmon made from ground surveys is also considered to be somewhat conservative, but not to the degree as the estimate made in 1995 when survey timing was late. The role that washout plays on the disappearance of salmon carcasses at Toklat Springs by the time surveys are conducted in mid-October is not known. Additionally, chum salmon population estimates based on ground surveys in 1995 and 1996 could be potentially biased high or low, depending upon assumptions associated with chum salmon spawner residence time at Toklat Springs.

Upstream passage of non-salmon species of sufficient size to be counted by sonar was not considered to have been a problem in either 1995 or 1996. However, a fish the size of an adult chum or coho salmon passing downstream through the insonified water column results in a vertical deflection, or spike, on the oscilloscope screen. These vertical deflections are generally sub-threshold and fleeting in nature, due to the relatively short duration and aspect of the target as it passes through the acoustic beam. Thus, a downstream moving adult salmon, while it may appear on an oscilloscope screen even near or above the threshold counting level, is not generally counted by the sonar counter since it is not in the acoustic beam long enough (A. Menin, Hydroacoustic Consulting, Sylmar, CA, personal communication). Similarly, smaller fish (e.g., whitefish) passing through the acoustic beam also result in vertical, sub-threshold deflections which could potentially hinder interpretation of calibration data, creating a positive or negative bias in passage estimates. While Bendix sonar salmon counters are not configured to count smaller fish species, there was no indication that the fleeting, sub-threshold spikes so prominent during certain periods, whether generated by another species or downstream moving salmon negatively influenced sonar calibrations in either 1995 or 1996.

Although positive and negative biases in fish passage from ping-rate settings were accounted for by comparing sonar counter output to visual observations on an oscilloscope, multiple counts of salmon as a result of a fish passing upstream through the acoustic beam more than once, would positively bias sonar-estimated escapement. I believe this was the greatest, non-quantifiable source of error in sonar-passage estimates for both 1995 and 1996. For example, the diel pattern observed in 1995 and 1996, typically observed with other Yukon River fall-run spawning stocks (Barton 1983, 1984b, 1985, 1987 and 1995; Simmons and Daum 1989; Daum and Simmons 1991; Osborne and Daum 1997), noticeably deteriorated in 1995 along the left bank during the time periods 11-15 September and 24-28 September. During these time strata necessary placement of the let-bank transducer was such that water velocity across the near-shore insonified zone was greatly reduced. In turn, fish swim speeds through the near-shore insonified zone greatly lessened, requiring the pulse repetition rate of the sonar counter to be slowed in an attempt to accommodate the slow fish swim speeds. Unfortunately, the pulse repetition rate was reduced to its lowest setting, but remained insufficient to prevent over-counting (positive bias) by the sonar counter. Although over-counting was adjusted in-season by comparing counter output to oscilloscope observations during these periods in 1995, an additional post-season adjustment was made for positive bias associated with multiple fish counts, i.e., for fish (salmon) moving upstream through the acoustic beam more than once (see Appendix B.1). During the 11-15 September and 24-28 September periods, chum salmon were physically observed in the immediate vicinity of the left-bank fish lead, and numerous non-quantifiable, sub-threshold spikes were manifested during oscilloscope calibrations. I believe that during these two periods an unknown number of salmon, after passing upstream and being counted by the left-bank sonar counter, swam downstream (creating sub-threshold target responses on the oscilloscope) only to be counted again as they likely migrated back upstream.

Transducer placement is a function of the hydrologic conditions of the river and accompanying debris loads. As such, placement during the two time periods mentioned above was less than favorable until the transducer could be relocated to deeper water where the current was swifter. Once moved and the fish lead extended, increased water velocity deterred fish from "milling" in the vicinity of the transducer, i.e., fish tended to move upstream in the stronger current past the transducer with less propensity to hold or fall back downstream. This is apparent from the decreased passage rates observed immediately subsequent to transducer moves at approximately noon on 16 and 28 September (see Appendix D.1).

Multiple fish counting as distinguished from over-counting, the latter of which was addressed by application of calibration data, is believed to have also occurred at other times in 1995, particularly along the left bank, as well as along both banks at the 1996 counting site. However, apart from the two time strata identified in 1995, there is no way to quantify this potential source of error since direction of fish movement cannot be determined with Bendix sonar counters. I believe the reason multiple fish counts may have been a significant factor in 1995 but not 1994, is from differences in river hydrology between the two years, even though actual counting location was the same. In 1995 high water persisted, whereas in 1994 a prevailing decline in water level was observed apart from one high water period of relatively short duration early in the season. Although water level fluctuations were similar in 1996 and 1994, a different counting site was used in 1996; a location apparently conducive for fish milling.

Sonar-estimated escapements of chum salmon to the Toklat River in 1995 and 1996 are considered biased high due to a non-quantifiable number of salmon that were estimated passing the sonar site (i.e., counted) more than once. However, this is not to imply that all of the disparity between the sonar-estimated escapements and subsequent expanded ground survey estimates was due to this phenomenon. For example, ground surveys conducted of Toklat Springs were delayed in 1995 due to unseasonably warm weather, and the resulting population estimate made from those survey observations is considered conservative. Similarly, the 1996 population estimate is also consider slightly conservative due to concealment of carcasses by snow cover during foot surveys. Further, some of the disparity between the annual estimates of abundance may be attributed to the utilization of additional spawning areas apart from that at Toklat Springs in both years. Although the relative size and importance of these areas are unknown, extent of additional mainstem spawning may be substantial in some years. Thus, apportionment of sonar counts to species may not be feasible in all years, based upon observations obtained from subsequent ground surveys only at Toklat Springs. Coho salmon were also observed spawning in other areas of the mainstem river. Thus, the proportion of coho salmon passing the sonar site may be under-estimated by using the ratio between the two species observed only at Toklat Springs.

In summary, variation of the difference between the two estimates of abundance among the three years this study has operated is substantial, and it remains unclear how to interpret the sonar-passage estimates with respect to subsequent expanded ground survey estimates at Toklat Springs. Further, because of the counting challenges encountered in 1995 and 1996 there remains a level of uncertainty associated with the true magnitude of escapements in these years. As such, the Toklat River sonar project should remain in a developmental phase. Toklat Springs ground surveys should continue to be conducted annually, but at the same time a better understanding is needed for Toklat River chum and coho salmon run timing and spawner distribution throughout the entire drainage. Future plans to monitor salmon escapement with sonar in the Toklat River at the present site should consider use of hydroacoustic equipment that can determine direction of fish movement.

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Table 1. Sonar–estimated fish passage in the Toklat River, 1995.

Date	Sonar Estimate [a]						Proportion Both Banks	
	Left (west) Bank		Right (east) Bank		Both Banks			
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum [b]
21–Aug [c]	44	44	7	7	51	51	0.00	0.00
22–Aug	145	189	23	30	168	219	0.00	0.00
23–Aug	116	305	19	49	135	354	0.00	0.00
24–Aug	185	490 [d]	30	78	215	568	0.00	0.01
25–Aug	942	1,432 [d]	151	229	1,093	1,661	0.01	0.01
26–Aug	1,699	3,131	272	501	1,971	3,632	0.02	0.03
27–Aug	2,456	5,587	393	894	2,849	6,481	0.03	0.06
28–Aug	1,879	7,466	301	1,195	2,180	8,661	0.02	0.08
29–Aug	2,794	10,260	447	1,642	3,241	11,902	0.03	0.11
30–Aug	2,213	12,473	354	1,996	2,567	14,469	0.02	0.13
31–Aug	722	13,195	116	2,111	838	15,306	0.01	0.14
01–Sep	662	13,857 [d]	51	2,162	713	16,019	0.01	0.14
02–Sep	603	14,460	106	2,268	709	16,728	0.01	0.15
03–Sep	791	15,251	162	2,430	953	17,681	0.01	0.16
04–Sep	1,720	16,971 [d]	99	2,529 [d]	1,819	19,500	0.02	0.18
05–Sep	2,649	19,620 [d]	35	2,564	2,684	22,184	0.02	0.20
06–Sep	3,577	23,197	214	2,778	3,791	25,975	0.03	0.23
07–Sep	3,032	26,229	385	3,163	3,417	29,392	0.03	0.27
08–Sep	2,911	29,140	477	3,640	3,388	32,780	0.03	0.30
09–Sep	1,427	30,567	787	4,427	2,214	34,994	0.02	0.32
10–Sep	2,014	32,581	656	5,083	2,670	37,664	0.02	0.34
11–Sep	3,095	35,676	359	5,442	3,454	41,118	0.03	0.37
12–Sep	3,123	38,799	570	6,012	3,693	44,811	0.03	0.40
13–Sep	3,853	42,652	406	6,418	4,259	49,070	0.04	0.44
14–Sep	5,408	48,060	670	7,088	6,078	55,148	0.05	0.50
15–Sep	6,118	54,178	283	7,371	6,401	61,549	0.06	0.56
16–Sep	4,484	58,662	466	7,837	4,950	66,499	0.04	0.60
17–Sep	4,100	62,762	594	8,431	4,694	71,193	0.04	0.64
18–Sep	4,838	67,600	931	9,362	5,769	76,962	0.05	0.69
19–Sep	3,425	71,025	1,064	10,426	4,489	81,451	0.04	0.73
20–Sep	3,665	74,690	863	11,289	4,528	85,979	0.04	0.78
21–Sep	2,635	77,325	1,599	12,888	4,234	90,213	0.04	0.81
22–Sep	2,181	79,506 [d]	1,125	14,013 [d]	3,306	93,519	0.03	0.84
23–Sep	1,727	81,233 [d]	651	14,664	2,378	95,897	0.02	0.86
24–Sep	1,273	82,506	1,257	15,921	2,530	98,427	0.02	0.89
25–Sep	1,439	83,945	1,360	17,281	2,799	101,226	0.03	0.91
26–Sep	809	84,754	1,133	18,414	1,942	103,168	0.02	0.93
27–Sep	1,420	86,174	1,101	19,515	2,521	105,689	0.02	0.95
28–Sep	1,086	87,260	622	20,137	1,708	107,397	0.02	0.97
29–Sep	1,146	88,406	522	20,659	1,668	109,065	0.02	0.98
30–Sep	473	88,879	248	20,907	721	109,786	0.01	0.99
01–Oct	314	89,193	218	21,125	532	110,318	0.00	1.00
02–Oct	183	89,376	147	21,272	330	110,648	0.00	1.00
03–Oct	106	89,482	113	21,385	219	110,867	0.00	1.00
Totals	89,482	81%	21,385	19%	110,867		1.00	

[a] No species apportionment made.

[b] First and third quartiles are shown as well as median day of passage.

[c] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.

[d] Sonar did not operate due to high water.

Table 2. Sonar-estimated fish passage in the Toklat River, 1996.

Date	Sonar Estimate [a]						Proportion Both Banks	
	Left (west) Bank		Right (east) Bank		Both Banks			
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum [b]
14-Aug [c]	271	271	77	77	348	348	0.00	0.00
15-Aug	168	439	39	116	207	555	0.00	0.01
16-Aug	264	703	26	142	290	845	0.00	0.01
17-Aug	318	1,021 [d]	32	174	350	1,195	0.00	0.01
18-Aug	372	1,393 [d]	26	200	398	1,593	0.00	0.02
19-Aug	428	1,821	18	218	446	2,039	0.00	0.02
20-Aug	371	2,192	15	233	386	2,425	0.00	0.03
21-Aug	187	2,379	15	248	202	2,627	0.00	0.03
22-Aug	582	2,961	14	262	596	3,223	0.01	0.04
23-Aug	484	3,445	5	267	489	3,712	0.01	0.04
24-Aug	695	4,140	14	281	709	4,421	0.01	0.05
25-Aug	1,100	5,240	15	296	1,115	5,536	0.01	0.06
26-Aug	834	6,074	26	322	860	6,396	0.01	0.07
27-Aug	991	7,065	130	452	1,121	7,517	0.01	0.08
28-Aug	607	7,672	220	672	827	8,344	0.01	0.09
29-Aug	590	8,262	627	1,299	1,217	9,561	0.01	0.11
30-Aug	709	8,971	857	2,156	1,566	11,127	0.02	0.12
31-Aug	862	9,833	751	2,907	1,613	12,740	0.02	0.14
01-Sep	1,265	11,098	1,106	4,013	2,371	15,111	0.03	0.17
02-Sep	981	12,079	1,097	5,110	2,078	17,189	0.02	0.19
03-Sep	1,061	13,140	1,042	6,152	2,103	19,292	0.02	0.21
04-Sep	1,186	14,326	1,185	7,337	2,371	21,663	0.03	0.24
05-Sep	893	15,219	982	8,319	1,875	23,538	0.02	0.26
06-Sep	705	15,924	665	8,984	1,370	24,908	0.02	0.28
07-Sep	780	16,704	692	9,676	1,472	26,380	0.02	0.29
08-Sep	1,363	18,067	735	10,411	2,098	28,478	0.02	0.32
09-Sep	1,469	19,536	604	11,015	2,073	30,551	0.02	0.34
10-Sep	1,172	20,708	557	11,572	1,729	32,280	0.02	0.36
11-Sep	1,275	21,983	753	12,325	2,028	34,308	0.02	0.38
12-Sep	1,317	23,300	650	12,975	1,967	36,275	0.02	0.40
13-Sep	1,291	24,591	673	13,648	1,964	38,239	0.02	0.42
14-Sep	1,197	25,788	406	14,054	1,603	39,842	0.02	0.44
15-Sep	1,297	27,085	601	14,655	1,898	41,740	0.02	0.46
16-Sep	2,156	29,241	1,068	15,723	3,224	44,964	0.04	0.50
17-Sep	2,398	31,639	1,464	17,187	3,862	48,826	0.04	0.54
18-Sep	3,819	35,458	2,339	19,526	6,158	54,984	0.07	0.61
19-Sep	2,764	38,222	1,440	20,966	4,204	59,188	0.05	0.66
20-Sep	2,983	41,205	1,329	22,295	4,312	63,500	0.05	0.71
21-Sep	2,207	43,412	1,441	23,736	3,648	67,148	0.04	0.75
22-Sep	552	43,964	781	24,517	1,333	68,481	0.01	0.76
23-Sep	439	44,403	529	25,046	968	69,449	0.01	0.77
24-Sep	514	44,917	543	25,589	1,057	70,506	0.01	0.78
25-Sep	759	45,676	826	26,415	1,585	72,091	0.02	0.80
26-Sep	1,190	46,866	1,366	27,781	2,556	74,647	0.03	0.83
27-Sep	2,225	49,091	1,535	29,316	3,760	78,407	0.04	0.87
28-Sep	1,709	50,800	1,884	31,200	3,593	82,000	0.04	0.91
29-Sep	1,894	52,694	1,173	32,373	3,067	85,067	0.03	0.94
30-Sep	2,243	54,937	1,322	33,695	3,565	88,632	0.04	0.98
01-Oct	782	55,719	630	34,325	1,412	90,044	0.02	1.00
Totals	55,719	62%	34,325	38%	90,044		1.00	

[a] No species apportionment made.

[b] First and third quartiles are shown as well as median day of passage.

[c] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.

[d] Sonar did not operate due to high water.

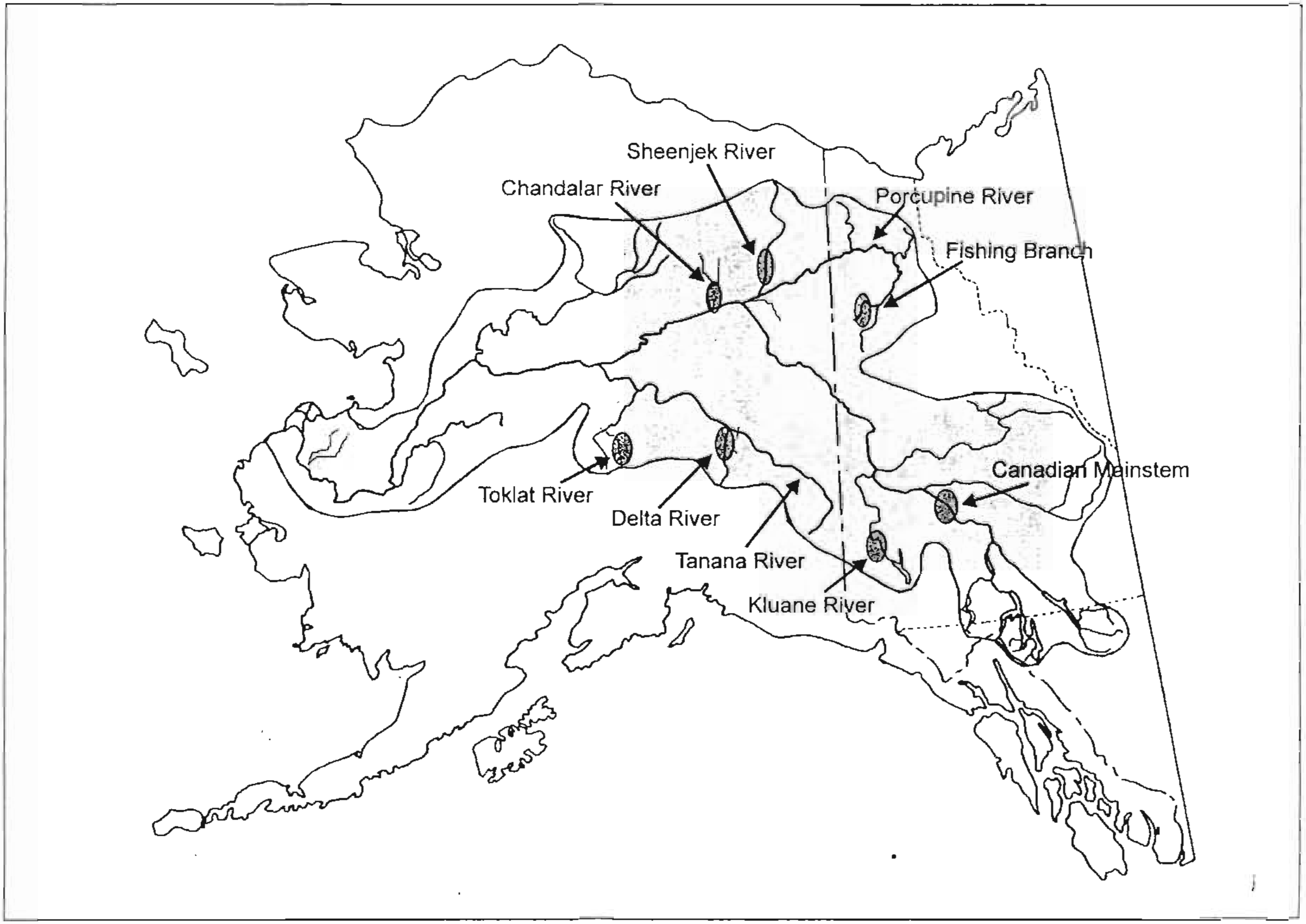

Figure 1. Important Yukon River fall chum salmon spawning areas.

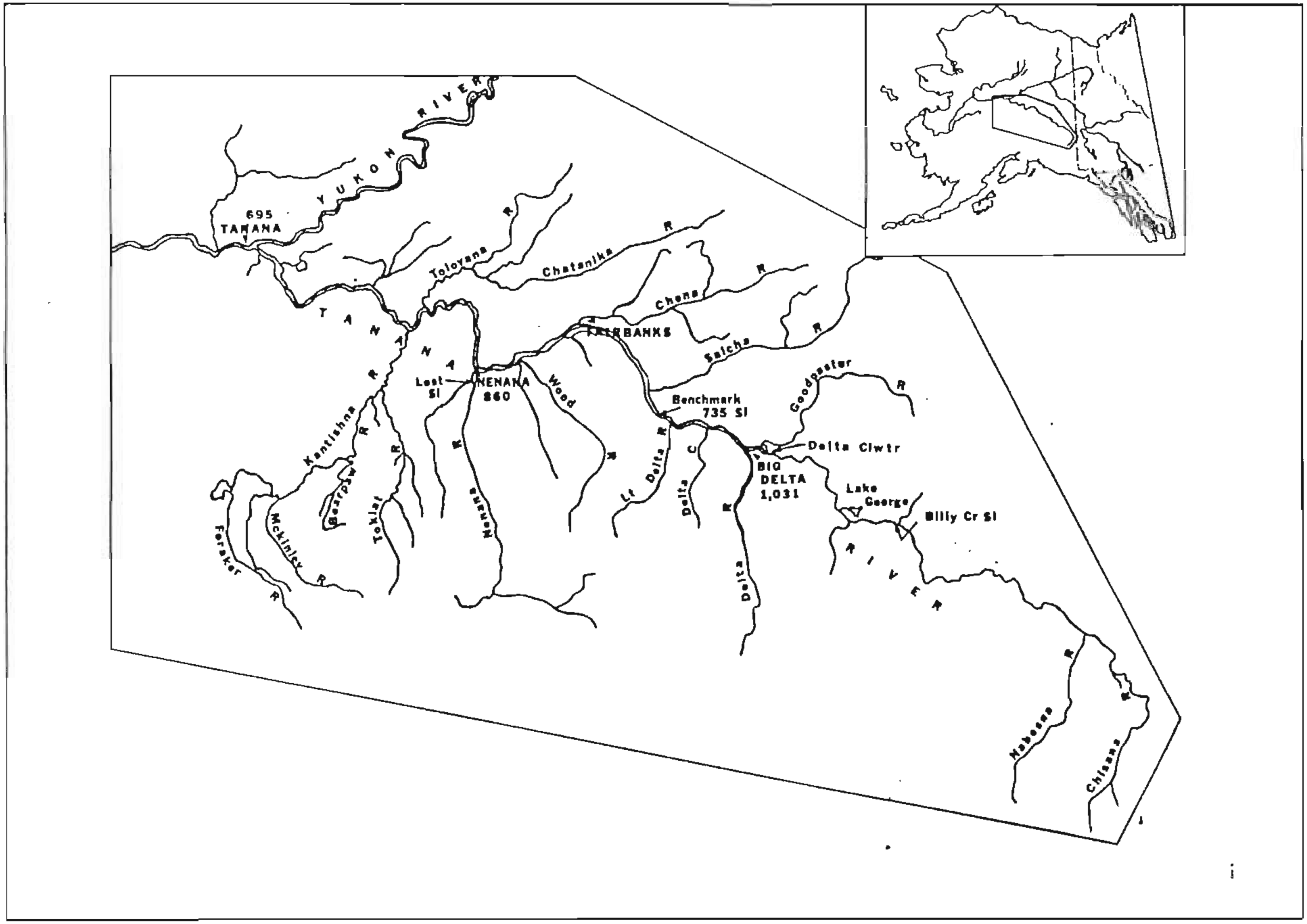

Figure ? The Tanana River drainage.

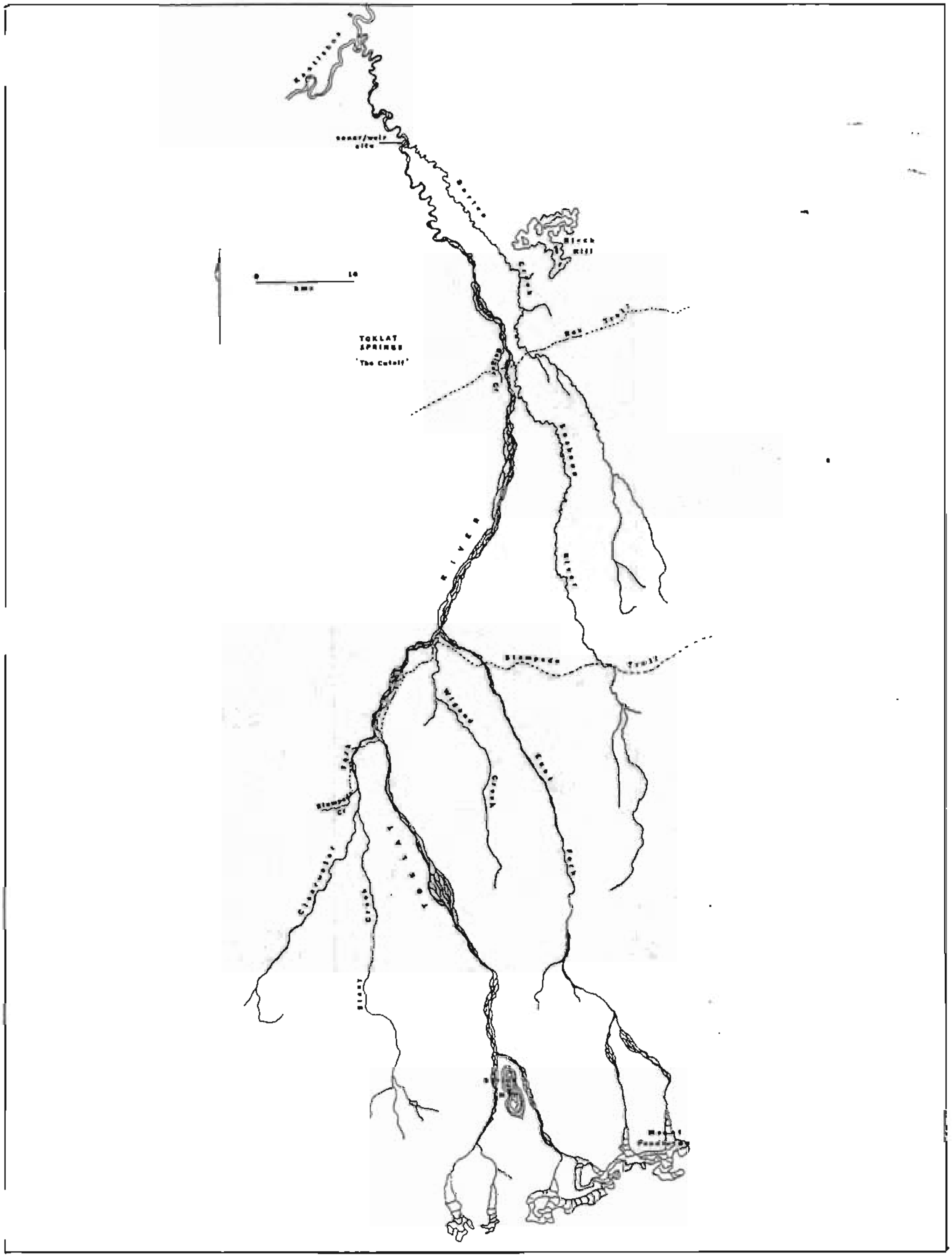

Figure 3. The Toklat River drainage.

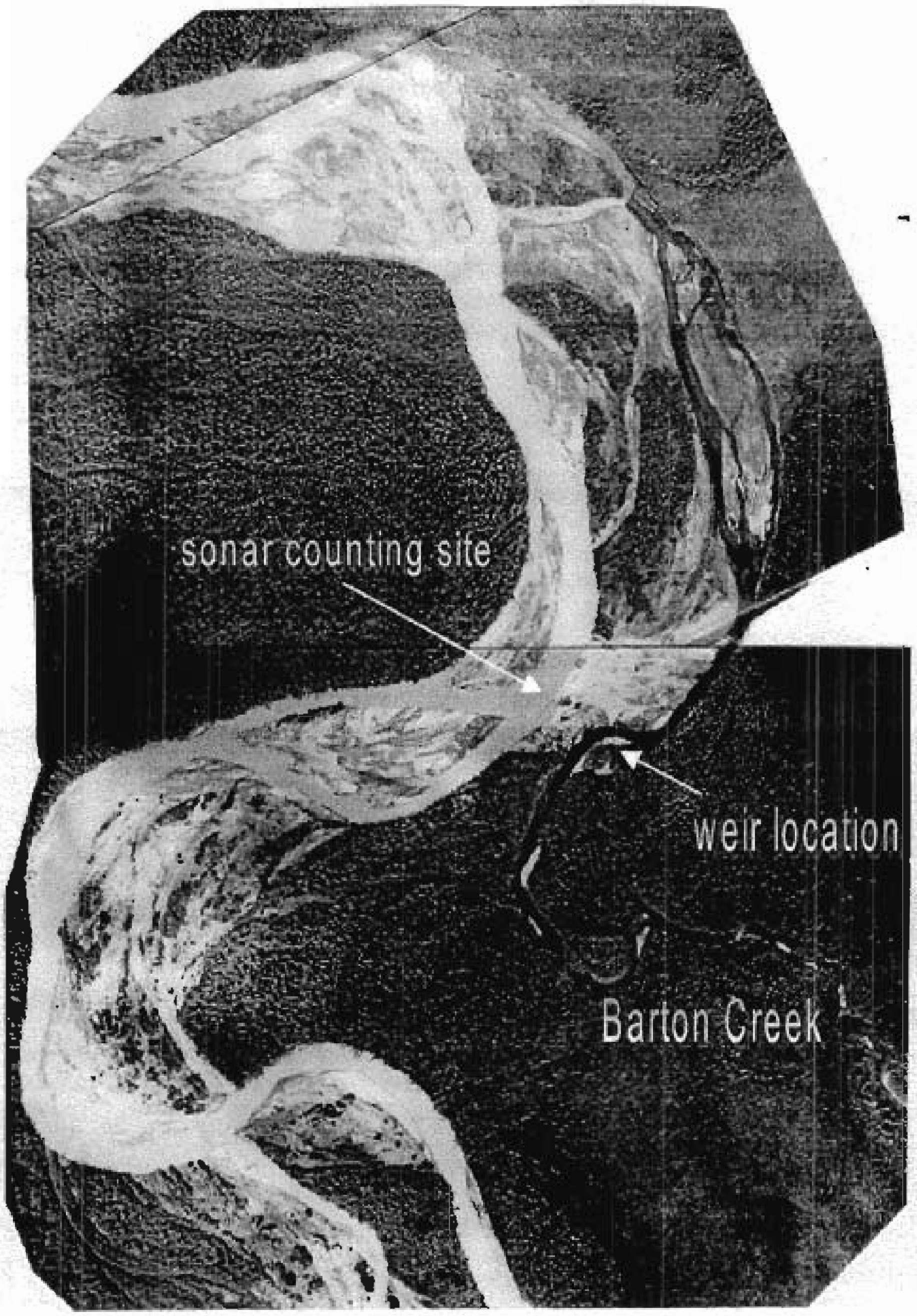

Figure 4. The Toklat River and Barton Creek terminus (photo by L. Barton, June 1992).

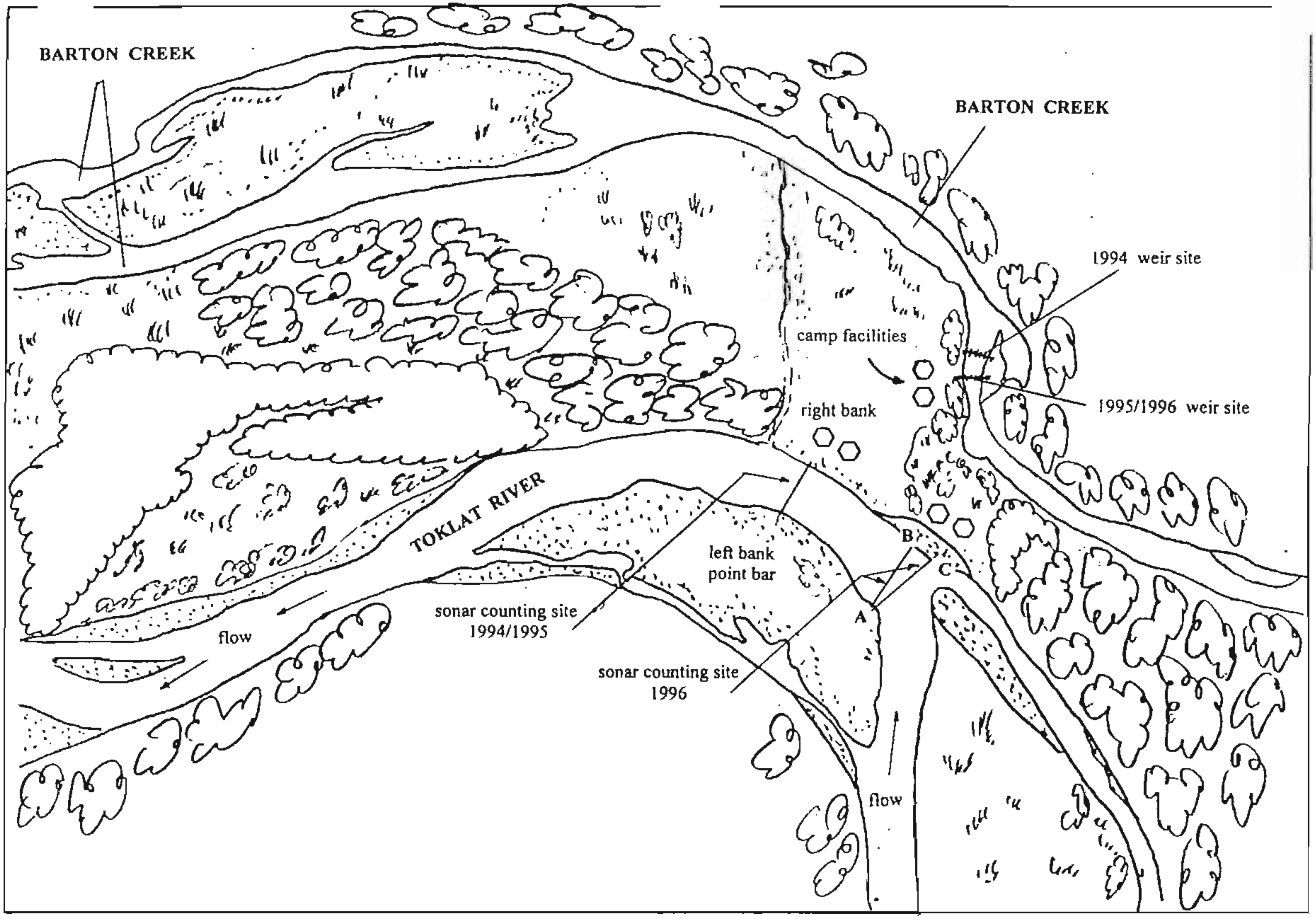

Figure 5. Map of the Toklat River project site.

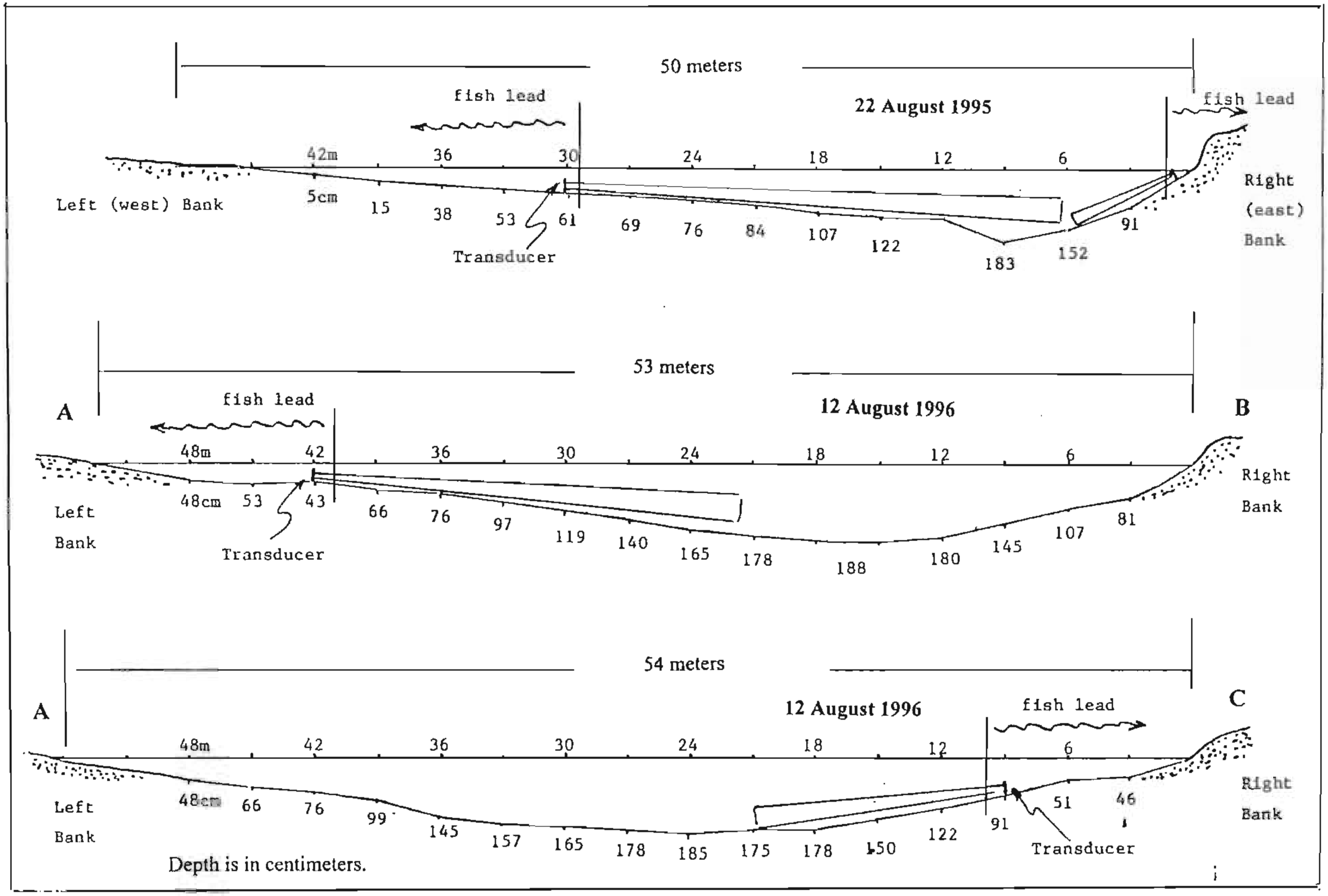

Figure 6. Toklat River bottom profiles at sonar counting locations in 1995 (top) and 1996 (middle and bottom).

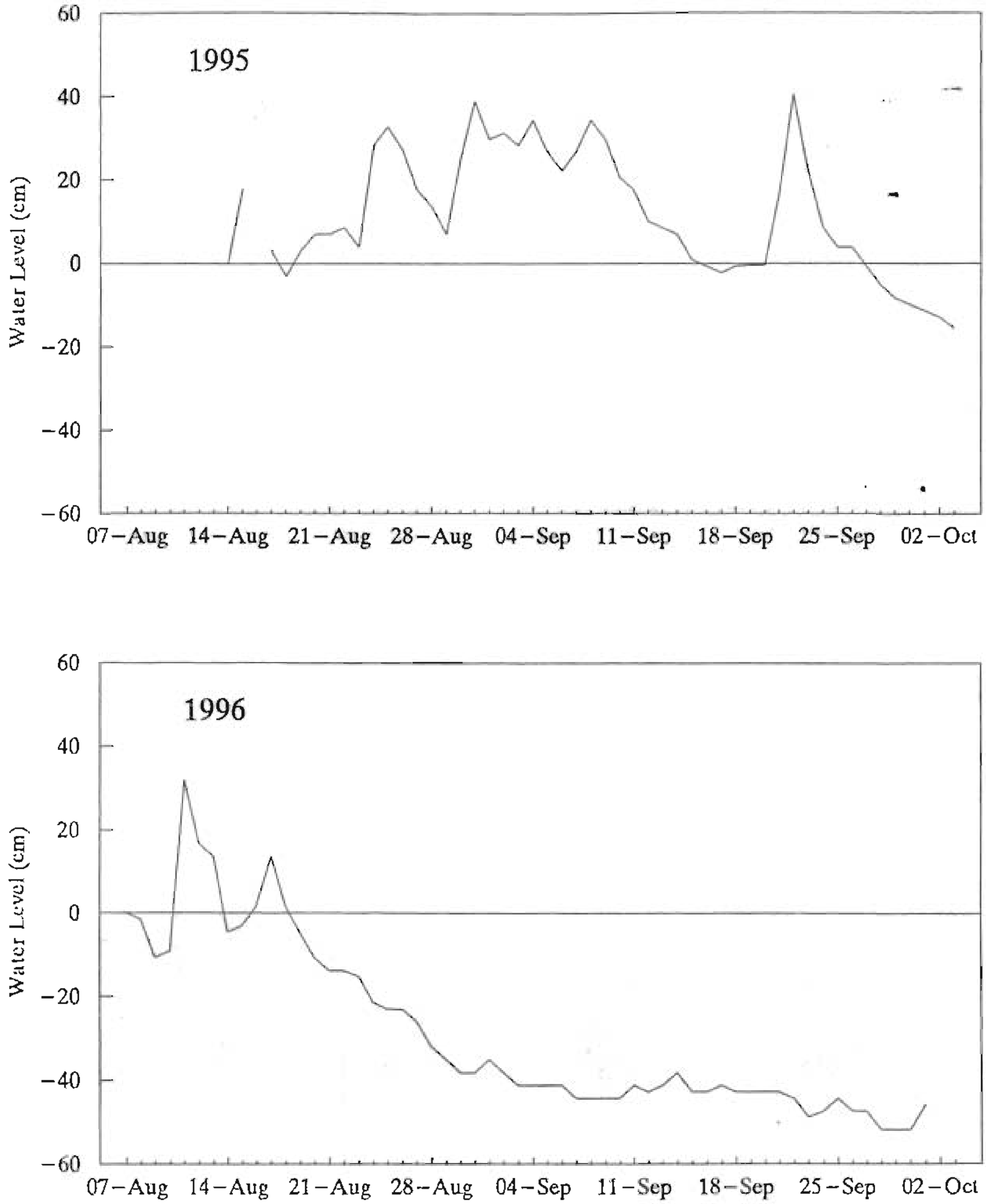

Figure 7. Daily water levels observed in the main channel Toklat River at the sonar project site in 1995 and 1996.

File-R\T\96\Climate.wk3

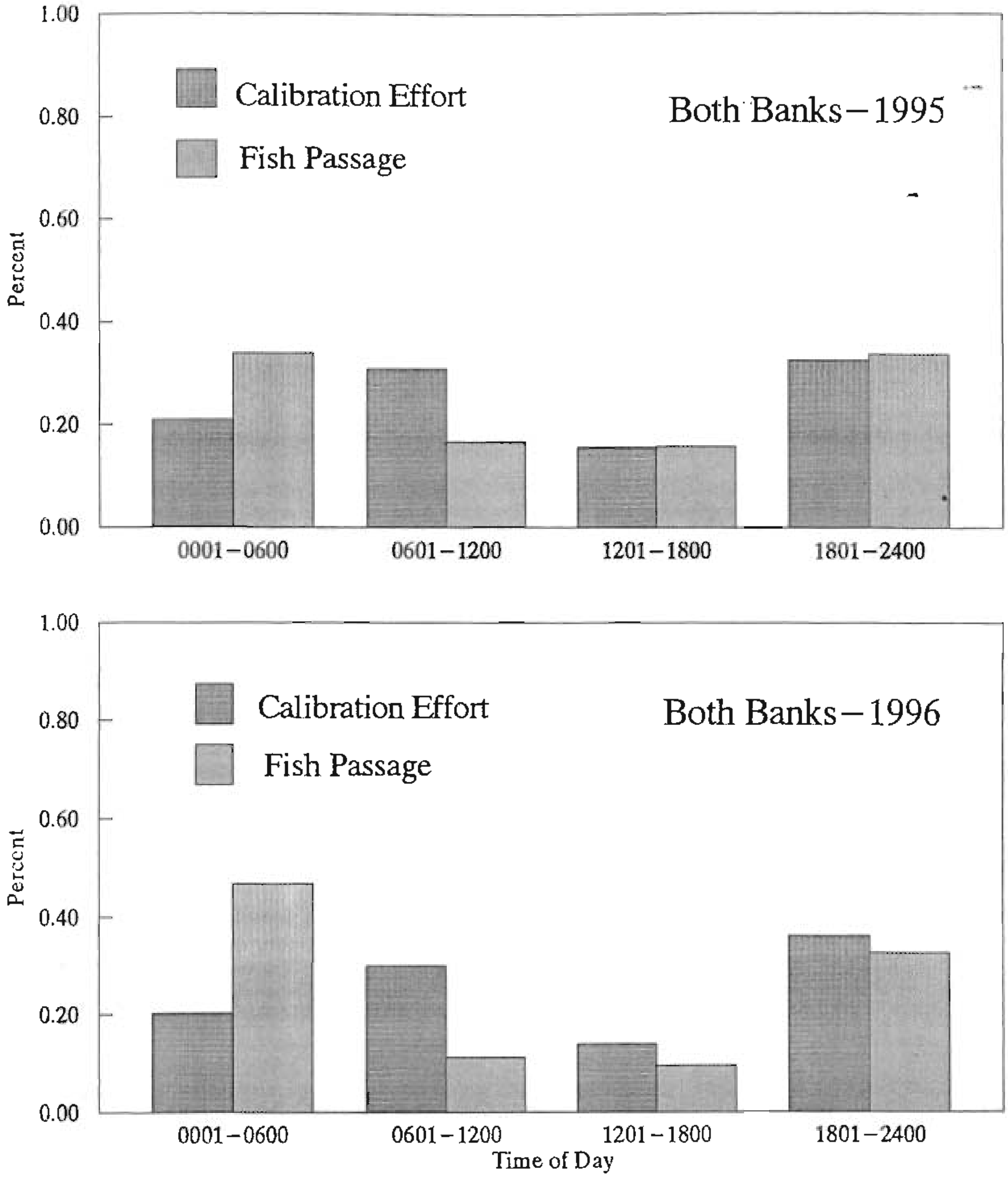

Figure 8. Average daily percent calibration effort versus average daily percent fish passage in 1995 (top) and 1996 (bottom) at the Toklat River sonar site.

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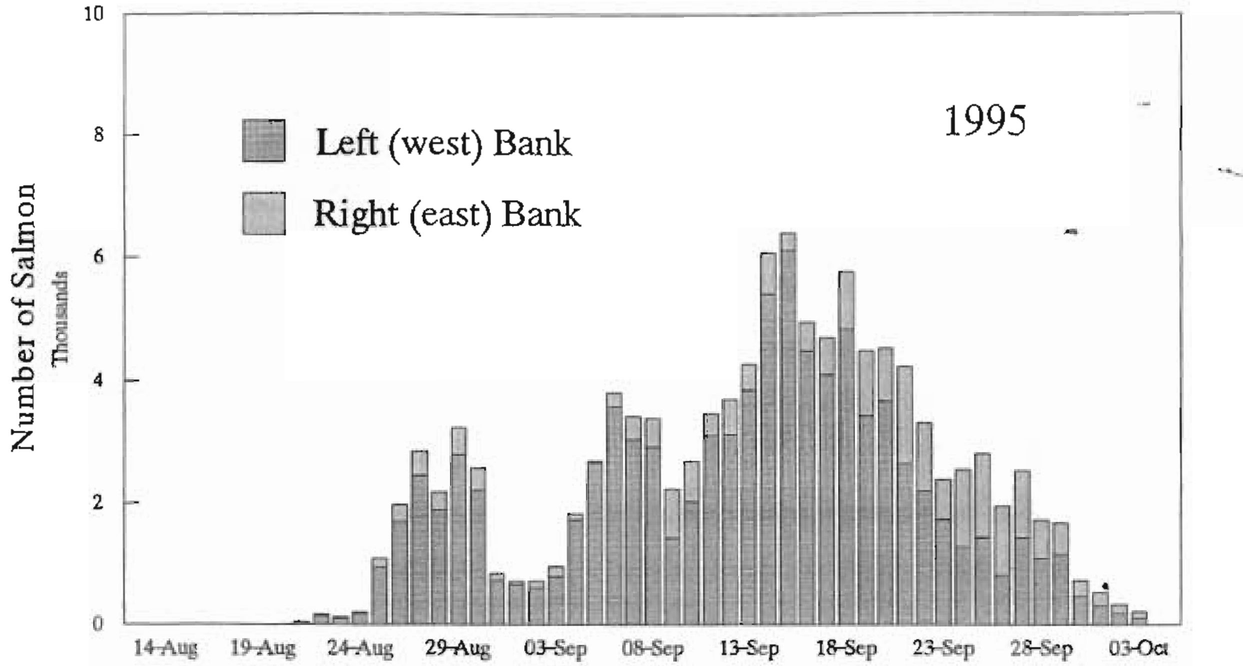

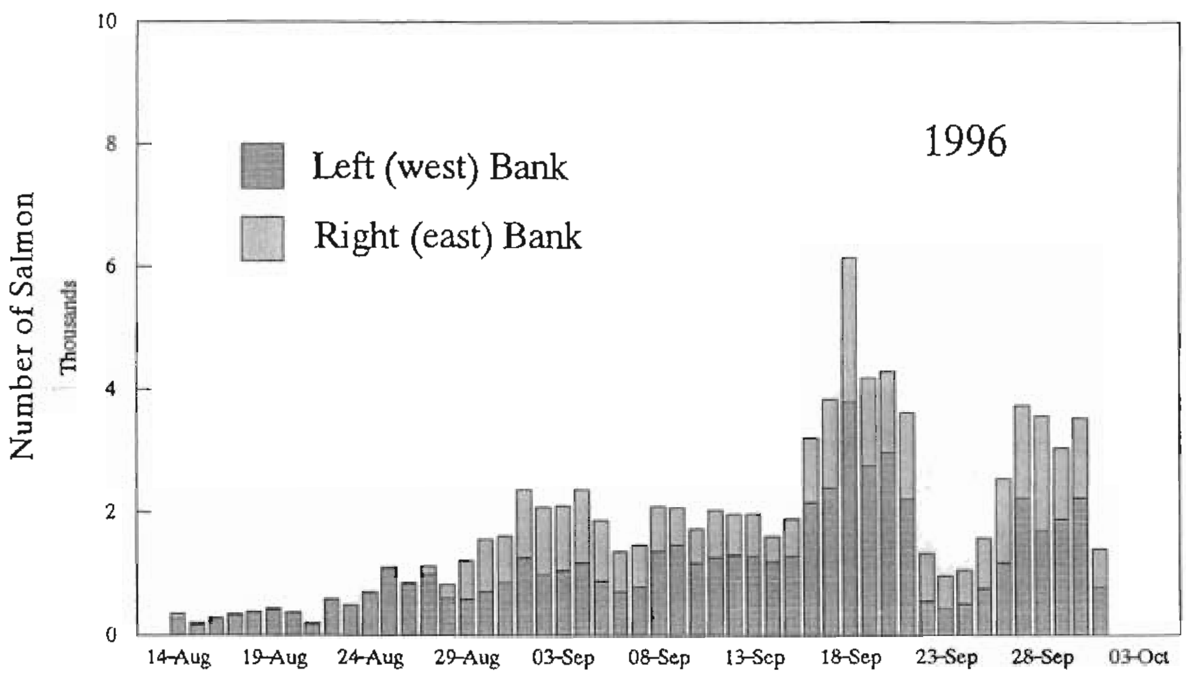

Figure 9. Daily sonar fish passage estimates (by bank) in the Toklat River, 1995 and 1996.

File−R\T\95-96\Timing.wk3

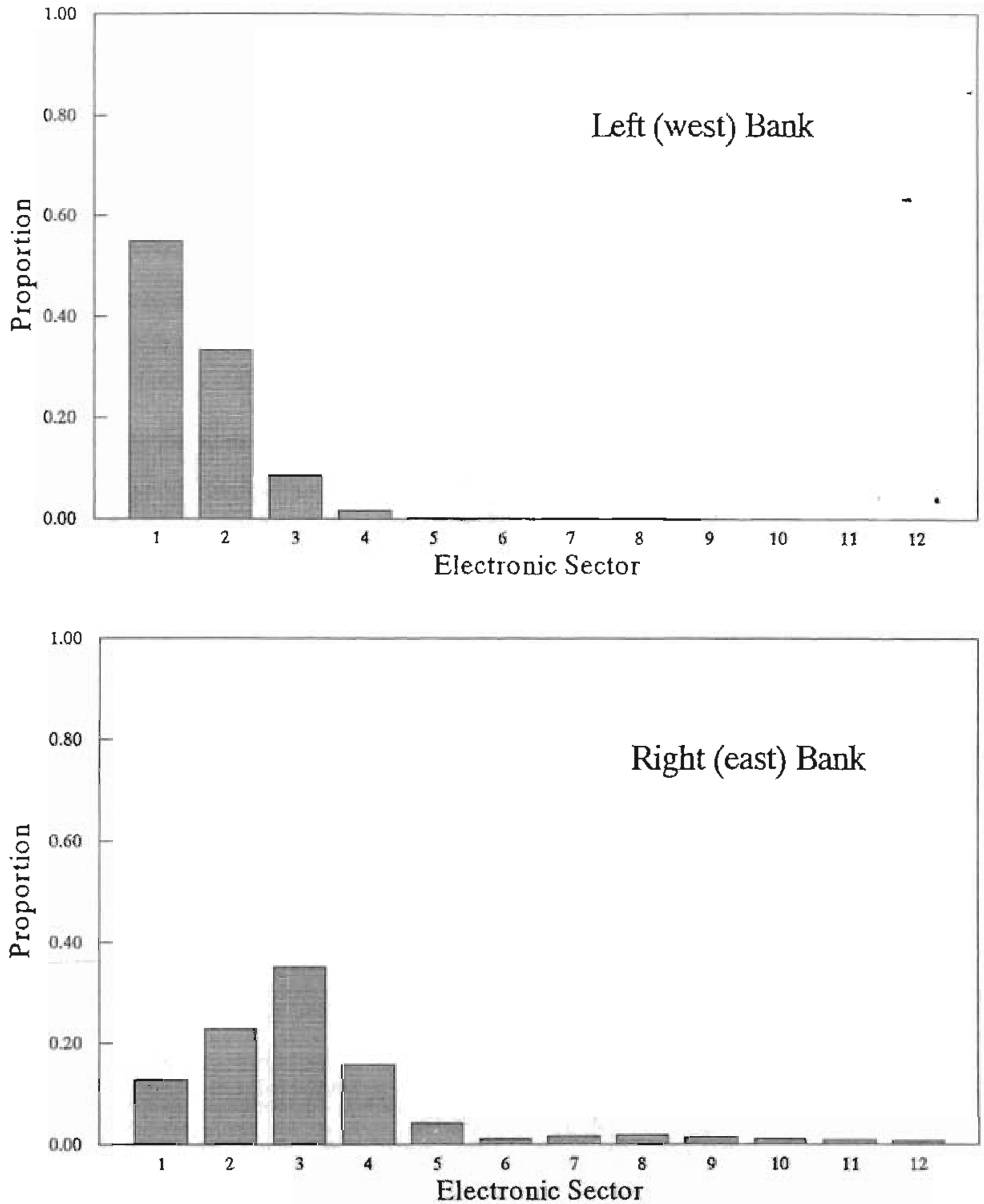

Figure 10. Estimated average proportion of fish passing the Toklat River sonar project site by electronic sector, 1995.

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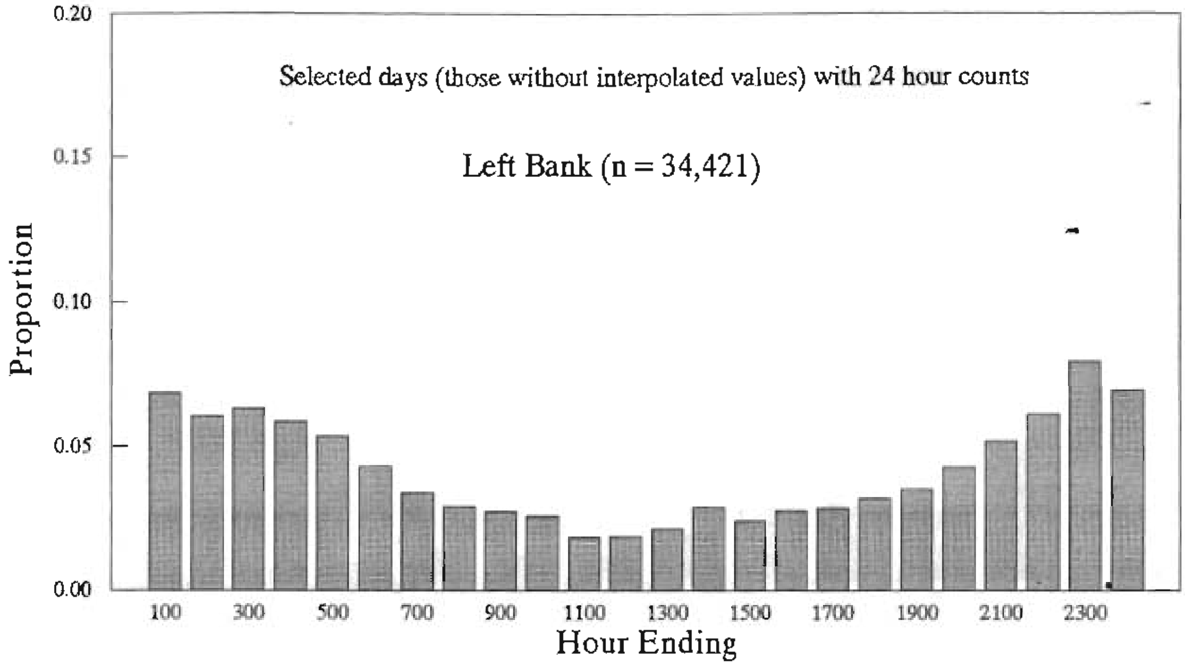


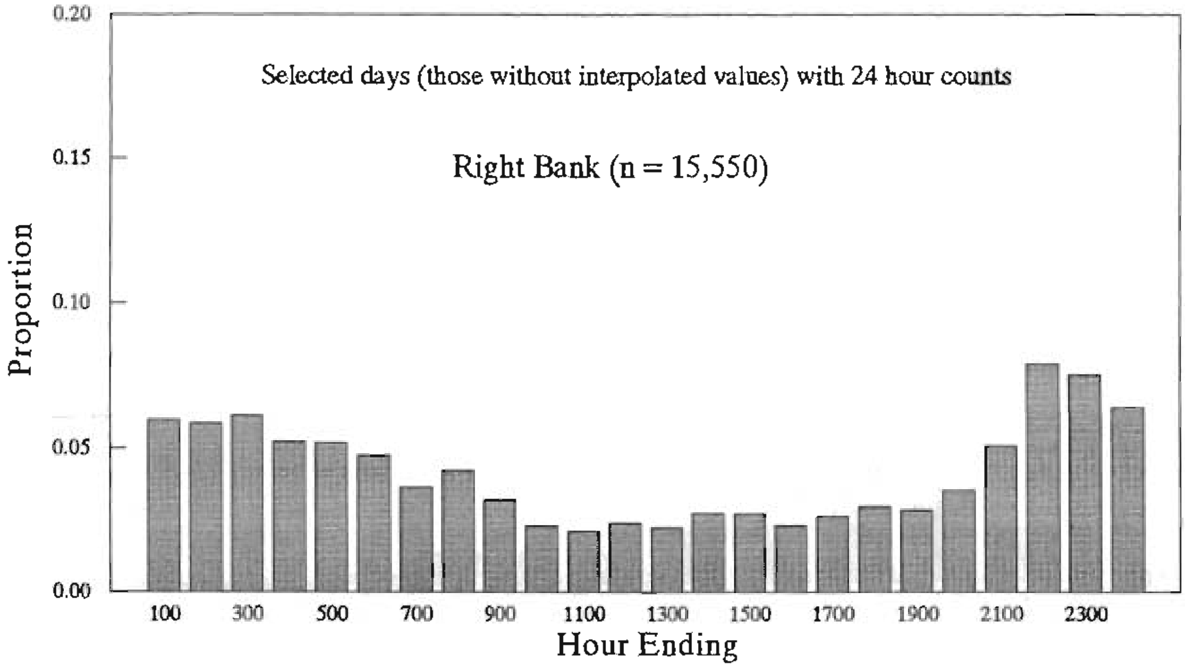
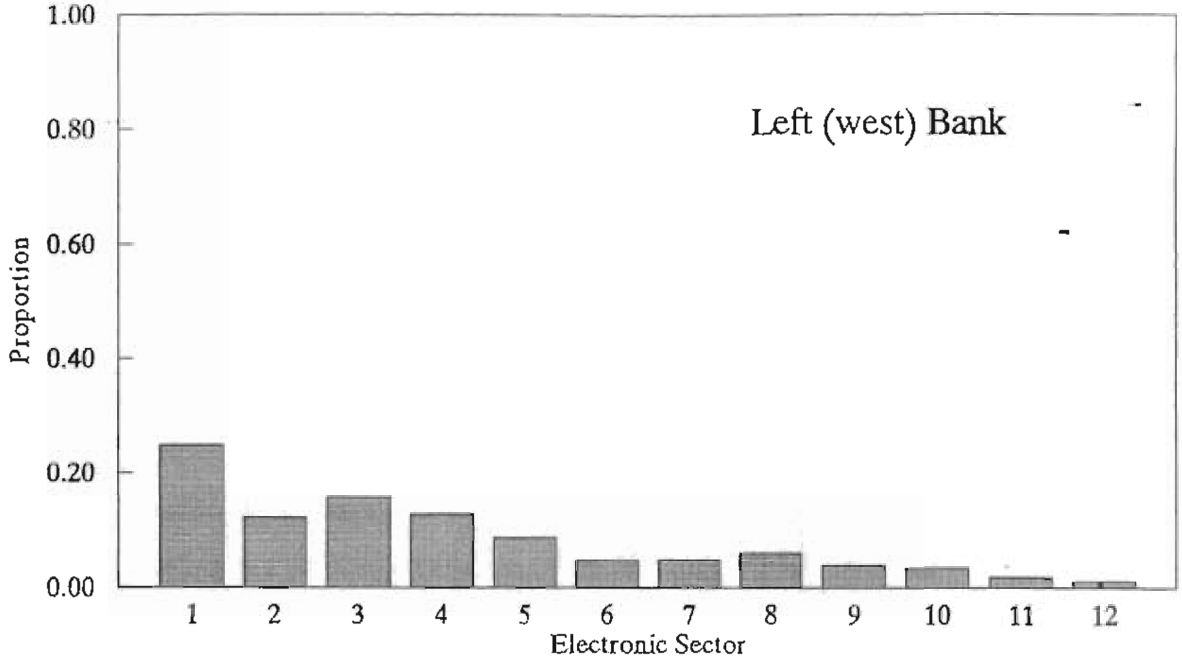


Figure 11. Average temporal migration pattern of fish passing the Toklat River sonar project site (by bank), 1995.

File – R\T\95\Temporal.wk3



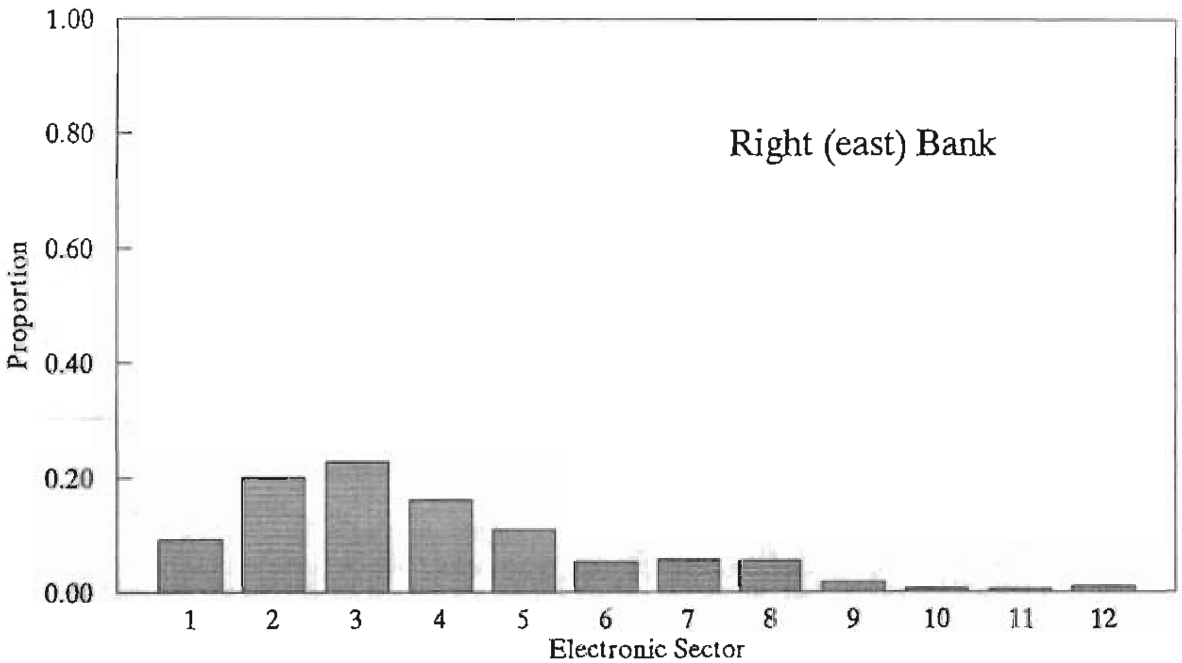


Figure 12. Estimated average proportion of fish passing the Toklat River sonar project site by electronic sector, 1996.

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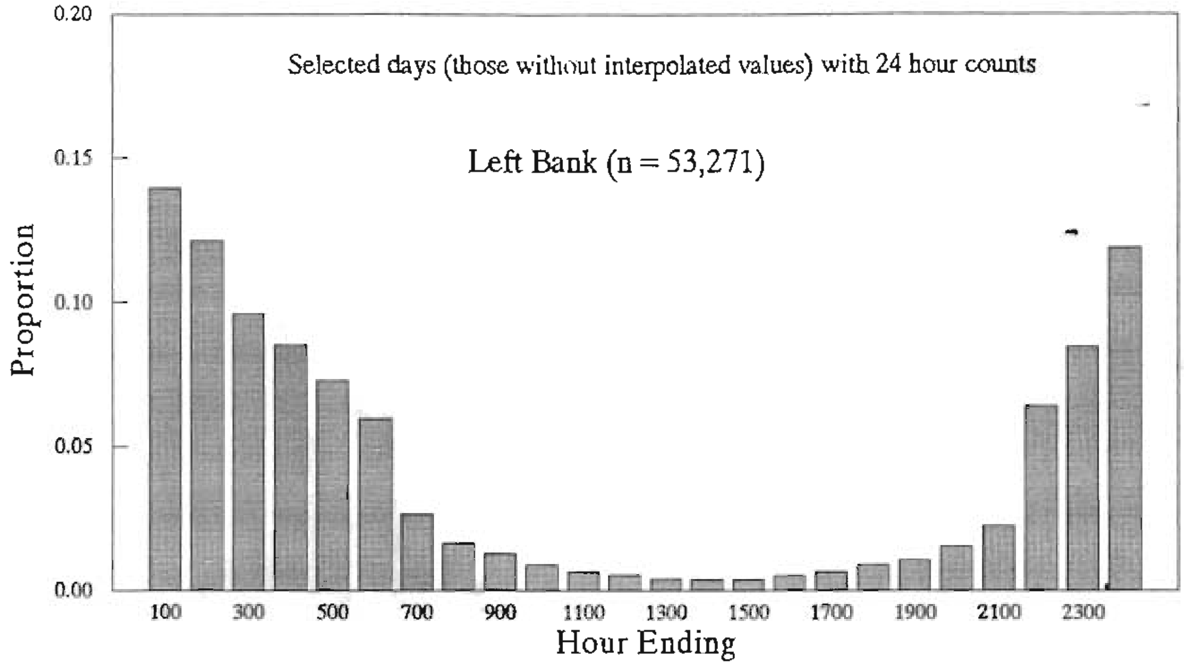


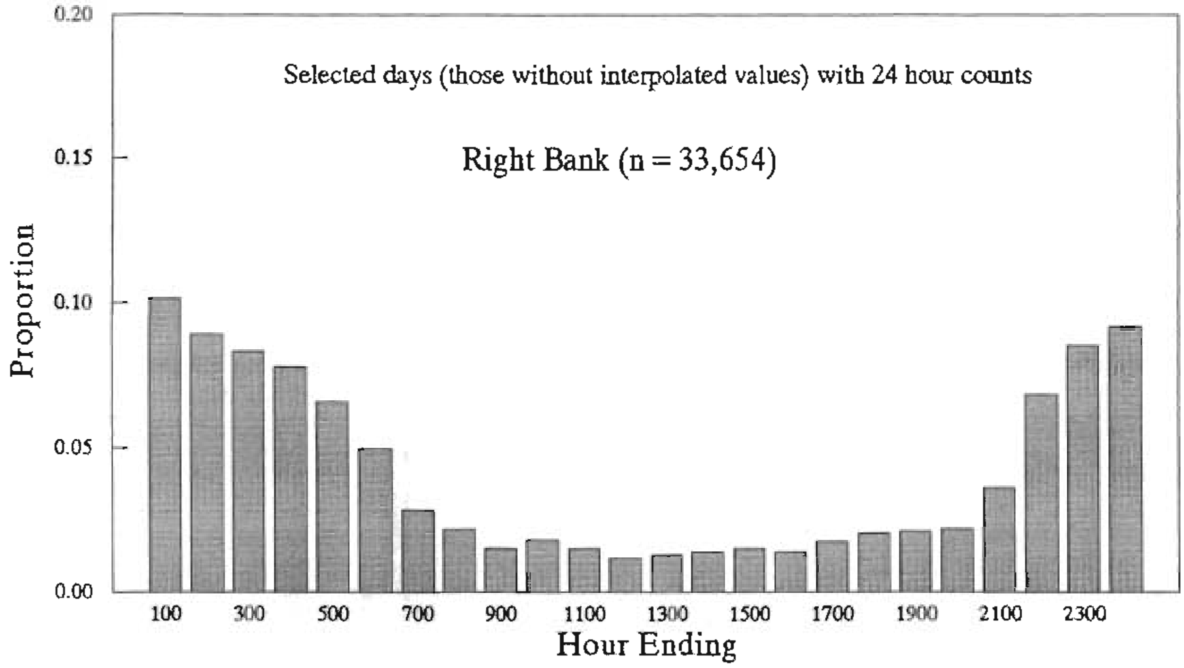
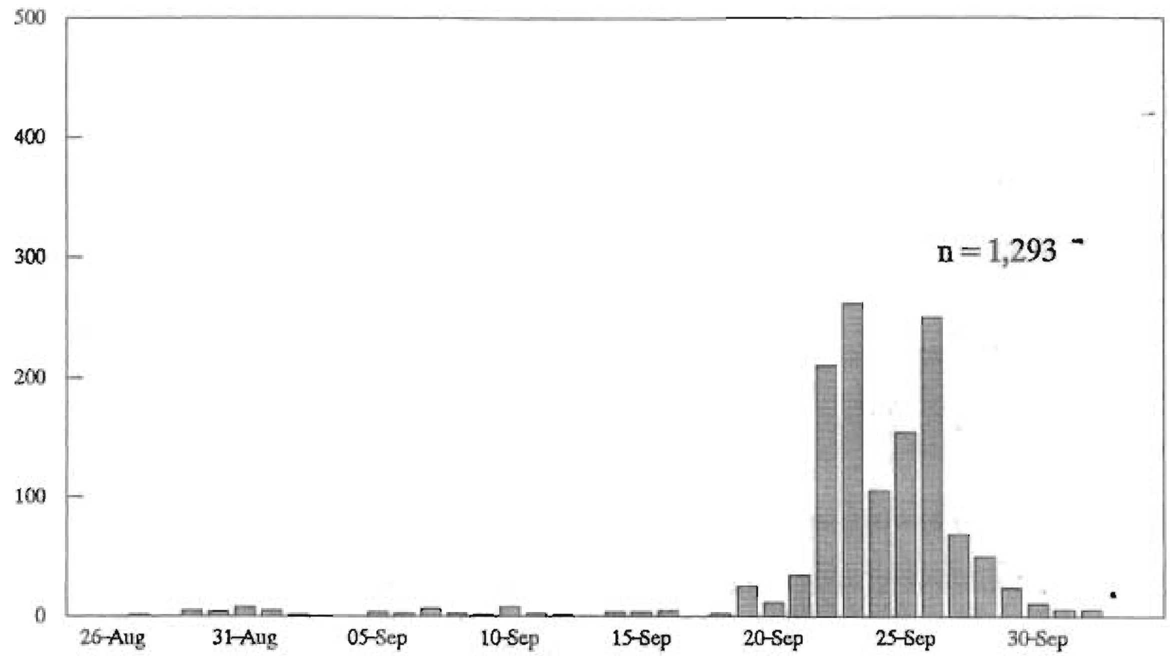


Figure 13. Average temporal migration pattern of fish passing the Toklat River sonar project site (by bank), 1996.

File–R\T\96\Temporal.wk3



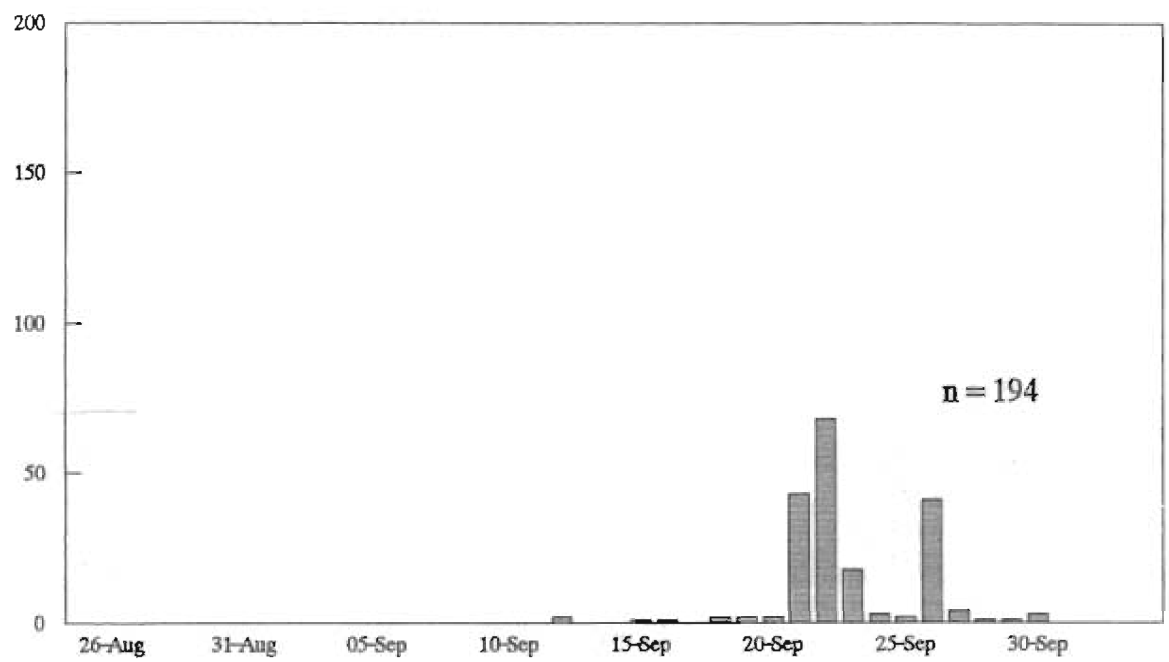


Figure 14. Daily passage of chum (top) and coho (bottom) salmon through Barton Creek weir, 1995.

File--R\T\95\ Weirsum.wk3

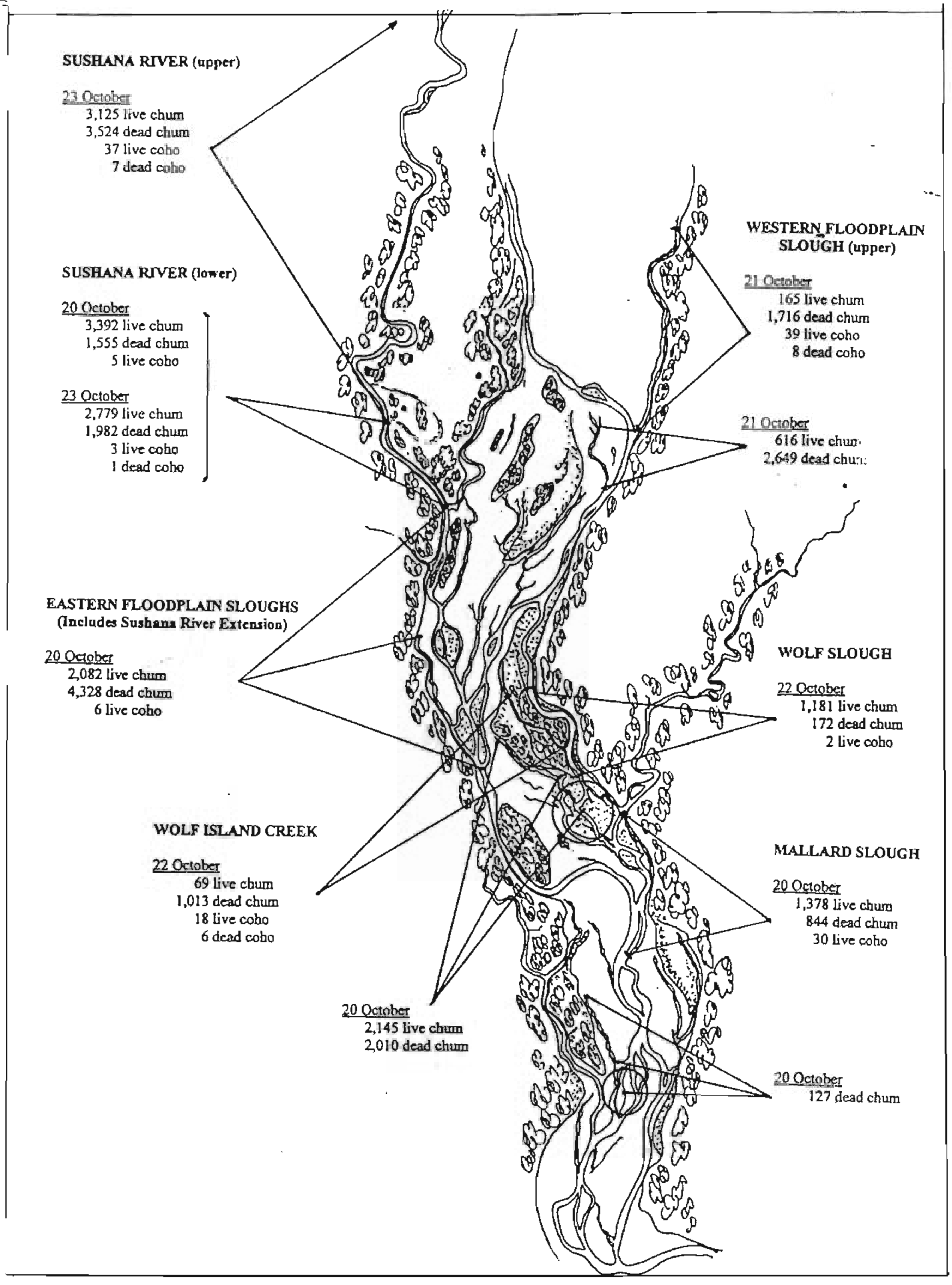


Figure 15. Salmon counts made during ground surveys of Sushana River and selected floodplain sloughs of Toklat Springs, October 1995.

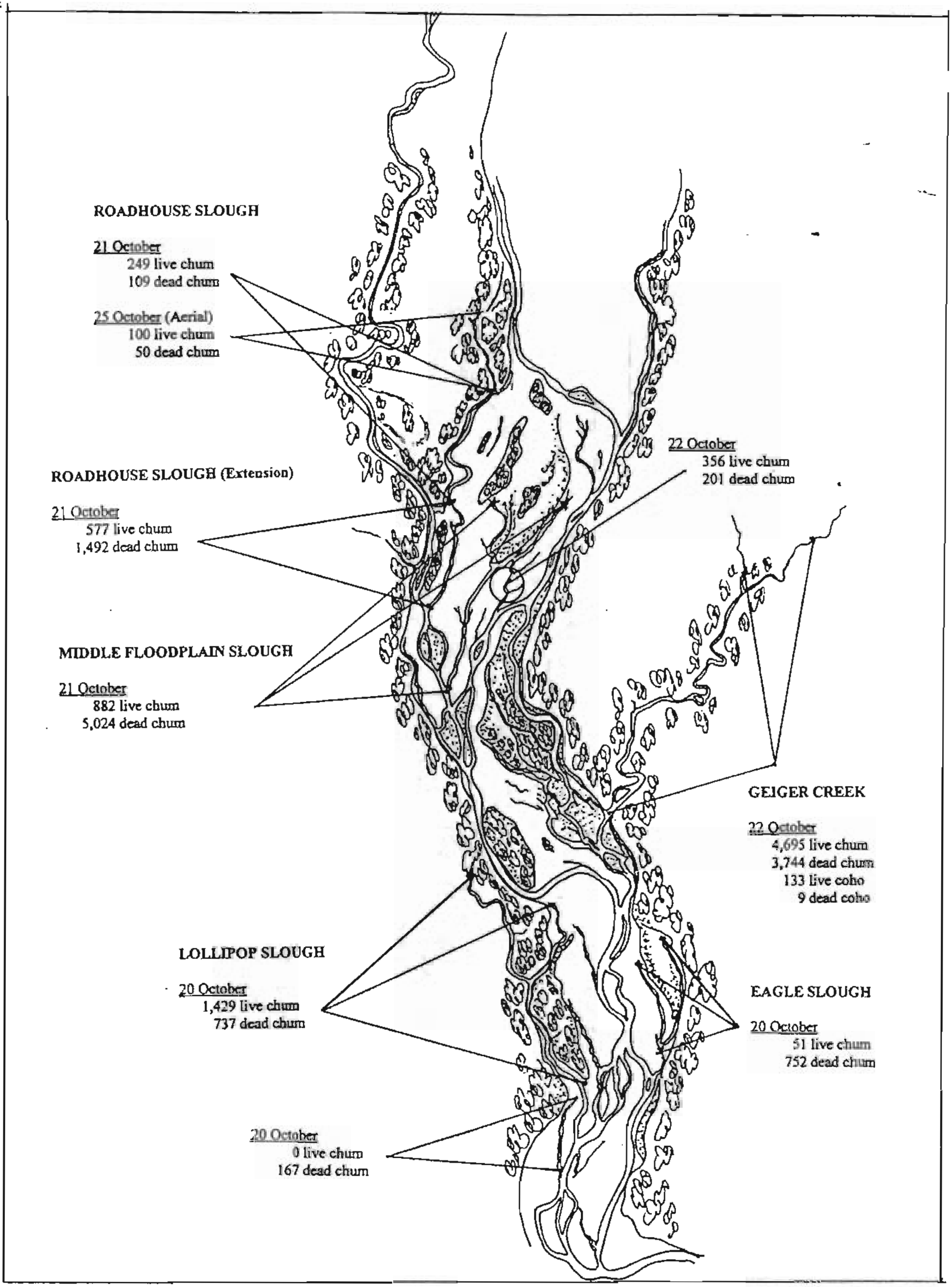


Figure 16. Salmon counts made during ground surveys of Geiger Creek and selected floodplain sloughs of Toklat Springs, October 1995.

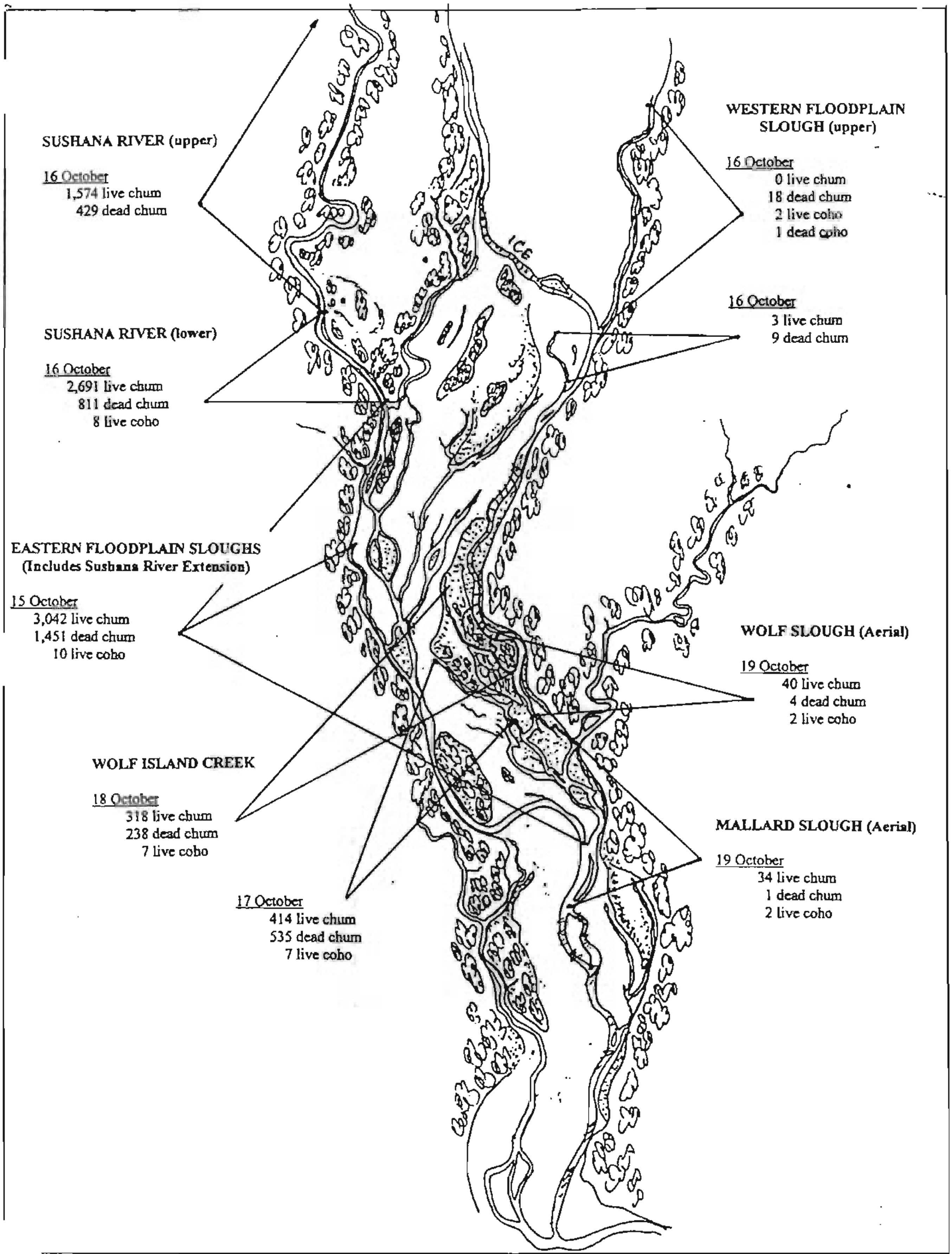


Figure 17. Salmon counts made during ground surveys of Sushana River and selected floodplain sloughs of Toklat Springs, October 1996.

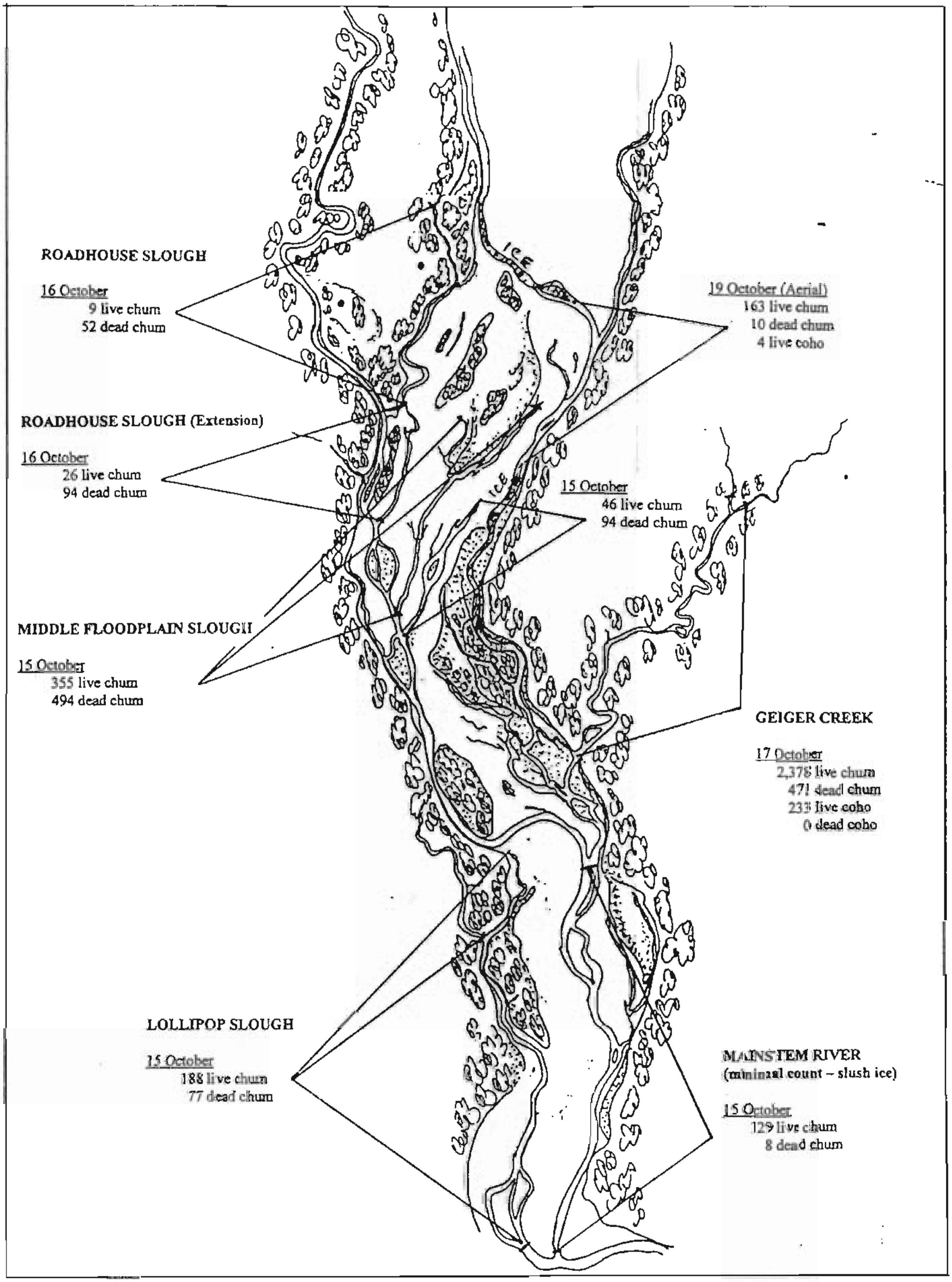


Figure 18. Salmon counts made during ground surveys of Geiger Creek and selected floodplain sloughs of Toklat Springs, October 1996.

APPENDIX A

TOKLAT RIVER CLIMATOLOGICAL AND HYDROLOGIC OBSERVATIONS

APPENDIX A: TOKLAT RIVER CLIMATOLOGICAL AND HYDROLOGIC OBSERVATIONS

Appendix A.1 Climatological and hydrologic observations and miscellaneous comments made at the Toklat River sonar project site, 1995.

Date	Time	Precipitation (code) [a]	Cloud Cover (code) [b]	Wind (Direction and Velocity)	Temperature (°C) Air	Temperature (°C) Water Surface	Water Gauge Relative (cm)	Water Gauge Actual (cm)	Water Color (code) [c]	Remarks
14-Aug	1130	C	O	SSW 5	Not Available		0.0	zero datum	D	Initial attempt to deploy left-bank sonar counter; place water gauge in Toklat River.
15-Aug	1245	B	O	SSW 6					D	
	1800	B	O	SSW 5-10					D	
	2130	B	O	SSW 5-10			18	18	D	
16-Aug	No readings								D	No climatological data recorded
17-Aug	2100	A	S	Calm	12.2	10.0	-15.0	3.0	D	Saw sun for first time in a week.
18-Aug	1200	A	B	SSW 5-10	13.3	8.9			D	
	2100	A	S	SSW 15	12.2	10.0	-6.0	-3.0	D	
19-Aug	1200	B	O	SSW 10	11.1	9.4			D	
	2100	B	O	SSW 10	11.1	10.3	6.0	3.0	D	
20-Aug	1200	A	S	SSW 5-10	15.6	10.0			D	Very few fish passing; hooked up bear lights; cut and dragged large tree from river upstream of sonar site.
	2100	A	B	SSW 5-10	15.6	12.8	4.0	7.0	D	
21-Aug	2100	A	S	Calm	12.2	12.8	0.0	7.0	D	Menin, Skvorc, Huttenun on site to trouble-shoot sonar system; left-bank counter finally in place
22-Aug	1200	A	O	N 5	14.4	10.0	New gauge sunk		D	Made detailed river profile at counting site; new water gauge set in river.
	2100	B	O	Calm	12.2	11.1	1.5	8.5	D	
23-Aug	1200	A	O	SSW 5	12.8	10.0			D	Worked on getting Barton Creek weir in place; not complete.
	2100	B	O	Calm	11.1	8.9	-4.6	3.9	D	
24-Aug	1200	A	B	SSW 5-10	13.9	10.6			D	Hard rain started at 1440 hours; had to remove left-bank counter at 1750 hours due to high water
	2100	B	S	SSW 0-5	12.2	12.8	24.4	28.3	D	
25-Aug	1145	A	S	SSW 0-5	14.4	10.0			D	Water is dropping at 2120 hours.
	2115	B	S	Calm	12.2	12.2	4.6	32.9	D	
26-Aug	1200	A	S	S 0-5	16.7	10.0			D	Saw two chums surface along left bank point bar.
	2115	A	S	SSW 5	11.1	12.2	-5.5	27.4	D	Completed Barton Creek weir.
27-Aug	1150	A	O	Calm	12.2	8.9			D	Left-bank counter back in operation at 1430 hours; lots of fish passing.
	2055	A	O	Calm	13.3	11.1	-9.8	17.6	D	Felt fish hitting the left-bank fish lead during a 2145 hour cleaning.
28-Aug	1200	A	C	SSW 5-10	8.9	9.4			D	Socked in with fog this morning.
	2100	A	B	Calm	14.4	12.2	-4.0	13.6	D	
29-Aug	1200	A	O	SSW 15	12.8	11.1			D	High winds today.
	2120	A	B	SW 15	14.4	11.7	-6.7	6.9	D	
30-Aug	1200	C	O	SSW 10	Not Available				D	The thermometer broke last night; water rising.
	2130	A	B	SW 15			18.3	25.2	D	
31-Aug	1150	A	S	SW 5-10					D	Fish felt along left bank lead; sonar pulled at 1430 hours due to high water; backwater slough too high to weir off.
	2100	A	O	Calm			13.7	38.9	D	
01-Sep	1200	B	O	SW 5-10					D	Deploy sound from right bank without a fish lead.
	2100	B	B	SW 5			-9.1	29.8	D	
02-Sep	1145	A	B	SW 5-10					D	Left-bank counter back in.
	2100	B	O	SW 5-10			1.5	31.3	D	
03-Sep	1324	A	S	SW 10-15			-3.0	28.3	D	Had to power down both sonar units this evening due to rising water; water still too high in backwater slough to weir off; have not seen any fish in that slough thus far this season.
	2100	A	B	NE 5-10					D	
04-Sep	1300	A	O	NE 5					D	Sound back in on right bank at 1400 hours.
	2100	B	O	NE 10			6.1	34.4	D	
05-Sep	1200	A	B	NE 15					D	Sound back in on left bank at 1430 hours.
	2100	A	B	NE 15-20			-7.6	26.8	D	
06-Sep	1200	A	B	NE 10-15					D	
	2100	B	B	NE 15-20			-4.6	22.2	D	
07-Sep	1200	B	B	SW 5					D	
	2100	B	B	Calm			4.6	26.8	D	
08-Sep	1200	A	O	SW 5-10					D	
	2100	A	O	NE 5-10			7.6	34.4	D	
09-Sep	1200	A	S	NE 15					D	Passage picked up on right bank but dropped on left bank.
	2100	A	S	NE 5			-4.6	29.8	D	
10-Sep	1200	B	B	SW 5					D	
	2100	A	S	Calm			-9.1	20.7	D	

-continued-

Appendix A.1 (page 2 of 2)

Date	Time	Precipitation (code) [a]	Cloud Cover (code) [b]	Wind (Direction and Velocity)	Temperature (°C) Air	Temperature (°C) Water Surface	Water Gauge Relative (cm)	Water Gauge Actual (cm)	Water Color (code) [c]	Remarks
11-Sep	1200	B	O	SW 5					D	Fish milling problems on left bank.
	2100	B	O	SW 5			-3.0	17.7	D	
12-Sep	1200	A	S	Calm	Not Available				D	Fish milling problems on left bank.
	2100	A	B	SW 5			-7.6	10.1	D	
13-Sep	1200	A	S	N 5					D	Fish milling problems on left bank.
	2100	A	O	Calm	6.9	6.9	-1.5	8.6	D	
14-Sep	1200	A	S	NE 3	12.2	6.1			D	Fish milling problems on left bank.
	2100	A	C	Calm	4.4	7.2	-1.5	7.1	D	
15-Sep	1330	A	C	NE 15	13.3	5.6			D	Found whitefish carcass above left-bank fish lead.
	2100	A	C	NE 15-20	12.2	7.2	-6.1	1.0	D	
16-Sep	1200	A	S	NE 15-20	13.9	5.6			D	
	2100	A	S	NE 15	14.4	7.8	-1.5	-0.5	D	
17-Sep	1130	A	S	NE 10-15	17.8	6.7			D	
	2100	A	S	Calm	7.8	6.7	-1.5	-2.0	D	
18-Sep	1200	A	S	SE 5-10	20.6	8.3			D	Subthreshold spikes appearing along left bank on o'scope.
	2100	A	B	SE 5-10	15.0	10.0	1.5	-0.5	D	Many chums behind left-bank fish lead at 2100 hours.
19-Sep	1200	A	O	E 20-30	21.1	10.0			D	Lots of subthreshold spikes present on o'scope - both banks.
	2100	A	O	E 20-30	20.6	10.6	0.3	-0.2	D	
20-Sep	1200	A	S	E 20-30	21.1	10.0			D	
	2100	A	S	E 10-20	17.8	11.1	0.0	-0.2	D	
21-Sep	1135	A	B	Calm	17.8	8.9			D	Could not calibrate at 0300 hours - silt storm; transducer cable problem with left-bank counter;
	2100	A	B	Calm	12.8	10.0	16.5	18.3	D	problem eventually corrected; power down both counters due to high water and debris.
22-Sep	1200	A	S	Calm	12.2	7.2			D	Heavy debris load in river.
	2100	A	O	Calm	10.6	8.3	24.4	40.7	D	
23-Sep	1200	A	B	Calm	8.3	6.1			D	Reinstall right-bank counter at 1230 hours.
	2100	A	S	Calm	8.9	6.7	-18.3	22.4	D	
24-Sep	1200	A	O	Calm	10.0	5.6			D	Reinstall left-bank counter at1015 hours.
	2100	B	O	Calm	7.2	6.1	-13.7	8.7	D	
25-Sep	1130	B	O	SSW 5-10	8.9	6.1			D	Lots of fish on left side of river; holding/milling problems on left side.
	2100	A	B	SW 5-10	7.8	7.2	-4.6	4.1	D	
26-Sep	1200	A	S	Calm	8.3	4.4			D	Many subthreshold spikes present on left bank as well as holding/milling problems.
	2100	A	C	Calm	2.8	5.0	0.0	4.1	D	
27-Sep	1200	A	C	NE 5-10	8.9	3.9			D	Holding and milling continues to be a problem on the left bank.
	2100	A	S	NE 5-10	4.4	4.4	-4.6	-0.5	D	
28-Sep	1200	B	O	NE 10	1.1	2.8			D	
	2100	B	O	NE 5	1.1	3.3	-4.6	-5.1	D	
29-Sep	1200	A	O	NE 5	1.1	1.1			D	
	2100	A	O	NE 5	1.1	2.8	-3.0	-8.1	D	
30-Sep	1200	A	S	NE 5	0.0	0.0			C	
	2100	A	S	NE 5	1.7	1.7	-1.5	-9.6	C	
01-Oct	1200	A	C	Calm	3.3	1.1			C	
	2030	A	C	Calm	2.2	1.7	-1.5	-11.1	C	
02-Oct	1200	A	O	Calm	4.4	1.1			C	
	2100	A	O	Calm	2.2	2.2	-1.5	-12.6	C	
03-Oct	1200	A	O	Calm	4.0	1.0			C	
	2100	A	O	Calm	2.0	2.0	-2.7	-15.3	C	

All climatological and hydrological observations refer to the Toklat River unless otherwise specific in remarks section.

[a] Precipitation code for the preceding 24-hour period: A = None; B = Intermittent rain: C = Continuous rain; D = Snow and rain mixed; E = Light snowfall; F = Continuous snowfall; G = Thunderstorm w/ or w/o precipitation.
[b] Instantaneous cloud cover code: C = Clear and visibility unlimited (CAVU);S = Scattered (<60%); B = Broken (60-90%); O = Overcast (100%); F = Fog or thick haze or smoke.
[c] Instantaneous water color code: A = Clear; B = Slightly murky or glacial; C = Moderately murky or glacial; D = Heavily murky or glacial; E = Brown, tanic acid stain.

Appendix A.2 Climatological and hydrologic observations and miscellaneous comments made at the Toklat River sonar project site, 1996.

Date	Time	Precipitation [a]	Cloud Cover (code) [b]	Wind (Direction and Velocity)	Temperature (°C) Air	Temperature (°C) Water Surface	Water Gauge Relative (cm)	Water Gauge Actual (cm)	Water Color (code) [c]	Remarks
07–Aug	2030	A	S	Calm	21	13	0.0	zero datum	D	Installed water gauge in Toklat River.
08–Aug	2130	B	O	SW 5–10	10	11	–1.5	–1.5	D	
09–Aug	2050	B–C	O	S 5	10	10	–9.1	–10.6	D	
10–Aug	2215	B	O	N 5	12	10	1.5	–9.1	D	
11–Aug	1845	B	B	N 5–10	19	12	41.1	32.0	D	
12–Aug	1800	A	S	Calm	21	12	–15.2	16.8	D	
13–Aug	1645	A	S	SSW 5–15	19	13	–3.0	13.7	D	Installed right–bank counter at 1330 hours.
14–Aug	1750	A	B	Var 5–20	18	14	–18.3	–4.5	D	Installed left–bank counter at 1700 hours.
15–Aug	1835	A–B	O	Calm	16	12	1.5	–3.0	D	Very few fish passing along either bank.
16–Aug	1750	B	B–O	SSW 5–10	20	13	4.6	1.5	D	Powered down left–bank counter due to heavy debris load and rising water.
17–Aug	1630	A	B	W 5–10	16	13	12.2	13.7	D	Very few fish passing along right bank.
18–Aug	1930	A	C–S	Var 5–10	18	13	–12.2	1.5	D	Barton Creek weir was completed at 1400 hours.
19–Aug	1845	A	C	NNE 10–15	18	12	–6.1	–4.5	D	Deploy left–bank sonar at 1400 hours; few fish passing on either bank.
20–Aug	1815	A	C	NE 5–10	18	12	–6.1	–10.6	D	Hardly any fish passage along right bank
21–Aug	1730	A	O	NNE 10–15	8	8	–3.0	–13.7	D	Hardly any fish passage along right bank
22–Aug	1800	B–C	O	NE 10–20	6	7	0.0	–13.7	D	Hardly any fish passage along right bank
23–Aug	1845	B	C	N 5–10	16	9	–1.5	–15.2	D	
24–Aug	1720	A	C–S	SW 15–25	18	11	–6.1	–21.3	D	Starting to see subthreshold spikes on left bank; too fast for upstream fish
25–Aug	1800	B	O	SW 0–5	12	11	–1.5	–22.8	D	
26–Aug	2130	B	C	NW 5–10	9	9	0.0	–22.8	D	
27–Aug	1735	A	C	NE 5–10	14		–3.0	–25.9	D	Broke thermometer
28–Aug	1750	A	C	NE 5–10	13–16		–6.1	–32.0	C	Air temperatures from 28 August to 8 September are estimates
29–Aug	1740	A	C	NE 5–10	13–16		–3.0	–35.0	C	
30–Aug	1804	A	S	S 5	13–16		–3.0	–38.1	C	
31–Aug	1830	A–B	S	W 5	10–13		0.0	–38.1	C	
01–Sep	1800	A–B	S	S 5	10–13		3.0	–35.0	C	Fish mostly passing in middle sectors along left bank.
02–Sep	1815	A	C	N 5–10	16–18		–3.0	–38.1	B–C	
03–Sep	1820	A	C	N 5–10	10–13		–3.0	–41.1	B	
04–Sep	1800	A	C	NE 15–20	13–16		0.0	0.0	B	Lots of subthreshold spikes on both banks (downstream targets?); noticed
05–Sep	1700	A	C	NE 15–20	13–16		0.0	0.0	B	as many subtheshold spikes as good targets (on left bank).
06–Sep	1800	A	C	NE 10–15	13–16		0.0	0.0	B	
07–Sep	1820	A	C	Calm	13–16		–3.0	–3.0	B	
08–Sep	1750	A	C	SW 5–10	13–16		0.0	–3.0	B	Fish holding problems on left bank near midnight.
09–Sep	1815	B	B	SW 5–10	10		0.0	–3.0	B	Subthreshold spikes at 0600 calibration – left bank
10–Sep	1800	B	O	SW 5	7		0.0	–3.0	B	
11–Sep	1800	B	O	NW 5	7		3.0	0.0	B	
12–Sep	1730	B	O	N 5	4–7		–1.5	–1.5	B	Fish splashing upstream of the left–bank fish lead.
13–Sep	1840	B–D	O	Calm	4		1.5	0.0	B	Heavy snowfall causing false counting.
14–Sep	1815	B–D	O	N 5–10	4		3.0	3.0	B	
15–Sep	1815	A	O	N 5	4		–4.6	–1.5	B	Pair of moose courting next to the sonar tent
16–Sep	1815	A	O	Calm	7		0.0	–1.5	B	
17–Sep	2000	A	S	NE 10–15	10		1.5	–0.0	B	Subthreshold spikes at 0300 calibration – left bank
18–Sep	1800	A	O	SE 10	7		–1.5	–1.5	B	
19–Sep	1730	B	O	SW 10–20	7		0.0	–1.5	B	
20–Sep	1930	A	S	SW 5–10	10		0.0	–1.5	A–B	Fish holding problems on left bank.
21–Sep	1900	E	S	SW 10–15	2		0.0	–1.5	A–B	Snowing today.
22–Sep	1700	A	O	S 5	2		–1.5	–3.0	A–B	Two whitefish above right–bank xducer; many whitefish above Barton Cr wel
23–Sep	1700	A	C	NE 10–15	4		–4.6	–7.6	A–B	New water gauge installed
24–Sep	1700	A	O	NE 10–15	2		1.5	–6.1	A–B	
25–Sep	1730	D	O	S 10–15	4		3.0	–3.0	B	Snowing today.
26–Sep	1700	E	B	SW 10–15	2		–3.0	–6.1	B	Holding problems on both banks.
27–Sep	1710	A	S	Var 5–10	4		0.0	–6.1	B	Holding and milling on left bank.
28–Sep	1800	E	B	SW 5–10	4		–4.6	–10.7	A	Subthreshold spikes are making calibrations difficult on both banks.
29–Sep	1745	E	B	S 10–15	2		0.0	–10.7	A	Conjecture the fast, subthreshold spikes are fish passing downstream.
30–Sep	1830	D	O	SW 10–15	2		0.0	–10.7	A	
01–Oct	1800	E	O	NE 10–15	2		6.1	–4.6	A	Power down both sonar units at 1200 hours.

[a] Precipitation code for the preceding 24–hour period: A = None; B = Intermittent rain; C = Continuous rain; D = Snow and rain mixed; E = Light snowfall; F = Continuous snowfall; G = Thunderstorm w/ or w/o precipitation.

[b] Instantaneous cloud cover code: C = Clear and visibility unlimited (CAVU); S = Scattered (<60%); B = Broken (60–90%); O = Overcast (100%); F = Fog or thick haze or smoke.

[c] Instantaneous water color code: A = Clear; B = Slightly murky or glacial; C = Moderately murky or glacial; D = Heavily murky or glacial; E = Brown, tanic acid stain.

APPENDIX B

TOKLAT RIVER SONAR COUNT ADJUSTMENTS

APPENDIX B: TOKLAT RIVER SONAR COUNT ADJUSTMENTS

Appendix B.1. Adjustments made to Toklat River sonar counts, 1995.

Left-Bank Adjustments (1995):

Partial-day counts (21, 24, 27, 31 August; and 3, 6, 21 September) were each expanded to daily totals by extrapolation based upon the season average temporal pattern in left-bank hourly passage. The average temporal pattern was estimated from those days when the left-bank sonar counter operated 24 hours per day. For example, on 21 August the sonar count was 15 for the period of operation 1800 through 2400 hours. On the average, counts during this period of a day represented 33.9% of the left-bank daily total. Thus, the total count for 21 August was estimated as 15 ÷ 0.339, or 44 fish.

Daily passage estimates for days when sonar did not operate due to high water (25, 26 August; and 1, 4, 5, 22, 23 September), were interpolated based upon the most recent daily passage estimate prior and subsequent to the high water event. For example, the estimated adjusted total count for 1 September (662 fish) was taken as the average of the counts on 31 August (722 fish) and 2 September (603 fish).

Further adjustments were made to left-bank sonar counts for two time periods: 11-16 September and 24-28 September. Not only did the diel migration pattern noticeably deteriorate during these time strata, but also numerous non-quantifiable, sub-threshold spikes were observed on the oscilloscope screen that were judged as downstream moving salmon.

16 September adjustment: The sonar count on 16 September from 0100 through 1200 hours totaled 3,658 and was considered inflated due to multiple counting of upstream-bound salmon, i.e., fish falling back downstream and likely moving back upstream. Subsequent to relocation of the transducer to deeper and swifter water, counts totaled 2,242 for the period 1300 through 2400 hours. On the average, counts for this period of a day represented 50% of the daily total. Thus, the 16 September count of 2,242 was expanded to a total of 4,484 for the day (2,242 ÷ 0.50). This indicated a 63.2% positive bias in counts for the period 0100 though 1200 hours.

11-15 September adjustment: Daily sonar counts during this period were adjusted downward for a 63.2% positive bias, based upon observations made on 16 September. For example, the daily *adjusted* count for 11 September was 3,095 fish (5,052 ÷1.632).

28 September adjustment: The sonar count on 28 September from 0100 through 0800 hours totaled 2,488 and was considered inflated due to multiple counting of upstream-bound salmon, i.e., fish falling back downstream and likely moving back upstream. Subsequent to relocation of the transducer to deeper and swifter water, counts totaled 564 for the period 1200 through 2400 hours. Based upon an average daily passage of 51.9% for the hours of 1200 to 2400, the 28 September count was expanded to 1,086 for the day (564 ÷ 0.519). This revealed a 376.6% positive bias in counts for the period 0100 through 0800 hours.

24-27 September adjustment: Daily sonar counts during this period were adjusted downward for a 376.6% positive bias, based upon observations made on 28 September. For example, the daily *adjusted* count for 27 September was 1,420 fish (6,765 ÷4.766).

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Right Bank Adjustments (1995):

Partial-day counts (1, 3, 5, 21, 23 September) were each expanded to daily totals by extrapolation based upon the season average temporal pattern in hourly passage. The average temporal pattern was estimated from those days when the right-bank sonar counter operated 24 hours per day. For example, on 1 September the sonar count was 14 for the period of operation 2100 through 2400 hours. On the average, counts during this period of a day represented 27.0% of the right-bank daily total. Thus, the total count for 1 September was estimated as 14 ÷ 0.270, or 51 fish.

Daily passage estimates for days when sonar did not operate due to high water (4, 22, September), were interpolated based upon the most recent daily passage estimate prior and subsequent to the high water event. For example, the estimated total count for 4 September (99 fish) was taken as the average of the counts on 3 September (162 fish) and 5 September (35 fish).

Additional adjustments to right-bank passage were made for the period 21 through 31 August when only the left-bank counter was in operation. Right-bank, daily passage estimates during this period were based upon the average daily proportion right-bank counts comprised (16 %) of the combined daily total when both sonar counters operated 24 hours per day over the next two-week period (7-20 September).

Appendix B.2. Adjustments made to Toklat River sonar counts, 1996.

Left-Bank Adjustments (1996):

Partial-day counts (14, 16, 19, August; and 1 October) were each expanded to daily totals by extrapolation based upon the season average temporal pattern in left-bank hourly passage. The average temporal pattern was estimated from those days when the left-bank sonar counter operated 24 hours per day. For example, on 14 August the sonar count was 88 for the period of operation 1800 through 2400 hours. On the average, counts during this period of a day represented 32.5% of the left-bank daily total. Thus, the total count for 14 August was estimated as 88 ÷ 0.325, or 271 fish.

Daily passage estimates for days when sonar did not operate due to high water, were interpolated based upon the most recent daily passage estimate prior and subsequent to the high water event. The estimated total count for 17 August (318 fish) and 18 August (372 fish) were interpolated from the counts on 16 August (264 fish) and 19 August (428 fish).

Right Bank Adjustments (1996):

Partial-day counts (14 August and 1 October) were each expanded to daily totals by extrapolation based upon the season average temporal pattern in right-bank hourly passage. The average temporal pattern was estimated from those days when the right-bank sonar counter operated 24 hours per day. For example, on 14 August the sonar count was 22 for the period of operation 2100 through 2400 hours. On the average, counts during this period of a day represented 28.3% of the right-bank daily total. Thus, the total count for 14 August was estimated as 22 ÷ 0.283, or 77 fish.

APPENDIX C

TOKLAT RIVER SONAR CALIBRATION DATA

APPENDIX C: TOKLAT RIVER SONAR CALIBRATION DATA

Appendix C.1. Oscilloscope data used to calibrate the left–bank sonar counter at the Toklat River project site, 1995.

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
21–Aug		No Calibrations								
22–Aug		No Calibrations								
23–Aug	20	15	1	4	0.250	0.130	3.0	80.0	83.0	4
	601	15	1	2	0.500	0.130	3.0	80.0	83.0	4
	2101	15	2	5	0.400	0.130	3.0	80.0	83.0	8
	2308	15	2	3	0.667	0.130	3.0	80.0	83.0	8
24–Aug	5	15	5	4	1.250	0.300	3.0	80.0	83.0	20
	600	15	1	1	1.000	0.300	3.0	80.0	83.0	4
	1140	15	0	1	0.000	0.300	3.0	80.0	83.0	0
	1605	15	1	1	1.000	0.300	3.0	80.0	83.0	4
25–Aug		No Calibrations								
26–Aug		No Calibrations								
27–Aug	1600	30	53	85	0.620	0.300	3.0	80.0	83.0	106
	2100	30	90	115	0.783	0.300	3.0	80.0	83.0	180
	2300	30	94	118	0.797	0.300	3.0	80.0	83.0	188
28–Aug	5	30	74	70	1.057	0.402	3.0	80.0	83.0	148
	600	30	90	175	0.514	0.402	3.0	80.0	83.0	180
	1100	30	30	32	0.938	0.402	3.0	80.0	83.0	60
	1600	30	48	40	1.200	0.4	3.0	80.0	83.0	96
	2100	30	65	64	1.016	0.4	3.0	80.0	83.0	130
	2300	30	110	116	0.948	0.402	3.0	80.0	83.0	220
29–Aug	1	30	113	134	0.843	0.402	3.0	80.0	83.0	226
	300	30	129	172	0.750	0.402	3.0	80.0	83.0	258
	600	30	63	75	0.840	0.402	3.0	80.0	83.0	126
	1100	30	33	46	0.717	0.402	3.0	80.0	83.0	66
	1631	28	45	63	0.714	0.402	3.0	80.0	83.0	96
	2100	30	57	74	0.770	0.402	3.0	80.0	83.0	114
	2300	30	43	36	1.194	0.5	3.0	80.0	83.0	86
30–Aug	6	30	50	34	1.471	0.515	3.0	80.0	83.0	100
	300	30	80	68	1.176	0.515	3.0	80.0	83.0	160
	600	30	47	44	1.068	0.515	3.0	80.0	83.0	94
	1101	30	24	28	0.857	0.515	3.0	80.0	83.0	48
	1600	15	8	8	1.000	0.515	3.0	80.0	83.0	32
	2103	15	12	11	1.091	0.515	4.0	80.0	84.0	48
	2325	30	40	28	1.429	0.515	4.0	80.0	84.0	80
31–Aug	14	30	19	37	0.514	0.515	4.0	80.0	84.0	38
	300	30	20	20	1.000	0.515	4.0	80.0	84.0	40
	603	30	21	23	0.913	0.515	4.0	80.0	84.0	42
	1114	28	4	6	0.667	0.515	4.0	80.0	84.0	9
01–Sep		No Calibrations								
02–Sep	1102	15	3	2	1.500	0.400	4.0	80.0	84.0	12
	1622	15	4	4	1.000	0.400	4.0	80.0	84.0	16
	2102	15	8	6	1.333	0.400	5.0	80.0	85.0	32
	2310	15	6	7	0.857	0.400	5.0	80.0	85.0	24
03–Sep	1	15	5	6	0.833	0.400	5.0	80.0	85.0	20
	317	30	22	19	1.158	0.400	5.0	80.0	85.0	44
	600	45	24	24	1.000	0.400	5.0	80.0	85.0	32
	1103	20	7	7	1.000	0.400	5.0	80.0	85.0	21
	1600	20	8	6	1.333	0.400	5.0	80.0	85.0	24
04–Sep		No Calibrations								
05–Sep		No Calibrations								
06–Sep	1601	30	60	73	0.822	0.400	5.0	80.0	85.0	120
	2100	30	103	115	0.896	0.488	5.0	80.0	85.0	206
	2310	30	145	138	1.051	0.545	5.0	80.0	85.0	290
07–Sep	30	30	128	154	0.831	0.545	5.0	80.0	85.0	256
	327	30	143	167	0.856	0.655	5.0	80.0	85.0	286
	600	30	106	102	1.039	0.765	5.0	80.0	85.0	212
	1105	30	27	24	1.125	0.765	4.0	80.0	84.0	54
	1605	30	108	233	0.464	0.765	4.0	80.0	84.0	216

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	2100	30	71	53	1.340	0.765	6.0	80.0	86.0	142
	2300	30	65	69	0.942	0.571	6.0	80.0	86.0	130
08-Sep	2	30	72	70	1.029	0.600	6.0	80.0	86.0	144
	300	30	73	66	1.106	0.600	6.0	80.0	86.0	146
	600	30	68	57	1.193	0.600	6.0	80.0	86.0	136
	1104	30	45	40	1.125	0.600	6.0	80.0	86.0	90
	1600	30	48	35	1.371	0.600	6.0	80.0	86.0	96
	2112	15	13	17	0.765	0.600	6.0	80.0	86.0	52
	2304	30	48	46	1.043	0.600	6.0	80.0	86.0	96
09-Sep	1	30	27	22	1.227	0.600	6.0	80.0	86.0	54
	300	30	31	28	1.107	0.600	6.0	80.0	86.0	62
	600	30	32	28	1.143	0.600	6.0	80.0	86.0	64
	1111	30	18	24	0.750	0.600	6.0	80.0	86.0	36
	1605	30	30	24	1.250	0.600	6.0	80.0	86.0	60
	2100	20	17	19	0.895	0.600	3.0	80.0	83.0	51
	2313	30	37	35	1.057	0.600	3.0	80.0	83.0	74
10-Sep	13	27	29	25	1.160	0.600	3.0	80.0	83.0	64
	305	30	50	65	0.769	0.600	3.0	80.0	83.0	100
	600	30	59	51	1.157	0.780	3.0	80.0	83.0	118
	1103	30	39	34	1.147	0.780	3.0	80.0	83.0	78
	1605	30	49	36	1.361	0.780	3.0	80.0	83.0	98
	2105	30	29	26	1.115	0.999	4.0	80.0	84.0	58
	2305	30	71	85	0.835	0.999	4.0	80.0	84.0	142
11-Sep	1	30	100	125	0.800	0.999	4.0	80.0	84.0	200
	300	30	131	153	0.856	0.999	4.0	80.0	84.0	262
	600	30	149	131	1.137	0.999	4.0	80.0	84.0	298
	1105	30	83	125	0.664	0.999	4.0	80.0	84.0	166
	1610	30	87	82	1.061	0.999	4.0	80.0	84.0	174
	2110	30	93	75	1.240	0.999	4.0	80.0	84.0	186
	2325	30	130	109	1.193	0.999	4.0	80.0	84.0	260
12-Sep	5	30	116	118	0.983	0.829	4.0	80.0	84.0	232
	300	30	132	170	0.776	0.829	4.0	80.0	84.0	264
	600	30	140	134	1.045	0.950	4.0	80.0	84.0	280
	1105	30	90	88	1.023	0.950	4.0	80.0	84.0	180
	1608	30	82	65	1.262	0.820	4.0	80.0	84.0	164
	2110	30	122	109	1.119	0.820	4.0	80.0	84.0	244
	2320	30	114	150	0.760	0.820	4.0	80.0	84.0	228
13-Sep	25	30	132	141	0.936	0.950	4.0	80.0	84.0	264
	325	30	148	174	0.851	0.950	4.0	80.0	84.0	296
	600	30	127	145	0.876	0.950	4.0	80.0	84.0	254
	1110	30	100	90	1.111	0.999	3.7	80.0	83.7	200
	1605	30	84	141	0.596	0.999	3.0	50.0	53.0	168
	2105	30	165	249	0.663	0.999	3.0	50.0	53.0	330
	2325	30	196	340	0.576	0.999	3.0	50.0	53.0	392
14-Sep	1	30	252	367	0.687	0.999	3.0	50.0	53.0	504
	320	30	258	357	0.723	0.999	3.0	50.0	53.0	516
	602	30	107	185	0.578	0.999	3.0	50.0	53.0	214
	1110	30	98	168	0.583	0.999	3.0	50.0	53.0	196
	1603	30	165	280	0.589	0.999	3.0	50.0	53.0	330
	2100	30	193	239	0.806	0.999	3.0	50.0	53.0	386
	2208	20	216	278	0.777	0.999	3.0	50.0	53.0	648
	2303	30	202	313	0.645	0.999	3.0	50.0	53.0	404
15-Sep	300	30	245	341	0.718	0.999	3.0	50.0	53.0	490
	610	25	138	201	0.687	0.999	3.0	50.0	53.0	331
	1132	22	122	160	0.763	0.999	3.0	50.0	53.0	333
	1605	30	137	132	1.038	0.999	3.0	50.0	53.0	274
	1749	10	58	85	0.682	0.999	3.0	50.0	53.0	348
	2105	30	169	181	0.934	0.999	3.0	50.0	53.0	338
	2320	30	181	301	0.601	0.999	3.0	50.0	53.0	362
16-Sep	300	30	190	266	0.714	0.999	3.0	50.0	53.0	380
	610	25	83	103	0.806	0.999	3.0	50.0	53.0	199
	1120	30	87	134	0.649	0.999	3.0	50.0	53.0	174
	1605	30	42	41	1.024	0.650	2.0	39.0	41.0	84
	2020	20	98	75	1.307	0.650	2.0	39.0	41.0	294

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	2105	30	96	83	1.157	0.650	2.0	39.0	41.0	192
	2305	20	100	113	0.885	0.650	2.0	39.0	41.0	300
17-Sep	300	30	78	75	1.040	0.650	2.0	39.0	41.0	156
	606	27	46	45	1.022	0.650	2.0	39.0	41.0	102
	954	6	9	13	0.692	0.650	2.0	39.0	41.0	90
	1002	15	6	6	1.000	0.650	2.0	39.0	41.0	24
	1105	30	53	58	0.914	0.650	2.0	39.0	41.0	106
	1610	30	46	36	1.278	0.650	2.0	39.0	41.0	92
	2144	15	96	106	0.906	0.500	1.5	37.0	38.5	384
	2315	20	150	181	0.829	0.600	1.5	37.0	38.5	450
	2337	15	101	111	0.910	0.700	1.5	37.0	38.5	404
18-Sep	300	30	106	98	1.082	0.700	1.5	37.0	38.5	212
	542	15	32	22	1.455	0.700	1.5	37.0	38.5	128
	602	15	35	34	1.029	0.550	1.5	37.0	38.5	140
	1110	30	25	24	1.042	0.550	1.5	37.0	38.5	50
	1610	20	45	47	0.957	0.550	1.5	37.0	38.5	135
	2105	30	140	140	1.000	0.550	2.0	37.0	39.0	280
	2330	15	92	110	0.836	0.550	2.0	37.0	39.0	368
19-Sep	10	10	50	53	0.943	0.850	2.0	37.0	39.0	300
	300	30	145	136	1.066	0.850	2.5	37.0	39.5	290
	610	25	41	47	0.872	0.850	2.5	37.0	39.5	98
	1105	30	20	17	1.176	0.850	2.5	37.0	39.5	40
	1405	15	14	13	1.077	0.850	2.5	37.0	39.5	56
	1615	30	46	32	1.438	0.850	2.5	37.0	39.5	92
	2105	49	257	287	0.895	0.850	2.5	37.0	39.5	315
	2201	5	41	52	0.788	0.850	2.5	37.0	39.5	492
	2301	30	134	141	0.950	0.850	2.5	37.0	39.5	268
20-Sep	305	30	90	100	0.900	0.850	2.5	37.0	39.5	180
	600	30	59	50	1.180	0.850	2.5	39.0	41.5	118
	1105	30	39	27	1.444	0.850	2.5	39.0	41.5	78
	1610	25	47	43	1.093	0.850	2.5	39.0	41.5	113
	2100	20	100	112	0.893	0.850	2.5	39.0	41.5	300
	2305	30	159	140	1.136	0.850	2.5	39.0	41.5	318
21-Sep	600	30	38	32	1.188	0.850	2.5	39.0	41.5	76
	1715	25	132	134	0.985	0.650	3.0	45.0	48.0	317
	2100	15	8	8	1.000	0.650	3.0	50.0	53.0	32
22-Sep		No Calibrations								
23-Sep		No Calibrations								
24-Sep	1145	15	50	51	0.980	0.650	3.0	39.0	42.0	200
	1630	27	100	188	0.532	0.650	3.0	39.0	42.0	222
	1718	12	30	41	0.732	0.999	3.0	39.0	42.0	150
	2125	30	166	138	1.203	0.999	3.0	45.0	48.0	332
	2300	20	74	48	1.542	0.999	3.0	45.0	48.0	222
25-Sep	335	25	94	85	1.106	0.999	3.0	44.0	47.0	226
	625	30	131	120	1.092	0.900	3.0	44.0	47.0	262
	1117	25	87	63	1.381	0.900	3.0	45.0	48.0	209
	1610	25	60	45	1.333	0.900	3.0	44.0	47.0	144
	2120	30	130	94	1.383	0.900	3.0	44.0	47.0	260
	2315	25	71	72	0.986	0.760	3.0	44.0	47.0	170
26-Sep	307	28	110	95	1.158	0.760	3.0	44.0	47.0	236
	625	30	144	135	1.067	0.700	3.0	44.0	47.0	288
	1120	30	15	9	1.667	0.700	3.0	44.0	47.0	30
	1615	20	7	5	1.400	0.700	3.0	44.0	47.0	21
	2125	33	43	40	1.075	0.600	3.0	44.0	47.0	78
	2315	25	65	73	0.890	0.600	3.0	42.0	45.0	156
27-Sep	300	30	108	100	1.080	0.650	3.0	42.0	45.0	216
	610	20	155	163	0.951	0.650	2.2	42.0	44.2	465
	705	10	50	53	0.943	0.650	2.2	42.0	44.2	300
	1108	24	100	132	0.758	0.650	2.2	42.0	44.2	250
	1625	25	230	221	1.041	0.650	2.2	42.0	44.2	552
	2125	25	85	96	0.885	0.650	2.2	42.0	44.2	204
	2305	28	112	100	1.120	0.700	2.2	42.0	44.2	240

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Appendix C.1. (page 4 of 4).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
28-Sep	320	30	172	182	0.945	0.700	2.2	42.0	44.2	344
	605	28	100	79	1.266	0.700	2.2	30.0	32.2	214
	950	15	80	230	0.348	0.700	2.2	30.0	32.2	320
	1120	15	2	2	1.000	0.700	3.0	45.0	48.0	8
	1605	15	5	4	1.250	0.600	3.0	45.0	48.0	20
	2137	22	29	28	1.036	0.600	3.0	45.0	48.0	79
	2305	25	28	27	1.037	0.600	3.0	45.0	48.0	67
29-Sep	300	25	34	32	1.063	0.600	3.0	45.0	48.0	82
	605	25	10	11	0.909	0.600	3.0	45.0	48.0	24
	1110	15	0	0	--	0.600	3.0	45.0	48.0	0
	1625	15	10	11	0.909	0.600	3.0	45.0	48.0	40
	2120	22	33	38	0.868	0.600	3.0	45.0	48.0	90
	2305	20	18	11	1.636	0.700	3.0	45.0	48.0	54
30-Sep	305	15	8	8	1.000	0.630	3.0	45.0	48.0	32
	610	20	3	0	--	0.630	3.0	45.0	48.0	9
	1125	10	0	0	--	0.630	3.0	45.0	48.0	0
	1644	15	2	2	--	0.630	3.0	45.0	48.0	8
	2105	20	15	12	1.250	0.630	3.0	45.0	48.0	45
	2305	20	14	10	1.400	0.630	3.0	45.0	48.0	42
01-Oct	325	15	2	0	--	0.600	3.0	45.0	48.0	8
	640	20	2	0	--	0.600	3.0	45.0	48.0	6
	1120	10	1	1	1.000	0.550	3.0	45.0	48.0	6
	1615	10	0	0	--	0.550	3.0	45.0	48.0	0
	2140	20	9	9	--	0.550	3.0	45.0	48.0	27
	2305	15	6	7	0.857	0.550	3.0	45.0	48.0	24
02-Oct	325	15	1	1	1.000	0.550	3.0	45.0	48.0	4
	610	15	0	0	--	0.550	3.0	45.0	48.0	0
	1105	15	0	0	--	0.550	3.0	45.0	48.0	0
	1620	10	0	0	--	0.550	3.0	45.0	48.0	0
	2135	15	13	10	1.300	0.550	3.0	45.0	48.0	52
	2340	15	1	1	1.000	0.550	3.0	45.0	48.0	4
03-Oct	615	15	0	0	--	0.550	3.0	45.0	48.0	0
	1140	10	0	0	--	0.550	3.0	45.0	48.0	0
	1625	10	0	0	--	0.550	3.0	45.0	48.0	0
	2130	15	3	2	1.500	0.550	3.0	45.0	48.0	12
	2310	15	3	3	1.000	0.550	3.0	45.0	48.0	12
Total	212	5,216	14,462	16,520	0.875					

Appendix C.2. Oscilloscope data used to calibrate the right-bank sonar counter at the Toklat River project site, 1995.

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
01-Sep	2112	15	1	1	1.000	0.200	2.0	12.0	14.0	4
	2312	15	0	0	--	0.200	2.0	12.0	14.0	0
02-Sep	1	10	0	0	--	0.200	2.0	12.0	14.0	0
	618	10	0	0	--	0.200	2.0	12.0	14.0	0
	1124	10	0	0	--	0.200	2.0	12.0	14.0	0
	1602	10	0	0	--	0.200	2.0	12.0	14.0	0
	2122	10	0	0	--	0.200	2.0	12.0	14.0	0
	2331	10	0	0	--	0.200	2.0	12.0	14.0	0
03-Sep	22	10	0	0	--	0.200	2.0	12.0	14.0	0
	300	10	0	0	--	0.200	2.0	12.0	14.0	0
	635	20	3	6	0.500	0.200	2.0	12.0	14.0	9
	1127	10	0	0	--	0.200	2.0	12.0	14.0	0
	1626	10	0	0	--	0.200	2.0	12.0	14.0	0
04-Sep		No Calibrations								
05-Sep	1600	10	0	0	--	0.200	2.0	12.0	14.0	0
	2116	20	2	3	0.667	0.200	2.0	12.0	14.0	6
	2345	15	0	0	--	0.333	2.0	12.0	14.0	0
06-Sep	1	15	0	0	--	0.333	2.0	12.0	14.0	0
	614	15	2	3	0.667	0.333	2.0	11.0	13.0	8
	1129	15	1	0	--	0.333	2.0	11.0	13.0	4
	1625	15	5	10	0.500	0.333	2.0	12.0	14.0	20
	2113	15	3	5	0.600	0.416	2.0	12.0	14.0	12
	2345	15	8	3	2.667	0.416	2.0	12.0	14.0	32
07-Sep	7	15	4	4	--	0.416	2.0	12.0	14.0	16
	301	15	8	9	0.889	0.416	2.0	12.0	14.0	32
	639	15	1	1	1.000	0.416	2.0	12.0	14.0	4
	1145	10	0	0	--	0.416	2.0	12.0	14.0	0
	1644	15	2	1	2.000	0.416	2.0	12.0	14.0	8
	2145	15	7	11	0.636	0.416	2.0	12.0	14.0	28
	2335	15	7	2	3.500	0.416	2.0	12.0	14.0	28
08-Sep	40	15	2	1	--	0.374	2.0	12.0	14.0	8
	335	15	1	1	1.000	0.374	2.0	12.0	14.0	4
	634	15	5	7	0.714	0.374	2.0	12.0	14.0	20
	1141	15	0	0	--	0.374	2.0	12.0	14.0	0
	1638	15	16	24	0.667	0.374	2.0	12.0	14.0	64
	2116	10	5	5	1.000	0.516	2.0	12.0	14.0	30
	2304	15	11	14	0.786	0.516	2.0	12.0	14.0	44
09-Sep	45	15	20	16	1.250	0.516	2.0	12.0	14.0	80
	340	20	12	3	4.000	0.516	2.0	12.0	14.0	36
	639	15	14	14	1.000	0.409	2.0	12.0	14.0	56
	1142	15	2	2	1.000	0.409	2.0	12.0	14.0	8
	1639	15	2	5	0.400	0.409	2.0	12.0	14.0	8
	2124	18	10	13	0.769	0.409	2.0	12.0	14.0	33
	2345	15	16	19	0.842	0.409	2.0	12.0	14.0	64
10-Sep	42	18	10	8	1.250	0.490	2.0	12.0	14.0	33
	340	20	13	14	0.929	0.490	2.0	12.0	14.0	39
	635	15	3	3	1.000	0.490	2.0	12.0	14.0	12
	1140	15	2	1	2.000	0.490	2.0	12.0	14.0	8
	1640	15	3	2	1.500	0.490	2.0	12.0	14.0	12
	2114	15	1	0	--	0.490	2.0	12.0	14.0	4
	2305	15	9	8	1.125	0.490	2.0	12.0	14.0	36
11-Sep	40	15	4	5	0.800	0.450	2.0	12.0	14.0	16
	335	15	5	5	1.000	0.450	2.0	12.0	14.0	20
	635	15	4	9	0.444	0.450	2.0	12.0	14.0	16
	1148	11	1	1	1.000	0.450	2.0	12.0	14.0	5
	1640	15	5	5	1.000	0.450	2.0	12.0	14.0	20
	2145	15	6	4	1.500	0.450	2.0	12.0	14.0	24
	2325	15	1	4	0.250	0.450	2.0	12.0	14.0	4
12-Sep	10	15	5	1	5.000	0.450	2.0	12.0	14.0	20
	345	15	5	6	0.833	0.400	2.0	12.0	14.0	20
	635	15	2	2	1.000	0.420	2.0	12.0	14.0	8
	1140	15	1	1	1.000	0.420	2.0	12.0	14.0	4

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	1645	15	4	1	4.000	0.370	2.0	12.0	14.0	16
	2135	15	8	3	2.667	0.370	2.0	12.0	14.0	32
	2335	15	11	18	0.611	0.370	2.0	12.0	14.0	44
13-Sep	5	15	4	6	0.667	0.500	2.0	12.0	14.0	16
	303	15	6	5	1.200	0.500	2.0	12.0	14.0	24
	640	15	6	2	3.000	0.500	2.0	12.0	14.0	24
	1145	15	5	13	0.385	0.400	2.0	12.0	14.0	20
	1640	15	6	6	1.000	0.400	2.0	12.0	14.0	24
	2150	9	0	1	0.000	0.400	2.0	12.0	14.0	0
	2305	15	7	6	1.167	0.400	2.0	12.0	14.0	28
14-Sep	40	15	2	1	2.000	0.400	2.0	12.0	14.0	8
	300	15	6	4	1.500	0.400	2.0	12.0	14.0	24
	640	20	4	5	0.800	0.400	2.0	12.0	14.0	12
	1145	15	3	1	3.000	0.400	2.0	12.0	14.0	12
	1642	8	5	6	0.833	0.350	2.0	40.0	42.0	38
	2140	15	8	14	0.571	0.350	2.0	40.0	42.0	32
	2340	20	8	7	1.143	0.350	2.0	40.0	42.0	24
15-Sep	340	15	3	5	0.600	0.400	2.0	40.0	42.0	12
	640	20	9	7	1.286	0.400	2.0	40.0	42.0	27
	707	12	4	11	0.364	0.400	2.0	40.0	42.0	20
	1135	15	0	0	--	0.400	1.5	35.0	36.5	0
	1640	15	1	0	--	0.400	1.5	35.0	36.5	4
	2140	15	9	11	0.818	0.400	1.5	35.0	36.5	36
	2326	24	12	22	0.545	0.400	1.5	35.0	36.5	30
16-Sep	340	15	6	8	0.750	0.400	1.5	12.0	13.5	24
	645	15	2	2	1.000	0.400	1.5	12.0	13.5	8
	1145	15	0	0	--	0.400	1.5	12.0	13.5	0
	1648	12	0	0	--	0.400	1.5	11.5	13.0	0
	2140	15	33	35	0.943	0.400	1.5	11.5	13.0	132
	2302	30	24	31	0.774	0.400	1.5	11.5	13.0	48
17-Sep	335	15	5	7	0.714	0.400	1.5	11.5	13.0	20
	641	19	3	3	1.000	0.400	1.5	11.5	13.0	9
	942	10	1	1	1.000	0.400	1.5	11.5	13.0	6
	1130	10	0	0	--	0.400	1.5	11.5	13.0	0
	1640	15	1	1	1.000	0.400	1.5	11.0	12.5	4
	2146	13	12	19	0.632	0.400	1.5	11.0	12.5	55
	2325	15	36	61	0.590	0.400	1.5	11.0	12.5	144
	2345	15	20	24	0.833	0.600	1.5	11.0	12.5	80
18-Sep	340	15	9	5	1.800	0.400	1.5	11.0	12.5	36
	640	20	8	3	2.667	0.400	1.5	11.0	12.5	24
	700	20	3	5	0.600	0.400	1.5	11.0	12.5	9
	1115	15	4	2	2.000	0.450	1.5	11.0	12.5	16
	1640	10	0	0	--	0.450	1.5	11.0	12.5	0
	2135	15	36	32	1.125	0.450	1.5	11.0	12.5	144
	2340	20	17	9	1.889	0.400	1.5	11.0	12.5	51
19-Sep	10	20	17	13	1.308	0.400	1.5	11.0	12.5	51
	335	15	25	29	0.862	0.400	1.5	11.0	12.5	100
	645	15	10	14	0.714	0.400	1.5	11.0	12.5	40
	1120	10	0	0	--	0.400	1.5	11.0	12.5	0
	1630	15	4	0	--	0.400	1.5	11.0	12.5	16
	1646	10	3	2	1.500	0.300	1.5	11.0	12.5	18
	2135	11	27	48	0.563	0.300	1.5	11.0	12.5	147
	2150	10	17	25	0.680	0.535	1.5	11.0	12.5	102
	2305	20	31	37	0.838	0.535	1.5	11.0	12.5	93
20-Sep	345	15	2	2	1.000	0.535	1.5	11.0	12.5	8
	635	15	8	9	0.889	0.535	1.5	11.0	12.5	32
	1150	9	0	0	--	0.535	1.5	11.0	12.5	0
	1640	15	4	0	--	0.535	1.5	11.0	12.5	16
	1700	10	9	7	1.286	0.435	1.5	11.0	12.5	54
	2120	15	14	23	0.609	0.435	1.5	10.0	11.5	56
	2148	11	13	15	0.867	0.500	1.5	10.0	11.5	71
	2305	20	25	22	1.136	0.500	1.5	10.0	11.5	75
21-Sep	649	10	8	12	0.667	0.500	1.5	10.0	11.5	48
	1115	14	3	3	1.000	0.500	1.5	12.0	13.5	13

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Appendix C.2. (page 3 of 4).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	1649	10	8	4	2.000	0.500	1.5	12.0	13.5	48
	2122	10	15	23	0.652	0.400	1.5	12.0	13.5	90
	2307	10	4	6	0.667	0.450	1.5	12.0	13.5	24
22-Sep		No Calibrations								
23-Sep	1246	13	1	1	1.000	0.450	2.0	10.0	12.0	5
	1630	15	5	5	1.000	0.450	2.0	10.0	12.0	20
	2120	20	8	4	2.000	0.450	2.0	10.0	12.0	24
	2310	15	6	3	2.000	0.450	2.0	10.0	12.0	24
	2325	10	5	4	1.250	0.400	2.0	10.0	12.0	30
24-Sep	640	15	8	4	2.000	0.400	1.5	10.0	11.5	32
	1144	15	10	14	0.714	0.400	1.5	10.0	11.5	40
	1630	15	4	0	--	0.400	1.5	11.0	12.5	16
	2100	15	15	18	0.833	0.400	1.5	11.0	12.5	60
	2325	15	24	32	0.750	0.400	1.5	11.0	12.5	96
25-Sep	310	15	9	6	1.500	0.400	1.5	11.0	12.5	36
	600	15	5	3	1.667	0.400	1.5	11.0	12.5	20
	1148	11	16	16	1.000	0.400	1.5	11.0	12.5	87
	1645	15	15	17	0.882	0.400	1.5	11.0	12.5	60
	2100	15	21	19	1.105	0.400	1.5	11.0	12.5	84
	2345	15	12	12	1.000	0.400	1.5	10.0	11.5	48
26-Sep	343	17	13	13	1.000	0.400	1.5	10.0	11.5	46
	600	15	13	10	1.300	0.400	1.5	10.0	11.5	52
	1105	15	10	8	1.250	0.400	1.5	11.0	12.5	40
	1640	15	7	14	0.500	0.400	1.5	11.0	12.5	28
	2100	15	10	12	0.833	0.400	1.5	11.0	12.5	40
	2345	15	15	13	1.154	0.400	1.5	11.0	12.5	60
27-Sep	335	15	13	10	1.300	0.400	1.5	11.0	12.5	52
	640	20	10	6	1.667	0.400	1.5	11.0	12.5	30
	1135	15	3	2	1.500	0.400	1.5	11.0	12.5	12
	1605	15	10	9	1.111	0.400	1.5	11.0	12.5	40
	2102	18	10	12	0.833	0.400	1.5	11.0	12.5	33
	2340	15	6	5	1.200	0.400	1.5	10.0	11.5	24
28-Sep	300	15	5	3	1.667	0.400	1.5	10.0	11.5	20
	645	15	10	5	2.000	0.400	1.5	10.0	11.5	40
	1125	15	4	5	0.800	0.350	1.5	10.0	11.5	16
	1630	15	4	5	0.800	0.350	1.5	11.0	12.5	16
	2130	15	28	41	0.683	0.350	1.5	11.0	12.5	112
	2305	20	14	14	1.000	0.450	1.5	11.0	12.5	42
29-Sep	335	15	8	8	1.000	0.450	1.5	11.0	12.5	32
	640	20	2	2	1.000	0.450	1.5	11.0	12.5	6
	1135	15	2	1	2.000	0.450	1.5	11.0	12.5	8
	1645	14	1	1	1.000	0.450	1.5	11.0	12.5	4
	2125	15	13	12	1.083	0.450	1.5	11.0	12.5	52
	2305	15	4	3	1.333	0.450	1.5	11.0	12.5	16
30-Sep	330	15	9	13	0.692	0.450	1.5	11.0	12.5	36
	635	20	3	4	0.750	0.450	1.5	11.0	12.5	9
	1110	10	0	0	--	0.450	1.5	11.0	12.5	0
	1645	15	0	0	--	0.450	1.5	11.0	12.5	0
	2115	15	9	9	1.000	0.450	1.5	11.0	12.5	36
	2305	18	11	10	1.100	0.450	1.5	11.0	12.5	37
01-Oct	300	15	4	3	1.333	0.450	1.5	11.0	12.5	16
	615	15	0	0	--	0.450	1.5	11.0	12.5	0
	1110	10	0	0	--	0.450	1.5	11.0	12.5	0
	1600	10	1	1	1.000	0.450	1.5	11.0	12.5	6
	2144	15	3	4	0.750	0.450	1.5	11.0	12.5	12
	2305	15	5	6	0.833	0.450	1.5	11.0	12.5	20
02-Oct	300	15	2	2	1.000	0.450	1.5	11.0	12.5	8
	631	17	0	0	--	0.450	1.5	11.0	12.5	0
	1105	15	0	0	--	0.450	1.5	11.0	12.5	0
	1620	10	0	0	--	0.450	1.5	11.0	12.5	0
	2105	10	3	1	3.000	0.450	1.5	11.0	12.5	18
	2120	10	3	3	1.000	0.400	1.5	11.0	12.5	18

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Appendix C.2. (page 4 of 4).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	2315	15	1	1	1.000	0.400	1.5	11.0	12.5	4
03–Oct	635	15	0	0	--	0.400	1.5	11.0	12.5	0
	1142	10	0	0	--	0.400	1.5	11.0	12.5	0
	1610	10	0	0	--	0.400	1.5	11.0	12.5	0
	2135	10	0	0	--	0.400	1.5	11.0	12.5	0
	2310	10	0	0	--	0.400	1.5	11.0	12.5	0
Total	192	2,792	1,261	1,388	0.923					

Appendix C.3. Oscilloscope data used to calibrate the left-bank sonar counter at the Toklat River project site, 1996.

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
14-Aug	2030	10	2	4	0.500	0.250	2.5	50.0	52.5	12
	2107	10	2	5	0.400	0.250	2.5	50.0	52.5	12
	2341	15	4	4	1.000	0.250	2.5	50.0	52.5	16
15-Aug	1607	15	0	0	--	0.250	2.5	50.0	52.5	0
	2112	15	1	1	1.000	0.250	2.5	50.0	52.5	4
16-Aug	5	15	4	7	0.571	0.250	2.5	50.0	52.5	16
	625	15	2	3	0.667	0.250	2.5	50.0	52.5	8
	1128	15	0	0	--	0.250	2.5	50.0	52.5	0
	1615	10	0	0	--	0.250	2.5	50.0	52.5	0
	2118	20	1	4	0.250	0.250	3.0	50.0	53.0	3
17-Aug	High water									
18-Aug	High water									
19-Aug	1445	20	4	8	0.500	0.250	2.0	50.0	52.0	12
	1640	10	7	11	0.636	0.250	2.0	50.0	52.0	42
	2101	10	4	5	0.800	0.250	2.0	50.0	52.0	24
	2335	10	3	4	0.750	0.250	2.0	50.0	52.0	18
20-Aug	640	16	4	11	0.364	0.250	2.0	50.0	52.0	15
	730	10	3	2	1.500	0.650	2.0	50.0	52.0	18
	1126	15	0	0	--	0.650	2.0	50.0	52.0	0
	1605	10	2	1	2.000	0.650	2.0	50.0	52.0	12
	2101	10	2	2	1.000	0.650	2.0	70.0	72.0	12
	2335	10	0	0	--	0.650	2.0	70.0	72.0	0
21-Aug	608	20	6	3	2.000	0.650	2.0	70.0	72.0	18
	630	10	1	1	1.000	0.500	2.0	70.0	72.0	6
	1155	15	2	4	0.500	0.500	2.5	70.0	72.5	8
	1710	20	8	9	0.889	0.500	2.5	70.0	72.5	24
	2101	10	5	4	1.250	0.500	2.5	70.0	72.5	30
	2330	15	7	7	1.000	0.500	2.5	70.0	72.5	28
22-Aug	715	15	7	8	0.875	0.500	2.5	60.0	62.5	28
	1105	15	0	0	--	0.500	2.5	60.0	62.5	0
	1723	17	3	1	3.000	0.500	2.5	60.0	62.5	11
	2110	10	0	0	--	0.500	2.5	60.0	62.5	0
	2311	10	6	7	0.857	0.500	2.5	60.0	62.5	36
23-Aug	630	15	1	1	1.000	0.500	2.5	60.0	62.5	4
	1035	15	0	0	--	0.500	2.5	60.0	62.5	0
	1625	10	0	0	--	0.500	2.5	60.0	62.5	0
	2101	10	4	5	0.800	0.500	2.5	60.0	62.5	24
	2200	60	15	22	0.682	0.500	2.5	60.0	62.5	15
	2301	15	7	9	0.778	0.500	2.5	60.0	62.5	28
24-Aug	608	47	38	44	0.864	0.500	2.5	70.0	72.5	49
	847	20	11	17	0.647	0.500	2.5	70.0	72.5	33
	1101	10	3	5	0.600	0.500	2.5	70.0	72.5	18
	1610	20	7	8	0.875	0.500	2.5	70.0	72.5	21
	1635	20	9	9	1.000	0.700	2.5	70.0	72.5	27
	2101	10	2	1	2.000	0.700	2.5	70.0	72.5	12
	2301	10	7	6	1.167	0.700	2.5	70.0	72.5	42
25-Aug	644	15	16	10	1.600	0.700	2.5	60.0	62.5	64
	711	16	18	18	1.000	0.600	2.5	60.0	62.5	68
	1137	16	9	15	0.600	0.600	2.5	60.0	62.5	34
	1355	15	6	9	0.667	0.600	2.5	60.0	62.5	24
	2115	30	44	46	0.957	0.600	2.5	58.0	60.5	88
	2301	30	24	28	0.857	0.600	2.5	58.0	60.5	48
26-Aug	616	15	21	42	0.500	0.400	2.5	58.0	60.5	84
	635	20	15	21	0.714	0.700	2.5	58.0	60.5	45
	700	15	12	15	0.800	0.700	2.5	58.0	60.5	48
	1115	15	6	12	0.500	0.700	2.5	54.0	56.5	24
	1620	15	4	2	2.000	0.700	2.5	54.0	56.5	16
	2101	10	7	4	1.750	0.700	2.5	54.0	56.5	42
	2301	10	8	7	1.143	0.700	2.5	54.0	56.5	48
27-Aug	301	30	63	50	1.260	0.600	2.5	54.0	56.5	126
	612	30	21	21	1.000	0.600	2.5	54.0	56.5	42

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	1130	15	2	1	2.000	0.600	2.5	54.0	56.5	8
	1600	15	0	0	--	0.600	2.5	54.0	56.5	0
	2128	20	13	15	0.867	0.600	2.5	44.0	46.5	39
	2301	30	38	44	0.864	0.600	2.5	44.0	46.5	76
28-Aug	301	30	25	29	0.862	0.600	2.5	44.0	46.5	50
	612	30	25	33	0.758	0.600	2.5	44.0	46.5	50
	1115	15	0	0	--	0.600	2.5	44.0	46.5	0
	1634	15	0	0	--	0.600	2.5	44.0	46.5	0
	2104	16	2	2	1.000	0.600	2.5	46.0	48.5	8
	2300	15	8	10	0.800	0.600	2.5	46.0	48.5	32
29-Aug	301	34	50	47	1.064	0.600	2.5	46.0	48.5	88
	735	15	2	1	2.000	0.600	2.5	46.0	48.5	8
	1100	15	0	0	--	0.600	2.5	46.0	48.5	0
	1602	16	1	1	1.000	0.600	2.5	46.0	48.5	4
	2115	20	13	11	1.182	0.600	2.5	46.0	48.5	39
	2310	30	28	21	1.333	0.600	2.5	46.0	48.5	56
30-Aug	102	15	31	29	1.069	0.550	2.5	44.0	46.5	124
	301	30	42	36	1.167	0.500	2.5	44.0	46.5	84
	624	17	9	7	1.286	0.500	2.5	44.0	46.5	32
	1112	15	0	0	--	0.500	2.5	44.0	46.5	0
	1609	15	0	0	--	0.500	2.5	44.0	46.5	0
	2115	15	10	12	0.833	0.500	1.0	37.0	38.0	40
	2306	25	39	42	0.929	0.500	1.0	37.0	38.0	94
31-Aug	300	30	44	44	1.000	0.500	1.0	37.0	38.0	88
	628	15	7	11	0.636	0.500	1.0	37.0	38.0	28
	1100	15	0	0	--	0.500	1.0	37.0	38.0	0
	1600	15	5	4	1.250	0.500	1.0	37.0	38.0	20
	2106	15	4	2	2.000	0.500	1.0	37.0	38.0	16
	2312	15	20	17	1.176	0.500	1.0	37.0	38.0	80
01-Sep	300	25	60	53	1.132	0.500	1.0	37.0	38.0	144
	620	15	6	5	1.200	0.500	1.0	37.0	38.0	24
	1100	15	1	1	1.000	0.500	1.0	37.0	38.0	4
	1600	15	0	0	ERR	0.500	1.0	37.0	38.0	0
	2100	30	25	24	1.042	0.500	1.0	35.0	36.0	50
	2302	25	81	87	0.931	0.500	1.0	34.0	35.0	194
02-Sep	303	25	35	33	1.061	0.500	1.0	34.0	35.0	84
	608	15	5	5	1.000	0.500	1.0	34.0	35.0	20
	1100	15	0	0	--	0.500	1.0	34.0	35.0	0
	1600	15	0	0	--	0.500	1.0	34.0	35.0	0
	2100	16	11	9	1.222	0.500	1.0	36.0	37.0	41
	2305	30	48	48	1.000	0.500	1.0	35.0	36.0	96
03-Sep	300	25	46	42	1.095	0.500	1.0	35.0	36.0	110
	427	13	22	21	1.048	0.480	1.0	35.0	36.0	102
	630	15	4	3	1.333	0.480	1.0	35.0	36.0	16
	1100	15	7	6	1.167	0.480	1.0	35.0	36.0	28
	1600	15	0	0	--	0.480	1.0	32.0	33.0	0
	2103	15	11	6	1.833	0.480	1.0	32.0	33.0	44
	2228	10	12	15	0.800	0.480	1.0	24.0	25.0	72
	2310	30	95	110	0.864	0.600	1.5	23.5	25.0	190
04-Sep	45	15	68	83	0.819	0.600	1.5	23.5	25.0	272
	300	25	61	49	1.245	0.600	1.5	23.5	25.0	146
	630	15	3	1	3.000	0.600	1.5	23.5	25.0	12
	1100	15	0	9	0.000	0.600	1.5	23.5	25.0	0
	1620	15	0	0	--	0.600	1.5	23.5	25.0	0
	2130	15	0	0	--	0.600	1.5	23.5	25.0	0
	2300	30	103	122	0.844	0.600	1.5	23.5	25.0	206
05-Sep	300	15	9	11	0.818	0.600	1.5	23.5	25.0	36
	615	15	7	9	0.778	0.600	1.5	23.5	25.0	28
	1130	15	0	0	--	0.600	1.5	23.5	25.0	0
	1602	15	1	1	1.000	0.600	1.5	23.5	25.0	4
	2130	15	3	2	1.500	0.600	1.5	23.5	25.0	12
	2300	30	103	125	0.824	0.600	1.5	23.5	25.0	206
06-Sep	300	15	8	13	0.615	0.600	1.5	23.5	25.0	32

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	604	30	19	16	1.188	0.600	1.5	23.5	25.0	38
	1122	15	0	0	--	0.600	1.5	23.5	25.0	0
	1605	15	0	0	--	0.600	1.5	23.5	25.0	0
	2115	15	3	3	1.000	0.600	1.5	23.5	25.0	12
	2300	15	2	3	0.667	0.600	1.5	23.5	25.0	8
07-Sep	300	30	54	58	0.931	0.600	1.5	23.5	25.0	108
	620	18	3	2	1.500	0.600	1.5	23.5	25.0	10
	1120	15	0	0	--	0.600	1.0	30.0	31.0	0
	1640	15	0	0	--	0.600	1.0	22.0	23.0	0
	2100	15	3	3	1.000	0.600	1.0	22.0	23.0	12
	2300	30	92	124	0.742	0.600	1.0	22.0	23.0	184
08-Sep	300	30	53	73	0.726	0.600	1.0	22.0	23.0	106
	620	30	10	8	1.250	0.600	1.0	24.0	25.0	20
	1108	15	0	0	--	0.600	1.0	22.0	23.0	0
	1600	15	0	0	--	0.600	1.0	22.0	23.0	0
	2100	15	5	3	1.667	0.600	1.0	22.0	23.0	20
	2300	30	98	110	0.891	0.600	1.0	22.0	23.0	196
09-Sep	300	30	69	68	1.015	0.700	1.0	22.0	23.0	138
	615	25	15	12	1.250	0.700	1.0	21.0	22.0	36
	1123	15	0	0	--	0.700	1.0	21.0	22.0	0
	1600	15	2	1	2.000	0.700	1.0	21.0	22.0	8
	2100	15	9	7	1.286	0.700	1.0	21.0	22.0	36
	2300	30	101	131	0.771	0.700	1.0	21.0	22.0	202
10-Sep	300	30	103	121	0.851	0.700	1.0	21.0	22.0	206
	612	20	7	6	1.167	0.700	1.0	21.0	22.0	21
	1103	20	1	1	1.000	0.700	1.0	21.0	22.0	3
	1620	20	0	0	--	0.700	1.0	21.0	22.0	0
	2100	15	0	0	--	0.700	1.0	21.0	22.0	0
	2300	50	141	176	0.801	0.700	1.0	21.0	22.0	169
11-Sep	300	30	73	83	0.880	0.700	1.0	21.0	22.0	146
	603	30	18	16	1.125	0.700	1.0	21.0	22.0	36
	1112	20	0	0	--	0.700	1.0	21.0	22.0	0
	1600	16	0	0	--	0.700	1.0	21.0	22.0	0
	2100	15	5	8	0.625	0.700	1.0	21.0	22.0	20
	2300	30	56	62	0.903	0.700	1.0	21.0	22.0	112
12-Sep	300	30	58	72	0.806	0.700	1.0	21.0	22.0	116
	422	15	33	37	0.892	0.750	1.0	21.0	22.0	132
	612	30	22	19	1.158	0.750	1.0	21.0	22.0	44
	1100	15	0	0	--	0.750	1.0	21.0	22.0	0
	1600	15	0	0	--	0.750	1.0	21.0	22.0	0
	2100	15	7	4	1.750	0.750	1.0	21.0	22.0	28
	2311	30	95	97	0.979	0.750	1.0	21.0	22.0	190
13-Sep	300	30	66	63	1.048	0.750	1.0	21.0	22.0	132
	600	15	0	0	--	0.750	1.0	21.0	22.0	0
	1100	15	0	0	--	0.750	1.0	21.0	22.0	0
	1605	15	1	2	0.500	0.750	1.0	21.0	22.0	4
	2125	25	9	4	2.250	0.750	3.0	19.0	22.0	22
	2323	30	34	36	0.944	0.750	1.0	24.0	25.0	68
14-Sep	230	30	59	56	1.054	0.750	1.0	24.0	25.0	118
	613	15	2	2	1.000	0.750	1.0	24.0	25.0	8
	1100	15	0	0	--	0.750	1.0	24.0	25.0	0
	1600	15	0	0	--	0.750	1.0	24.0	25.0	0
	2100	40	60	53	1.132	0.750	1.0	23.0	24.0	90
	2300	27	36	41	0.878	0.750	1.0	22.0	23.0	80
15-Sep	1	21	57	63	0.905	0.750	1.0	22.0	23.0	163
	300	28	61	69	0.884	0.750	1.0	22.0	23.0	131
	620	20	14	13	1.077	0.750	1.0	22.0	23.0	42
	1100	18	2	2	1.000	0.750	1.0	22.0	23.0	7
	1600	15	0	0	--	0.750	1.0	22.0	23.0	0
	2145	30	40	33	1.212	0.750	1.0	22.0	23.0	80
	2315	30	95	75	1.267	0.750	1.0	22.0	23.0	190
	2350	15	100	93	1.075	0.720	1.0	22.0	23.0	400
16-Sep	300	15	80	64	1.250	0.720	1.0	22.0	23.0	320

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Appendix C.3. (page 4 of 5).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	317	15	54	57	0.947	0.690	1.0	22.0	23.0	216
	615	15	9	7	1.286	0.690	1.0	22.0	23.0	36
	1100	15	0	0	--	0.690	1.0	22.0	23.0	0
	1620	15	0	0	--	0.690	1.0	22.0	23.0	0
	2120	30	64	54	1.185	0.690	1.0	22.0	23.0	128
	2301	30	193	197	0.980	0.690	1.0	22.0	23.0	386
17-Sep	300	30	100	86	1.163	0.690	1.0	22.0	23.0	200
	620	20	20	14	1.429	0.690	1.0	22.0	23.0	60
	1100	15	2	1	2.000	0.690	1.0	22.0	23.0	8
	1600	15	4	4	1.000	0.690	1.0	22.0	23.0	16
	2105	5	4	0	--	0.690	1.0	22.0	23.0	48
	2110	26	100	97	1.031	0.600	1.0	22.0	23.0	231
	2309	17	109	123	0.886	0.600	1.0	22.0	23.0	385
18-Sep	307	15	61	42	1.452	0.600	1.0	22.0	23.0	244
	324	15	62	82	0.756	0.500	1.0	22.0	23.0	248
	628	20	37	44	0.841	0.550	1.0	22.0	23.0	111
	1100	15	4	4	1.000	0.550	1.0	22.0	23.0	16
	1734	26	122	100	1.220	0.550	1.0	22.0	23.0	282
	2050	10	30	21	1.429	0.550	1.0	22.0	23.0	180
	2100	15	75	68	1.103	0.500	1.0	22.0	23.0	300
	2117	10	50	49	1.020	0.480	1.0	22.0	23.0	300
	2300	10	95	122	0.779	0.480	1.0	22.0	23.0	570
	2310	10	131	128	1.023	0.470	1.0	22.0	23.0	786
19-Sep	300	30	63	64	0.984	0.480	1.0	22.0	23.0	126
	600	30	84	82	1.024	0.480	1.0	22.0	23.0	168
	1100	15	2	1	2.000	0.480	1.0	22.0	23.0	8
	1608	15	5	6	0.833	0.480	1.0	22.0	23.0	20
	2100	30	54	41	1.317	0.480	1.0	22.0	23.0	108
	2300	30	203	264	0.769	0.480	1.0	22.0	23.0	406
20-Sep	5	11	98	106	0.925	0.500	1.0	22.0	23.0	535
	305	20	122	129	0.946	0.500	1.0	22.0	23.0	366
	605	25	45	37	1.216	0.500	1.0	22.0	23.0	108
	1120	21	0	0	--	0.500	1.0	22.0	23.0	0
	1600	15	1	1	1.000	0.500	1.0	22.0	23.0	4
	2100	15	9	12	0.750	0.500	1.0	22.0	23.0	36
	2300	15	45	60	0.750	0.500	1.0	22.0	23.0	180
21-Sep	1	30	290	274	1.058	0.750	1.0	22.0	23.0	580
	300	25	122	128	0.953	0.750	1.0	22.0	23.0	293
	615	20	17	13	1.308	0.750	1.0	22.0	23.0	51
	1111	16	1	0	--	0.750	1.0	22.0	23.0	4
	1607	16	0	0	--	0.750	1.0	22.0	23.0	0
	2100	15	4	3	1.333	0.750	1.0	22.0	23.0	16
	2307	30	34	30	1.133	0.750	1.0	22.0	23.0	68
22-Sep	300	15	9	12	0.750	0.750	1.0	22.0	23.0	36
	611	20	5	4	1.250	0.750	1.0	22.0	23.0	15
	1105	15	0	0	--	0.750	1.0	22.0	23.0	0
	1610	10	0	0	--	0.750	1.0	22.0	23.0	0
	2108	15	6	3	2.000	0.750	1.0	22.0	23.0	24
	2300	15	7	5	1.400	0.750	1.0	22.0	23.0	28
23-Sep	300	15	6	6	1.000	0.750	1.0	22.0	23.0	24
	627	15	1	0	--	0.750	1.0	22.0	23.0	4
	645	15	3	2	1.500	0.700	1.0	32.0	33.0	12
	743	15	2	2	1.000	0.700	1.0	32.0	33.0	8
	1120	17	1	1	1.000	0.700	1.0	32.0	33.0	4
	1606	17	1	1	1.000	0.700	1.0	32.0	33.0	4
	2120	20	14	17	0.824	0.700	1.0	32.0	33.0	42
	2300	30	26	36	0.722	0.700	1.0	32.0	33.0	52
24-Sep	300	15	9	11	0.818	0.700	1.0	32.0	33.0	36
	600	20	12	14	0.857	0.700	1.0	32.0	33.0	36
	620	18	9	8	1.125	0.750	1.0	32.0	33.0	30
	713	22	7	7	1.000	0.750	1.0	32.0	33.0	19
	1105	15	1	2	0.500	0.750	1.0	32.0	33.0	4
	1647	13	0	0	--	0.750	1.0	32.0	33.0	0
	2100	15	9	8	1.125	0.750	1.0	32.0	33.0	36
	2315	20	21	24	0.875	0.750	1.0	32.0	33.0	63

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Appendix C.3. (page 5 of 5).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
25-Sep	300	15	8	11	0.727	0.750	1.0	32.0	33.0	32
	602	30	17	15	1.133	0.750	1.0	32.0	33.0	34
	720	30	13	13	1.000	0.750	1.0	32.0	33.0	26
	1101	15	0	0	--	0.750	1.0	32.0	33.0	0
	1610	15	0	0	--	0.750	1.0	32.0	33.0	0
	2100	30	42	40	1.050	0.750	1.0	32.0	33.0	84
	2300	30	47	47	1.000	0.750	1.0	32.0	33.0	94
26-Sep	300	30	55	66	0.833	0.750	1.0	32.0	33.0	110
	600	30	31	32	0.969	0.750	1.0	32.0	33.0	62
	1135	15	0	0	--	0.750	1.0	32.0	33.0	0
	1620	15	1	1	1.000	0.750	1.0	32.0	33.0	4
	2100	30	116	132	0.879	0.750	1.0	32.0	33.0	232
	2300	30	57	59	0.966	0.750	1.0	32.0	33.0	114
27-Sep	300	30	50	53	0.943	0.750	1.0	32.0	33.0	100
	615	27	18	32	0.563	0.750	1.0	32.0	33.0	40
	727	15	7	4	1.750	0.750	1.0	32.0	33.0	28
	1106	20	3	4	0.750	0.750	1.0	32.0	33.0	9
	1653	15	4	6	0.667	0.750	1.0	32.0	33.0	16
	2100	30	102	116	0.879	0.750	1.0	32.0	33.0	204
	2300	30	146	142	1.028	0.750	1.0	32.0	33.0	292
28-Sep	300	30	40	31	1.290	0.750	1.0	32.0	33.0	80
	602	30	31	25	1.240	0.750	1.0	32.0	33.0	62
	1148	20	0	0	--	0.750	1.0	32.0	33.0	0
	1600	15	3	3	1.000	0.750	1.0	32.0	33.0	12
	2100	30	128	107	1.196	0.750	1.0	32.0	33.0	256
	2325	15	43	35	1.229	0.600	1.0	32.0	33.0	172
29-Sep	3	15	57	57	1.000	0.600	1.0	32.0	33.0	228
	320	15	65	69	0.942	0.620	1.0	32.0	33.0	260
	630	15	8	7	1.143	0.620	1.0	32.0	33.0	32
	1100	15	7	7	1.000	0.620	1.0	32.0	33.0	28
	1600	15	1	1	1.000	0.620	1.0	32.0	33.0	4
	2100	30	131	146	0.897	0.620	1.0	32.0	33.0	262
	2328	30	101	113	0.894	0.600	1.0	32.0	33.0	202
30-Sep	245	15	41	62	0.661	0.620	1.0	32.0	33.0	164
	315	15	38	39	0.974	0.680	1.0	32.0	33.0	152
	700	15	9	11	0.818	0.680	1.0	32.0	33.0	36
	1100	15	13	11	1.182	0.680	1.0	32.0	33.0	52
	1600	15	9	10	0.900	0.680	1.0	32.0	33.0	36
	2105	30	78	88	0.886	0.680	1.0	32.0	33.0	156
	2300	32	80	105	0.762	0.680	1.0	32.0	33.0	150
01-Oct	615	15	3	4	0.750	0.680	1.0	32.0	33.0	12
	1100	15	3	2	1.500	0.680	1.0	32.0	33.0	12
Total	300	5,661	7,874	8,268	0.952					

Appendix C.4. Oscilloscope data used to calibrate the right–bank sonar counter at the Toklat River project site, 1996.

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
14–Aug	2047	10	0	0	--	0.090	2.0	31.0	33.0	0
	2347	10	3	7	0.429	0.200	2.0	31.0	33.0	18
15–Aug	135	10	0	0	--	0.200	2.0	31.0	33.0	0
	649	10	0	0	--	0.200	2.0	31.0	33.0	0
	1628	15	0	0	--	0.200	2.0	31.0	33.0	0
	2130	15	0	0	--	0.200	2.0	31.0	33.0	0
16–Aug	25	15	0	0	--	0.200	2.0	31.0	33.0	0
	601	15	0	0	--	0.200	2.0	31.0	33.0	0
	1111	15	0	0	--	0.200	2.0	31.0	33.0	0
	1640	10	0	0	--	0.200	2.5	31.0	33.5	0
	2350	16	1	3	0.333	0.200	2.5	31.0	33.5	4
17–Aug	810	10	0	0	--	0.200	2.5	31.0	33.5	0
	1150	20	0	1	0.000	0.200	2.5	31.0	33.5	0
	1617	15	0	0	--	0.200	2.5	31.0	33.5	0
	2110	10	1	2	0.500	0.200	2.5	31.0	33.5	6
	2355	20	0	0	--	0.200	2.5	31.0	33.5	0
18–Aug	831	15	0	0	--	0.200	2.5	31.0	33.5	0
	1615	15	1	2	0.500	0.200	1.5	31.0	32.5	4
	2110	10	1	1	1.000	0.200	1.5	31.0	32.5	6
	2345	23	0	0	--	0.200	1.5	31.0	32.5	0
19–Aug	805	15	0	0	--	0.200	1.5	31.0	32.5	0
	1510	10	0	0	--	0.200	1.5	31.0	32.5	0
	1649	10	1	1	1.000	0.200	1.5	31.0	32.5	6
	2100	10	0	0	--	0.200	1.5	31.0	32.5	0
	2347	10	1	2	0.500	0.200	1.5	31.0	32.5	6
20–Aug	618	15	0	0	--	0.200	1.5	40.0	41.5	0
	1145	15	0	0	--	0.200	1.5	40.0	41.5	0
	1635	10	0	0	--	0.200	1.0	40.0	41.0	0
	2115	10	1	1	1.000	0.200	1.0	40.0	41.0	6
	2310	10	0	0	--	0.200	1.0	40.0	41.0	0
21–Aug	645	15	0	0	--	0.200	1.0	40.0	41.0	0
	1212	10	0	0	--	0.200	1.0	40.0	41.0	0
	1652	15	0	0	--	0.200	1.0	40.0	41.0	0
	2115	10	2	2	1.000	0.200	1.0	40.0	41.0	12
	2330	10	1	1	1.000	0.200	1.0	40.0	41.0	6
22–Aug	655	15	0	0	--	0.200	1.0	40.0	41.0	0
	1125	10	0	0	--	0.200	1.0	40.0	41.0	0
	1745	10	0	0	--	0.200	1.0	40.0	41.0	0
	2125	10	1	1	1.000	0.200	1.0	40.0	41.0	6
	2340	10	0	0	--	0.200	1.0	40.0	41.0	0
23–Aug	650	10	0	0	--	0.200	1.0	40.0	41.0	0
	1100	10	0	0	--	0.200	1.0	40.0	41.0	0
	1610	10	0	0	--	0.200	1.0	40.0	41.0	0
	2115	10	0	0	--	0.200	1.0	40.0	41.0	0
	2315	10	0	0	--	0.200	1.0	40.0	41.0	0
24–Aug	710	10	0	0	--	0.200	1.0	40.0	41.0	0
	1110	10	0	0	--	0.200	1.0	40.0	41.0	0
	1708	10	0	0	--	0.200	1.0	40.0	41.0	0
	2115	10	0	0	--	0.200	1.0	40.0	41.0	0
	2315	10	2	2	1.000	0.200	1.0	40.0	41.0	12
25–Aug	735	10	0	0	--	0.200	1.0	40.0	41.0	0
	1125	10	0	0	--	0.200	1.0	40.0	41.0	0
	1807	10	0	0	--	0.200	1.0	40.0	41.0	0
	2147	10	0	0	--	0.200	1.0	40.0	41.0	0
	2340	10	1	1	1.000	0.200	1.0	40.0	41.0	6
26–Aug	732	10	0	0	ERR	0.200	1.0	40.0	41.0	0
	1135	10	0	0	ERR	0.200	1.0	40.0	41.0	0
	1637	10	0	0	ERR	0.200	1.0	40.0	41.0	0
	2140	15	0	0	ERR	0.200	1.0	32.0	33.0	0
	2315	10	3	2	1.500	0.200	1.0	32.0	33.0	18

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Appendix C.4. (page 2 of 5).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
27–Aug	335	10	2	2	1.000	0.200	1.0	32.0	33.0	12
	650	15	1	2	0.500	0.200	1.0	32.0	33.0	4
	1147	15	0	0	--	0.200	1.0	32.0	33.0	0
	1620	15	0	0	--	0.200	1.0	32.0	33.0	0
	2130	10	1	1	1.000	0.200	1.0	32.0	33.0	6
	2335	10	3	2	1.500	0.200	1.0	32.0	33.0	18
28–Aug	335	15	0	0	--	0.200	1.0	32.0	33.0	0
	645	15	0	0	--	0.200	1.0	32.0	33.0	0
	735	15	8	11	0.727	0.200	1.0	32.0	33.0	32
	1138	20	4	6	0.667	0.200	1.0	32.0	33.0	12
	1650	10	0	0	--	0.200	1.0	32.0	33.0	0
	2125	18	11	17	0.647	0.200	1.0	32.0	33.0	37
	2330	15	6	19	0.316	0.200	1.0	27.0	28.0	24
	2350	15	5	6	0.833	0.400	1.0	27.0	28.0	20
29–Aug	344	20	9	8	1.125	0.400	1.0	27.0	28.0	27
	758	16	4	5	0.800	0.400	1.0	27.0	28.0	15
	1101	15	0	0	--	0.400	1.0	27.0	28.0	0
	1623	15	6	7	0.857	0.400	1.0	27.0	28.0	24
	2138	20	11	5	2.200	0.400	1.0	27.0	28.0	33
	2345	30	16	22	0.727	0.400	1.0	27.0	28.0	32
30–Aug	337	15	14	23	0.609	0.400	1.0	27.0	28.0	56
	645	15	7	8	0.875	0.400	1.0	27.0	28.0	28
	1133	15	8	8	1.000	0.400	1.0	27.0	28.0	32
	1627	15	5	5	1.000	0.400	1.0	27.0	28.0	20
	2138	20	13	11	1.182	0.400	1.0	27.0	28.0	39
	2335	25	23	24	0.958	0.400	1.0	27.0	28.0	55
31–Aug	345	30	25	31	0.806	0.400	1.0	27.0	28.0	50
	645	15	1	2	0.500	0.400	1.0	27.0	28.0	4
	1117	15	0	0	--	0.400	1.0	27.0	28.0	0
	1618	15	4	4	1.000	0.400	1.0	27.0	28.0	16
	2128	15	2	1	2.000	0.400	1.0	27.0	28.0	8
	2355	20	38	51	0.745	0.400	1.0	27.0	28.0	114
01–Sep	18	20	32	36	0.889	0.450	1.0	27.0	28.0	96
	331	25	29	26	1.115	0.450	1.0	27.0	28.0	70
	639	15	8	8	1.000	0.450	1.0	27.0	28.0	32
	1118	15	1	1	1.000	0.450	1.0	27.0	28.0	4
	1617	19	5	17	0.294	0.450	1.0	27.0	28.0	16
	2133	27	37	27	1.370	0.450	1.0	27.0	28.0	82
	2203	10	21	19	1.105	0.450	1.0	27.0	28.0	126
	2330	27	70	85	0.824	0.450	1.0	27.0	28.0	156
02–Sep	2	15	32	35	0.914	0.500	1.0	27.0	28.0	128
	333	26	45	43	1.047	0.500	1.0	27.0	28.0	104
	627	20	13	12	1.083	0.500	1.0	27.0	28.0	39
	1117	15	3	4	0.750	0.500	1.0	27.0	28.0	12
	1617	15	0	0	--	0.500	1.0	27.0	28.0	0
	2118	15	7	6	1.167	0.500	1.0	27.0	28.0	28
	2345	25	40	29	1.379	0.500	1.0	27.0	28.0	96
03–Sep	15	15	23	21	1.095	0.450	1.0	27.0	28.0	92
	345	20	23	19	1.211	0.450	1.0	27.0	28.0	69
	407	10	9	9	1.000	0.430	1.0	27.0	28.0	54
	644	15	3	2	1.500	0.430	1.0	27.0	28.0	12
	1118	15	3	2	1.500	0.430	1.0	27.0	28.0	12
	1615	15	7	8	0.875	0.430	1.0	26.0	27.0	28
	2121	15	11	11	1.000	0.430	1.0	26.0	27.0	44
	2345	15	30	40	0.750	0.430	1.0	26.0	27.0	120
04–Sep	2	15	34	36	0.944	0.550	1.0	26.0	27.0	136
	328	30	70	65	1.077	0.550	1.0	26.0	27.0	140
	644	15	1	1	1.000	0.550	1.0	26.0	27.0	4
	1107	15	0	0	--	0.550	1.0	26.0	27.0	0
	1640	15	0	0	--	0.550	1.0	26.0	27.0	0
	2144	15	0	0	--	0.550	1.0	26.0	27.0	0
	2320	30	55	66	0.833	0.550	1.0	26.0	27.0	110
05–Sep	315	15	9	12	0.750	0.550	1.0	26.0	27.0	36
	640	15	11	9	1.222	0.550	1.0	26.0	27.0	44

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Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	1110	15	1	1	1.000	0.550	1.0	26.0	27.0	4
	1620	15	1	1	1.000	0.550	1.0	26.0	27.0	4
	2144	15	4	4	1.000	0.550	1.0	26.0	27.0	16
	2330	30	62	67	0.925	0.550	1.0	26.0	27.0	124
06–Sep	319	15	9	12	0.750	0.550	1.0	26.0	27.0	36
	642	15	8	9	0.889	0.550	1.0	26.0	27.0	32
	1140	15	0	0	––	0.550	1.0	26.0	27.0	0
	1625	15	4	5	0.800	0.550	1.0	26.0	27.0	16
	2100	15	0	0	––	0.550	1.0	26.0	27.0	0
	2315	30	25	25	1.000	0.550	1.0	26.0	27.0	50
07–Sep	330	15	9	9	1.000	0.550	1.0	26.0	27.0	36
	643	15	4	3	1.333	0.550	1.0	26.0	27.0	16
	1137	15	1	1	1.000	0.550	1.0	26.0	27.0	4
	1701	17	2	3	0.667	0.550	1.0	26.0	27.0	7
	2115	15	5	4	1.250	0.550	1.0	26.0	27.0	20
	2332	15	9	14	0.643	0.550	1.0	26.0	27.0	36
08–Sep	332	15	9	8	1.125	0.550	1.0	26.0	27.0	36
	700	15	3	2	1.500	0.550	1.0	26.0	27.0	12
	1125	15	2	2	1.000	0.550	1.0	26.0	27.0	8
	1618	18	5	4	1.250	0.550	1.0	26.0	27.0	17
	2115	16	3	3	1.000	0.550	1.0	26.0	27.0	11
	2330	30	47	46	1.022	0.550	1.0	26.0	27.0	94
09–Sep	332	16	6	6	1.000	0.550	1.0	26.0	27.0	23
	651	15	2	2	1.000	0.550	1.0	26.0	27.0	8
	1101	17	3	2	1.500	0.550	1.0	26.0	27.0	11
	1620	15	0	0	––	0.550	1.0	26.0	27.0	0
	2115	15	5	4	1.250	0.550	1.0	26.0	27.0	20
	2330	30	45	48	0.938	0.550	1.0	26.0	27.0	90
10–Sep	330	15	8	9	0.889	0.550	1.0	26.0	27.0	32
	636	20	7	5	1.400	0.550	1.0	26.0	27.0	21
	1140	15	5	4	1.250	0.550	1.0	26.0	27.0	20
	1645	15	0	0	––	0.550	1.0	26.0	27.0	0
	2115	15	4	1	4.000	0.550	1.0	26.0	27.0	16
	2309	30	30	35	0.857	0.550	1.0	26.0	27.0	60
11–Sep	330	15	3	2	1.500	0.550	1.0	26.0	27.0	12
	649	30	25	23	1.087	0.550	1.0	26.0	27.0	50
	1135	20	3	4	0.750	0.550	1.0	26.0	27.0	9
	1615	15	1	1	1.000	0.550	1.0	26.0	27.0	4
	2115	15	8	10	0.800	0.550	1.0	26.0	27.0	32
	2335	30	28	28	1.000	0.550	1.0	26.0	27.0	56
12–Sep	339	20	11	14	0.786	0.550	1.0	26.0	27.0	33
	645	15	3	3	1.000	0.550	1.0	26.0	27.0	12
	1116	15	3	4	0.750	0.550	1.0	26.0	27.0	12
	1616	15	0	0	––	0.550	1.0	26.0	27.0	0
	2122	15	8	7	1.143	0.550	1.0	26.0	27.0	32
	2352	30	32	33	0.970	0.550	1.0	26.0	27.0	64
13–Sep	335	15	8	10	0.800	0.550	1.0	26.0	27.0	32
	615	15	0	0	––	0.550	1.0	26.0	27.0	0
	1115	15	0	0	––	0.550	1.0	26.0	27.0	0
	1621	30	1	1	1.000	0.550	2.0	25.0	27.0	2
	2210	30	21	20	1.050	0.550	2.0	25.0	27.0	42
14–Sep	1	30	18	13	1.385	0.550	2.0	25.0	27.0	36
	305	15	9	8	1.125	0.550	2.0	25.0	27.0	36
	633	15	6	5	1.200	0.550	2.0	25.0	27.0	24
	1115	15	0	0	––	0.550	2.0	25.0	27.0	0
	1615	15	2	1	2.000	0.550	2.0	25.0	27.0	8
	2202	16	9	14	0.643	0.550	2.0	25.0	27.0	34
	2330	25	6	7	0.857	0.550	2.0	25.0	27.0	14
15–Sep	332	25	16	15	1.067	0.550	2.0	25.0	27.0	38
	640	15	0	0	––	0.550	2.0	25.0	27.0	0
	1120	15	0	0	––	0.550	2.0	25.0	27.0	0
	1615	15	0	0	––	0.550	2.0	25.0	27.0	0

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Appendix C.4. (page 4 of 5).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctng Range	Total Range	Passage Rate (Fish/hour)
	2225	15	11	9	1.222	0.550	2.0	25.0	27.0	44
16-Sep	25	30	55	54	1.019	0.550	2.0	25.0	27.0	110
	345	20	24	23	1.043	0.550	2.0	25.0	27.0	72
	630	20	9	11	0.818	0.550	2.0	25.0	27.0	27
	1115	15	2	2	1.000	0.550	2.0	25.0	27.0	8
	1635	15	0	0	--	0.550	2.0	25.0	27.0	0
	2200	30	60	60	1.000	0.550	1.0	26.0	27.0	120
	2337	30	94	97	0.969	0.550	1.0	26.0	27.0	186
17-Sep	337	30	68	88	0.773	0.550	1.0	26.0	27.0	136
	413	10	10	9	1.111	0.650	1.0	26.0	27.0	60
	645	15	3	2	1.500	0.630	1.0	26.0	27.0	12
	1116	15	2	2	1.000	0.630	1.0	26.0	27.0	8
	1616	15	3	3	1.000	0.630	1.0	26.0	27.0	12
	2140	15	28	23	1.217	0.630	1.0	26.0	27.0	112
	2213	15	43	50	0.860	0.550	1.0	26.0	27.0	172
	2334	26	72	71	1.014	0.550	1.0	26.0	27.0	166
18-Sep	350	25	36	37	0.973	0.550	1.0	26.0	27.0	86
	640	20	6	4	1.500	0.550	1.0	26.0	27.0	18
	1116	15	5	6	0.833	0.550	1.0	26.0	27.0	20
	1806	16	11	10	1.100	0.550	1.0	26.0	27.0	41
	2135	25	77	67	1.149	0.550	1.0	26.0	27.0	185
	2201	10	43	41	1.049	0.520	1.0	26.0	27.0	258
	2335	20	75	89	0.843	0.520	1.0	26.0	27.0	225
19-Sep	330	30	29	31	0.935	0.520	1.0	26.0	27.0	58
	633	20	18	15	1.200	0.520	1.0	26.0	27.0	54
	1117	10	0	0	--	0.520	1.0	26.0	27.0	0
	1625	15	2	2	1.000	0.520	1.0	26.0	27.0	8
	2131	20	24	26	0.923	0.520	1.0	26.0	27.0	72
	2330	30	35	30	1.167	0.520	1.0	26.0	27.0	70
20-Sep	331	20	27	24	1.125	0.520	1.0	26.0	27.0	81
	635	18	9	9	1.000	0.520	1.0	26.0	27.0	30
	1142	15	2	2	1.000	0.520	1.0	26.0	27.0	8
	1620	15	3	3	1.000	0.520	1.0	26.0	27.0	12
	2115	30	44	50	0.880	0.520	1.0	26.0	27.0	88
	2335	21	65	68	0.956	0.520	1.0	26.0	27.0	186
21-Sep	335	27	71	78	0.910	0.520	1.0	26.0	27.0	158
	640	20	15	20	0.750	0.520	1.0	26.0	27.0	45
	705	20	3	2	1.500	0.520	1.0	26.0	27.0	9
	1131	17	2	2	1.000	0.520	1.0	26.0	27.0	7
	1627	15	6	7	0.857	0.520	1.0	26.0	27.0	24
	2115	15	9	13	0.692	0.520	1.0	26.0	27.0	36
	2340	20	11	9	1.222	0.520	1.0	26.0	27.0	33
22-Sep	320	30	35	38	0.921	0.520	1.0	26.0	27.0	70
	640	20	8	5	1.600	0.520	1.0	26.0	27.0	24
	838	15	5	6	0.833	0.520	1.0	26.0	27.0	20
	1127	17	1	2	0.500	0.520	1.0	26.0	27.0	4
	2130	15	20	20	1.000	0.520	1.0	26.0	27.0	80
	2320	15	8	7	1.143	0.520	1.0	26.0	27.0	32
23-Sep	315	15	4	5	0.800	0.520	1.0	26.0	27.0	16
	711	15	6	7	0.857	0.520	1.0	26.0	27.0	24
	1100	15	1	1	1.000	0.520	1.0	26.0	27.0	4
	1627	15	0	0	--	0.520	1.0	26.0	27.0	0
	2135	15	5	6	0.833	0.520	1.0	26.0	27.0	20
	2345	15	2	1	2.000	0.520	1.0	26.0	27.0	8
24-Sep	315	15	7	11	0.636	0.520	1.0	26.0	27.0	28
	640	25	10	10	1.000	0.520	1.0	26.0	27.0	24
	1125	20	4	7	0.571	0.520	1.0	26.0	27.0	12
	1625	15	0	0	--	0.520	1.0	22.0	23.0	0
	2115	15	0	0	--	0.520	1.0	22.0	23.0	0
	2335	20	14	15	0.933	0.520	1.0	22.0	23.0	42
25-Sep	319	15	5	7	0.714	0.520	1.0	22.0	23.0	20
	640	30	14	15	0.933	0.520	1.0	22.0	23.0	28
	1120	15	3	3	1.000	0.520	1.0	22.0	23.0	12

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Appendix C.4. (page 5 of 5).

Date	Time Start	Duration (minutes)	Scope Count	Sonar Count	Adjustment Factor	PRR	Dead Range	Ctrig Range	Total Range	Passage Rate (Fish/hour)
	1630	15	6	6	1.000	0.520	1.0	22.0	23.0	24
	2130	30	37	45	0.822	0.520	1.0	22.0	23.0	74
	2330	30	27	32	0.844	0.520	1.0	22.0	23.0	54
26-Sep	330	15	9	14	0.643	0.520	1.0	22.0	23.0	36
	640	20	29	40	0.725	0.520	1.0	22.0	23.0	87
	725	15	6	5	1.200	0.550	1.0	22.0	23.0	24
	1115	15	5	5	1.000	0.550	1.0	22.0	23.0	20
	1640	15	4	5	0.800	0.550	1.0	22.0	23.0	16
	2130	30	54	52	1.038	0.550	1.0	22.0	23.0	108
	2335	20	29	32	0.906	0.550	1.0	22.0	23.0	87
27-Sep	330	30	38	52	0.731	0.550	1.0	22.0	23.0	76
	647	30	15	16	0.938	0.550	1.0	22.0	23.0	30
	1129	20	6	9	0.667	0.550	1.0	22.0	23.0	18
	1635	15	1	0	--	0.550	1.0	22.0	23.0	4
	2130	30	155	140	1.107	0.550	1.0	22.0	23.0	310
	2330	30	40	37	1.081	0.550	1.0	22.0	23.0	80
28-Sep	330	30	43	37	1.162	0.550	1.0	22.0	23.0	86
	638	30	14	14	1.000	0.550	1.0	22.0	23.0	28
	1215	15	8	11	0.727	0.550	1.0	22.0	23.0	32
	1615	15	3	2	1.500	0.550	1.0	22.0	23.0	12
	2130	30	124	120	1.033	0.550	1.0	22.0	23.0	248
29-Sep	32	30	101	84	1.202	0.550	1.0	22.0	23.0	202
	107	20	41	39	1.051	0.520	1.0	22.0	23.0	123
	355	30	38	35	1.086	0.520	1.0	22.0	23.0	76
	630	15	2	2	1.000	0.520	1.0	22.0	23.0	8
	1120	15	0	0	--	0.520	1.0	22.0	23.0	0
	1615	15	2	2	1.000	0.520	1.0	22.0	23.0	8
	2135	30	78	65	1.200	0.520	1.0	22.0	23.0	156
30-Sep	6	32	90	71	1.268	0.520	1.0	22.0	23.0	169
	40	10	21	19	1.105	0.500	1.0	22.0	23.0	126
	335	30	27	24	1.125	0.500	1.0	22.0	23.0	54
	715	15	4	3	1.333	0.500	1.0	22.0	23.0	16
	1120	15	4	3	1.333	0.500	1.0	22.0	23.0	16
	1629	30	3	4	0.750	0.500	1.0	22.0	23.0	6
	2138	32	65	65	1.000	0.500	1.0	22.0	23.0	122
	2335	25	16	18	0.889	0.500	1.0	22.0	23.0	38
01-Oct	630	15	8	10	0.800	0.500	1.0	22.0	23.0	32
	115	15	1	1	1.000	0.500	1.0	22.0	23.0	4
Total	295	5,008	3,846	3,955	0.972					

APPENDIX D

TOKLAT RIVER TEMPORAL SONAR COUNT DATA

APPENDIX D: TOKLAT RIVER TEMPORAL SONAR COUNT DATA.

Appendix D.1. Temporal distribution of daily sonar counts along the left bank Toklat River, 1995.

Printer Printout Time	21-Aug [a]	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug	31-Aug	01-Sep	02-Sep	03-Sep	04-Sep	05-Sep
0100		5	4	13				60	201	136	32			13		
0200		2	0	9				62	190	163	34			26		
0300		8	1	16				12	299	200	47			31		
0400		11	5	18				18	321	172	38			37		
0500		17	16	13				3	271	147	44		(279)	37		
0600		4	2	8				28	199	143	66		(46.3%)	18		
0700		2	4	2				103	94	110	42			39		
0800		3	3	3			(1,279)	122	116	105	36			24		
0900	(29)	4	9	2			(52.1%)	65	60	93	23			77		
1000	(66.1%)	6	2	2				71	86	105	29			18		
1100		4	2	8		(1,699)		41	62	40	25	(662)	21	22		(2,649)
1200		5	3	8				79	65	24	26		29	30		
1300		6	8	6				44	51	30	11		46	38		
1400		3	8	2			41	62	63	20	1		23	20		
1500		1	3	2	(942)		70	91	64	49	0		28	28		
1600		1	3	4			143	63	48	68	0		39	39		
1700		2	1	2			104	80	69	53	0		26	23	(1,720)	
1800		3	4	4			92	50	104	49			14	21		
1900	2	6	1				93	66	23	61			22	33		
2000	3	16	3				69	128	49	165			23	24		
2100	5	1	12	(63)			100	129	110	47	(268)		14	27		
2200	3	4	6	(33.9%)			114	140	92	68	(37.1%)		12			
2300	0	16	12				150	152	98	76			12	(166)		
2400	2	15	4				201	190	59	67			15	(21.0%)		
Daily Passage Estimate	44	145	116	185	942	1,699	2,456	1,879	2,794	2,213	722	662	603	791	1,720	2,649
Percent	0.0%	0.2%	0.1%	0.2%	1.1%	1.9%	2.7%	2.1%	3.1%	2.5%	0.8%	0.7%	0.7%	0.9%	1.9%	3.0%

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[a] Totals exclude days with partial counts (21, 24, 27, 31 August and 2, 3, 6, 21, 24 September), no counts (25, 26 August and 1, 4, 5, 22, 23 September) and 11-16 & 25-27 September.
[b] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.
[c] Total estimated passage, including days with expanded counts.

Appendix D.1. (page 2 of 3).

Printer Printout Time	06-Sep	07-Sep	08-Sep	09-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep
0100		283	159	101	75	210	263	290	558	446	368	244	326	329	236	346
0200		302	157	64	54	226	235	298	562	659	408	239	248	186	250	240
0300		303	151	81	60	319	265	277	390	445	338	198	250	232	220	39
0400		311	134	63	78	186	280	313	495	472	355	159	195	254	173	181
0500		259	190	80	98	271	254	284	511	570	345	127	149	208	178	70
0600		208	149	70	56	227	277	271	531	493	316	163	119	128	138	43
0700	(2,050)	144	140	42	62	223	223	197	341	314	187	99	127	101	97	69
0800	(57.3%)	43	76	4	67	97	128	244	282	270	265	57	247	31	93	75
0900		112	130	26	71	227	304	253	146	278	219	119	107	51	71	75
1000		114	91	14	67	126	245	172	178	346	301	123	94	28	60	82
1100		64	99	5	54	218	65	213	172	423	342	70	49	46	69	
1200		46	80	1	60	139	166	220	200	295	214	89	59	35	65	
1300		33	82	64	41	117	152	201	289	132	84	89	87	100	82	
1400		20	153	126	89	95	160	201	277	232	73	112	80	78	158	
1500		39	141	60	79	124	164	220	272	418	123	68	57	75	82	
1600	93	46	140	54	74	121	154	276	320	490	142	111	119	93	95	
1700	95	40	93	41	78	126	136	253	285	242	60	146	138	84	108	
1800	92	31	151	17	89	303	171	220	370	602	181	121	263	56	86	
1900	140	73	122	106	94	263	192	206	329	556	138	133	221	104	139	(1,415)
2000	203	73	99	80	147	302	174	307	371	521	230	186	231	87	170	(53.7%)
2100	174	81	118	102	90	368	223	287	432	456	221	252	382	175	143	
2200	188	65	92	49	34	204	240	248	423	395	220	356	310	350	314	
2300	265	175	99	87	184	267	324	433	570	461	435	465	519	321	365	
2400	277	167	65	90	213	291	303	405	522	461	335	374	461	241	285	
Daily Passage Estimate	3,577	3,032	2,911	1,427	2,014	3,096	3,123	3,853	5,408	5,118	4,484	4,100	4,836	3,425	3,665	2,635
Percent	4.0%	3.4%	3.3%	1.6%	2.3%	3.5%	3.5%	4.3%	6.0%	5.8%	5.0%	4.6%	5.4%	3.8%	4.1%	2.9%

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[a] Totals exclude days with partial counts (21, 24, 27, 31 August and 2, 3, 6, 21, 24 September), no counts (25, 26 August and 1, 4, 5, 22, 23 September) and 11–16 & 25–27 September.

[b] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.

[c] Total estimated passage, including days with expanded counts.

Appendix D.1. (page 3 of 3).

Printer Printout Time	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	01-Oct	02-Oct	03-Oct	Total [a]	% passage by time
0100				288	230	226	316	55	64	54	4	5	2,363	0.069
0200				292	289	293	361	51	49	53	6	7	2,083	0.061
0300			(612)	265	232	305	388	85	40	26	7	4	2,177	0.063
0400			(48.1%)	282	197	228	360	69	34	14	8	3	2,022	0.059
0500				369	229	220	275	49	29	7	10	5	1,843	0.054
0600				477	370	151	270	41	12	7	6	2	1,475	0.043
0700				268	289	300	217	21	4	7	5	1	1,163	0.034
0800				166	162	192	300	10	6	6	0	1	990	0.029
0900		(1,727)		295	336	212		4	6	9	1	2	940	0.027
1000				329	257	219		4	6	6	10	2	879	0.026
1100				361	310	271		6	6	6	0	1	624	0.018
1200			47	197	82	257	38	4	6	15	0	2	638	0.019
1300	(2,181)		206	150	25	277	15	2	4	0	8	0	731	0.021
1400			215	255	52	349	9	10	0	1	0	0	981	0.029
1500			248	246	27	481	11	9	1	0	0	0	819	0.024
1600			246	212	58	324	25	28	1	4	0	0	948	0.028
1700			320	157	41	567	13	39	3	2	1	0	978	0.028
1800			215	265	64	282	16	24	4	2	1	3	1,090	0.032
1900			250	420	46	250	23	10	1	2	5	11	1,198	0.035
2000			266	380	60	293	56	11	6	2	14	5	1,472	0.043
2100			304	357	57	313	90	33	38	31	13	20	1,777	0.052
2200			296	299	68	252	112	80	62	22	43	15	2,102	0.061
2300			268	253	208	271	83	68	42	23	27	7	2,736	0.079
2400			268	271	185	232	73	73	49	15	14	10	2,392	0.069
													34,421 [a]	
Daily Passage Estimate	2,181	1,727	1,273	1,439	809	1,420	1,086	1,146	473	314	183	106	89,482 [c]	
Percent	2.4%	1.9%	1.4%	1.6%	0.9%	1.6%	1.2%	1.3%	0.5%	0.4%	0.2%	0.1%	100.0%	

[a] Totals exclude days with partial counts (21, 24, 27, 31 August and 2, 3, 6, 21, 24 September), no counts (25, 26 August and 1, 4, 5, 22, 23 September) and 11-16 & 25-27 September.
[b] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.
[c] Total estimated passage, including days with expanded counts.

Appendix D.2. Temporal distribution of daily sonar counts along the right bank Toklat River, 1995.

Printer Printout Time	01-Sep	02-Sep	03-Sep	04-Sep	05-Sep	06-Sep	07-Sep	08-Sep	09-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep
0100		6	6			3	21	30	43	33	16	10	11	34	25	17	34
0200		2	8			8	30	60	40	45	9	29	3	56	16	24	46
0300		1	5			9	26	42	49	51	44	13	6	48	17	19	34
0400		3	5			3	38	36	52	40	17	25	11	37	18	28	27
0500		5	15			6	17	8	73	11	22	9	17	36	31	6	42
0600		0	11			9	40	8	63	19	11	27	12	40	21	11	53
0700		2	12			3	13	20	54	29	15	9	15	26	13	9	12
0800		0	1			18	15	34	35	36	11	47	33	20	15	11	6
0900		3	18			8	15	14	54	39	11	33	9	13	8	3	7
1000		9	7			2	11	4	26	11	6	20	19	8	1	1	4
1100	(37)	9	1		(23)	7	7	11	32	9	3	13	15	15	3	1	2
1200	(73%)	0	6		(66.6%)	0	1	4	14	16	3	39	21	8	3	0	1
1300		5	1			9	10	15	15	15	19	12	9	41	6	8	4
1400		3	4			17	6	12	14	23	7	21	39	24	6	7	8
1500		4	4	(99)		22	10	5	15	47	14	30	27	34	6	1	3
1600		3	2			6	12	5	6	27	6	13	13	54	9	0	11
1700		1	2			6	2	22	7	40	5	13	15	44	2	6	10
1800		4	13			2	15	8	46	54	24	25	28	16	3	0	3
1900		6	5		0	5	4	18	15	26	21	32	30	17	3	2	10
2000		21	0		0	3	8	9	13	24	23	27	8	10	3	11	4
2100	2	1	7		1	2	15	19	18	18	37	22	15	13	1	27	36
2200	6	7	7		7	15	38	22	23	16	21	24	17	21	13	84	59
2300	2	9	(22)		2	9	14	33	30	8	7	36	11	34	41	111	95
2400	4	2	(14%)		2	42	17	38	50	19	8	39	22	21	21	79	83
Daily Passage Estimate	51	106	162	99	35	214	385	477	767	656	359	570	406	670	283	466	594
Percent	0.3%	0.5%	0.8%	0.5%	0.2%	1.1%	2.0%	2.5%	4.1%	3.4%	1.9%	3.0%	2.1%	3.5%	1.5%	2.4%	3.1%

–continued–

[a] Totals only include days with 24–hour counts (i.e., excludes 1, 3–5, and 21–23 September)
[b] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.
[c] Total estimated passage, including days with expanded counts.

Appendix D.2. (page 2 of 2).

Printer Printout Time	18–Sep	19–Sep	20–Sep	21–Sep	22–Sep	23–Sep	24–Sep	25–Sep	26–Sep	27–Sep	28–Sep	29–Sep	30–Sep	01–Oct	02–Oct	03–Oct	Total [a]	% passage by time
0100	60	92	111	65			24	76	48	62	26	40	20	37	12	13	924	0.059
0200	42	98	71	56			45	43	48	73	37	44	16	10	10	3	906	0.058
0300	48	117	64	56			58	50	48	62	29	49	26	22	4	11	947	0.061
0400	28	104	25	64			51	36	33	82	39	44	15	10	4	7	811	0.052
0500	38	33	52	36		(346)	96	82	26	62	43	29	6	19	7	8	804	0.052
0600	49	34	27	27		(53.2%)	72	70	46	36	26	27	11	20	3	5	740	0.048
0700	14	30	30	38			54	82	37	37	41	12	6	0	0	5	568	0.037
0800	14	6	40	33			31	69	106	50	32	31	1	4	2	2	659	0.042
0900	5	6	25	77			39	35	75	49	34	9	0	4	0	1	499	0.032
1000	2	4	14	67			35	49	73	47	6	1	1	4	1	0	360	0.023
1100	5	3	20	23			46	51	28	29	4	3	1	9	1	1	330	0.021
1200	9	4	16	26			57	56	61	26	21	5	1	7	1	0	374	0.024
1300	14	1	16	53	(1,125)		37	36	31	30	6	9	0	0	0	2	350	0.023
1400	10	5	16	60		15	43	45	61	24	4	29	0	0	0	2	426	0.027
1500	6	4	5	42		7	49	69	45	21	3	2	0	1	0	1	424	0.027
1600	2	10	7	19		19	44	59	30	28	2	11	0	0	0	0	361	0.023
1700	12	7	12	46		16	31	49	39	57	13	9	1	5	2	0	409	0.026
1800	14	23	16	119		25	33	60	37	26	10	5	5	2	3	1	463	0.030
1900	25	32	11	118		17	67	59	22	29	6	0	3	0	2	1	446	0.029
2000	24	83	56	139		32	50	50	31	56	20	0	6	2	2	4	550	0.035
2100	64	67	60	128		38	71	45	37	44	53	25	15	14	15	17	791	0.051
2200	167	135	64	82		22	98	73	58	48	79	53	46	14	27	14	1,236	0.079
2300	162	83	61	(223)		44	58	61	67	49	44	57	34	20	36	13	1,175	0.076
2400	97	62	42	(14.0%)		70	66	65	58	34	42	28	34	12	15	2	997	0.064
																	15,560 [a]	
Daily Passage Estimate	931	1,064	663	1,599	1,125	651	1,257	1,360	1,133	1,101	622	522	248	218	147	113	19,274 [c]	
Percent	4.8%	5.5%	4.5%	8.3%	5.8%	3.4%	6.5%	7.1%	5.9%	5.7%	3.2%	2.7%	1.3%	1.1%	0.8%	0.6%	100.0%	

[a] Totals only include days with 24–hour counts (i.e., excludes 1, 3–5, and 21–23 September)

[b] Boxed areas indicate times when passage was estimated by interpolation, extrapolation, or other means.

[c] Total estimated passage, including days with expanded counts.

Appendix D.3. Temporal distribution of daily sonar counts along the left bank Toklat River, 1998.

Printer Printout Time	14-Aug[b]	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug
0100		17	17				14	2	21	1	17	18	59	106	62	42	71
0200		22	15				30	10	78	17	37	57	76	67	71	63	101
0300		22	16				21	10	45	5	29	66	60	105	77	75	92
0400		18	12				30	6	39	27	37	64	51	144	51	74	77
0500		6	18				24	6	39	8	67	66	54	54	44	75	93
0600		1	12				24	4	52	31	102	99	60	84	33	52	51
0700	(163)	5	9	(318)	(372)	(262)	17	9	53	12	44	50	18	42	44	29	15
0800	(67.5%)	0	4			(66.0%)	37	2	44	16	52	45	37	51	28	18	12
0900		1	5				10	15	17	35	31	51	37	32	19	8	8
1000		0	3				22	8	18	28	25	33	23	16	8	6	0
1100		1	7				12	13	4	34	29	28	21	16	5	0	9
1200		1	10				12	9	10	0	6	46	39	3	2	0	3
1300		3	1				12	10	11	0	13	22	8	7	16	1	0
1400		3	1				10	4	6	21	18	26	14	7	6	1	0
1500		4	9			8	12	4	8	40	5	24	13	5	9	4	0
1600		11	3			40	44	3	17	40	16	21	14	9	2	1	2
1700		4	7			14	10	3	8	8	14	17	23	8	0	1	0
1800	10	3	32			7	7	14	6	23	18	20	18	1	5	0	1
1900	15	10				16	4	2	17	13	23	51	18	11	5	0	3
2000	2	5				6	8	9	3	22	21	32	26	14	13	4	2
2100	18	8	(83)			10	4	15	0	34	15	29	32	28	11	6	7
2200	13	8	(31.5%)			8	4	8	10	35	18	67	34	39	25	35	27
2300	15	5				12	3	10	11	16	39	64	32	45	43	37	46
2400	15	10				25	0	15	65	18	19	104	65	77	28	58	89
Daily Passage Estimate	271	168	264	318	372	428	371	187	382	484	695	1,100	834	991	607	590	709
Percent	0.2%	0.3%	0.3%	0.0%	0.0%	0.3%	0.7%	0.4%	1.1%	0.9%	1.3%	2.1%	1.6%	1.9%	1.1%	1.1%	1.3%

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[a] Totals only include days with 24-hour counts (i.e., excludes 14 and 16-19 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

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Printer Printout Time	31-Aug	01-Sep	02-Sep	03-Sep	04-Sep	05-Sep	06-Sep	07-Sep	08-Sep	09-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep
0100	165	142	167	203	312	173	140	139	275	272	260	212	210	184	144	155	274
0200	145	146	158	164	187	131	121	111	180	184	185	194	227	270	199	164	249
0300	94	119	58	96	71	95	134	95	127	129	83	171	155	200	150	174	202
0400	83	129	70	79	98	87	50	96	130	115	172	140	113	119	147	132	272
0500	56	132	88	77	116	58	69	51	86	170	114	140	123	116	93	110	178
0600	52	80	40	37	106	34	49	22	57	105	55	91	72	78	65	112	100
0700	6	40	31	23	10	12	18	7	15	22	12	19	29	45	9	40	42
0800	17	19	20	10	18	2	11	3	11	8	0	10	27	16	4	14	19
0900	3	15	11	10	6	0	2	0	6	3	3	1	5	3	4	4	17
1000	3	9	10	17	3	2	4	0	0	1	1	0	13	3	0	0	10
1100	2	12	8	13	3	0	0	0	1	3	1	1	0	2	1	0	5
1200	1	14	1	17	6	0	0	0	0	0	3	1	2	0	0	5	9
1300	3	3	1	1	0	2	0	0	2	2	3	1	1	2	0	0	4
1400	1	4	0	0	0	0	0	0	0	0	0	3	0	0	0	3	5
1500	0	1	0	2	0	1	0	0	0	8	0	0	3	9	3	0	1
1600	1	4	0	2	0	0	0	0	0	4	1	0	0	1	0	1	1
1700	8	2	0	0	0	3	2	0	1	4	0	0	0	5	0	0	7
1800	9	1	0	2	0	0	0	0	3	8	1	1	0	10	2	1	13
1900	8	4	7	4	1	1	3	4	2	1	2	2	3	12	2	5	15
2000	27	6	16	6	1	13	1	4	11	1	4	1	13	8	18	10	31
2100	18	11	34	7	7	7	2	2	15	10	1	4	6	8	20	16	30
2200	15	50	52	35	6	16	22	17	47	81	40	39	60	34	162	38	98
2300	78	116	78	104	19	47	24	43	109	113	82	112	102	86	73	95	240
2400	67	206	131	152	214	209	53	186	285	225	149	131	163	80	103	218	334
Daily Passage Estimate	862	1,265	981	1,061	1,186	893	705	780	1,363	1,469	1,172	1,275	1,317	1,291	1,197	1,297	2,156
Percent	1.6%	2.4%	1.8%	2.0%	2.2%	1.7%	1.3%	1.5%	2.6%	2.8%	2.2%	2.4%	2.5%	2.4%	2.2%	2.4%	4.0%

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[a] Totals only include days with 24-hour counts (i.e., excludes 14 and 16-19 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

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Printer Printout Time	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	01-Oct	Total [a]	% passage by time
0100	307	293	396	571	528	53	37	48	57	119	348	220	249	360	164	7,441	0.140
0200	245	245	266	457	259	70	26	61	75	103	158	162	354	311	142	6,460	0.121
0300	195	217	306	362	214	95	30	38	93	136	133	97	152	279	53	5,107	0.096
0400	183	242	128	364	270	66	40	52	46	104	86	63	140	118	47	4,542	0.085
0500	209	169	219	183	253	42	36	30	44	39	62	62	84	137	20	3,882	0.073
0600	187	133	267	71	359	7	25	28	35	53	62	22	53	124	24	3,176	0.060
0700	48	60	116	92	48	16	11	28	18	48	46	53	40	68	13	1,410	0.026
0800	32	23	32	33	21	16	20	26	23	19	15	19	20	29	9	879	0.017
0900	28	51	35	16	22	4	16	3	13	17	19	43	25	37	20	686	0.013
1000	26	15	3	13	8	8	12	1	7	17	9	42	19	44	13	485	0.009
1100	4	26	10	6	8	1	0	1	1	2	5	22	20	21	3	351	0.007
1200	7	20	9	2	0	3	1	1	0	2	5	14	15	26	2	295	0.006
1300	19	13	2	7	0	0	3	0	0	9	3	3	1	31		219	0.004
1400	2	5	6	7	0	0	0	0	0	6	3	0	1	41		205	0.004
1500	1	24	3	2	1	0	1	0	1	2	4	4	1	12		212	0.004
1600	10	15	2	0	0	0	0	0	0	5	4	3	2	47		283	0.005
1700	8	127	9	1	7	0	2	1	6	8	20	4	2	27		350	0.007
1800	8	227	13	4	2	2	0	2	2	3	30		4	14		478	0.009
1900	8	148	10	2	1	7	0	0	8	9	76	35	13	20	(272)	570	0.011
2000	33	164	40	16	1	7	1	9	4	21	48	55	55	28	(34.8%)	810	0.015
2100	57	159	87	25	7	25	7	16	44	55	107	70	112	31		1,188	0.022
2200	176	424	156	162	25	49	51	53	93	168	314	310	214	99		3,404	0.064
2300	223	500	268	298	74	55	66	60	93	70	289	267	167	205		4,505	0.085
2400	382	520	377	291	99	36	54	56	96	175	381	127	151	134		6,333	0.119
																53,271 [a]	
Daily Passage Estimate	2,399	3,819	2,764	2,983	2,207	552	439	514	759	1,190	2,225	1,709	1,894	2,245	782	55,719 [c]	
Percent	4.5%	7.2%	5.2%	5.6%	4.1%	1.0%	0.8%	1.0%	1.4%	2.2%	4.2%	3.2%	3.6%	4.2%	1.0%	100.0%	

[a] Totals only include days with 24-hour counts (i.e., excludes 14 and 16-19 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

Appendix D.4. Temporal distribution of daily sonar counts along the right bank Tokiat River, 1996.

Printer Printout Time	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug	22-Aug	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug	29-Aug	30-Aug
	[b]																
0100		4	0	1	2	3	2	0	0	1	4	2	2	11	4	38	27
0200		3	0	1	0	3	2	1	0	0	0	2	0	17	1	33	35
0300		3	1	1	1	1	2	0	0	1	1	0	0	4	10	38	50
0400		4	1	0	0	1	4	1	9	0	0	3	0	14	3	45	49
0500		4	1	1	0	0	0	5	0	2	0	2	1	5	5	18	43
0600		2	1	1	1	1	0	0	0	0	0	0	1	10	2	14	28
0700		1	0	1	1	1	0	0	0	0	1	0	0	2	9	18	36
0800		2	1	1	0	0	0	0	0	0	1	2	0	2	14	19	32
0900	(55)	1	0	1	0	1	0	0	0	0	0	1	0	3	1	14	58
1000	(71.7%)	0	0	1	0	0	0	0	0	0	0	2	0	8	7	24	42
1100		0	0	1	0	0	0	0	0	0	0	0	0	0	9	2	33
1200		0	1	1	0	1	0	0	0	0	0	0	0	2	6	5	23
1300		0	3	3	1	1	0	0	0	0	0	0	0	2	5	24	36
1400		1	1	1	1	2	0	0	0	0	0	0	0	1	3	31	25
1500		4	1	3	0	0	0	1	0	0	0	0	0	0	3	22	30
1600		1	1	2	3	0	2	3	0	0	0	0	0	5	9	36	18
1700		1	1	1	2	1	0	0	1	0	0	0	0	7	0	9	41
1800		1	1	3	1	0	1	0	0	0	0	0	0	0	10	48	18
1900		1	0	1	0	0	0	0	0	0	0	0	0	3	17	43	35
2000		1	0	1	7	0	0	1	0	0	0	0	0	0	17	21	60
2100	6	2	2	3	1	0	1	0	2	1	0	0	0	0	19	13	26
2200	3	1	2	1	4	0	1	2	1	0	0	0	0	1	23	23	25
2300	7	1	3	1	0	1	0	0	1	0	1	0	18	17	27	34	25
2400	6	1	5	1	1	1	0	1	0	0	6	1	4	16	18	55	62
Daily Passage Estimate	77	39	26	32	26	18	15	15	14	5	14	15	26	130	220	627	657
Percent	0.1%	0.1%	0.1%	0.1%	100.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%	0.7%	1.9%	2.5%

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[a] Totals only include day with 24-hour counts (i.e., excludes 14 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

Appendix D.4. (page 2 of 3).

Printer Printout Time	31-Aug	01-Sep	02-Sep	03-Sep	04-Sep	05-Sep	06-Sep	07-Sep	08-Sep	09-Sep	10-Sep	11-Sep	12-Sep	13-Sep	14-Sep	15-Sep	16-Sep
0100	82	123	132	84	160	122	93	120	70	93	108	122	99	58	37	27	128
0200	69	110	68	66	204	98	70	108	61	53	60	74	59	104	87	67	88
0300	62	91	101	59	148	94	86	81	66	35	27	77	64	65	41	71	126
0400	66	74	81	48	131	75	80	93	52	40	49	58	51	64	51	48	104
0500	36	39	79	36	110	126	70	45	61	39	59	49	56	48	43	45	75
0600	44	57	31	24	70	39	40	54	60	26	29	48	45	46	25	44	57
0700	29	36	40	17	27	22	23	12	17	12	16	25	21	21	16	28	18
0800	8	24	29	17	11	22	12	10	13	16	7	36	8	19	5	14	13
0900	6	21	16	29	12	18	10	6	4	4	7	19	9	6	1	16	16
1000	8	47	40	63	13	19	16	7	10	4	9	18	9	26	3	1	5
1100	9	27	55	43	14	18	11	5	25	8	4	4	8	1	1	3	5
1200	8	11	27	25	5	14	2	7	5	10	15	20	7	5	6	3	11
1300	15	14	40	35	8	9	4	7	12	11	8	7	6	0	5	4	8
1400	22	23	30	39	9	4	2	7	0	11	6	2	5	8	1	7	10
1500	23	36	42	17	2	15	4	12	13	24	6	6	10	12	2	6	15
1600	29	25	47	0	3	10	8	1	11	8	0	1	2	1	7	9	2
1700	16	14	14	58	5	11	14	1	14	3	9	6	4	4	2	4	3
1800	18	11	30	8	19	23	5	9	11	8	10	7	7	52	4	7	20
1900	34	11	5	28	11	11	14	7	22	11	12	11	5	12	5	10	11
2000	34	12	15	60	18	23	14	6	11	11	2	2	1	2	4	10	15
2100	48	38	30	28	19	15	8	1	9	13	7	15	21	34	4	16	12
2200	11	63	18	46	11	24	6	7	22	39	18	32	26	12	14	28	70
2300	26	71	63	92	48	42	10	25	42	69	29	64	58	41	18	41	129
2400	48	126	64	120	127	128	63	61	124	90	60	48	67	32	24	92	127
Daily Passage Estimate	751	1,106	1,097	1,042	1,185	982	666	692	735	604	557	753	650	673	408	601	1,068
Percent	2.2%	3.3%	3.3%	3.1%	3.5%	2.9%	2.0%	2.1%	2.2%	1.9%	1.7%	2.2%	1.9%	2.0%	1.2%	1.8%	3.2%

-continued-

[a] Totals only include day with 24-hour counts (i.e., excludes 14 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

Appendix D.4. (page 3 of 3).

Printer Printout Time	17-Sep	18-Sep	19-Sep	20-Sep	21-Sep	22-Sep	23-Sep	24-Sep	25-Sep	26-Sep	27-Sep	28-Sep	29-Sep	30-Sep	01-Oct	Total [a]	% passage by time
0100	166	159	102	132	205	68	40	46	50	87	163	151	153	140	79	3,421	0.102
0200	71	126	148	99	129	101	24	32	44	81	118	168	106	209	68	3,000	0.089
0300	105	75	142	130	190	77	42	40	80	103	73	135	69	138	52	2,806	0.083
0400	115	85	49	108	189	96	46	32	60	104	89	154	98	99	32	2,623	0.078
0500	129	99	151	67	133	49	33	26	40	71	70	97	62	86	40	2,216	0.066
0600	67	59	112	44	166	41	35	40	36	91	25	61	49	50	24	1,676	0.050
0700	26	26	54	33	36	34	6	29	47	86	17	35	26	50	26	959	0.028
0800	26	83	42	17	22	26	17	14	33	47	29	11	13	16	5	736	0.022
0900	36	29	20	29	10	25	4	16	8	25	10	13	7	5	10	519	0.015
1000	19	32	37	10	25	6	11	14	9	24	14	20	9	6	9	618	0.018
1100	13	53	22	9	7	8	4	2	9	39	18	25	4	17	12	516	0.015
1200	9	54	18	5	2	8	6	7	10	14	15	25	1	11	6	405	0.012
1300	4	38	30	15	10	3	3	1	13	14	13	11	8	7		440	0.013
1400	17	69	38	21	0	7	18	1	4	14	3	9	6	13		472	0.014
1500	8	55	32	13	10	8	4	2	9	30	4	4	11	17		518	0.015
1600	15	73	22	21	9	5	5	6	3	18	15	13	7	12		468	0.014
1700	13	150	15	27	27	0	12	6	15	21	19	14	14	11	(265)	592	0.018
1800	30	144	31	23	2	2	3	13	18	31	21	17	11	14	(42.1%)	692	0.021
1900	38	71	35	39	4	26	36	23	13	27	31	21	16	10		710	0.021
2000	43	72	21	20	5	22	26	9	18	20	37	60	24	15		740	0.022
2100	41	113	29	35	13	22	33	23	43	47	124	157	86	63		1,217	0.036
2200	92	247	61	93	60	76	26	37	84	168	301	251	172	116		2,317	0.069
2300	154	206	137	169	113	48	55	71	109	100	174	278	134	143		2,890	0.086
2400	225	219	92	170	74	23	36	53	71	104	152	154	85	74		3,103	0.092
																33,654 [a]	
Daily Passage Estimate	1,464	2,339	1,440	1,329	1,441	781	529	543	826	1,366	1,535	1,884	1,173	1,322	630	34,325 [c]	
Percent	4.4%	7.0%	4.3%	3.9%	4.3%	2.3%	1.6%	1.6%	2.5%	4.1%	4.6%	5.6%	3.5%	3.9%	1.1%	100.0%	

[a] Totals only include day with 24-hour counts (i.e., excludes 14 August and 1 October).
[b] Boxed areas indicate times when passage was estimated by interpolation or extrapolation.
[c] Total estimated passage, including days with expanded counts.

APPENDIX E

BARTON CREEK WEIR SALMON PASSAGE DATA

APPENDIX E: BARTON CREEK WEIR SALMON PASSAGE DATA

Appendix E.1. Daily salmon passage at Barton Creek weir, 1995.

Date	Chum Salmon					Coho Salmon					Remarks (other fish passed)
	Male	Female	Unknown	Total	Cum	Male	Female	Unknown	Total	Cum	
26-Aug				0	0				0	0	Weir completed.
27-Aug	1	1		2	2				0	0	
28-Aug				0	2				0	0	
29-Aug	4	1		5	7				0	0	
30-Aug	3	1		4	11				0	0	One rainbow trout caught in fencing.
31-Aug	7	1		8	19				0	0	
01-Sep	2	3		5	24				0	0	
02-Sep	1	1		2	26				0	0	
03-Sep				0	26				0	0	
04-Sep				0	26				0	0	
05-Sep	4			4	30				0	0	
06-Sep	2	1		3	33				0	0	
07-Sep	5	2		7	40				0	0	
08-Sep	2	1		3	43				0	0	
09-Sep	2			2	45				0	0	Two chum carcasses on fencing.
10-Sep	6	2		8	53				0	0	
11-Sep	2	1		3	56				0	0	
12-Sep	2			2	58	2			2	2	
13-Sep	1			1	59				0	2	
14-Sep	3	1		4	63				0	2	
15-Sep	3	1		4	67	1			1	3	
16-Sep	3	2		5	72	1			1	4	Partial count; weir pulled at 1800 hrours due to heavy leaf accumualtion.
17-Sep				0	72				0	4	Weir inoperable due to heavy leaf loading.
18-Sep	3			3	75	2			2	6	Partial count; weir reinstalled at 1030 hours. Several whitefish observed.
19-Sep	15	10		25	100	2			2	8	Several dozen whitefish upstream side of weir.
20-Sep	6	6		12	112	2			2	10	Dozen or so chums spawning just upstream of weir.
21-Sep	15	20		35	147	32	11		43	53	
22-Sep	32	78	100	210	357	13	7	48	68	121	
23-Sep	20	135	107	262	619	2	2	14	18	139	
24-Sep	38	67		105	724	2	1		3	142	
25-Sep	57	97		154	878	2			2	144	
26-Sep	68	63	119	250	1,128	3	11	27	41	185	
27-Sep	35	33		68	1,196	1	3		4	189	20 chum carcasses on fencing.
28-Sep	21	29		50	1,246		1		1	190	
29-Sep	15	9		24	1,270	1			1	191	36 chum carcasses on fencing.
30-Sep	6	5		11	1,281	1	2		3	194	49 chum carcasses on fencing.
01-Oct	4	2		6	1,287				0	194	35 chum carcasses on fencing.
02-Oct	3	3		6	1,293				0	194	34 chum carcasses on fencing.
03-Oct				0	1,293				0	194	Weir removed.
Total	391	576	326	1,293		67	38	89	194		

Appendix E.2. Daily salmon passage at Barton Creek weir, 1998.

Date	Chum Salmon Male	Female	Unknown	Total	Cum	Coho Salmon Male	Female	Unknown	Total	Cum	Remarks (other fish passed)
09–Aug				0	0				0	0	Weir completed at 1400 hours.
10–Aug				0	0				0	0	No fish seen below wier; one chinook upstream of weir.
11–Aug				0	0				0	0	One live chinook seen below weir; 3 dead chinook and 1 dead chum.
12–Aug				0	0				0	0	Pulled weir due to high water.
13–Aug				0	0				0	0	
14–Aug				0	0				0	0	
15–Aug				0	0				0	0	
16–Aug				0	0				0	0	
17–Aug				0	0				0	0	
18–Aug				0	0				0	0	Reinstalled weir at 1400 hours.
19–Aug				0	0				0	0	Four chums seen upstream of weir.
20–Aug				0	0				0	0	
21–Aug				0	0				0	0	
22–Aug		1		1	1				0	0	One chum escaped the holding pen.
23–Aug				0	0				0	0	Two summer–run chum carcasses in fencing.
24–Aug				0	0				0	0	
25–Aug				0	0				0	0	Two chum seen below weir.
26–Aug				0	0				0	0	
27–Aug				0	0				0	0	
28–Aug				0	0				0	0	
29–Aug				0	0				0	0	One summer–run chum carcass in fencing.
30–Aug				0	0				0	0	Two summer–run chum carcasses in fencing.
31–Aug				0	0				0	0	One chinook and one chum carcass in fencing.
01–Sep				0	0				0	0	
02–Sep				0	0				0	0	Two chum and one chinook seen below weir.
03–Sep				0	0				0	0	
04–Sep				0	0				0	0	Heavy foliage accumulation; No fish seen up or downstream of weir.
05–Sep				0	0				0	0	Pulled weir due to heavy leaf accumulation.
06–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
07–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
08–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
09–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
10–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
11–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
12–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
13–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
14–Sep				0	0				0	0	One chum and two coho salmon seen at mouth of Barton Creek.
15–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
16–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
17–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
18–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
19–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
20–Sep				0	0				0	0	Reinstall weir at 1430 hours.
21–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
22–Sep				0	0				0	0	Large school of whitefish seen above weir.
23–Sep				0	0				0	0	Several dozen whitefish seen above weir.
24–Sep				0	0				0	0	One whitefish caught in fencing (headed downstream).
25–Sep				0	0				0	0	
26–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
27–Sep				0	0				0	0	
28–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
29–Sep				0	0				0	0	Walked Barton Creek below weir; no fish present.
30–Sep				0	0				0	0	Weir removed at 1200 hours.
Total	0	1	0	1		0	0	0	0		

APPENDIX F

TOKLAT SPRINGS GROUND SURVEY DATA

Appendix F.1. Abundance and distribution of chum and coho salmon at Toklat Springs based upon ground surveys conducted in mid–October 1995.

	Survey Date	Chum Salmon				Coho Salmon		Survey Rating
		Live	(%)	Dead	(%)	Live	Dead	
SUSHANA RIVER								
Lower section, downstream of cabin	20–Oct	3,392	68.6%	1,555	31.4%	5	0 *	Good
Lower section, downstream of cabin	23–Oct *	2,779	58.4%	1,982	41.6%	3 *	1	Good–Fair
Upper section, upstream of cabin	23–Oct *	3,125	47.0%	3,524	53.0%	37 *	7	Good
Total Sushana River		5,904	51.7%	5,506	48.3%	40	8	
EASTERN FLOODPLAIN SLOUGHS								
Roadhouse Slough, lower (downstream of Roadhouse)	21–Oct	249	69.6%	109	30.4%	0	0	Good
Roadhouse Sl, upper (section flowing in timber) Aerial	25–Oct	100	66.7%	50	33.3%	0	0	Poor
Total Roadhouse Sl	*	349	68.7%	159	31.3%	0	0	
Slough flowing immediately behind (west) two small islands downsteam of Sushana River mouth – (Roadhouse Slough extension)	21–Oct *	577	27.9%	1,492	72.1%	0	0	Good
Sloughs on eastern floodplain below mouth of Sushana Ri to their convergence with main channel turbid flow	20–Oct *	2,082	32.5%	4,326	67.5%	6	0	Good–Fair
Lollipop Slough	20–Oct *	1,429	66.0%	737	34.0%	0	0	Good
Total Eastern Floodplain Sloughs		4,437	39.8%	6,716	60.2%	6	0	*
MIDDLE FLOODPLAIN								
Mid–floodplain Sloughs between Lollipop and Eagle Sls	20–Oct *	0	0.0%	294	100.0%	0	0	Incomplete
Mid–floodplain Sloughs between Wolf Is and Mallard Sl	20–Oct *	2,145	51.6%	2,010	48.4%	0	0	Good–Fair
Middle Floodplain Slough	21/22–Oct *	1,854	19.1%	7,874	80.9%	0	0	Good
Total Middle Floodplain Sloughs		3,999	28.2%	10,176	71.8%	0	0	
WESTERN FLOODPLAIN								
Upper Western Floodplain Slough	21–Oct *	165	8.8%	1,716	91.2%	39	8	Good
Wolf Island Creek	22–Oct *	69	6.4%	1,013	93.6%	18	6	Good
Wolf Slough (part of main channel flow – turbid)	22–Oct *	1,181	87.3%	172	12.7%	2	0	Poor – Incomplete
Mallard Slough	20–Oct *	1,378	62.0%	844	38.0%	30	0	Good–Fair
Eagle Slough (downstream Mallard Slough)	20–Oct *	51	6.4%	752	93.6%	0	0	Good
Total Western Floodplain Sloughs		2,844	38.7%	4,497	61.3%	89	14	
GEIGER CREEK								
Mouth to beaver dam	22–Oct *	4,695	55.6%	3,744	44.4%	133	9	Good
Upstream of beaver dam		Not Surveyed						
Total Geiger Creek		4,695	55.6%	3,744	44.4%	133	9	
MAIN TOKLAT RIVER CHANNEL	Main channel flow was turbid							

SUMMARY:

	Chum Live	(%)	Chum Dead	(%)	Coho Live	Coho Dead
Sushana River	5,904	51.7%	5,506	48.3%	40	8
Geiger Creek	4,695	55.6%	3,744	44.4%	133	9
Toklat Floodplain	11,280	34.5%	21,391	65.5%	95	14
Toklat River Index Area Totals	21,879	41.7%	30,641	58.3%	268	31

Total = 52,520 chum salmon 299 coho salmon

* Survey observations included in totals.

Appendix F.2. Abundance and distribution of chum and coho salmon at Toklat Springs based upon ground surveys conducted in mid-October, 1996.

	Survey Date	Chum Salmon				Coho Salmon		Survey Rating
		Live	(%)	Dead	(%)	Live	Dead	
SUSHANA RIVER								
Lower section, downstream of cabin	Oct.-16	2691	76.8%	811	23.2%	8	0	Good
Upper section, upstream of cabin	Oct.-18	1574	78.6%	429	21.4%	0	0	Good
Total Sushana River		4265	77.5%	1240	22.5%	8	0	
EASTERN FLOODPLAIN SLOUGHS								
Roadhouse Slough	Oct.-16	9	14.8%	52	85.2%	0	0	Good
Roadhouse Slough Extension	Oct.-16	26	21.7%	94	78.3%	0	0	Good
Sloughs on eastern floodplain below mouth of Sushana River to their convergence with main channel	Oct.-15	3042	67.7%	1451	32.3%	10	0	Good
Lollipop Slough	Oct.-15	188	70.9%	77	29.1%	0	0	Good
Total Eastern Floodplain Sloughs		3265	66.1%	1674	33.9%	10	0	
MIDDLE FLOODPLAIN								
Middle floodplain sloughs between Roadhouse Extension and Mainstem (Wolf Island)	Oct.-15	404	40.4%	597	59.6%	0	0	Good
Total Middle Floodplain Sloughs		404	40.4%	597	59.6%	0	0	
WESTERN FLOODPLAIN								
Upper Western Floodplain Slough	Oct.-16	0	0.0%	18	100.0%	2	1	Good
East Wolf Island Slough	Oct.-17	414	43.6%	535	56.4%	7	0	Good
Wolf Island Creek	Oct.-18	318	57.2%	238	42.8%	7	0	Good
Total Western Floodplain Sloughs		732	48.1%	791	51.9%	16	1	
GEIGER CREEK								
Mouth to beaver dam	Oct.-17	2378	83.5%	471	16.5%	233	0	Good
Upstream of beaver dam			Not surveyed					
Total Geiger creek		2378	83.5%	471	16.5%	233	0	
MAIN TOKLAT RIVER CHANNEL								
Confluence of Lollipop Slough to just below Mallard Slough	Oct.-15	129	94.2%	8	5.8%	0	0	Fair
Mallard Slough upstream to just above upper Western Floodplain Slough (aerial survey, R-44)	Oct.-19	237	94.0%	15	6.0%	8	0	Good-Fair
Total Main River Channel		366	94.1%	23	5.9%	8	0	

SUMMARY:

	Live	(%)	Dead	(%)	Live	Dead
Sushana River	4265	77.5%	1240	22.5%	8	0
Geiger Creek	2378	83.5%	471	16.5%	233	0
Toklat Floodplain	4401	59.0%	3062	41.0%	26	1
Toklat Main Channel	366	94.1%	23	5.9%	8	0
Toklat River Index Area Totals	11410	70.4%	4796	29.6%	275	1

Total = 16,206 chum salmon 276 coho salmon