SHEENJEK RIVER SALMON ESCAPEMENT ENUMERATION IN 1987

By

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ABSTRACT

Fall chum salmon escapement in the Sheenjek River was monitored by hydroacoustic techniques for the seventh consecutive year in 1987. The sonar-estimated escapement, including an estimated 1,586 fish which passed upstream in the uninsonified zone, was 140,086 from 25 August to 24 September. The mean date of run passage was 10 September.

The chum salmon sex ratio was 34% males and 66% females based upon beach seine samples collected late in the run. Overall age composition as determined from vertebrae was approximately 2% age 3 fish; 90% age 4 fish; and, 7% age 5 fish. Less than 1% of the fish sampled were age 6. Fall chum salmon samples were also collected for subsequent analyses in support of on-going stock separation studies.

KEY WORDS: Fall chum salmon, Oncorhynchus keta, sonar, hydroacoustic, escapement, enumeration, Yukon River, Porcupine River, Sheenjek River.

INTRODUCTION

Yukon River fall chum salmon (Oncorhynchus keta Walbaum) are in great demand commercially and are harvested in all 6 fishing districts in the Alaskan portion of the drainage. Commercial harvest also occurs in the Canadian portion of the drainage near Dawson. Although commercial harvest is permitted in portions of the Tanana River, none is permitted in the Koyukuk or Porcupine River drainages. The majority of commercial catches are presently made in the lower river, downstream of the village of Anvik. However, 1987 marked the first year in which a complete closure of the commercial fall chum salmon fishery was enacted in the Alaskan portion of the drainage for conservation purposes. Fall chum salmon subsistence use is greater throughout the upper river, upstream of the village of Koyukuk, than in the lower portion of the drainage.

Fall chum salmon are larger, spawn later, and are less abundant than their counterpart, summer chum salmon. They primarily spawn in the upper Yukon River drainage (upstream of the village of Tanana) in spring-fed tributaries which usually remain ice-free during the winter.

During the period 1960 through 1980, only various segments of annual returns of fall chum salmon were occasionally estimated from mark-and-recapture studies. Excluding these tagging studies and apart from aerial assessment of selected tributaries since the early 1970's, comprehensive enumeration studies were sporadic and limited to only 2 streams through 1980; the Fishing Branch River (Porcupine River drainage) and Delta River (Tanana River drainage). Although total abundance estimates for fall chum salmon returns to the Yukon River are still lacking, comprehensive escapement enumeration studies have intensified throughout the drainage in recent years, particularly since 1985.

The most complete data base on comprehensive studies of fall chum salmon spawning abundance exists for the Sheenjek River. Run timing and total abundance estimates have been made annually on this river since 1981 by the Alaska Department of Fish and Game (ADF&G) using hydroacoustic techniques. During that period, total escapement estimates have ranged from 27,130 to 152,768 with a 7-year average (including 1987) of approximately 79,800 fish.

Daily information on timing and abundance of fall chum salmon escapement to the Sheenjek River has proven to be of great value in assessment of overall Yukon River run strength and stock status on a post season basis. When taken with other inseason sources of fall chum salmon information (e.g., sonar counts in the Chandalar River, performance of lower river fishery, and

catches at the test fishing site near Ruby), information has also been used to a limited extent for inseason evaluation of management strategies in the upper river fisheries, particularly District 5 and to a lesser degree District 6.

STUDY AREA

The Sheenjek River heads in the glacial ice fields of the Romanzof Mountains, a northern extension of the Brooks Range, and flows southward approximately 250 rivermiles to its confluence with the Porcupine River (Figure 1). Although created by glaciers, the river's numerous clearwater tributaries quickly convert it to a clearwater stream. Water clarity is somewhat unpredictable, but is generally clearest during periods of low water; water level normally begins dropping in late August and September. Upwelling ground water composes a significant proportion of the river flow volume, especially in winter, and it is in these spring areas that fall chum salmon spawn, particularly within the lower 100 miles of the river. As far as is known, the Sheenjek River has been the single most important fall chum salmon producer in the Yukon River drainage in recent years in terms of number of spawners. At present, an escapement objective of 62,000 fall chum salmon exists for this stream.

OBJECTIVES

Overall objectives of the 1987 Sheenjek River fall chum salmon study were to determine the timing and magnitude of adult salmon escapement and to collect age, sex, and size information on sampled portions of the run. The following specific objectives were identified:

1. Estimate timing and magnitude of the fall chum salmon escapement using hydroacoustic techniques;

2. Estimate age, sex and size composition of the spawning population;

3. Support stock separation studies based upon scale pattern analysis (SPA) and protein-gel electrophoretic analysis; and,

4. Monitor selected climatological and hydrological parameters daily at the project site for use as baseline data.

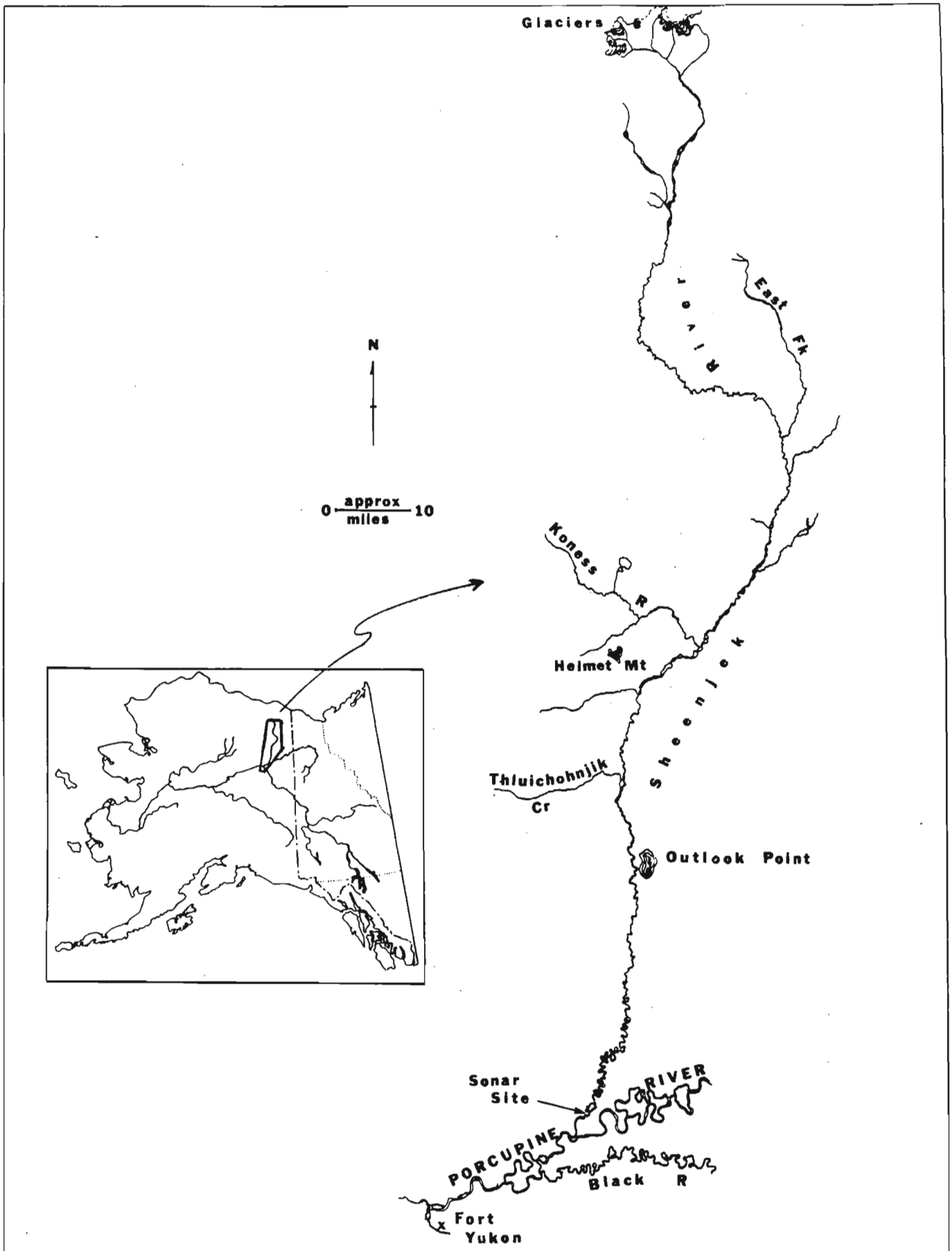

Figure 1. Sheenjek River drainage.

MATERIALS AND METHODS

Two Bendix side-scanning sonar counters were operated at approximately rivermile 6 on the Sheenjek River in 1987 at the same counting site used in 1985 and 1986 (Figure 2). A 1977-model counter was operated from the west bank and a 1981-model counter from the east bank. A 1985-model, long-range counter was also made available in 1987, however, electronic malfunction of that unit precluded its use. The 1977- and 1981-model counters were operated without deployment of artificial substrates.

Fish leads were constructed to shore from each deployed transducer, preventing salmon from passing upstream inshore of the transducers. A 20-foot aluminum counting tower was assembled and deployed near the west bank transducer to facilitate visual and electronic calibrations of the west bank sonar counter. Installation and operational procedures of each counter was the same as in previous years. Daily sonar calibration procedures for each unit are described by Barton (1983).

The number of salmon passing in the uninsonified zone was estimated as follows:

$$X_n = \sum_{i=1}^{I} \left(\frac{C^{sec}_{ni}}{D^{sec}_{ni}} Z_{ni} \right)$$

where: X_n = Number of salmon to midriver in unisonified zone for counter n

C^{sec}_{ni} = Adjusted count in outer sector for counter n on day i

D^{sec}_{ni} = Linear distance (in feet) of outer sector for counter n on day i

Z_{ni} = Uninsonified zone (in feet) to midriver from counter n on day i

n = East or west bank counter

I = Total number of days both units operated together

An adult salmon beach seine (100 feet long, 66 meshes deep, 2½-inch stretch measure) was periodically fished at approximately rivermile 12 to sample adult salmon for age, sex and size composition. The sample goal was 450 chum salmon. Chum salmon were sexed by external examination, measured to the nearest 5 millimeters from mid-eye to fork of tail, and scale sampled for

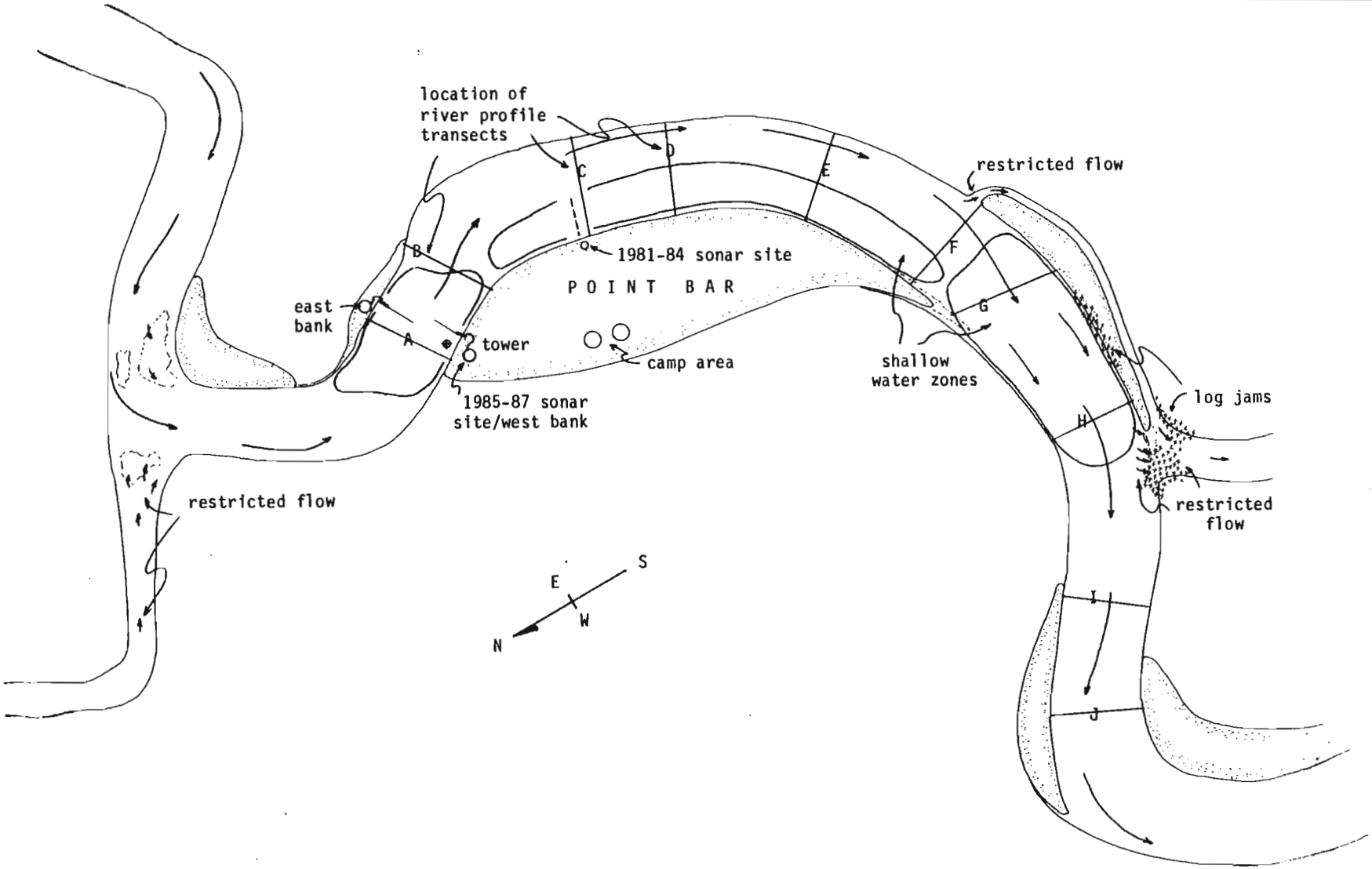

Figure 2. Sheenjek River project site.

subsequent SPA studies. Three scales were removed from an area posterior to the base of the dorsal fin and above the lateral line on the left side of each fish. A small section of spine (3-4 vertebrae) was removed from an area posterior to the anal fin of each fish for subsequent age determinations.

One hundred fifty chum salmon taken in beach seine hauls were further subsampled for subsequent electrophoretic analysis. Tissue/organ samples from each fish were individually bagged and placed into coolers containing dry ice before being flown to Fairbanks for freezing. Containers were labeled according to location, species, and date(s) samples were collected and then forwarded to the U.S. Fish and Wildlife Service (USFWS) office in Anchorage for subsequent processing.

A depth profile was made at the counting site on 27 August by stretching a ¼-inch diameter rope across the river and measuring water depth every 10 feet with a precalibrated spruce pole. Other river profiles were subsequently made using a Biosonics X-115 recording depth sounder. Daily changes in water level and surface water temperature were measured at noon. Surface water velocity was measured daily at each sonar transducer with a digital flow meter. Other daily observations included recording the occurrence of precipitation and percent cloud cover.

An aerial survey was flown of the Sheenjek River fall chum salmon spawning areas in a PA-18 (Super Cub) to estimate abundance and distribution of adult salmon spawners. Ground surveys were also attempted via riverboat to locate spawning areas and enumerate spawners.

RESULTS AND DISCUSSION

River and Sonar Counting Conditions

The field crew arrived at the project site on 22 August in 1987. River water level was extremely high on that date with water flowing over the gravel bar behind the campsite normally selected for use. River width at the counting site was estimated to have exceeded 400 feet. It was apparent the morning of 23 August that water level was indeed falling, so establishment of a permanent camp was initiated. Water level, after having receded approximately 1.5 feet since 22 August, was monitored daily throughout the course of the project by installation of a water gauge (meter stick) on 25 August.

The west bank sonar counter became operational on 25 August. A river profile made on 27 August revealed the river to be 360 feet wide at the counting site (Figure 3); the widest and highest the river has been by this date in the three years that operations

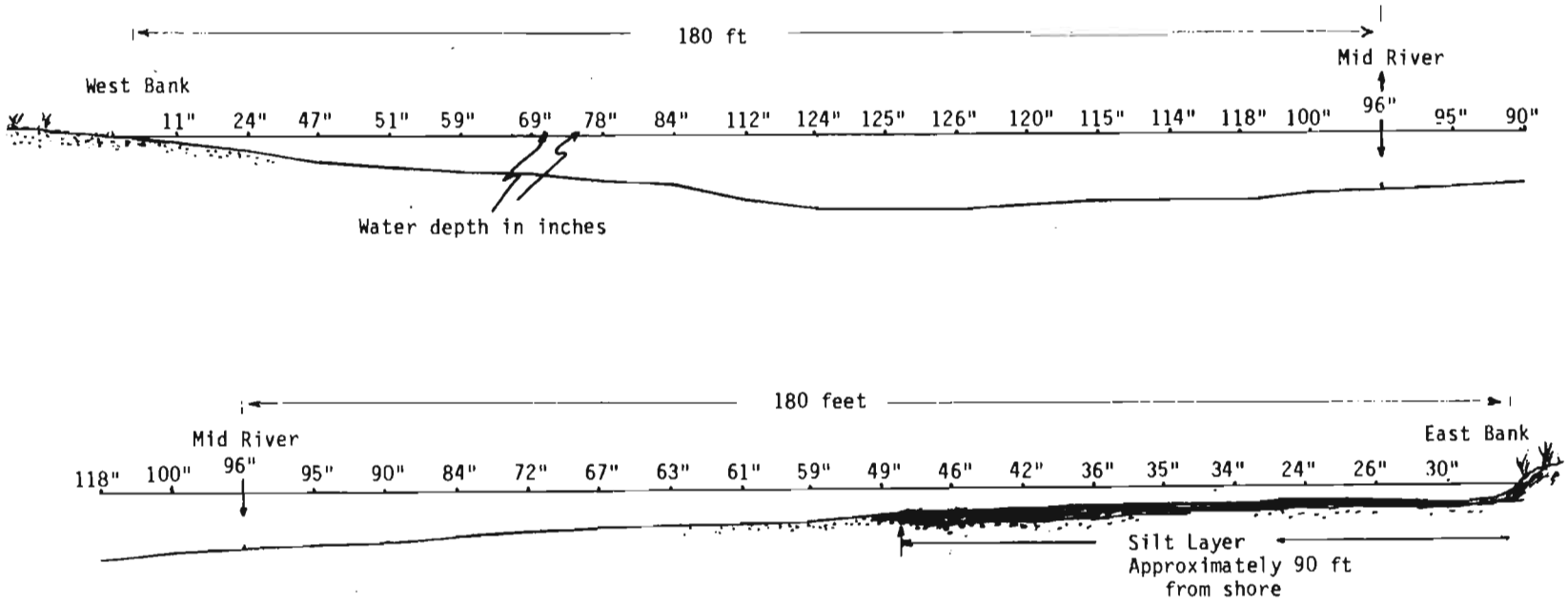

Figure 3. Sheenjek River depth profile at the sonar counting site on 27 August 1987.

have involved two counters. To illustrate, the river was 320 feet wide at the counting site on 17 August in 1986 and only 264 feet wide on 1 September in 1985.

Water level in 1987 declined during the 11-day period of 25 August to 5 September with an overall drop of 2.2 feet (Figure 4 and Appendix A. However, the river rose 3.1 feet during the next 7-day period (5-11 September), after which, a steady decline occurred through 24 September, falling 4.1 feet.

The high water conditions encountered in 1987 severely hindered sonar operations. Not only could counting not have commenced prior to 25 August but also high water levels accompanied by increased velocities (Figure 4 and Appendix B), and a debris-ladened water column often destroyed fish leads and washed silt from transducer pods. These problems resulted in interference with sonar calibrations and constant reaiming of transducers. Further, much alteration of the stream bed occurred at the counting site subsequent to 1986, particularly to the eastern portion of the channel. A layer of silt approximately one foot deep had been deposited over the gravel bottom on that side to a distance of nearly 90 feet from shore.

A major effort was made between 27 August and 2 September to install a 1985-model, long range counter on the east bank. Various positioning and repositioning of the east bank transducer was necessitated in an attempt to find the most favorable location. Water level was too high during this period to allow positioning of the transducer on gravel substrate, i.e., beyond the silt layer. Electronic malfunction of the 1985-model counter necessitated replacing it with a 1981-model counter on 2 September.

Problems were again encountered with the east bank unit during the week of high water from 5-11 September. The primary problem was shifting of the transducer due to silt being washed from beneath the transducer stand by river current. On these occasions false counting occurred and constant reaiming of the transducer was required. Shifting of the transducer also created interference (background noise) during sonar calibrations.

A recording depth sounder was used to obtain ten river profiles on 16 September at selected river locations in the general vicinity of the project location (see Figure 2). As a result, the present counting site was confirmed to be poor, having changed dramatically during the previous spring and winter months. It had the least conducive profile for operating a side scanning sonar counter of all sites examined. The bottom irregularities at this site were not detected when using the rope-and-pole method of obtaining a profile.

The best site was found to be located in proximity of where counting operations occurred from 1981-1984. River bottom was smooth and evenly sloped from the point bar to a maximum depth of

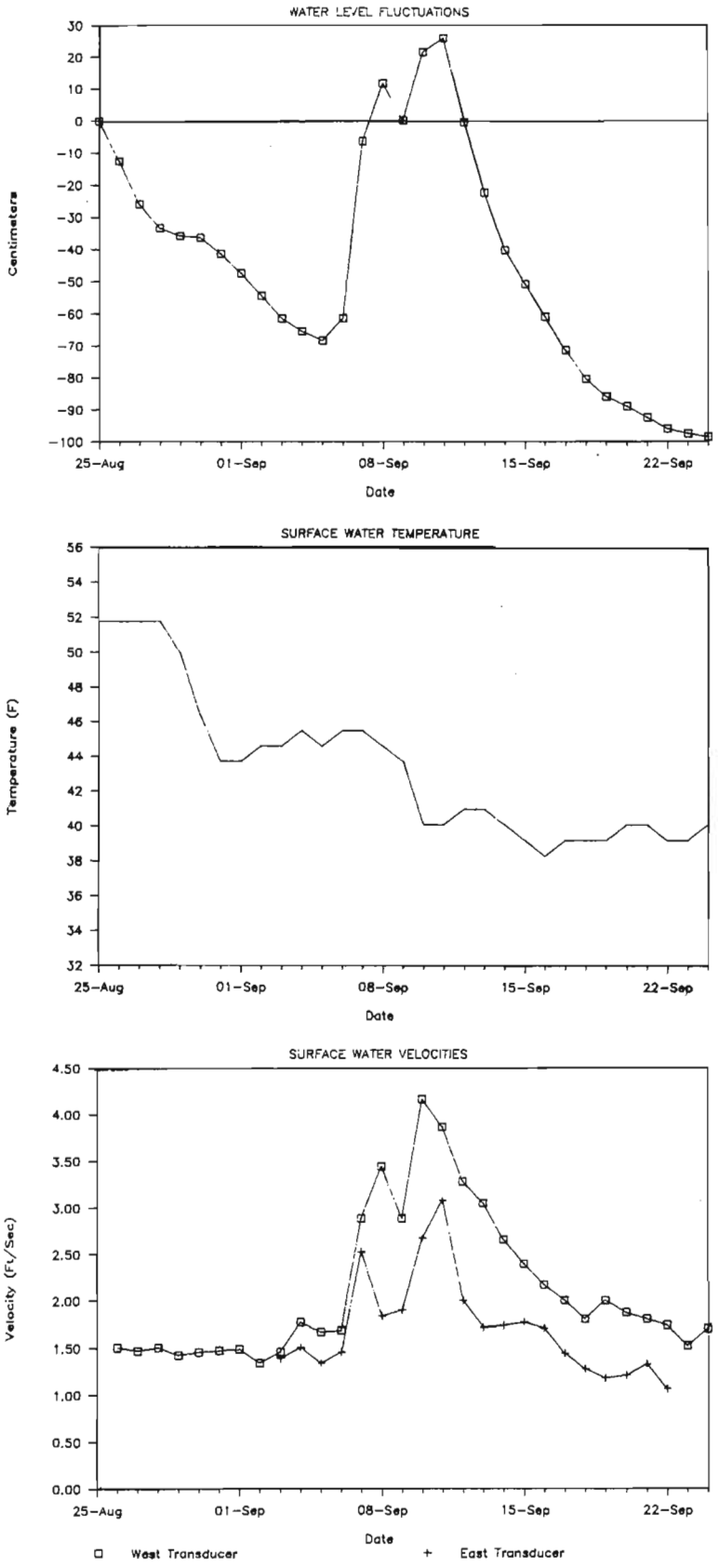

Figure 4. Water level fluctuations, surface temperatures, and surface water velocities at the Sheenjek River project site from 25 August to 24 September 1987.

13 feet at the cutbank side of the river. Depth near midstream was 8 feet. River width was not precisely measured but estimated to be slightly in excess of 200 feet on this date.

The west bank unit remained operable through 24 September while the east bank unit was shut down on 22 September. Thus, project duration was 31 days, the second longest since hydroacoustic enumeration began on the Sheenjek River in 1981.

Although sonar operations have terminated each year prior to the end of the salmon run by an unknown number of days, it is hypothesized that a relatively small portion of the total run passes subsequent to the termination of annual operations in most years based upon results of historic aerial surveys. Generally, fall chum salmon are present and spawning at most major spawning areas in the Sheenjek River by late September.

Abundance Estimation

Sonar counts were adjusted daily based upon calibration of each unit. A total of 172 calibrations averaging 25 minutes each were made to the west bank counter, while 111, 21-minute calibrations were made to the east bank counter. The lower number of periods associated with the east bank counter reflects fewer number of operating days for that unit due to high water. Together, nearly 112 hours were devoted to sonar calibration. Resulting effort showed calibrations were generally weighted to periods of the day when upstream migration was heaviest (Table 1).

The west bank sonar unit became functional by 1600 hours on 25 August and 65 fish were estimated passing through 2400 hours. This estimate was expanded to 126 fish for the entire day based upon the average daily proportion of west bank counts observed between 1600-2400 hours on 26-28 August. Estimates were made for the 14 days the east bank counter was inoperable due to high water by using the proportion contributed by east bank counts to total daily counts on days when both sonar units operated. The resulting total adjusted west and east bank sonar counts were 33,107 and 105,393, respectively, or 138,500 for both banks combined for the period 25 August through 24 September (Table 2).

Actual counting range for the west bank sonar counter varied throughout the season from 58 to 95.5 feet while that for the east bank varied from 94 to 98 feet, depending upon initial placement and subsequent relocation of transducers as necessitated by fluctuations in river water level (Appendix C and D). Consequently, the uninsonified zone in midstream also varied throughout the season and ranged from a maximum of 47.5 feet on 20-22 September to a minimum of 41 feet on 17 September, for days both sonar units were operating.

Table 1. Distribution of sonar calibration effort with respect to time of day versus estimated average fish passage rate by time of day in the Sheenjek River, 1987.

	Calibration Effort		Estimated Daily Passage
Time of Day	West Bank	East Bank	Both Banks
0001-0600 hrs	18% (13.2 hrs)	17% (6.5 hrs)	30%
0601-1200 hrs	25% (18.0 hrs)	22% (8.5 hrs)	22%
1201-1800 hrs	19% (13.2 hrs)	20% (8.0 hrs)	20%
1801-2400 hrs	39% (28.0 hrs)	42% (16.3 hrs)	28%
Total	65% (72.4 hrs)	35% (39.3 hrs)	

Table 2. Adjusted east and west bank sonar counts and estimated number of salmon passing the sonar site in midstream in the Sheenjek River, 25 August - 24 September, 1987.

Date	Adjusted East Bank Sonar Count	Adjusted West Bank Sonar Count	Estimated No Chums Passing in Mid-stream c	Daily		Cumulative	
				Number	Percent	Number	Percent
25-Aug	40 a	126 b	2 d	168	0.1%	168	0.1%
26-Aug	74 a	236	4 d	314	0.2%	482	0.3%
27-Aug	188 a	598	9 d	795	0.6%	1,277	0.9%
28-Aug	225 a	715	11 d	951	0.7%	2,228	1.6%
29-Aug	235 a	747	11 d	993	0.7%	3,221	2.3%
30-Aug	331 a	1,053	16 d	1,400	1.0%	4,621	3.3%
31-Aug	387 a	1,233	19 d	1,639	1.2%	6,260	4.5%
01-Sep	930 a	2,962	45 d	3,937	2.8%	10,197	7.3%
02-Sep	779 a	2,479	37 d	3,295	2.4%	13,492	9.6%
03-Sep	1,534	5,987	64	7,585	5.4%	21,077	15.0%
04-Sep	2,747	8,540	99	11,386	8.1%	32,463	23.2%
05-Sep	3,877	6,976	109	10,962	7.8%	43,425	31.0%
06-Sep	1,432	3,947	60	5,439	3.9%	48,864	34.9%
07-Sep	1,182	8,852	148	10,182	7.3%	59,046	42.1%
08-Sep	2,463	8,185	474	11,122	7.9%	70,168	50.1%
09-Sep	1,614	6,869	4	8,487	6.1%	78,655	56.1%
10-Sep	1,314 a	4,184	63 d	5,561	4.0%	84,216	60.1%
11-Sep	1,154 a	3,673	55 d	4,882	3.5%	89,098	63.6%
12-Sep	1,487 a	4,736	71 d	6,294	4.5%	95,392	68.1%
13-Sep	1,261	4,562	8	5,831	4.2%	101,223	72.3%
14-Sep	1,469	3,010	6	4,485	3.2%	105,708	75.5%
15-Sep	1,119	2,830	14	3,963	2.8%	109,671	78.3%
16-Sep	1,031	3,063	24	4,118	2.9%	113,789	81.2%
17-Sep	734	4,026	3	4,763	3.4%	118,552	84.6%
18-Sep	1,332	2,977	17	4,326	3.1%	122,878	87.7%
19-Sep	582	2,030	23	2,635	1.9%	125,513	89.6%
20-Sep	623	2,499	38	3,160	2.3%	128,673	91.9%
21-Sep	960	2,215	48	3,223	2.3%	131,896	94.2%
22-Sep	538	1,417	33	1,988	1.4%	133,884	95.6%
23-Sep	680 a	2,165	33 d	2,878	2.1%	136,762	97.6%
24-Sep	785 a	2,501	38 d	3,324	2.4%	140,086	100.0%
Total	33,107	105,393	1,586	140,086			

a Estimates based upon the contribution of east bank counts to total counts on days when both sonar units operated.

b Origional sonar estimate was 65 for 1600-2400 hours. Estimate was expanded to 126 based upon the average daily proportion of west bank counts from 1600-2400 hours on 26-28 August.

c Estimated midriver counts on days both sonar units operated and based upon counts in the outer electronic sector of each unit (see Appendix C and D).

d Estimated midriver counts based upon the average percentage midriver estimates were of east plus west bank counts (1.143%) on days when both sonar units operated.

The number of salmon estimated passing in the uninsonified zone for days on which only the west bank counter operated was based upon the contribution of west bank counts to the total estimate (west, east, and midriver) on days when both counters operated. An estimate of 1,586 fish was made for salmon passing the sonar site in the uninsonified zone, resulting in a total sonar-estimated escapement of 140,086 fall chum salmon for the period of 25 August through 24 September (see Table 2). Although this represents the second largest escapement estimate in the Sheenjek River since sonar enumeration began in 1981 (Figure 5), it should be remembered that no commercial harvest of fall chum salmon was permitted in the Alaskan portion of the Yukon River drainage in 1987.

Run Timing and Spatial Distribution

Based upon a time density model developed by Mundy (1982, 1984) to describe salmon migration run timing, timing of the 1987 Sheenjek River fall chum salmon run appeared most similar to timing of returns in 1982-1984 with the mean date falling on 10 September (Figure 6). Peak daily escapement estimates of 11,386 and 11,122 fish occurred on 4 and 8 September, respectively (see Table 2). The diel pattern in migration of chum salmon observed in previous years, excluding 1985, was not as pronounced in 1987, particularly along the east bank (Figure 7).

Most upstream migrants passed the sonar site in the nearshore sectors in 1987 (Figure 8), unlike 1985 or 1986. Approximately 96% of the west bank counts occurred in the inshore half of the counting range while approximately 79% of the east bank counts occurred in the inshore half of the counting range for that unit. This may have been a function of higher water levels and increased mid-river water velocities than observed in either 1985 or 1986. As a consequence, a substantially fewer number of salmon was estimated passing upstream in the uninsonified mid-river zone in 1987.

Age, Sex and Size Composition

Enumeration of salmon escapement is the highest priority associated with Sheenjek River project objectives. Consequently, effort at test fishing to collect age, sex and size information on the salmon run was essentially suspended early in the 1987 season in view of problems experienced with high water and expenditure of time necessary to insure proper functioning of the east bank sonar unit. Only a single day of beach seining was attempted prior to 18 September, during which time sonar calibrations were intensified. The total catch from 4 beach seine hauls on 4 September was 163 chum salmon (55 males; 108 females) and 5 Arctic grayling (Thymallus arcticus signifer

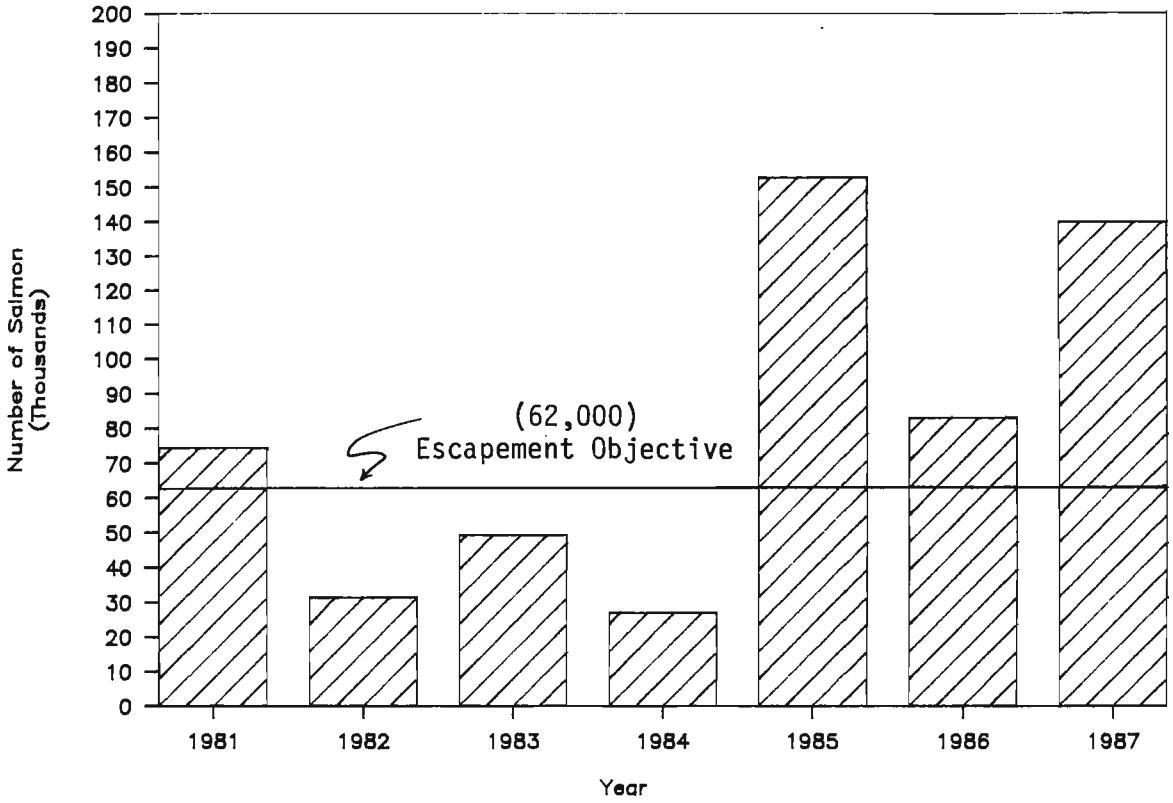

Figure 5. Comparative Sheenjek River fall chum salmon escapements, 1981-1987.

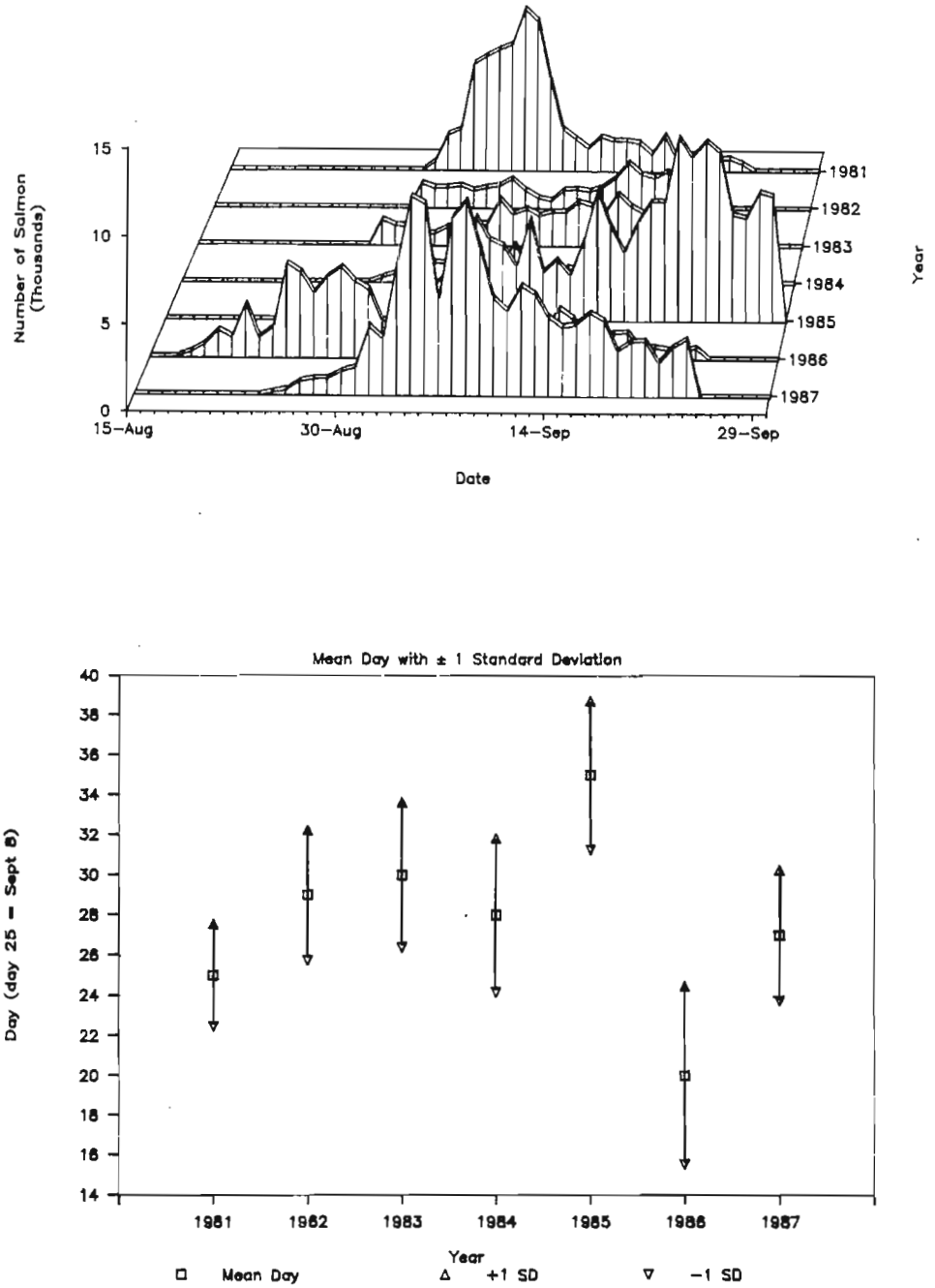

Figure 6. Fall chum salmon run timing in the Sheenjek River, 1981-1987.

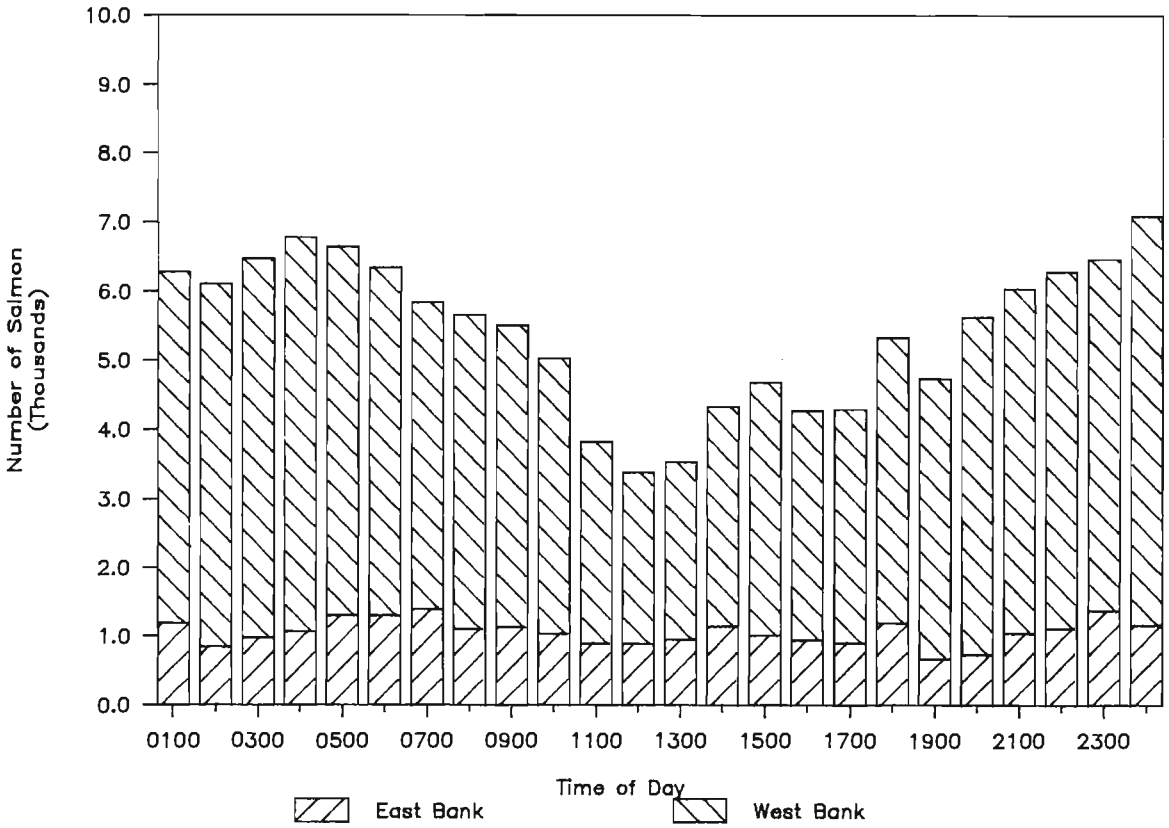

Figure 7. Average migration of Sheenjek River fall chum salmon past the sonar site by time of day, 25 August to 24 September 1987.

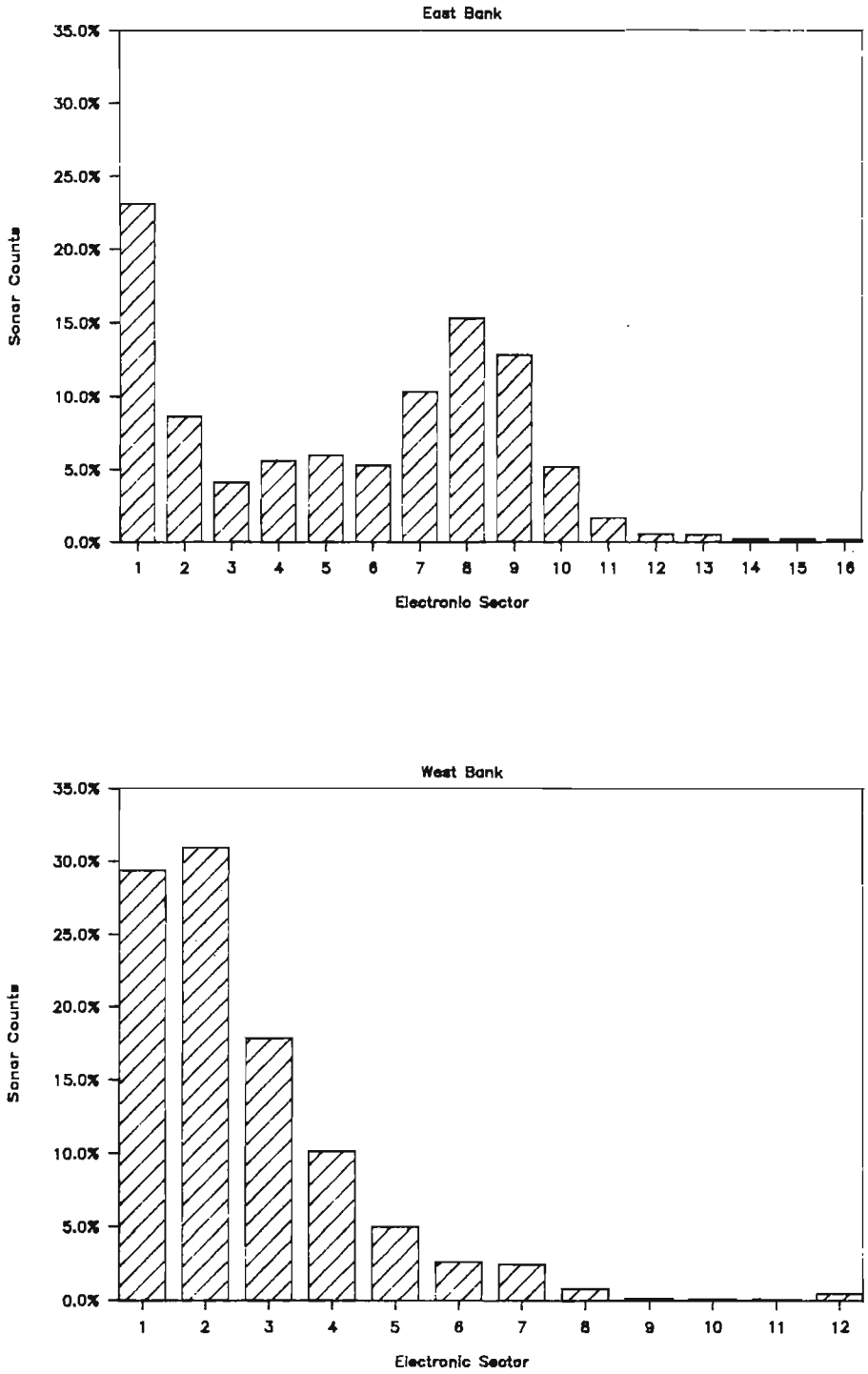

Figure 8. Spatial distribution of fall chum salmon past the Sheenjek River sonar site, 1987.

Richarson). Additional seine samples were collected on 18, 19 and 21 September: 746 chum salmon (226 males; 520 females) and 27 Arctic grayling.

Legible vertebrae (431) collected from 450 chum salmon revealed age composition to be as follows:

Age 0.2	=	2.1%	(brood year 1984)
Age 0.3	=	89.8%	(brood year 1983)
Age 0.4	=	7.2%	(brood year 1982)
Age 0.5	=	0.9%	(brood year 1981)

Both males and females were dominated by age 0.3 fish, 30.6% and 59.2% respectively. The male-to-female ratio of the ageable samples was 1.00:1.97 with males larger than females for a given age group (Table 3).

It should be pointed out that because the majority of seine samples were collected near the latter part of the chum salmon run as opposed to being collected throughout the duration of the run, resulting age composition and sex ratios may not be representative for the entire run in 1987. The higher than usual percentage of females may have been a function of timing differences by sex. This should be kept in mind when viewing Table 4 which shows historic age composition data for Sheenjek River escapements.

The effect on escapement age and sex composition as a result of the commercial fishing closure in 1987 is not known but is speculated to have been negligible.

Spawning Distribution

An aerial survey was flown of the Sheenjek River from the mouth to approximately 13 rivermiles upstream of Outlook Point (rivermile 100) on 15 September. The survey was rated "poor" due to turbid water conditions. It was estimated approximately 70% of the river's width was generally obscured by turbidity, with visibility only good in shallow water zones along gravel bars. The survey was flown prior to peak of spawning and numerous sightings of small groups of fish (less than 10) were noted throughout the entire survey, apparently still en route to spawning areas. A total of 10,706 chum salmon were observed of which 99% were alive. Results of this early survey represented approximately 10% of the sonar estimate through the date of the survey and less than 8% of the total sonar-estimated escapement for the season.

A second attempt was made by riverboat from 26-29 September to precisely locate spawning areas and obtain salmon counts in the lower 90 miles of the river. Only the lower 55 miles were examined before the trip was terminated due to inclement weather,

Table 3. Mean length at age (by sex) of fall chum salmon sampled in the Sheenjek River in 1987. a

Brood Year	1984	1983	1982	1981	
	0.2	0.3	0.4	0.5	total
FEMALES					
mean length	599	597	615	597	
standard error	9.78	1.57	6.69	14.81	
sample size	6	255	22	3	286
percent	1.4%	59.2%	5.1%	0.7%	66.4%
MALES					
mean length	630	628	648	—	
standard error	35.00	2.49	8.29	—	
sample size	3	132	9	1	145
percent	0.7%	30.6%	2.1%	0.2%	33.6%
COMBINED					
mean length	609	607	626	611	
standard error	12.98	1.53	5.91	17.96	
sample size	9	387	31	4	431
percent	2.1%	89.8%	7.2%	0.9%	100.0%

a Ages were determined form vertebrae and designated using European method. Lengths were measured from mid-eye to fork of tail to nearest 5 mm.

Table 4. Comparative age compostion of Sheenjek River fall chum salmon escapements, 1974-1987. a

Year	Age 0.2	Age 0.3	Age 0.4	Age 0.5	Sample Size	Male:Female ratio of Age Sample
1974 b	66%	30%	3%	0%	137	1.00:1.32
1975 b	3.5%	95%	1.5%	0%	197	1.00:1.37
1976 b	2%	44%	54%	0%	118	1.00:1.19
1977 b	11%	73%	16%	0%	178	?
1978 b	8%	82%	10%	0%	190	?
1979	—	—	—	—	—	—
1980	—	—	—	—	—	—
1981 c	3%	85%	12%	Tr	340	1.00:0.93
1982 c	3%	47%	50%	Tr	109	1.00:1.79
1983 c	6.5%	87%	6.5%	0%	108	1.00:0.86
1984 d	10%	81%	9%	0%	297	1.00:0.65
1985 d	1%	93%	6%	0%	513	1.00:0.70
1986 d,e	8%	41%	50%	1%	442	1.00:1.15
1987 d,e,f	2%	90%	7%	1%	431	1.00:1.97

a All age determination was from scales unless otherwise indicated. Age designation is European.

b Carcass samples handpicked from the spawning grounds.

c Escapement samples taken with 5-7/8 inch mesh gillnets at rivermile 6. Thus, older age fish may be over-represented while younger age fish under-represented.

d Escapement samples taken with beach seine at rivermile 12.

e Age determination was from vertebrae.

f Escapement samples were predominantly taken near end of run.

shallow water and outboard motor problems. Excluding the spawning area at Mahler's cabin and apart from frequently encountering small schools of 5-10 fish, no concentrations were observed until in the vicinity of rivermile 29 where 401 chum salmon were observed spawning along a cutbank with gravel substrate. Brisk winds and the occurrence of "sweepers" resulted in a minimal estimate at that location. Three more spawning concentrations were observed in the vicinity of rivermile 35. Again, spawning in these areas was adjacent to cutbanks with gravel substrates. A total of 1,187 chum salmon were counted under poor visibility conditions.

Only 33 live chum salmon were observed in a small side slough downstream from Russell's cabin while 96 carcasses were counted in Russell Cabin Slough. No live counts were possible in the latter due to turbid water conditions. The survey ended at rivermile 55 where an additional 87 chum salmon were observed.

The total number of chum salmon observed on this 3-day survey, including those near Mahler's cabin, was slightly in excess of 2,200. No tagged fish were observed.

SUMMARY

1. High water hindered hydroacoustic enumeration of salmon in the Sheenjek River in 1987 and counting could not have begun prior to 25 August.

2. The 1987 Sheenjek River sonar-estimated escapement from 25 August to 24 September was 140,086 fall chum salmon, including an estimated 1,586 fish which passed upstream between the counting units in the uninsonified zone. This represents approximately 2.25 times the escapement objective (62,000) established for this stream.

3. The mean date of run passage was 10 September with peak daily passage (8.1%) falling on 4 September.

4. A good aerial survey of the Sheenjek River to estimate spawning abundance and distribution was not obtained in 1987. An early survey with respect to peak of spawning and flown under poor conditions on 15 September, resulted in an estimate of 10,706 chum salmon. This represented only 10% of the sonar estimate through that date and less than 8% of the total sonar-estimated escapement for the season.

5. Approximately 2,200 chum salmon spawners were observed under poor survey conditions by riverboat over a 3-day period from 26-29 September. Approximately 6 spawning areas were examined during this trip.

6. The chum salmon sex ratio in 1987 was 34% males and 66% females based upon beach seine samples collected at rivermile 12, primarily late in the run. Overall age composition as determined from vertebrae was approximately 2% age 3 fish, 90% age 4 fish, and 7% age 5 fish. Less than 1% of the fish sampled were age 6.

7. Tissue/organ samples were collected form 150 chum salmon and forwarded to the USFWS for subsequent electrophoretic analysis. Scales were also collected from these fish in support of stock separation studies (SPA) conducted by ADF&G.

CONCLUSIONS AND RECOMMENDATIONS

It is recommended that in the future a single, 1985-model, long range counter be operated from the point bar in the vicinity of the 1981-84 counting site after a detailed river profile has been made with a recording depth sounder. The 1985-model counter can be operated at variable ranges to a maximum of 500 feet, thus eliminating the need for two counting units if operated from the point bar. In addition, "valid hit" criteria can be manually selected as necessary for each of the individual electronic sectors. These combined features of the 1985-model counter should result in eliminating an uninsonified zone as well as permit a more accurate determination of spatial distribution of migrating fish.

It is also recommended that ground surveys be attempted by riverboat in late September to collect samples for age, sex and size information as well as to estimate spawner abundance and distribution in the lower 100 rivermiles.

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Appendix A. Daily changes in water level and surface water temperature at the Sheenjek River project site, 1987.

		WATER LEVEL			
Day	Date	Meter Reading a	Daily Change	Zero Datum	Water Temp b
1	25-Aug	19.50		0.0	52
2	26-Aug	32.00	-12.50	-12.5	52
3	27-Aug	45.50	-13.50	-26.0	52
4	28-Aug	53.00	-7.50	-33.5	52
5	29-Aug	55.50	-2.50	-36.0	50
6	30-Aug	56.00	-0.50	-36.5	46
7	31-Aug	61.00	-5.00	-41.5	44
8	01-Sep	67.00	-6.00	-47.5	44
9	02-Sep	74.00	-7.00	-54.5	45
10	03-Sep	81.00	-7.00	-61.5	45
11	04-Sep	85.00	-4.00	-65.5	46
12	05-Sep	88.00	-3.00	-68.5	45
13	06-Sep	81.00	7.00	-61.5	46
14	07-Sep	26.00	55.00	-6.5	46
15	08-Sep	8.00	18.00	11.5	45
16	09-Sep	19.50	-11.50	0.0	44
17	10-Sep	-2.00	21.50	21.5	40
18	11-Sep	-6.50	4.50	26.0	40
19	12-Sep	20.00	-26.50	-0.5	41
20	13-Sep	42.00	-22.00	-22.5	41
21	14-Sep	60.00	-18.00	-40.5	40
22	15-Sep	70.50	-10.50	-51.0	39
23	16-Sep	80.50	-10.00	-61.0	38
24	17-Sep	91.00	-10.50	-71.5	39
25	18-Sep	100.00	-9.00	-80.5	39
26	19-Sep	105.50	-5.50	-86.0	39
27	20-Sep	108.50	-3.00	-89.0	40
28	21-Sep	112.00	-3.50	-92.5	40
29	22-Sep	115.50	-3.50	-96.0	39
30	23-Sep	117.00	-1.50	-97.5	39
31	24-Sep	118.00	-1.00	-98.5	40

a Meter reading in centimeters.
b Temperature in degrees Fahrenheit.

Appendix B. Surface water velocities measured daily at the east and west bank sonar transducers, Sheenjek River, 1987.

		SURFACE WATER VELOCITY			
		CM/SEC		FT/SEC	
Day	Date	West Bank	East Bank	West Bank	East Bank
1	25-Aug				
2	26-Aug	46.0		1.51	
3	27-Aug	45.0		1.48	
4	28-Aug	46.0		1.51	
5	29-Aug	43.5		1.43	
6	30-Aug	44.5		1.46	
7	31-Aug	45.0		1.48	
8	01-Sep	45.5		1.49	
9	02-Sep	41.0		1.35	
10	03-Sep	44.5	42.5	1.46	1.39
11	04-Sep	54.0	46.0	1.77	1.51
12	05-Sep	51.0	41.0	1.67	1.35
13	06-Sep	51.5	44.5	1.69	1.46
14	07-Sep	88.0	77.0	2.89	2.53
15	08-Sep	105.0	56.0	3.44	1.84
16	09-Sep	88.0	58.0	2.89	1.90
17	10-Sep	127.0	81.5	4.17	2.67
18	11-Sep	118.0	94.0	3.87	3.08
19	12-Sep	100.0	61.0	3.28	2.00
20	13-Sep	93.0	52.5	3.05	1.72
21	14-Sep	81.0	53.0	2.66	1.74
22	15-Sep	73.0	54.0	2.40	1.77
23	16-Sep	66.0	52.0	2.17	1.71
24	17-Sep	61.0	44.0	2.00	1.44
25	18-Sep	55.0	39.0	1.80	1.28
26	19-Sep	61.0	36.0	2.00	1.18
27	20-Sep	57.0	37.0	1.87	1.21
28	21-Sep	55.0	40.5	1.80	1.33
29	22-Sep	53.0	32.5	1.74	1.07
30	23-Sep	46.5		1.53	
31	24-Sep	52.0		1.71	

Appendix C. Distance (feet) of insonified and uninsonified zones by the west bank sonar counter and estimated number of chum salmon passing upstream in the west side uninsonified zone in the Sheenjek River 1987.

Date	Transducer distance from shore (1)	Dead Range (2)	Counting Range (3)	Extent of insonified zone (includes inshore lead) (1)+(2)+(3) (4)	Width of sector 12 (Ft) (5)	Adjusted count in sector 12 (6)	Average count per lineal ft (sector 12) (6)/(5) (7)	River Width (8)	Uninsonified zone (to mid-river) (8)/2-(4) (9)	Distance east beam extends past midriver	Distance between sonar beams (uninsonified zone)	Expanded cts to midway between sonar beams/using west bank sect 12 cts
25-Aug	20	1.5	58.0	79.5	4.83		0.0	360	100.5	-180.0	280.5	
26-Aug	20	1.5	58.0	79.5	4.83	34	7.0	360	100.5	-180.0	280.5	
27-Aug	30	1.5	58.5	90.0	4.88	107	21.9	360	90.0	-180.0	270.0	
28-Aug	30	1.5	88.5	120.0	7.38	10	1.4	360	60.0	-180.0	240.0	
29-Aug	30	1.5	95.5	127.0	7.96	5	0.6	360	53.0	-180.0	233.0	
30-Aug	30	1.5	95.5	127.0	7.96	5	0.6	360	53.0	-180.0	233.0	
31-Aug	30	1.5	95.5	127.0	7.96	7	0.9	360	53.0	-180.0	233.0	
01-Sep	30	1.5	90.0	121.5	7.50	8	1.1	360	58.5	-180.0	238.5	
02-Sep	30	1.5	90.0	121.5	7.50	3	0.4	360	58.5	-180.0	238.5	
03-Sep	45	1.5	76.0	122.5	6.33	12	1.9	360	51.0	6.5	44.5	42
04-Sep	45	1.5	76.0	122.5	6.33	27	4.3	360	51.0	6.5	44.5	95
05-Sep	45	1.5	76.0	122.5	6.33	29	4.6	360	51.0	6.5	44.5	102
06-Sep	45	1.5	76.0	122.5	6.33	16	2.5	360	51.0	6.5	44.5	56
07-Sep	45	5.0	73.0	123.0	6.08	41	6.7	360	50.5	6.5	44.0	148
08-Sep	45	5.0	73.0	123.0	6.08	131	21.5	360	50.5	6.5	44.0	474
09-Sep	45	5.0	73.0	123.0	6.08	1	0.2	360	50.5	6.5	44.0	4
10-Sep	45	9.0	70.0	124.0	5.83	28	4.8	360	56.0	-180.0	236.0	
11-Sep	45	9.0	68.0	122.0	5.67	5	0.9	360	58.0	-180.0	238.0	
12-Sep	45	9.0	68.0	122.0	5.67	0	0.0	360	58.0	-180.0	238.0	
13-Sep	45	9.0	68.0	122.0	5.67	0	0.0	360	52.0	6.0	46.0	0
14-Sep	28	10.0	87.0	125.0	7.25	2	0.3	360	48.5	6.5	42.0	6
15-Sep	28	10.0	87.0	125.0	7.25	0	0.0	360	48.5	6.5	42.0	0
16-Sep	28	10.0	87.0	125.0	7.25	2	0.3	360	48.5	6.5	42.0	6
17-Sep	28	10.0	87.0	125.0	7.25	1	0.1	360	48.0	7.0	41.0	3
18-Sep	28	10.0	87.0	125.0	7.25	6	0.8	360	48.5	6.5	42.0	17
19-Sep	28	10.0	87.0	125.0	7.25	7	1.0	360	48.5	6.5	42.0	20
20-Sep	40	1.5	78.0	119.5	6.50	7	1.1	360	54.0	6.5	47.5	26
21-Sep	40	1.5	78.0	119.5	6.50	12	1.8	360	54.0	6.5	47.5	44
22-Sep	40	1.5	78.0	119.5	6.50	8	1.2	360	54.0	6.5	47.5	29
23-Sep	40	1.5	78.0	119.5	6.50	2	0.3	360	60.5	-180.0	240.5	
24-Sep	40	1.5	78.0	119.5	6.50	7	1.1	360	60.5	-180.0	240.5	
						523						1,072

Appendix D. Distance (feet) of insonified and uninsonified zones by the east bank sonar counter and estimated number of chum salmon passing upstream in the east side uninsonified zone in the Sheenjek River 1987.

Date	Transducer distance from shore (1)	Dead Range (2)	Counting Range (3)	Extent of insonified zone (includes inshore lead) (1)+(2)+(3) (4)	Width of sector 16 (Ft) (5)	Adjusted count in sector 16 (6)	Average count per lineal ft (sector 16) (6)/(5) (7)	River Width (8)	Uninsonified zone (to mid-river) (8)/2-(4) (9)	Distance end of west beam is from midriver	Distance between sonar beams (uninsonified zone)	Expanded cts to midway between sonar beams/using east bank sect 16 cts
25-Aug				0				360	180.0			
26-Aug				0				360	180.0			
27-Aug				0				360	180.0			
28-Aug				0				360	180.0			
29-Aug				0				360	180.0			
30-Aug				0				360	180.0			
31-Aug				0				360	180.0			
01-Sep				0				360	180.0			
02-Sep				0.0				360	180.0			
03-Sep	87.0	1.5	98.0	186.5	6.125	6	1.0	360	-6.5	51.0	44.5	22
04-Sep	87.0	1.5	98.0	186.5	6.125	1	0.2	360	-6.5	51.0	44.5	4
05-Sep	87.0	1.5	98.0	186.5	6.125	2	0.3	360	-6.5	51.0	44.5	7
06-Sep	87.0	1.5	98.0	186.5	6.125	1	0.2	360	-6.5	51.0	44.5	4
07-Sep	87.0	4.5	95.0	186.5	5.938	0	0.0	360	-6.5	50.5	44.0	0
08-Sep	87.0	4.5	95.0	186.5	5.938	0	0.0	360	-6.5	50.5	44.0	0
09-Sep	87.0	4.5	95.0	186.5	5.938	0	0.0	360	-6.5	50.5	44.0	0
10-Sep				0				360	180.0	56.0		
11-Sep				0				360	180.0	58.0		
12-Sep				0				360	180.0	58.0		
13-Sep	87.0	3.0	96.0	186.0	6.000	2	0.3	360	-6.0	52.0	46.0	8
14-Sep	87.0	5.5	94.0	186.5	5.875	0	0.0	360	-6.5	48.5	42.0	0
15-Sep	87.0	5.5	94.0	186.5	5.875	4	0.7	360	-6.5	48.5	42.0	14
16-Sep	87.0	5.5	94.0	186.5	5.875	5	0.9	360	-6.5	48.5	42.0	18
17-Sep	87.0	5.0	95.0	187.0	5.938	0	0.0	360	-7.0	48.0	41.0	0
18-Sep	87.0	1.5	98.0	186.5	6.125	0	0.0	360	-6.5	48.5	42.0	0
19-Sep	87.0	1.5	98.0	186.5	6.125	1	0.2	360	-6.5	48.5	42.0	3
20-Sep	87.0	1.5	98.0	186.5	6.125	3	0.5	360	-6.5	54.0	47.5	12
21-Sep	87.0	1.5	98.0	186.5	6.125	1	0.2	360	-6.5	54.0	47.5	4
22-Sep	87.0	1.5	98.0	186.5	6.125	1	0.2	360	-6.5	54.0	47.5	4
23-Sep				0				360	180.0			
24-Sep				0				360	180.0			