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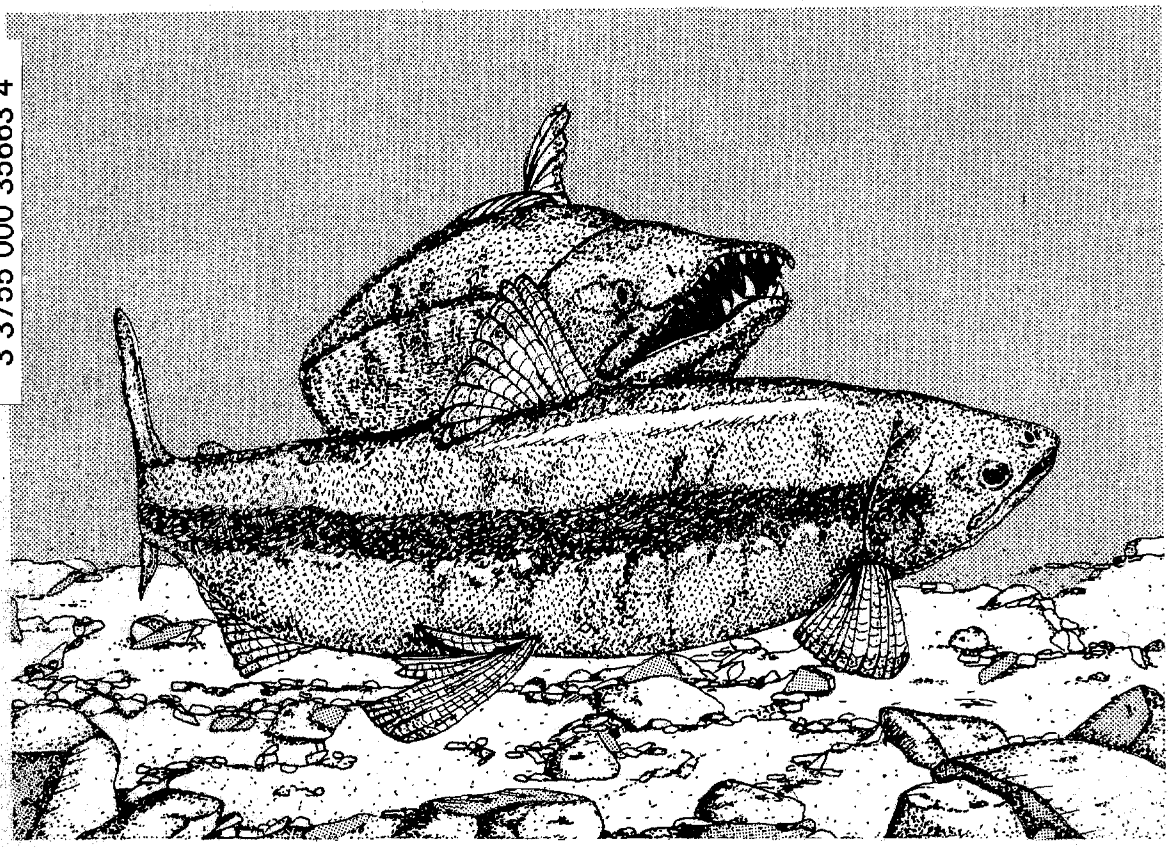

SUSITNA HYDRO AQUATIC STUDIES
PHASE II FINAL DATA REPORT

Volume 2, Adult Anadromous Fish Studies, 1982.

ALASKA
DEPARTMENT OF FISH AND GAME

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SUSITNA HYDRO AQUATIC STUDIES
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Volume 2, Adult Anadromous
Fish Studies, 1982.

by

Alaska Department of Fish and Game
Susitna Hydro Aquatic Studies
2207 Spenard Road
Anchorage, Alaska 99503

PREFACE

This report is part of a five volume presentation of the fisheries, aquatic habitat, and instream flow data collected by the Alaska Department of Fish and Game (ADF&G) Susitna Hydroelectric (Su Hydro) Feasibility Aquatic Studies Program during the 1981-82 (October-May) ice-covered and 1982 open water (May-October) seasons. It is one of a series of reports prepared for the Alaska Power Authority (APA) and its principal contractor, Acres American (Acres) by the ADF&G and other contractors to evaluate the feasibility of the proposed Susitna Hydroelectric Project. This report is intended for data transmittal to other Susitna Hydroelectric Feasibility Study participants. A preliminary draft was circulated for review in February.

The topics discussed in Volumes Two through Five are illustrated in Figure A. Volume One presents a synopsis of the information contained in the other four volumes. Volume Two also includes a comparison of 1981 and 1982 adult anadromous fisheries data.

An ADF&G data analysis report will include an analysis of the pre-project fishery and habitat relationships derived from this and related reports prepared by other study participants. A review draft will be circulated to study participants on May 1, 1983. The final report will be submitted to the APA on June 30, 1983 for formal distribution to study participants, state and federal agencies, and the public. Also scheduled for completion on June 30, 1983 is the first draft of the ADF&G 1982-83 ice-covered season basic data report. It will include a presentation of 1982-83 incubation and other fishery and habitat data.

These and other ADF&G reports (1974, 1976, 1977, 1978, 1979, 1981a, b, c, d, e, f, 1982) and information reported by others will be summarized and analyzed by the Arctic Environmental Information and Data Center (AEIDC) to evaluate post-project conditions. Woodward

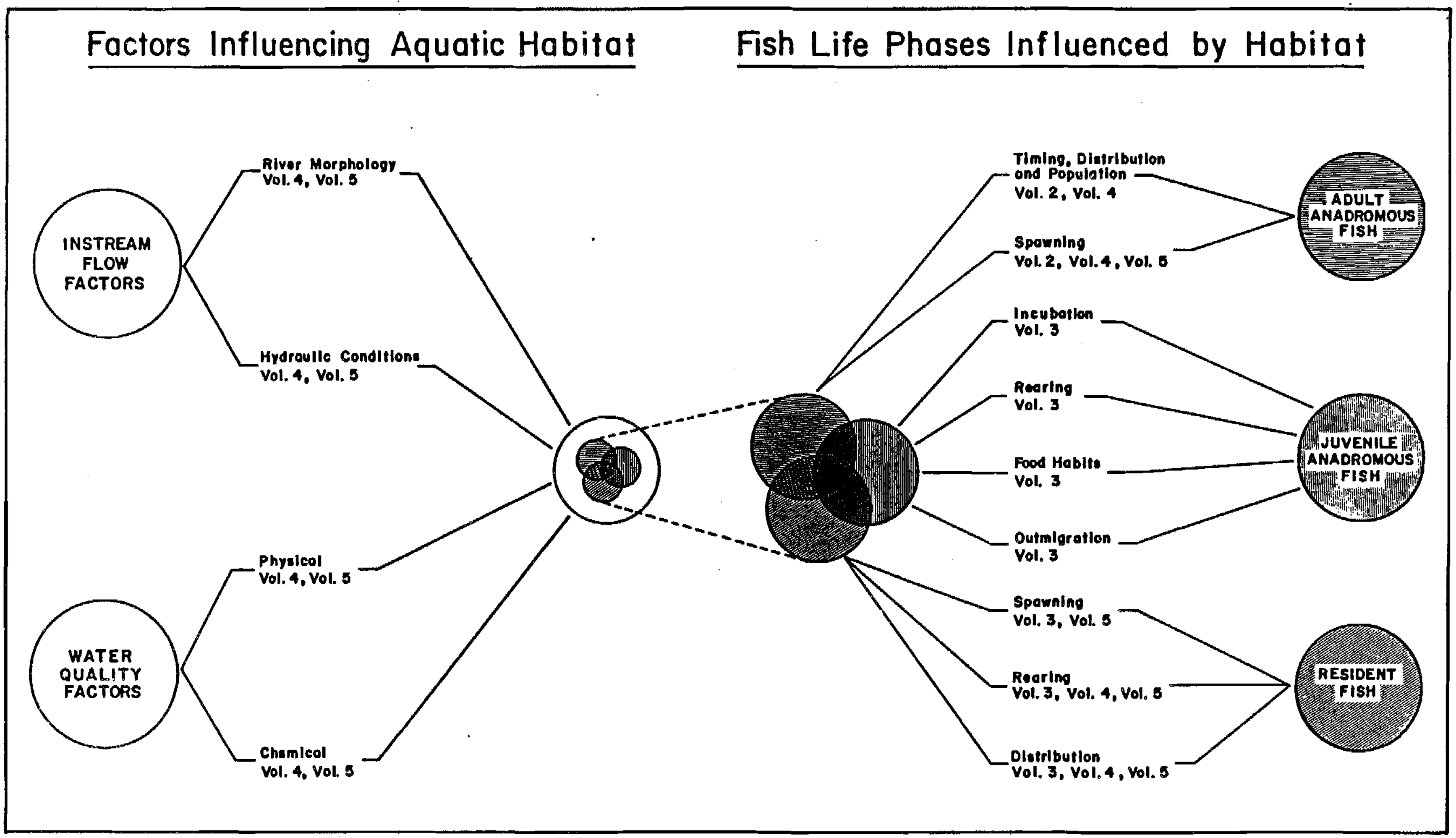

Figure A. Program elements presented in Volumes Two through Five.

Clyde Consultants will, in turn, use this information to support their preparation of the Federal Energy Regulatory Commission License Application for Acres.

The five year (Acres 1980) ADF&G Su Hydro Aquatic Studies program was initiated in November, 1980. It is subdivided into three study sections: Adult Anadromous Fish Studies (AA), Resident and Juvenile Anadromous Fish Studies (RJ), and Aquatic Habitat and Instream Flow Studies (AH).

Specific objectives of the three sections are:

1. AA - determine the seasonal distribution and relative abundance of adult anadromous fish populations produced within the study area (Figure B);

2. RJ - determine the seasonal distribution and relative abundance of selected resident and juvenile anadromous fish populations within the study area; and

3. AH - characterize the seasonal habitat requirements of selected anadromous and resident fish species within the study area and the relationship between the availability of these habitat conditions and the mainstem discharge of the Susitna River.

The 1982 ADF&G portion (Figures C and D) of the overall feasibility project study area (Figure B) was limited to the mainstem Susitna River and the mouths of major tributaries. Portions of tributaries which will be inundated by the proposed impoundments were also evaluated. Descriptions of study sites are presented in each of these volumes including the ADF&G reports (ADF&G 1981a, b, c, d, e, f).

The Susitna River is approximately 275 miles long from its sources in the Alaska Mountain Range to its point of discharge into Cook Inlet. Its drainage encompasses an area of 19,400 square miles. The mainstem

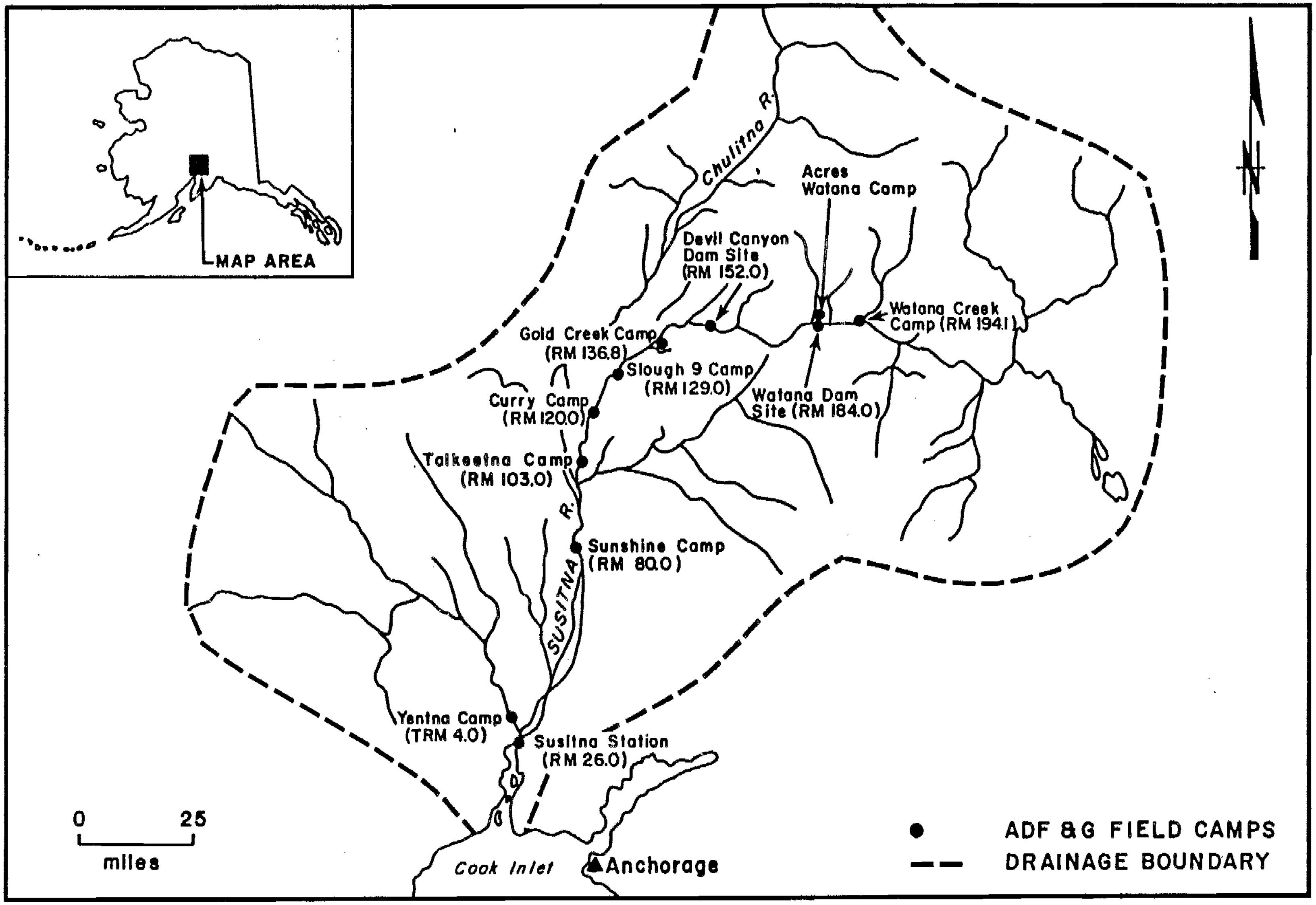

Figure B. Susitna River drainage basin.

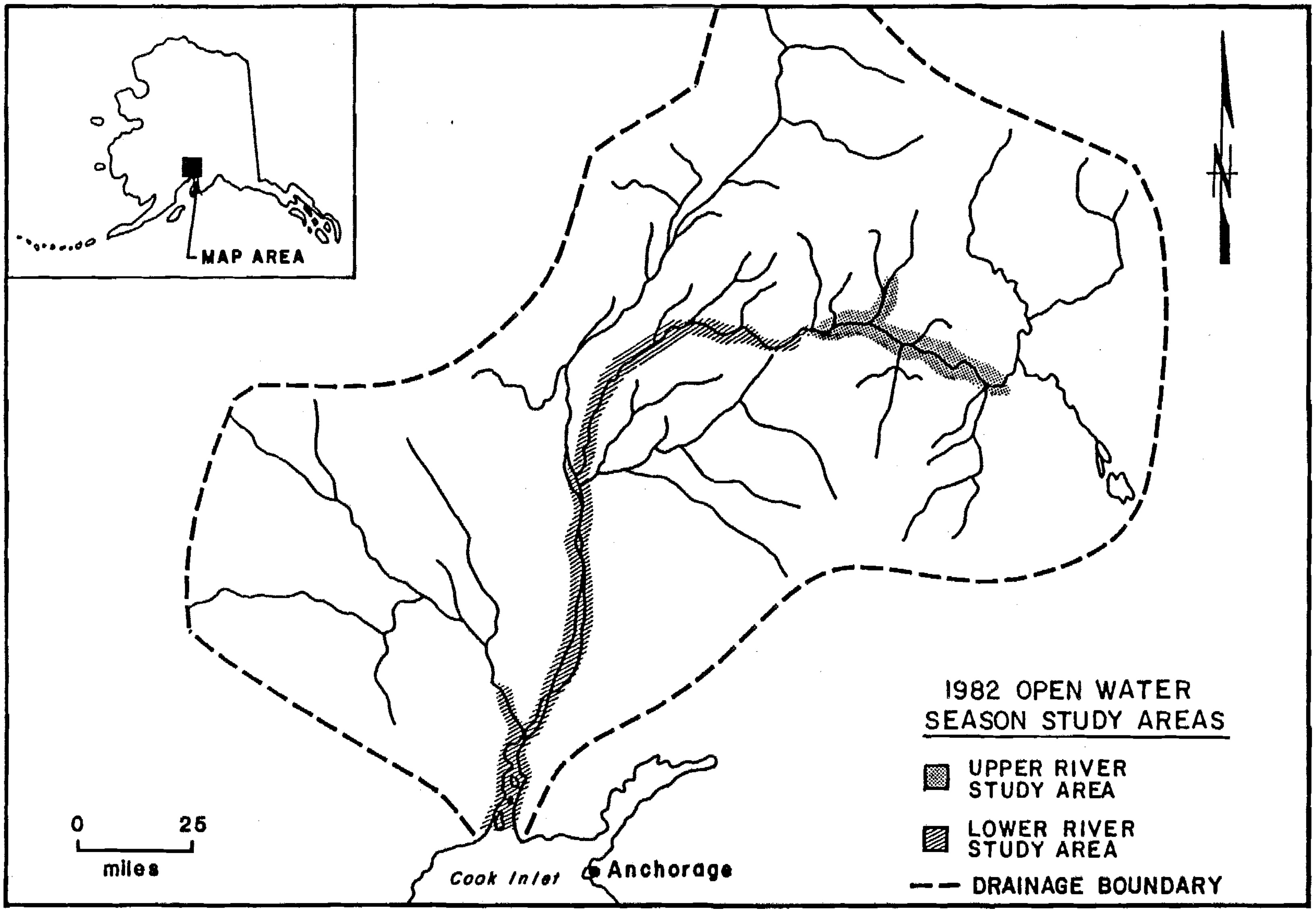

Figure C. 1982 ADF&G open water season (May through October) study area.

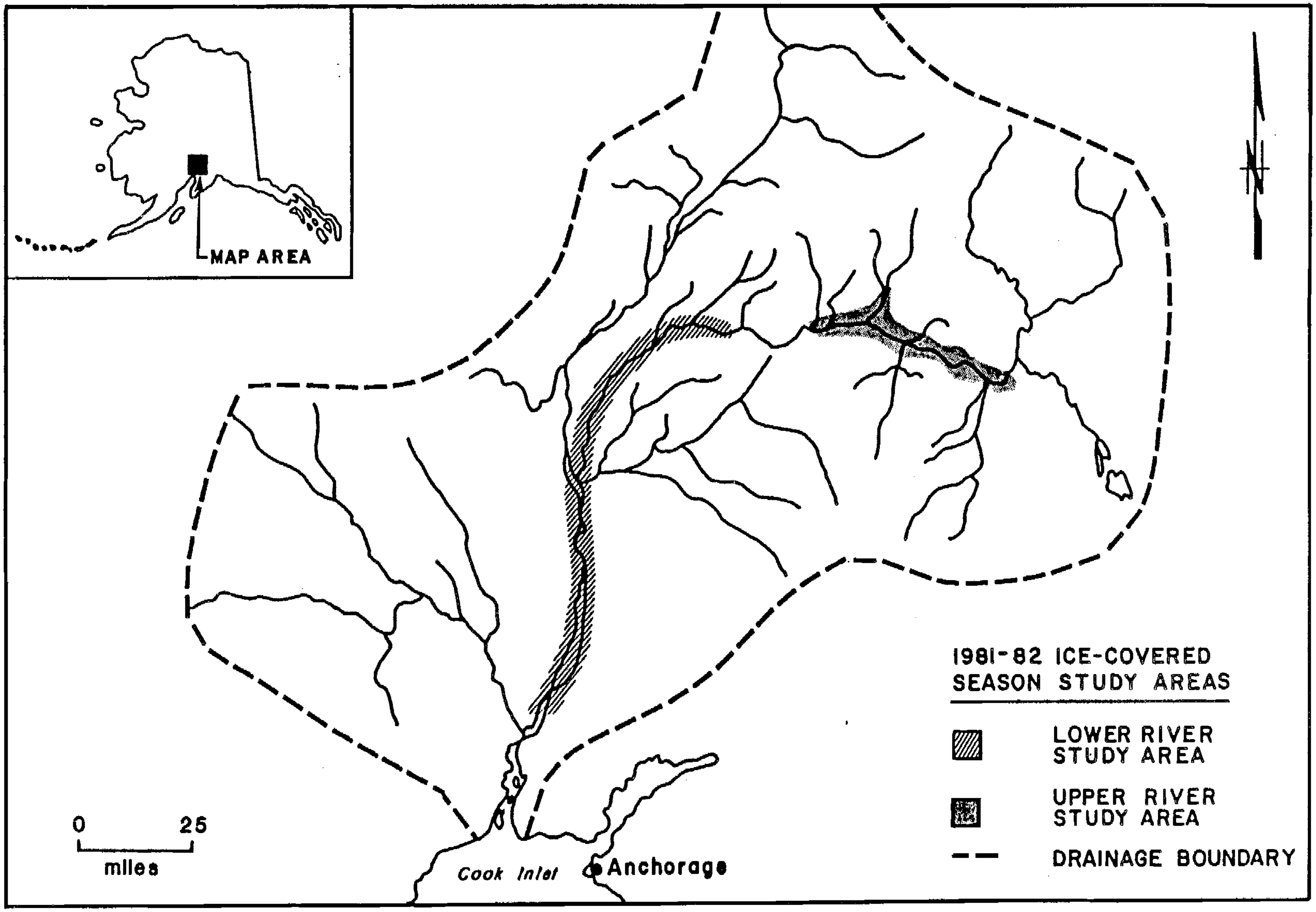

Figure D. 1981-82 ADF&G ice-covered season (October through May) study area.

and major tributaries of the Susitna River, including the Chulitna, Talkeetna and Yentna rivers, originate in glaciers and carry a heavy load of glacial flour during the ice-free months (approximately May through October). There are many smaller tributaries which are perennially clear.

Questions concerning these reports should be directed to:

Thomas W. Trent
Aquatic Studies Coordinator
Alaska Department of Fish & Game
Su Hydro Aquatic Studies Program
2207 Spenard Road
Anchorage, Alaska 99503
Telephone (907) 274-7583

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PRINCIPAL CONTRIBUTORS

Adult Anadromous Project Leader	Bruce M. Barrett
Adult Anadromous Assistant Project Leader	Frederick M. Thompson
Adult Anadromous Operations Control Leader	Susan Wick
Adult Anadromous Radio Telemetry Crew Leader	Steven Krueger

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Fisheries Biologist III Barrett, Bruce

Fisheries Biologist II Thompson, Frederick

Fisheries Biologist I

Bigler, Jeffrey
Dolezal, Claude
Gustin, Richard
Hessing, Pauline
Kerkvliet, Carol
Krueger, Steven
Pechek,Stuart
Queral, Isaac
Robinette, Karen
Sharp, Dan
Tilly, Fred
Wenger, Mark
Wick, Susan
Zosel, Katrin

Fisheries Technician II

Badgley, Albert
Beers, Dean
Blaney, Alden
Crowe, Thomas
Delong, David
Duffy, Heather
Fink, Mark
Gleaves, John
Harris, Patricia
Jones, Craig
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1.0 OBJECTIVE

This study was effected to meet the following objective:

Objective 1.0 Determine seasonal distribution and relative abundance of the anadromous fish population within the study area.

Task 1.1 Emunerate and characterize the escapements.

Task 1.2 Determine timing and nature of migration, milling and spawning activities.

Task 1.3 Identify spawning locations within the study area including main channel associated sloughs, side channels, stream confluences and estimate their comparative importance.

Anadromous fish species investigated under 1.0 Objective above were

Eulachon	*Thaleichthys pacificus*
Pacific Salmon	*Onchorhynchus sp*
Chinook Salmon	*O. tshawytscha*
Sockeye Salmon	*O. nerka*
Pink Salmon	*O. gorbuscha*
Chum Salmon	*O. keta*
Coho Salmon	*O. kisutch*
Bering Cisco	*Coregonus laurettae*

2.0 METHODS

2.1 Eulachon

2.1.1 Estuary

Two set net locations were selected May 16, 1982 in the Susitna River estuary at the locations shown in Figure 2-2-1. Each location was fished with a standard sinking gill net from May 16 through June 9, at a frequency of once every third high tide for the first seven days and once every fifth high tide thereafter. The standard net used was 7.6 meters (m) long, 1.5 m deep with a 3.8 centimeter (cm) stretch mesh. Net deployment was accomplished using a 20 foot (ft) long river boat powered by a 75 horse power (hp) jet outboard. Each net was set perpendicular to the river channel and was anchored by a single, nine kilogram (kg) Navy anchor and marked on the surface by a single 30 cm diameter buoy at each end (Plate 2-2-1).

Both set net locations were fished for a total of 30 minutes starting at site 1, 45 minutes prior to high tide and at site 2, 15 minutes following high tide (Figure 2-2-1). Time of high tide was determined by subtracting a 36 minute correction factor from the 1982 high tide table for the Anchorage District (U.S. Coast Guard, 1982). Fishing time at each location was recorded to the nearest minute, and eulachon catches were sorted and logged as pre-spawners or post-spawners. Pre-spawners were defined as gravid fish and post-spawners as eulachon essentially void of eggs or milt. The determination was made by morphological examination and when necessary, by applying slight hand pressure to the abdominal region.

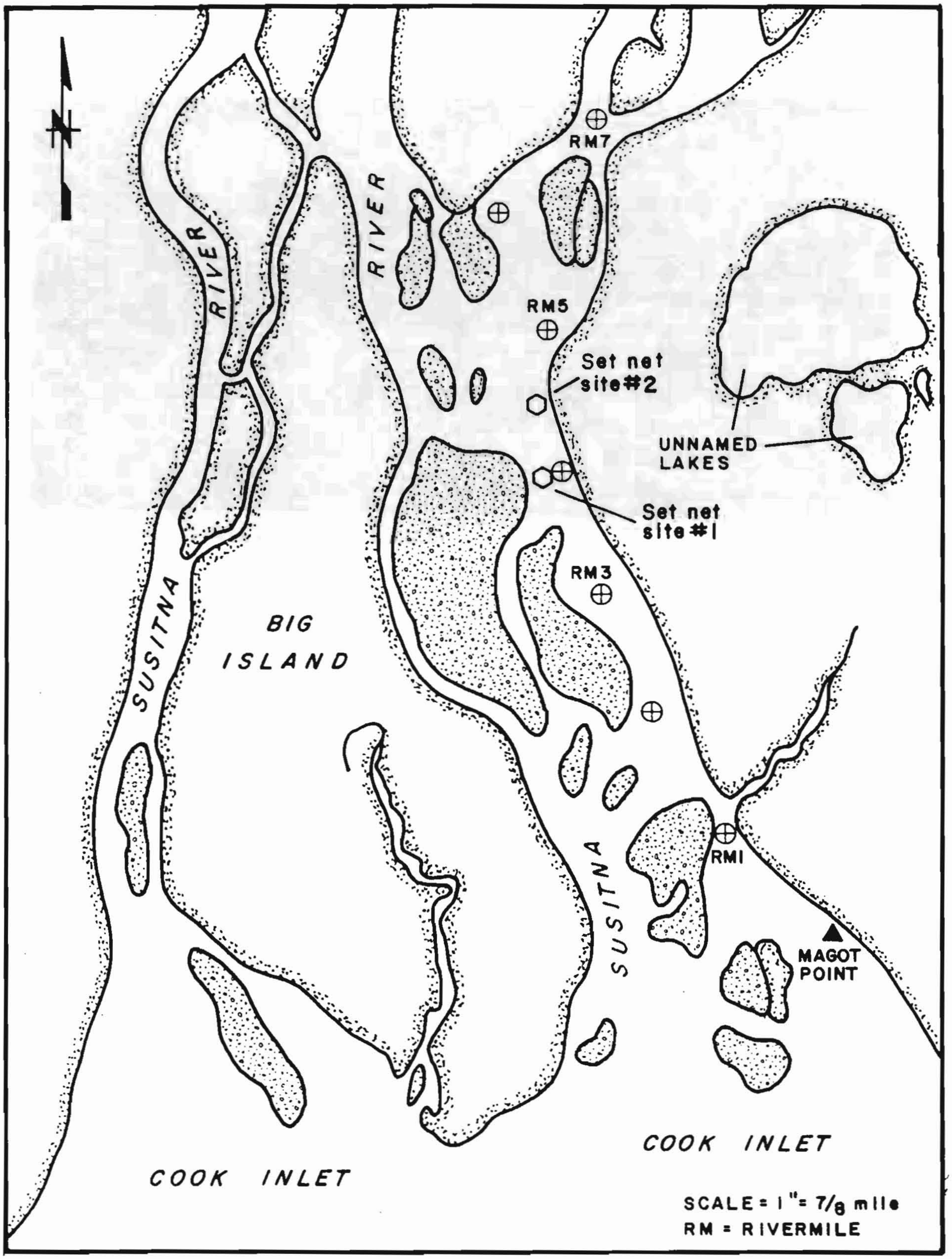


Figure 2-2-1. Susitna River estuary with eulachon set net sites defined, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Plate 2-2-1. Sinking gill net set in the Susitna River estuary, Adult Anadromous Investigations, Su Hydro Studies, 1982.

2.1.2 Main Channel

Main channel sampling operations in 1982 extended from RM 4.5 in the Susitna River estuary to the Kashwitna River confluence (RM 61) for the period of May 16 through June 9. Daily sampling was conducted using dip nets and electroshocking equipment (Plates 2-2-2 and 2-2-3).

All electroshocking was conducted from a 20 ft. long river boat powered by a 75 hp jet outboard. The electroshocking unit used was a Model VVP-3E Coffelt electroshocker with a 3500 watt Homelite generator as a power source. Input to the electroshocking unit was 230 volts alternating current (A.C.) and output currents available were either: A.C., direct current (D.C.) or pulsating D.C.

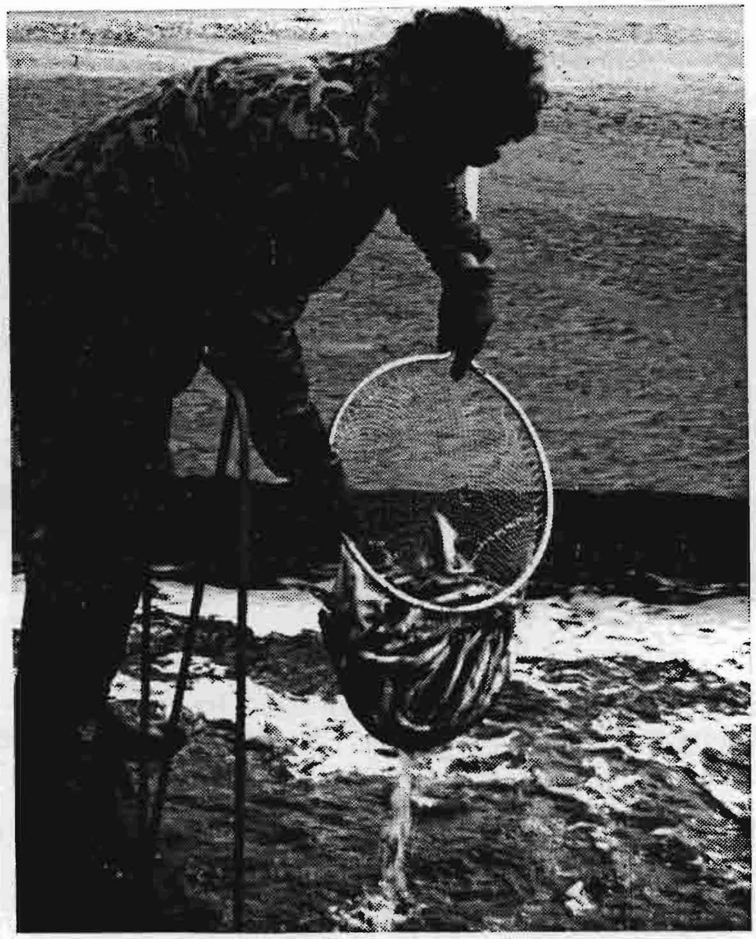


Plate 2-2-2. Eulachon dip net sample in the Susitna River estuary, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The power output cord from the electroshocking unit was set up with the anode (+) electrode wired to a hand held dip net and the cathode (-) electrode grounded to the boat. Depression of a foot switch activated the current flow through the water. The activation period ranged from five to 10 seconds followed by a 20 to 40 second pause to avoid possible fish herding. One to 3.5 amps of D.C. or pulsating D.C. was found to be the most effective output mode for electroshocking eulachon. Safety measures followed included the use of rubber boots and gloves by personnel and a kill switch attached to the generator which was in ready reach of the boat operator at all times.

Plate 2-2-3. Electroshocking eulachon in the lower Susitna River, Adult Anadromous Investigations, Su Hydro Studies, 1982.

A sex composition sample from a minimum of 100 eulachon was collected daily. In addition 10 age, length and weight samples per sex were taken daily in the river reach between RM 4.5 and 61.

For age determination, two otoliths per fish were collected and stored in pre-labeled vials containing 50 percent ethanol solution. Eulachon lengths were taken from tip of snout to fork of tail and recorded to the nearest millimeter (mm). The weights were recorded to the nearest decigram (0.1 g) using an Ohaus, Dial-O-Gram balance. Sex was determined by morphological examination.

Eulachon spawning surveys were conducted on a daily basis in conjunction with other scheduled sampling duties. Three separate methods were tested in the attempt to define where eulachon were spawning. The methods in order of trial were:

1. An assumption that eulachon were not spawning at a catch location unless:

   A. Male and female eulachon sampled were freely expelling milt and eggs, respectively, and were all in a vigorous free-swimming condition.

   B. Twenty or more eulachon were caught from a specific location that met criteria A above.

2. Eulachon spawning was occurring or had occurred in areas where substrate samples collected with an Ekman dredge or Surber sampler contained a 'significant' number of eggs identifiable by a hand held magnifying glass and or the application of Rit dye.

3. A single sampling of an area supporting spawning activity would produce a catch of at least one pre-spawning condition female and one post-spawning condition female in addition to male eulachon which were all in a vigorous free-swimming condition.

2.2 Adult Salmon

2.2.1 Main Channel

Escapement monitoring operations on adult salmon were conducted at five stations on the Susitna and Yentna rivers in 1982 as shown in Figure 2-2-2. Individual station maps have been provided in Appendix 2-A. Monitoring gear

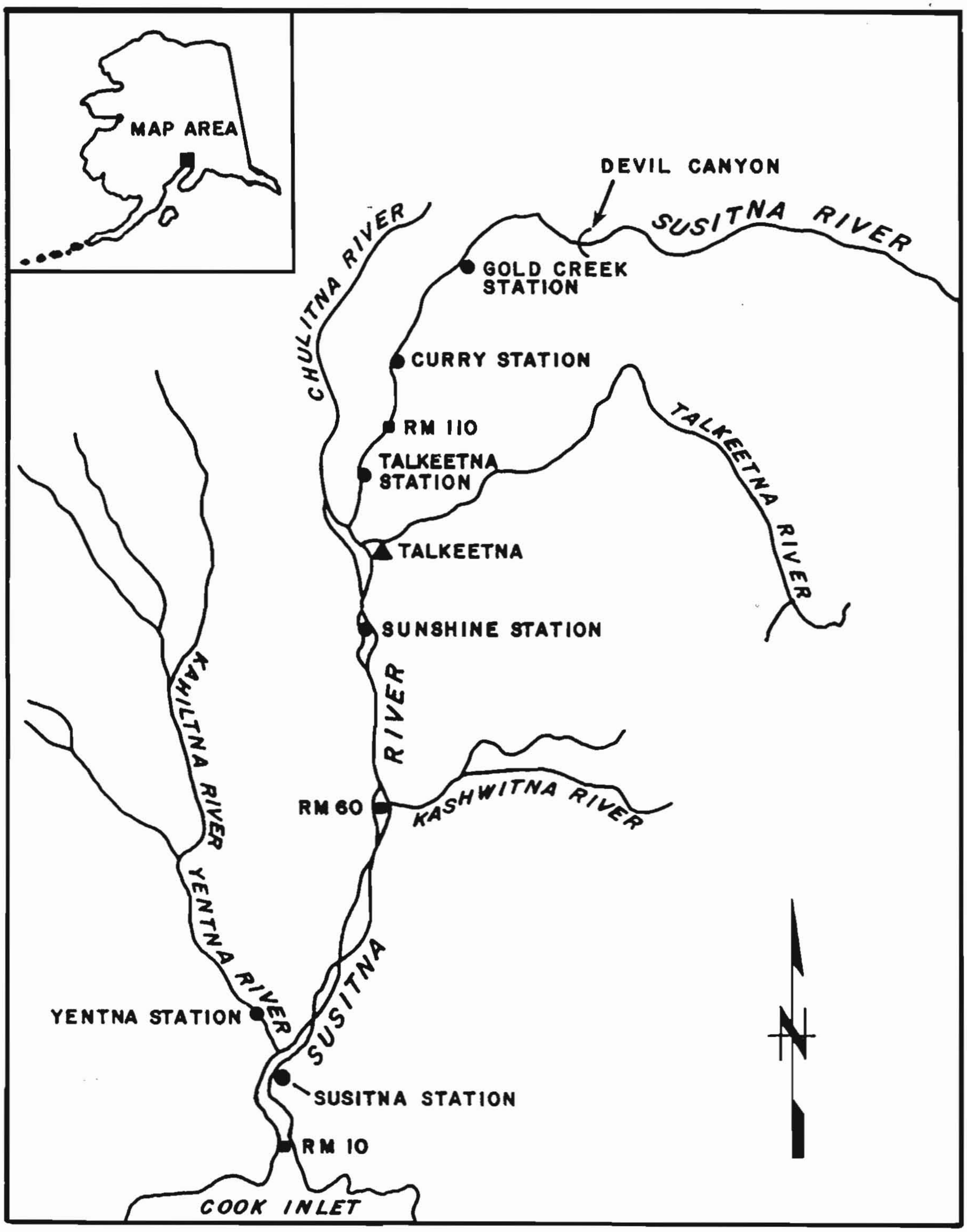


Figure 2-2-2. Susitna River basin map showing field stations and major glacial streams, Adult Anadromous Investigations, Su Hydro Studies, 1982.

used included Bendix Model 1980 side scan sonar (SSS) counters and fishwheels. The specific operating dates, and type and amount of gear deployed at each fish sampling station have been listed in Table 2-2-1. All sampling locations with the exception of Susitna Station (RM 26) were staffed in 1982 by Su Hydro, Adult Anadromous personnel. Susitna Station was staffed by ADF&G personnel from the Region II Soldotna office of the Commercial Fisheries Division.

Table 2-2-1. Anadromous adult salmon sampling location, gear type and operational dates on mainstem Susitna and Yentna Rivers, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Site	Location		Period		Gear Deployed	
	River	River Mile	Begin	End	Sonars	Fishwheels
Susitna Station	Susitna	26	7/1	9/5	2	2
Yentna Station	Yentna	04	6/27	9/5	2	2
Sunshine Station	Susitna	80	6/4	10/1	2	4
Talkeetna Station	Susitna	103	6/5	9/14	2	4
Curry Station	Susitna	120	6/9	9/18	0	2

2.2.1.1 Sonar

Side scan sonar (SSS) counters were deployed at Susitna (RM 23), Yentna (RM 04), Sunshine (RM 80) and Talkeetna (RM 103) stations in accordance with the 1980 Side Scan Sonar Counter Installation and Operation Manual by Bendix Corporation (1980).

At each location SSS counter accuracy was checked daily for four or more 30 minute periods using a Model 323, Sony oscilloscope (Plate 2-2-4). Adjustments were made to a counter when the percent agreement between hand tallied oscilloscope counts and corresponding registered SSS counts was less than 90 percent in three consecutive monitorings (Plate 2-2-5). Attendant to each counter was a nearby fishwheel which was used to apportion SSS counts to species based on the fishwheel catch composition.

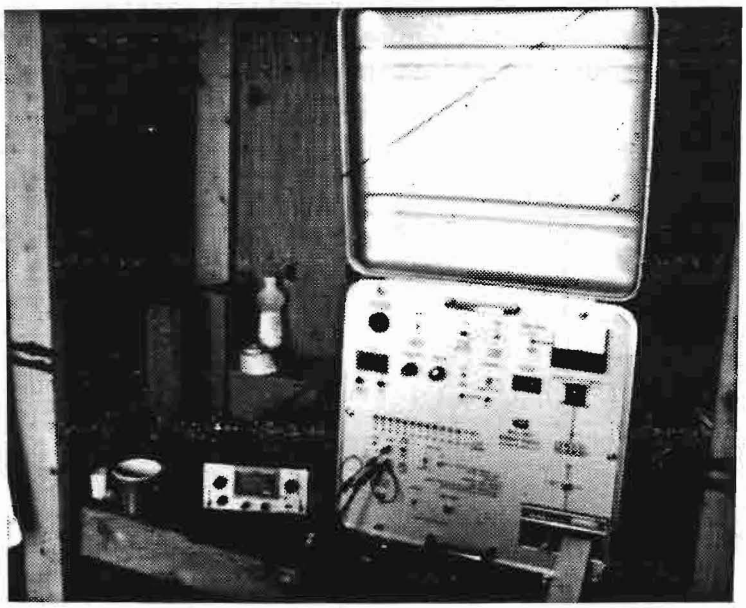


Plate 2-2-4. 1980 Model Bendix SSS counter with Sony oscilloscope monitoring fish passage and corresponding counter accuracy, Adult Anadromous Investigations, Su Hydro Studies, 1982.

2.2.1.2 Fishwheel

Fishwheels were operated at all escapement monitoring stations in 1982 (Table 2-2-1). Fishwheels at Susitna Station (RM 26) were an aluminum conduit design (Barrett, 1974). Fishwheels deployed at Yentna (RM 04), Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations were designed in 1981 by ADF&G/Su Hydro Adult Anadromous staff (Plate 2-2-6). Construction specifications and deployment procedures can be found in the Phase I, ADF&G/Su Hydro, Adult Anadromous Report (1981). The fishwheel design was modified in 1982 by reducing the size of fishwheel baskets to an average length and width of 2.3 m and 1.8 m respectively and building live boxes that were re-sized to 1.0 m width, 1.8 m length and 0.9 m depth at Sunshine, Talkeetna and Curry stations.

Plate 2-2-5. Raising a sonar substrate for debris removal and adjustment, Adult Anadromous Investigations, Su Hydro Studies, 1982.

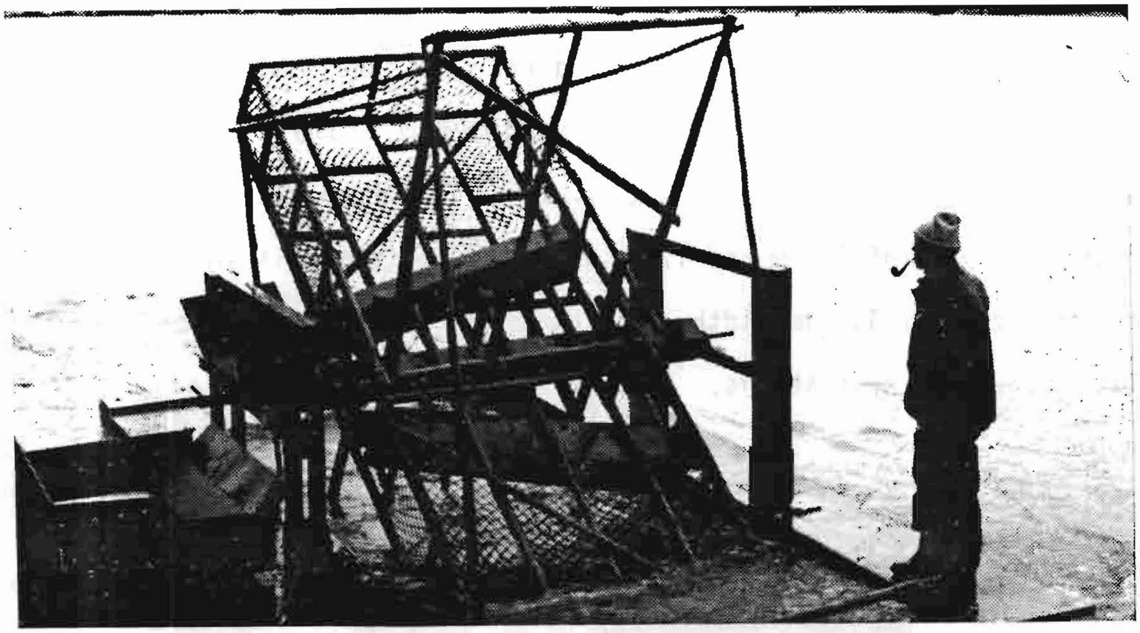


Plate 2-2-6. Fishwheel operating off east bank of the Susitna River at Sunshine Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Fishwheels were operated at Yentna (RM 04) and Susitna (RM 80) stations daily with a minimum catch limit established for sonar apportionment at 150 fish. At Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations fishwheels were operated continuously, 24 hours per day. Variances from this schedule included shut-downs for routine maintenance, debris problems associated with flood events, and occasionally at Sunshine Station, shutdowns due to large catches that could not always be processed due to safety and personnel constraints.

2.2.1.3 Tagging

All fishwheel intercepted chinook (≥ 351 mm length), sockeye, pink, chum and coho salmon at Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations were tagged in 1982. Petersen disc tags, 2.5 cm in diameter, were used to tag chinook salmon (≥ 351 mm length), and at the three stations. These tags were also used for marking sockeye, pink, chum and coho salmon at Curry Station. Floy FT-4 spaghetti tags were used to tag sockeye, pink, chum and coho salmon at Sunshine and Talkeetna stations (Plate 2-2-7). All tags were color coded by respective station and a subsample was numbered (Table 2-2-2).

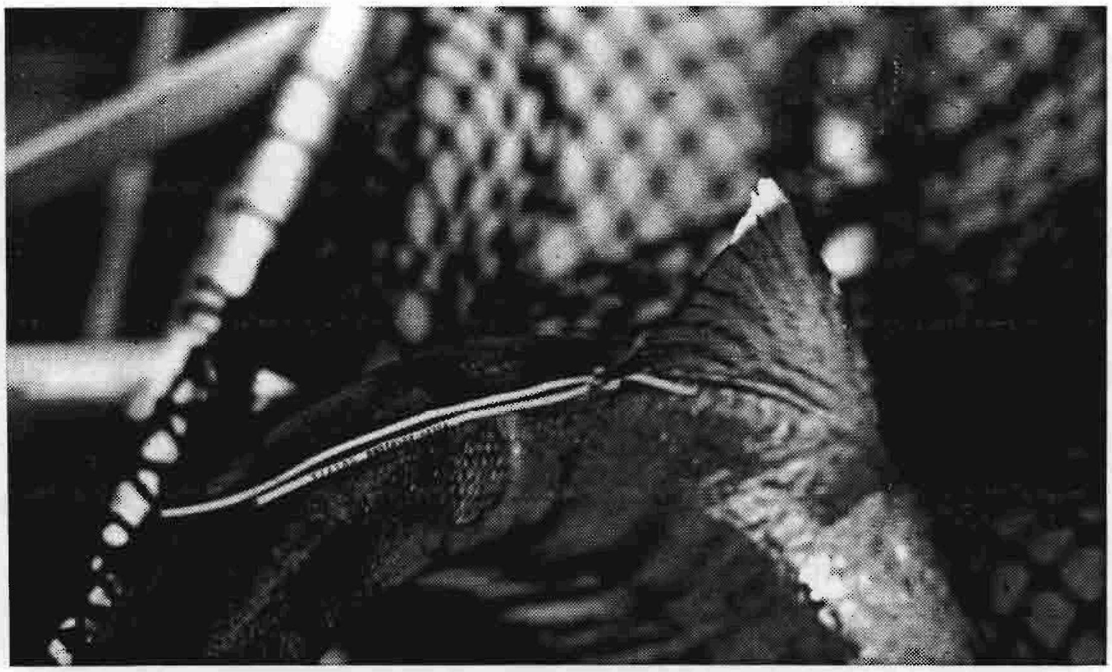


Plate 2-2-7. Chum salmon tagged with Floy FT-4 numbered spaghetti tag, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-2-2. Tag type and color code used at Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Location	River Mile	Tag	
		Type	Color
Sunshine Station	80	FT-4/Spaghetti Petersen Disc	Int. Orange White
Talkeetna Station	103	FT-4/Spaghetti Petersen Disc	Yellow Yellow
Curry Station	120	Petersen Disc	Int. Orange

The procedures that were followed in 1982 for attaching Petersen disc and spaghetti tags on salmon are defined in the Phase I Final Draft Report, Adult Anadromous Fisheries Project, ADF&G/Su Hydro, 1981.

All fish recaptured at upstream sampling stations were released following species identification and recording of tag type, color and number.

2.2.1.4 Age, Length and Sex

Age, length and sex composition samples were collected daily in 1982 from all fishwheel intercepted chinook salmon and from 40 sockeye, 20 chum and 20 coho salmon at each sampling station. Pink salmon, all two year old fish, were sampled at a rate of 20 fish daily at each site. Age samples were obtained by removing the 'preferred scale' located two rows above the lateral line on the diagonal between the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Sex was determined from morphologic characteristics. Fork length (FL) measurements were taken from mid-eye to fork of tail and recorded to the nearest five mm on all salmon except chinook salmon where recordings were made to the nearest 10 mm. Average processing time for age, length and sex sampling per fish ranged from 20 to 30 seconds. All fish were released immediately following sampling.

2.2.1.5 Radio Telemetry

In 1982, sixteen chinook, 18 chum and 16 coho salmon were intercepted by fishwheels at Talkeetna (RM 103) and Curry (RM 120) stations and implanted with radio transmitters according to the following schedule:

Chinook Salmon	June 22	- July 15
Chum Salmon	July 30	- August 28
Coho Salmon	August 17	- August 29

Two additional chum salmon were radio tagged on August 22 at the entrance of Devil Canyon (RM 150.4).

All transmitters and associated tracking equipment were developed by Smith-Root Incorporated, Vancouver, Washington. Fish selection, processing, transmitter insertion and telemetry procedures were similar to those used in 1981 (ADF&G/Su Hydro, 1981). Variances in 1982 were that no live weights were recorded, and antennas were anchored in chinook and chum salmon by inserting a #2 nickel coated beak hook in the dorsal gum of the mouth instead of along either side of the roof mid-line. The 1981 'heat-to-shrink' method of anchoring transmitter antennas on chum salmon was not used in 1982 (ADF&G, 1981a).

Transmitters implanted in coho salmon in 1982 incorporated a new technique developed by Su Hydro staff and termed the 'mohair modification'. In this procedure, two 0.6 cm wide mohair strips of 'ski skin' were attached with waterproof, quick cure glue opposite each other and lengthwise on the transmitter with the mohair fibers pointing anteriorly. The mohair strips were positioned flush with the distal end of the transmitter and extended anteriorly to within 0.8 cm of the antenna connection. Placement of radio antenna on coho salmon was accomplished by using the hook method defined above for chinook and chum salmon and alternatively using the 'wire modification' (ADF&G, 1981a).

Radio tracking was conducted a minimum of three times weekly from fixed wing aircraft and waterbourne craft. Chinook salmon were tracked from June 22 through August 11; chum salmon were monitored from July 30 through October 4 and coho were tracked from August 17 through October 4. Fish locations were recorded to the nearest 0.1 river mile.

2.2.1.6 Lower Devil Canyon Gill Netting

Two set net locations in the lower Devil Canyon (RM 150 - 151) reach were each fished on an average of two hours weekly from August 7 to September 7 in 1982. One net location was at RM 150.4 and the second at RM 150.2. The standard gill net used measured 15.2 m long and 1.5 m deep with 13.3 cm stretched mesh. The nearshore end of each net was staked to the bank and the offshore net end was held in place on a downstream arc by a single 35 pound Navy anchor. All fish caught were identified to species and released.

2.2.1.7 Stock Separation

For stock separation purposes, age composition data was collected from all second run sockeye salmon caught in fishwheels at Talkeetna (RM 103) and Curry (RM 120) stations in July, August and September. The same data was collected from a sample of 200 second run sockeye salmon from the Tokositna River, tributary to the Chulitna River (RM 98.5) and the outlet stream of Larsen Lake, tributary to the Talkeetna River (RM 97.0) in mid August using a beach seine.

The Statewide Biology Group of ADF&G, Commercial Fisheries Division, analyzed the samples for stock differences by procedures as defined in Appendix 2-H.

2.2.2 Spawning

2.2.2.1 Main Channel

The main channel of the Susitna River was surveyed for spawning areas by three - two member crews based at Yentna (RM 04), Sunshine (RM 80) and Gold Creek (RM 136.7) stations in 1982. The geographic area of responsibility and survey period for each crew were as defined below:

Yentna Crew	RM 0.0 - RM 61.0	August 1 - September 30
Sunshine Crew	RM 61.0 - RM 98.5	August 1 - October 7
Gold Creek Crew	RM 98.5 - RM 151.0	August 7 - October 7

The surveys were conducted by a combination of four methods:

1. Electroshockers, portable and boat mounted
2. Drift gill nets
3. Egg deposition pumps
4. Visual assessment

The main gear used to sample for salmon spawning were boat mounted electrofishing units. Specific models used were the VVP - 3C, VVP - 3E and VVP - 15 Coffelt electroshockers. Each boat mounted unit was powered by a 3500 watt Homelite generator. The operation of this gear was the same as defined in section 2.1.2 of this report. All portable or backpack shockers used were the Coffelt Model BP-IC. All drift gill nets deployed measured 15.2 m long and 1.5 m deep with a 13.3 cm stretch mesh. Each egg deposition pump had a backpack mounted Model XLS1 Homelite two cycle engine, water pump and a standing screen cod end net which sampled a 1,800 cm^2 area of substrate.

Nearly all main channel areas of the Susitna River were electrofished with boat mounted units. Shallow areas which prevented boat access were sampled by portable electroshockers and drift gill nets. Foot surveys were made in areas where water clarity allowed visual observation.

Anadromous fish intercepted by drift net and electrofishing gear in main channel areas were not assumed to be spawning at the catch location unless the following criteria were met:

1. Fish exhibited spawning maturation colors and morphology.

2. Fish expelled eggs or milt when slight pressure was exerted on the abdomen.

3. Fish were in vigorous condition, with 25 percent or more of the eggs or milt remaining in the body cavity.

4. Additional sampling effort produced fish meeting criteria 1 through 3 above.

Fish observed on foot surveys were not assumed to be spawning at a specific location unless: (1) redds were discernible and (2) subsequent site sampling with an egg deposition pump produced eggs.

2.2.2.2 Sloughs and Streams

All known Susitna River sloughs and streams between Chulitna River (RM 98.5) and Devil Canyon (RM 151) were surveyed weekly from August 3 to October 7, 1982.

Streams in the Susitna River reach north of RM 151 to Devil Creek (RM 161) were surveyed as time permitted from the first through fourth week of August. A single survey of all known sloughs and streams between RM 98.5 and 161 was made during the fourth week of October.

All surveys were conducted by foot except for the occasional use of a helicopter and boat. Surveyors wore polaroid sunglasses and enumerated live and dead fish with hand held tally counters.

Tag recovery counts were conducted north of RM 98.5 in conjunction with the scheduled escapement surveys. Tag recovery surveys were also performed south of RM 98.5 to RM 88 in pre-selected spawning areas when visibility conditions allowed accurate distinction between live tagged and untagged fish (Table 2-2-3). These surveys were conducted on foot with the number of live tagged and untagged fish by species recorded.

Table 2-2-3. Survey schedule of selected spawning areas between RM 88 and Chulitna River (RM 98.5), Adult Anadromous Investigations, Su Hydro Studies, 1982.

Spawning Area	Location 1/	Period	Frequency
Birch Creek (lower)	88.4	8/7 - 8/25 9/15 - 9/28	weekly weekly
Fish Creek	97.1	8/15 - 8/28	weekly
Byers Creek	97.8	8/15 - 9/7	weekly
Troublesome Creek	97.8	8/27 - 9/15	weekly
Answer Creek	84.1	9/15 - 9/28	weekly
Question Creek	84.1	9/15 - 9/28	weekly
Cache Creek	95.4	9/15 - 9/28	weekly
Swan Creek	97.8	9/21 - 9/28	once

1/ Confluence of spawning area or its receiving waters with Susitna River mainstem.

2.2.2.2.1 Chinook Salmon Index Surveys

Chinook salmon escapement index surveys were made in the Susitna River basin from July 12 through August 12 on all known and suspected spawning areas north of RM 98.5, and south of RM 98.5 on major streams with known spawning activity. Surveys conducted north of Talkeetna (RM 97.0) were performed by ADF&G Su Hydro Adult Anadromous Project personnel; surveys south of Talkeetna were conducted by ADF&G, Region II, Sport Fish Division staff with minor assistance from ADF&G Su Hydro personnel.

Chinook salmon index surveys were performed either by foot or helicopter with observers wearing polaroid sunglasses and enumerating individual live and dead fish by hand held tally counters.

2.3 Bering Cisco

2.3.1 Main Channel Escapement

Sampling for Bering cisco was done with fishwheels at Susitna (RM 26), Yentna (RM 04), Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations in conjunction with scheduled 1982 adult salmon operations. Additionally, at Sunshine Station the upper east bank fishwheel was operated 24 hours per day through October 1 in 1982 to sample Bering cisco.

All fishwheel catches of Bering cisco were recorded and 20 age and length samples were collected daily when available at each sampling station. Average processing time per fish for age and length sampling was 20 seconds or less. All cisco were released after sampling.

Age samples were collected by removing the 'preferred scale' as identified in report section 2.2.1.4. Lengths were taken from the tip of snout to fork of tail and recorded to the nearest mm.

2.3.2 Main Channel Spawning

The main channel of the Susitna River was surveyed from RM 0.0 to RM 151.0 for Bering cisco spawning areas in 1982 using the same methods and schedule defined in report section 2.2.2.1.

Sex composition samples were collected September 15 through October 13 from all Bering cisco intercepted in the main channel. Sex and spawning ripeness determinations were made by palpitation of the abdomen of each fish to induce milt or egg release. Females were considered ripe when slight abdominal pressure caused egg release. Males were judged to be ripe when a free release of milt occurred when minimal abdominal pressure was applied.

2.4 Data Analysis and Evaluation

2.4.1 Eulachon Length Data

First and second run eulachon length data were tested at the 95 percent confidence level to determine whether significant differences in lengths existed between fish sampled of the two runs. The two tests used were:

1. Students T test (Dixon and Massey, 1969); and

2. Mann-Whitney median test (Daniel, 1978).

2.4.2 Salmon Tag and Recapture Escapement Estimates

Chinook ($>$ 350 mm length), sockeye, pink, chum and coho salmon escapements to Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations were calculated according to the following formula (Ricker, 1975):

$$\hat{N} = (m+1)(c+1)/(r+1)$$

where:

m = Number of fish successfully marked = (number originally tagged)•(tag retention (R) factor)

c = Total number of fish examined for marks (tags) during sampling census

r = Total number of marked (tagged) fish observed during sampling census

$\hat{N}$ = Population estimate

The 95 percent confidence limits around $\hat{N}$ were determined by using the formula (Dixon and Massey, 1969):

$$r/c + 1.96\sqrt{\frac{r/c\ (1-r/c)}{c}} < r/c < r/c - 1.96\sqrt{\frac{r/c\ (1-r/c)}{c}} = .95$$

$$r/c_{upper}\ (1/m) < 1/\hat{N} < r/c_{lower}\ (1/m)$$

Tag losses were estimated by data collected from repeated surveys in spawning areas where visibility conditions permitted unrestricted identification of shed tags, tagged scarred fish (where applicable) and live tagged fish (Appendix Table 2-F-3). Computation of tag retention by tag type and tagging location was made through the following formula:

$$R = \frac{T}{S + T}$$

where:

T = Number of live tagged fish observed by tag type and tagging station.

S = Number of shed tags by tag type and tagging station and or when applicable number of tagged scarred fish.

R = Tag retention factor

The formula used to estimate the number of chinook salmon length (FL) 350 mm and less migrating to Sunshine, Talkeetna and Curry stations was:

$$J = \frac{\hat{N}b}{e}$$

where:

$\hat{N}$ = Population estimate for fish larger than 350 mm length (FL).

b = number of fish intercepted at tagging location length (FL) 350 mm and less.

e = number of fish intercepted at tagging location larger than 350 mm length (FL).

J = Population estimate of fish length (FL) 350 mm and less.

2.4.3 Presentation of Salmon Escapement Estimates

The SSS counts recorded at Susitna (RM 26) and Sunshine (RM 80) stations have been presented in this report as relative escapement estimates by species for the respective location. The rationale for classifying Susitna Station SSS counts as relative escapement estimates can be found in the 1982 Upper Cook Inlet Data Report, ADF&G, Soldotna, Alaska (Tarbox and King, in press). The basis for classifying Sunshine Station SSS counts in the same manner were: (1) the two sonar counters at Sunshine Station were sited in a braided, non-consolidated main channel reach (Appendix Figure 2-A-3); and electroshocking in the area of Sunshine Station established the presence of adult salmon in channels that were not monitored by SSS gear (Appendix Table 2-F-1); and (2) the two SSS counters at Sunshine Station were not sited directly across from each other (Appendix Figure 2-A-3); one counter was located off the far east bank of the river at RM 79 and the west bank sonar was sited off the far west bank of the river at RM 81; a number (unquantified) of fish probably crossed between the two SSS sites and were not counted or were counted twice.

The SSS counts logged at Yentna Station (RM 04) have been reported as total escapement numbers to the Yentna River (RM 28). The basis for this decision was that: (1) the SSS sector data, collected in 1981 and 1982 at Yentna Station indicated that no significant ($\geq$10%) fish passage occurred offshore of the counting ranges of either sonar (Appendix 2-B); (2) the Yentna River at RM 04 was consolidated with no side channels; (3) the bottom profiles collected at both SSS locations indicated the two sonar substrates were in full contact with the river bottom (Appendix 2-B); (4) the two SSS counters were nearly directly across from one another therein there was probably minimal, if any fish cross-over between the two sonar installations; and (5) no alternate or 'better' escapement monitoring method in use on the Yentna River.

A factor which should be considered when reviewing Yentna Station (RM 04) SSS counts was that the counts were apportioned by unadjusted fishwheel catch (relative abundance) data. Inasmuch as fishwheels have been shown to be species selective (Thompson and Barrett, in press), the Yentna Station apportioned SSS counts may be biased. It is probable that the counts recorded at Yentna Station were over apportioned for pink salmon and under apportioned for chum salmon due to general selectivity of fishwheels for pink salmon and against chum salmon and the migrational overlap of the two species in timing at Yentna Station (Thompson and Barrett, in press).

The two SSS counters at Talkeetna Station (RM 103) were: (1) sited in a non-braided main channel reach; (2) sited off opposite banks nearly in direct line with one another (Appendix 2-A); (3) sited where bottom profiles indicated that complete stream bed contact occurred with the sonar substrates (Appendix 2-B); and (4) sited at a location on the main channel where the resultant sector distribution data did not indicate significant ($\geq$ 10%) fish migration offshore of the two counting ranges (Appendix 2-B). Talkeetna Station SSS counts, however, were not used to report Susitna River escapement to RM 103 due to: (1) probable misapportionment of the SSS counts due to fishwheel selectivity; and (2) an escapement estimate obtained by the Petersen method for RM 103 which was not biased by fishwheel selectivity.

The Petersen population estimates have been reported as total escapement numbers by species. The estimates, however, do not represent just the number of fish by species that spawned above each of the particular tagging sites. Adult salmon milling activity occurs in the Susitna River main channel. It is common for adult salmon to migrate upstream beyond their respective spawning area and then descend and enter a system to spawn (Barrett 1974, Friese 1975). The Petersen population estimates presented in this report were the number of fish, by species, that migrated to the respective tagging sites. This includes the milling fish and the fish that spawned upstream.

Six basic assumptions were made in calculating the Petersen population estimates for Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations presented in this report. These assumptions listed in Begon (1979) were: (1) fishwheel catches were random with respect to the population; (2) there was no mortality due to the tagging process; (3) tagged salmon had the same natural mortality as untagged salmon; (4) tagged salmon mixed randomly within the population; (5) tagged salmon were recognized during surveys; and (6) tag losses did not occur or were determined. Violation of one or more of these assumptions would bias toward an over estimate of the escapement. In an attempt to minimize this probability several preventive measurements were followed. At Sunshine, Talkeetna and Curry stations equal numbers of fishwheels were operated off each bank of the river. All wheels were operated at the same efficiency from the beginning of the season to the end. Only fish in robust conditions were tagged. Fish which appeared stressed or were lethargic were not tagged. Sampling for tag recoveries was continuous through the spawning period and was not conducted closer than five miles to the tagging location to insure random mixing of tagged and untagged fish. Tag losses were monitored and numbers adjusted to account for losses (Appendix Table 2-F-3). And lastly, tag recovery surveys were conducted only when survey conditions permitted unrestricted visibility to insure accurate distinction between tagged and untagged fish.

The 1981 and 1982 Petersen population estimates reported for Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations should be considered quite reliable or 'good' for estimating the salmon escapements at these locations. Exceptions in the 1981 Petersen population estimates were: (1) the pink salmon estimate for Talkeetna Station which was 'average'; and (2) the pink salmon and coho salmon estimates for Curry Station which were 'poor' and 'less than poor' respectively. The 1982 exceptions were: (1) the chinook and coho salmon escapement estimates for Talkeetna Station which both were 'average'; and (2) the Curry Station chinook and coho salmon estimates which were 'average' and 'poor' respectively. These ratings were based on a 95 percent confidence interval of 20 percent, 40 percent and 60 percent of the estimated value for ratings of 'good', 'average' and 'poor', respectively (Cousens et al., 1982).

2.4.4. Calculation of Main Channel Escapement Timing

Escapement timing by species was determined for each of the main channel stations through interpretation of fishwheel catch rate data wherein the migration was defined to have 'started', 'reached a midpoint' and 'ended' on the date when 5.0 percent, 50.0 percent and 95.0 percent respectively of the cumulative daily mean hourly fishwheel catch was attained at the respective station.

2.4.5 Age Determination

Age determination was made by standard scale analysis techniques using a portable microfiche reader. Age classes were described using the Gilbert-Rich notation. By this notation, age 5_2 fish are those fish which return to spawn in their fifth year of life having migrated or smolted from freshwater to the marine environment in their second year of life after having spent one winter rearing in fresh water.

3.0 RESULTS AND DISCUSSION

3.1 Eulachon

3.1.1. Estuary

Eulachon were intercepted on the first day fished with set gill nets in the estuary on May 16, 1982. This was also the day the Susitna River main channel was first ice-free. The catch of eulachon per net minute (CPUE) fished on May 16 was 1.1 pre-spawners (Table 2-3-1). From May 17 through May 22 the catches in the estuary were relatively stable with CPUE's recorded between 1.2 and 1.5 eulachon. Over the next eight days eulachon catches declined to a 0.1 CPUE on May 30.

A second run of eulachon entered the Susitna River estuary on or about June 1, 1982 (Table 2-3-1). On June 2, a CPUE of 17.9 pre-spawning eulachon was recorded, a 17,900 percent increase over the 0.1 CPUE recorded three days earlier. On June 5 and 7 CPUE values were 2.6 and 2.5 eulachon, respectively. The migration of second run eulachon was over by June 9 based on a recorded CPUE on that date of 0.0 eulachon.

Second run eulachon were approximately 4.5 times more abundant than first run fish, as determined by set net catch data reported in Table 2-3-1.

Eulachon set net catches in the estuary and water temperatures recorded at RM 26 are graphed in Figure 2-3-1. There is no correlation apparent between the two variables.

Table 2-3-1. Eulachon set net catches in Susitna River estuary, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Date	Tide 1/		Location		Fishing Time 2/			Eulachon Catch			C.P.U.E. 5/
					Net		Total	Pre-	Post-		
	Ht.	Time 2/	Site No. 3/	RM 4/	In	Out	Min.	Spawners	Spawners	Total	
5/16	22.6	1214	1	4.0	1320	1350	30	42	0	42	1.1
5/16	22.6	1214	2	4.5	1200	1230	30	24	0	24	
5/17	23.0	1333	1	4.0	1248	1322	34	72	0	72	1.5
5/17	23.0	1333	2	4.5	1348	1418	30	22	0	22	
5/19	27.8	0344	1	4.0	0257	0327	30	47	0	47	1.2
5/19	27.8	0344	2	4.5	0359	0429	30	27	0	27	
5/20	28.0	1642	1	4.0	1557	1627	30	31	0	31	1.4
5/20	28.0	1642	2	4.5	1704	1734	30	50	0	50	
5/22	31.5	0532	1	4.0	0447	0517	30	60	0	60	1.3
5/22	31.5	0532	2	4.5	0546	0614	28	15	0	15	
5/23	30.8	1906	1	4.0	1821	1852	31	38	8	46	0.7
5/23	30.8	1906	2	4.5	1921	1951	30	7	18	25	
5/26	32.0	0825	1	4.0	0740	0810	30	32	1	33	1.0
5/26	32.0	0825	2	4.5	0840	0910	30	25	15	40	
5/28	28.7	1014	1	4.0	0929	1000	31	2	3	5	0.4
5/28	28.7	1014	2	4.5	1029	1059	30	24	48	72	
5/30	25.4	1245	1	4.0	1200	1230	30	1	4	5	0.1
5/30	25.4	1245	2	4.5	1300	1330	30	6	23	29	
6/2	28.6	0344	1	4.0	0259	0303	4	98	1	99	17.9
6/2	28.6	0344	2	4.5	0359	0403	4	45	0	45	

Table 2-3-1. Continued.

Date	Tide 1/ Ht.	Tide 1/ Time 2/	Location Site No. 3/	Location RM 4/	Fishing Time 2/ Net In	Fishing Time 2/ Net Out	Fishing Time 2/ Total Min.	Eulachon Catch Pre-Spawners	Eulachon Catch Post-Spawners	Eulachon Catch Total	C.P.U.E. 5/
6/5	28.2	1753	1	4.0	1711	1741	30	30	11	41	2.6
6/5	28.2	1753	2	4.5	1820	1850	30	124	94	218	
6/7	29.4	0634	1	4.0	0549	0619	30	4	63	67	2.5
6/7	29.4	0634	2	4.5	0649	0719	30	143	148	291	
6/9	28.6	0741	1	4.0	0640	0710	30	0	2	2	
6/9	28.6	0741	2	4.5	0736	0802	26	1	16	17	0.0

1/ High Tide in feet

2/ Military Time

3/ Site No:1 (T14N R7W Section 5 DAC)
Site No:2 (T14N R7W Section 5 AAC)

4/ River Mile

5/ C.P.U.E.: Mean number of pre-spawners/net/minute

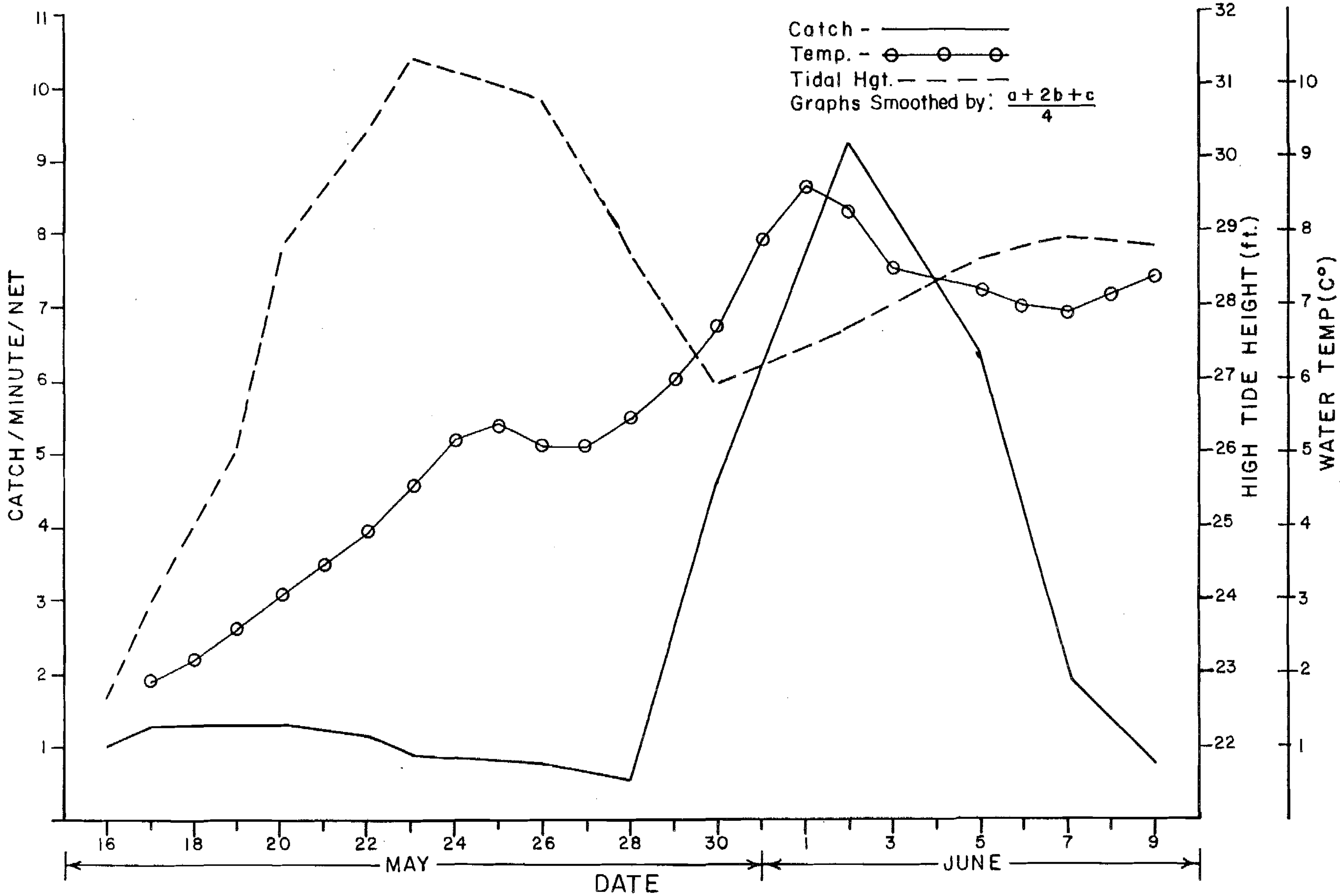


Figure 2-3-1. Mean number of pre-spawning eulachon intercepted per net minute in the Susitna River estuary and corresponding high tide ranges and temperatures, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The first run of eulachon (May 16-30) entered the estuary at high tides ranging from 22.6 to 32.9 feet. The second run (June 1-8) entered the estuary at high tides ranging from 25.5 to 29.4 feet. A plot of daily high tide levels and eulachon catches as provided in Figure 2-3-1 does not indicate a correlation between the two variables.

Post-spawning condition eulachon were first intercepted in the estuary May 23 when 26 fish were caught in 61 net minutes (Table 2-3-1 and Plate 2-3-1.). Five days later on May 28 the catches peaked and then began a decline. An inseason low was reached on June 2. Catches then began to increase and on June 7 a season high was reached when 211 post-spawners were caught in 60 net minutes. By June 9 the catch had dropped to one-tenth the June 7 catch. Based on these catch patterns two distinct downstream movements of

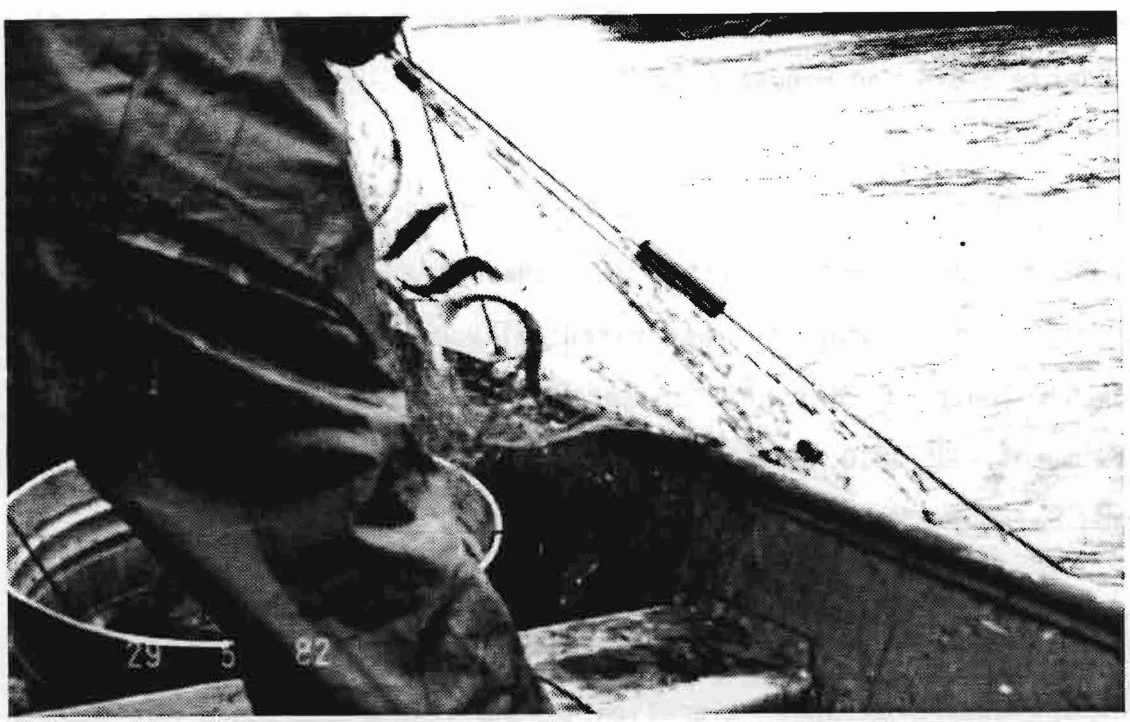


Plate 2-3-1. Eulachon escapement sampling with gill net at Susitna River mile 4.5.

post-spawners occurred between May 23 and June 9. The first movement occurred between May 23 and June 2, and the second began June 5 and ended on June 9, approximately.

3.1.2 Main Channel

The results of sampling the Susitna River main channel from the estuary to RM 53.8 for eulachon presence, spawning condition and sex composition are summarized in Tables 2-3-2 and 2-3-4 (Plates 2-3-2 and 2-3-3).

The first run of eulachon which entered the estuary between May 16 and May 30 began spawning in the Susitna River mainstem on or about May 21 in 1982 (Tables 2-3-2 and 2-3-3). Spawning by first run fish was essentially over by May 31. The furthest point first run fish ascended was RM 40.5, approximately (Table 2-3-2). The majority of the spawning occurred below RM 28.1 (Table 2-3-4 and Figure 2-3-2).

The second run of eulachon which passed through the estuary between June 1 and June 8, 1982 first initiated main channel spawning on or about June 4. Spawning by second run fish was essentially over by June 9 (Table 2-3-3). The upper limit of migration of second run fish in the Susitna River was approximately RM 48.0 (Table 2-3-2). The majority of the second run fish spawned below RM 28.1 (Table 2-3-4).

Both first and second run eulachon entered the Yentna River (RM 28). The extent and nature of their migration in the Yentna River was not determined in accordance with the Phase II project scope.

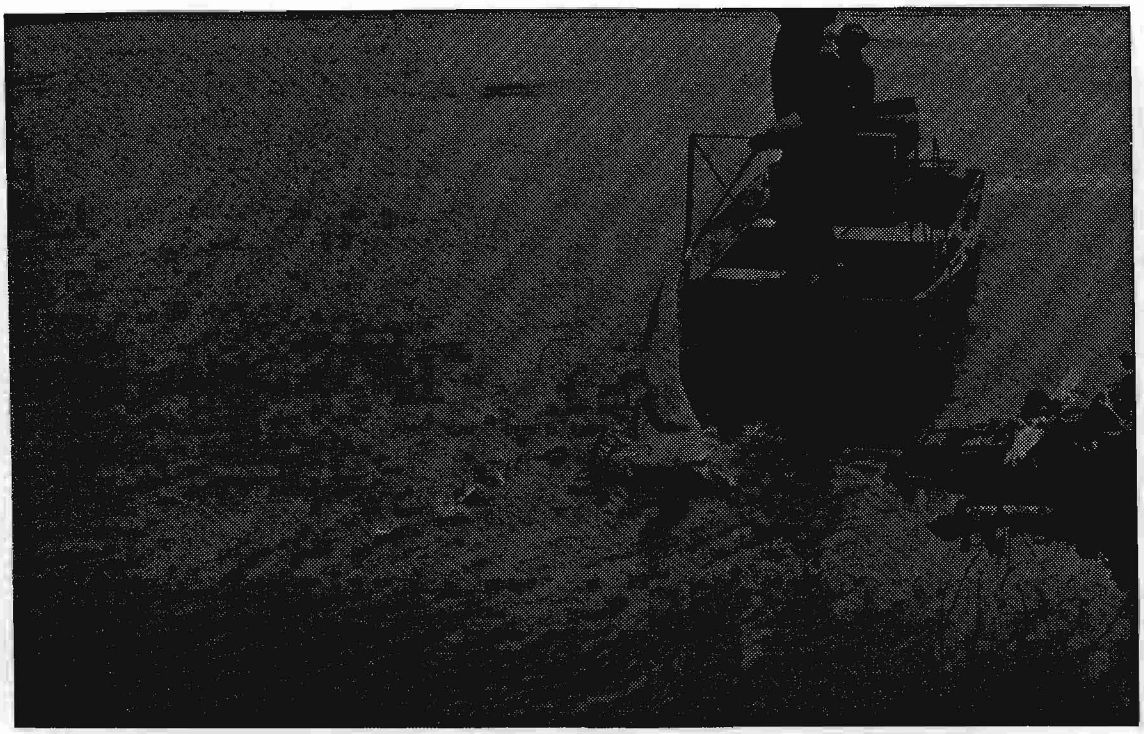


Plate 2-3-2. Electroshocking the Susitna River for eulachon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Plate 2-3-3. Eulachon escapement sampling with dipnet at Susitna River mile 4.5, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-2. Presence and spawning condition of eulachon in Susitna River mainstem, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Date	River Mile	Sampling Method[1] D/N	Sampling Method[1] Elect.	Eulachon Present	Spawning Condition Pre.	Spawning Condition Post.[2]
5/16	4.5	X		X	X	
5/17	4.5	X		X	X	
5/18	25.5		X	X	X	
5/18	28.0		X	X	X	
5/18	25.5		X	X	X	
5/19	4.5	X		X	X	
5/19	25.5	X		X	X	
5/20	4.5	X		X	X	
5/20	36.7	X	X	X	X	
5/20	40.4		X	X	X	
5/20	40.5		X	X	X	
5/20	40.8		X			
5/21	25.5	X		X	X	2
5/21	46.9		X			
5/21	47.0		X			
5/21	47.1		X			
5/21	48.4		X			
5/21	48.5		X			
5/21	48.8		X			
5/21	48.9		X			
5/21	49.0		X			
5/21	49.4		X			
5/21	49.5		X			
5/21	49.0-49.8		X			
5/21	49.1-49.3		X			
5/22	25.5	X		X	X	3
5/23	16.3-16.5	X		X	X	3
5/23	20.1		X	X	X	2
5/23	21.9		X	X	X	
5/23	22.0		X	X	X	
5/24	25.5	X		X	X	2
5/24	27.8-28.2		X			
5/24	33.3		X			
5/24	33.9-34.2		X			
5/24	35.7		X			
5/24	36.9		X			
5/24	38.3		X			
5/24	40.0		X			
5/24	40.3		X	X		
5/24	40.5		X			
5/24	43.3		X			
5/25	25.5	X		X		
5/25	26.4-26.5		X	X	X	3
5/25	27.0	X	X	X	X	3
5/25	30.7-31.0		X			
5/25	28.7-29.2		X			
5/25	30.4-30.5		X			
5/26	4.5	X		X	X	3
5/26	7.5		X			
5/26	8.5		X	X	X	3
5/26	10.8		X	X	X	3
5/26	13.5		X	X	X	1
5/26	16.3		X	X	X	1
5/26	18.3	X		X	X	3
5/26	19.5	X		X	X	3
5/26	22.5	X		X	X	3
5/27	22.5	X		X	X	1
5/28	16.3	X		X	X	1
5/28	18.5	X		X	X	3
5/28	25.5	X		X	X	3
5/29	27.0	X		X	X	3
5/29	36.6-36.7		X			
5/29	43.0-43.6		X			
5/29	43.6-43.7		X			
5/29	43.7-43.8		X			
5/29	44.5		X			
5/29	46.6		X			
5/29	48.8-48.9		X			
5/29	48.9		X			
5/29	52.9		X			
5/29	53.0		X			
5/30	19.8	X		X	X	3
5/30	16.3	X		X	X	3
5/30	18.5	X		X	X	1
5/30	22.8		X	X	X	3
5/30	24.8		X	X	X	1
5/31	25.5	X		X	X	1
5/31	25.8		X	X	X	1

Table 2-3-2. Continued.

Date	River Mile	Sampling Method[1/] D/N	Sampling Method[1/] Elect.	Eulachon Present	Spawning Condition Pre.	Spawning Condition Post.[2/]
5/31	25.8-26.0		X	X	X	3
5/31	26.5	X		X		
6/1	16.3	X		X	X	1
6/1	18.5	X		X	X	
6/1	19.5	X		X	X	
6/1	21.0	X		X	X	3
6/1	21.0	X		X	X	3
6/1	25.5	X		X	X	1
6/2	25.5	X		X	X	1
6/2	30.1	X		X	X	1
6/2	36.8	X		X	X	1
6/2	41.4	X		X	X	1
6/2	45.8	X		X	X	1
6/2	47.9	X		X	X	1
6/2	48.7	X				
6/2	50.4	X				
6/3	25.5	X		X	X	2
6/3	36.8	X		X	X	1
6/3	38.4	X		X	X	1
6/3	41.4	X		X	X	1
6/3	44.0	X		X	X	1
6/3	45.0	X				
6/3	45.7	X				
6/3	46.0	X				
6/3	49.1	X				
6/3	49.2	X				
6/3	53.8	X				
6/4	25.5	X		X	X	1
6/4	36.8		X	X	X	1
6/4	41.4		X	X	X	
6/4	45.0	X		X	X	3
6/4	45.8		X			
6/4	47.8		X			
6/4	48.0	X		X	X	2
6/4	49.1		X			
6/4	53.1		X			
6/4	50.7-50.9		X			
6/5	9.5	X		X	X	3
6/5	15.0	X		X	X	3
6/5	25.5	X		X	X	3
6/5	27.9	X		X	X	3
6/5	31.0	X		X	X	1
6/5	31.8	X		X	X	1
6/6	15.0	X		X	X	3
6/6	16.3	X		X	X	3
6/6	25.5	X		X	X	3
6/7	35.5	X		X	X	3
6/7	45.6	X				
6/7	45.9	X				
6/7	47.3	X		X	X	1
6/7	47.4	X				
6/7	49.2	X				
6/7	49.7	X				
6/7	50.8	X				
6/8	18.3	X		X	X	3
6/8	20.0	X		X	X	1
6/8	21.7	X		X	X	2
6/8	31.2	X		X	X	1
6/8	31.3	X				
6/8	32.4	X				
6/8	34.6	X				
6/8	34.9	X				
6/8	35.0	X				
6/8	36.1	X				
6/8	36.7	X				
6/9	15.0	X		X	X	3

1/D/N = Dip Net; Elect. = Electrofishing

2/ 1 = Male post spawners present; 2 = Female post spawners present; 3 = Male and female post spawners present

Table 2-3-3. Sex composition and spawning condition of eulachon sampled at various Susitna River locations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Date	Location (R.M.) 1/	Sample Size	Number Males	Number Females	Sex Ratio (M:F)	Spawning Condition 2/ (%) Males Pre.	Males Post.	Females Pre.	Females Post.
5/16	4.5	110	74	36	2.1:1	100	0	100	0
5/17	4.5	173	98	75	1.3:1	100	0	100	0
5/18	25.5	11	9	2	4.5:1				
5/18	28.0	53	42	11	3.8:1				
5/18	28.5	106	85	21	4.1:1				
5/19	4.5	103	51	52	1.0:1	100	0	100	0
5/19	25.5	117	61	56	1.1:1				
5/20	4.5	151	82	69	1.2:1	100	0	100	0
5/20	36.7	47	37	10	3.7:1	100	0	100	0
5/20	40.4	8	6	2	3.0:1	100	0	100	0
5/20	40.5	16	12	4	3.0:1	100	0	100	0
5/21	25.5	360	211	149	1.4:1	100	0	98.0	2.0
5/22	25.5	100	42	58	0.7:1	92.9	7.1	84.5	15.5
5/23	20.5	119	22	97	0.2:1	100	0	88.7	11.3
5/23	21.9	144	132	12	11.0:1				
5/23	16.3	148	112	36	3.1:1	96.4	3.6	94.4	5.6
5/24	25.5	139	87	52	1.7:1	100	0	53.9	46.1
5/25	25.5	104	80	24	3.3:1	76.2	23.8	79.2	20.8
5/25	27.0	356	352	4	88.0:1	92.3	7.7	75.	25
5/25	26.5	84	78	6	13.0:1	79.5	20.5	50	50
5/26	4.5	114	52	62	0.8:1	94.2	5.8	88.7	11.3
5/26	8.5	32	10	22	0.5:1	90	10	59.1	40.9
5/26	10.8	66	34	32	1.1:1	91.2	8.8	96.9	3.1
5/26	13.15	15	12	3	4.0:1	66.7	33.3	100	0
5/26	16.35	203	119	84	1.4:1	88.2	11.8	100	0
5/26	18.3	222	200	22	9.1:1	85.5	14.5	95.5	4.5
5/26	19.5	112	92	20	4.6:1	56	44	80	20
5/26	22.5	100	49	51	1.0:1	75.5	24.5	98	2
5/27	25.5	105	40	65	0.6:1	47.5	52.5	100	0
5/28	16.3	105	73	32	2.3:1	38.4	61.6	100	0
5/28	18.5	115	113	2	56.5:1	70.8	29.2	50	50
5/28	25.5	145	77	68	1.1:1	84.4	15.6	91.2	8.8
5/29	27.0	244	236	8	29.5:1	80.1	19.9	50	50
5/30	22.8	73	38	35	1.1:1	65.8	34.2	97.1	2.9
5/30	24.8	10	10	0		40	60		
5/30	16.3	103	92	11	8.4:1	68.5	31.5	90.9	9.1
5/30	18.5	117	117	0		83.8	16.2		
5/30	19.8	25	16	9	1.8:1	68.7	31.3	33.3	66.7
5/31	25.5	65	59	6	9.8:1				
5/31	26.5	124	123	1	123.0:1				
5/31	25.8	46	45	1	45.0:1	80	20	100	0
5/31	25.9	45	43	2	21.5:1	48.8	51.2	0	100

Table 2-3-3. Continued.

Date	Location (R.M.) 1/	Sample Size	Number: Males	Number: Females	Sex Ratio (M:F)	Spawning Condition 2/ (%) Males: Pre.	Males: Post.	Females: Pre.	Females: Post.
6/1	16.3	486	255	231	1.1:1	98.8	1.2	100	
6/1	18.5	214	112	102	1.1:1	98.2	1.8	100	
6/1	19.5	209	112	97	1.2:1	100	0	100	0
6/1	21.0	259	174	85	2.1:1	97.1	2.9	98.8	1.2
6/1	21.0	265	174	91	1.9:1	97.1	2.9	98.9	1.1
6/1	25.5	143	103	40	2.6:1	97.1	2.9	100	0
6/2	25.5	109	55	54	1.0:1	96.4	3.6	100	0
6/2	30.1	179	84	95	0.9:1	100	0	100	0
6/2	36.8	104	49	55	0.9:1	100	0	100	0
6/2	41.4	236	105	131	0.8:1	100	0	100	0
6/2	45.8	6	3	3	1.0:1	100	0	100	0
6/2	47.9	17	9	8	1.1:1				
6/3	25.5	216	106	110	1.0:1	100	0	98.2	1.8
6/3	36.8	155	93	62	1.5:1	100	0	100	0
6/3	38.4	3	2	1	2.0:1				
6/3	41.4	139	71	68	1.0:1	100	0	100	0
6/3	44.0	143	85	58	1.5:1	100	0	100	0
6/4	36.8	156	85	71	1.2:1	95.3	4.7	100	0
6/4	41.4	136	88	48	1.8:1	100	0	100	0
6/4	25.5	187	111	76	1.5:1	100	0	100	0
6/4	45.0	147	106	41	2.6:1	99.1	0.9	97.6	2.4
6/4	48.0	145	99	46	2.2:1	100	0	97.8	2.2
6/5	9.5	156	71	85	0.8:1	33.8	66.2	70.6	29.4
6/5	15.0	104	82	22	3.7:1	85.4	14.6	86.4	13.6
6/5	25.5	167	68	99	0.7:1	75.0	25.0	76.7	30.3
6/5	27.9	177	112	65	1.7:1	77.7	22.3	32.3	67.7
6/5	31.0	145	72	73	1.0:1				
6/5	31.8	193	92	101	0.9:1				
6/6	15.0	314	288	26	11.1:1	81.6	18.4	61.5	38.5
6/6	16.3	212	142	70	2.0:1	82.4	17.6	92.9	7.1
6/6	25.5	143	85	58	1.5:1	44.7	55.3	55.2	44.8
6/7	35.5	161	98	63	1.6:1	63.3	36.7	95.2	4.8
6/7	47.3	17	15	2	7.5:1	0	100	100	0
6/8	18.3	150	144	6	24.0:1	51.4	48.6	83.3	16.7
6/8	20	94	90	4	22.5:1	48.9	51.1	100	
6/8	21.7	62	59	3	19.7:1	0	100	66.7	33.3
6/8	31.2	7	5	2	2.5:1				
6/9	15.0	156	145	11	13.2:1	26.9	73.1	0	100

1/ River Mile
2/ Pre-spawning condition: gravid
Post-spawning condition: spent

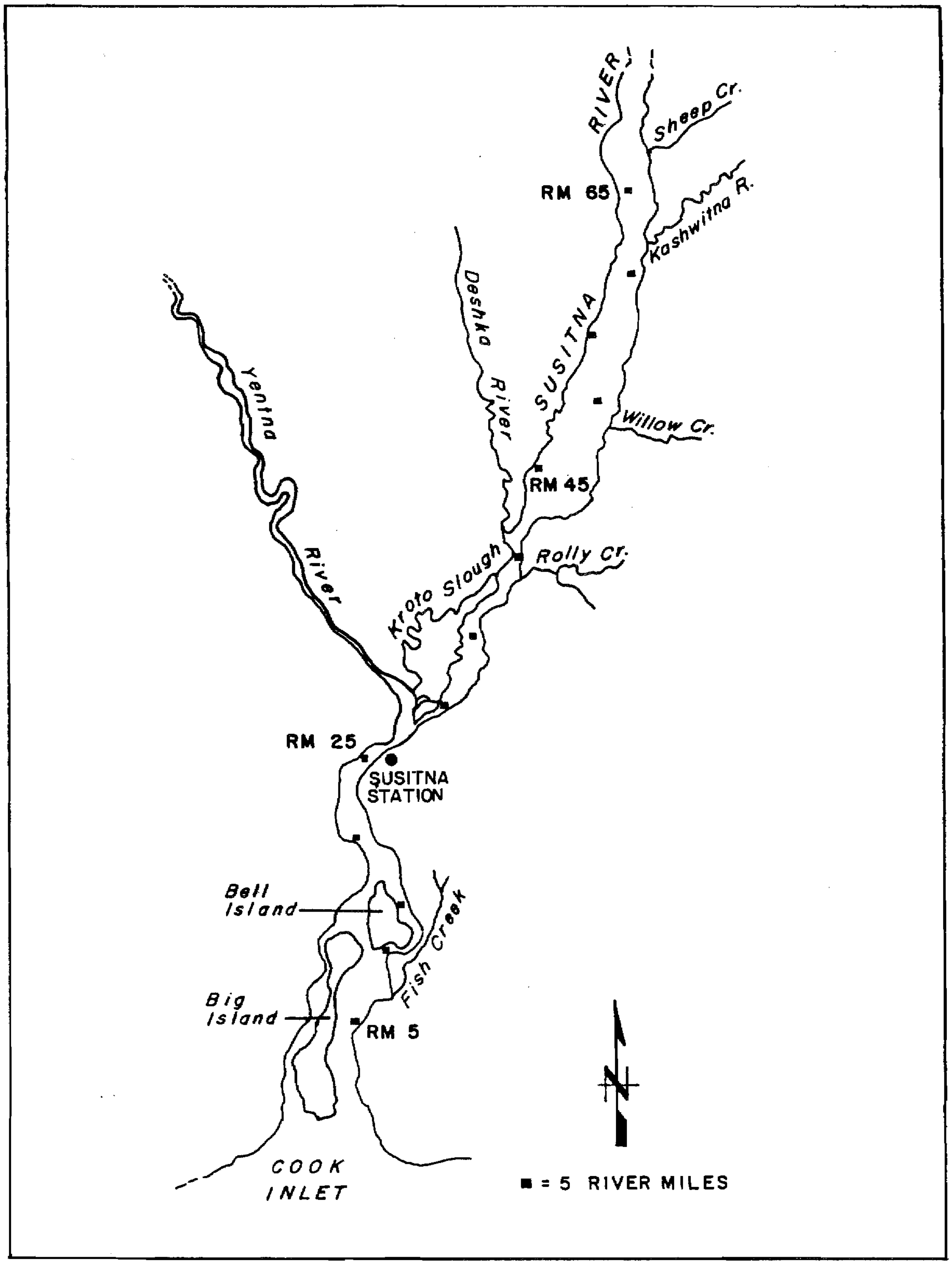


Figure 2-3-2. Lower Susitna River reach from estuary to Sheep Creek, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-4. Incidence of eulachon in Susitna River by date and river mile sector, Adult Anadromous Investigations, Su Hydro Studies, 1982.

River Mile Sector	Eulachon Periodicity 1/																						
	May														June								
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9
5.1-7.0																							
7.1-9.0									±														
9.1-11.0									±										±				
11.1-13.0																							
13.1-15.0									+										±	±			±
15.1-17.0						±			+		+		±		+					±			
17.1-19.0									±		±		+		+							±	
19.1-21.0					±				±				±		±							+	
21.1-22.0					+																	±	
22.1-24.0									±				±										
24.1-26.0	+	+		±	±		±	±		+	±		+	±	+	+	±	+	±	±			
26.1-28.0	+						/	±			+	±	+					±					
28.1-30.0	+							/															
30.1-32.0								/								+			+			+	
32.1-34.0							/															/	
34.1-36.0							/														±	/	
36.1-38.0			+				/									+	+	+				/	
38.1-40.0							/										+						
40.1-42.0			+				+									+		+					
42.1-44.0							/										+						
44.1-46.0												/				+	+	±			/		
46.1-48.0				/								/				+		±			+		
48.1-50.0				/								/				/	/	/			/		
50.1-52.0																/		/			/		
52.1-54.0												/					/	/					

1/ Periodicity Code: + = Present
± = Pre and post spawning condition eulachon present
/ = Absent

Spawning occurred in the Susitna River at water temperatures ranging from 3.0 to 9.5°C as recorded at RM 26 in 1982 (Figure 2-3-3). The lower limits of spawning in the Susitna River of first and second run eulachon were not established but can be estimated to be somewhere between RM 4.5 and 8.5 (Table 2-3-2).

The 1982 Susitna River eulachon migration was comprised of age 3_1 and 4_1 fish based on 496 age samples (Table 2-3-5). First run males sampled were 73.6 percent age 3_1 and 26.4 percent age 4_1. First run female eulachon sampled were 88.5 percent age 3_1 and 11.5 percent age 4_1 (Figure 2-3-4). Second run eulachon males sampled were 76.7 and 23.3 percents age 3_1 and 4_1, respectively. Second run females sampled had identical age composition as second run males sampled at 76.7 percent age 3_1 and 23.3 percent age 4_1.

Table 2-3-5. Age composition of male and female Susitna River eulachon in percent by sampling period, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Period	Male			Female		
	Sample Size	Age		Sample Size	Age	
		3 yr.	4 yr.		3 yr.	4 yr.
5/16 - 5/31	159	73.6	26.4	157	88.5	11.5
6/1 - 6/9	90	76.7	23.3	90	76.7	23.3

Length (TL) and associated weight data collected from first and second run eulachon during 1982 are presented in Table 2-3-6.

Mean length and weight of male first and second run eulachon sampled were 214.3 mm and 74.0 g, and 217.6 mm and 75.9 g, respectively. First run females sampled averaged 209.7 mm in length and 69.2 g in weight. Second run females averaged 213.0 mm and 70.1 g.

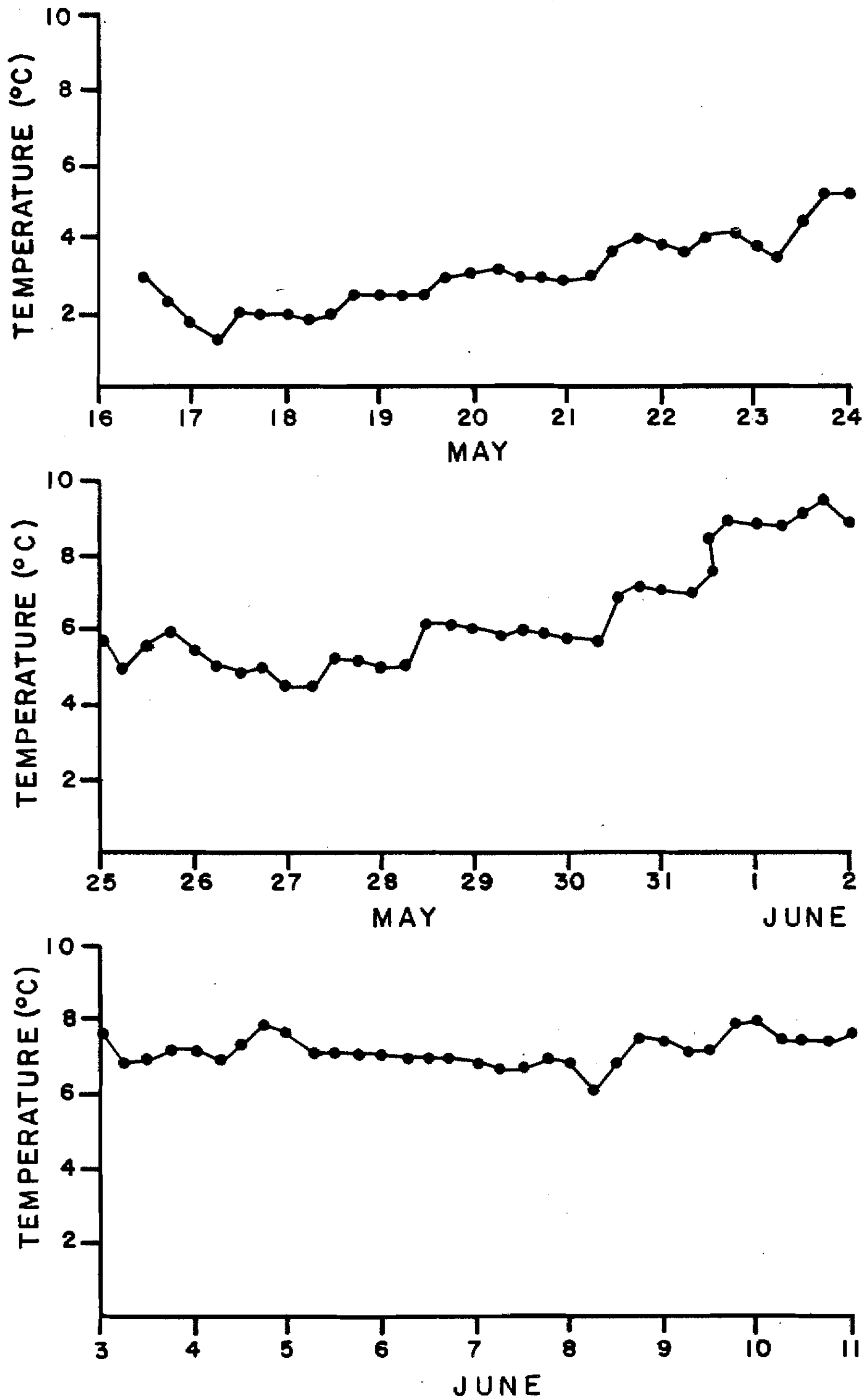


Figure 2-3-3. Daily temperature data (^{O}C) by six hour increments for main channel Susitna River at RM 26, May 16 - June 10, 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

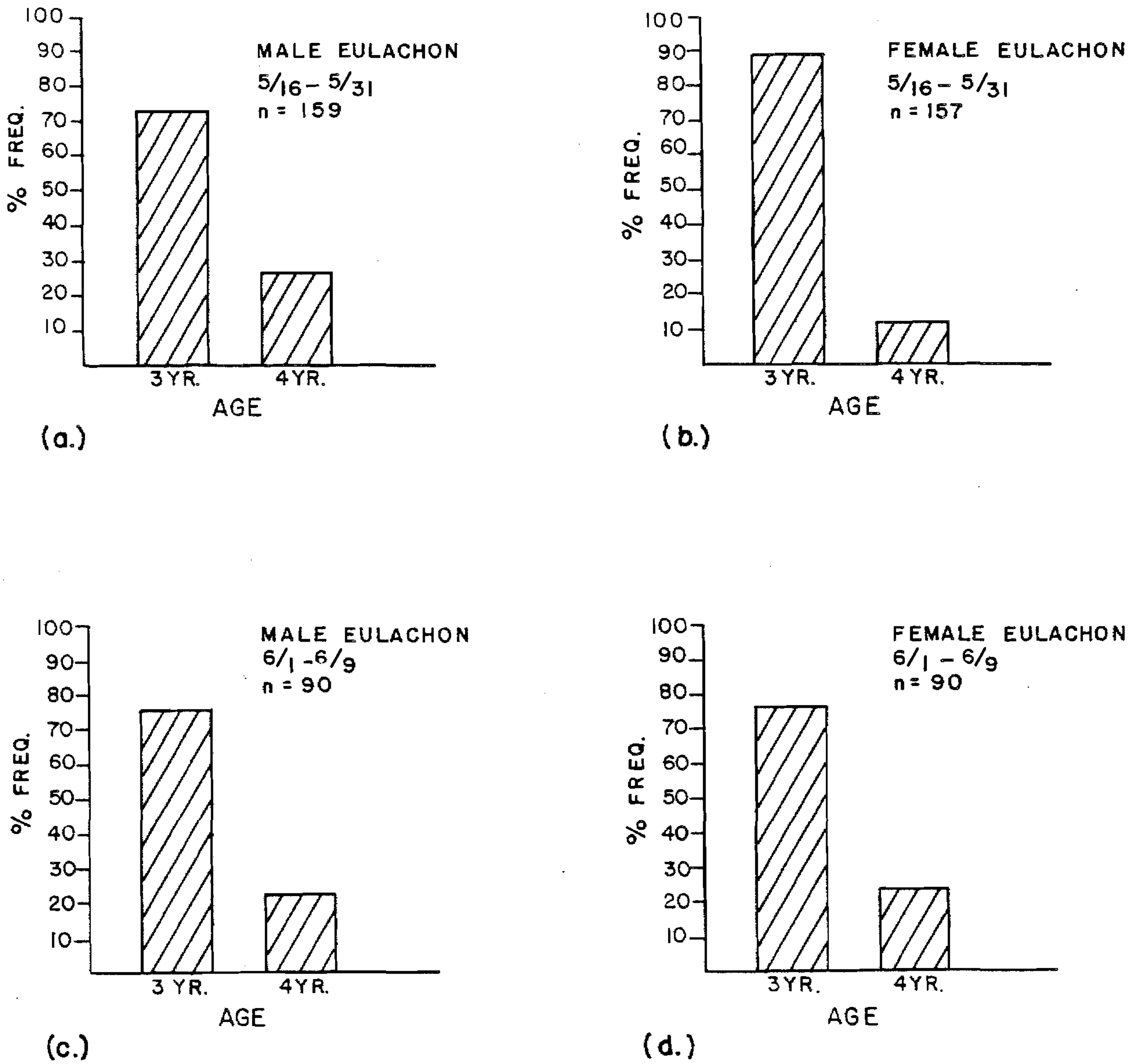


Figure 2-3-4. Age composition of (a-b) first period 5/16-5/31 intercepted male and female eulachon and (c-d) second period 6/1-6/9 intercepted male and female eulachon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-6. Eulachon length and weight data collected by age, sex and sampling period, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Age	Sex	Sample Period	Length (mm) Sample Size	Range Limits	Mean	95% Conf. Limits 1/	Median	Weight (g) Sample Size	Range Limits	Mean	95% Conf. Limits 1/	Median
3	M	5/16-5/31	117	180-230	212.7	210.7-214.7	215.0	109	44.60-102.40	71.73	69.53-73.92	73.00
3	F	5/16-5/31	139	174-234	209.0	207.0-211.2	209.0	132	36.90-99.20	68.60	66.31-70.89	69.70
3	M	6/1-6/9	69	192-238	216.1	213.7-218.4	216.0	69	48.70-95.15	74.40	71.87-76.92	73.60
3	F	6/1-6/9	69	197-226	212.3	210.9-213.8	213.0	69	45.00-87.05	68.80	66.58-71.02	69.45
4	M	5/16-5/31	42	202-235	218.3	216.0-220.6	219.5	40	59.90-99.80	79.65	76.37-82.93	79.40
4	F	5/16-5/31	18	202-229	216.3	212.6-220.0	217.5	17	47.60-93.00	75.46	69.48-81.44	75.70
4	M	6/1-6/9	21	210-234	222.5	219.8-225.3	223.0	21	65.65-90.80	80.70	77.15-84.43	83.35
4	F	6/1-6/9	21	195-230	215.1	210.4-219.8	215.0	21	53.00-92.30	74.17	68.56-79.78	76.40
Unclassified 2/	M	5/16-5/31	160	180-235	214.3	212.6-215.9	216.5	150	44.60-102.40	73.96	72.06-75.86	75.23
Unclassified 2/	F	5/16-5/31	158	174-234	209.7	207.8-211.7	210.0	150	36.90-99.20	69.18	67.01-71.35	70.03
Unclassified 2/	M	6/1-6/9	90	192-238	217.6	215.6-219.5	218.0	90	48.70-95.15	75.89	73.73-78.04	75.30
Unclassified 2/	F	6/1-6/9	90	195-230	213.0	211.4-214.5	213.0	90	45.00-92.30	70.05	67.91-72.19	70.43
Unclassified 2/	M	5/16-6/9	250	180-238	215.4	214.2-216.7	217.0	240	44.60-102.40	74.68	73.26-76.11	75.23
Unclassified 2/	F	5/16-6/9	248	74-234	210.9	209.6-212.3	211.0	240	36.90-99.20	69.51	67.95-71.07	70.23

1/ Confidence limits

2/ Includes composite of age 3 and 4 year old eulachon.

First run eulachon segregated by sex and age were smaller in length (TL) than same age and sex second run eulachon sampled (Table 2-3-6). An exception was the age four females which did not have statistically different lengths at the 95 percent confidence level. The differences in length between same age and sex first and second run fish cannot fully be explained by a difference in marine rearing time which averaged less than 10 days based on the difference in estuary timing. Two reasons for this are: (1) a 3.3 mm to 4.2 mm mean length difference between same age and sex first and second run fish, which was determined to be significant by Student's "t" and Mann-Whitney tests; and (2) age 4_1 fish sampled with one additional growth year averaged only a six mm larger length than age 3_1 fish sampled. If the recorded differences in length of age 3_1 fish were due solely to 10 additional days of marine rearing time, it would have been reasonable to expect that the age 4_1 eulachon sampled would have been significantly larger in length than observed. It can therefore be postulated that the length differences observed between first and second run, age 3_1 eulachon may have been due to other factors including possible differences in genetics and marine rearing areas.

Male to female eulachon ratios, non-segregated to run timing or age, ranged from 0.2:1 to 123:1 from 80 samples of 10,547 eulachon (Table 2-3-3). Male eulachon outnumbered female eulachon in 94.7 percent of the samples. Highest male to female ratios were recorded in samples comprised of post-spawning fish (Table 2-3-3).

The maturation data collected in conjunction with sex composition sampling, indicate that individual male eulachon spawn over a several day period whereas individual female eulachon spawn shortly after ripening and generally within one day (Table 2-3-3). It was also interpreted that individual male eulachon did not outmigrate or die immediately after spawning but remained in the river several days thereafter. Individual female eulachon, in contrast, either outmigrated immediately or died within approximately one day following culmination of spawning. These differences were further supported by post-spawning condition male and female eulachon intercepted in the estuary and main channel. The post-spawning males characteristically had severely frayed pectoral and pelvic fins and a dull body coloration or absence of sheen while the females had not lost their spawning coloration or sheen and showed no visual signs of fin erosion.

The difference in male and female eulachon spawning life as earlier defined would explain why male eulachon sampled were substantially more abundant than female eulachon sampled once spawning began (Tables 2-3-3 and 2-3-7). A near true sex ratio of Susitna River eulachon would therefore likely be reflected in samples collected prior to significant spawning. Given this conclusion, 1982 first run male to female eulachon ratio was 1.6:1 based on samples from May 16 through May 20 (Table 2-3-3). Comparatively, the male to female ratio of second run eulachon was 1.3:1 from samples from June 1 through June 4.

Nearly all the male eulachon that were sampled in the Susitna River between RM 4.5 and 48.0 were found to be either ripe (freely expelling milt) or in the post-spawning condition (Tables 2-3-2 and 2-3-3). In comparison, the females intercepted were generally all in pre-spawning condition with few in post-spawning condition and even fewer in actual spawning condition

Table 2-3-7. Sex ratios 1/ of Susitna River eulachon recorded by river mile sector and date, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Date	River Mile Sector 0-5.0	5.1-10.0	10.1-15.0	15.1-20.0	20.1-25.0	25.1-30.0	30.1-35.0	35.1-40.0	40.1-45.0	45.1-50.0
May										
16	2.1:1									
17	1.3:1									
18						3.6:1				
19	1.0:1					1.1:1				
20	1.2:1							3.7:1	3.0:1	
21						1.4:1				
22						0.7:1				
23				3.1:1	1.2:1					
24						1.7:1				
25						8.6:1				
26	0.8:1	0.5:1	1.9:1	3.3:1	1.0:1					
27						0.6:1				
28				5.2:1		1.1:1				
29						29.5:1				
30				5.4:1	3.2:1					
31						21.9:1				
June										
1				1.1:1	1.4:1	2.6:1				
2						1.0:1	0.9:1	0.9:1	0.8:1	1.1:1
3						1.0:1		1.6:1	1.2:1	
4						1.5:1		1.2:1	2.2:1	2.2:1
5		0.8:1	3.7:1			1.1:1	0.9:1			
6			11.1:1	2.0:1		1.5:1				
7								1.5:1		7.5:1
8				23.3:1	19.6:1		2.5:1			
9			13.2:1							

1/ Male:Female

(freely expelling eggs). Given the problem of not being able to collect a significant number of female eulachon freely expelling eggs at any specific location, and the relative scarcity of post-spawning condition females, an inseason decision was made to define where spawning was occurring by the presence of eggs in substrate samples. Samples were collected over a variety of suspected spawning areas and only an occasional egg was found. Eggs that were located were opaque and comparable in size to large grains of sand and adhesive to debris and sand particles, all of which made their identification nearly impossible with equipment available. An attempt was made to make the eggs more eye visible by addition of a dye. In a test, several substrate samples containing planted eulachon eggs were mixed in various Rit dye concentrations. The results did not prove useful. Having been unsuccessful in classifying spawning habitat by the previous methods, a final criteria was chosen which was that if a location were a spawning area a single sample would contain both ripe and spent (post spawning condition) female eulachon in conjunction with male eulachon. It was this criteria that was used to report general spawning habitat characteristics presented below.

Areas in which 1982 electroshock and dip net sampling did not produce suspected spawning eulachon were clear water streams and their mixing zones, and semi-placid main channel areas including slough habitats. Spawning preference areas were near cut banks and where the bottom composition included unconsolidated sand and gravels, and riffle zones or bars with relatively moderate velocity (0.2 - 0.6 m/sec) and unconsolidated sands and gravels.

Total 1982 Susitna River eulachon escapement was not empirically calculated. However, from carcass observations the 1982 escapement was estimated to be in the range of millions of fish (Plate 2-3-4).

Plate 2-3-4. Eulachon carcasses located at RM 15.0, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Total 1982 eulachon sport catch from unrecorded staff observations was estimated at 3,000 to 5,000 fish. Sport fishing mainly occurred between RM 10 and 30 including the Yentna River (RM 28). The only gear observed being used by sport fisheries was hand held dip nets.

3.2 Adult Salmon

3.2.1 Chinook Salmon

3.2.1.1 Estuary to Talkeetna

3.2.1.1.1 Main Channel Escapement

At Yentna (RM 04) and Susitna (RM 26) stations, fishwheels and SSS counters were operational on June 27 and July 1, 1982, respectively, which was after the majority of the chinook salmon had already past these locations (ADF&G, 1982). A total of 925 chinook salmon were counted over the SSS counters at Susitna Station (RM 26) from July 1 to September 5 and there was 25 chinook salmon caught in the fishwheels between these dates (Tables 2-3-8 and 2-3-9). On the Yentna River (RM 28) at Yentna Station (RM 04) 493 chinook salmon were counted from June 27 to September 5, 1982. Approximately 80 percent of the 127 chinook salmon caught with fishwheels at Yentna Station occurred on the south side of the river. The highest daily fishwheel catch at the station was made on July 1, 1982. The chinook salmon migration was essentially over by July 8 at Yentna Station based on fishwheel catches (Figure 2-3-5).

Table 2-3-8. Apportioned sonar counts of chinook salmon by sampling location, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	Sonar Operating Period	Chinook Salmon Counted
Susitna Station	1 July - 5 September	925
Yentna Station	27 June - 5 September	1,193
Sunshine Station	6 July - 12 September	2,924
Talkeetna Station	4 July - 14 September	2,850

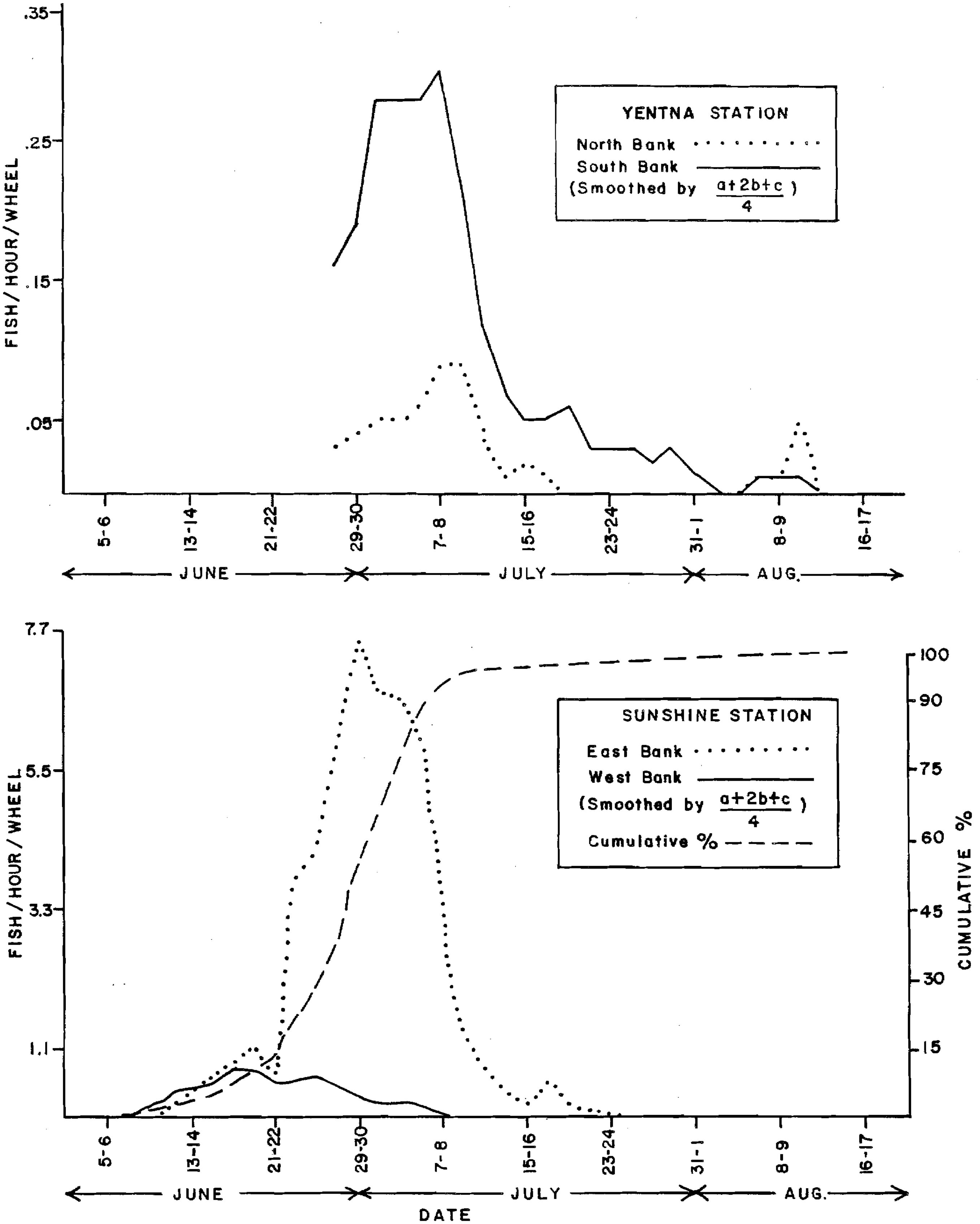


Figure 2-3-5. Mean hourly and cumulative percent fishwheel catch of chinook salmon by two day periods at Yentna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-9. Summary of fishwheel catches by species and sampling locations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	River Mile	Catch Chinook	Sockeye	Pink	Chum	Coho
Susitna Station	26	25	1,382	5,174	382	470
Yentna Station	04	127	3,386	16,627	1,261	1,203
Sunshine Station	80	5,653	18,604 1/	47,671	36,335	8,227
Talkeetna Station	103	881	509	13,781	2,942	619
Curry Station	120	791	161	7,302	1,736	229

1/ Total is comprised of 1,196 first run sockeye and 17,408 second run sockeye salmon.

The chinook salmon escapement to Sunshine Station (RM 80) in 1982 was estimated at 52,900 fish by the Petersen method (Table 2-3-10). Approximately 49,600 of these fish were larger than 350 mm in length (FL) and 3,300 of them were 350 mm or less in length (Tables 2-3-11 and 2-3-12).

Fishwheels operated at Sunshine Station intercepted a total of 5,653 chinook salmon in 1982 (Table 2-3-9). Based on the catch rates, the chinook salmon migration at Sunshine Station began on June 18, reached a midpoint on June 30 and ended on July 9. The peak of the migration occurred on June 29 approximately (Figure 2-3-5).

Table 2-3-10. Susitna River escapements by species and sampling location, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	River Mile	Escapement 1/					
		Chinook	Sockeye 3/	Pink	Chum	Coho	Total
Yentna Station	04	2/	113,847	447,257	27,830	34,089	623,023
Sunshine Station	80	52,900	151,485	443,198	430,442	45,735	1,123,707
Talkeetna Station	103	10,900	3,123	73,038	49,118	5,111	141,274
Curry Station	120	11,300	1,261	58,835	29,413	2,438	103,254

1/ Escapement numbers are derived from Petersen population estimates with the exception of the Yentna Station escapements which are determined by SSS.

2/ Yentna Station was not operated during the entire chinook migration and therefore escapement numbers are not available.

3/ Second run fish.

The age class composition of the 1982 chinook salmon escapement at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations was determined by escapement sampling, the results are reported in Table 2-3-13.

An insufficient number of chinook salmon were caught at Susitna Station (RM 26) and aged to define possible stock characteristics. At Yentna Station (RM 04) 43.3 percent of the chinook salmon sampled were age 3_2, 29.9 percent age 4_2, 14.9 percent age 5_2 and 11.9 percent were age 6_2. All adult chinook salmon sampled at Yentna Station had smolted in the second year of life. At Sunshine Station (RM 80) 14.8 percent of the escapement sample was age 3_2, 27.2 percent age 4_2, 20.5 percent age 5_2 and 36.1 percent age 6_2 fish.

Approximately 99.2 percent of the chinook salmon sampled at this station smolted in the second year of life. The remaining 0.8 percent were fish that had migrated to sea in their first year of life.

Table 2-3-11. Petersen population estimates and corresponding 95% confidence intervals of adult salmon migrating to Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Population Estimate Location	Parameter 1/	Species				
		Chinook 2/	Sockeye 3/	Pink	Chum	Coho
Sunshine Station	m	5,038	15,760	4,390	32,990	6,769
	c	3,254	3882	48,447	14,912	2,708
	r	330	403	479	1,142	400
	$\hat{N}$	49,552	151,485	443,198	430,442	45,735
	95%C.I.	44,962- 55,188	138,684- 166,889	406,971- 486,506	407,728- 455,835	41,946- 50,278
Talkeetna Station	m	619	394	12,807	2,427	536
	c	1,436	2,126	13,936	9,588	1,065
	r	88	268	2,443	473	111
	$\hat{N}$	10,011	3,123	73,038	49,118	5,111
	95%C.I.	8,334- 12,532	2,809- 3,516	70,500- 75,766	45,155- 53,844	4,349- 6,197
Curry Station	m	610	109	4,789	1,356	164
	c	642	1,970	4,470	7,802	398
	r	35	171	363	359	26
	$\hat{N}$	10,913	1,261	58,835	29,413	2,438
	95%C.I.	8,284- 15,987	1,103- 1,470	53,562- 65,261	26,717- 32,713	1,787- 3,835

1/ m = Number of fish marked (adjusted for tag loss)
c = Total fish examined for marks during sampling census
r = Total number of marked fish observed during sampling census
$\hat{N}$ = Population estimate
C.I. = Confidence interval around $\hat{N}$

2/ Chinook salmon escapement estimates do not include fish 350mm and less in length (FL).

3/ Sockeye salmon escapement estimate for Sunshine Station does not include the population estimate for first run sockeye.

Table 2-3-12. Estimated escapement of chinook salmon 350mm or less in length at Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	River Mile	Number of chinook salmon intercepted 350mm	350mm	Estimate of Chinook 350mm
Sunshine Station	80	5,301	352	3,300
Talkeetna Station	130	810	71	900
Curry	120	763	28	400

Length (FL) composition data of chinook salmon sampled in 1982 at Susitna (RM 26), Yentna (RM 04) and Susitna (RM 80) stations are presented in Table 2-3-14.

Table 2-3-13. Analysis of chinook salmon age data by percent from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	n	Age Class 1/ 3_1	3_2	4_1	4_2	5_1	5_2	6_2	7_2
Susitna Station	10	-	40.0	-	40.0	-	10.0	10.0	-
Yentna Station	67	-	43.3	-	29.9	-	14.9	11.9	-
Sunshine Station	1351	0.2	14.8	0.2	27.2	0.4	20.5	36.1	0.4
Talkeetna Station	358	0.6	20.1	0.6	35.2	1.1	19.5	22.3	0.6
Curry Station	441	1.1	15.9	0.8	28.5	2.5	20.0	30.8	0.5

1/ Gilbert-Rich Notation

An insufficient number of chinook salmon were sampled for length (FL) at Susitna and Yentna stations to define possible stock characteristics. At Sunshine Station the age 3_2 males sampled averaged 368 mm in length. Male and female age 4_3 fish averaged 585 mm and 592 mm, age 5_2 742 mm and 782 mm, and age 6_2 951 mm and 911 mm, respectively.

Chinook salmon sex composition data were collected at Yentna (RM 04) and Sunshine (RM 80) stations in 1982 and the results are summarized in Table 2-3-14 and illustrated in Figure 2-3-6. The overall male to female ratio recorded at Yentna Station was 6.4:1, and at Sunshine Station the ratio was 1.2:1.

3.2.1.1.2 Main Channel Spawning

In 1982, 811 Susitna River main channel sites between RM 7 and 98.5 were surveyed for chinook salmon spawning activity from August 1 through October 13 (Appendix 2-F). No chinook salmon spawning areas were found during the survey period in this main channel river reach in 1982.

3.2.1.2 Talkeetna to Upper Devil Canyon

3.2.1.2.1 Main Channel Escapement

The 1982 chinook salmon escapement to Talkeetna Station (RM 103) was estimated at 10,900 fish (Table 2-3-10). Approximately 10,000 of these fish were larger than 350 mm in length (FL) and 900 of them were 350 mm or less in length (Tables 2-3-10 and 2-3-11).

An estimated 11,300 chinook salmon migrated to Curry Station (RM 120) in 1982 (Table 2-3-10). Approximately 10,900 of the fish reaching Curry Station were larger than 350 mm in length (FL) and 400 were 350 mm or smaller in length (Tables 2-3-11 and 2-3-12).

Table 2-3-14. Analysis of chinook salmon lengths, in millimeters, by age class from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age Class	n		Range Limits		Mean		95% Conf. Limits 3/		Median	
		m 1/	f 2/	m	f	m	f	m	f	m	f
Susitna Station	3_2	3	1	348-430	419	398	419	-	-	417	419
	4_2	1	3	565	510-582	565	552	-	-	565	565
	5_2	0	1	-	842	-	842	-	-	-	842
	6_2	0	1	-	871	-	871	-	-	-	871
Yentna Station	3_2	29	0	266-447	-	347	-	330.8,363.7	-	341	-
	4_2	17	3	461-632	468-645	568	567	-	-	561	588
	5_2	8	2	609-938	719-828	784	774	-	-	791	774
	6_2	4	4	899-989	862-912	954	891	-	-	963	895
Sunshine Station	3_1	2	1	600-630	570	615	570	-	-	615	570
	3_2	200	1	230-510	450	368	450	362.6,373.8	-	370	450
	4_1	1	2	720	610-880	-	745	-	-	-	745
	4_2	272	94	440-740	480-880	585	592	578.5,592.1	-	590	580
	5_1	1	4	970	830-1020	970	900	-	-	970	875
	5_2	119	157	400-920	520-1030	742	782	723.1,759.9	768.3,795.5	750	800
	6_2	142	345	430-1160	710-1150	951	911	933.7,967.6	904.7,917.7	950	910
	7_2	1	5	920	840-1040	920	958	-	-	920	990
Talkeetna Station	3_1	2	0	610-630	-	620	-	-	-	620	-
	3_2	71	1	280-600	390	383	390	371.0,394.0	-	380	390

Table 2-3-14. Continued.

Collection Site	Age Class	n m 1/	n f 2/	Range Limits m	Range Limits f	Mean m	Mean f	95% Conf. Limits 3/ m	95% Conf. Limits 3/ f	Median m	Median f
Talkeetna Station Cont.	4_1	1	1	940	820	-	820	-	-	-	820
	4_2	112	14	340-730	330-880	567	575	551.7,581.3	-	580	546
	5_1	0	4	-	855-940	-	891	-	-	-	885
	5_2	31	39	300-1000	610-950	761	808	-	-	780	810
	6_2	31	49	510-1100	490-1050	916	883	-	-	945	900
	7_2	1	1	1020	880	1020	880	-	-	1020	880
Curry Station	3_1	3	2	490-615	610-665	572	638	-	-	610	638
	3_2	69	1	270-470	360	370	360	360.7,380.0	-	370	360
	4_1	1	2	750	835-845	750	840	-	-	750	840
	4_2	92	34	495-695	540-675	604	621	594.3,612.7	609.1,632.6	600	625
	5_1	5	6	835-1040	890-975	935	939	-	-	930	943
	5_2	40	48	555-960	625-975	799	820	-	-	813	818
	6_2	52	84	760-1200	780-1010	988	918	-	908.2,928.4	995	920
	7_2	2	0	1015-1030	-	1023	-	-	-	1023	-

1/ Males

2/ Females

3/ Confidence Limits on Mean

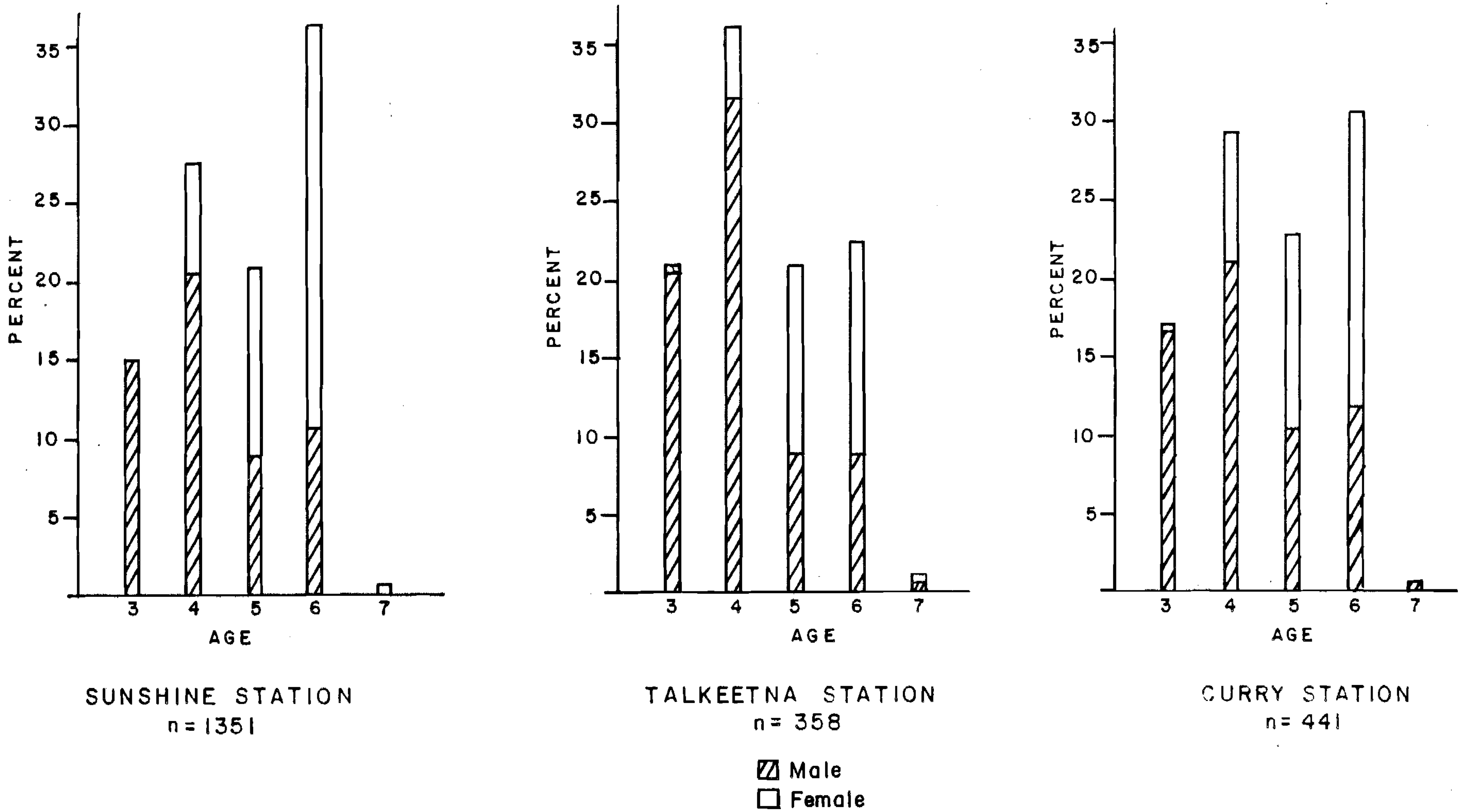


Figure 2-3-6. Age composition of fishwheel intercepted chinook salmon at Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The difference of approximately 400 fish in the two population estimates for Talkeetna (RM 103) and Curry (RM 120) stations should not be considered significant. The 95 percent confidence limits on both estimates have range limits exceeding 4,000 fish (Table 2-3-11). It should be considered that approximately the same number of chinook salmon migrated to Talkeetna Station as migrated to Curry Station in 1982.

Fishwheels operated at Talkeetna Station (RM 103) caught a total of 881 chinook salmon in 1982 (Table 2-3-9). From fishwheel catch rate data the 1982 migration began on June 26, reached a midpoint on July 4 and terminated on July 23 (Figure 2-3-7). The peak fishwheel catch occurred on July 1. Approximately 55.3 percent of the catch was made by east bank fishwheels. The remaining 44.7 percent of the catch was made by west bank fishwheels.

The total number of SSS chinook salmon counts recorded at Talkeetna Station (RM 103) from July 4 when the counters were first installed to September 14 was 2,850 (Table 2-3-8). This count was considered a measure of the relative abundance of the chinook salmon escapement reaching RM 103 from July 4 through September 14 (Section 2.4.3).

The total fishwheel catch of chinook salmon at Curry Station (RM 120) in 1982 was 791 fish (Table 2-3-9). From fishwheel catch rate data, the chinook salmon migration at Curry Station began on June 25, reached a midpoint on July 3 and ended on July 19 in 1982 (Figure 2-3-7). The peak catches occurred on July 1 and July 4 (Appendix 2-C). At Curry Station, the east bank fishwheel caught 55.1 percent of the catch and the balance, 44.9 percent, was intercepted by the west bank fishwheel.

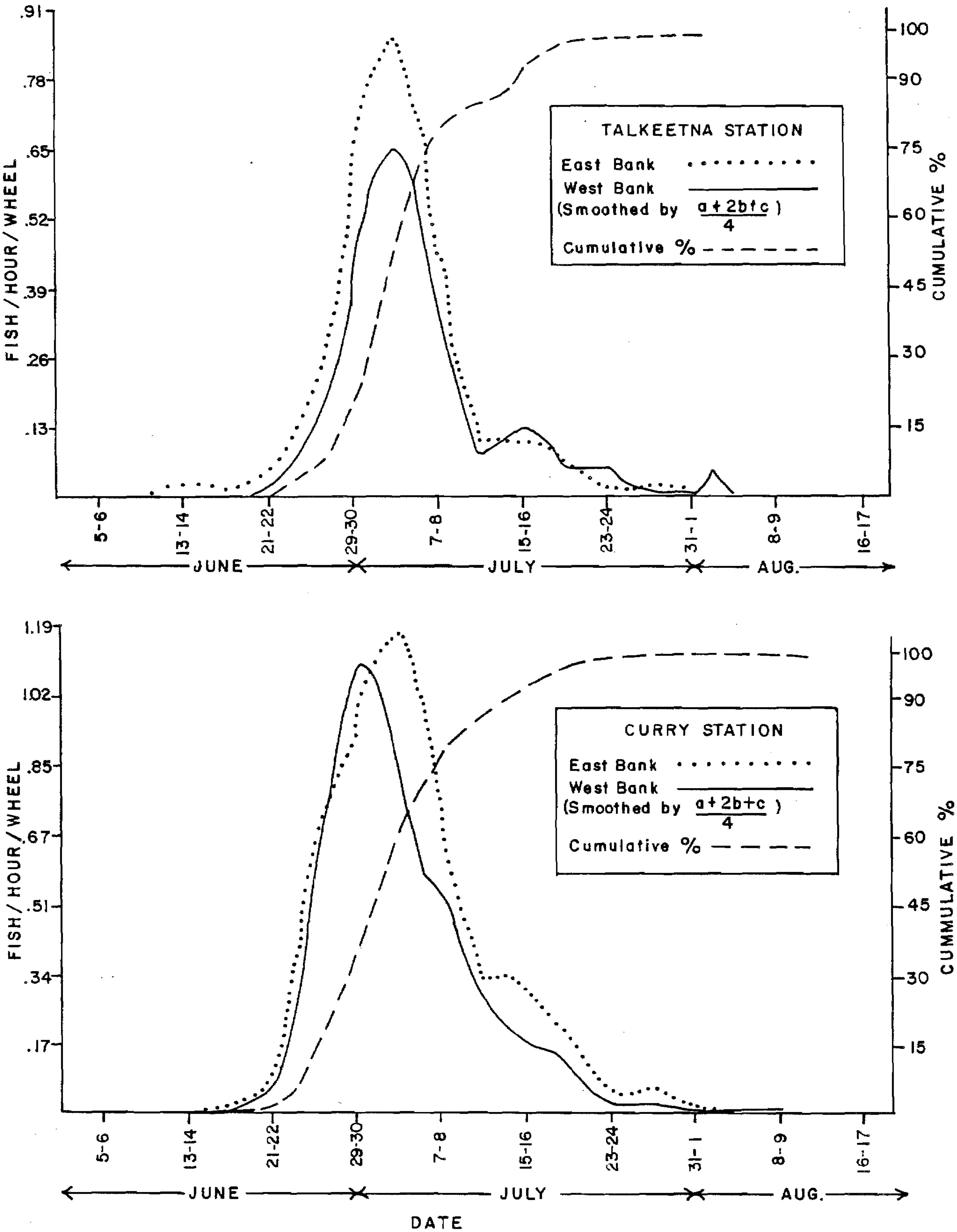


Figure 2-3-7 Mean hourly and cumulative percent fishwheel catch of chinook salmon by two day periods at Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Recapture data indicates that chinook salmon in 1982 averaged 11.2 days of travel time between Sunshine (RM 80) and Talkeetna (RM 103) stations for an average speed of 2.1 miles per day (mpd) (Figure 2-3-8). The average travel time between Talkeetna and Curry stations was 7.7 days. Average travel speed was 2.2 mpd. Between Sunshine and Curry stations the average travel time was 13.0 days. Average speed was 3.1 mpd.

Approximately 35.2 percent of the chinook salmon sampled at Talkeetna Station (RM 103) were age 4_2, 23.3 percent age 6_2, 19.5 percent age 5_2 and 20.1 percent age 3_2 fish (Table 2-3-13). Other age classes represented in the escapement sampled were: 3_1, 4_1, 5_1 and 7_2. Nearly 98 percent of the chinook salmon caught at Talkeetna Station in 1982 were fish that had smolted in the second year of life and 2.3 percent were fish that had smolted in the first year of life.

At Curry Station (RM 120) approximately 30.8 percent of the chinook salmon sampled were age 6_2, 28.5 percent age 4_2, 20.0 percent age 5_2 and 15.9 percent age 3_2 fish (Table 2-3-13). The remaining 4.9 percent of the escapement sample were age 4_1, 5_1 and 7_2 fish. Approximately 95.7 percent of the chinook salmon aged from Curry Station had smolted in the second year of life and 4.3 percent had smolted in the first year of life (Table 2-3-13).

Length (FL) composition data of chinook salmon sampled at Talkeetna (RM 103) and Curry (RM 120) stations in 1982 are summarized in Table 2-3-14.

Chinook salmon males were more abundant than females sampled in 1982 at Talkeetna Station (RM 103) by a male to female ratio of 2.3:1 (Table 2-3-15).

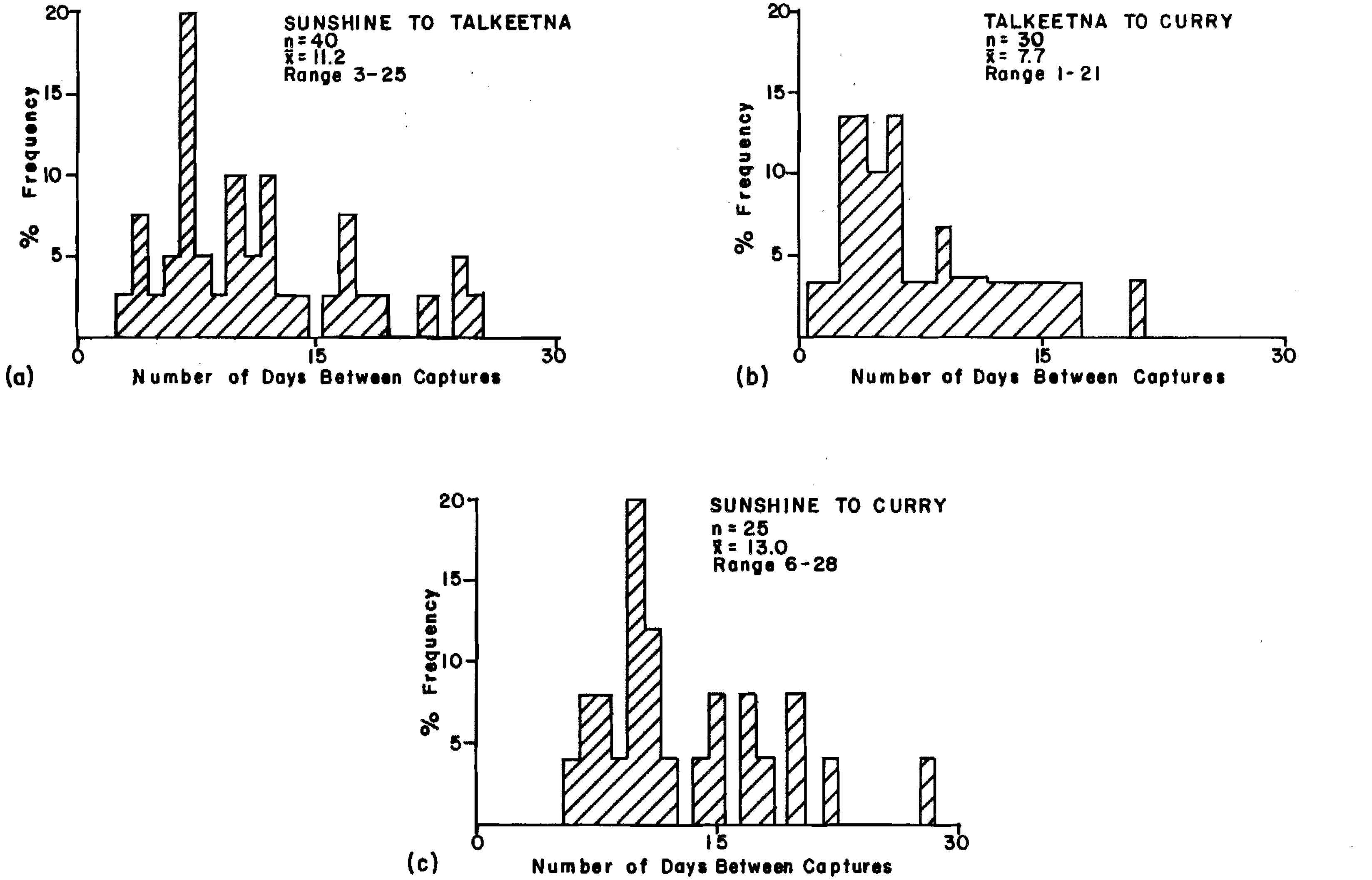


Figure 2-3-8. Migrational rates of chinook salmon between (a) Sunshine and Talkeetna stations, (b) Talkeetna and Curry stations and (c) Sunshine and Curry stations based on fishwheel recaptures, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-15. Sex ratio of male and female chinook salmon by age from escapement samples collected at Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age	Sample Size	Number		Sex Ratio (M:F)
			Males	Females	
Yentna Station	3	29	29	0	-
	4	20	17	3	5.7:1
	5	10	8	2	4.0:1
	6	8	4	4	1.0:1
Sunshine Station	3	204	202	2	101.0:1
	4	370	274	96	2.9:1
	5	282	120	162	0.7:1
	6	489	142	347	0.4:1
	7	6	1	5	0.2:1
Talkeetna Station	3	74	73	1	73.0:1
	4	128	113	15	7.5:1
	5	74	31	43	0.7:1
	6	80	31	49	0.6:1
	7	2	1	1	1.0:1
Curry Station	3	75	72	3	24.0:1
	4	129	93	36	2.6:1
	5	99	45	54	0.8:1
	6	136	52	84	0.6:1
	7	2	2	0	-

Females sampled were more abundant than males sampled at Talkeetna Station among five and six year old fish. Males were more abundant than females among three and four year old fish sampled (Figure 2-3-6).

At Curry Station (RM 120), the overall chinook salmon male to female ratio in 1982 was 1.5:1 (Table 2-3-15). Males outnumbered females among three, four and seven year old fish, and females outnumbered males among five and six year old fish sampled at Curry Station (Figure 2-3-6).

3.2.1.2.2 Radio Telemetry

Seven chinook salmon were radio tagged at Talkeetna Station (RM 103) in 1982 (Table 2-3-16). Of the seven fish tagged five eventually entered spawning streams downstream or south of Talkeetna Station. The remaining two fish migrated upstream and eventually spawned in Indian River (RM 138.6) (Appendix 2-E).

Four of the seven radio tagged chinook salmon at Talkeetna Station (RM 103) in 1982 descended after being released and milled in the confluence of the Chulitna, Talkeetna and Susitna rivers (RM 98±) several days before re-initiating upstream migration (Figure 2-3-9). Another two of the seven fish tagged at RM 103 migrated upstream as far as lower Devil Canyon and then descended and entered spawning streams below Talkeetna Station. One radio tagged fish migrated directly upstream and entered Indian River (RM 138.6) (Appendix 2-E).

Table 2-3-16. Tagging location, transmitter frequency and physical characteristics of radio tagged chinook salmon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Tag and Release		Transmitter		Petersen			
Date	Location (RM) 1/	Frequency (MHz) Pulse/Second	Size 2/	Disc Tag Number	Sex (M/F)	Length 3/ (cm)	Coloration 4/ (Dorsal/Ventral)
6/22	103.0	40.701-1	M	302	M	84.5	Gray-Pink/Gray
6/23	119.5	40.610-2	M	347	M	67.5	Silver-Gray/Silver-Pink
6/24	119.5	40.670-1	M	348	F	82.0	Gray-Pink/Silver-Pink
6/24	103.0	40.720-3A	M	349	F	89.0	Silver/Silver-Gray
6/24	103.0	40.731-1	L	326	M	94.5	Gray/Pink
6/25	119.5	40.731-3	L	344	F	96.5	Silver-Gray/Silver-Gray
6/25	103.0	40.681-3	M	336	M	80.0	Gray-Pink/Pink
6/26	103.0	40.660-1	M	345	F	80.0	Silver-Gray/Silver-Gray
6/28	119.5	40.741-2	L	154	F	87.5	Gray/Silver-Pink
6/29	119.5	40.731-2	L	333	F	94.0	Silver-Gray/Pink
6/30	119.5	40.620-1	M	155	M	67.5	Silver-Gray/Pink
7/2	103.0	40.600-2	M	156	F	91.5	Gray/Red
7/6	120.7	40.740-3	L	158	M	104.0	Gray/Pink-Red
7/7	103.0	40.711-3	M	161	F	90.0	Gray-Red/Gray
7/8	120.7	40.721-1	M	159	F	81.5	Gray/Pink-Gray
7/9	119.5	40.720-3B	L	160	F	96.5	Gray/Pink-Gray

1/ River Mile: Talkeetna Station RM 103, Curry Station RM 120.
2/ Transmitter sizes: S = 5.2 cm long, 1.6 cm wide, 18.0 cm antennae
M = 7.6 cm long, 1.6 cm wide, 13.0 cm antennae
3/ Length: mid-eye to fork of tail.
4/ Coloration: Predominate color underlined.

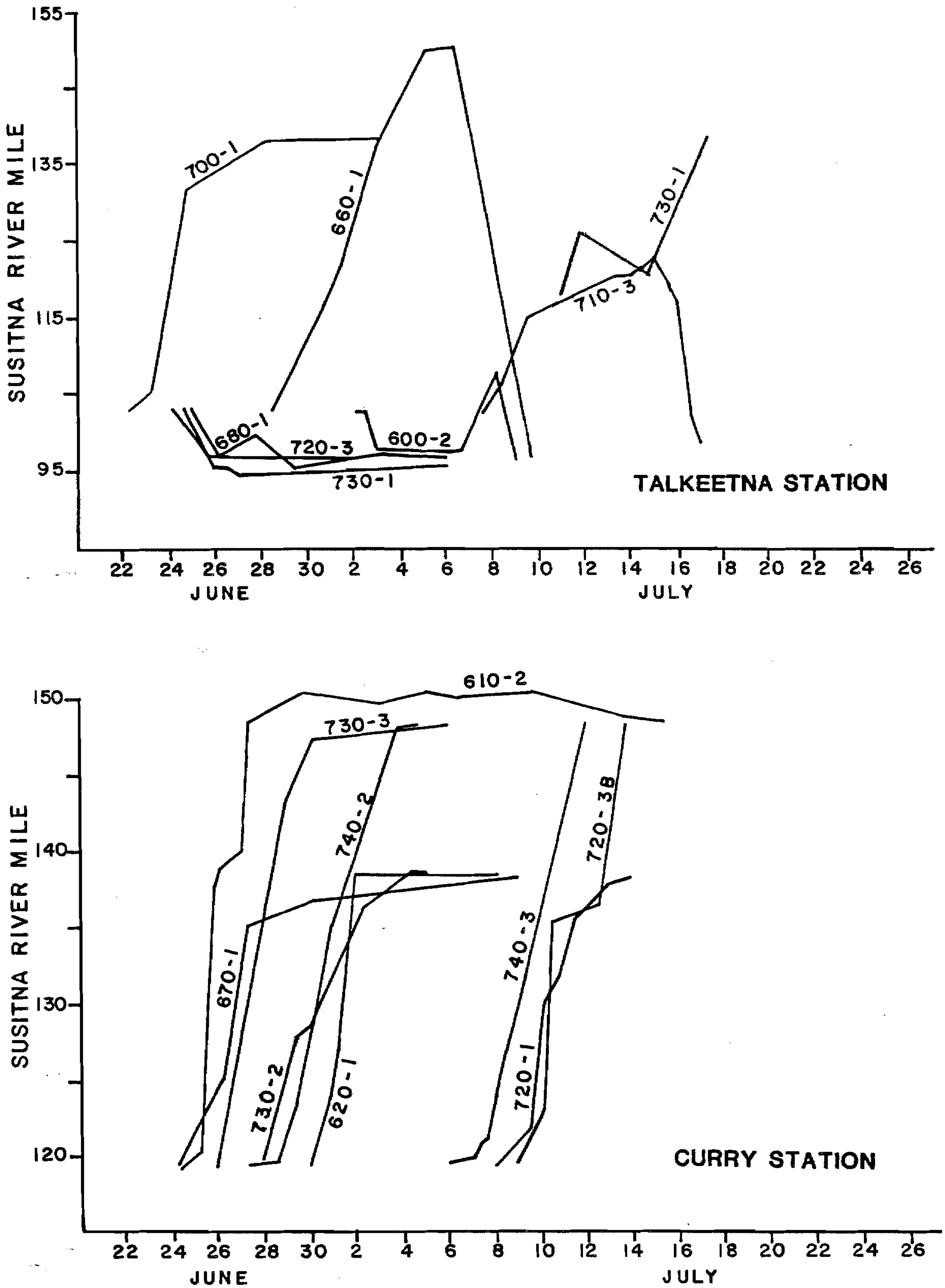


Figure 2-3-9 Movements of Talkeetna and Curry stations radio tagged chinook salmon in the Susitna River during June and July, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The two radio tagged chinook salmon released at Talkeetna Station (RM 103) in 1982 which spawned above the station did so in the Indian River (RM 138.6). The migrational movements of these fish were dissimilar. For example fish 700-1, which was tagged on June 22 at Talkeetna Station migrated past Curry Station (RM 120) between June 24 and June 25, and was in the mouth of Indian River (RM 138.6) on June 26, four days after release at RM 103. Fish 730-1, which was tagged on June 24 at Talkeetna Station, displayed intra drainage milling behavior before entering Indian River. After being radio tagged, this fish descended and milled in the confluence of the Chulitna, Talkeetna and Susitna rivers (RM 98±) for approximately nine days (June 26 - July 3), then migrated up the Chulitna River 11.4 miles (July 5 - 9), and later moved out of the Chulitna River and re-entered the Susitna River and was in the mouth of Indian River on July 17, twenty-three days after being tagged (Appendix 2-E).

The maximum (upstream) migrational speed recorded in 1982 of a chinook salmon radio tagged at Talkeetna Station (RM 103) was 19.3 mpd (Table 2-3-17).

Nine chinook salmon were radio tagged in 1982 at Curry Station (RM 120) (Table 2-3-16). All nine fish migrated upstream after being tagged (Figure 2-3-9). Five of the fish selected Indian River (RM 138.6) and the remaining four fish selected Portage Creek (RM 148.9) as their final destination. Seven of the nine radio tagged fish migrated directly to these streams. One of the five chinook salmon which spawned in Indian River migrated beyond Indian River and milled in Portage Creek about six days before descending and entering Indian River. Three of the remaining four chinook salmon which (presumably) spawned in Portage Creek migrated directly to Portage Creek.

Table 2-3-17. Twenty fastest radio tagged chinook salmon movements, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Speed Traveled (mpd) 1/	Distance Traveled (miles)	Hours Elapsed	Location of Movement (RM - RM) 2/	Observation Dates	Transmitter Number
26.4	1.1	1.0	138.4-139.5	6/25	610-2
22.6	4.8	5.1	119.5-124.3	7/9	720-3B
19.3	4.1	5.1	114.1-118.2	6/24	700-1
18.8	1.8	2.3	130.8-132.6	6/25	700-1
18.0	0.9	1.2	135.4-136.3	7/2	730-2
17.8	2.0	2.7	131.0-133.0	7/2	660-1
16.6	18.0	26.1	120.4-138.4	6/24-25	610-2
16.1	11.9	17.7	123.1-135.0	6/30-7/1	740-2
14.7	1.9	3.1	125.3-127.2	6/25	670-1
14.7	5.5	9.0	112.0-117.5	6/30	660-1
14.0	13.8	23.6	124.8-138.6	7/1-2	620-1
13.6	12.6	22.2	118.2-130.8	6/24-25	700-1
13.2	9.1	16.6	105.0-114.1	6/23-24	700-1
12.0	12.2	24.5	120.2-132.4	6/25-26	730-3
11.3	5.3	11.3	123.0-128.3	7/9	720-1
11.2	10.0	21.5	124.3-134.3	7/9-10	720-3B
10.8	8.8	19.6	140.1-148.9	7/2-3	740-2
10.3	0.3	0.7	136.7-137.0	7/11	720-3B
9.5	9.6	24.3	120.8-130.4	7/15-16	730-1
8.0	5.4	16.2	131.0-136.4	7/9-10	740-3

1/ mpd: Miles per day
2/ Movement: River mile to river mile

The fourth fish entered Portage Creek after spending approximately 15 days in lower Devil Canyon between RM 150.5 and 151.5 (Appendix 2-E).

The number of days required of a radio tagged chinook salmon released at Curry Station (RM 120) to reach Indian River (RM 138.6) and Portage Creek (RM 148.9) in 1982 ranged from three to six days. The maximum (upstream) migrational speed displayed by chinook salmon tagged at Curry Station was 26.4 mpd (Table 2-3-17).

Individual movements of radio tagged chinook salmon released at Talkeetna (RM 103) and Curry (RM 120) station are further described in Appendix 2-E.

3.2.1.2.3 Lower Devil Canyon Milling

The results of set netting at RM 150.2 and 150.4 locations, which are identified in Figure 2-3-10, are summarized in Table 2-3-18. No chinook salmon set net catches were made in the 19.6 net hours fished from August 10 through September 12.

The area in the proximity of the set net site at RM 150.4 was electroshocked four times between August 11 and September 23 in 1982. No chinook salmon were caught (Table 2-3-19).

Radio telemetry investigations outlined under Section 3.2.1.2.2 established chinook salmon milling activity in the lower Devil Canyon reach RM 150.4 to 151.5 from June 26 to July 14 in 1982. One of the seven and one of nine radio tagged chinook salmon released at Talkeetna (RM 103) and Curry (RM 120) stations, respectively, entered lower Devil Canyon in 1982.

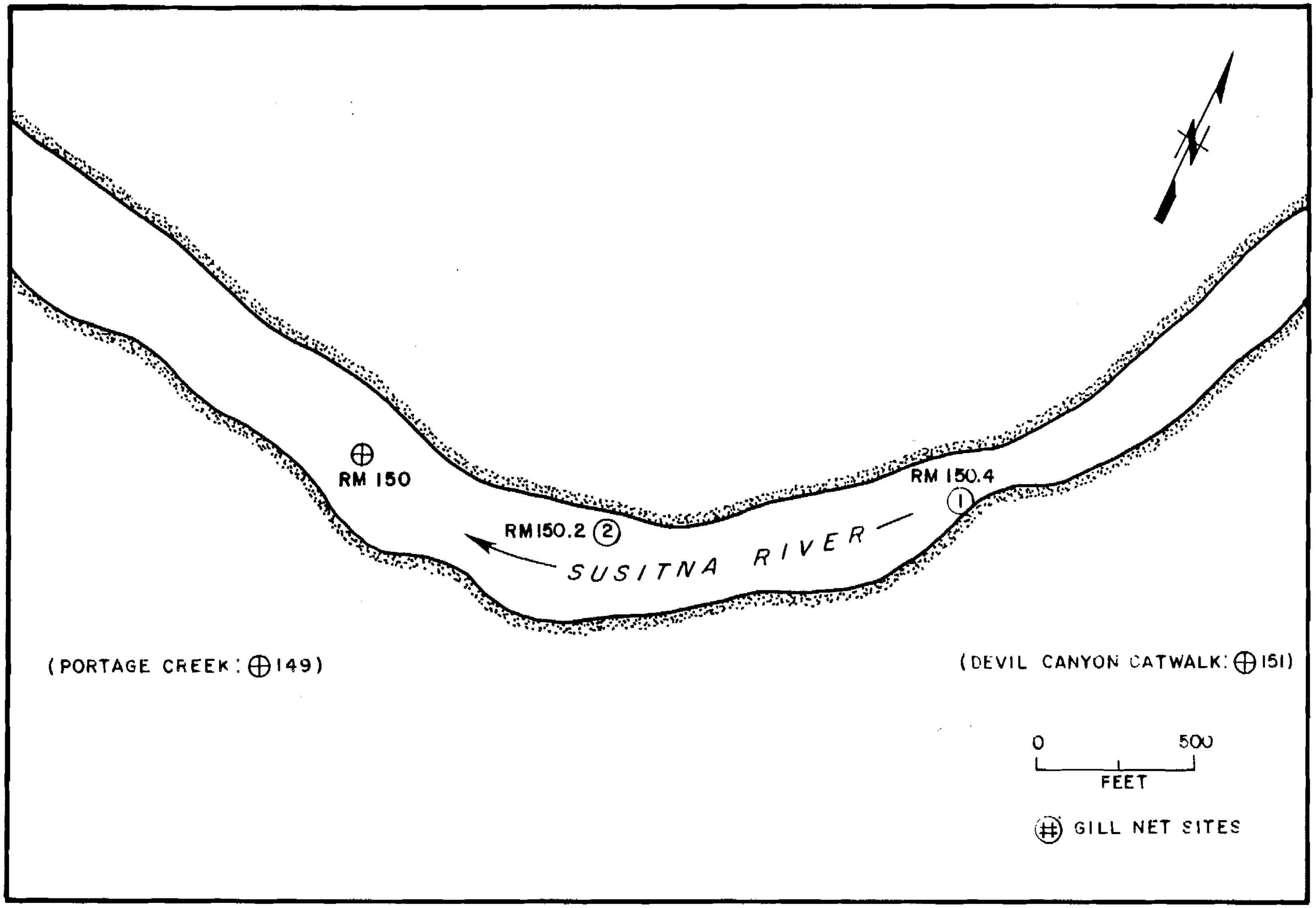


Figure 2-3-10. Set gill net fishing locations on main channel Susitna River in lower Devil Canyon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-18. Results of set gill netting in Susitna River mainstem between Devil Canyon and Portage Creek, Adult Anadromous Investigations, Su Hydro Studies, 1982.

	Location		Fishing Time[1]			Catch					
Date	Site No.	River Mile	Begin	End	Total Hours	Sockeye	Pink	Chum	Coho	Other	Remarks
8/10	1	150.4	1100	1300	2.0	0	1	0	0	0	Net fished excellent; pink was tagged at RM 103 on 8/6/82.
8/10	2	150.2	1115	1315	2.0	0	0	0	0	0	Net fished well (good).
8/16	1	150.4	1230	1330	1.0	0	0	2	0	0	Net fished excellent; all fish in pre-spawning condition.
8/16	2	150.2	1230	1400	1.5	0	0	1	0	0	Net fished well; chum in excellent pre-spawning condition.
8/16	1	150.4	1400	1800	4.0	0	0	7	0	0	Net fished excellent; all fish in pre-spawning condition; 1 chum tagged RM 103 on 8/3/82; 1 chum tagged RM 120 on 8/6/82.
8/16	2	150.2	1430	1830	4.0	0	0	0	0	0	Net fished well.
8/22	1	150.4	1140	1200	0.3	0	0	14	0	0	Net fished excellent; fish in pre-spawning condition.
8/22	2	150.2	1130	1200	0.5	0	0	1	0	0	Net fished well; fish in pre-spawning condition.
8/28	1	150.4	1115	1130	0.2	0	0	0	3	0	Net fished excellent; fish in pre-spawning condition; 1 coho was tagged at RM 120 on 8/12/82, another was tagged RM 80, no tag number.
9/12	1	150.4	1300	1705	4.1	0	0	0	0	0	Net fished excellent.

[1] Time in military hours.

Table 2-3-19. Electroshocking catch results in lower Devil Canyon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Date	River Mile	Distance Shocked (Yards)	Catch				
			Chinook	Sockeye	Pink	Chum	Coho
8/11	150.4	150	0	0	2	5	0
8/18	150.4	200	0	0	1	12	0
9/5	150.4	200	0	0	0	0	1
9/23	150.4	100	0	0	0	0	0

3.2.1.2.4 Spawning

3.2.1.2.4.1 Main Channel

A total of 397 Susitna River main channel sites between RM 98.5 and 150 were surveyed for chinook salmon spawning activity in 1982 (Appendix 2-F). No chinook salmon spawning areas were found in the Susitna River main channel between RM 98.5 and 150 in 1982.

3.2.1.2.4.2 Sloughs and Streams

In 1982, 34 sloughs were examined for chinook salmon from RM 98.6 to 161.0 between July 28 and October 25 (Appendix 2-G). No chinook salmon were observed in any slough habitat surveyed except on August 6 when a single chinook salmon was recorded milling in Moose Slough (RM 123.5).

Between RM 98.6 and 161.0 chinook salmon were observed in the following 11 Susitna River streams in 1982 (Appendix 2-G):

1. Chase Creek (RM 106.9)
2. Lane Creek (RM 113.6)
3. Fifth of July Creek (RM 123.7)
4. Sherman Creek (RM 130.8)
5. Fourth of July Creek (RM 131.1)
6. Gold Creek (RM 136.7)
7. Indian River (RM 138.6)
8. Jack Long Creek (RM 148.9)
9. Portage Creek (RM 148.9)
10. Cheechako Creek (RM 152.4)
11. Chinook Creek (RM 157.0)

The total of the peak survey counts of live and dead chinook salmon in 1982 for these 11 streams was 2,474 fish (Appendix 2-G). This number may represent no more than 52 percent of the total chinook salmon escapement to these streams (Neilsen and Geen, 1981).

The distribution of chinook salmon in the 11 streams in respective order was: Portage Creek (50.6%), Indian River (42.6%), Fourth of July Creek (2.2%), Lane Creek (1.9%), Gold Creek (0.8%), Cheechako Creek (0.6%), Chase Creek (0.6%), Chinook Creek (0.2%), Fifth of July Creek (0.1%), Sherman Creek (0.1%) and Jack Long Creek (0.1%). The peak of chinook salmon spawning occurred during the the last week of July and the first week of August in 1982 (Appendix 2-G).

Cheechako (RM 152.4) and Chinook (RM 157.0) creeks previously unknown as salmon spawning streams were found to contain chinook salmon by ADF&G Su Hydro Adult Anadromous staff in 1982 (Figure 2-3-11). Fish were first observed in these streams on August 4 and 5, respectively.

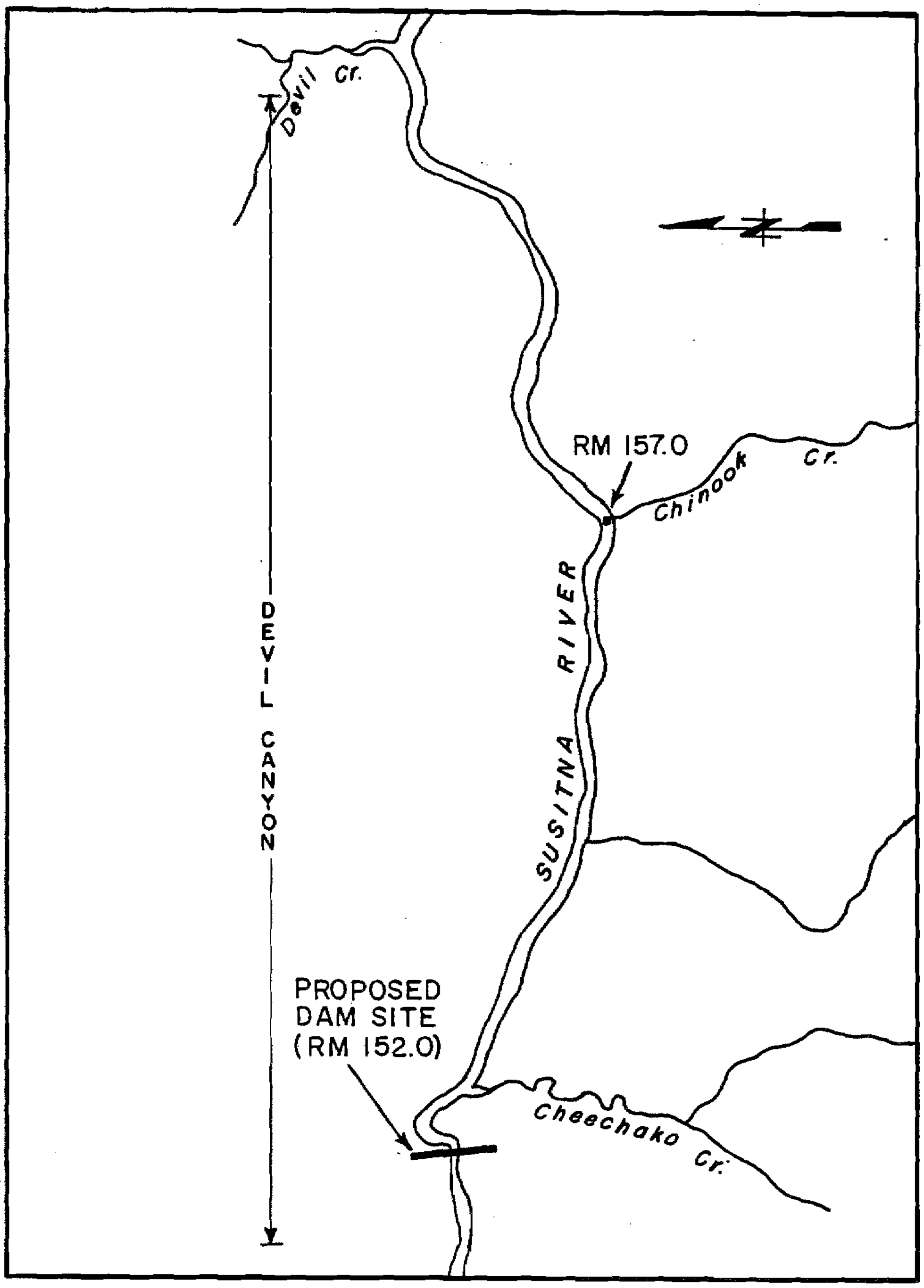


Figure 2-3-11. Map illustrating location of Cheechako Creek and Chinook Creek in relationship to Susitna River Devil Canyon reach, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Two observations that were made on August 5, 1982 during surveys of Cheechako (RM 152.4) and Chinook (RM 157.0) creeks were:

1. In excess of 50 percent of all fish observed spawning and or ripening in Cheechako and Chinook creeks on August 5 were in the glacial, clear water mixing or transitional zone with the main channel Susitna River (Plates 2-3-5 and 2-3-6).

2. Two chinook salmon redds had been vacated on a semi-dewatered cobble shoal extending downstream 200± yards from the upper point of the Cheechako Creek confluence with main channel Susitna River. Both redds contained live eggs on August 5.

Plate 2-3-5. Cheechako Creek chinook salmon spawning area at Susitna River confluence, August 5, Adult Anadromous Investigations, Su Hydro Studies, 1982.

These observations indicate that at least some chinook salmon spawning had already occurred in Cheechako Creek (RM 152.4) and that spawning habitat at the mouth of Cheechako Creek is subject to the influence of main channel Susitna River flow. Additionally, it is probable that not all fish present at the Cheechako and Chinook creeks confluences on August 5 were counted due to restricted visibility in the clear-glacial water transition zones.

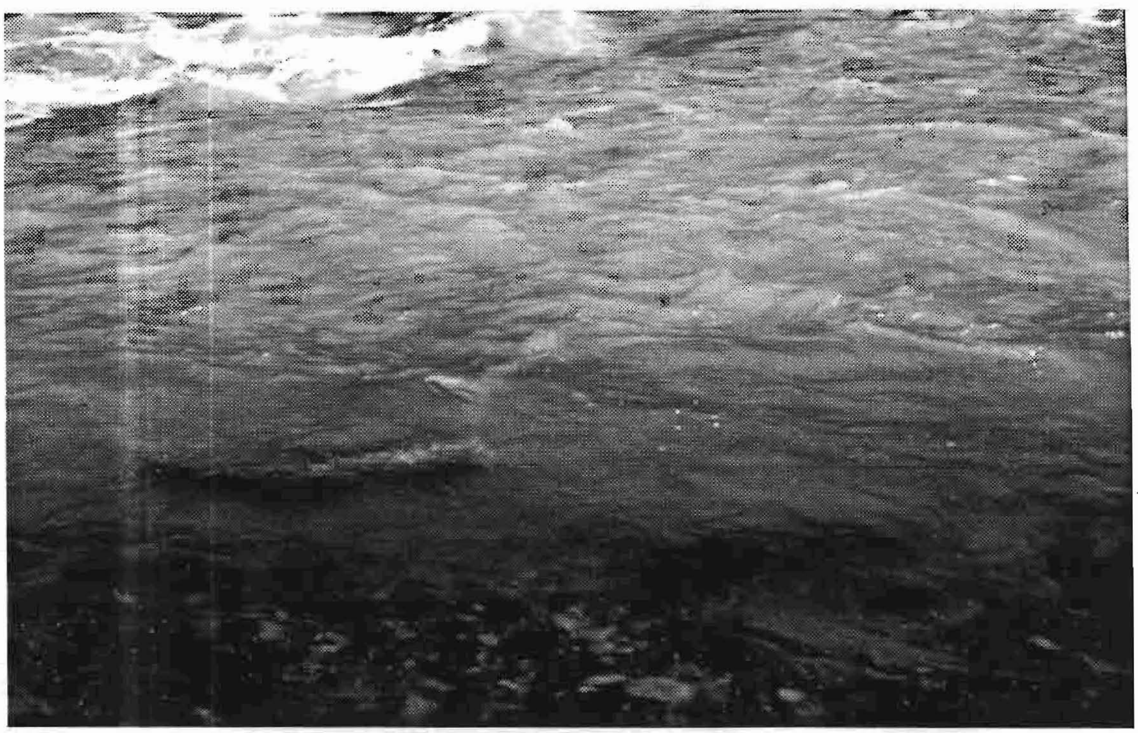


Plate 2-3-6. Chinook salmon in Devil Canyon spawning at the confluence of Cheechako Creek and Susitna River August 5, Adult Anadromous Investigations, Su Hydro Studies, 1982.

3.2.1.3 Escapement Index Surveys

Thirty-four chinook salmon spawning streams were surveyed in the Susitna River basin in 1982. Twenty-five streams were surveyed below RM 98.5 and nine above RM 98.6. The escapement counts recorded on these streams have been presented in Table 2-3-20.

Twenty-one of the 34 chinook salmon spawning streams surveyed in 1982 are classified as index streams that normally are surveyed annually for comparison of between year escapements. The location of the index streams are identified in Figure 2-3-12. The peak chinook salmon counts recorded on the index stream are listed in Table 2-3-21. Each peak count represents probably not more than 52 percent of the total stream escapement including age 3_1 and 3_2 precocious fish (Neilsen and Geen, 1981).

Nine of 21 chinook salmon index streams surveyed in 1982 were surveyed during the peak of spawning (Table 2-3-21). These nine systems were considered the 1982 chinook salmon escapement index. Based on this index, the Susitna River chinook salmon escapement for 1982 was approximately 80 percent higher than in the previous year and above the mean average for years 1976 through 1981 (Table 2-3-21). West side Susitna River streams below RM 97 had an approximately 45 percent higher chinook salmon escapements in 1982 than in 1981 but lower than the mean average escapements for years 1976 through 1981. East side Susitna River streams below RM 97 were not surveyed during the peak of spawning in 1982 and therefore no comparisons can be given (Table 2-3-21).

Table 2-3-20. 1982 chinook salmon escapement surveys of Susitna River Basin streams, Adult Anadromous Investigations, Su Hydro Studies, 1982.

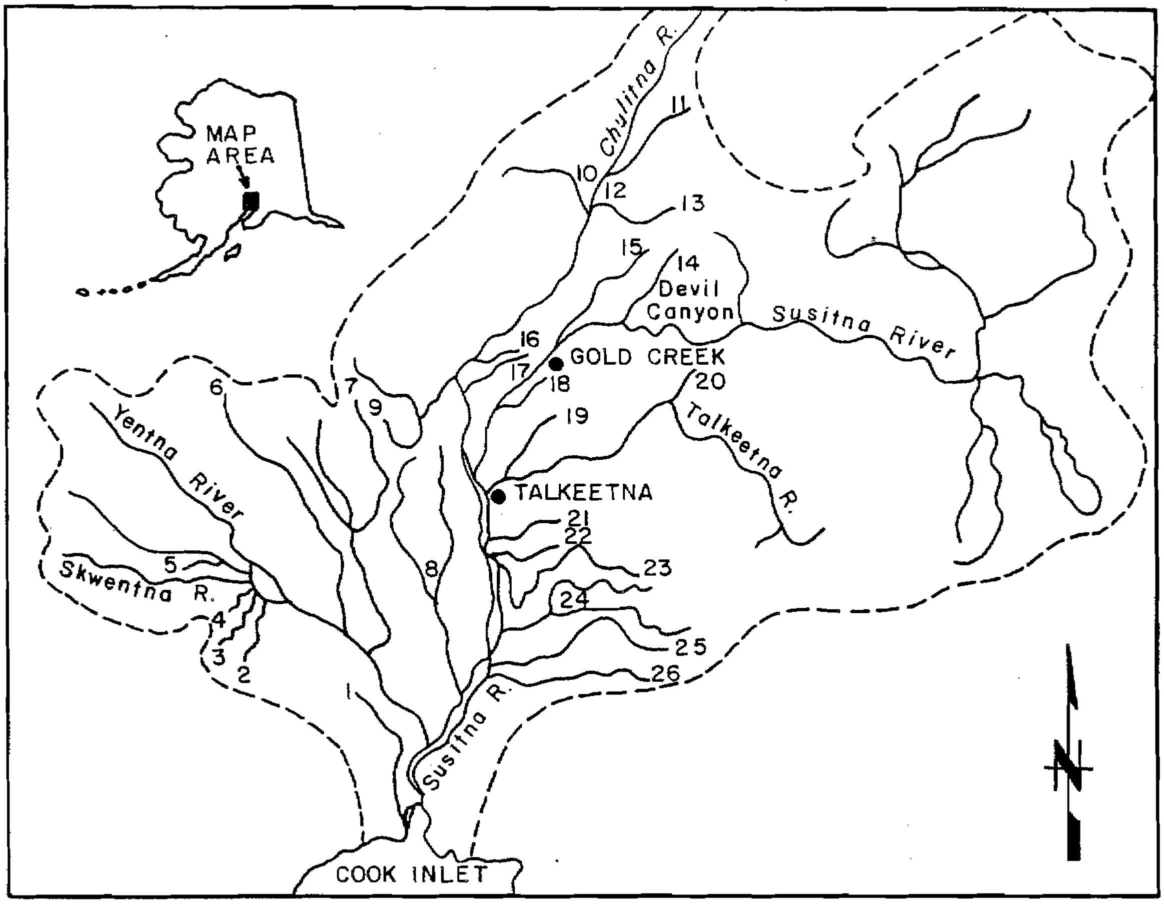
Stream Surveyed	Date	Survey Method	Survey Conditions	Chinook Salmon Counted Live	Chinook Salmon Counted Dead	Chinook Salmon Counted Total
Alexander Creek (Mouth to Lake)	7/31	Hel.	Good	1,687	0	1,687
Wolverine Creek (Alexander Creek drainage)	7/28	Hel.	Good	537	0	537
Sucker Creek (Alexander Creek drainage)	7/28	Hel.	Good	322	0	322
Bunco Creek	8/7	Hel.	Fair	168	30	198
Byers Creek	8/12	Hel.	Excellent	7	0	7
Chase Creek	8/11	Foot	Good	8	7	15
Cheechako Creek (Devil Canyon)	8/6	Hel.	Good	16	0	16
Chinook Creek (Devil Canyon)	8/6	Hel.	Good	5	0	5
Chulitna River	8/12	Hel.	Excellent	49	51	100
Chulitna River (East Fork)	8/12	Hel.	Excellent	67	52	119
Chulitna River (Middle Fork)	8/12	Hel.	Excellent	385	259	644
Clear Creek	7/21	Hel.	Fair	978	4	982
Deshka River 1/	8/5-9	Hel.	Fair 2/	10,471	200	10,671
4th of July Creek	7/29	Foot	Good	55	1	56
Gold Creek	8/3	Hel.	Good	20	1	21
Goose Creek	8/7	Hel.	Good	98	42	140
Honolulu Creek	8/12	Hel.	Excellent	11	16	27
Indian River	7/21	Hel.	Good	1,049	4	1,053
Jack Long Creek	8/4	Foot	Excellent	2	0	2
Kashwitna River (North Fork)	8/10	Hel.	Excellent	128	28	156

Table 2-3-20. Continued.

Stream Surveyed	Date	Survey Method	Conditions	Chinook Salmon Counted Live	Dead	Total
Lake Creek	8/2	Hel.	Good	2,267	50	2,317
Camp Creek (Lake Creek drainage)	8/2	Hel.	Excellent	517	0	517
Sunflower Creek (Lake Creek drainage)	8/2	Hel.	Excellent	743	0	743
Lane Creek	7/12	Foot	Excellent	47	0	47
	7/28	Foot	Excellent	40	1	41
Little Willow Creek	8/7	Hel.	Good	190	126	316
Montana Creek	8/5	Foot	Good	829	58	887
Portage Creek	7/21	Hel.	Excellent	955	0	955
	8/3	Hel.	Excellent	1,198	55	1,253
Praire Creek	7/31	Hel.	Excellent	3,782	62	3,844
Sheep Creek	8/7	Hel.	Good	316	211	527
Spink Creek	8/7	Hel.	Excellent	12	0	12
Talachulitna River	8/1	Hel.	Excellent	3,101	0	3,101
Troublesome Creek	8/12	Hel.	Excellent	34	2	36
Willow Creek	8/6	Foot	Fair	506	86	592
Deception Creek (Willow Creek Drainage)	8/6	Foot	Fair	212	17	229

1/ Partial count; Mainstem Deshka from Trapper Creek to Forks; Trapper Creek not surveyable.

2/ Survey conditions on Deshka River and tributaries ranged from good to poor.



1. ALEXANDER CREEK
2. TALACHULITNA
3. QUARTZ CREEK
4. CANYON CREEK
5. RED CREEK
6. LAKE CREEK
7. PETERS CREEK
8. DESHKA RIVER
9. BUNCO CREEK
10. CHULITNA MIDDLE FORK
11. CHULITNA EAST FORK
12. CHULITNA RIVER
13. HONOLULU CREEK
14. PORTAGE CREEK
15. INDIAN RIVER
16. BYERS CREEK
17. TROUBLESOME CREEK
18. LANE CREEK
19. CLEAR CREEK
20. PRAIRIE CREEK
21. MONTANA CREEK
22. GOOSE CREEK
23. SHEEP CREEK
24. KASHWITNA RIVER NORTH FORK
25. LITTLE WILLOW CREEK
26. WILLOW CREEK

Figure 2-3-12. Susitna River basin with chinook salmon index streams defined, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-21. Chinook salmon escapement counts of Susitna River Basin streams from 1976 to 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

	Year[1/]						
Stream	1976	1977	1978	1979	1980	1981	1982
Alexander Creek	5,412	9,246	5,854	6,215	a/	a/	2,546
Deshka River	21,693	39,642	24,639	27,385	a/	a/	16,000 e/
Willow Creek	1,660	1,065	1,661	1,086	a/	1,357	592 d/
Little Willow Creek	833	598	436	324 c/	a/	459	316 d/
Kashwitna River (North Fork)	203	336	362	457	a/	557	156 d/
Sheep Creek	455	630	1,209	778	a/	1,013	527 d/
Goose Creek	160	133	283	b/	a/	262	140 d/
Montana Creek	1,445	1,443	881	1,094 c/	a/	814	887 d/
Lane Creek	b/	b/	b/	b/	b/	40	47
Indian River	537	393	114	285	a/	422	1,053
Portage Creek	702	374	140	190	a/	659	1,253
Prairie Creek	6,513	5,790	5,154	a/	a/	1,900	3,844
Clear Creek	1,237	769	997	864 c/	a/	a/	982
Chulitna River (East Fork)	112	168	59	a/	a/	a/	119 d/
Chulitna River (MF)	1,870	1,782	900	a/	a/	a/	644 d/
Chulitna River	124	229	62	a/	a/	a/	100 d/
Honolulu Creek	24	36	13	37	a/	a/	27 d/
Byers Creek	53	69	a/	28	a/	a/	7 d/
Troublesome Creek	92	95	a/	a/	a/	a/	36 d/
Bunco Creek	112	136	a/	58	a/	a/	198
Peters Creek	2,280	4,102	1,335	a/	a/	a/	a/
Lake Creek	3,735	7,391	8,931	4,196	a/	a/	3,577
Talachulitna River	1,319	1,856	1,375	1,648	a/	2,129	3,101
Canyon Creek	44	135	b/	b/	b/	84	b/
Quartz Creek	b/	8	b/	b/	b/	8	b/
Red Creek	b/	1,511	385	b/	b/	749	b/

1/ 1976-1980 counts - (ADF&G/Kubik, S.W.)
a/ No total count due to high turbid water
b/ Not counted
c/ Poor counting conditions
d/ Counts conducted after peak spawning
e/ Estimated peak spawning count - (ADF&G/Delaney, K.)

The 1982 chinook salmon escapement above RM 98.6 exceeded the 1981 escapement by approximately 85 percent and the six year (1976-81) mean average by more than 200 percent. Several chinook salmon spawning streams upstream of RM 103 including Lane Creek (RM 113.6), Indian River (RM 138.6) and Portage Creek (RM 148.9) supported escapements above the historic high for years 1976 through 1981 (Table 2-3-21).

3.2.2 Sockeye Salmon

3.2.2.1 Estuary to Talkeetna

3.2.2.1.1 Main Channel Escapement

3.2.2.1.1.1 First Run

In accordance with Phase II studies, escapement sampling of first run sockeye salmon was conducted at Sunshine Station (RM 80) in 1982. No escapement sampling was conducted at Susitna (RM 26) and Yentna (RM 04) stations.

Approximately 5,800 first run sockeye salmon reached Sunshine Station (RM 80) in 1982 (Table 2-3-22). The 95 percent confidence interval of this estimate calculated at 4,900 to 7,300 fish (Table 2-3-22).

The migration of first run sockeye salmon at Sunshine Station (RM 80) began on June 9, reached a midpoint on June 13 and was essentially over by June 21 as determined by fishwheel catches (Appendix 2-C). Approximately 99.9 percent of the escapement of first run fish migrated along the east bank at Sunshine Station (RM 80) and 0.1 percent migrated along the west bank based on fishwheel catches (Appendix 2-C).

Table 2-3-22. Petersen population estimate of Susitna River first run sockeye salmon migrating past Sunshine Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Population Estimate Location	River Mile	Number Tagged (m)	Number Examined For Tags (c)	Number Recaptures (r)	Population Estimates 1/ (n)	95% Confidence Limits
Sunshine Station	80	1,099	423	79	5,830	4,869 - 7,264

1/ Migration period of first run sockeye extended from June 6 through June 28.

Age and length (FL) composition data of first run sockeye salmon sampled at Sunshine Station (RM 80) are summarized in Tables 2-3-23 and 2-3-24, respectively. Age 5_2 fish comprised 89.5 percent of the escapement sample followed by age 4_2 and age 6_3 fish at 6.4 and 4.1 percents, respectively. Approximately 95.9 percent of the fish sampled had smolted in the second year of life and 4.1 percent in the third year of life. The average lengths (FL) of male and female age 4_2 fish were 462.9 mm and 460 mm, age 5_2 fish 567.1 mm and 529.5 mm and age 6_3 fish 557.5 mm and 527.9 mm, respectively (Table 2-3-24).

Sex composition data collected at Sunshine Station (RM 80) established that first run sockeye salmon males were more numerous than females among age 4_2 fish and less numerous than the females among age 5_2 and 6_3 fish in 1982 (Table 2-3-25). Overall, males were less numerous than females by a male to female ratio of 0.6:1.

Table 2-3-23. Analysis of sockeye salmon age data by percent from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	n	Age Class 1/										
		3_1	3_2	4_1	4_2	4_3	5_1	5_2	5_3	6_2	6_3	7_3
Susitna Station	966	0.1	0.4	0.1	22.4	0.2	0.1	65.8	2.1	-	8.8	-
Yentna Station	708	0.4	3.5	0.4	27.7	0.4	-	52.7	4.0	0.6	10.3	-
Sunshine Station												
First run	314				6.4	-	-	89.5	-	-	4.1	-
Second run	648	0.3	2.8	1.2	22.1	0.5	-	69.8	0.9	0.3	2.0	0.2
Talkeetna Station	373	-	4.3	-	21.2	2.1	-	70.8	0.8	-	0.8	-
Curry Station	105	1.0	21.9	-	30.5	9.5	-	32.4	4.8	-	-	-

1/ Gilbert-Rich Notation

3.2.2.1.1.2 Second Run

Second run sockeye salmon escapement estimates were obtained at Yentna (RM 04) and Sunshine (RM 80) stations in 1982 (Table 2-3-10). No total escapement estimate was available for Susitna Station (RM 26) for reasons defined in Section 2.4.3.

The Yentna River (RM 28) escapement of second run sockeye salmon in 1982 was approximately 113,800 fish as determined by SSS counters at Yentna Station (RM 04) (Table 2-3-10). At Sunshine Station (RM 80) the escapement was approximately 151,000 fish as determined by the Petersen method (Table 2-3-11).

The 1982 Susitna River escapement of second run sockeye salmon was approximately 265,000 fish not including escapements to spawning systems between RM 6 and 77 excluding the Yentna River (RM 28). The estimate

Table 2-3-24. Analysis of sockeye salmon lengths, in millimeters, by age class from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age Class	n		Range Limits		Mean		95% Conf. Limits 3/		Median	
		m 1/	f 2/	m	f	m	f	m	f	m	f
Susitna Station	3_1	1	0	531	-	531	-	-	-	531	-
	3_2	4	0	295-432	-	340	-	-	-	317	-
	4_1	0	1	-	572	-	572	-	-	-	572
	4_2	143	73	385-561	390-587	452	477	447.1,456.7	466.2,487.0	450	478
	4_3	1	1	380	416	380	416	-	-	380	416
	5_1	0	1	-	610	-	610	-	-	-	610
	5_2	284	351	412-663	340-671	584	564	579.9,587.7	561.1,566.9	590	567
	5_3	11	9	422-573	445-533	500	482	-	-	516	470
	6_3	36	49	434-630	472-603	568	556	-	-	574	562
Yentna Station	3_1	1	2	510	425-572	510	499	-	-	510	499
	3_2	18	3	277-313	445-549	297	502	-	-	296	511
	4_1	3	0	520-601	-	573	-	-	-	598	-
	4_2	150	46	306-626	400-590	477	496	467.5,486.8	482.6,508.4	458	496
	4_3	3	0	394-437	-	422	-	-	-	434	-
	5_2	243	130	430-637	447-601	582	554	577.6,586.5	548.8,558.8	589	559
	5_3	15	13	432-604	441-557	516	490	-	-	522	485
	6_2	3	1	594-601	590	597	590	-	-	597	590
	6_3	37	35	456-630	445-584	570	536	-	525.1,546.1	577	538

Table 2-3-24. Continued.

Collection Site	Age Class	n m 1/	n f 2/	Range Limits m	Range Limits f	Mean m	Mean f	95% Conf. Limits 3/ m	95% Conf. Limits 3/ f	Median m	Median f
Sunshine Station	4_2	12	8	365-590	410-570	463	460	-	-	440	453
First Run	5_2	103	178	420-615	410-650	567	530	-	525.2,533.8	570	530
	6_3	6	7	510-600	495-560	558	528	-	-	560	525
Sunshine Station	3_1	2	0	435-600	-	518	-	-	-	518	-
Second Run	3_2	17	1	290-400	345	330	345	-	-	325	345
	4_1	2	6	580-610	510-645	595	568	-	-	595	553
	4_2	70	73	385-656	375-650	472	502	457.1,487.7	488.8,515.5	453	500
	4_3	2	1	315-405	380	360	380	-	-	360	380
	5_2	203	249	425-725	410-690	596	559	591.1,601.4	554.4,564.2	600	560
	5_3	4	2	450-595	485-490	546	488	-	-	570	488
	6_2	1	1	570	560	570	560	-	-	570	560
	6_3	9	4	590-610	535-570	590	555	-	-	610	558
	7_3	1	0	610	-	610	-	-	-	610	-
Talkeetna Station	3_2	16	0	300-410	-	340	-	-	-	343	-
	4_2	53	26	370-630	410-600	524	505	504.9,542.6	485.5,524.9	530	515
	4_3	7	1	310-370	335	349	335	-	-	350	335
	5_2	134	130	450-655	420-650	590	566	584.0,596.0	559.8,571.3	600	570
	5_3	2	1	490-580	500	535	500	-	-	535	500
	6_3	1	2	440	540-600	440	570	-	-	440	570

Table 2-3-24. Continued.

Collection Site	Age Class	n		Range Limits		Mean		95% Conf. Limits 3/		Median	
		m 1/	f 2/	m	f	m	f	m	f	m	f
Curry Station	3_1	1	0	385	-	385	-	-	-	385	-
	3_2	23	0	220-550	-	350	-	-	-	340	-
	4_2	22	10	330-620	420-590	496	503	457.4,533.5	-	515	493
	4_3	9	1	310-390	580	338	580	-	-	330	580
	5_2	14	20	450-620	420-605	573	555	-	-	580	563
	5_3	2	3	410-580	415-540	495	475	-	-	495	470

1/ Male

2/ Female

3/ Confidence Limits on Mean

Table 2-3-25. Sex ratio of male and female sockeye salmon by age from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age	Sample Size	Number Males	Number Females	Sex Ratio (M:F)
Susitna Station	3	5	5	0	-
	4	219	144	75	1.9:1
	5	656	295	361	0.8:1
	6	85	36	49	0.7:1
Yentna Station	3	24	19	5	3.8:1
	4	202	156	46	3.4:1
	5	401	258	143	1.8:1
	6	76	40	36	1.1:1
Sunshine Station					
First Run	4	20	12	8	1.5:1
	5	281	103	178	0.6:1
	6	13	6	7	0.9:1
Second Run	3	20	19	1	19.0:1
	4	154	74	80	0.9:1
	5	458	207	251	0.8:1
	6	15	10	5	2.0:1
	7	1	1	0	-
Talkeetna Station	3	16	16	0	-
	4	87	60	27	2.2:1
	5	267	136	131	1.0:1
	6	3	1	2	0.5:1
Curry Station	3	21	21	0	-
	4	44	33	11	3.0:1
	5	40	17	23	0.7:1

represents the combined escapements of second run sockeye salmon to Yentna Station (RM 04) and Sunshine Station (RM 80) in 1982 (Table 2-3-10).

A total of 123,913 second run sockeye salmon were enumerated by SSS counters at Susitna Station (RM 26) and 75,925 were counted at Sunshine Station (RM 80) in 1982 (Table 2-3-26). These counts represent an index of escapement (Section 2.4.3).

Table 2-3-26. Apportioned sonar counts by species and sampling location, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	River Mile	Apportioned Sonar Counts					
		Chinook 1/	Sockeye	Pink	Chum	Coho	Total
Susitna Station	26	925	123,913	493,156	20,245	33,137	680,376
Yentna Station	04	1,193	113,847	447,257	27,830	34,089	624,216
Sunshine Station	80	2,924	75,925	352,014	178,434	42,415	651,712
Talkeetna Station	103	2,850	3,297	85,377	28,823	7,189	127,536

1/ Chinook migrations were underway prior to the installation of sonar equipment. The counts should be considered as indices of abundance for the portion of the migration that the sonar equipment was operational.

Determined from fishwheel catch data, the second run of sockeye salmon at Susitna Station (RM 26) in 1982 began, reached a midpoint and ended on or about July 18, July 24 and August 5, respectively (Figure 2-3-13). In the Yentna River (RM 28) at Yentna Station (RM 04), the migration began on July 18, reached a midpoint on July 24 and terminated on August 6 (Figure 2-3-14). At Sunshine Station (RM 80), the second run escapement began, reached a midpoint and ended on July 20, July 27 and August 3, respectively.

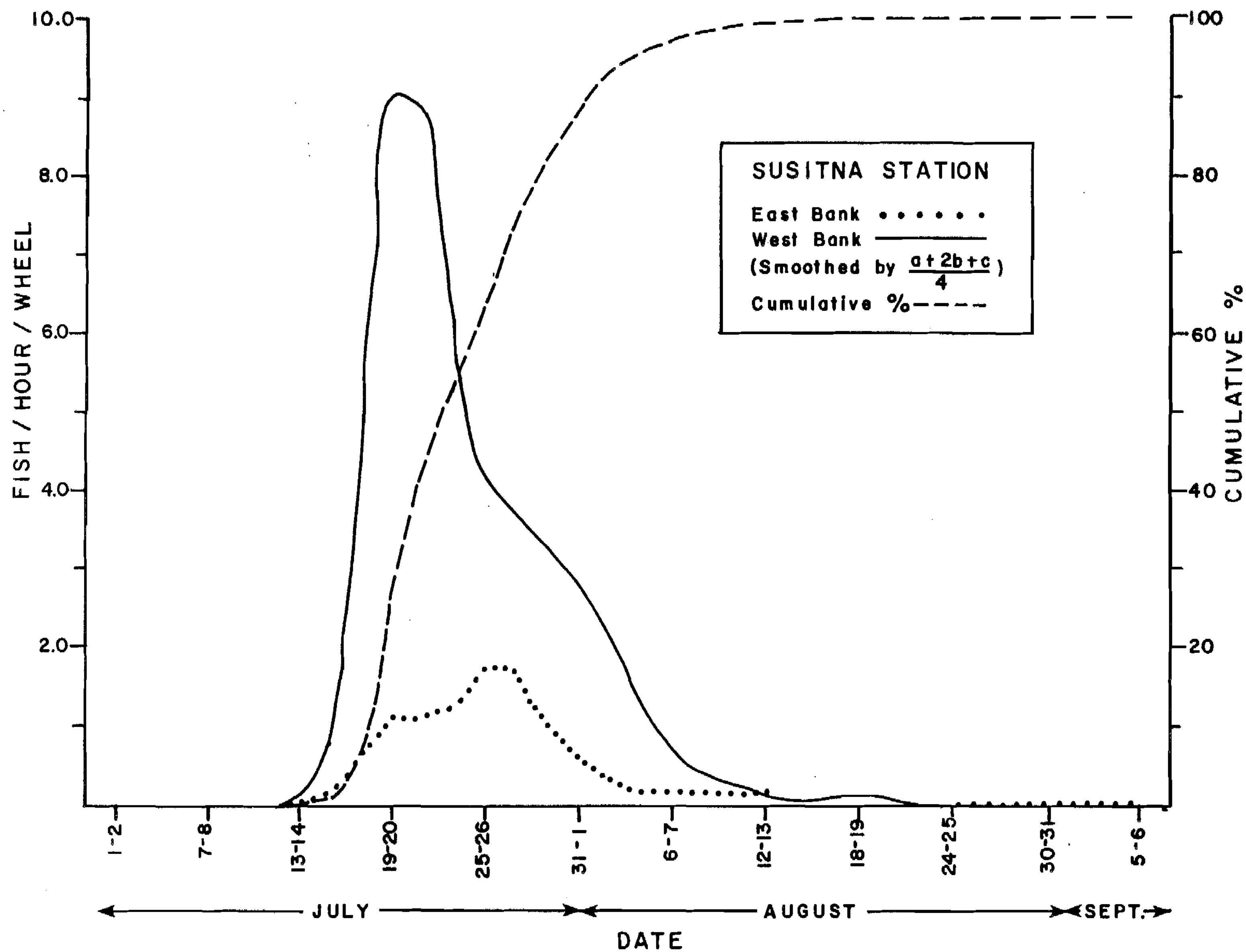


Figure 2-3-13. Mean hourly and cumulative percent fishwheel catch of sockeye salmon by two day periods at Susitna Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

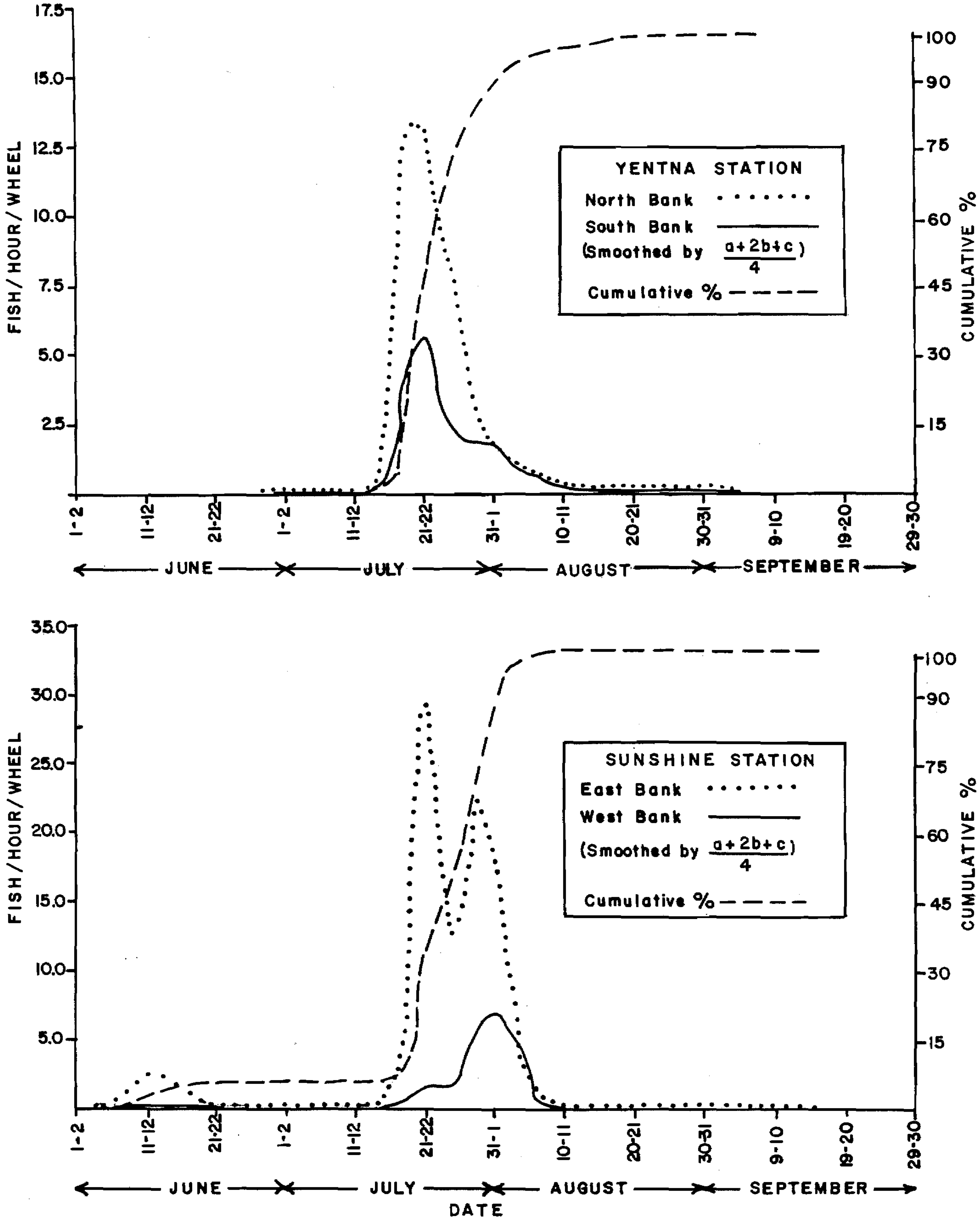


Figure 2-3-14. Mean hourly and cumulative percent fishwheel catch of sockeye salmon by two day periods at Yentna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Second run sockeye salmon were caught in fishwheels at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982. Daily and cumulative catch data have been presented in Appendix 2-C.

A total of 1,382, 3,386 and 17,408 second run sockeye salmon were intercepted with fishwheels at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 (Table 2-3-9). Peak fishwheel catches occurred on July 19 at Susitna Station, July 20 at Yentna Station and on July 22 at Sunshine Station (Appendix 2-C).

A sharp inseason reduction in fishwheel catches of sockeye salmon occurred at Sunshine Station (RM 80) on July 26, 1982 (Appendix 2-C and Figure 2-3-14). The reduction can be attributed, at least in part, to high water conditions. USGS gauging station #15292780 (RM 83.8) recorded a peak discharge of 99,300 cfs on July 26 (USGS provisional, 1982). Flows three days preceding and following this event were 66,200 and 67,900 cfs, respectively. It was suspected that the high water event on July 26 slowed migration of second run fish and to a lesser extent, reduced fishwheel efficiency.

Based on fishwheel catches, second run sockeye salmon averaged one day or less travel for the six miles between Susitna (RM 26) and Yentna (RM 04) stations, and approximately 2.3 days travel for the 54 miles between Susitna (RM 26) and Sunshine (RM 80) stations (Appendix 2-C). These travel times were computed under the assumption of no fundamental difference in timing between stocks.

Second run sockeye salmon displayed migrational preference in 1982 to the west bank at Susitna Station (RM 26), south bank at Yentna Station (RM 04) and east bank at Sunshine Station (RM 80) based on fishwheel catches (Figures 2-3-13 and 2-3-14). These preferences may be attributed to specific site characteristics including channel configuration, velocity and water depth.

Age composition data collected from second run sockeye salmon at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 are summarized in Table 2-3-23 and Figure 2-3-15. Age 5_2 fish comprised 65.8, 52.7 and 69.8 percent of the escapement sample from Susitna, Yentna and Sunshine stations, respectively. Next abundant were age 4_2 sockeye salmon which represented 22.4 percent of the age sample at Susitna Station, 27.7 percent at Yentna Station and 22.1 percent at Sunshine Station.

Based on scale growth patterns 88.6 percent of the sockeye salmon sampled for age from Susitna Station (RM 26) in 1982 had smolted in the second year, 11.1 percent the third year and 0.3 percent in the first year of life. At Yentna Station (RM 04) these percentages in order were 84.5, 14.7 and 0.8 percent, and at Sunshine Station (RM 80) 95.0, 3.6 and 1.5 percent (Table 2-3-23).

Length (FL) composition data were collected of second run sockeye salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations. The results are summarized in Table 2-3-24 and Appendix 2-D.

The average (FL) length of age 5_2 male and female second run fish sampled were: 584 mm and 564 mm at Susitna Station (RM 26); 582 mm and 554 mm at Yentna Station; and 586 mm and 547 mm at Sunshine Station (RM 80), respectively. Age 4_2 male and female average lengths were: 452 mm and 477 mm at Susitna Station; 477 mm and 496 mm at Yentna Station; and 471 mm and 498 mm at Sunshine Station, respectively.

Sex composition data from 1982 second run fish sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations are reported in Table 2-3-25. At Susitna Station, males outnumbered females among three and four year old fish while females outnumbered males among five and six year old fish. At Yentna Station, males outnumbered females in all ages sampled. Males were more numerous than females in all but four and five year old fish sampled at Sunshine Station (Figure 2-3-15).

Overall male to female sex ratios in 1982 were 1.0:1, 2.1:1 and 0.9:1 at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations, respectively.

3.2.2.1.2 Spawning

3.2.2.1.2.1 Main Channel

The main channel of the Susitna River from RM 7 to 98.5 was surveyed for sockeye spawning areas in 1982. A total of 811 main channel sites were examined between August 1 and October 13 (Appendix 2-F). No sockeye salmon spawning was found at any of the locations.

3.2.2.1.2.2 Streams and Sloughs

3.2.2.1.2.2.1 First Run

Spawning ground surveys were conducted to provide tag recapture data for determining the escapement of first run escapement to Sunshine Station (RM 80) in 1982. The survey results are presented in Table 2-3-27.

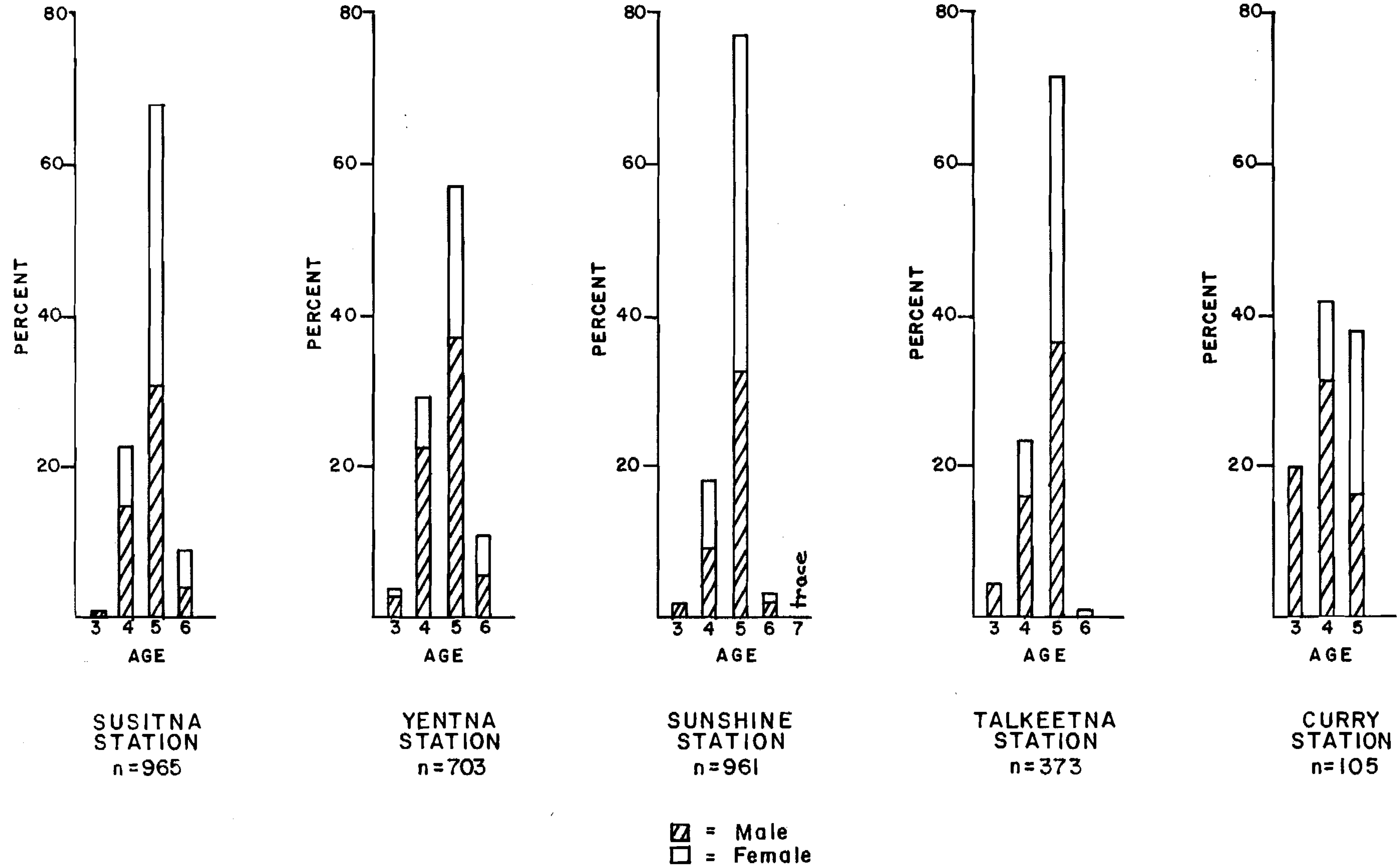


Figure 2-3-15. Age composition of fishwheel intercepted sockeye salmon at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-27. Escapement survey counts of tagged and untagged first run sockeye salmon tagged at Sunshine Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Area Surveyed	River Mile 1/	Date	Survey Conditions	Sunshine Tags Tagged (r)	Untagged	Total (c)	Ratio (c/r)
Papa Bear Lake Inlet Creek	97.1	8/2	Excell.	56	276	332	5.9
Fish Creek	97.1	6/24	Good	21	57	78	3.7

1/ Confluence of stream or receiving system with Susitna River mainstem.

Aerial and ground surveys in the Chulitna River drainage (RM 98.5), Susitna River basin above RM 80 and Talkeetna River system (RM 97.0) were conducted between mid July and mid August in association with 1982 scheduled chinook salmon spawning surveys. No area above RM 80, other than the Fish Creek subdrainage of Chunilna (Clear) Creek a Talkeetna River stream (RM 97.0), was found to be a spawning area of first run sockeye salmon (Figure 2-3-16).

The approximate spawning period of first run sockeye salmon in the Fish Creek drainage was July 21 through August 7, 1982.

3.2.2.1.2.2.2 Second Run

Second run sockeye salmon surveys were conducted for tag recovery data. The results are presented in Appendix 2-G.

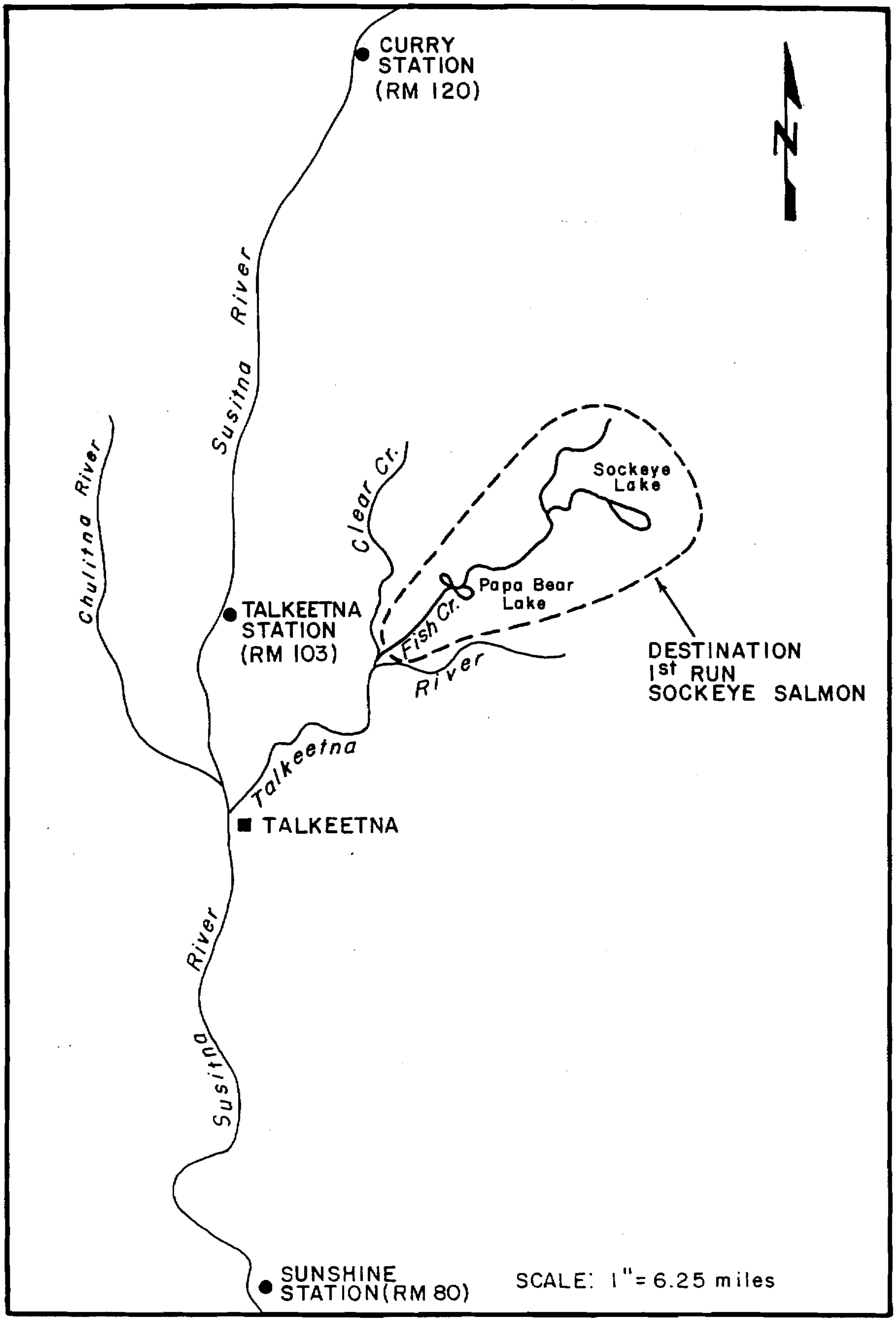


Figure 2-3-16. Destination of first run sockeye salmon tagged at Sunshine station on the Susitna River, Adult Anadromous Investigations, Su Hydro Studies, 1982.

3.2.2.2 Talkeetna to Upper Devil Canyon

3.2.2.2.1 Main Channel Escapement

3.2.2.2.1.1 First Run

At Talkeetna Station (RM 103), nine sockeye salmon were intercepted in fishwheels between June 7 and 18, 1982 (Appendix 2-C). The peak catch occurred on June 9. In the 19 days from June 19 to July 7 no sockeye salmon were caught at Talkeetna Station. Data indicates that all nine sockeye salmon intercepted at Talkeetna Station between June 7 and 18 were probably first run fish.

No estimate of 1982 first run sockeye salmon escapement to Talkeetna Station was made due to the absence of any known spawning areas above RM 103 or any recaptures of first run fish at Curry Station (RM 120).

At Curry Station (RM 120) there were no sockeye salmon caught in the station fishwheels between June 9 and July 15, 1982 (Appendix 2-C). Based on this observation it was probable that minimal, if any, first run sockeye salmon reached or extended upstream of RM 120 in 1982.

3.2.2.2.1.2 Second Run

In 1982 approximately 3,100 second run sockeye salmon migrated to Talkeetna Station (RM 103) as determined by the Petersen method. The 95 percent confidence interval on this estimate was calculated at 2,800 to 3,500 fish (Table 2-3-11).

A total of 3,297 second run sockeye salmon were enumerated over the SSS counters at Talkeetna Station (RM 103) in 1982 (Table 2-3-26). This number was considered an escapement index as defined in Section 2.4.3.

The escapement of second run sockeye salmon to Curry Station (RM 120) was approximately 1,300 fish by the Petersen method. The 95 percent confidence interval of this estimate calculated at 1,100 to 1,500 fish (Table 2-3-11).

The migration of second run sockeye salmon to Talkeetna Station (RM 103) began on July 27, reached a midpoint on August 1 and ended on August 18 in 1982 as derived from fishwheel catches (Figure 2-3-17). At Curry Station (RM 120) the migration began on July 27, reached a midpoint on August 5 and ended on August 28 (Appendix 2-C). Peak 1982 fishwheel catches of second run sockeye salmon occurred at Talkeetna Station (RM 103) on July 29 and at Curry Station (RM 120) on August 5 (Figure 2-3-17).

The average migration time of second run sockeye salmon between Sunshine (RM 80) and Talkeetna (RM 103) stations in 1982 was 8.5 days based on 57 recaptures (Figure 2-3-18). Eleven sockeye salmon averaged 2.3 days of travel between Talkeetna (RM 103) and Curry (RM 120) stations (Figure 2-3-18). The minimum and maximum days travelled was one and four days respectively. Twelve recaptured fish averaged 11.7 days travelling time between Sunshine (RM 80) and Curry (RM 120) stations (Figure 2-3-18). The range was 4 to 40 days.

A total of 509 and 161 second run sockeye salmon were intercepted in 1982 by fishwheels at Talkeetna (RM 103) and Curry (RM 120) stations respectively

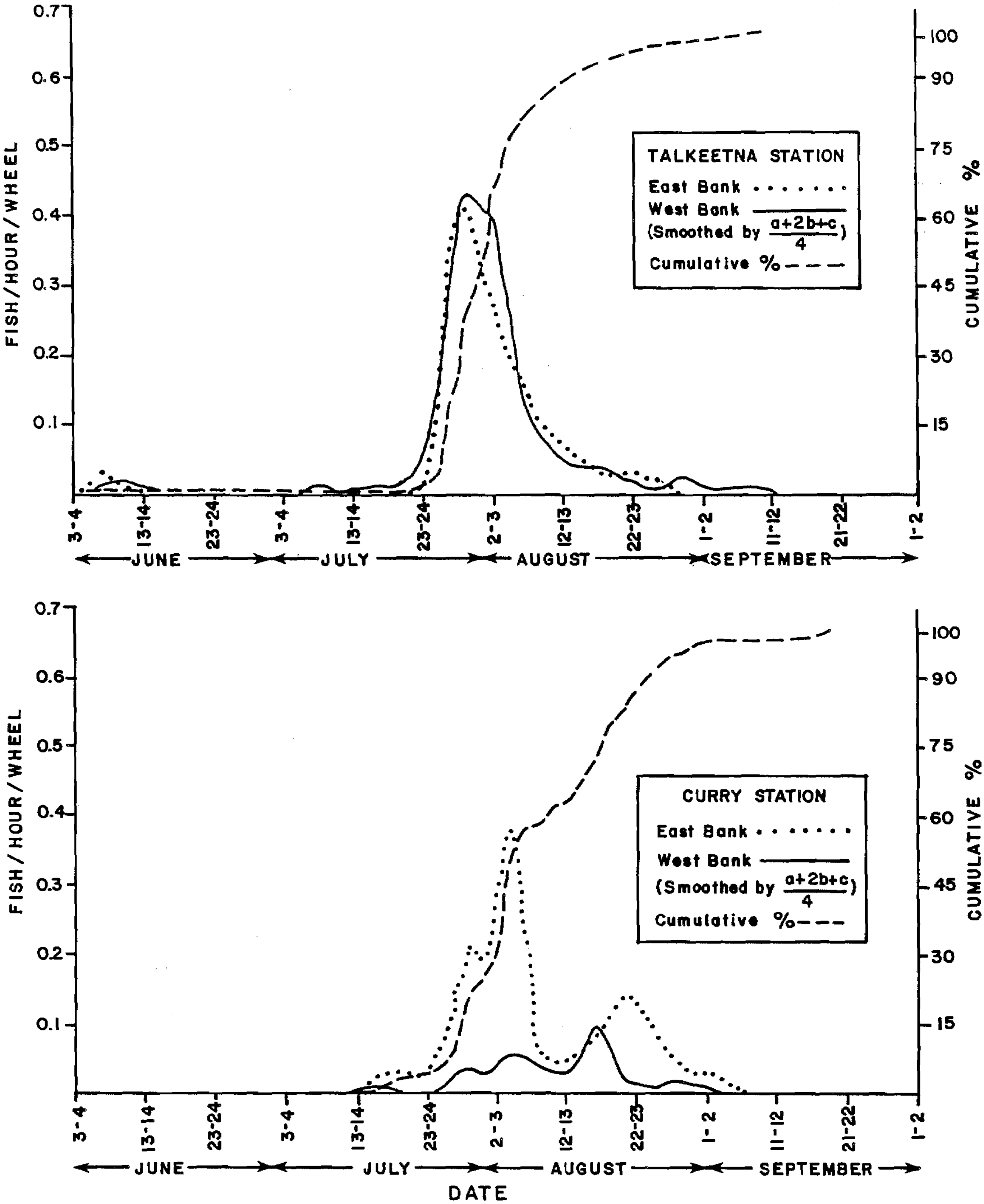


Figure 2-3-17. Mean hourly and cumulative percent fishwheel catch of sockeye salmon by two day periods at Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

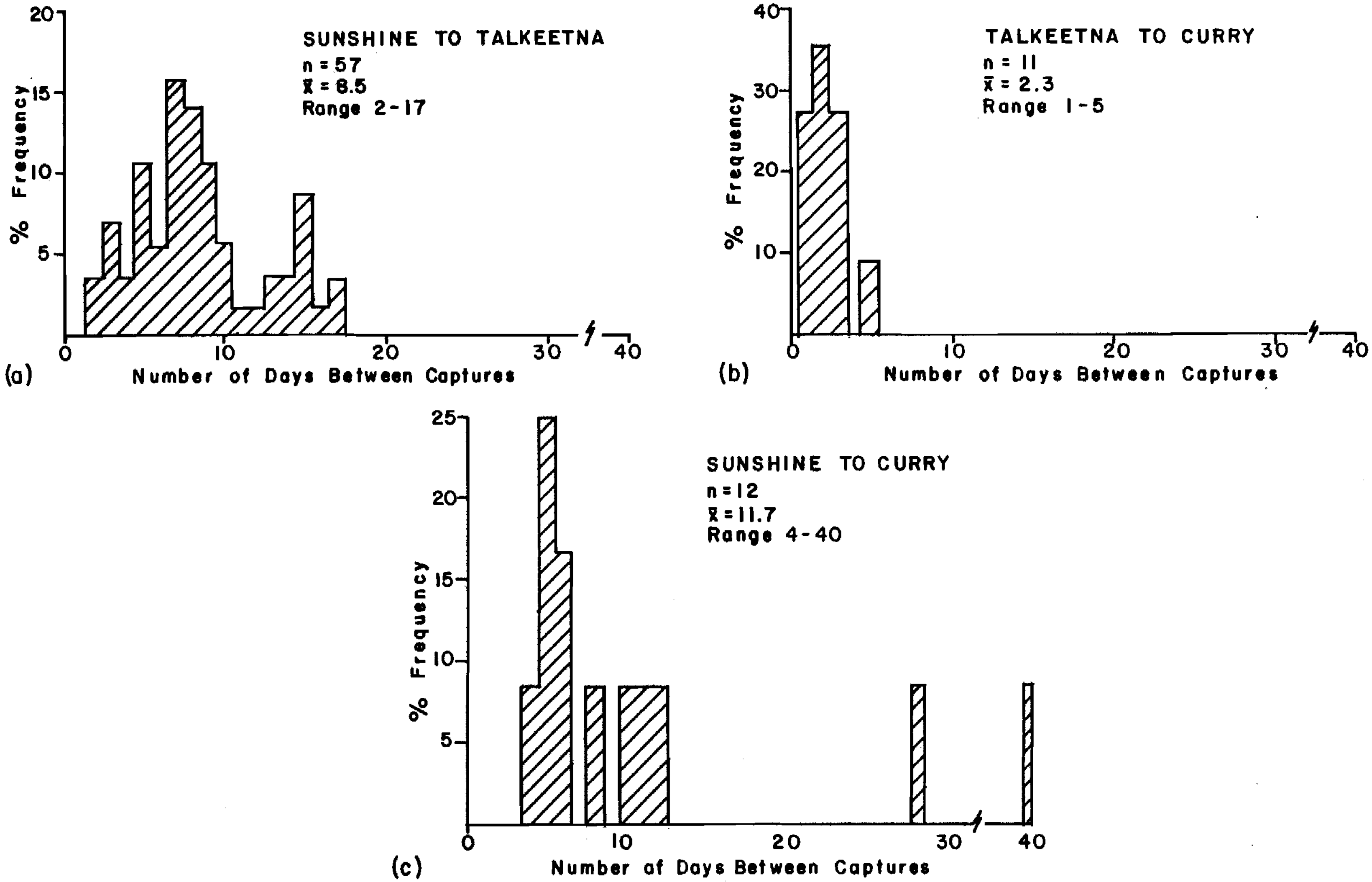


Figure 2-3-18. Migrational rates of sockeye salmon between (a) Sunshine and Talkeetna stations, (b) Talkeetna and Curry stations and (c) Sunshine and Curry stations based on fishwheel recaptures, Adult Anadromous Investigations, Su Hydro Studies, 1982.

(Table 2-3-9). Based on these catches, 53.0 percent of the escapement migrated offshore of the west bank at Talkeetna Station and 47.0 percent travelled off the east bank at RM 103 (Appendix 2-C). At Curry Station 79.5 percent of the escapement migrated along the east bank and 20.5 percent travelled along the west bank.

Age and length (FL) composition data of second run sockeye salmon sampled at Talkeetna (RM 103) and Curry (RM 120) stations are summarized in Tables 2-3-23 and 2-3-24, respectively.

At Talkeetna Station (RM 103) approximately 70.8 percent of the escapement sampled were age 5_2 fish followed by age 4_2 fish at 21.2 percent. Based on scale growth characteristics, 96.3 percent of the fish sampled had smolted in the second year of life and 3.7 percent had smolted in the third year of life. The average length (FL) of age 4_2 males and females was 524 mm and 505 mm while age 5_2 males and females sampled at Talkeetna Station averaged 590 mm and 566 mm respectively (Table 2-3-24).

At Curry Station (RM 120) age 3_2, 4_2 and 5_2 sockeye salmon comprised 21.9, 30.5 and 32.4 percents respectively of the age sample (Table 2-3-23 and Figure 2-3-15). Approximately 84.9 percent of the fish aged from Curry Station (RM 120) had smolted in the second year of life followed by 14.3 percent in the third year of life and 1.0 percent in the first year of life.

Age 3_2 male sockeye salmon sampled for length (FL) at Curry Station (RM 120) averaged 350 mm and age 4_2 males and females averaged 496 mm and 503 mm, respectively. Age 5_2 males averaged 573 mm and females averaged 555 mm (Table 2-3-24).

Results of 1982 sex composition sampling at Talkeetna (RM 103) and Curry (RM 120) stations are reported in Table 2-3-25 and Figure 2-3-15. At Talkeetna Station sockeye salmon males were more abundant than females among the three, four and five year old fish and less abundant than females among six year old fish sampled. Overall male to female ratio was 1.3:1. At Curry Station (RM 120) males outnumbered females among the three and four year old fish sampled and were less numerous than females among five year old fish sampled. Overall male to female ratio was 2.1:1.

3.2.2.2.2 Lower Devil Canyon Milling

Set net fishing results for 1982 in lower Devil Canyon are summarized in Table 2-3-18. No sockeye salmon were caught in the 19.6 net hours fished at RM 150.2 and 150.4 from August 10 through September 12, 1982 (Plate 2-3-7).

Plate 2-3-7. Preparing to deploy gill net in lower Devil Canyon near RM 150.4, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Electroshocking was conducted four times at RM 150.4 between August 11 and September 23, 1982 and did not produce a sockeye salmon catch (Table 2-3-19).

Based on gill netting and electroshocking in lower Devil Canyon minimal, if any, sockeye salmon were present in lower Devil Canyon (RM 150 to 151) from August 10 through September 23, 1982.

3.2.2.2.3 Spawning

3.2.2.2.3.1 Main Channel

Surveys for sockeye salmon spawning were conducted in the Susitna River reach from RM 98.5 to 150 between August 7 and October 7, 1982. A total of 397 sites were examined for sockeye salmon spawning activity (Appendix 2-F). Survey results indicated sockeye salmon did not spawn in the main channel reach between RM 98.5 and 150.

3.2.2.2.3.2 Sloughs and Streams

In 1982, 34 sloughs between RM 98.6 and 161.0 were surveyed (Appendix 2-G). The following 10 sloughs were found to contain sockeye salmon:

1. Slough 8C (RM 121.9)
2. Slough 8B (RM 122.2)
3. Moose Slough (RM 123.5)
4. Slough 8A (RM 125.1)
5. Slough B (RM 126.3
6. Slough 9 (RM 128.3)
7. Slough 9B (RM 129.2)
8. Slough 9A (RM 133.8)
9. Slough 11 (RM 135.3)
10. Slough 21 (RM 141.1)

All sockeye salmon surveyed between RM 98.6 to 161.0 were second run fish as determined from escapement sampling at Talkeetna (RM 103) and Curry (RM 120) stations (Section 3.2.2.2.1.1).

The total of the peak survey counts of live and dead sockeye salmon for all sloughs was 607 fish in 1982 (Appendix 2-G). This count represents the minimum level of escapement to the 10 referenced sloughs.

Based on peak survey counts, sockeye salmon in 1982 were most abundant in sloughs: 11 (75.1%), 8A (11.2%), and 21 (8.7%).

Peak of spawning by second run sockeye salmon in slough habitats occurred during the last week of August and the first three weeks in September, 1982 (Appendix 2-G).

Slough B (RM 126.3) was identified as a new anadromous fish spawning habitat by ADF&G Su Hydro Adult Anadromous staff on August 12, 1982 (Appendix 2-G). Slough B supported a peak survey count of eight sockeye salmon on September 5, 1982 (Appendix 2-G).

A total of 19 streams were surveyed between RM 98.6 and 161.0 in 1982. Four sockeye salmon were observed at the mouth of Portage Creek (RM 148.9) on August 29. These were the only sockeye salmon observed in any stream habitat in 1982 (Appendix 2-G).

The four sockeye salmon recorded at Portage Creek (RM 148.9) on August 29, 1982 were considered milling fish as there were no further sightings of these fish in subsequent surveys (Appendix 2-G).

3.2.2.2.4 Stock Separation

Phase II investigations were subcontracted to the Statewide Stock Biology Group of ADF&G Commercial Fisheries Division to determine: (1) separatability of second run sockeye salmon stocks sampled at Curry (RM 120) and Talkeetna (RM 103) stations, from Larson Lake outlet stream a Talkeetna River (RM 97.0) tributary, and from the Tokositna River a Chulitna River (RM 98.5) tributary; and (2) the probable fate of second run sockeye fry spawned upstream of Curry Station.

Results of the stock separation work are presented in Appendix 2-H.

3.2.3 Pink Salmon

3.2.3.1 Estuary to Talkeetna

3.2.3.1.1 Main Channel Escapement

Pink salmon escapement estimates were obtained for Yentna (RM 04) and Sunshine (RM 80) stations in 1982 (Table 2-3-10). No total escapement estimate was available for Susitna Station (Section 2.4.3).

Sonar counters operated at Susitna Station (RM 26) counted 493,156 pink salmon between July 1 and September 5, 1982 (Table 2-3-26). These counts were considered an index of the escapement to RM 26 (Section 2.4.3). Daily and cumulative SSS counts have been presented in Appendix 2-B.

The Yentna River (RM 28) pink salmon escapement in 1982 was approximately 447,300 fish based on SSS monitoring at Yentna Station (RM 04) (Table 2-3-10). Daily and cumulative SSS counts recorded at Yentna Station have been presented in Appendix 2-B.

At Sunshine Station (RM 80) the pink salmon escapement was approximately 443,200 fish estimated by the Petersen method with a 95 percent confidence interval of 407,000 to 486,500 fish (Table 2-3-11).

The Susitna River pink salmon escapement in 1982 was approximately 890,500 fish. This estimate does not reflect escapement to systems between RM 6 and 77 excluding the Yentna River (RM 28) and represents the combined number of pink salmon counted by sonar at Yentna Station (RM 04) and the estimate of the pink salmon migrating to Sunshine Station (RM 80) by the Peterson method (Table 2-3-10).

A total of 352,014 pink salmon were counted with SSS counters at Sunshine Station (RM 80) in 1982 (Table 2-3-26). This count was considered an index of the pink salmon escapement to RM 80 (Section 2.4.3). Daily and cumulative SSS counts recorded at Sunshine Station are provided in Appendix 2-B.

Pink salmon were caught in fishwheels at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982. Daily and cumulative fishwheel catch data are presented in Appendix 2-C.

Fishwheels operated at Susitna Station (RM 26) intercepted a total of 5,174 pink salmon in 1982. The east bank fishwheel caught 59.8 percent of the catch and the 40.2 percent remainder was caught with the west bank fishwheel (Table 2-3-9). Based on fishwheel catches, the pink salmon migration at Susitna Station began on July 23, reached a midpoint on July 28 and terminated on August 6 (Figure 2-3-19).

At Yentna Station (RM 04) 16,627 pink salmon were caught in fishwheels in 1982. The south bank fishwheel caught 54.5 percent of the catch and the north bank fishwheel caught 45.5 percent of the catch. Based on catch rates, the migration at Yentna Station began, reached a midpoint and ended on July 23, on July 29 and August 7, respectively (Figure 2-3-20). Approximately 85 percent of the pink salmon escapement at Yentna Station in 1982 migrated within 15 feet of the north and south shore based on SSS sector counts (Appendix 2-B).

At Sunshine Station (RM 80) 47,671 pink salmon were intercepted by fishwheels in 1982 (Table 2-3-9). The migration, as indicated by fishwheel catches began July 29 and ended on August 10 with the midpoint occurring on approximately August 3 (Figure 2-3-20). Based on fishwheel catches the majority (91.7%) of the pink salmon migrated along the east bank.

Pink salmon averaged approximately one travel day for the six miles between Susitna (RM 26) and Yentna (RM 04) stations in 1982 from fishwheel catch data interpretation (Figures 2-3-19 and 2-3-20). The average travel time for pink salmon between Susitna and Sunshine (RM 80) stations, a distance of approximately 54 miles, was approximately eight days. Estimated travel rates assume no differential timing between stocks.

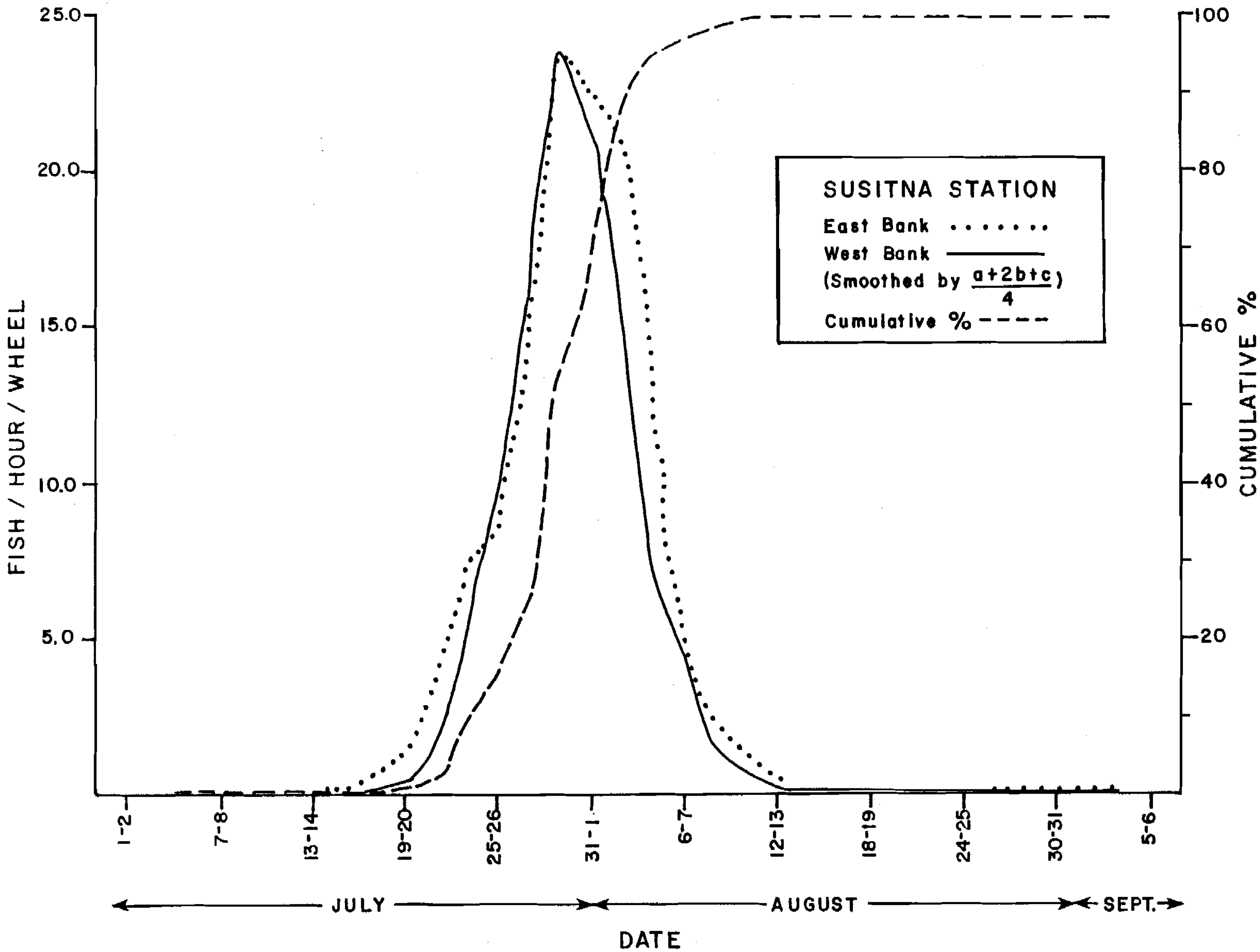


Figure 2-3-19. Mean hourly and cumulative percent fishwheel catch of pink salmon by two day periods at Susitna Station, Adult Anadromous Investigations, Su Hydro Studies 1982.

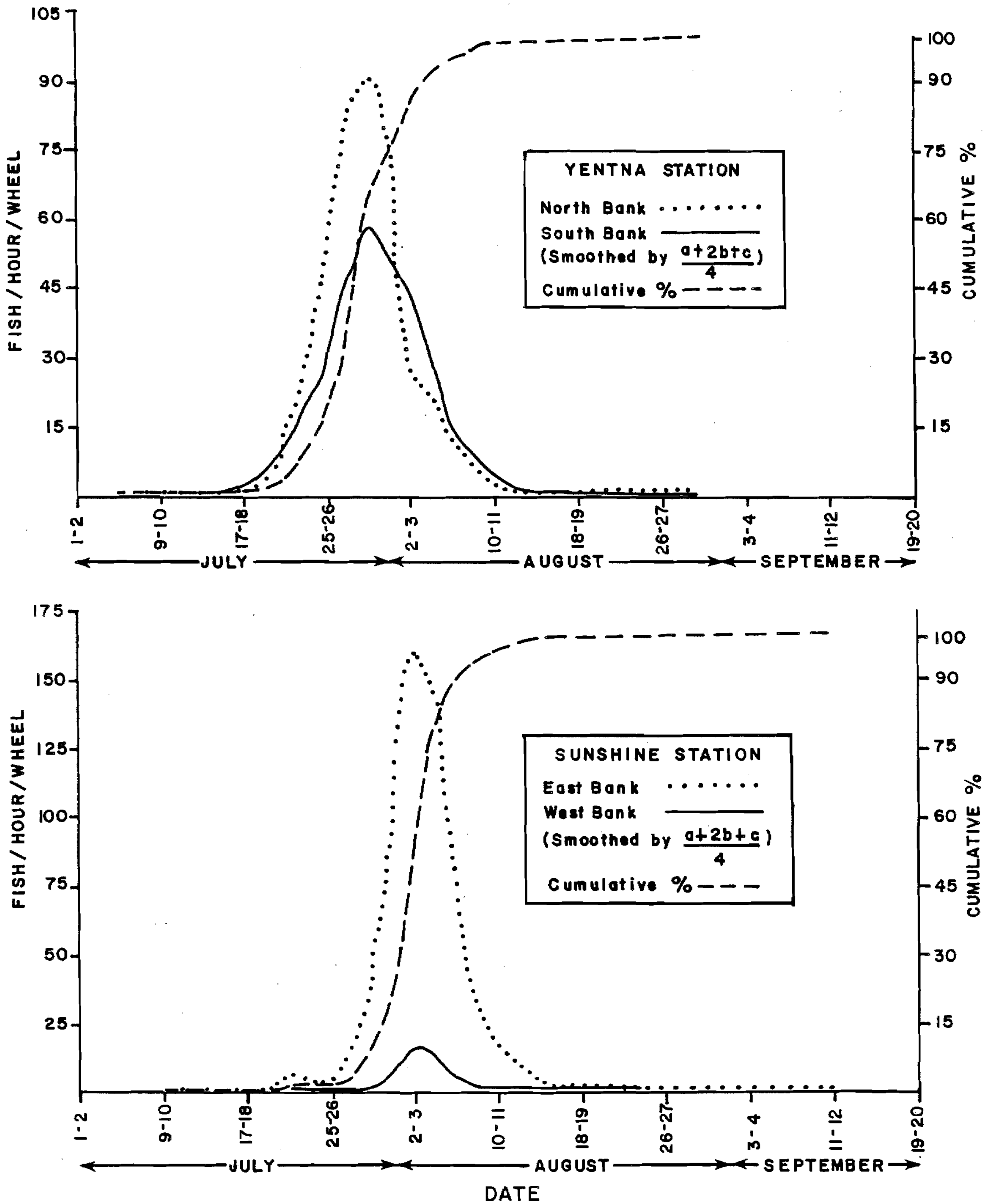


Figure 2-3-20. Mean hourly and cumulative percent fishwheel catch of pink salmon by two day periods at Yentna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Length (FL) composition data of pink salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 are summarized in Table 2-3-28 and Appendix 2-D.

Pink salmon ranged in length (FL) at Susitna Station (RM 26) from 245 mm to 516 mm, at Yentna Station (RM 04) from 240 mm to 593 mm and at Sunshine Station (RM 80) from 275 mm to 580 mm. Male pink salmon averaged 432 mm at Susitna Station, 433 mm at Yentna Station and 441 mm in length at Sunshine Station. Female pink salmon had average lengths of 412 mm, 422 mm and 423 mm at Susitna, Yentna and Sunshine stations, respectively.

At Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations the male to female pink salmon ratios recorded from escapement sampling were 0.9:1, 1.0:1 and 1.8:1, respectively (Table 2-3-28).

3.2.3.1.2 Main Channel Spawning

In 1982, 811 Susitna River main channel sites between RM 7 and 98.6 were investigated for pink salmon spawning between August 1 and October 13 (Appendix 2-F). Survey results indicate that no pink salmon spawning occurred in the subject river reach in 1982.

3.2.3.2 Talkeetna to Devil Canyon

3.2.3.2.1 Main Channel

In 1982 approximately 73,000 pink salmon migrated to Talkeetna Station (RM 103), as calculated by the Petersen method (Table 2-3-10). The 95 percent

Table 2-3-28. Analysis of pink salmon lengths in millimeters from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	n		Sex Ratio (M:F)	Range Limits		Mean		95% Conf. Limits 3/		Median	
	m 1/	f 2/		m	f	m	f	m	f	m	f
Susitna Station	130	137	0.9:1	293-516	245-491	432	412	425-439	405-420	435	422
Yentna Station	638	632	1.0:1	321-593	240-539	433	422	431-436	420-424	431	423
Sunshine Station	618	342	1.8:1	275-580	275-500	441	423	438-445	420-426	440	425
Talkeetna Station	587	361	1.6:1	340-590	320-640	425	428	422-428	425-431	420	430
Curry Station	483	322	1.5:1	270-525	325-480	417	421	414-420	418-423	415	420

1/ Male

2/ Female

3/ Confidence Limits on Mean

confidence interval for the escapement estimate was calculated at 70,500 to 75,800 fish (Table 2-3-11).

The escapement of pink salmon to Curry Station (RM 120) in 1982 was estimated at 58,800 pink salmon by the Petersen method (Table 2-3-10). The 95 percent confidence interval was 53,600 to 65,300 fish (Table 2-3-11).

Fishwheels at Talkeetna Station (RM 103) caught a total of 13,781 pink salmon in 1982 with 55.6 percent of the catch being made with the two east bank fishwheels (Appendix 2-C). Based on fishwheel catch rates the pink salmon migration began on August 2, reached a midpoint on August 6 and terminated on August 13 (Figure 2-3-21).

Side scan sonars at Talkeetna Station (RM 103) registered 85,377 pink salmon counts in 1982 (Table 2-3-26). The east and west SSS counters registered 41.8 percent and 58.2 percent of the counts respectively (Appendix 2-B). The SSS count of pink salmon at Talkeetna Station was considered an index of the escapement as discussed in Section 2.4.3.

The two fishwheels at Curry Station (RM 120) intercepted a total of 7,302 pink salmon in 1982 (Table 2-3-9). From fishwheel catch rate interpretation the migration began on August 2, reached a midpoint on August 6 and terminated on August 13. Approximately 51.8 percent of the pink salmon migrated along the east bank of the Susitna River at Curry Station and the remaining 48.2 percent migrated along the west bank as indicated by fishwheel catches.

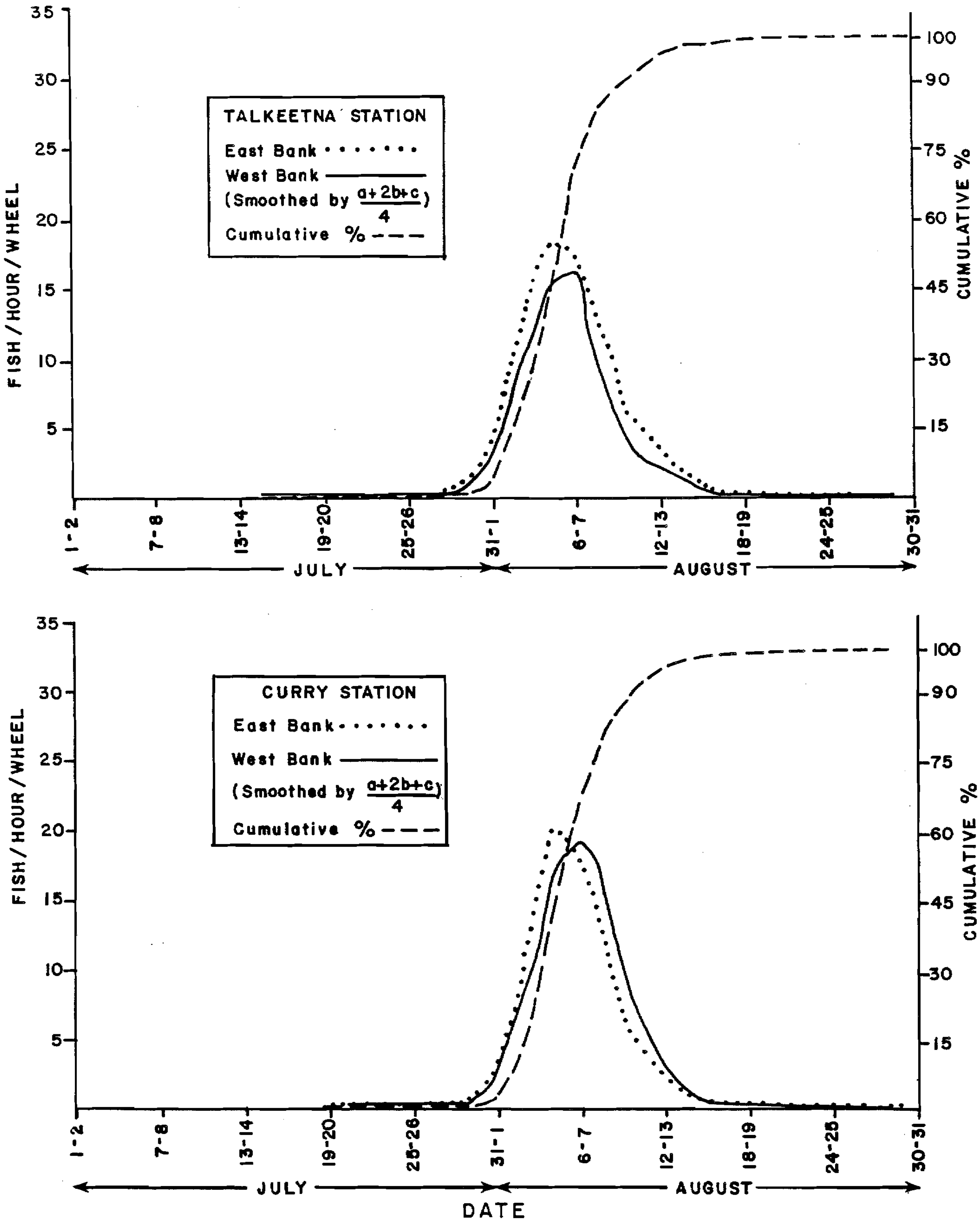


Figure 2-3-21. Mean hourly and cumulative percent fishwheel catch of pink salmon by two day periods at Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

In 1982, pink salmon travelled the 23 miles between Sunshine Station (RM 80) and Talkeetna Station (RM 103) in an average of 3.1 days based on tagged fish recaptures. The range was 1 to 11 days (Figure 2-3-22). The travel time between Sunshine (RM 80) and Curry (RM 120) stations, a distance of 40 miles, averaged 5.6 days with a range of 2 to 18 days. The 17 miles between Talkeetna and Curry stations was travelled in an average of 1.7 days. The minimum was less than one day and the maximum was 20 days.

Pink salmon length (FL) data collected at Talkeetna (RM 103) and Curry (RM 120) stations in 1982 have been summarized in Table 2-3-28 and Appendix 2-D. At Talkeetna Station (RM 103) male pink salmon ranged in length from 340 mm to 590 mm. The average was 425 mm. Females ranged in length from 320 mm to 640 mm and the average was 428 mm. At Curry Station (RM 120) male pink salmon averaged 417 mm and females averaged 421 mm in length.

Male pink salmon sampled in 1982 at Talkeetna (RM 103) and Curry (RM 120) stations were more abundant than females by a male to female ratio of 1.6:1 and 1.5:1, respectively (Table 2-3-28).

3.2.3.2.2 Lower Devil Canyon Milling

Two set net locations in lower Devil Canyon (RM 150-151) were fished 19.6 net hours between August 10 and September 12, 1982 (Figure 2-3-10 and Table 2-3-18). The effort produced a single pink salmon. The catch occurred on August 10 at RM 150.4. The pink salmon had been tagged on August 6 at Talkeetna Station (RM 103) and had averaged a travel speed of 11.9 mpd between RM 103 and 150.4.

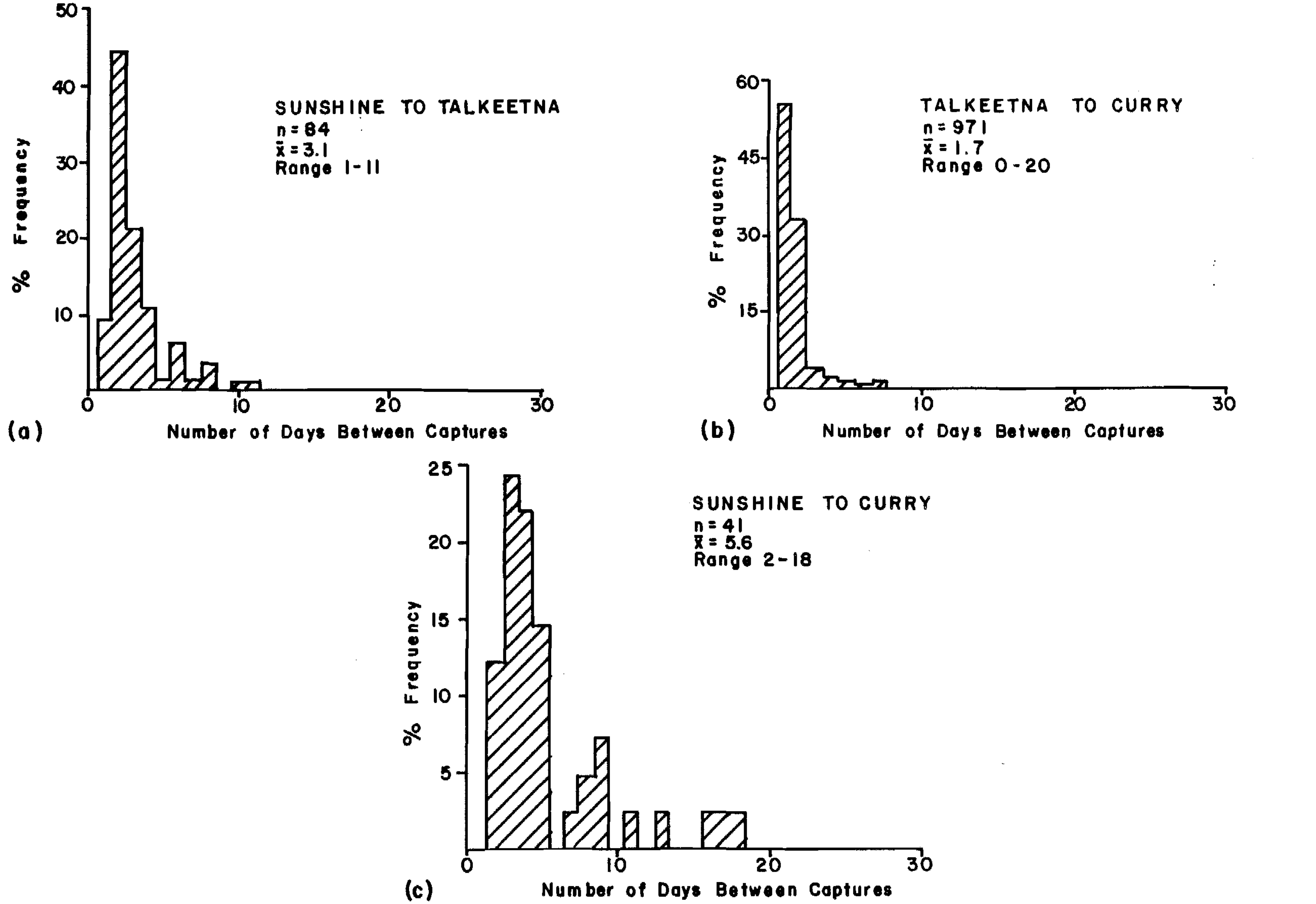


Figure 2-3-22. Migrational rates of pink salmon between (a) Sunshine and Talkeetna stations, (b) Talkeetna and Curry stations and (c) Sunshine and Curry stations based on fishwheel recaptures, Adult Anadromous Investigations, Su Hydro Studies, 1982.

In lower Devil Canyon (RM 150-151) electroshocking was conducted four times between August 11 and September 23, 1982. Three pink salmon were captured. Two fish were intercepted on August 11 and a single pink salmon was caught on August 18 (Table 2-3-19).

Set net and electroshocking results indicate that pink salmon were present in lower Devil Canyon (RM 150-151) from August 10 through 18, 1982.

3.2.3.2.3 Spawning

3.2.3.2.3.1 Main Channel

From August 7 to October 7, 397 main channel areas between RM 98.6 and 150 were surveyed for pink salmon spawning in 1982 (Appendix 2-F). Based on these survey results no pink salmon spawning occurred in the referenced main channel reach.

3.2.3.2.3.2 Sloughs and Streams

Between RM 98.6 and 151, 34 sloughs were surveyed for salmon presence from July 28 to October 25, 1982 (Appendix 2-G). Ten of the sloughs contained pink salmon and these were:

1.	6A (RM 112.3)	6.	11 (RM 135.3)
2.	Moose (RM 123.5)	7.	15 (RM 137.2)
3.	8A (RM 125.1)	8.	19 (RM 139.7)
4.	B (RM 126.3)	9.	20 (RM 140.0)
5.	9 (RM 128.3)	10.	21 (RM 141.1)

A total of 507 pink salmon were counted in the peak surveys of the 10 sloughs listed above (Appendix 2-G). Pink salmon were most abundant in sloughs: 15 (26.0%), 11 (25.8%), 20 (12.6%), 21 (12.6%), 6A (6.9%) and B (6.3%). The peak of spawning by pink salmon in slough habitats occurred during the third and fourth weeks of August in 1982.

Nineteen streams were surveyed for salmon in 1982. The following 14 streams were found to contain pink salmon:

1. Whiskers Creek (RM 101.4)
2. Chase Creek (RM 106.9)
3. Lane Creek (RM 113.6)
4. L. McKenzie Creek (RM 116.2)
5. McKenzie Creek (RM 116.7)
6. L. Portage Creek (RM 117.7)
7. Fifth of July Creek (RM 123.7)
8. Skull Creek (RM 124.7)
9. Sherman Creek (RM 130.8)
10. Fourth of July Creek (RM 131.1)
11. Gold Creek (RM 136.7)
12. Indian River (RM 138.6)
13. Jack Long Creek (RM 144.5)
14. Portage Creek (RM 148.9)

The combined peak spawning count of the 14 listed streams was 2,855 pink salmon (Appendix 2-G). It should be recognized this count does not represent the total number of pink salmon that spawned in these streams due to only a portion (index) of each stream being counted, and early and late spawning fish generally not being present when peak counts are made. The highest peak spawning counts of pink salmon were made in Indian River (25.9%), Fourth of July Creek (24.6%), Lane Creek (22.4%) and Portage Creek (5.9%) in 1982.

The peak of pink salmon spawning in stream habitats occurred between August 11 and August 23, 1982. Spawning in streams by pink salmon was approximately one week earlier than the peak of spawning in the sloughs in 1982 (Appendix 2-G).

3.2.4 Chum Salmon

3.2.4.1 Estuary to Talkeetna

3.2.4.1.1 Main Channel Escapement

Susitna River chum salmon escapement estimates were obtained for Yentna (RM 04) and Sunshine (RM 80) stations in 1982 (Table 2-3-10). No total escapement estimate was available for Susitna Station as defined in Section 2.4.3.

The number of chum salmon that were counted over the SSS counters in 1982 at Susitna Station (RM 26) was 29,245 fish (Table 2-3-8 and Appendix 2-B). This count was considered an index of the chum salmon escapement to Susitna Station (Section 2.4.3).

The 1982 escapement of chum salmon to the Yentna River (RM 28) as recorded by SSS counters at Yentna Station (RM 04) was approximately 27,800 fish (Table 2-3-10). Daily and cumulative Yentna Station SSS counts have been presented in Appendix 2-B. At Sunshine Station (RM 80) escapement was approximately 430,400 fish as determined by the Petersen method (Table 2-3-10). The 95 percent confidence interval of the estimate was calculated at 407,700 to 455,800 fish (Table 2-3-11).

The Susitna River chum salmon escapement in 1982 was approximately 458,000 fish not including escapements to spawning systems above RM 6 and below RM

77, excluding the Yentna River (RM 28) (Table 2-3-10). This estimate was derived by summation of the SSS count of chum salmon at Yentna Station (RM 04), and the Petersen estimate of chum salmon to Sunshine Station (RM 80).

The SSS counters at Sunshine Station (RM 80) recorded 178,434 chum salmon counts in 1982 (Table 2-3-26). This number was considered an index of the chum salmon escapement to Sunshine Station (Section 2.4.3).

Chum salmon returning to the Susitna River drainage in 1982 were caught by fishwheels at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations. Daily and cumulative catch data have been presented in Appendix 2-C.

Fishwheels at Susitna Station (RM 26) intercepted 382 chum salmon in 1982 (Table 2-3-9). The onset, midpoint and end of the chum salmon migration to Susitna Station derived from fishwheel catch data were approximately July 19, July 31 and August 10, respectively (Figure 2-3-23). Peak fishwheel catches occurred on August 3.

At Yentna Station (RM 04) on the Yentna River (RM 28) 1,261 chum salmon were caught in fishwheels in 1982 (Table 2-3-9). From catch rate data, the chum salmon migration began on July 20, reached a midpoint on August 2 and ended on August 18 (Figure 2-3-24). Fishwheel catches peaked on August 1 (Appendix 2-C).

At Sunshine Station (RM 80), the 1982 chum salmon migration began on July 29, was at midpoint on August 7 and ended on August 21 based on fishwheel catches

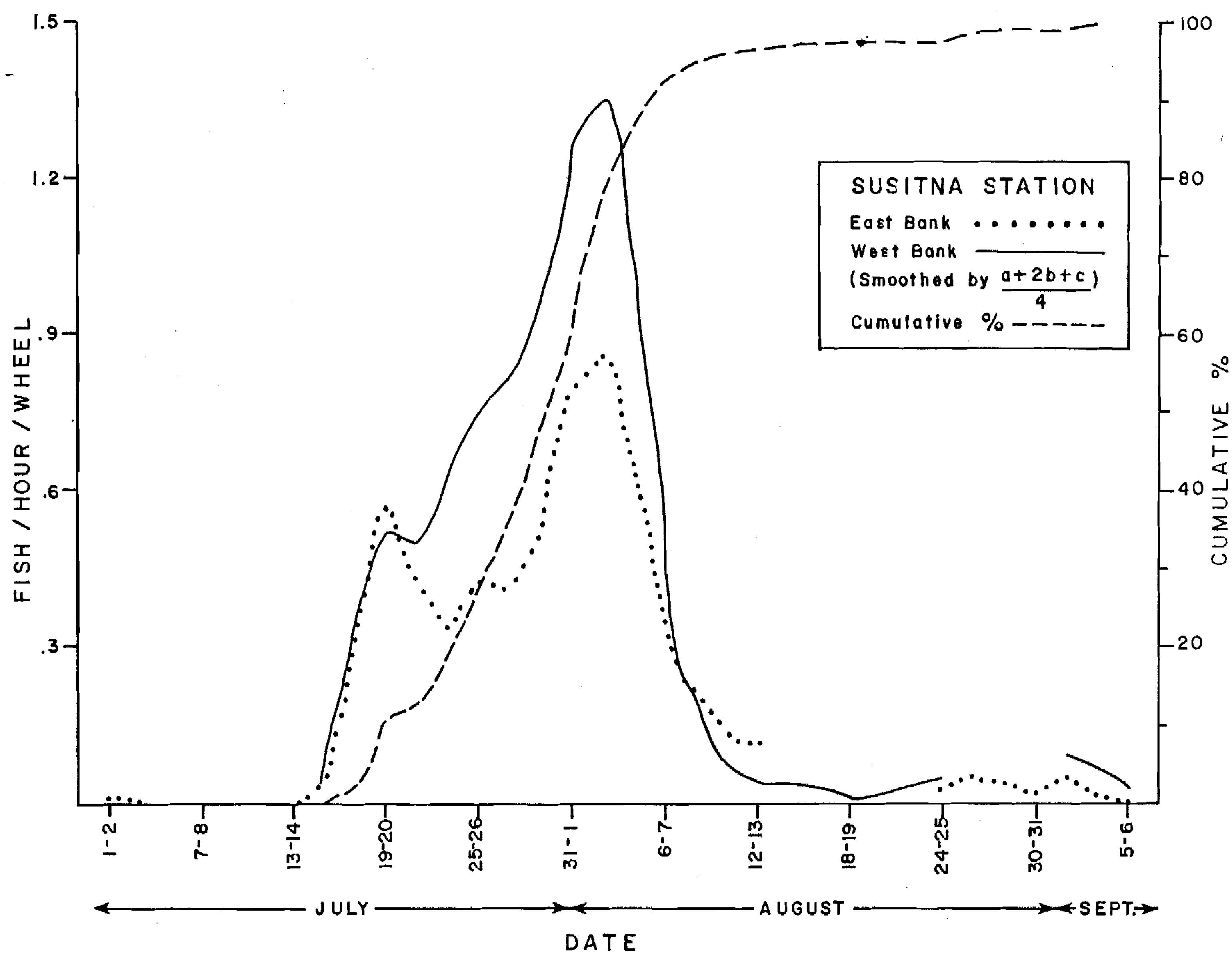


Figure 2-3-23. Mean hourly and cumulative percent catch of chum salmon by two day periods at Susitna Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

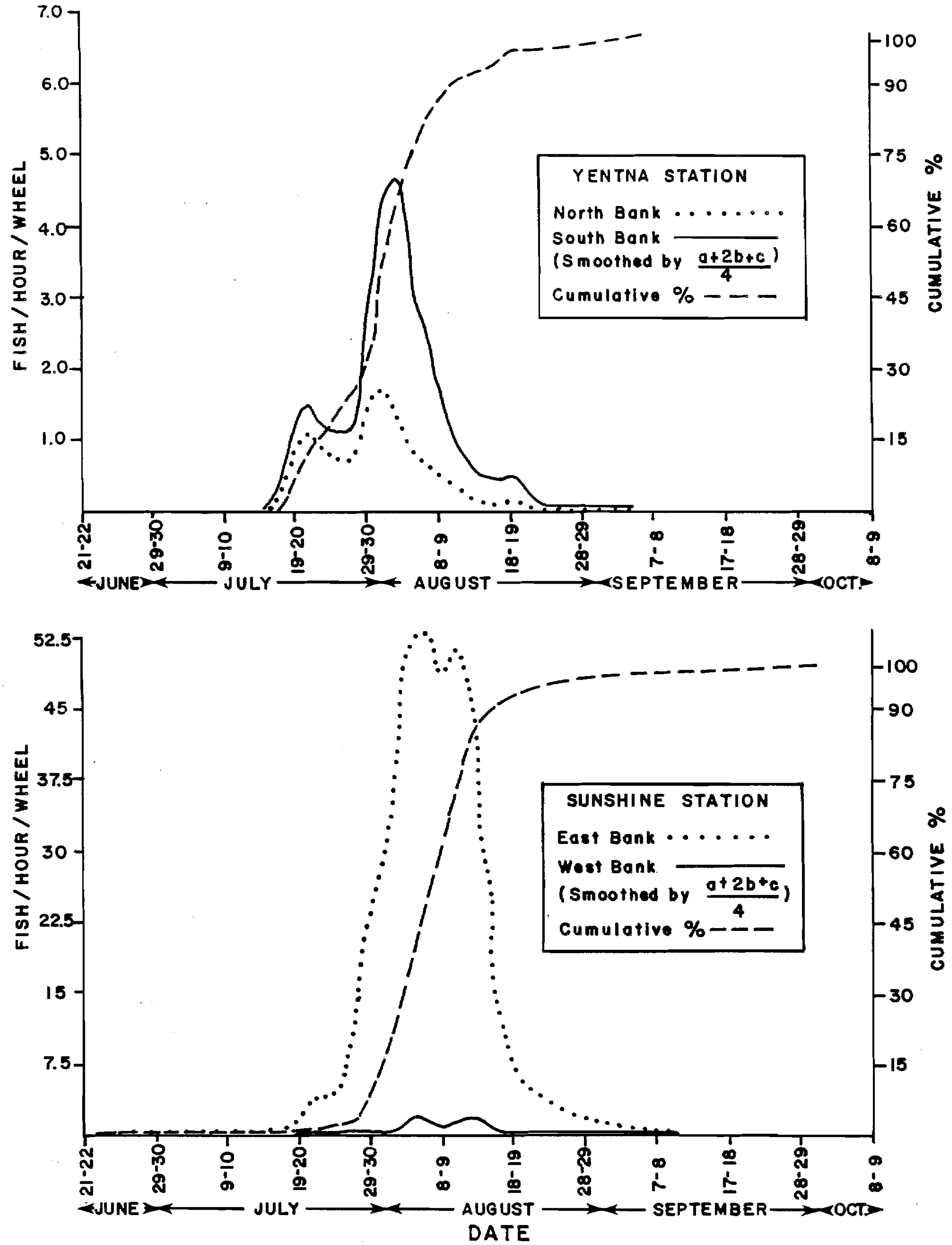


Figure 2-3-24. Mean hourly and cumulative percent fishwheel catch of chum salmon by two day periods at Yentna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

(Figure 2-3-24). The total fishwheel catch of chum salmon at Sunshine Station in 1982 was 36,335 fish. The peak catch occurred on August 5, 1982 (Appendix 2-C).

Fishwheel catches at Susitna Station (RM 26) indicated that approximately 55.5 percent of the chum salmon salmon escapement migrated off the west bank at that location and the 44.5 percent remainder migrated off the east bank in 1982 (Appendix 2-C). In the Yentna River (RM 28) at Yentna Station (RM 04) approximately 70.8 percent of the fish migrated off the north bank and 29.2 percent travelled of the south bank. At Sunshine Station (RM 80) 96.7 percent of the chum salmon migrated on the east side of the river and 3.3 percent passed on the west side.

Fishwheel data indicates that chum salmon spent less than one day travelling between Susitna (RM 26) and Yentna (RM 04) stations, and 7.5 days between Susitna and Sunshine (RM 80) stations in 1982 (Appendix 2-C). These estimates are valid under an assumption of no differential timing between stocks.

Chum salmon age samples were collected at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982. The results are summarized in Table 2-3-29. Age 4_1 chum salmon represented 84.4 percent, 90.3 percent and 91.1 percent of the fish sampled at the respective stations. Other age classes represented were age 3_1 and 5_1 fish.

Table 2-3-29. Analysis of chum salmon age data by percent from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry Stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	n	Age Class 1/		
		3_1	4_1	5_1
Susitna Station	333	4.5	84.4	11.1
Yentna Station	629	3.3	90.3	6.3
Sunshine Station	906	5.5	91.1	3.4
Talkeetna Station	526	4.9	87.1	8.0
Curry Station	480	2.1	85.8	12.1

1/ Gilbert-Rich Notation

Length (FL) composition data of chum salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) station in 1982 are presented in Table 2-3-30. Age 4_1 males averaged 602 mm, 604 mm and 614 mm in length at Susitna, Yentna and Sunshine stations, respectively. Females of the same age class and station order averaged 594 mm, 591 mm and 600 mm lengths, respectively.

Sex composition data of chum salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 are presented in Table 2-3-31. Data indicates that females were more abundant than males in all age classes sampled at Susitna Station. Males outnumbered females in age 4_1 and 5_1 samples and were less numerous than females in age 3_1 samples at Yentna Station. At Sunshine Station females outnumbered males in age 3_1 and 4_1 samples and males outnumbered females in age 5_1 samples (Figure 2-3-25).

Table 2-3-30. Analysis of chum salmon lengths, in millimeters, by age class from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age Class	n		Range Limits		Mean		95% Conf. Limits 3/		Median	
		m 1/	f 2/	m	f	m	f	m	f	m	f
Susitna Station	3_1	3	12	556-620	456-624	583	571	-	-	573	578
	4_1	116	165	482-679	506-657	602	594	595.0,608.0	590.3,598.6	607	597
	5_1	16	21	583-682	577-649	630	612	-	603.7,621.0	628	616
Yentna Station	3_1	5	16	535-590	515-599	559	557	-	-	560	554
	4_1	323	245	398-696	500-680	604	591	600.6,608.0	587.2,594.4	605	591
	5_1	28	12	582-694	528-651	625	606	613.9,635.1	-	623	613
Sunshine Station	3_1	19	31	465-620	455-630	558	569	-	-	570	580
	4_1	401	424	440-710	475-690	614	600	610.6,617.5	596.8,602.8	615	600
	5_1	4	27	585-715	415-675	633	621	-	-	630	630
Talkeetna Station	3_1	14	12	540-670	540-595	588	568	-	-	580	565
	4_1	297	161	500-680	495-680	610	601	606.5,613.8	596.1,605.3	610	600
	5_1	35	7	600-700	550-690	643	637	628.9,657.1	-	640	650
Curry Station	3_1	5	5	545-660	540-585	583	565	-	-	570	560
	4_1	218	193	530-650	420-665	603	596	600.0,606.7	591.6,600.0	605	600
	5_1	33	25	585-680	575-680	631	627	622.0,639.2	618.8,636.0	630	630

1/ Male

2/ Female

3/ Confidence Limits on Mean

Table 2-3-31. Sex ratio of male and female chum salmon by age from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age	Sample Size	Number Males	Number Females	Sex Ratio (M:F)
Susitna Station	3	15	3	12	0.3:1
	4	281	116	165	0.7:1
	5	37	16	21	0.8:1
Yentna Station	3	21	5	16	0.3:1
	4	568	323	245	1.3:1
	5	40	28	12	2.3:1
Sunshine Station	3	50	19	31	0.6:1
	4	826	402	424	0.9:1
	5	69	42	27	1.6:1
Talkeetna Station	3	26	14	12	1.2:1
	4	458	297	161	1.8:1
	5	43	36	7	5.1:1
Curry Station	3	10	5	5	1.0:1
	4	412	218	194	1.1:1
	5	58	33	25	1.3:1

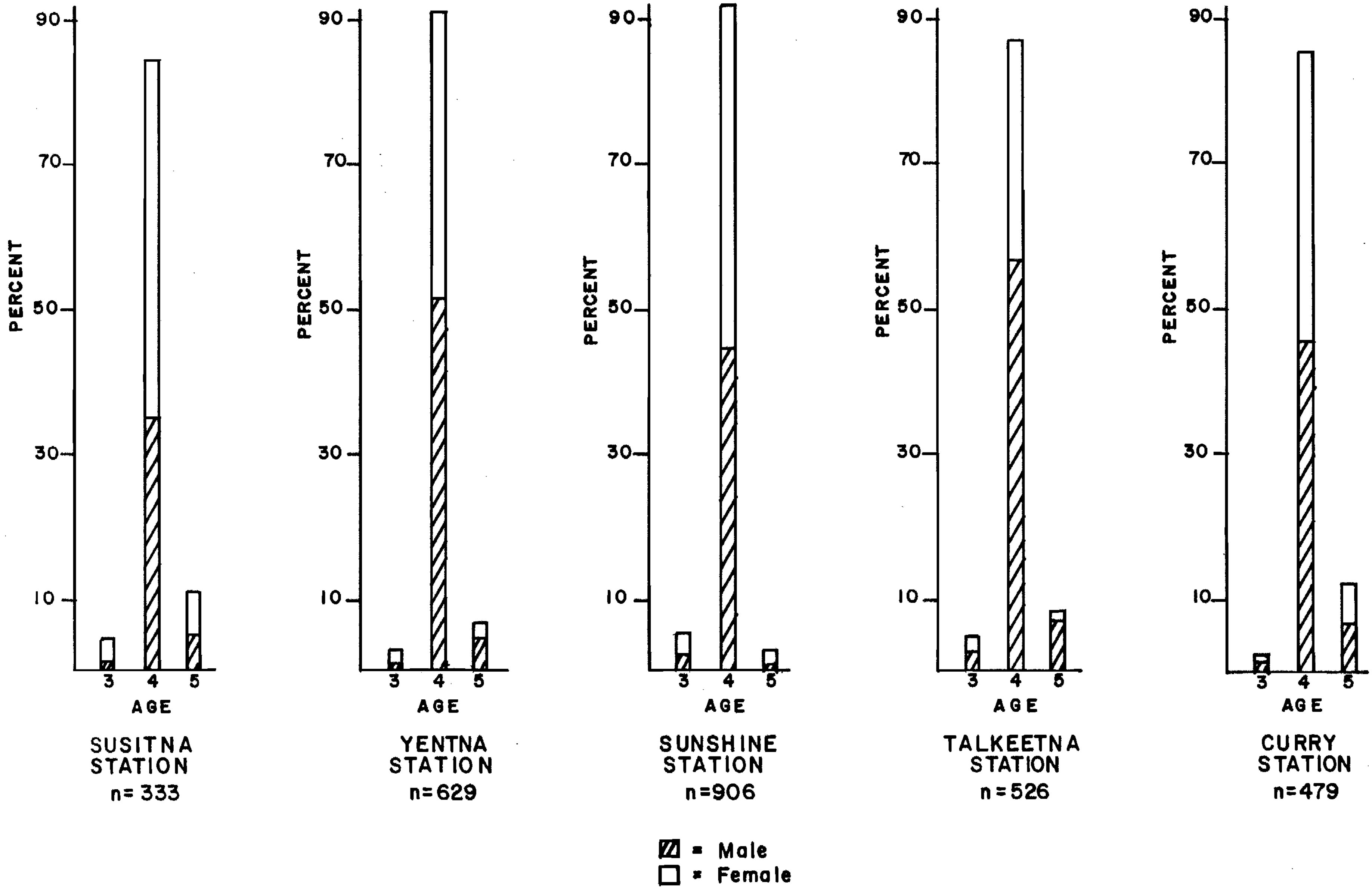


Figure 2-3-25. Age composition of fishwheel intercepted chum salmon at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

In 1982 the overall male to female chum salmon ratio at Susitna Station (RM 26) was 0.7:1. At Yentna (RM 04) and Sunshine (RM 80) stations the male to female ratios were 1.3:1 and 1.0:1, respectively (Table 2-3-31).

3.2.4.1.2 Main Channel Spawning

A total of 811 Susitna River main channel sites were evaluated for chum salmon spawning activity in 1982 between RM 7 and 98.5 (Appendix 2-F). Survey results indicate that chum salmon did not spawn in the Susitna River main channel between RM 7 and 98.5 in 1982.

3.2.4.2 Talkeetna to Upper Devil Canyon

3.2.4.2.1 Main Channel Escapement

The 1982 chum salmon escapement to Talkeetna Station (RM 103) was approximately 49,100 fish estimated by the Petersen method. The 95 percent confidence interval calculated at 45,200 to 53,900 fish (Table 2-3-11).

At Curry Station (RM 120) the chum salmon escapement in 1982 was approximately 29,400 fish with a 95 percent confidence interval of 26,700 to 32,700 fish. The estimate was calculated by the Petersen method (Table 2-3-11).

Side scan sonar counters at Talkeetna Station (RM 103) recorded 29,245 chum salmon counts between July 4 and September 14, 1982 (Table 2-3-26). The count was 59.6 percent of the 1982 station Petersen escapement estimate of approximately 49,100 chum salmon (Table 2-3-10). The Talkeetna Station SSS chum salmon count was considered an index of escapement as defined in Section 2.4.3.

Fishwheels at Talkeetna Station (RM 103) intercepted 2,942 chum salmon between July 5 and September 14, 1982 (Table 2-3-9). Based on catch rates, the chum salmon migration at Talkeetna Station began on August 2, reach a midpoint on August 8 and terminated on August 22 (Figure 2-3-26). Peak fishwheel catches occurred on August 7.

At Curry Station 1,736 chum salmon were caught in fishwheels between June 9 and September 18, 1982 (Table 2-3-9). Catch rate data indicated the chum salmon migration essentially began on August 3, reached a median on August 12 and ended on August 26. The peak fishwheel catches occurred on August 9 (Figure 2-3-26).

During 1982 chum salmon migrated in higher numbers on the west side of the river at Talkeetna Station (RM 103) than on the east side. At Curry Station (RM 120) the majority of the chum salmon migrated on the east side of the river. The fishwheels operating off the west bank at Talkeetna Station caught 58.4 percent of the total catch, and at Curry Station the east bank fishwheel intercepted 77.5 percent of the total catch (Appendix 2-C).

Chum salmon averaged 3.1 days travelling between Sunshine (RM 80) and Talkeetna (RM 103) stations in 1982 as determined from 122 recaptures (Figure 2-3-27). The minimum recorded travel time between these stations was one day and the maximum 20 days. Average speed travelled was 7.4 mpd. Chum salmon

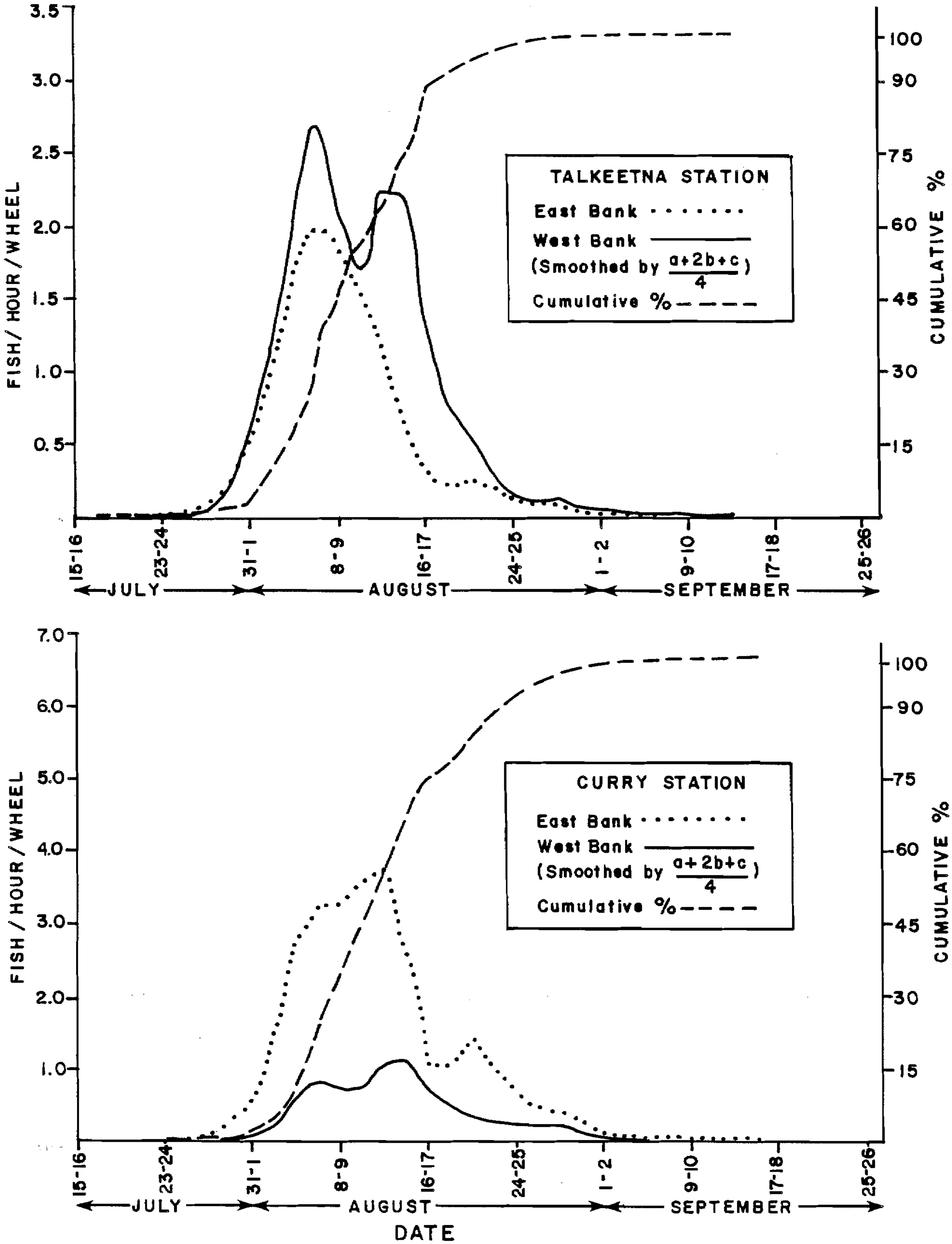


Figure 2-3-26. Mean hourly and cumulative percent fishwheel catch of chum salmon by two day periods at Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

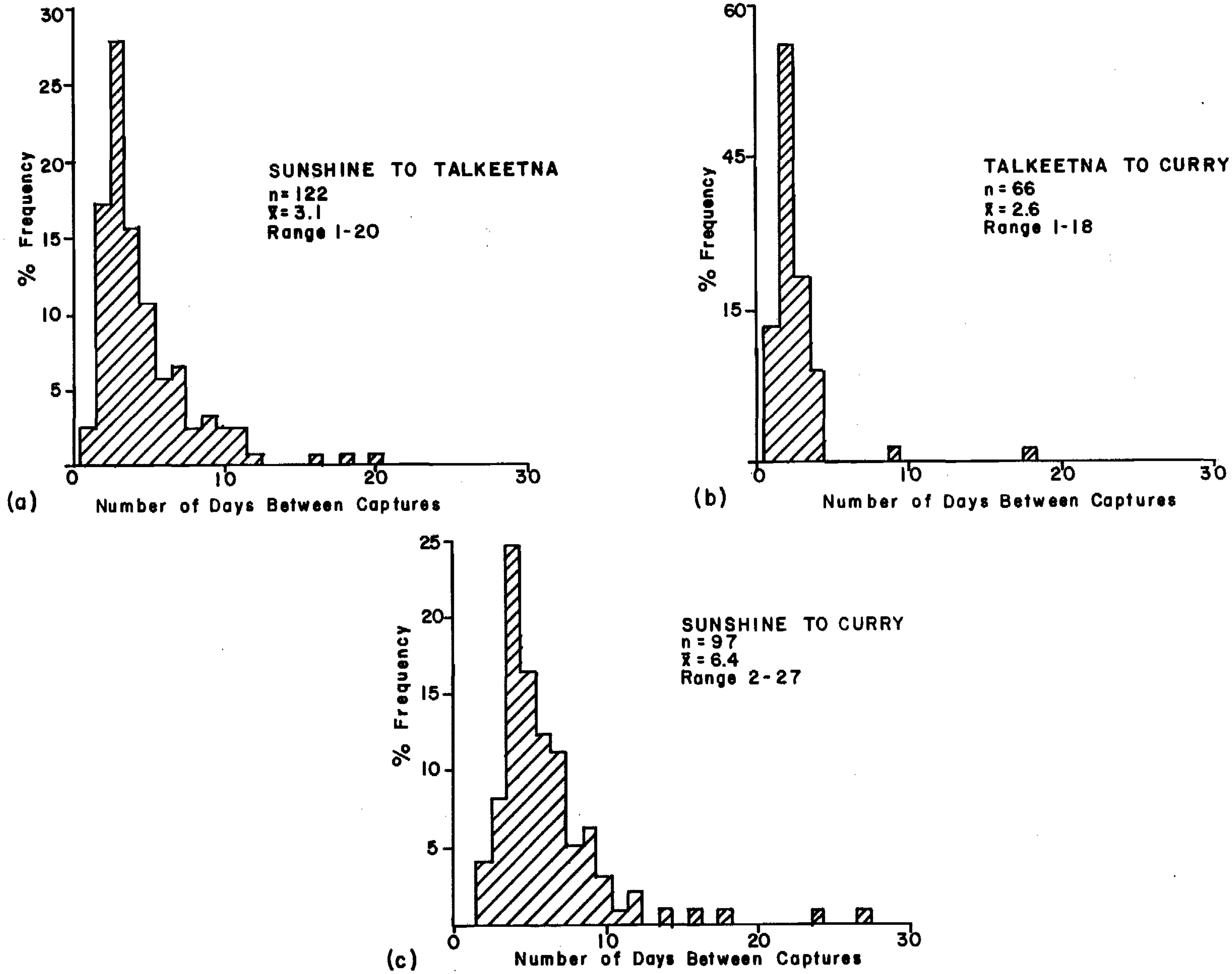


Figure 2-3-27. Migrational rates of chum salmon between (a) Sunshine and Talkeetna stations, (b) Talkeetna and Curry stations and (c) Sunshine and Curry stations based on fishwheel recaptures, Adult Anadromous Investigations, Su Hydro Studies, 1982.

averaged 6.4 days between Sunshine (RM 80) and Curry (RM 120) stations for an average speed of approximately 6.3 mpd. The minimum and maximum number of days spent between these stations was two and 27, respectively from a sample of 97 recaptures. The average time travelled between Talkeetna and Curry stations was 2.6 days based on 66 recaptures. The minimum migration time was one day and the maximum was 18 days.

Chum salmon age samples were collected at Talkeetna (RM 103) and Curry (RM 120) stations. The majority of the chum salmon caught were age 4_1 fish (Table 2-3-29). At Talkeetna Station age 4_1 fish represented 87.1 percent and at Curry Station 85.8 percent of the escapement sample. Age 5_1 chum salmon were represented in 8.0 percent and 12.1 percent, and age 3_1 fish 4.9 percent and 2.1 percent of the Talkeetna and Curry stations sample, respectively.

A total of 526 and 479 chum salmon were sampled for length (FL) and sex at Talkeetna (RM 103) and Curry (RM 120) stations, respectively (Tables 2-3-30 and 2-3-31). Age 4_1 males averaged 610 mm and 603 mm and females 601 mm and 596 mm lengths, respectively at Talkeetna and Curry stations. Age 5_1 males sampled at Talkeetna Station averaged 643 mm and females averaged 637 mm. At Curry Station age 5_1 males and females averaged 631 mm and 627 mm, respectively.

Male chum salmon in 1982 were generally more abundant than females at Talkeetna (RM 103) and Curry (RM 120) stations (Table 2-3-31). The overall male to female ratio was 1.9:1 at Talkeetna Station and at Curry Station the ratio was 1.1:1 as determined from escapement samples.

3.2.4.2.2 Radio Telemetry

Ten chum salmon were radio tagged at Talkeetna Station (RM 103) in 1982 (Table 2-3-32). Four of the ten radio tagged fish migrated downstream and entered the Talkeetna River (RM 97.0) within three to six days (Figure 2-3-28). Another two migrated upstream beyond Curry Station (RM 120) and then descended and entered the Talkeetna River (RM 97.0). Four of the remaining sample entered spawning streams and sloughs above Talkeetna Station including Slough 9 (RM 128.3), Fourth of July Creek (RM 131.1), Slough 21 (RM 140.0) and Portage Creek (RM 148.9).

Eight chum salmon were radio tagged and released at Curry Station (RM 120) in 1982 (Table 2-3-32 and Figure 2-3-28). Two of the eight fish tagged migrated directly upstream and presumably spawned in Indian River (RM 138.6). One of the eight fish migrated ten miles above Curry Station, then descended 2.2 miles below Curry Station and later spawned in Slough 8A, 5.7 miles above Curry Station. Another radio tagged fish migrated beyond Slough 21 (RM 140.0) and entered lower Devil Canyon (RM 150.3) and then Portage Creek (RM 148.9) before descending and finally spawning in Slough 21. One of the eight radio tagged fish spawned above the station in Slough 8C (RM 121.9) after 24 days at other locations, including the Indian River confluence (RM 138.6).

Three of the eight chum salmon radio tagged at Curry Station (RM 120) migrated upstream to as far as the Indian River confluence (RM 138.6) and then descended (Appendix 2-E). One of the three fish entered the Talkeetna River (RM 97.0), and the second and third fish were last located below Curry Station at RM 96.0 and RM 110.6, respectively.

Table 2-3-32. Tagging location, transmitter frequency and physical characteristics of radio tagged chum salmon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Tag and Release		Transmitter	Petersen		
Date	Location (RM) 1/	Frequency (MHz) Pulse/Second	Disc Tag Number	Sex (M/F)	Length 2/ (cm)
7/30	103.0	40.662-2	161	M	65.0
7/30	119.5	40.710-2	162	M	62.0
7/31	103.0	40.670-2	163	M	63.0
8/2	120.7	40.680-2	164	M	64.0
8/2	103.0	40.620-2	165	F	58.5
8/4	103.0	40.630-2	166	M	67.5
8/4	119.5	40.699-2	167	F	66.5
8/7	103.0	40.640-2	168	M	61.0
8/7	119.5	40.720-1	169	F	65.0
8/9	103.0	40.601-3	170	F	60.0
8/9	119.5	40.620-3	171	M	59.0
8/12	119.5	40.650-2	173	F	62.0
8/13	103.0	40.660-1	172	-	61.0
8/15	103.0	40.629-3	000	M	66.0
8/16	103.0	40.710-3	175	M	57.0
8/19	119.5	40.610-3	179	F	65.0
8/22	150.4	40.700-3	182	M	63.5
8/22	150.4	40.670-3	183	M	65.0
8/26	119.5	40.670-2	189	F	65.0
8/28	103.0	40.630-3	193	M	66.0

1/ River Mile: Talkeetna Station RM 103, Curry Station RM 120
2/ Length: mid-eye to fork of tail.

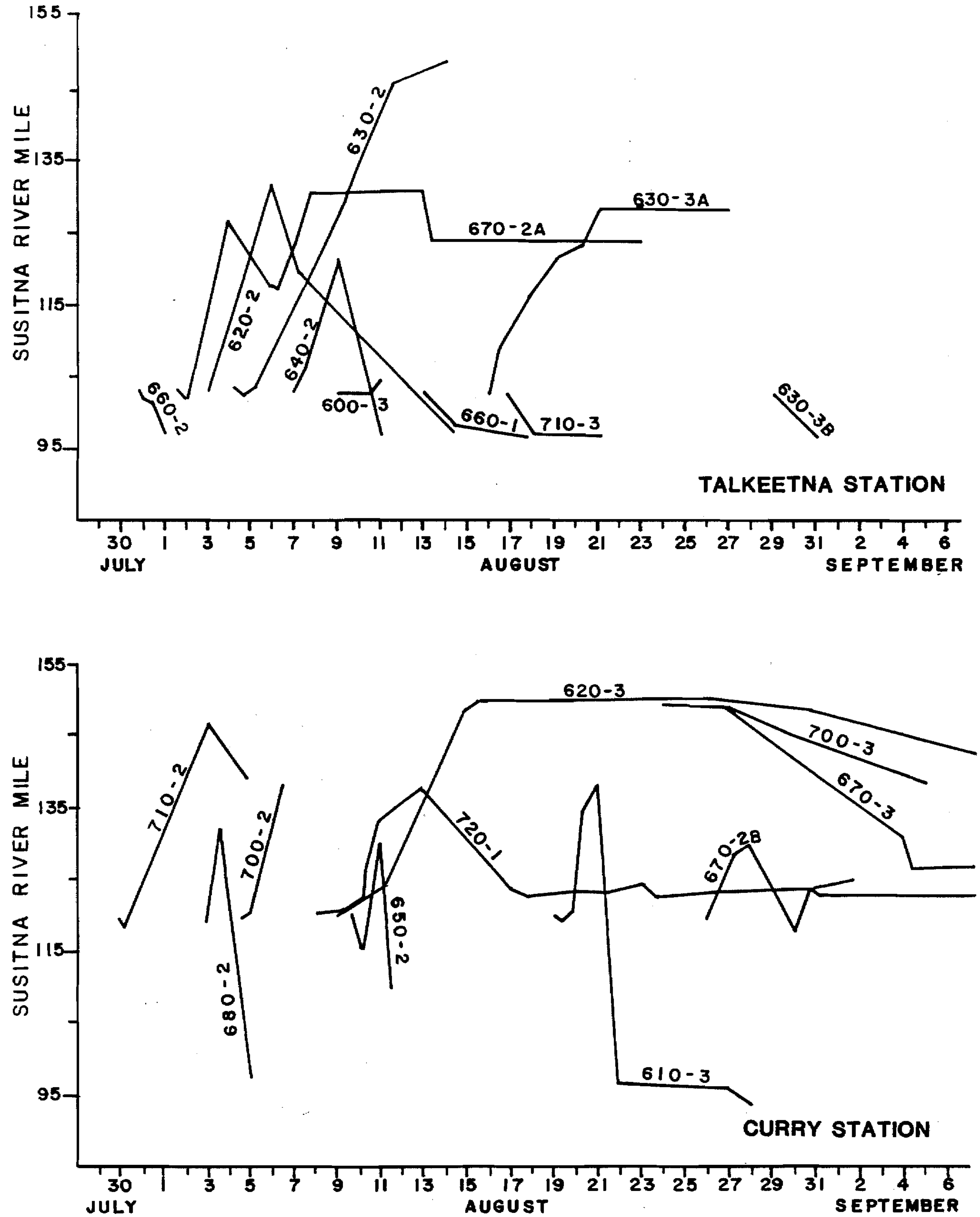


Figure 2-3-28. Movements of Talkeetna and Curry stations radio tagged chum salmon in the Susitna River during July, August and September, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The two fastest recorded (upstream) travel speeds of a radio tagged chum salmon were 54.2 mpd over a distance of seven miles and 29.8 mpd over a 16 miles reach. The fastest recorded travel speed of a radio tagged chum salmon for a period of time not less than 24 hours was 12.5 mpd (Table 2-3-33).

Chum salmon radio tagged at Talkeetna Station (RM 103) in 1982 arrived at upstream spawning destinations between 6 and 11 days after being tagged. Curry Station (RM 120) tagged chum salmon reached spawning destinations from 2 to 30 days after being tagged (Appendix 2-E).

Two chum salmon were caught in a set net in lower Devil Canyon at RM 150.4 on August 22, 1982 and released with radio tags (Appendix 2-E). Both fish moved downstream after tagging and entered Portage Creek (RM 148.9) within four days. Sometime between August 26 and September 5, the two fish exited Portage Creek and re-entered the Susitna River main channel at RM 148.9. On September 5, one of the two fish entered Indian River (RM 138.6) and remained there through at least September 9 and presumably spawned in the river. The second fish after exiting Portage Creek migrated downstream and was last detected at RM 92.0 on September 24.

Individual movements of radio tagged chum salmon are further described in Appendix 2-E.

3.2.4.2.3 Lower Devil Canyon Milling

Twenty-five chum salmon were caught from August 10 through September 12, 1982 in 19.6 net hours fished at RM 150.2 and 150.4 (Table 2-3-18). Ten fish were

Table 2-3-33. Twenty fastest radio tagged chum salmon movements, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Speed Traveled (mpd) 1/	Distance Traveled (miles)	Hours Elapsed	Location of Movement (RM - RM) 2/	Observation Dates	Transmitter Number
54.2	7.0	3.1	103.0-110.0	8/15	630-3A
29.8	16.0	12.9	105.8-121.8	8/7-8	640-2
21.6	2.7	3.0	124.6-127.3	8/4	620-2
19.4	2.1	2.6	115.8-117.9	8/4	630-2
19.0	3.8	4.8	116.7-120.5	8/17	630-3A
18.0	0.9	1.2	136.0-136.9	8/21	610-3
17.5	0.8	1.1	130.2-131.0	8/11	620-3
17.2	13.8	19.3	122.2-136.0	8/20-21	610-3
15.6	1.3	2.0	129.0-130.3	8/27	670-2B
14.5	2.3	3.8	119.9-122.2	8/20	610-3
14.4	2.4	4.0	117.9-120.3	8/6	630-2
13.4	7.6	13.6	120.2-127.8	8/4-5	700-2
12.5	13.7	26.4	123.8-137.5	7/31-8/1	710-2
12.4	10.6	20.5	103.0-113.6	8/2-3	620-2
11.6	1.6	3.3	136.9-138.5	8/21	610-3
11.6	11.0	22.7	120.7-131.7	8/2-3	680-2
11.6	11.6	24.0	102.0-113.6	7/31-8/1	670-2A
11.4	1.0	2.1	120.2-121.2	8/9	720-1
11.4	3.5	7.4	126.7-130.2	8/11	620-3
10.5	12.8	29.3	103.0-115.8	8/5-6	630-2

1/ mpd: Miles per day
2/ Movement: River mile to river mile

caught on August 16, and 15 on August 22. No catches were made August 10, 28 or September 12.

Electroshocking efforts at RM 150.4 on four occasions between August 11 and September 23, 1982 produced 17 chum salmon (Table 2-3-19). Five fish were captured August 11, and 12 fish on August 18. No chum salmon catches were made on September 5 and 23.

Gill net and electroshocking catches indicate chum salmon were present in lower Devil Canyon (RM 150-151) from August 11 through 22, 1982 and particularly abundant in the lower canyon area from August 16 through 22 (Tables 2-3-18 and 2-3-19).

Two chum salmon that were caught at RM 150.4 on August 16, 1982 had been tagged at downstream locations (Table 2-3-18). One fish had been tagged at Talkeetna Station (RM 103) on August 3 and the second fish had been tagged and released at Curry Station (RM 120) on August 6. The average migrational speeds of these fish were 3.6 mpd and 3.0 mpd, respectively.

Further information on chum salmon migrational behavior in lower Devil Canyon can be found in report section 3.2.4.2.2.

3.2.4.2.4 Spawning

3.2.4.2.4.1 Main Channel

A total of 397 main channel sites between RM 98.5 and 150 were investigated for chum salmon spawning from August 7 to October 7, 1982 (Appendix 2-F).

Main channel surveys revealed nine chum salmon spawning sites in 1982 (Table 2-3-34). Maps of these sites are provided in Appendix 2-G.

The nine chum salmon spawning areas were located at RM 114.4, 128.6, 129.8, 131.3, 136.0, 137.4, 138.9, 143.3 and 148.2. Spawning at these sites occurred between September 2 and September 12, 1982.

3.2.4.2.4.2 Sloughs and Streams

A total of 34 sloughs were examined between July 28 and October 25 for chum salmon presence in 1982 (Appendix 2-G). Seventeen of the sloughs had chum salmon present. These were:

1. 5 (RM 107.5)
2. 6A (RM 112.3)
3. 8D (RM 121.8)
4. 8C (RM 121.9)
5. 8B (RM 122.2)
6. Moose (RM 123.5)
7. 8A (RM 125.1)
8. B (RM 126.3)
9. 9 (RM 128.3)
10. 9B (RM 129.2)
11. 9A (RM 133.8)
12. 10 (RM 133.8)
13. 11 (RM 135.3)
14. 15 (RM 137.2)
15. 17 (RM 138.9)
16. 20 (RM 140.0)
17. 21 (RM 141.1)

A total of 2,244 chum salmon were counted in the peak spawning surveys of the 17 sloughs listed above. The highest level of spawning occurred in sloughs 21 (32.8%), 11 (20.5%), 8A (15.0%), 9 (13.4%) and 9A (5.3%) between August 7 and September 25, 1982 (Plate 2-3-8).

Table 2-3-34. Mainstem Susitna River salmon spawning locations with survey and egg deposition sampling results, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Location		Survey							Egg Deposition Sampling					Remarks
					No. Caught/Observed						Egg			
River Mile	Legal	Date	Method	Distance	Sockeye	Pink	Chum	Coho	Date	No. Plots	Live	Dead	Total	
114.4	S28N04W06 CAB	9/2 9/2	Electroshock Visual	200 200	0 0	0 0	8 10	1 0	10/5	4	0	0	0	Chum salmon observed spawning 9/2. Redds silted over 10/5.
128.6	S30N03W16 BCA	9/5 9/7	Visual Visual	200 200	0 0	0 0	10 7	0 0	10/4	4	6	0	6	Chum salmon spawning and redds observed 9/5.
129.8	S30N03W09 DAB	9/12	Visual	800	0	0	5	0	10/4	1	2	0	2	Chum salmon spawning and redds observed 9/12
131.3	S30N03W03 DAD	8/19 9/4	Electroshock Visual	80 100	0 0	0 0	3 12	0 0	10/4	2	2	0	2	Chum salmon spawning and redds observed 9/4.
136.0	S31N02W19 AD-	8/12 9/4	Electroshock Visual	400 150	0 0	20 0	14 50	4 0	10/3	3	2	0	2	Chum salmon spawning and redds observed 9/4. Silted over 9/20.
137.4	S31N02W17 DBB	8/19	Electroshock	200	0	0	25	0	9/6	1	6	0	6	Chum salmon spawning and redds observed 9/5.
138.2	S31N02W16 BBB	9/27	Visual	200	0	0	0	0	10/2	3	1	2	3	Live egg eyed up.
138.9	S31N02W09 DBD	9/4	Visual	200	0	0	16	0	10/2	2	27	0	27	Chum salmon spawning and redds observed 9/4.
143.3	S32N01W31 BCB	9/4	Visual	100	0	0	22	0	9/6	1	6	0	6	Chum salmon spawning and redds observed 9/4.
148.2	S32N01W26 DCA	8/18 9/5	Electroshock Electroshock	125 100	0 1	0 0	400 4	0 1						Spawning chum salmon intercepted on 8/18 and 9/5.

Spawning ground surveys indicated the peak of chum salmon spawning in slough habitats occurred between the third week of August and the third week of September, 1982. Peak spawning in sloughs 8A, 9, 9A, 11 and 21 occurred the last week of August and the first week of September.

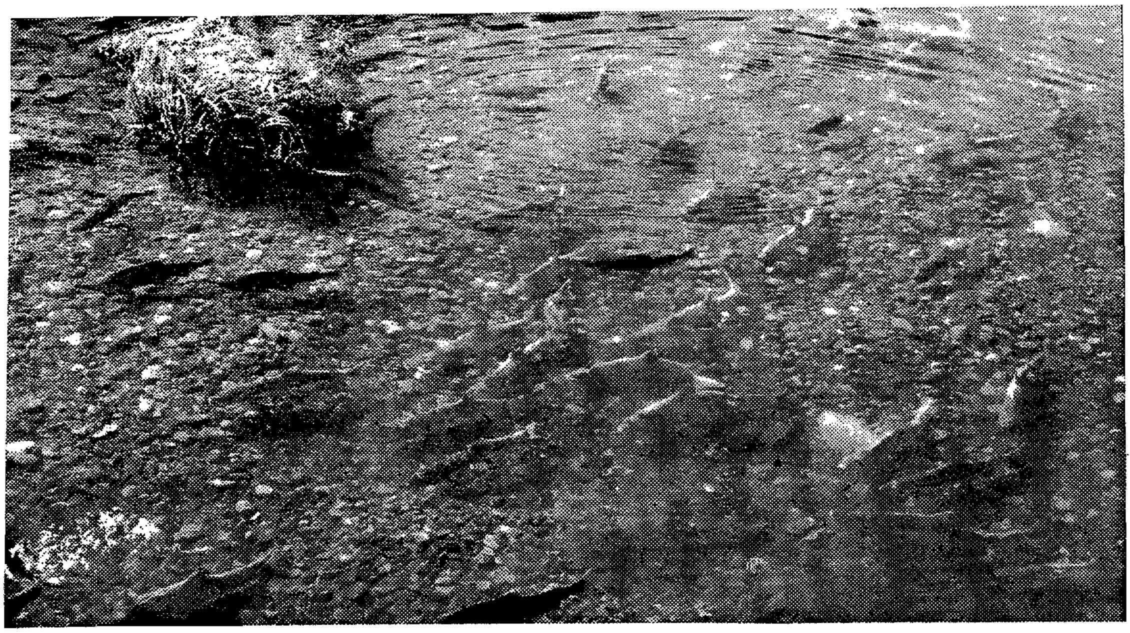


Plate 2-3-8. Chum and sockeye salmon spawning in Slough 11 in early September, Adult Anadromous Investigations, Su Hydro Studies, 1982.

In 1982, 19 streams were surveyed and eight were found to contain chum salmon. These were:

1. Lane Creek (RM 113.6)
2. Little Portage Creek (RM 117.7)
3. Fifth of July Creek (RM 123.7)
4. Skull Creek (RM 124.7)
5. Fourth of July Creek (131.1)
6. Indian River (138.6)
7. Jack Long Creek (144.5)
8. Portage Creek (RM 148.9)

Survey results are presented in Appendix 2-G.

A combined total of 1,748 chum salmon were counted at the peak of spawning in the index areas of the eight streams listed. The majority of the chum salmon were recorded in Indian River (77.0%), Fourth of July Creek (10.9%) and Portage Creek (8.8%).

Based on stream surveys, the peak of chum salmon spawning occurred from the last week of August through the first week of September in 1982 (Appendix 2-G).

3.2.5. Coho Salmon

3.2.5.1 Estuary to Talkeetna

3.2.5.1.1 Main Channel Escapement

Coho salmon escapement estimates were obtained for Yentna (RM 04) and Sunshine (RM 80) stations in 1982 (Table 2-3-10). No total escapement estimate was available for Susitna Station (RM 26) for reasons defined in Section 2.4.3.

The Yentna River (RM 28) escapement of coho salmon in 1982 was approximately 34,100 fish as determined by SSS at Yentna Station (RM 04) (Table 2-3-10). Daily and cumulative counts are presented in Appendix 2-B.

The coho salmon escapement to Sunshine Station (RM 80) in 1982 was approximately 45,700 fish with a 95 percent confidence interval calculated at 41,900 to 50,300 fish (Table 2-3-11). The estimate was calculated by the Petersen method.

The escapement of coho salmon to the Susitna River was approximately 80,000 fish (Table 2-3-10). This escapement estimate does not include those coho salmon spawning in Susitna River streams above RM 6 and below RM 77 excluding the Yentna River (RM 28). The estimate was formulated by combining the Yentna Station (RM 04) sonar count and the Sunshine Station (RM 80) estimate of the coho salmon escapement.

Coho salmon returning to the Susitna River drainage in 1982 were intercepted by fishwheels located at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations. Daily and cumulative catch data have been presented in Appendix 2-C.

Susitna Station (RM 26) fishwheels intercepted 470 coho salmon in 1982 (Table 2-3-9). Daily fishwheel catches indicate that the coho salmon migration began, reached a midpoint and ended on July 19, July 31 and August 9, respectively at Susitna Station (Figure 2-3-29). The majority (72.5%) of the captures occurred with the west bank fishwheel.

Yentna Station (RM 04) fishwheels captured 1,203 coho salmon in 1982 (Table 2-3-9). From catch data interpretation the migration at Yentna Station began on July 20, reached a median on August 2 and terminated on August 24. Coho salmon showed a slight preference for movement along the south bank as indicated by 56.1 percent of the catch occurring with the south bank fishwheel (Figure 2-3-30).

Fishwheels at Sunshine Station (RM 80) intercepted 8,227 coho salmon (Table 2-3-9). The coho salmon migration at Sunshine Station essentially began,

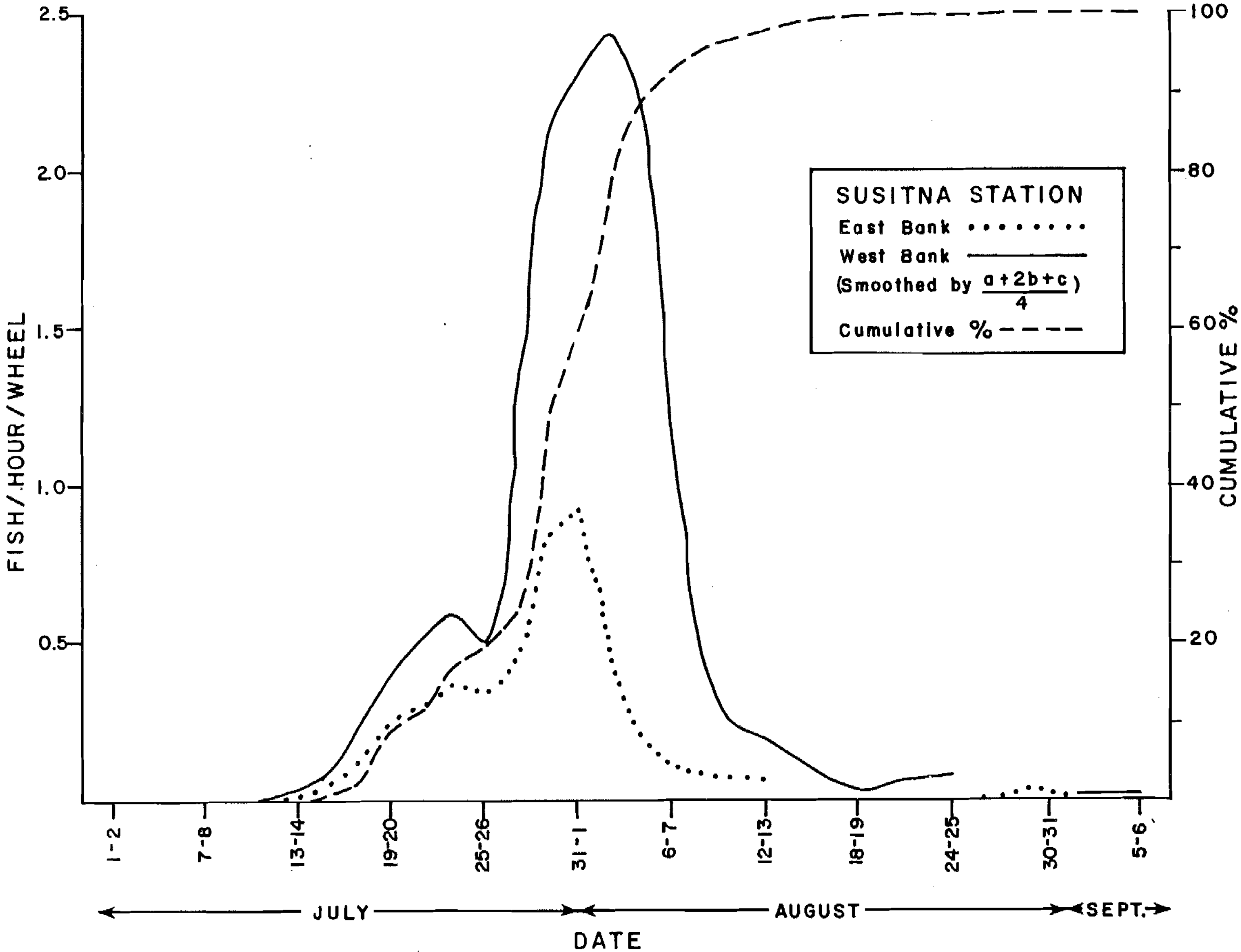


Figure 2-3-29. Mean hourly and cumulative percent fishwheel catch of coho salmon by two day periods at Susitna Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

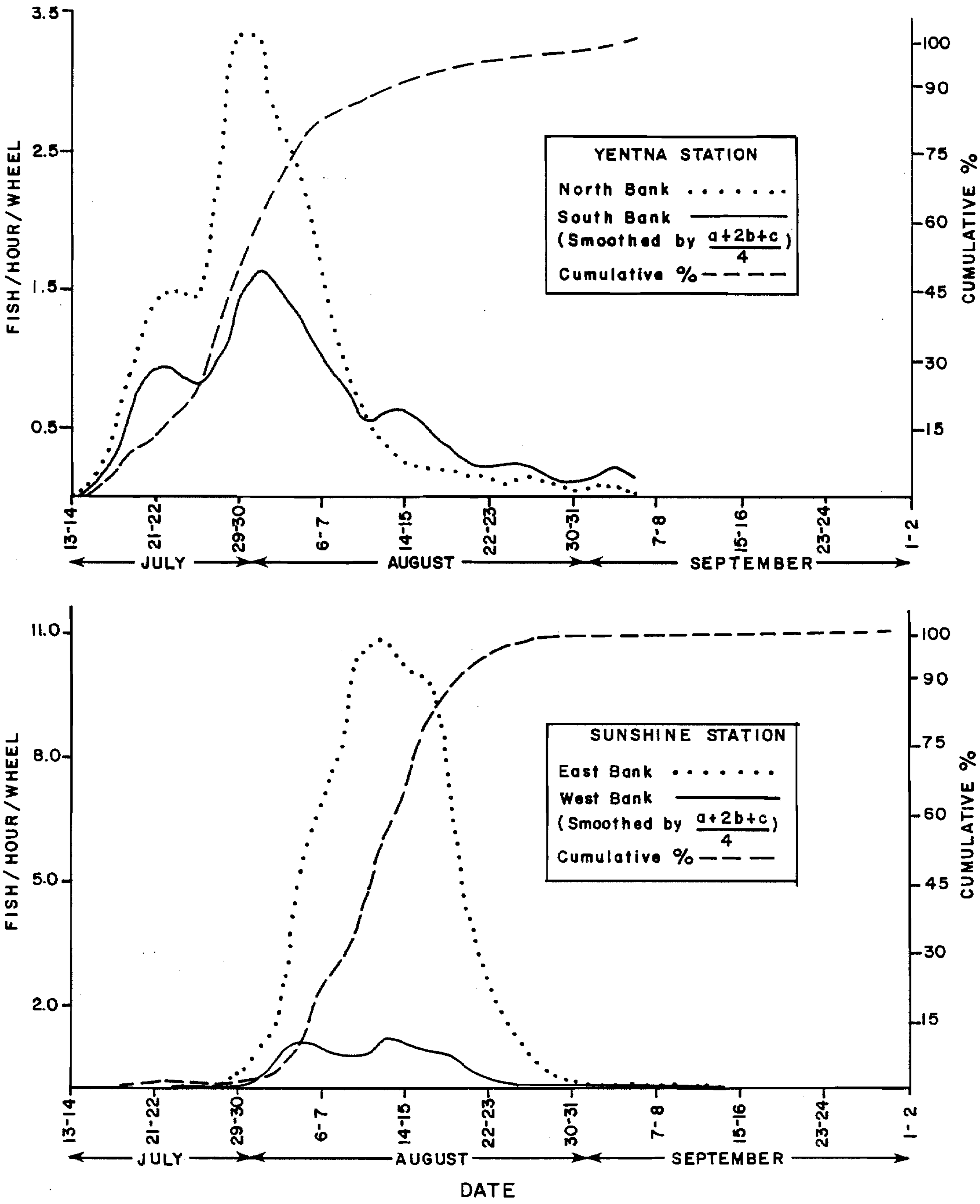


Figure 2-3-30. Mean hourly and cumulative percent fishwheel catch of coho salmon by two day periods at Yentna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

reached a midpoint and terminated on August 3, August 12 and August 23, respectively from catch data. Coho salmon displayed an affinity for movement along the east bank at Sunshine Station as 89.0 percent of the captures occurred with east bank fishwheels.

The 1982 coho salmon age class composition was determined from the escapement sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations. The results have been summarized in Table 2-3-35.

Table 2-3-35. Analysis of coho salmon age data by percent from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	n	Age Class 1/			
		3_2 1.1	4_3 2.1	4_4	5_4
Susitna Station	299	33.8	64.6	-	1.7
Yentna Station	422	31.8	66.8	-	1.4
Sunshine Station	342	49.3	50.1	0.3	0.3
Talkeetna Station	212	59.0	41.0	-	-
Curry Station	98	54.0	46.0	-	-

1/ Gilbert-Rich Notation

A total of 299 coho salmon from Susitna Station (RM 26) were examined for age in 1982 (Table 2-3-35). Four year old (4_3) coho represented the largest age class totalling 64.6 percent of those sampled followed by age class 3_2 fish at 33.8 percent and age 5_4 fish at 1.7 percent.

Four year old (4_3) coho salmon made up 66.8 percent of the escapement sampled at Yentna Station (RM 04). Age 3_2 and 5_4 coho salmon comprised the remaining 33.2 percent of the sample at 31.8 and 1.4 percents, respectively.

At Sunshine Station (RM 80), 50.1 percent of the coho salmon scales examined for age in 1982 represented four year old (4_3) fish followed by age classes 3_2, 4_4 and 5_4 with 49.3, 0.3 and 0.3 percents, respectively. The one coho salmon determined to be age 4_4 was an anomaly as it did not overwinter in the ocean environment.

Coho salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations smolted after spending up to three years in freshwater. The majority 64.6, 66.8 and 50.1 percents at Susitna, Yentna and Sunshine stations smolted after two winters spent in freshwater while 33.8, 31.8 and 49.3 percents smolted following one winter in freshwater. Less than five percent of the fish sampled at all stations remained three winters in the freshwater.

Coho salmon length (FL) data collected at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 were tabulated by age class and sex (Table 2-3-36).

Male coho salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations non-segregated by age were: (1) consistently larger in length (FL) than females at all stations in 1982 (Appendix 2-D); and (2) generally more abundant than females except at Susitna Station (Figure 2-3-31). The overall male to female sex ratios in 1982 were 0.6:1, 2.4:1 and 1.4:1 at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations, respectively (Table 2-3-36).

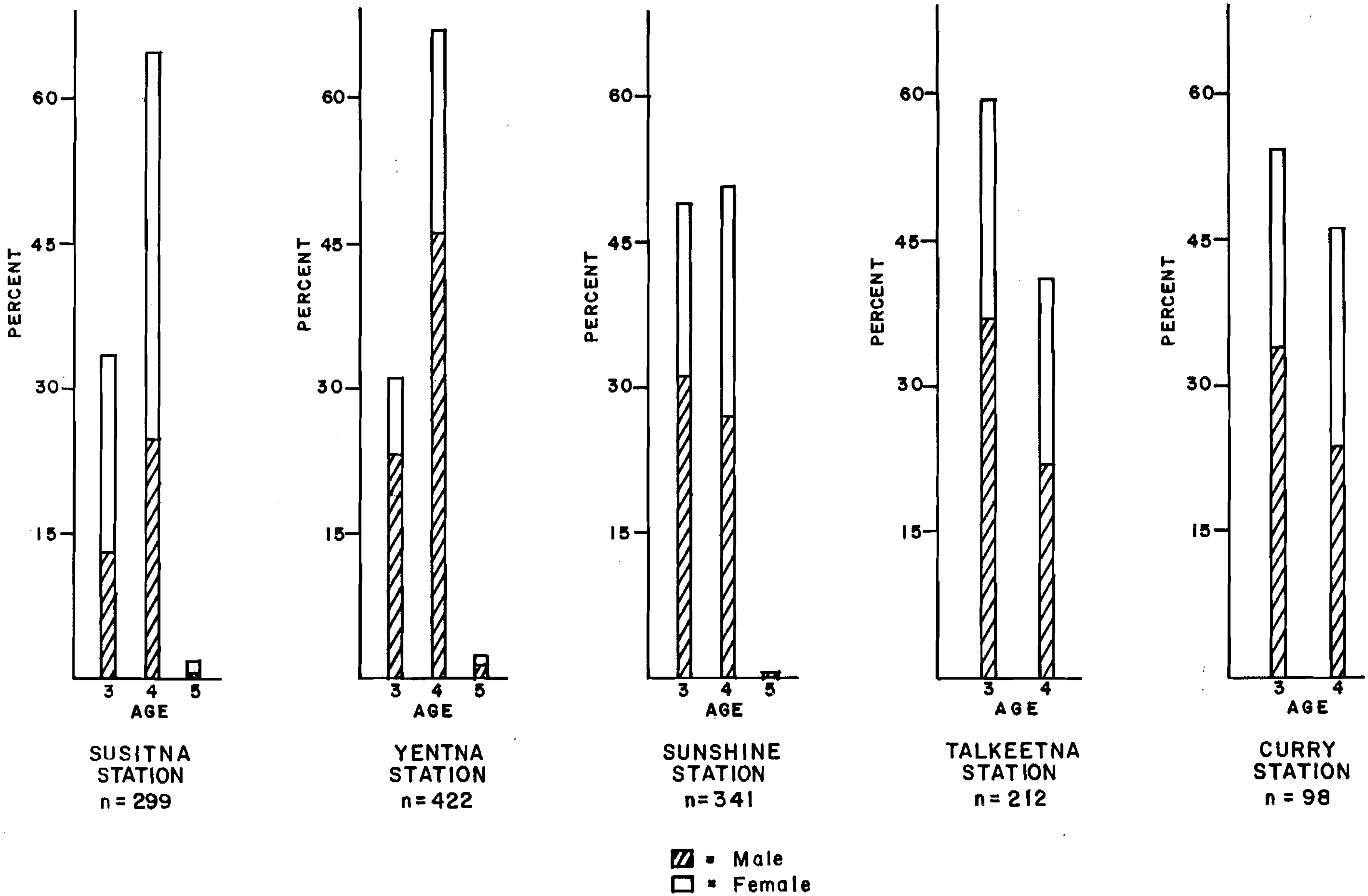


Figure 2-3-31. Age composition of fishwheel intercepted coho salmon at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Table 2-3-36. Analysis of coho salmon lengths, in millimeters, by age class from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age Class	n		Range Limits		Mean		95% Conf. Limits 3/		Median	
		m 1/	f 2/	m	f	m	f	m	f	m	f
Susitna Station	3_2	39	62	432-628	402-620	545	525	528.2,560.9	513.0,536.9	556	528
	4_3	74	119	421-680	371-638	561	544	550.0,571.5	534.5,553.5	570	557
	5_4	2	3	513-625	577-602	569	591	-	-	569	594
Yentna Station	3_2	99	35	338-631	399-611	539	524	527.8,549.5	507.4,540.1	550	535
	4_3	194	88	350-656	400-626	549	544	541.2,556.7	534.3,553.7	565	555
	5_4	4	2	559-617	496-575	578	536	-	-	569	536
Sunshine Station	3_2	106	62	425-685	445-620	546	540	535.2,556.1	529.6,551.1	558	545
	4_3	91	80	325-680	375-645	564	551	551.3,575.8	540.2,561.9	575	560
	4_4	1	0	340	-	340	-	-	-	340	-
	5_4	1	0	550	-	550	-	-	-	550	-
Talkeetna Station	3_2	79	46	390-640	440-665	546	555	533.9,558.8	543.1,567.5	550	555
	4_3	47	40	430-650	390-650	562	554	-	-	570	558
Curry Station	3_2	33	20	300-620	415-595	501	534	-	510.3,556.7	540	548
	4_3	23	22	335-625	460-620	544	558	-	-	565	565

1/ Male

2/ Female

3/ Confidence Limits on Mean

3.2.5.1.2 Main Channel Spawning

The main channel Susitna River from RM 7 to 98.5 was surveyed for coho salmon spawning activity in 1982 with 811 sites examined from August 1 to October 13 (Appendix 2-F). Coho salmon did not spawn in the main channel between RM 7 and 98.5 in 1982 based on survey results.

3.2.5.2 Talkeetna to Upper Devil Canyon

3.2.5.2.1 Main Channel Escapement

The coho salmon escapement to Talkeetna Station (RM 103) in 1982 was approximately 5,100 fish determined by the Petersen method (Table 2-3-10). The 95 percent confidence interval for this escapement estimate calculated at 4,300 to 6,200 fish (Table 2-3-11).

Sonar counters operated at Talkeetna Station (RM 103) recorded a total of 7,189 coho salmon in 1982 (Table 2-3-26). These counts were considered an index of escapement to RM 103 per report Section 2.4.3.

The 1982 coho salmon escapement to Curry Station (RM 120) was approximately 2,400 fish from the Petersen method (Table 2-3-10). The 95 percent confidence limit calculated at 1,800 to 3,800 fish (Table 2-3-11).

Fishwheels operated at Talkeetna Station (RM 103) intercepted 619 coho salmon in 1982 (Table 2-3-9). The majority, 60.3 percent, were captured with west bank fishwheels (Figure 2-3-32). Daily fishwheel catches established the coho salmon migration beginning, midpoint and completion at August 5, August 13 and September 2, respectively (Appendix 2-C).

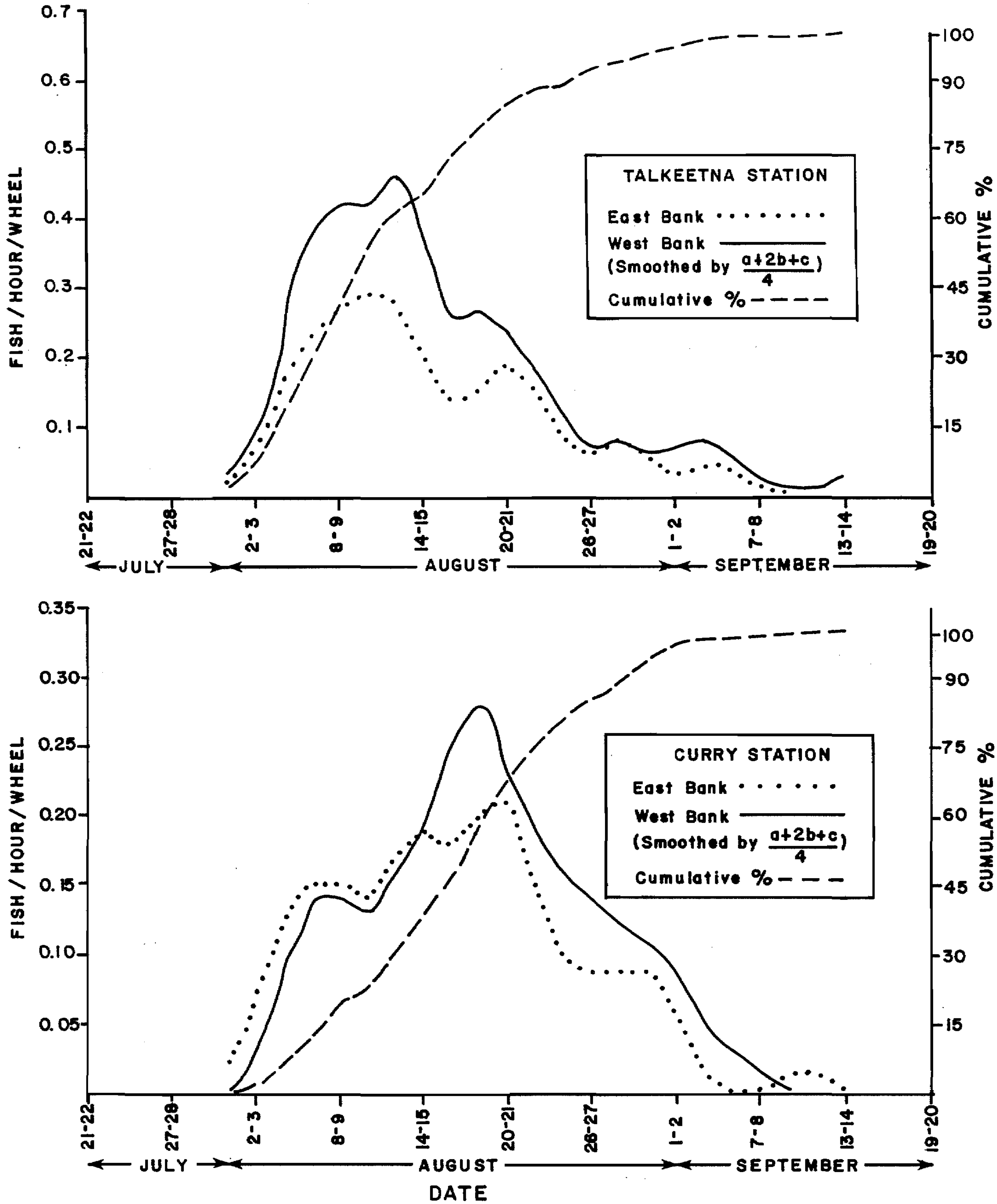


Figure 2-3-32. Mean hourly and cumulative percent fishwheel catch of coho salmon by two day periods at Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Curry Station (RM 120) fishwheels captured 229 coho salmon in 1982 (Table 2-3-9). Fishwheel catch data indicated the migration began, reached a midpoint and terminated on August 5, August 18 and September 2, respectively (Figure 2-3-32). Coho salmon migrating past Curry Station displayed essentially no bank preference as evidenced by 53.3 percent of the total catch with the west bank fishwheel and 46.7 percent with the east bank fishwheel (Appendix 2-C).

Coho salmon scales from fish sampled at Talkeetna (RM 103) and Curry (RM 120) stations in 1982 were analyzed to determine age class composition (Table 2-3-35). Talkeetna Station coho salmon were represented by two age classes 3_2 and 4_3 comprising 59.4 and 40.6 percent of those examined, respectively. Age 3_2 coho salmon also dominated the fish sampled at Curry Station comprising 57.1 percent of the sample while four year old (4_3) fish constituted the remaining 42.9 percent.

Scale analysis also indicated that 59.4 and 57.1 percent of the coho salmon at Talkeetna (RM 103) and Curry (RM 120) stations in 1982 had smolted after rearing one winter in freshwater. The remaining 40.6 and 42.9 percent of the fish sampled at Talkeetna and Curry stations reared in freshwater two winters before outmigrating (Table 2-3-35).

Length (FL) composition data of coho salmon sampled at Talkeetna (RM 103) and Curry (RM 120) stations have been summarized in Table 2-3-36. Talkeetna Station male and female coho salmon, age class 3_2 averaged 546 mm and 555 mm in length while age 4_3 males and females had average lengths of 501 mm and

534 mm, respectively. Age 3_2 male and female coho salmon sampled at Curry Station averaged 501 mm and 534 mm in length, respectively, while four year old (4_3) fish averaged 544 mm and 558 mm, respectively.

Sex composition data of coho salmon sampled from Talkeetna (RM 103) and Curry (RM 120) stations indicated males occurred in equal or larger numbers than females (Figure 2-3-31). Age 3_2 and 4_3 coho salmon examined at Talkeetna Station had male to female sex ratios of 1.7:1 and 1.2:1, respectively (Table 2-3-37). Curry Station three year old (3_2) male coho salmon were also more abundant than females by a ratio of 1.6:1 while age 4_3 males and females were equally abundant 1.0:1. The overall male to female coho salmon ratio at Talkeetna Station was 1.5:1 and at Curry Station the ratio was 1.3:1.

Fishwheel recaptures of coho salmon at Talkeetna (RM 103) and Curry (RM 120) stations were not sufficient to define migration rates in 1982. An approximate estimate of the migrational rate can be made by comparing fishwheel catches at Sunshine (RM 80), Talkeetna and Curry stations. From these observations it is estimated that coho salmon required an average of 11 days or a travel rate of 6.2 miles per day (mpd) to travel from Sunshine Station to Talkeetna Station and an average of 5.7 additional days to Curry Station, for an overall rate of 7.0 mpd. Fishwheel catches show the distance between Talkeetna and Curry stations to be travelled in an average 1.7 days for a rate of 10.0 mpd (Figures 2-3-30 and 2-3-32). These estimates assumed no differential migration between Susitna River coho salmon stocks.

3.2.5.2.1.2 <u>Radio Telemetry</u>

In 1982, eleven coho salmon were radio tagged and released at Talkeetna

Table 2-3-37. Sex ratio of male and female coho salmon by age from escapement samples collected at Susitna, Yentna, Sunshine, Talkeetna and Curry stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age	Sample Size	Number		Sex Ratio (M:F)
			Males	Females	
Susitna Station	3	101	39	62	0.6:1
	4	193	74	119	0.6:1
	5	5	2	3	0.7:1
Yentna Station	3	131	97	34	2.8:1
	4	282	194	88	2.2:1
	5	9	6	3	2.0:1
Sunshine Station	3	168	106	62	1.7:1
	4	172	92	80	1.2:1
	5	1	1	0	-
Talkeetna Station	3	125	79	46	1.7:1
	4	87	47	40	1.2:1
Curry Station	3	53	33	20	1.6:1
	4	45	23	22	1.0:1

Station (RM 103) and, similarly, five were tagged at Curry Station (RM 120) (Table 2-3-38). Ten of the 11 coho salmon tagged at Talkeetna Station (RM 103) presumably spawned below the station. Three of these fish spawned in Whiskers Creek (RM 101.2); another three descended to spawning areas in the Talkeetna River drainage (RM 97.0); two others were last detected in Birch Creek (RM 88.4); and another two were last located at RM 97.6 and 105.6, respectively (Figures 2-3-33 and Appendix 2-E).

Only one coho salmon (fish 620-3A) tagged at Talkeetna Station (RM 103) in 1982 was known to have spawned above RM 103. After being tagged and released at RM 103, fish 620-3A migrated upstream to the Chase Creek confluence (RM 106.9), then ascended to the confluence of Slough 5 (RM 107.6) and finally entered Gash Creek (RM 111.6) to spawn approximately 24 days after being released at Talkeetna Station (Appendix 2-E).

A typical example of the movements of a coho salmon tagged at Talkeetna Station (RM 103) which was suspected to have spawned in the Talkeetna River system (RM 97.0) was as follows. Tagged on August 27, 1982, fish 600-2 descended from Talkeetna Station to RM 100.9 within 16.5 hours after its release. Four days later it entered the Talkeetna River (RM 97.0). Fish 600-2 continued to ascend the Talkeetna River and was last detected 15.5 miles upstream in the river on September 9, 13 days after its initial release. A second example of intra-drainage milling behavior was the movements of fish 640-3 which spawned in Whiskers Creek (RM 101.2). Fish 640-3 was tagged on August 25 at RM 103. By August 31, this fish had moved downstream and had entered the Talkeetna River (RM 97.0). On September 1 the fish was located 2.2 miles upstream in the Talkeetna River. By September 3

Table 2-3-38. Tagging location, transmitter frequency and physical characteristics of radio tagged coho salmon, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Tag and Release		Transmitter		Petersen			
Date	Location (RM) 1/	Frequency (MHz) Pulse/Second	Size 2/	Disc Tag Number	Sex (M/F)	Length 3/ (cm)	Coloration 4/ (Dorsal/Ventral)
8/17	103.0	40.650-1	M	176	F	58.0	Silver/Silver
8/17	119.5	40.699-1	M	174	M	65.0	Red/Red
8/18	103.0	40.641-1	M	177	M	58.0	Red-Pink/Red
8/19	120.7	40.650-4	M	178	F	58.5	Silver-Pink/Silver-Gray
8/19	103.0	40.711-2	M	180	M	61.0	Red-Pink/Silver-Pink
8/21	103.0	40.721-2	M	181	M	56.5	Silver-Pink/Silver-Pink
8/22	119.5	40.611-1	M	184	M	61.5	Silver-Gray/Pink
8/25	103.0	40.640-3	M	185	M	60.0	Red-Pink/Gray-Red
8/25	119.5	40.660-3	M	186	F	59.0	Silver/Silver-Pink
8/25	119.5	40.601-3	S	187	F	58.5	Silver/Silver-Pink
8/26	103.0	40.619-3	S	188	F	58.5	Silver/Silver-Pink
8/27	103.0	40.600-2	S	190	M	58.5	Pink/Pink
8/28	103.0	40.680-3	M	194	M	61.5	Red/Red
8/28	103.0	40.630-1	M	191	M	61.0	Gray/Red-Pink
8/28	103.0	40.610-3	M	192	F	59.5	Gray/Gray-Pink
8/28	103.0	40.600-1	M	195	M	66.0	Red-Pink/Red-Pink

1/ River Mile: Talkeetna Station RM 103, Curry Station RM 120.
2/ Transmitter sizes: S = 5.2 cm long, 1.6 cm wide, 18.0 cm antennae
M = 7.6 cm long, 1.6 cm wide, 13.0 cm antennae
3/ Length: mid-eye to fork of tail.
4/ Coloration: Predominate color underlined.

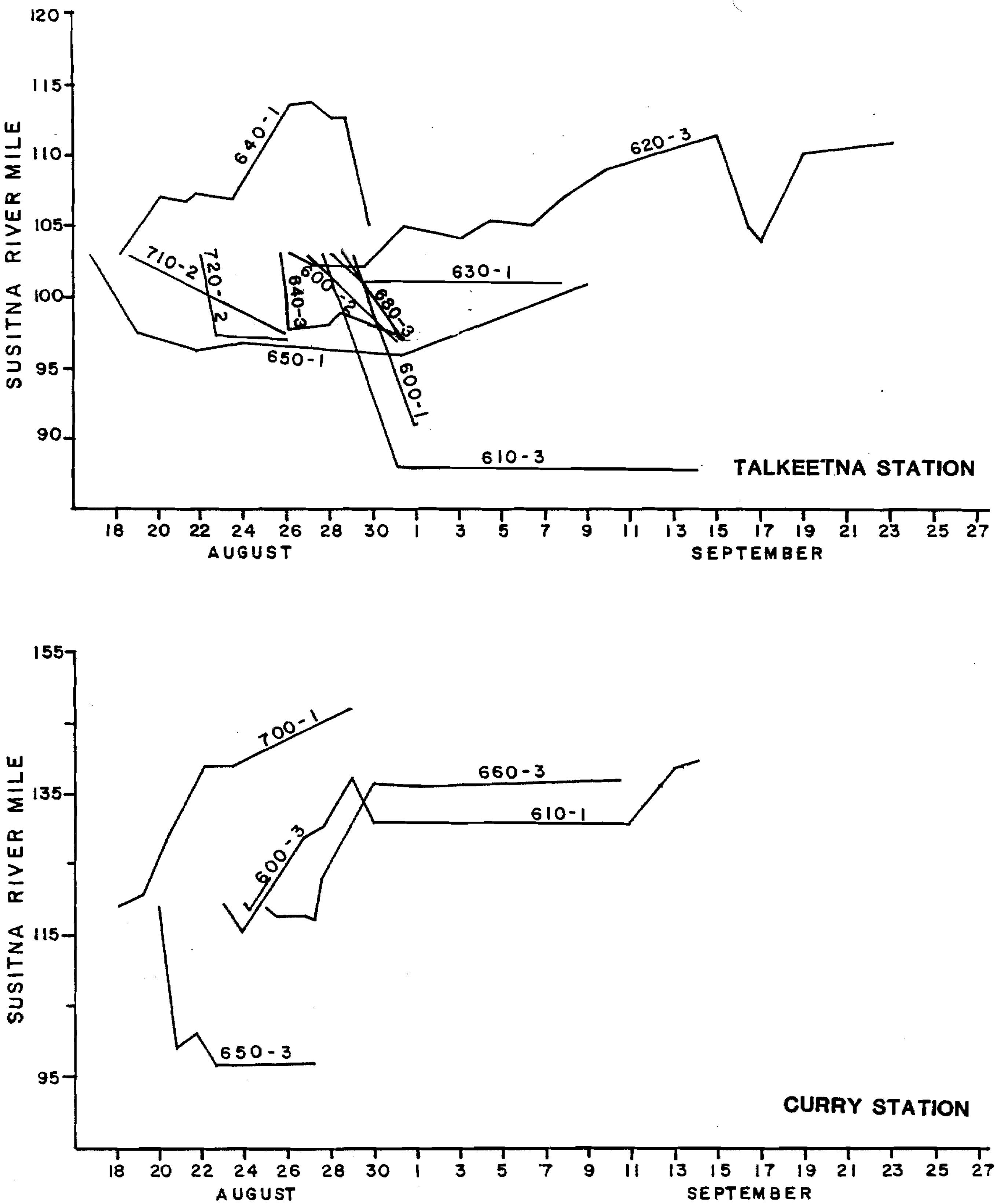


Figure 2-3-33. Movements of Talkeetna and Curry stations radio tagged coho salmon in the Susitna River drainage during August and September, Adult Anadromous Investigations, Su Hydro Studies, 1982.

fish 640-3 had moved out of the Talkeetna River and was in the Susitna River at RM 98.0. The fish was next located in the Chulitna River (RM 98.6) where it remained through at least September 9. By September 13 fish 640-3 had returned to the Susitna River where it was located on that date at RM 97.5. Between September 18 and 24, fish 640-3 migrated upstream and entered Whiskers Creek (RM 101.2). This fish was last detected 0.5 miles upstream in Whiskers Creek on September 27 (Appendix 2-E).

Of the five radio tagged coho salmon released at Curry Station in 1982, one spawned below RM 120 presumably in the Talkeetna River (RM 97.0). The other four fish spawned upstream of RM 120 in Indian River (RM 138.6) and Portage Creek (RM 148.9) (Figure 2-3-33 and Appendix 2-E).

The one radio tagged coho salmon which presumably spawned below Curry Station in 1982, exhibited the following migrational movements. Released at RM 120 on August 19 fish 650-4 descended to RM 112.8 within approximately 8.4 hours. The next day it was at RM 100.5 near the Talkeetna River confluence (RM 97.0). It remained in the general area of RM 98 through at least August 23. On August 26, fish 650-4 was located in the Talkeetna River where it remained through September 9, the last day monitored (Appendix 2-E).

The migrational behavior of fish 610-1 can be considered illustrative of the milling behavior of coho salmon radio tagged at Curry Station (RM 120), which spawned upstream of the station in 1982. Fish 610-1 was tagged on August 22. On August 26 the fish was at RM 129.6 and two days later at RM 135.8. Fish 610-1 descended to RM 131.1 on or about August 29 and remained there at the confluence of Fourth of July Creek through September 7. On September 8 the fish moved further downstream to RM 126.5 and on the following day migrated upstream, again, to RM 131.1. By September 13, fish 610-1 had moved upstream to the mouth of Slough 15 at RM 137.3. Between September 14 and 18, fish 610-1 entered Indian River (RM 138.6) and was last detected on September 22, 2.5 miles upstream in Indian River, 31 days after its initial release at RM 120 (Appendix 2-E).

In 1982 the fastest (upstream) movement recorded of a radio tagged coho salmon released at Curry Station (RM 120) was 18.1 mpd (Table 2-3-39).

A common migrational pattern exhibited by several salmon released at Talkeetna and Curry stations in 1982 was the tendency for the fish to mill or hold, for up to several days in semi-placid areas of the main channel like the mouths of clear water streams and sloughs prior to resuming migration. Examples of this behavior can be found in the tracking reports of coho salmon 610-1, 620-3A, 640-1, 650-1, 660-3 and 740-3 provided in Appendix 2-E.

Further information on coho salmon migrational behavior can be found in Appendix 2-E.

3.2.5.2.3 Lower Devil Canyon Milling

Three coho salmon were caught in 19.6 hours of set netting at RM 150.2 and 150.4 from August 10 to September 12 (Table 2-3-17). The three salmon were caught on August 28. One of the three fish had been tagged at Curry Station (RM 120) on August 12 (Plate 2-3-9).

Table 2-3-39. Twenty fastest radio tagged coho salmon movements, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Speed Traveled (mpd) 1/	Distance Traveled (miles)	Hours Elapsed	Location of Movement (RM - RM) 2/	Observation Dates	Transmitter Number
21.1	4.3	4.9	118.0-122.3	8/27	660-3
11.5	2.4	5.0	128.7-131.1	8/19	700-1
9.1	1.6	4.2	137.0-138.6	8/21	700-1
8.5	8.5	23.9	122.3-130.8	8/27-28	660-3
7.2	7.4	24.6	121.3-128.7	8/18-19	700-1
6.1	4.5	17.6	126.5-131.0	9/8-9	610-1
5.8	3.4	14.0	97.5-100.9	9/13-14	640-3
5.4	5.6	24.7	130.2-135.8	8/27-28	610-1
4.9	4.2	20.6	130.8-135.0	8/28-29	660-3
4.6	4.3	22.5	103.0-107.3	8/18-19	640-1
3.5	3.1	21.1	133.9-137.0	8/20-21	700-1
3.1	6.6	51.9	107.0-113.6	8/23-25	640-1
2.8	1.8	15.7	119.5-121.3	8/17-18	700-1
2.8	5.4	46.3	101.2-106.6	8/29-31	620-3
2.6	2.8	25.4	131.1-133.9	8/19-20	700-1
2.2	2.0	22.8	119.3-121.3	8/25-26	600-3
1.6	1.6	23.3	98.0-99.6	8/27-28	640-3
1.6	1.6	23.5	107.6-109.2	9/6-7	620-3
1.4	1.3	22.7	137.3-138.6	9/13-14	610-1
1.0	0.9	21.2	100.5-101.4	8/20-21	650-3

1/ mpd: Miles per day
2/ Movement: River mile to river mile

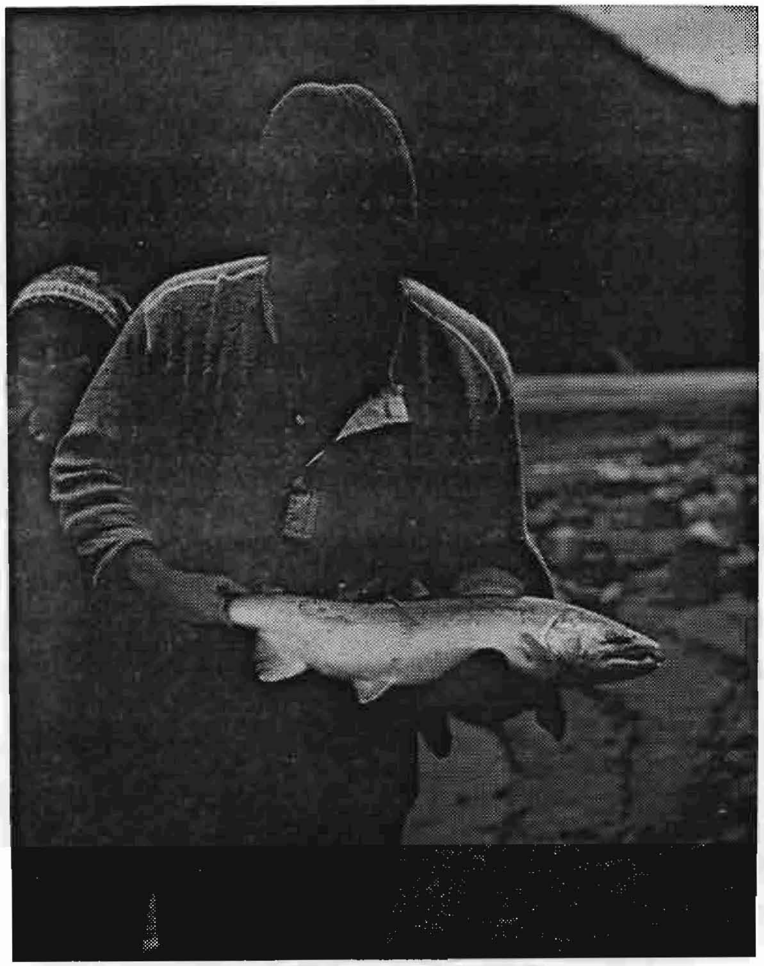


Plate 2-3-9. Tag recaptured coho salmon in lower Devil Canyon from Sunshine Station, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Electroshocking was conducted four times at RM 150.4 between August 11 and September 23, 1982. The total catch was one coho salmon on September 5 (Table 2-3-19).

Gill netting and electroshocking data indicate that coho salmon were present in lower Devil Canyon (RM 150-151) from August 28 through September 5, 1982 (Tables 2-3-18 and 2-3-19).

3.2.5.2.4 Spawning

3.2.5.2.4.1 Main Channel

A total of 397 main channel sites were investigated for coho salmon spawning activity in 1982 (Appendix 2-G). The sites surveyed were located between RM 98.5 and 150.

No Susitna River main channel habitats between RM 98.5 and 150 were found to support coho salmon spawning (Appendix 2-G).

3.2.5.2.4.2 Sloughs and Streams

In 1982, 34 sloughs between RM 98.6 and 161.0 were surveyed for coho salmon from July 28 to October 24, 1982 (Appendix 2-G).

Coho salmon were observed in three of the 34 sloughs surveyed. The three sloughs were: 6A (RM 112.3), 8A (RM 125.1) and 15 (RM 137.2). The peak survey count of live and dead coho salmon in Slough 6A was 35 fish, in Slough 8A 4 fish and in Slough 15, 14 fish. These counts were recorded on August 19, October 2 and August 11, respectively.

Based on survey observations coho salmon spawned only in Slough 8A. The peak of spawning in Slough 8A occurred between the fourth week of September and the first week of October, 1982. The coho salmon observed in sloughs 6A and 15 were milling fish and did not spawn in these sloughs.

Nineteen streams between RM 98.6 and 161.0 were surveyed for coho salmon in 1982 (Appendix 2-G). Twelve streams contained coho salmon. These were:

1. Whiskers Creek (RM 101.4)
2. Chase Creek (RM 106.9)
3. Slash Creek (RM 111.2)
4. Gash Creek (RM 111.6)
5. Lane Creek (RM 113.6)
6. Lower McKenzie Creek (RM 116.2)
7. Little Portage Creek (RM 117.7)
8. Fourth of July Creek (RM 131.1)
9. Gold Creek (RM 136.7)
10. Indian River (RM 138.6)
11. Jack Long Creek (RM 144.5)
12. Portage Creek (RM 148.9)

Peak survey counts of coho salmon were recorded in the 12 listed streams between August 23 and October 2, 1982. The combined peak survey count of live and dead coho salmon for these streams was 633 fish. The majority of the fish were observed in Whiskers Creek (27.8%), Lower McKenzie Creek (21.0%), Indian River (16.0%) and Portage Creek (13.9%). It should be recognized that peak survey counts do not represent the total number of coho salmon that spawned in the streams surveyed. Early and late spawning fish are normally absent when peak counts are recorded and only a portion (index) of each stream habitat was surveyed in this study (Appendix 2-G).

Survey observations indicated that the peak of coho salmon spawning activity in stream habitats took place between the last week of August and the first week of October in 1982. Peak of coho salmon spawning in Whiskers Creek, Lower McKenzie Creek and Indian River were between August 23 and September 21, September 21 and October 2, and September 18 and September 30, respectively.

3.3 Bering Cisco

3.3.1 Estuary to Talkeetna

3.3.1.1 Main Channel Escapement

Bering cisco were captured at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in fishwheels in 1982. Daily and cumulative catch records are presented in Appendix 2-C.

At Susitna Station (RM 26) 42 Bering cisco were intercepted with fishwheels in 1982. Based on these catches, the migration started at Susitna Station on August 7 and concluded sometime after September 5, the last day the station was operated (Figure 2-3-34). The majority (75%) of the Bering cisco migrated along the east shore of the Susitna River at Susitna Station based on fishwheel catch data.

Yentna Station (RM 04) fishwheels caught four Bering cisco in 1982, one per day on August 21, 29, September 2 and 3. The north bank fishwheel intercepted 75.0 percent of the total catch while the south bank fishwheel captured the remaining 25.0 percent. The Bering cisco catch at Yentna Station was not sufficient to establish migrational timing.

Fishwheels at Sunshine Station (RM 80) intercepted 165 Bering cisco in 1982. From catch data, the migration can be determined to have started on September 4 and to have ended sometime after October 1, the last day fishwheels were operated. The entire catch at Sunshine Station was made with fishwheels operating off the east bank.

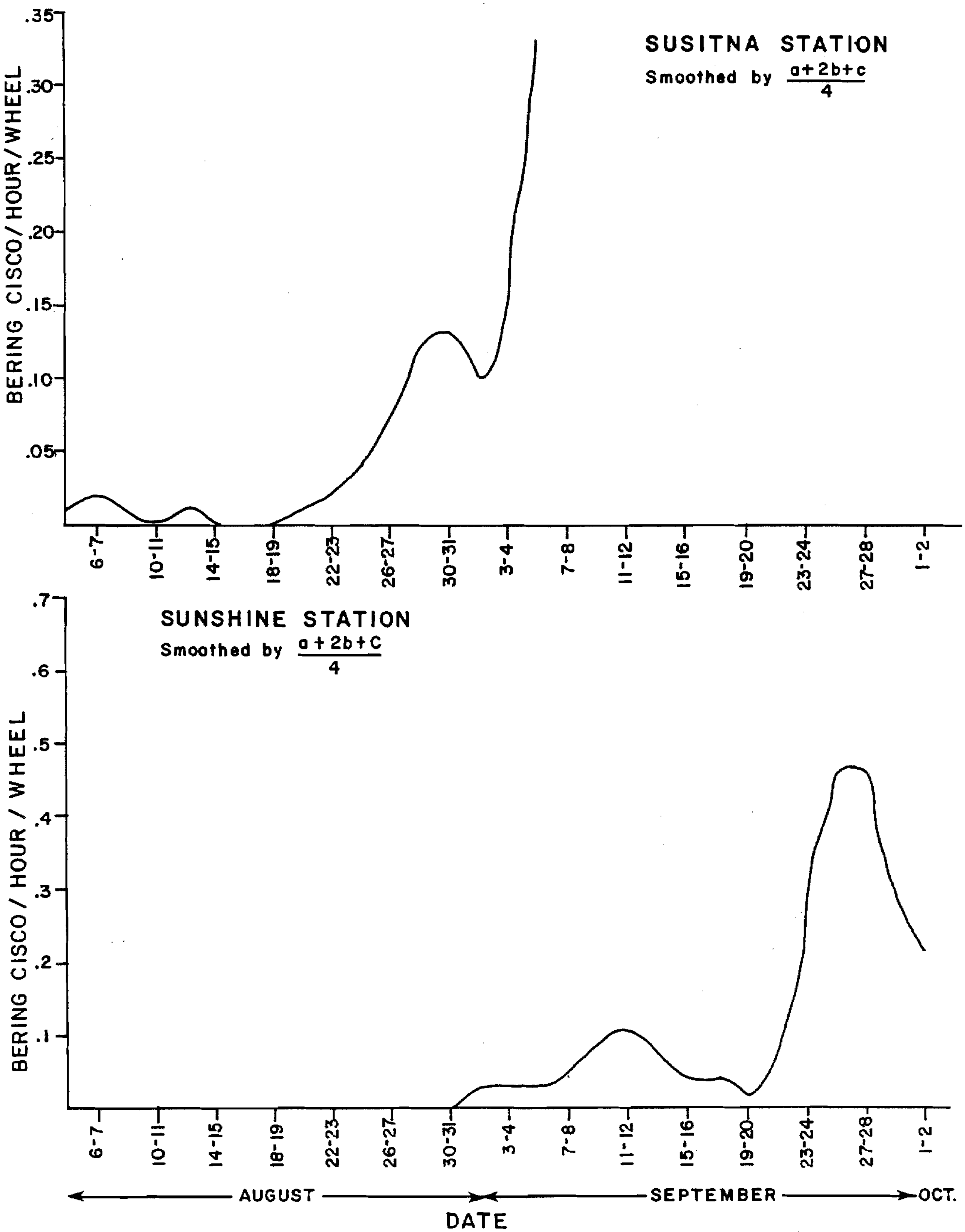


Figure 2-3-34. Mean hourly fishwheel catch of Bering cisco by two day periods at Susitna and Sunshine stations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

All subsequently reported age and length data of Bering cisco are based on a composite of fish captures at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations (Tables 2-3-40 and 2-3-41).

Table 2-3-40. Analysis of Bering cisco age data by percent from escapement samples collected at all sampling locations, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Sample Size	Age Class 1/			Brood Year		
		4_1	5_1	6_1	1977	1978	1979
All Locations	100	34	62	4	4	62	34

1/ Gilbert-Rich notation

Approximately 62.0 percent of the Susitna River Bering cisco escapement were age 5_1 fish followed by age 4_1 fish at 34.0 percent and age 6_1 fish at 4.0 percent (Table 2-3-40). Age 4_1 Bering cisco had a mean length (TL) of 318.9 mm and age 5_1 and 6_1 fish had mean lengths of 342.3 mm and 365.0 mm, respectively (Table 2-3-41).

Table 2-3-41. Analysis of Bering cisco lengths, in millimeters, by age class from all escapement samples, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Collection Site	Age Class 1/	n	Limits	Mean	95% Confidence Limits 2/	Median
All Sampling Locations	4_1	34	235-365	318.9	310.7-237.2	231.5
	5_1	62	305-383	342.3	338.0-346.7	343.0
	6_1	4	330-405	365.0	313.4-416.6	362.5

1/ Gilbert-Rich notation.
2/ Confidence Limits on Mean.

All Bering cisco intercepted in fishwheels at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations were in pre-spawning condition. No sex determinations were made due to homogenity in physical appearance of both sexes.

3.3.1.2 Main Channel Spawning

Main channel spawning surveys began August 1 and ended on October 13, 1982. A total of 518 Bering cisco were caught or observed during this time period (Appendix 2-F).

Sex composition data of Bering cisco were collected from 62 fish during the spawning surveys. It was found that prior to October 13, the male to female ratio was 3.0:1 (Table 2-3-42). The last day sampled, October 13, 18 Bering cisco were examined and 15 were females and 3 were males, for a sex ratio of 0.2:1. Assuming that electroshocking, as a method of capture, was random the incidence of males was then a function of presence and not capture avoidance. It follows, then, that male Bering cisco left the spawning locations earlier than females. Alternatively, it may also be possible that gravid females preparing to or actually spawning were more susceptible to capture which could also cause a change in the sex ratio.

Ripe female Bering cisco, as defined in Section 2.3.2, were first observed on October 2 with encounters continuing through October 13, the final day of sampling. Of the fifteen females examined on October 13 for spawning condition: 10 fish were considered to be actively spawning; 4 fish were determined by necropsy to have already spawned and 1 fish was a pre-spawner. The data would indicate that peak of spawning in 1982 occurred on or before October 13.

Table 2-3-42. Sex ratios of Bering cisco collected during mainstem spawning surveys, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Location (River Mile)	Date	Sample Size	Males	Females	Sex Ratio (m:f)
79.4	10/3	12	11	1	11.0:1
34.0	10/4	5	3	2	1.5:1
34.1	10/6	1	1	0	1:0
83.4	10/6	5	4	1	4.0:1
88.0	10/6	1	0	1	0:1
71.5	10/8	1	1	0	1:0
72.7	10/8	3	2	1	2.0:1
75.0	10/8	3	1	2	0.5:1
77.6	10/8	13	10	3	3.3:1
75.5	10/13	7	2	5	.4:1
77.6	10/13	9	0	9	0:9
85.2	10/13	2	1	1	1.0:1

Main channel spawning investigations established a probable Bering cisco spawning site located on a relatively shallow gravel shoal extending from RM 76.8 to 77.6 (Appendix 2-G). On October 13, nine females captured at this site were all ripe. The site was classified probable as verification was not possible due to ice flows after October 13 which precluded further investigations.

A sampling drift of RM 81.2 established the presence of 'high' numbers (15-20) of Bering cisco at this location on October 13, 1982 (Appendix 2-G). The site was a probable spawning area. However, verification was not possible due to ice and snow conditions which prevented further sampling after October 13.

A previously tagged Bering cisco was recaptured on September 13, 1982 at RM 31.1. The fish had been tagged on October 5, 1981 at a confirmed spawning area located at RM 77.0 (Phase I, ADF&G/Su Hydro, Resident Fish Investigation on the Lower Susitna River, 1981). An analysis of several scales from the recaptured fish revealed that it was age 4_1 in 1981 and age 5_1 in 1982. The lengths (TL) of the fish at capture and recovery were 340 mm and 352 mm, respectively translating into a 1981-82 growth rate of 12 mm. Sex was not determined. Based on the incidence of no immature Bering cisco in any catch sample, the recaptured individual was a probable 1981 spawner and ascending the river in 1982 as a potential repeat spawner. The significance of this tag recovery cannot be understated as no known occurrence of Bering cisco repeat spawning has been reported. Scale analysis of Bering cisco stocks from the Yukon and Kuskokwim rivers indicate that repeat spawning does not occur (Alt, 1973).

3.3.2 Talkeetna to Upper Devil Canyon

3.3.2.1 Main Channel Escapement

A summary of the 1982 fishwheel catches of Bering cisco at Talkeetna (RM 103) and Curry (RM 120) stations are provided in Appendix 2-C.

Fishwheels operating at Talkeetna Station (RM 103) from June 5 through September 14 intercepted one Bering cisco on September 13, 1982. This was the only Bering cisco intercepted at this station in 1982.

Curry Station (RM 120) fishwheels operated from June 9 through September 18, 1982. There were no reported Bering cisco captures during this period.

3.3.2.2 Main Channel Spawning

Main channel surveys investigated 397 sites between RM 98.5 and 150 in 1982. The results of these investigations have been summarized in Appendix 2-G.

No Bering cisco spawning was found from RM 98.5 to 150 in 1982. A single capture on October 1 at RM 101.9 represented the only Bering cisco caught in this river reach in 1982.

4.0 SUMMARY

4.1 Eulachon

The Susitna River supported two eulachon runs in 1982. The first run of fish migrated through the Susitna River estuary from May 16 to May 30, approximately. The second run of fish entered the estuary between June 1 and 8.

There was no correlation found between timing of estuary entrance of first and second run eulachon in 1982 with changes in water temperature or Cook Inlet tide levels.

In 1982 the upper limit of migration by the first run eulachon in the Susitna River was RM 40.5 approximately. The upper limit of migration by second run fish was approximately RM 48.5.

Spawning by first run eulachon began on or about May 21 and extended through May 31, 1982. Second run fish spawned between June 4 and 9, approximately.

First and second run eulachon principally spawned in the Susitna River main channel from RM 8.5 to the Yentna River confluence (RM 28).

The major spawning areas by first and second run eulachon were located off cut banks and in riffle zones in the Susitna River main channel where the bottom substrates were mainly unconsolidated sands and gravels. Areas that were not utilized were clear water streams including their confluences, semi-placid main channel reaches and slough habitats.

The spawning life of male and female eulachon differed. In 1982 male eulachon spawned over a several day period whereas female eulachon spawned within approximately one day upon ripening. Additionally, male eulachon did not outmigrate or die after completing spawning unlike female eulachon which either died or outmigrated within approximately one day after spawning.

The 1982 first and second eulachon runs were both comprised of age 3_1 and 4_1 fish. Nearly 80 percent of both runs were age 3_1 fish. Male eulachon outnumbered female eulachon in both the first and second run by male to female ratios of 1.6:1 and 1.3:1, respectively.

First run eulachon were, by Student's t and Mann-Whitney tests at the 95 percent level, significantly smaller in length (TL) and weight than second run fish.

The 1982 Susitna River combined escapement of first and second run eulachon was estimated in the range of millions of fish.

The 1982 eulachon sport harvest was estimated at 3,000 to 5,000 fish. Sport fishing mainly occurred from RM 10 to 30 including the Yentna River (RM 28).

4.2 Adult Salmon

The estimated salmon escapements in the Susitna River for 1981 and 1982 are reported in Table 2-4-1. A summary of the number of salmon migrating to Yentna (RM 04), Sunshine (RM 80), Talkeetna (RM 103) and Curry (RM 120) stations in 1981 and 1982 are provided in Table 2-4-2. All references to 1981 data presented in the following subsections can be found in the Phase I Final Draft Report, Adult Anadromous Fisheries Project, ADF&G/Su Hydro, 1981.

Table 2-4-1. Susitna River drainage escapement estimates by species for 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Year	Escapement Estimate 1/			
	Sockeye 2/	Pink	Chum	Coho
1981	272,500	85,600	282,700	36,800
1982	265,200	890,500	458,200	79,800

1/ Defined as the summation of the Yentna River escapement recorded at Yentna Station and the Susitna River escapement recorded at Sunshine Station. These estimates do not include escapements to Susitna River tributaries above RM 6 and below RM 77 excluding the Yentna River (RM 28).

2/ Sockeye salmon escapement estimates do not include first run sockeye salmon escapements.

4.2.1 Chinook Salmon

4.2.1.1 Estuary to Talkeetna

4.2.1.1.1 Main Channel Escapement

In accordance with Phase I and II studies, chinook salmon were investigated incidental to other salmon species at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1981 and 1982. The exception in 1982 was at Sunshine Station where chinook salmon received equal study emphasis.

Table 2-4-2. Escapement by species and sampling location for 1981 and 1982. Adult Anadromous Investigations, Su Hydro Studies, 1982.

Sampling Location	River Mile	Escapement 1/									
		Chinook		Sockeye 4/		Pink		Chum		Coho	
		1981 2/	1982	1981	1982	1981	1982	1981	1982	1981	1982
Yentna Station	04		3/	139,400	113,800	36,100	447,300	19,800	27,800	17,000	34,100
Sunshine Station	80		52,900	133,500	151,500	49,500	443,200	262,900	430,400	19,800	45,700
Talkeetna Station	103		10,900	4,800	3,100	2,300	73,000	20,800	49,100	3,300	5,100
Curry Station	120		11,300	2,800	1,300	1,000	58,800	13,100	29,400	1,100	2,400

1/ Escapement estimates are derived from Petersen population estimates with the exception of the Yentna Station escapements which are represented by sonar counts.

2/ Chinook salmon were not monitored for escapement in 1981.

3/ Yentna Station sonar equipment was installed after the onset of chinook migration and total escapement was not estimated.

4/ Second run sockeye salmon escapement.

The 1982 chinook salmon escapement to Sunshine Station (RM 80) was estimated at 52,800 fish by the Petersen method. Approximately 93.8 percent of these fish were larger than 350 mm in length. The 1982 chinook salmon escapement to Sunshine Station was more than twice the 1981 escapement level based upon a between year comparison of fishwheel catch rates. In 1981, the chinook salmon migration began on or before June 22 and ended on approximately July 7. In 1982, the migration began, reached a midpoint and ended on June 18, June 30 and July 9, respectively.

Chinook salmon appear to have a migrational preference for movement along the east bank at Sunshine Station (RM 80) as indicated by 87.6 percent in 1981 and 90.1 percent in 1982 of the catch occurring with the east bank fishwheels.

Chinook salmon sampled for age at Sunshine Station (RM 80) in 1981 were 25.6 percent age 3_2, 30.5 percent age 4_2, 21.8 percent age 5_2 and 16.6 percent age 6_2 fish. In 1982, 14.8 percent of the escapement sample was age 3_2, 27.2 percent age 4_2, 20.5 percent age 5_2 and 36.1 percent age 6_2. From freshwater growth characteristics, approximately five percent of the fish sampled in 1981 and one percent in 1982 had smolted in the first year of life. The balance had smolted in the second year of life.

Chinook salmon sampled for length at Sunshine Station (RM 80) averaged 22 mm more in length in 1982 than in 1981 by respective age class and sex.

At Sunshine Station (RM 80) in 1981 and 1982 male chinook salmon were more abundant than females among the three and four year old fish sampled and females were more numerous than males among the six year old fish sampled.

Among five year old fish, males were more abundant than females in 1981 and less abundant than females in 1982. The overall male to female ratio, non segregated to age, in 1981 was 3.5:1 and in 1982, 1.2:1.

4.2.1.1.2 Main Channel Spawning

A total of 280 and 811 Susitna River main channel sites between RM 7 and 98.5 were surveyed for chinook salmon spawning in 1981 and 1982, respectively. The surveys were conducted from July 15 to October 15, 1981 and from August 1 to October 13, 1982. Survey results indicated that chinook salmon did not spawn in the main channel between RM 7 and 98.5 in 1981 or 1982.

4.2.1.2 Talkeetna to Upper Devil Canyon

4.2.1.2.1 Main Channel Escapement

Under Phase I investigations chinook salmon escapement estimates were not obtained for Talkeetna (RM 103) and Curry (RM 120) stations in 1981. They were obtained in 1982 under Phase II studies.

An estimated 10,900 and 11,300 chinook salmon migrated to Talkeetna (RM 103) and Curry (RM 120) stations in 1982, respectively. Both estimates were calculated by the Petersen method and the 400 fish discrepancy between estimates was considered insignificant based on the 95 percent confidence intervals of the two estimates. Approximately 80 percent of the chinook salmon migrating to Talkeetna Station and 95 percent to Curry Station were larger than 350 mm in length (FL).

A comparison of 1981 and 1982 chinook salmon fishwheel catches at Talkeetna (RM 103) and Curry (RM 120) stations indicated that the 1982 escapement was more than twice the 1981 escapement level at each of the two stations.

The chinook salmon migration occurred earlier in 1981 than in 1982 at Talkeetna (RM 103) and Curry (RM 120) stations. At Talkeetna Station the 1981 migration began on or before June 22, peaked on June 25 and ended approximately on July 10. In 1982 these dates were June 26, July 4 and July 23, respectively. At Curry Station (RM 120), the 1981 migration began June 17, reached a midpoint June 24 and terminated July 24. The respective dates in 1982 were June 25, July 3 and July 19 (Figure 2-4-1).

Tagged recaptures were made at Talkeetna (RM 103) and Curry (RM 120) stations in 1982. The average migrational time of chinook salmon between Sunshine and Talkeetna stations, a distance of 23 miles, was 11.2 days (2.1 mpd). Between Talkeetna and Curry stations, 17 miles, the average travelling time was 7.7 days (2.2 mpd).

Age composition sampling at Talkeetna Station (RM 103) established that the majority of the chinook salmon in 1981 were age classes 3_2 (12.6%), 4_2 (27.1%), 5_2 (21.4%) and 6_2 (24.4%) fish. In 1982 the major age classes were 3_2 (20.1%), 4_2 (35.2%), 5_2 (19.5%) and 6_2 (23.3%) fish.

At Curry Station (RM 120) in 1981 age 3_2 fish represented 14.8 percent, age 4_2 fish 29.8 percent, age 5_2 fish 25.7 percent and age 6_2 fish 18.0 percent of the escapement sampled. These same age classes registered 15.9, 28.5, 20.0 and 30.8 percents respectively in 1982.

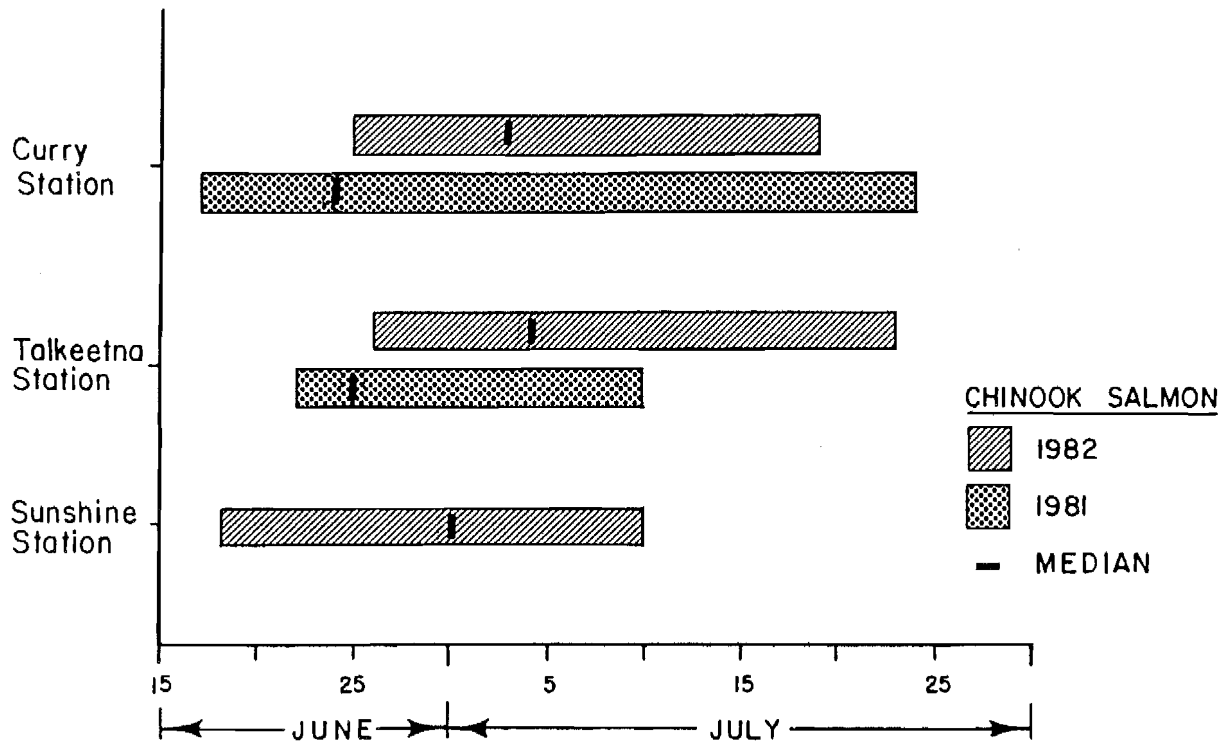


Figure 2-4-1. Migrational timing of chinook salmon at selected sampling locations in the Susitna River basin in 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

All adult chinook salmon sampled for age at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 and 1982 were fish that had migrated to sea (smolted) after spending no more than one winter as fry in freshwater. Approximately 88.7 percent in 1981 and 97.7 percent in 1982 of the escapement sampled at Talkeetna Station were fish that had smolted after spending one winter in freshwater. The balance, 11.3 percent (1981) and 2.3 percent (1982), had smolted before their first winter. At Curry Station, 88.3 percent in 1981 and 95.6 percent in 1982 of the adults, as fry, had smolted after one winter in freshwater. The remainder, 11.7 percent in 1981 and 4.4 percent in 1982 had smolted before their first winter.

Age samples collected from Susitna River locations downstream of Talkeetna Station (RM 103) in both 1981 and 1982 indicate an essential absence of adult chinook salmon that, as fry, had migrated to sea with less than one winter in freshwater. Nearly all the returning adults sampled at downstream locations had spent one winter as fry in freshwater before smolting. The presence at Talkeetna and Curry (RM 120) stations in 1981 and 1982 of returning adults that, as fry, had smolted before their first winter may be indicative of 'high' food availability in the Susitna River reach north of RM 103. A study conducted in 1980 indicates that early chinook salmon fry outmigration is related to food availability; when food is plentiful some young-of-year fry reach smolt size early and outmigrate in the fall of their first year (Delaney et al., 1981).

Chinook salmon sampled for length (FL) at Talkeetna Station (RM 103) in 1981 averaged 11 mm larger, segregated by age and sex, than in 1982. At Curry Station (RM 120) they averaged 20 mm smaller in 1981 than in 1982.

Chinook salmon intercepted with fishwheels at Talkeetna Station were shorter in length than at Curry Station by an average of 3 mm in 1981 and 32 mm in 1982.

Chinook salmon males outnumbered females in 1981 at Talkeetna (RM 103) and Curry (RM 120) stations by ratios of 2.6:1 and 1.9:1, respectively. Males were more abundant than females at both stations in 1981 among three and four year old fish and generally less abundant than females among five and six year old fish. The same was true in 1982 at both stations. The overall male to female ratio at Talkeetna Station in 1982 was 2.3:1 and at Curry Station 1.5:1.

4.2.1.2.2 Radio Telemetry

Migrational movements of chinook salmon radio tagged at Talkeetna Station (RM 103) were generally similar between 1981 and 1982. The Chulitna, Susitna and Talkeetna river confluences (RM 98±) was used as a milling area in both years. In 1981, all four of the radio tagged fish released at Talkeetna Station and four of the seven fish in 1982 remained there up to two weeks before re-initiating upstream migration. One difference between years was that a higher percentage of the fish tagged at Talkeetna Station in 1982 spawned below the station than in 1981. Only one of four fish tagged in 1981 spawned below Talkeetna Station while in 1982 five of the seven radio tagged fish spawned below.

In 1981 and 1982, Curry Station (RM 120) tagged chinook salmon displayed similar migrational movements. Nearly all of the 21 radio tagged chinook salmon released at Curry Station in 1981 and 1982 migrated upstream after tagging and entered spawning streams. Two of the 12 fish tagged at Curry Station in 1981 and one of the nine fish tagged in 1982 spent up to 15 days in lower Devil Canyon (RM 150.5 - RM 151.7) before selecting a spawning stream.

Radio tagged chinook salmon released at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 and 1982 spawned mainly in two streams, Indian River (RM 138.6) and Portage Creek (RM 148.9).

Chinook salmon tagged at Curry Station (RM 120) migrated to their respective spawning stream in less time in 1982 than in 1981. For example, radio tagged fish were first detected at the confluence of, or in, Indian River within 2 to 11 days after being released in 1981 versus 3 to 6 days in 1982. Radio tagged fish were first detected in, or near, Portage Creek 5 to 14 days after being tagged at Curry Station in 1981 compared to 3 to 6 days in 1982.

In both 1981 and 1982 a radio tagged chinook salmon spent several days in both Portage Creek (RM 148.9) and Indian Creek (RM 138.6). The significance of multi-stream occupancy is not known. However, it may be one example of milling. Numerous radio tracking observations were recorded in 1981 and 1982 of chinook salmon ascending the Susitna River main channel several miles and then later descending and entering a spawning stream.

An additional behavior difference was noted between chinook salmon tagged in 1981 and 1982 at Talkeetna (RM 103) and Curry (RM 120) stations. In 1981 two radio tagged fish occupied a mainstem pool at RM 123.5 for 3 to 10 days prior to migrating upstream. Another fish in 1981 remained at the mouth of Sherman Creek (RM 130.8) for about three days before resuming upstream movement. In 1982 no radio tagged chinook salmon were detected holding positions at the above or other main channel locations, excluding confluence zones of spawning streams, lower Devil Canyon and the confluence of the Chulitna, Talkeetna and Susitna rivers.

4.2.1.2.3 Lower Devil Canyon Milling

In 1981, gill nets were fished 30.2 hours in lower Devil Canyon locations between RM 150.1 and 150.4 from July 29 through September 9. No chinook salmon were caught with this effort. In 1982, 19.6 hours were fished with the same gear at RM 150.2 and 150.4 from August 10 through September 12. As in 1981, there were no chinook salmon caught. In addition to set netting, electroshocking was also conducted in lower Devil Canyon four times at RM 150.4 between August 11 and September 23, 1982. Again, no chinook salmon catches were made. From these observations it can be concluded that there were minimal, if any, chinook salmon in lower Devil Canyon after July 28 in 1981 and after August 10 in 1982.

Radio telemetry investigations under Section 4.2.1.2.2 documented chinook salmon milling activity in the lower Devil Canyon reach between RM 150 and 151.7 in 1981 and 1982. In 1981, 2 of 16 radio tagged fish at Talkeetna (RM 103) and Curry (RM 120) stations milled in lower Devil Canyon. The same event was documented in 1982 where 2 of the 16 radio tagged fish released at these stations milled in lower Devil Canyon. Dates of observed milling activity in 1981 were from July 5 to 7, and in 1982 from June 26 to July 14.

4.2.1.2.4 Spawning

4.2.1.2.4.1 Main Channel

Chinook salmon spawning surveys in the Susitna River main channel were conducted from July 15 to October 15, 1981 and from August 7 to October 7, 1982. A total of 37 and 397 sites between RM 98.5 and 150 were surveyed for spawning in 1981 and 1982, respectively. Survey results indicate that chinook salmon did not spawn in the Susitna River main channel in 1981 or 1982.

4.2.1.2.4.2 Sloughs and Streams

In 1981 and 1982, 33 and 34 slough habitats respectively were surveyed for chinook salmon presence. Based on two years of survey data, chinook salmon do not use slough habitats between RM 98.6 and 161.0 for spawning.

Three streams between RM 98.6 and 161.0 in 1981 were surveyed for chinook salmon presence. These were: Portage Creek (RM 148.9), Indian River (RM 138.6) and Lane Creek (RM 113.6). The peak numbers of fish recorded in these streams were: 659, 422 and 40 chinook salmon respectively. In 1982, 19 streams were surveyed between RM 98.6 and 161.0 and 11 were found to support chinook salmon. The peak numbers of fish recorded in the four major streams were: 1,253 fish in Portage Creek (RM 148.9), 1,053 fish in Indian River (138.6), 56 fish in Fourth of July Creek (RM 131.1) and 47 fish in Lane Creek (RM 113.6).

The combined peak survey count of chinook salmon in Portage Creek (RM 148.9), Indian River (RM 138.6) and Lane Creek (RM 113.6) was 1,121 fish in 1981 and 2,353 fish in 1982. Based on these figures, the chinook salmon escapement above RM 98.5 in 1982 was approximately twice the 1981 escapement level. This conclusion is also supported by fishwheel catches at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 and 1982 (Section 4.2.1.2.1).

In 1982 two new chinook salmon spawning habitats were located. These were Cheechako (RM 152.4) and Chinook (RM 157.0) creeks, which enter as streams in the Devil Canyon reach (RM 151-161) of the Susitna River. Based on peak survey counts Cheechako Creek supported approximately 0.6 percent and Chinook Creek 0.2 percent of the 1982 chinook salmon escapement to the Susitna River reach above RM 98.6.

4.2.1.3 Escapement Index Surveys

In 1981, 14 chinook salmon escapement index streams were surveyed in the Susitna River basin. In 1982, 21 index streams were surveyed.

Based on comparative year index counts, the chinook salmon escapement to the Susitna River basin was near average in 1981 relative to previous year escapements. In 1982, the escapement was approximately 80 percent higher than the 1981 escapement and above the mean average for years 1976 through 1981.

In 1982, the west side streams entering the Susitna River below RM 97 supported approximately 45 percent higher chinook salmon escapements than in 1981 but lower than mean average escapements for the years 1976 through 1981. East side Susitna River streams downstream of RM 97 in 1982 were not surveyed during peak spawning due to high turbidity and therefore no comparison can be made. The chinook salmon escapement above RM 98.6 in 1982 exceeded 1981 escapement level by approximately 85 percent and the six year mean average by more than 200 percent. Several of the chinook salmon spawning streams upstream of RM 98.6 including Lane Creek (RM 113.6), Indian River (RM 138.6) and Portage Creek (RM 148.9) supported escapements above the historic high for years 1976 through 1981.

4.2.2 Sockeye Salmon

4.2.2.1 Estuary to Talkeetna

4.2.2.1.1 Main Channel Escapement

4.2.2.1.1.1 First Run

First run sockeye salmon were not investigated under Phase I 1981 Adult Anadromous Studies, but were monitored in 1982 at Sunshine Station (RM 80) in conjunction with Phase II studies.

An estimated 5,800 first run sockeye salmon migrated in 1982 to Sunshine Station (RM 80) as determined by the Petersen method. The 95 percent confidence interval of this estimate calculated at 4,900 to 7,300 fish.

The migration of first run sockeye salmon at Sunshine Station (RM 80) began in 1982 on June 4, reached a midpoint on June 13 and was over by June 26. Based on fishwheel catches, approximately 99.9 percent of the fish migrated along the east bank of the Susitna River at RM 80.

The age composition of first run sockeye salmon at Sunshine Station (RM 80) in 1982 was 89.5 percent age 5_2, 6.4 percent age 4_2, and 4.1 percent age 6_3. Approximately 95.9 percent of the adults had migrated, as fry, to sea in their second year of life and 4.1 percent in their third year as determined by scale characteristics.

The average length (FL) of age 4_2 first run sockeye males and females sampled at Sunshine Station (RM 80) was 463 mm and 460 mm, respectively. The age 5_2 males averaged 567 mm and females 530 mm while the age class 6_3 fish averaged 558 mm for males and 528 mm for females.

Sex composition results indicate the males outnumbered the females among age 4_2 second run sockeye salmon sampled in 1982 at Sunshine Station (RM 80) by a 1.5:1 ratio, while the females outnumbered the males among age 5_2 and 6_3 fish sampled by 0.6:1 and 0.9:1 ratios, respectively.

4.2.2.1.1.2 Second Run

The Susitna River escapement of second run sockeye salmon was approximately 273,000 fish in 1981 and 265,000 fish in 1982 not including, in both years, escapement returns to tributaries between RM 6 and 77 with exception of the Yentna River (RM 28) (Table 2-4-1). These estimates represent the combined number of sockeye salmon, by respective year, counted by sonar at Yentna Station (RM 04) and estimated by the Petersen method at Sunshine Station (RM 80).

The Yentna River (RM 28) averaged escapements of second run sockeye salmon in excess of 100,000 fish in 1981 and 1982 but smaller escapements than were recorded in both years for the Susitna River at Sunshine Station (RM 80) (Table 2-4-2). The Yentna River escapement recorded with SSS counts at Yentna Station (RM 04) was approximately 139,400 fish in 1981 and 113,800 fish in 1982. At Sunshine Station, the escapements were approximately 133,500 fish in 1981 and 151,500 fish in 1982 calculated by the Petersen method.

The migration of second run sockeye salmon occurred earlier in the Susitna River basin in 1981 than in 1982. At Susitna Station (RM 26) the migration began on July 4, was midway on July 21 and terminated on July 31. In 1982 the migration began, reached a midpoint and ended on July 18, July 24 and August 5, respectively. In the Yentna River (RM 28) at Yentna Station (RM 04), the 1981 migration began on July 10, reached a midpoint on July 18 and ended on July 30. In 1982, the respective dates were July 18, July 24 and August 6. At Sunshine Station (RM 80) in 1981, the migration began, reached a midpoint, and ended on July 16, July 22 and August 8, respectively. At this station in 1982 the dates were July 20, July 27 and August 3.

The peak fishwheel catches of second run sockeye salmon also occurred earlier in 1981 than in 1982. The peak catches in 1981 were recorded on July 16 at

Susitna Station (RM 26), July 15 at Yentna Station (RM 04) and July 22 at Sunshine Station. In 1982, peak catches were recorded on July 19, July 20 and July 22 respectively.

Second run sockeye salmon can generally considered to be abundant in the Susitna River main channel from RM 26 to 80 in any year from July 4 through August 8 as determined by escapement sampling in 1981 and 1982 at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations (Figure 2-4-2).

Fishwheel catches and SSS counts recorded in 1981 and 1982 at main channel sampling locations indicate a preference by second run sockeye salmon to migrate along the west bank at Susitna Station (RM 26), south bank at Yentna Station (RM 04) and east bank at Sunshine Station (RM 80).

The migrational time for second run sockeye salmon to travel between sampling stations in 1981 and 1982 was nearly identical in one instance and substantially different in another. Fish travelling between Susitna (RM 26) and Yentna (RM 04) stations averaged the six mile trip in one day or less in both years. However, between Susitna and Sunshine (RM 80) stations, second run fish in 1981 had an average travel time of 6.8 days whereas in 1982, the average was 2.3 days for the 54 miles between RM 26 and 80.

The results of sockeye salmon age sampling indicated that the majority (70.2-83.9%) of the second run escapement at Susitna (RM 26), Yentna (RM 04) and Sunshine stations in 1981 were age 5_2 fish followed by age 4_2 fish (7.5-21.0%). The same age ranking occurred in 1982 at these locations.

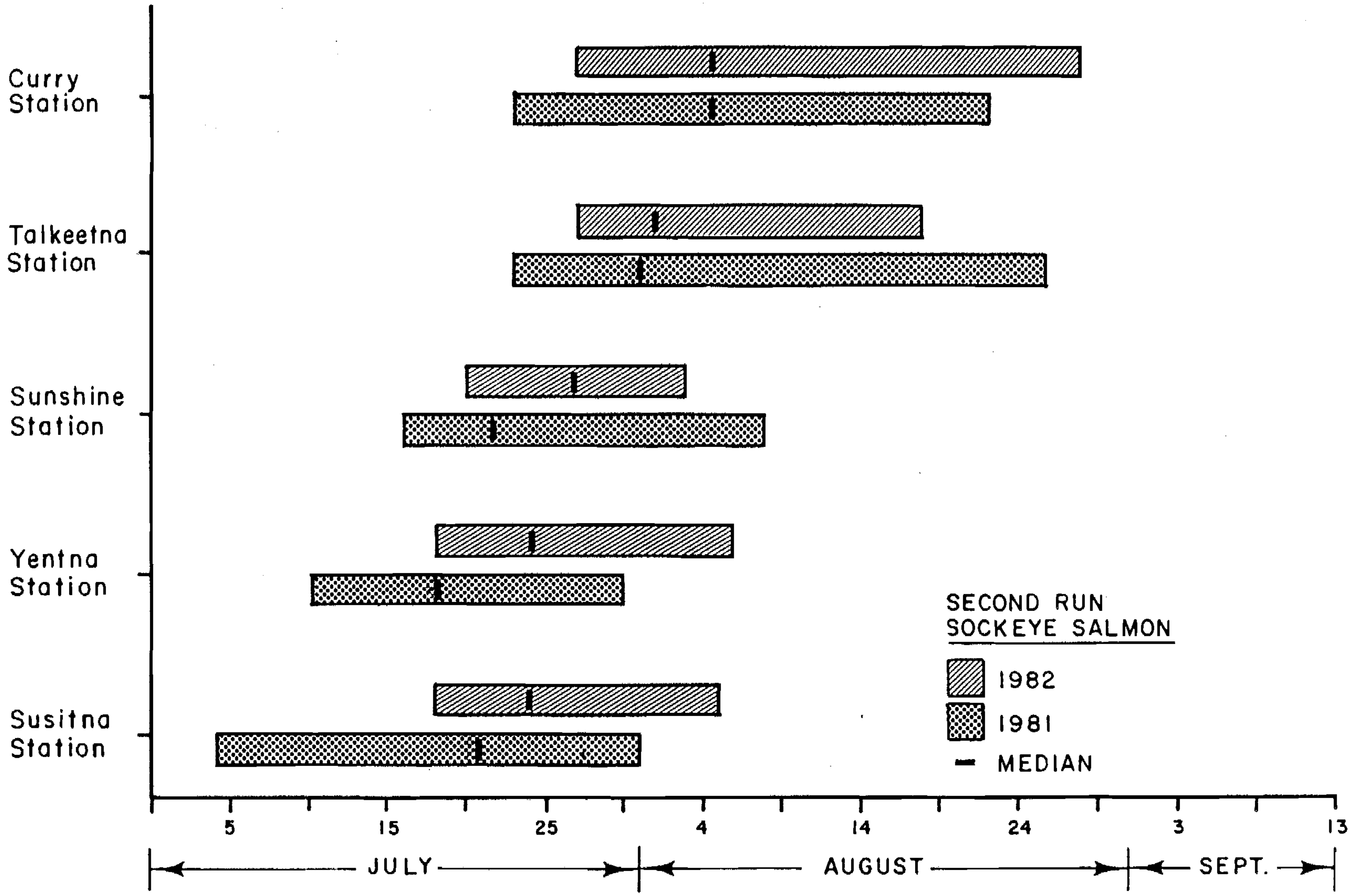


Figure 2-4-2. Migrational timing of second run sockeye salmon at selected sampling locations in the Susitna River basin in 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Distinct differences between years were the contribution of age 5_2 fish which were less abundant by percent composition in 1982 than in 1981. For example, at Susitna Station, 1981 second run age 5_2 and 4_2 fish were 83.9 and 8.4 percents of the escapement sample respectively whereas, in 1982 age 5_2 fish comprised 65.8 percent and age 4_2 fish were represented at 22.4 percent.

Nearly all of the adult second run sockeye salmon sampled for age at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1981 and 1982 had smolted as fry in their second year of life. The percent of the escapement sample in this category in 1981 was 93.0 percent at Yentna Station, 91.4 percent at Yentna Station and 92.5 percent at Sunshine Station. In 1982, the levels were 88.6, 85.4 and 95.0 percents by station order.

Second run sockeye salmon were smaller in length (FL) in 1981 than in 1982 among a composite of four and five year old fish sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations. In 1981, four year old males averaged 477 mm and the females averaged 520 mm, and five year old males and females averaged 600 mm and 566 mm, respectively. In 1982 four and five year old males and females measured 467 mm and 490 mm, and 584 and 555 mm, respectively.

Sex composition data indicated that the overall male to female sex ratio of second run sockeye salmon sampled at Susitna Station (RM 26) was 0.9:1 and 1.0:1, at Yentna Station (RM 04) 1.2:1 and 2.1:1, and at Sunshine Station (RM 80) 1.0:1 and 0.9:1 in 1981 and 1982, respectively.

4.2.2.1.2 Spawning

4.2.2.1.2.1 Main Channel

A total of 280 and 811 Susitna River main channel sites between RM 7 and 98.5 were investigated for sockeye salmon spawning in 1981 and 1982, respectively. Surveys were conducted between July 15 and October 15 in 1981 and August 7 and October 7 in 1982. The two years of investigations indicate that sockeye salmon do not utilize the Susitna River main channel between RM 7 and 98.5 for spawning.

4.2.2.1.2.2 Sloughs and Streams

4.2.2.1.2.2.1 First Run

The first run of sockeye salmon that was intercepted at Sunshine Station (RM 80) in 1982 spawned in the Fish Creek subdrainage of Chunilna (Clear) Creek, tributary to Talkeetna River (RM 97.0). No other stream or slough habitat in 1982 provided spawning habitat for these fish.

4.2.2.1.2.2.2 Second Run

Selected streams and sloughs were surveyed below RM 98.5 only as required to formulate Petersen population estimates of the 1981 and 1982 escapements of second run sockeye salmon to Sunshine Station (RM 80).

4.2.2.2 Talkeetna to Upper Devil Canyon

4.2.2.2.1 Main Channel Escapement

4.2.2.2.1.1 First Run

First run sockeye salmon were not investigated under 1981 Phase I studies.

In 1982, a total of nine (suspected) first run sockeye salmon were intercepted in fishwheels at Talkeetna Station (RM 103). These nine fish, caught between June 7 and 18, were considered stays or milling fish as no second run fish were sampled upstream of RM 103 including Curry Station (RM 120).

4.2.2.2.1.2 Second Run

The escapement of second run sockeye to Talkeetna Station (RM 103) in 1981 was approximately 4,800 fish and in 1982, 3,100 fish. At Curry Station (RM 120), the estimated escapement was 2,800 fish in 1981 and 1,300 fish in 1982. These estimates were calculated by the Petersen method.

The migration of the second run sockeye salmon to Talkeetna (RM 103) and Curry (RM 120) stations began earlier in 1981 than in 1982. In 1981 at Talkeetna Station the migration began on July 23, reached a midpoint on July 31 and ended on August 26. The migration started in 1982 on July 27, reached a midpoint on August 1 and ended on August 18. At Curry Station (RM 120), the 1981 migration began, reached a midpoint and terminated on July 23, August 5 and August 22, respectively. In 1982, these dates were July 27, August 5 and August 28.

Combined fishwheel catch data, indicated that second run sockeye salmon were generally abundant in the Susitna River main channel from RM 103 to 120 between July 23 and August 28 of any year as indicated by escapement timing data recorded in 1981 and 1982 at Talkeetna (RM 103) and Curry (RM 120) stations (Figure 2-4-2).

Based on 1981 and 1982 fishwheel catch data, second run sockeye salmon have no strong migrational preference to either the east or west bank at Talkeetna Station (RM 103). At Curry Station (RM 120) a strong preference to migrate along the east bank is evident based upon approximately 82 percent of the total fishwheel catch at Curry Station being made in the east bank fishwheel in 1981 and 1982.

The migration speeds of second run sockeye salmon between Sunshine (RM 80) and Talkeetna (RM 103) stations, from fishwheel recaptures, averaged 4.6 mpd in 1981 and 2.7 mpd in 1982. Between Talkeetna and Curry (RM 120) stations, second run sockeye salmon averaged a travel speed of 3.5 mpd in 1981 and 2.4 mpd in 1982.

Second run sockeye salmon milling activity occurred between RM 80 and 120 in 1981 and 1982 based on tagged fish recaptures. Minimum and maximum recorded travel times of tagged fish between Sunshine (RM 80) and Talkeetna (RM 103) stations were 3 and 44 days in 1981 and 2 and 17 days, in 1982.

Travel times between Talkeetna (RM 103) and Curry (RM 120) stations in 1981 ranged from 1 to 28 days and from 1 to 5 days in 1982. Between Sunshine (RM 80) and Curry (RM 120) stations the range in travel time was 5 and 41 days in 1981, and 4 and 40 days in 1982.

The majority of the second run sockeye salmon sampled for age at Talkeetna (RM 103) and Curry (RM 120) stations were age 5_2 and 4_2 fish. At Talkeetna Station age 5_2 fish comprised 70.2 percent of the sample in 1981 and 70.8 percent in 1982. The age 4_2 fish represented 22.8 percent in 1981 and 21.2 percent in 1982. At Curry Station (RM 120), age 5_2 fish comprised 65.9 percent and 32.4 percent in 1982. The age 4_2 fish represented 27.4 percent in 1981 and 30.5 percent in 1982.

Approximately 95.6 percent of the second run sockeye salmon adults sampled for age from Talkeetna (RM 103) and Curry (RM 120) station were fish that had smolted in their second year of life. In 1982, this percentage was 89.5. The balance of the adults sampled from these stations in 1981 and 1982 were fish that had smolted their first and third years of life.

Second run sockeye salmon sampled for length (FL) at Talkeetna (RM 103) and Curry (RM 120) stations measured larger in 1981 than in 1982. At Talkeetna Station, five year old males averaged 571 mm in 1981 and 590 mm in 1982. The females averaged 551 mm in 1981 and 566 mm in 1982. At Curry Station five year old males averaged 584 mm in 1981 and 573 mm in 1982. The females averaged 560 mm and 555 mm in 1981 and 1982, respectively. Four year old males sampled at Talkeetna and Curry stations had a average length of 502 mm in 1981 and 510 mm in 1982. The four year old females had a average length of 525 mm in 1981 and 505 mm in 1982.

Sex composition data established male second run sockeye salmon to be more abundant than females at Talkeetna (RM 103) and Curry (RM 120) stations by a average ratio of 0.7:1 in 1981 and 1.7:1 in 1982. Among four year old second run sockeye salmon sampled at both stations in both years males outnumbered females, and among five year old fish females outnumbered males.

4.2.2.2.2 Lower Devil Canyon Milling

In 1981, gill nets were fished in lower Devil Canyon (RM 150-151) on July 29, August 5 and 26, September 2, 10 and 19 for a total of 30.2 hours. This effort produced a catch of two sockeye salmon. Both fish were intercepted on August 26, 1981. In 1982 gill nets were fished on August 10, 16, 22 and 28 and September 12 at RM 150.2 and 150.4. No sockeye salmon were caught in the 19.6 hours fished. Electroshocking conducted on August 11 and 18 and September 5 and 23 in the same area in 1982 also produced no sockeye salmon.

The 1981 and 1982 set net and 1982 electroshocking efforts indicate sockeye salmon are not commonly present in lower Devil Canyon (RM 150-151) in late July, August or early September.

4.2.2.2.3 Spawning

4.2.2.2.3.1 Main Channel

The Susitna River main channel was surveyed from July 15 to October 15, 1981 and from August 7 to October 7, 1982 for sockeye salmon spawning. A total of 37 and 397 main channel locations were examined in 1981 and 1982, respectively from RM 98.5 to 150. Data indicates that sockeye salmon spawning did not occur in the Susitna River main channel between RM 98.5 and 150 in 1981 or 1982.

4.2.2.2.3.2 Sloughs and Streams

Spawning ground surveys were conducted between RM 98.6 and 161.0 in 33 sloughs in 1981 and in 34 sloughs in 1982 with the addition of Slough B (RM 126.3) a newly located habitat. Sockeye salmon were observed in 12 of the 33 and 10 of the 34 slough habitats, respectively in years 1981 and 1982.

Sockeye salmon were nearly twice as abundant in slough habitats in 1981 than in 1982. The peak survey counts of live and dead sockeye salmon totalled 1,241 fish in 1981 and 607 fish in 1982. These numbers represent a relative index of the sockeye salmon escapement to slough habitats between RM 98.6 and 161.0.

In 1981, sockeye salmon were most abundant in sloughs: 11 (72.0%), 8A (14.3%), 9B (6.5%), 21 (3.1%), 19 (1.9%), 9 (0.8%), 3A (0.6%), 17 (0.5%), 9A (0.2%) and 20 (0.2%), 3B(0.1%), and 6A (0.1%). And in 1982, these sloughs were: 11 (75.0%), 8A (11.2%), 21 (8.7%), Moose (1.3%) and B (1.3%), 8B (0.8%) and 9 (0.8%), 8C (0.3%), 9B (0.2%) and 9A (0.2%).

Not all sloughs occupied by adult sockeye salmon in 1981 were occupied in 1982. Sloughs 3B, 3A, 6A, 17, 19 and 20 occupied by sockeye salmon in 1981 were not occupied in 1982. Conversely, sockeye salmon were recorded in 8C, 8B, and Moose sloughs in 1982 but not in 1981. Sockeye salmon were observed in Slough B in 1982, a new located fish habitat.

Peak spawning of sockeye salmon occurred in slough habitats during the last week of August and first three weeks of September in 1981 and 1982 (Figure 2-4-3).

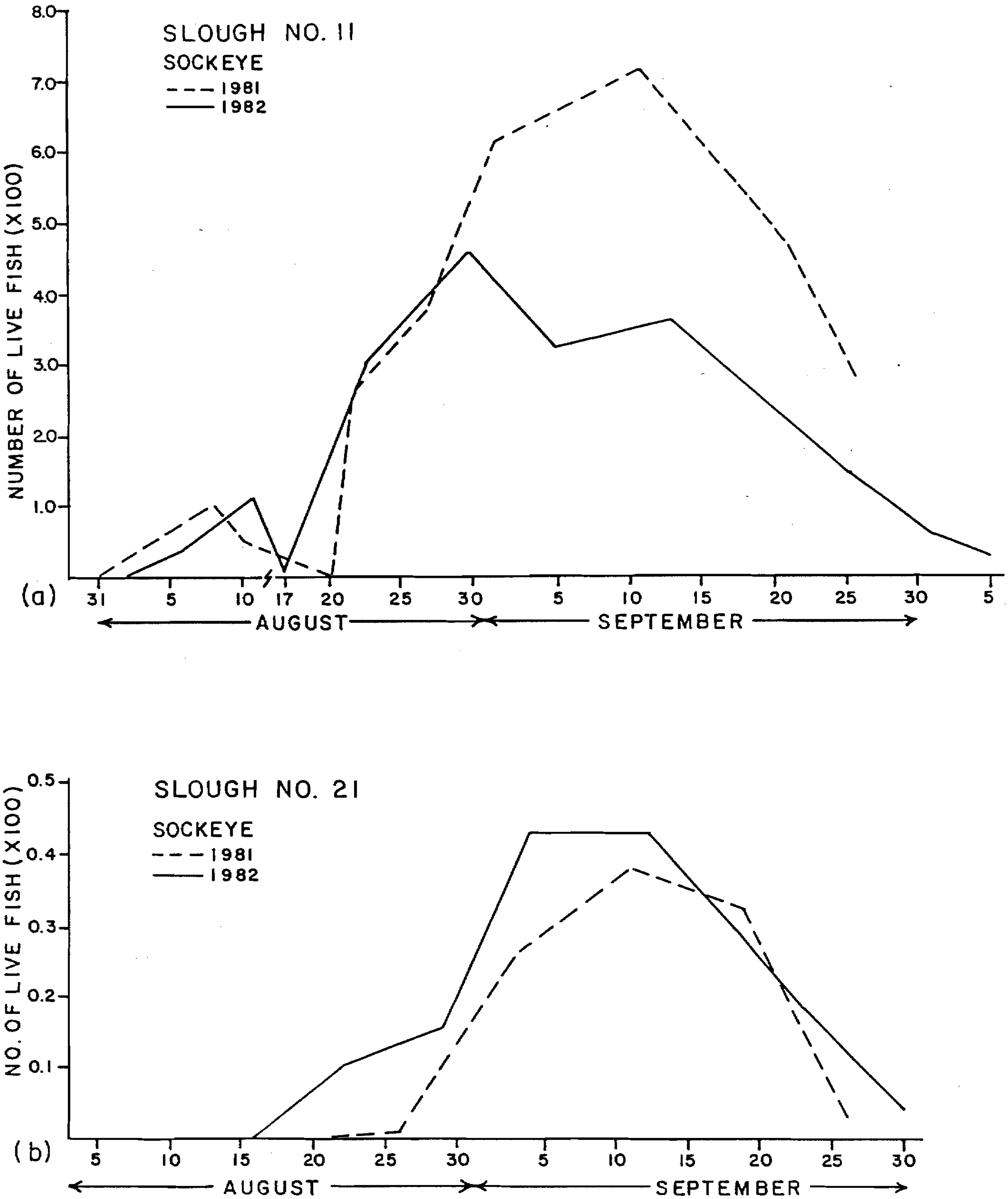


Figure 2-4-3. Sockeye salmon live counts by date in (a) Slough No. 11 and (b) Slough No. 21 for 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

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Fifteen streams between RM 98.6 and 161.0 were surveyed for adult sockeye salmon in 1981 and 19 streams were surveyed in 1982. Only one stream in each year had sockeye salmon present. In 1981, a single sockeye salmon was observed on August 23 in lower McKenzie Creek (RM 116.2) and in 1982 four were counted in Portage Creek on August 29. These fish were not observed spawning and were considered strays or milling fish.

Chase Creek (RM 106.9) and Indian River (RM 138.6) lake systems were not surveyed in 1981 and 1982 in accordance with 1981 Phase I and 1982 Phase II project scopes. These areas will require investigation before sockeye salmon can be disassociated with stream systems in the RM 98.6 to 161.0 Susitna River reach.

4.2.2.2.4 Stock Separation

The sockeye salmon that migrated to Curry Station (RM 120) in 1982 may not be a discrete stock of fish but strays from the Talkeetna (RM 97.0) and Chulitna (RM 98.5) rivers in 1982. Based on a stock separation analysis, the sockeye salmon fry produced from spawning habitats upstream of Curry Station (RM 120) most likely die or rear in areas in the Susitna River basin below RM 98.5 (Bernard et al, 1983).

4.2.3 Pink Salmon

4.2.3.1 Estuary to Talkeetna

4.2.3.1.1 Main Channel Escapement

The Susitna River escapement of pink salmon was approximately 85,500 fish in 1981 and 890,500 fish in 1982 not including returns in both years to systems between RM 6 and 77, with the exception of the Yentna River (RM 28) (Table 2-4-1). These escapement estimates represent the combined number of pink salmon by respective year counted by sonar at Yentna Station (RM 04) and estimated by the Petersen method at Sunshine Station (RM 80).

The pink salmon escapement to the Yentna River (RM 28) in 1981 was approximately 36,100 fish and in 1982, 447,300 fish as determined by SSS counters. At Sunshine Station (RM 80) the escapement in 1981 was an estimated 49,500 fish and in 1982, 443,200 fish as determined by the Petersen method.

Fishwheels used for escapement sampling at Susitna Station (RM 26) intercepted 691 pink salmon in 1981 and 5,174 fish in 1982. The peak catches occurred on July 28 in 1981 and July 29 in 1982. Based on fishwheel catch rates the 1981 migration began on July 18, reached a midpoint on July 28 and ended on August 2. These dates for 1982 were July 23, July 28 and August 6.

At Yentna Station (RM 04) the total fishwheel catch of pink salmon was 2,729 fish in 1981 and 16,627 fish in 1982. The peak catches occurred on July 30 in 1981 and on July 29 in 1982. Fishwheel catch rates established that the 1981 migration began, reached a midpoint and ended on July 10, July 30 and August 24. In 1982 these dates were July 23, July 29 and August 7.

Sunshine Station (RM 80) fishwheels caught 7,099 and 47,671 pink salmon in the 1981 and 1982 seasons, respectively. The peak 1981 catch occurred on August 1 and in 1982 on August 3. The migration at Sunshine Station in 1981 began on July 26, reached a midpoint on August 1 and ended on August 14. In

1982 the migration began, reached a midpoint and ended on July 29, August 3 and August 10, respectively (Figure 2-4-4).

Based on fishwheel catches pink salmon at Susitna (RM 26) and Sunshine (RM 80) stations in 1981 and 1982 displayed a migrational preference to travel along the east bank of the Susitna River at these locations. In 1981 at Susitna Station the east bank fishwheel intercepted 57.5 percent of the pink salmon caught at this station and 59.8 percent in 1982. The Sunshine Station (RM 80) east bank fishwheels caught 91.3 percent in 1981 and 91.7 percent in 1982 of the station catch. At Yentna Station (RM 04) 54.5 percent in 1981 and 63.2 percent in 1982 of the station catch was made with the south bank fishwheel indicating a general preference by pink salmon for travelling along the south bank.

Pink salmon measured for length (FL) at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations averaged 4 mm to 49 mm larger in 1981 than in 1982. In 1981 the male and female pink salmon lengths at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations averaged 444 mm and 433 mm; 478 mm and 471 mm; and 445 mm and 449 mm, respectively. The same stations in 1982 averaged 432 mm and 412 mm; 433 mm and 422 mm; and 441 mm and 423 mm, respectively for male and female pink salmon lengths.

Sex composition sampling established that female pink salmon outnumbered male pink salmon in 1981 at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations by a 0.4:1, 0.8:1 and 0.8:1 male to female ratio, respectively. In 1982 the male to female ratios recorded at Susitna and Yentna stations, 1.0:1

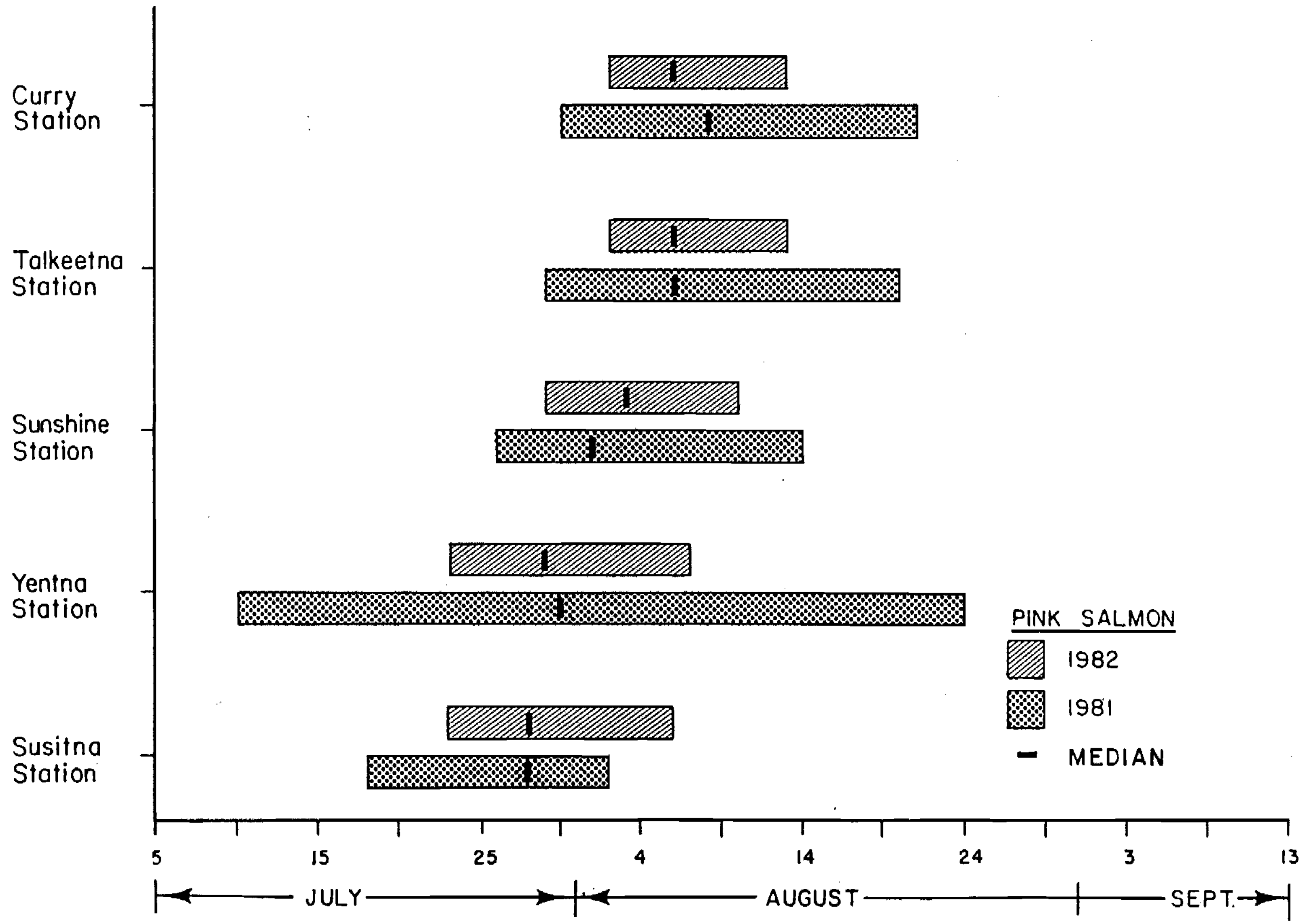


Figure 2-4-4. Migrational timing of pink salmon at selected sampling locations in the Susitna River basin in 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

and 1.0:1 respectively, showed that male and female pink salmon were equally abundant whereas at Sunshine Station the males outnumbered the females by a 1.8:1 ratio.

4.2.3.1.2 Main Channel Spawning

The Susitna River main channel between RM 7 and 98.5 was surveyed for pink salmon spawning from July 15 to October 7, 1981 and from August 1 to October 13, 1982. Surveys were conducted at 280 sites in 1981 and 811 sites in 1982. Both years of survey data indicate that pink salmon do not spawn in the Susitna River main channel between RM 7 and 98.5 as no spawning areas were found.

4.2.3.2 Talkeetna to Upper Devil Canyon

4.2.3.2.1 Main Channel Escapement

The 1982 escapements of pink salmon to Talkeetna (RM 103) and Curry (RM 120) stations exceeded the 1981 escapements. At Talkeetna Station in 1981 the escapement calculated by the Petersen method was approximately 2,300 pink salmon while in 1982 the escapement was estimated at 73,000 fish. At Curry Station the escapement was approximately 1,000 and 58,800 pink salmon in 1981 and 1982, respectively.

Based on fishwheel catch rates, the 1981 pink salmon migration at Talkeetna Station (RM 103) began, reached a midpoint and terminated on July 29, August 6 and August 20, respectively. In 1982 the migrational beginning, midpoint and end was on August 2, August 6 and August 13 respectively (Figure 2-4-4).

The peak fishwheel catches were on August 8 in 1981 and on August 6 in 1982. At Curry Station (RM 120) the 1981 pink salmon migration began, reached a midpoint and ended on July 30, August 8 and August 21, and in 1982 on August 2, August 6 and August 13, respectively. The peak fishwheel catches at Curry Station occurred on August 8 and August 5 respectively in 1981 and 1982.

Fishwheel catches at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 and 1982 indicate that pink salmon prefer to travel along the east side of the Susitna River at both locations. In 1981, 59.4 and 69.9 percent of the pink salmon were caught with east side fishwheels at Talkeetna and Curry stations, respectively. In 1982, these percentages were 55.6 and 51.8 by station order.

Based on tagged recaptures, pink salmon migrated between Sunshine (RM 80) and Curry (RM 120) stations at a slower rate in 1981 than in 1982. Between Sunshine Station and Talkeetna Station (RM 103), and between Talkeetna Station and Curry Station the average travel speed in 1981 was 2.6 mpd and 6.0 mpd, respectively. In 1982 the average speed between Sunshine and Talkeetna stations was 7.4 mpd and between Talkeetna and Curry stations 10.0 mpd. The faster migration rate exhibited in 1982 may be due in part to between year differences in water temperature and or water velocity (flow).

Pink salmon had larger average lengths (FL) in 1981 than in 1982 at both Talkeetna (RM 103) and Curry (RM 120) stations. Male and female pink salmon both averaged 434 mm in 1981 at Talkeetna Station and averaged 432 mm at Curry Station. In 1982 at Talkeetna Station males averaged 425 mm and the females 428 mm. And at Curry Station the males averaged 417 mm and the females 421 mm.

Sex composition sampling established that male pink salmon were more abundant than females in both 1981 and 1982 at Talkeetna Station (RM 103) by a 1.2:1 and 1.6:1 male to female ratio, respectively. In 1981 at Curry Station (RM 120) males were less numerous than females by a ratio of 0.8:1 while in 1982, males outnumbered females by a 1.5:1 ratio.

4.2.3.2.2 Lower Devil Canyon Milling

In 1981, gill nets were fished in lower Devil Canyon on July 29, August 5 and 26, September 2, 10 and 19, between RM 150.1 and 150.4. There were no pink salmon catches made on any of these dates. In 1982, the same gear was fished at RM 150.2 and 150.4 and one pink salmon was caught on August 10 and none were caught on August 16, 22 and 28 or September 12. Electroshocking gear was also used at RM 150.4 in 1982 on August 11, 18, September 5 and 23. Two pink salmon were caught on August 11 and one was caught on August 18. There were no pink salmon caught on September 5 or 23.

Catch results indicate that in 1981 pink salmon were not present in lower Devil Canyon from July 29 to September 19. In 1982, pink salmon were present only at relatively minimum levels between August 10 and 18.

4.2.3.2.3 Spawning

4.2.3.2.3.1 Main Channel

The Susitna River main channel between RM 98.5 and 150.0 was surveyed for pink salmon spawning from July 15 to October 15, 1981 and from August 1 to October 13, 1982. A total of 37 and 397 sites were examined in 1981 and

1982, respectively. Both years of survey data indicate that pink salmon do not spawn in the Susitna River main channel between RM 98.5 and 150.0 as no spawning habitat was found.

4.2.3.2.3.2 Sloughs and Streams

In 1981 and 1982, 33 and 34 sloughs, respectively between RM 98.6 and 161.0 were surveyed for salmon presence. Pink salmon were found in 3 of 33 (9.1%) sloughs surveyed in 1981 and 10 of 34 (29.4%) surveyed in 1982.

The total peak counts of live and dead pink salmon in slough habitats in 1982 was 28 fish and in 1982 507 fish. The fish were most abundant in sloughs 8 (89.3%) and A (7.1%) in 1981, and sloughs 15 (26.0%), 11 (25.8%), 20 (12.6%), 21 (12.6%), 6A (6.9%) and B (6.3%) in 1982. The peak of spawning occurred in the third and fourth weeks of August in 1981 and 1982.

Stream habitats were surveyed for the presence of salmon and pink salmon were found in 9 of the 15 streams (60.0%) surveyed in 1981 and 14 of the 19 (73.7%) in 1982. Peak survey counts of live and dead pink salmon in the stream index areas totalled 378 and 2,855 fish in 1981 and 1982, respectively. The pink salmon were most abundant in the index areas of Lane Creek (77.0%), Chase Creek (10.1%) and Fourth of July Creek (7.7%) in 1981, and Indian River (25.9%), Fourth of July Creek (24.6%), Lane Creek (22.4%) and Portage Creek (5.9%) in 1982.

The peak of spawning by pink salmon in stream habitats, including Lane Creek, occurred in the third and fourth weeks of August in 1981 and the second and third weeks of August in 1982 as determined by index counts (Figure 2-4-5).

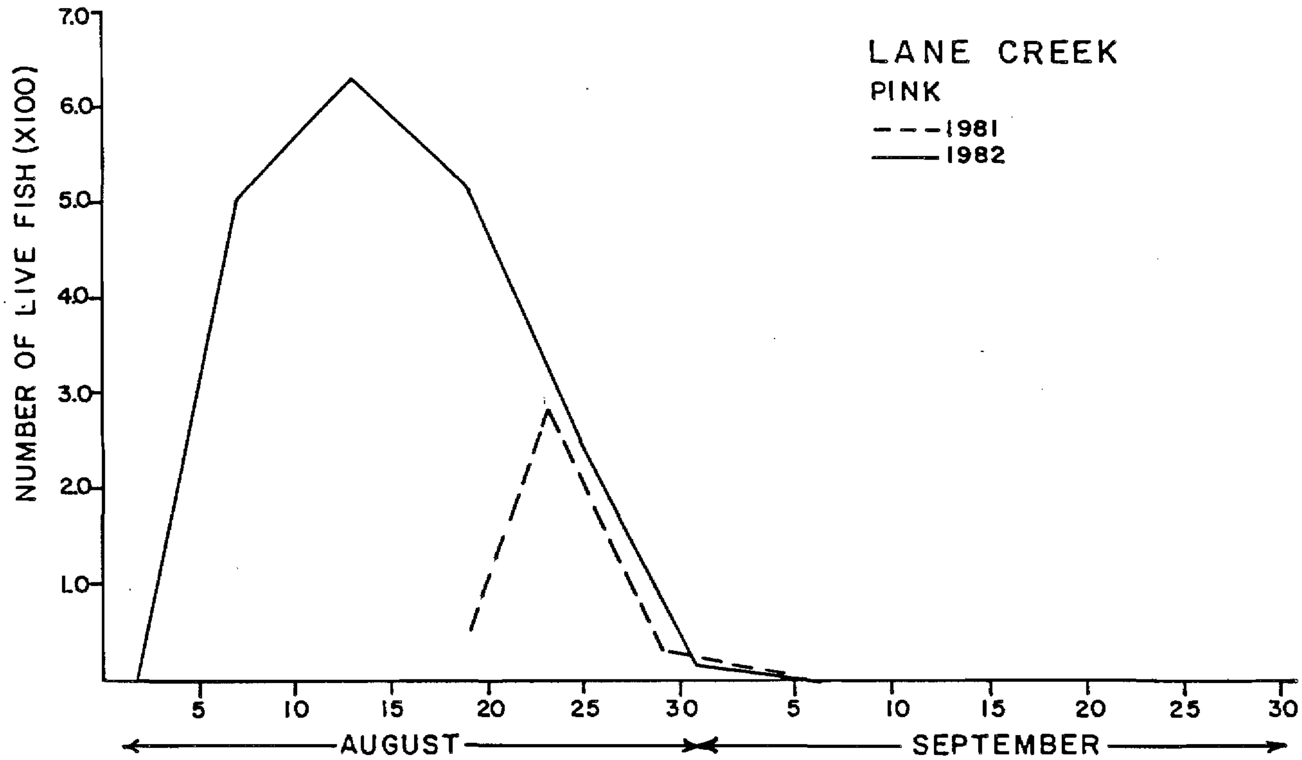


Figure 2-4-5. Pink salmon live counts by date in Lane Creek for 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

4.2.4 Chum Salmon

4.2.4.1 Estuary to Talkeetna

4.2.4.1.1 Main Channel Escapement

The Susitna River escapement of chum salmon was approximately 283,000 fish in 1981 and 458,000 fish in 1982, not including escapement returns in both years to systems between RM 6 and 77 with exception of the Yentna River (RM 28) (Table 2-4-1). These escapement estimates represent the combined number of chum salmon counted by sonar at Yentna Station (RM 04) and estimated by the Petersen method to Sunshine Station (RM 80) for each year (Table 2-4-2).

The Yentna River (RM 28) chum salmon escapement was approximately 19,800 fish in 1981 and 27,800 fish in 1982 as determined by SSS counters at Yentna Station (RM 04) (Table 2-4-2). The chum salmon escapement to Sunshine Station (RM 80) was estimated at 262,900 fish in 1981 and in 1982 at 430,400 fish by the Petersen method.

Fishwheels used for escapement sampling at Susitna Station (RM 26) intercepted 250 chum salmon in 1981 and 382 in 1982. The peak catches occurred on July 31 in 1981 and on August 3 in 1982. Based on catch rates the migration of chum salmon in 1981 began on July 10, reached a midpoint on July 31 and ended on August 24 at Susitna Station. In 1982 these dates were July 19, July 31 and August 10, respectively (Figure 2-4-6).

In the Yentna River (RM 28) at Yentna Station (RM 04) a total of 1,415 and 1,261 chum salmon were caught with fishwheels respectively in 1981 and 1982. The peak fishwheel catches occurred on July 23 in 1981 and on August 1 in 1982.

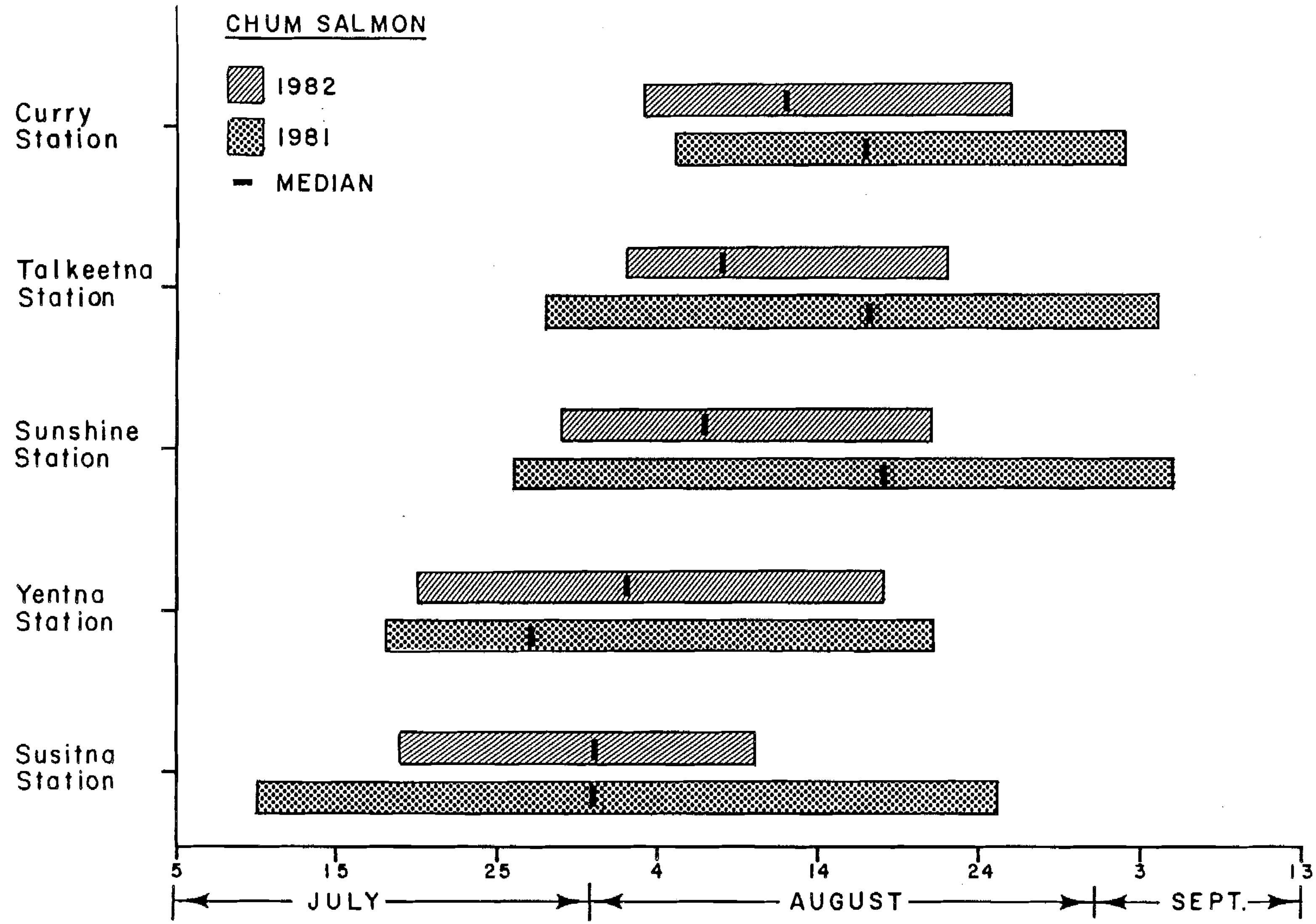


Figure 2-4-6. Migrational timing of chum salmon at selected sampling locations in the Susitna River basin in 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

As determined from fishwheel catches, the chum salmon migration in 1981 at Yentna Station began on July 18, reached a midpoint on July 27 and terminated on August 21. In 1982 the migration began on July 20, reached a midpoint on August 2 and ended August 18 (Figure 2-4-6).

Sunshine Station (RM 80) fishwheels intercepted a total of 9,168 chum salmon in 1981 and 36,335 in 1982. The peak catches were recorded on August 19 in 1981 and August 5 in 1982. Based on fishwheel catch rates the migration at Sunshine Station in 1981 began, reached a midpoint and ended on July 26, August 18 and September 5. The 1982 dates were July 29, August 7 and August 21 (Figure 2-4-6).

The majority (60.0%) of the chum salmon migrated past Susitna Station (RM 26) along the east bank in 1981 while in 1982 the majority (55.5%) migrated along the west bank, based upon fishwheel catches. In the Yentna River (RM 28) at Yentna Station (RM 04), 66.3 percent of the fish in 1981 and 70.8 percent in 1982 migrated off the north bank. And at Sunshine Station (RM 80) 90.8 percent in 1981 and 96.7 percent in 1982 of the chum salmon migrated along the east side of the river as indicated by fishwheel catches.

Three age classes (3_1, 4_1 and 5_1) of chum salmon were sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in both 1981 and 1982. The majority of the fish aged in both years were age 4_1 fish. At Susitna, Yentna and Sunshine stations in 1981 the percent composition of age class 4_1 fish were 88.6, 84.1 and 88.7 percents; and in 1982, 84.4, 90.3 and 91.1, respectively.

Chum salmon lengths (FL) generally averaged less in 1981 at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations than in 1982. At Susitna Station in 1981, chum salmon ranged in length from 500 mm to 658 mm; age 4_1 males averaged 593 mm and females 581 mm. In 1982, lengths ranged from 458 mm to 682 mm with age 4_1 males averaging 602 mm and females, 594 mm. In 1981 at Yentna Station lengths ranged from 436 mm to 697 mm; age 4_1 males averaged 601 mm and females 585 mm. Lengths ranged from 398 mm to 696 mm in 1982 with age 4_1 males averaging 604 mm and females 591 mm. In 1981 at Sunshine Station lengths ranged from 455 mm to 718 mm with age 4_1 males averaging 624 mm and females 588 mm. Lengths in 1982 ranged from 440 mm to 715 mm with age 4_1 males averaging 614 mm and females 600 mm.

Sex composition analysis established that chum salmon males were generally less numerous than females at Susitna (RM 26), Yentna (RM 26) and Sunshine (RM 80) stations. Male to female ratios were 0.6:1, 1.0:1 and 0.8:1, respectively. In 1982 the male to female ratio at Susitna Station was 0.6:1, at Yentna Station 1.3:1 and at Sunshine Station 1.0:1.

4.2.3.1.2 Main Channel Spawning

The Susitna River main channel from RM 7 to 98.5 was surveyed for chum salmon spawning from July 15 to October 7, 1981 and from August 1 to October 13, 1982. A total of 280 and 811 sites were examined in 1981 and 1982, respectively.

Six chum salmon spawning sites between RM 7 and 98.5 were located in 1981. The locations were at RM 68.3, 76.6, 83.3, 92.2, 96.8 and 97.0. The earliest recorded spawning was September 5 at RM 83.3 and the latest recorded spawning was October 9 at RM 92.2 in 1981.

All main channel chum salmon spawning sites located in 1981 were examined in 1982. The results indicated that chum salmon did not use these or any other main channel areas from RM 7 to 98.5 for spawning in 1982.

4.2.4.2 Talkeetna to Upper Devil Canyon

4.2.4.2.1 Main Channel Escapement

The 1981 and 1982 estimated chum salmon escapements to Talkeetna Station (RM 103) were 20,800 and 49,100 fish, respectively (Table 2-4-2). Both estimates were calculated by the Petersen method. At Curry Station (RM 120) the chum salmon escapement was estimated, by the Petersen method, in 1981 at 13,100 fish and in 1982, 29,400 fish.

Fishwheels were operated at Talkeetna Station (RM 103) in 1981 and 1982 for escapement sampling. A total of 1,285 and 2,942 chum salmon were caught respectively at this station in 1981 and 1982. The fishwheel peak catches occurred on August 7 in both years. An evaluation of catches established that the 1981 migration of chum salmon at Talkeetna Station began July 28, reached a midpoint on August 17 and ended on September 4. The respective dates in 1982 were August 2, August 8 and August 22 (Figure 2-4-6).

Curry Station (RM 120) fishwheels intercepted 1,276 and 1,736 chum salmon respectively in 1981 and 1982. The peak catches occurred on August 6 in 1981 and on August 9 in 1982. Based on fishwheel catches, the chum salmon migration in 1981 began, reached a midpoint and terminated on August 5, August 17 and September 2. In 1982 the respective dates were August 3, August 12 and August 26 (Figure 2-4-6).

Chum salmon were more abundant on the west side of the river than on the east side at Talkeetna Station (RM 103) in both 1981 and 1982. The west bank fishwheels caught 51.3 percent and 58.4 percent of the Talkeetna Station catches in 1981 and 1982, respectively. At Curry Station (RM 120) the majority of the chum salmon migrated on the east side of the river. In 1981 and 1982, 89.6 percent and 77.5 percent of the respective year catch was made with the east bank fishwheel at RM 120.

Chum salmon took more time to migrate between Sunshine (RM 80) and Talkeetna (RM 103) stations and between Talkeetna and Curry (RM 120) stations in 1981 than in 1982. Chum salmon spent an average 4.5 days travelling the 23 miles between Sunshine and Talkeetna stations in 1981 and 3.1 days in 1982. Between Talkeetna and Curry, the average travel time was 4.5 days in 1981 and 2.6 days in 1982. The average migration time spent travelling between Sunshine and Curry stations (40 miles) in 1981 was not determined due to an insufficient number of recaptures. In 1982, a sufficient number of recaptures were made to determine the average travel time for chum salmon to be 6.4 days between Sunshine and Curry stations.

Three age classes of chum salmon were represented in both the 1981 and 1982 chum salmon escapements sampled at Talkeetna (RM 103) and Curry (RM 120) stations. The majority of the fish were age 4_1 representing 85.2 percent in 1981 and 87.1 percent in 1982 of the Talkeetna Station escapement sample, and

84.0 percent in 1981 and 85.8 percent in 1982 of the Curry Station escapement sample. The remainder of the fish were in age classes 3_1 and 5_1.

The average length (FL) of chum salmon was smaller in 1981 than in 1982 among the fish sampled at Talkeetna (RM 103) and Curry (RM 120) stations. The age 4_1 males averaged 586 mm in 1981 at Talkeetna Station and 610 mm in 1982. The females, age 4_1, averaged 578 mm and 601 mm in 1981 and 1982, respectively. At Curry Station males averaged 593 mm in 1981 and 603 mm in 1982; females averaged 614 mm and 596 mm respectively.

Male chum salmon were more abundant than female chum salmon in both 1981 and 1982 at Talkeetna (RM 103) and Curry (RM 120) stations. The male to female ratio was 1.3:1 at Talkeetna Station and 1.1:1 at Curry Station in 1981. In 1982, the ratios were 1.9:1 and 1.1:1, respectively.

4.2.4.2.2 Radio Telemetry

Four chum salmon were radio tagged at Talkeetna Station (RM 103) in 1981 and ten were tagged there in 1982.

One of the four radio tagged fish released at Talkeetna Station (RM 103) in 1981 and six of the ten fish released in 1982 spawned below Talkeetna Station mainly in the Talkeetna River (RM 97.0). These findings indicated that a major percentage of the chum salmon reaching RM 103 were not destined to upstream spawning areas but were fish milling above their spawning areas. No common milling or holding areas, however, were identified in the Susitna River mainstem among the radio tagged fish released at RM 103 in either year.

Seven chum salmon were tagged at Curry Station (RM 120) in 1981 and eight were tagged at the station in 1982. Six of the radio tagged fish in 1981 and five of the fish released in 1982 migrated to upstream spawning destinations. The remainder, one fish in 1981 and 3 fish in 1982, descended the Susitna River and presumably spawned in systems below Talkeetna Station (RM 103) including an unnamed slough at RM 98.5 and the Talkeetna River (RM 97.0).

The numbers of radio tagged chum salmon that spawned below Talkeetna (RM 103) and Curry (RM 120) stations indicated a greater degree of milling activity among chum salmon migrating to Talkeetna Station than to Curry Station in both 1981 and 1982.

Chum salmon migration speeds recorded in years 1981 and 1982 indicate that radio tagged chum salmon migrated upstream faster in 1982 than in 1981. For example, in 1982 a Talkeetna Station (RM 103) tagged fish was monitored moving at 29.8 mpd and a Curry Station (RM 120) fish was recorded travelling at 17.3 mpd. Comparatively, the fastest recorded speed of a Talkeetna and Curry station tagged chum salmon in 1981 was 16.4 mpd and 12.0 mpd, respectively. The between year differences in travel speed were probably related to main channel flow differences.

In 1982, two chum salmon were radio tagged in lower Devil Canyon at RM 150.4. Both fish moved downstream from the release site within four days and entered Portage Creek (RM 148.9). These fish later departed Portage Creek and re-entered the Susitna River mainstem and continued a downstream movement. One fish entered and presumably spawned in Indian River (RM 138.6) and the second fish descended to RM 92.0 where radio contact was lost. The milling behavior demonstrated by the movements of these two fish was considered typical. From 1981 and 1982 radio tracking observations of fish released at Talkeetna and Curry stations, chum salmon commonly exhibit such migrational movements before spawning.

4.2.4.2.3 Lower Devil Canyon Milling

In 1981, gill nets were fished 30.2 hours in lower Devil Canyon (RM 150-151) between July 29 and September 19. The total catch was two chum salmon. These were caught on July 29. There were no catches made on August 5 and 26, September 2, 10 or 19. In 1982, 25 chum salmon were caught between August 10 and September 12 in 19.6 net hours. Ten fish were caught August 16, and 15 fish on August 22. No catches were made on August 10 and 28 or September 12 in 1982. Electroshocking was also conducted in lower Devil Canyon in 1982. The effort produced five chum salmon on August 11, and 12 fish on August 18. No chum salmon were caught by electroshocking on September 5 or 23.

Based on 1981 and 1982 set net and 1982 electroshocking catches, chum salmon occupy lower Devil Canyon, particularly during the last three weeks of August.

None of the 11 radio tagged fish released at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 nor any of the 18 fish released at these locations in 1982 entered lower Devil Canyon (RM 150-151) (Section 4.2.4.2.2). In 1982 two chum salmon caught in gill nets in lower Devil Canyon were released with radio tags. The results are reported in section 4.2.4.2.2.

4.2.4.2.4 Spawning

4.2.4.2.4.1 Main Channel

A total of 37 and 397 main channel Susitna River sites were surveyed for chum salmon spawning in 1981 and 1982, respectively. These sites were distributed from RM 98.5 to 150. The surveys were conducted from July 15 to October 15 in 1981 and from August 7 to October 7 in 1982.

Four main channel chum salmon spawning sites were located in 1981. The locations were at RM 129.2, 130.5, 131.1 and 135.2 where 2, 3, 3 and 6 chum salmon respectively were observed spawning between September 6 and 8.

In 1982 main channel surveys identified nine chum salmon spawning sites. These sites were located at RM 114.4, 128.6, 129.8, 131.3, 136.0, 137.4, 138.9, 143.3 and 148.2. Chum salmon spawning activity was observed at all sites between September 2 and 12.

4.2.4.2.4.2 Sloughs and Streams

Chum salmon escapement surveys were conducted in 33 sloughs in 1981 and with the addition of the newly identified Slough B (RM 126.3) 34 sloughs were surveyed in 1982. Chum salmon were observed in 20 of 33 sloughs (60.6%) surveyed in 1981 and 17 of 34 (50.0%) in 1982.

Peak survey counts of live and dead chum salmon indicate that the escapement to slough habitats was slightly higher in 1981 than in 1982. The 1981 peak count totalled 2,567 and in 1982, 2,244 fish. In 1981 chum salmon were most abundant in sloughs 8A (24.2%), 11 (15.0%), 8 (11.8%), 21 (10.7%) and 9 (10.1%). And in 1982 sloughs 21 (32.8%), 11 (20.5%), 8A (15.0%) and 9 (13.4%) supported the majority of the fish.

Not all sloughs used by chum salmon in 1981 were used in 1982. Chum salmon were observed in sloughs 1, 2, 8, A[1], A, 13, 16, 19 and 21A in 1981 but not in 1982. Conversely, chum salmon were observed in sloughs 8D, 8C, 8B and 10 in 1982 but not in 1981. Chum salmon were also observed in the newly located Slough B in 1982.

Slough survey results indicated peak chum salmon spawning in sloughs occurred during the last week of August and the first week of September in 1981 and 1982 (Figures 2-4-7 and 2-4-8).

Chum salmon were observed in 8 of the 15 streams (53.3%) surveyed in 1981 and 8 of the 19 streams (42.1%) surveyed in 1982. Peak spawning counts in 1981 established that chum salmon were most abundant in Fourth of July Creek (RM 131.0), Lane Creek (RM 113.6) and Indian River (RM 138.6) where the respective index counts were 90, 76 and 40 fish. In 1982 chum salmon were most abundant in Indian River, Fourth of July Creek and Portage Creek (RM 148.9) where 1,346, 191 and 153 fish, respectively were counted.

Based on stream surveys the peak of chum salmon spawning occurred from the second week of August to the second week of September in 1981 and during the last week of August and the first week of September in 1982.

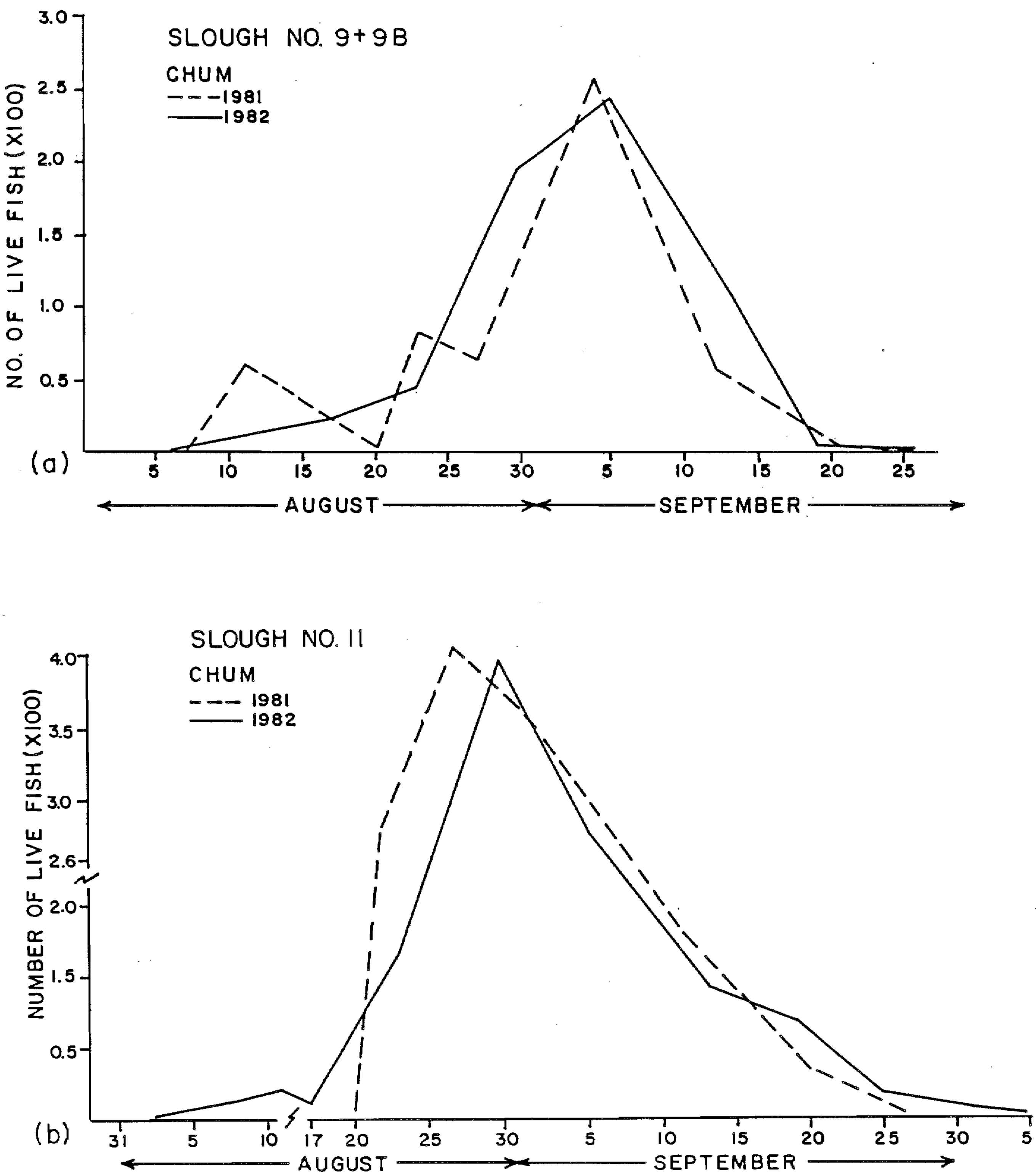
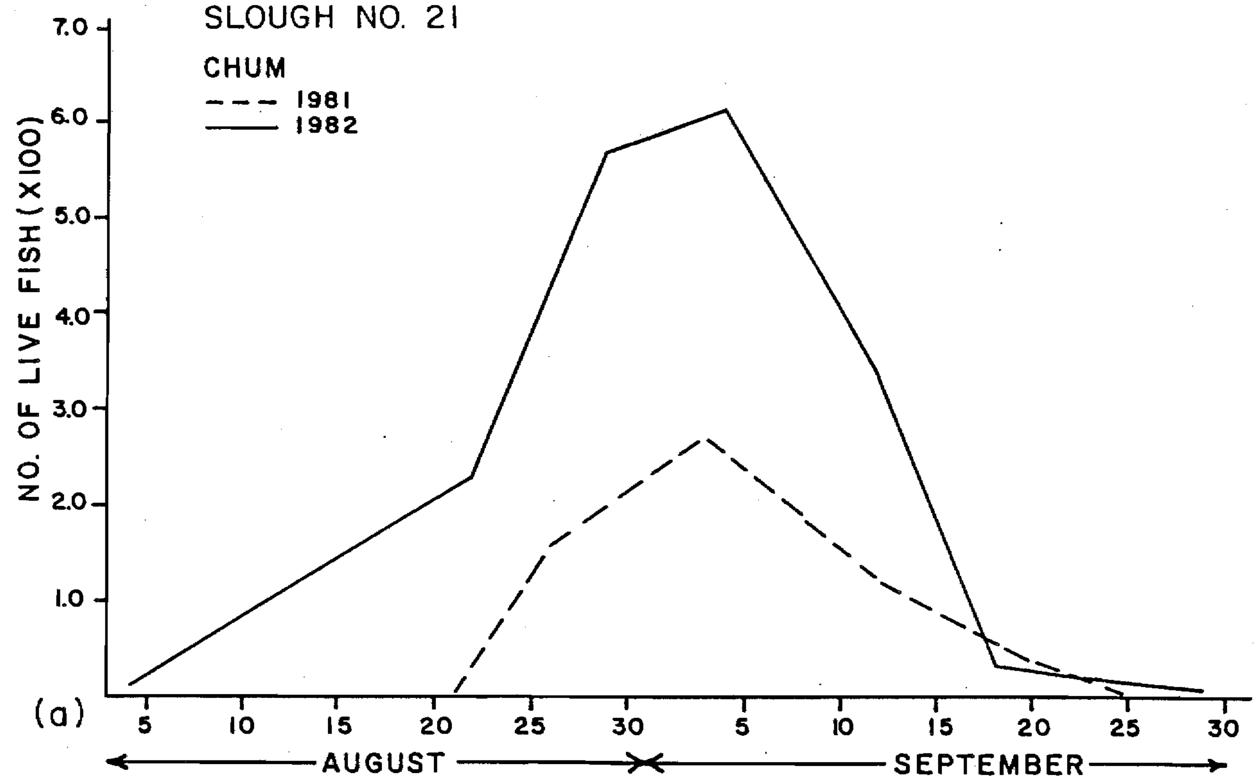


Figure 2-4-7. Chum salmon live counts by date in (a) Slough No. 9+9B and (b) Slough No. 11 for 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.



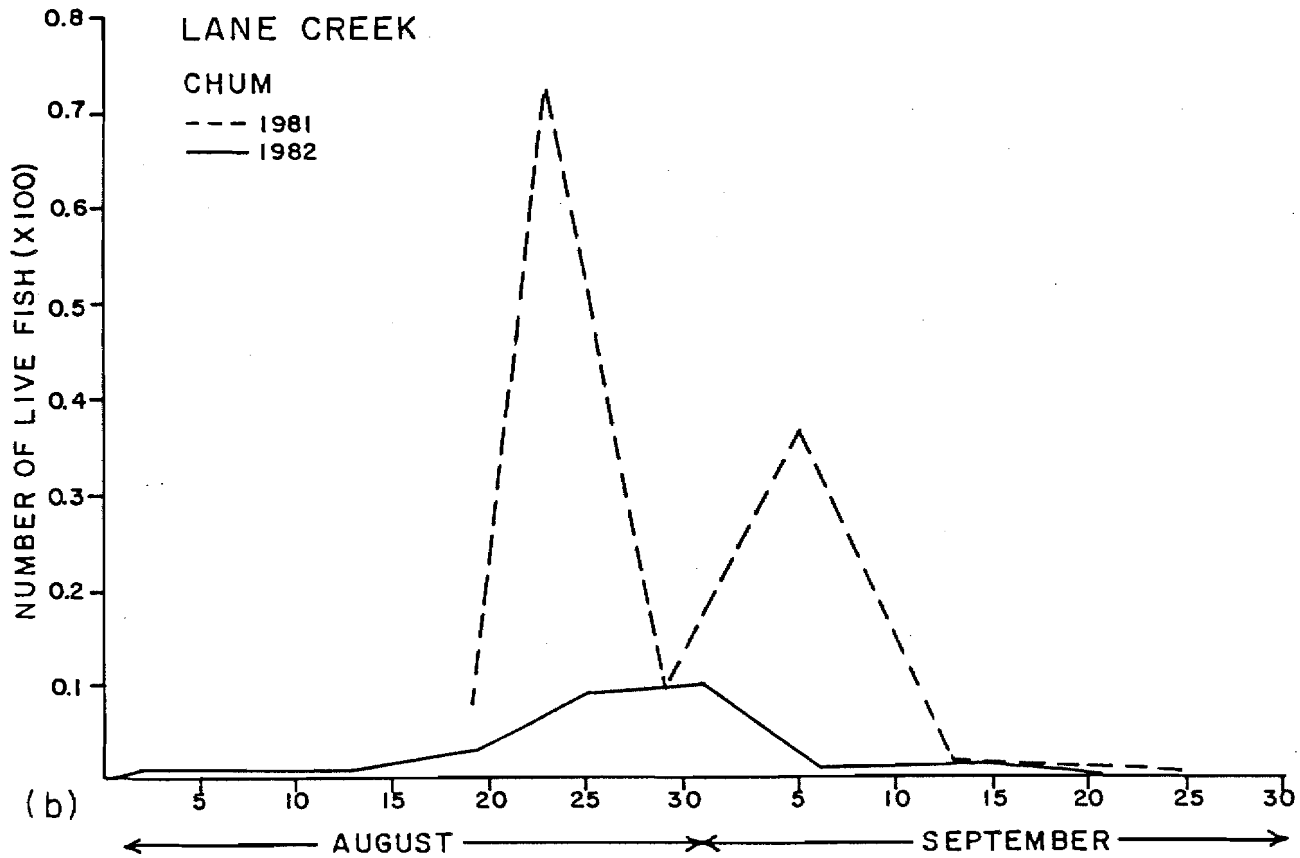


Figure 2-4-8. Chum salmon live counts by date in (a) Slough No. 21 and (b) Lane Creek for 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

The 1982 peak survey count of live and dead chum salmon for all sloughs totalled 2,244 fish. This was 334 chum salmon less than the 1,910 fish recorded in 1981. However, the 1982 chum salmon escapement to Talkeetna Station (RM 103) was approximately 2.4 times greater than in 1981 (Section 4.2.4.2.1). An explanation for difference in chum salmon escapement and slough utilization may be the large increase of chum salmon observed in streams in 1982. In 1981 the peak index count for all streams totalled 245 chum salmon and in 1982 this total was 1,748, approximately 7.2 times greater than in 1981.

4.2.5 Coho Salmon

4.2.5.1 Estuary to Talkeetna

4.2.5.1.1 Main Channel Escapement

Susitna River and Yentna River coho salmon stocks were monitored at three sampling locations in 1981 and 1982: Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations.

Susitna Station (RM 26) SSS counts in 1981 and 1982 were considered index counts and were not used in total escapement computations per report Section 2.4.3.

Yentna Station (RM 04) SSS counters recorded an escapement of 17,000 coho salmon into the Yentna River in 1981, approximately 2.0 times less than the 34,100 fish counted in 1982.

The Sunshine Station (RM 80) escapement in 1981, calculated by the Petersen method, was 19,800 coho salmon with a 95 percent confidence interval of

18,100 to 22,000 fish. The 1982 escapement was estimated at 45,700 coho salmon with a 95 percent confidence interval of 41,900 to 50,300 fish.

The Susitna River coho salmon escapement was an estimated 37,000 fish in 1981 and 80,000 fish in 1982, not including escapement returns between RM 6 and 77 excluding the Yentna River (RM 28) in both years. These estimates represent the total number of coho salmon by respective year counted by sonar at Yentna Station (RM 04) and estimated by the Petersen method to Sunshine Station (RM 80) (Table 2-4-1).

In 1981 fishwheels operated for escapement sampling at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations caught respectively 329, 1,122 and 2,928 coho salmon. In 1982 470, 1,203 and 8,227 coho salmon were caught at the respective stations.

Fishwheel interceptions at Susitna Station (RM 26) identified the coho salmon migration onset, midpoint and end to be on July 23, July 28 and August 9 in 1981 and on July 19, July 21 and August 9 in 1982. Coho salmon migrating past Susitna Station exhibited a strong west bank preference evidenced by 76.3 percent and 72.5 percent of the catch occurring in west bank fishwheels in 1981 and 1982, respectively.

Yentna Station (RM 04) fishwheel catches indicated that the coho salmon migration in 1981 and 1982 began on July 22 and July 20, reached a midpoint on July 31 and August 2 and ended on August 17 and August 24, respectively.

The coho salmon migration was predominately (75.7%) along the south bank in 1981 and near equally distributed in 1982 with 56.1 percent moving along the south bank and 43.9 percent along the north bank.

Based on fishwheel captures at Sunshine Station (RM 80) the coho salmon migration start, midpoint and endpoint in 1981 was on August 1, August 20 and August 28, respectively while the corresponding dates in 1982 was on August 3, August 12 and August 23. The 1981 coho salmon migration past Sunshine Station showed little bank preference with 51.6 and 48.4 percents migrating along the east and west bank, respectively. However, in 1982 a definite east bank preference occurred as indicated by 89.0 percent of the catch recorded with east bank fishwheels.

Combined fishwheel catch data, indicated that coho salmon were generally abundant in the river reach between RM 26 to 80 from July 23 to August 28 in 1981 and from July 19 to August 23 in 1982 (Figure 2-4-9).

The average coho salmon migration rate between Susitna Station (RM 26) and Yentna Station (RM 04) on the Yentna River (RM 28) in 1981 was 3.0 mpd, one half the 1982 rate of 6.0 mpd. The 54 miles between Susitna and Sunshine (RM 80) stations were travelled at the same rate, 3.9 mpd in both 1981 and 1982.

Age class composition data indicated that a majority of the coho salmon sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in both 1981 and 1982 were age 3_2 and 4_3 fish. In 1981 age class 3_2 fish comprised 22.0 percent at Susitna Station, 16.1 percent at Yentna Station and 31.8 percent of the escapement sample at Sunshine Station. In 1982 these percentages were 33.8, 31.8 and 49.3 respectively. Age 4_3 coho salmon in

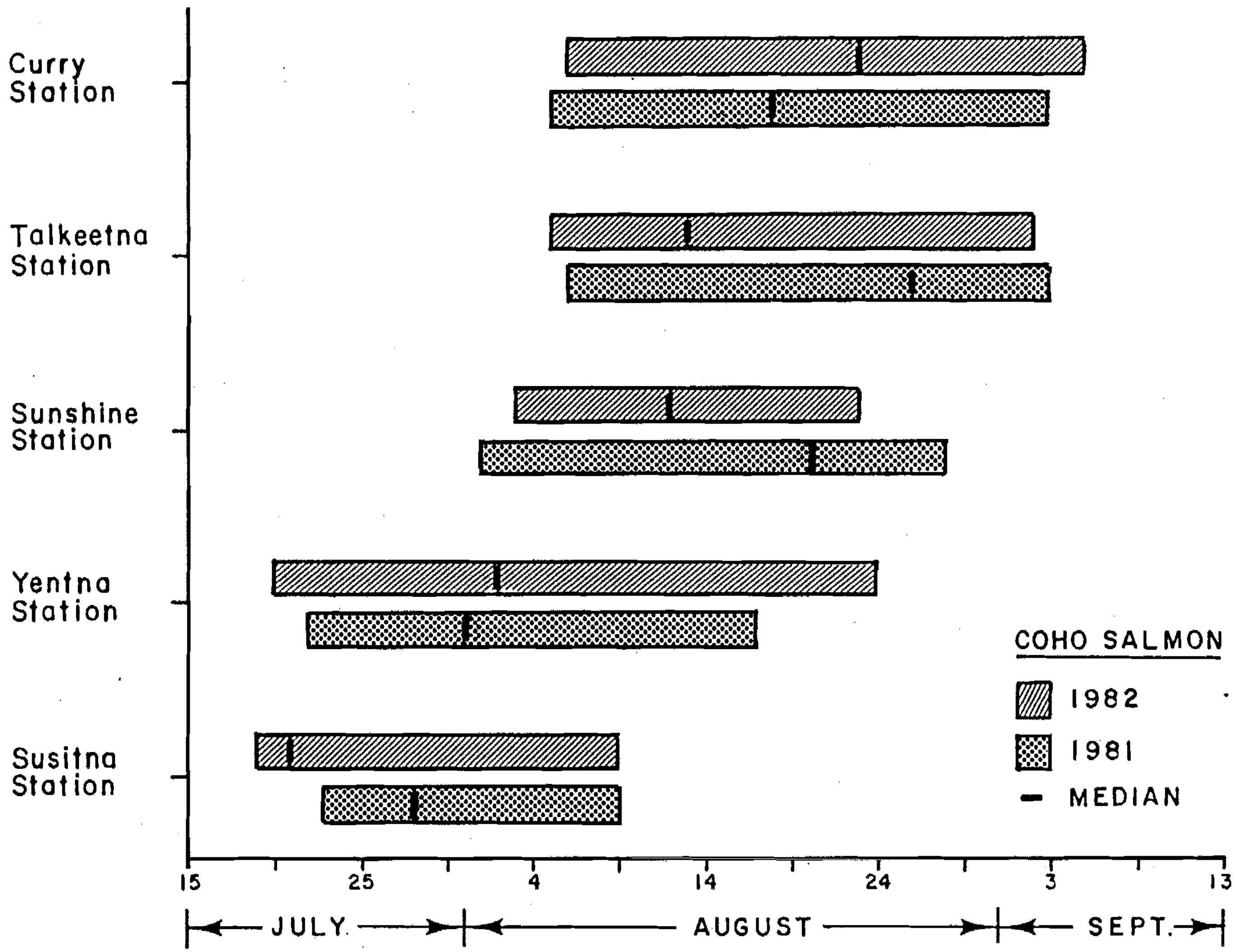


Figure 2-4-9. Migrational timing of coho salmon at selected sampling locations in the Susitna River basin in 1981 and 1982, Adult Anadromous Investigations, Su Hydro Studies, 1982.

1981 represented 68.8 percent at Susitna Station, 82.9 percent at Yentna Station and 65.1 percent of the escapement sample at Sunshine Station. In 1982 the percentages were 64.6, 66.8 and 50.1, respectively.

Less than 10 percent of the coho salmon escapements at Susitna, Yentna and Sunshine stations were comprised of other age class fish.

Scale analysis of the coho salmon escapement sampled at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1981 indicated that 22.0, 16.1 and 31.8 percents of the adult fish respectively had, as fry, migrated to sea after rearing one winter in freshwater. In the above station order, 33.8, 31,8 and 49.3 percent outmigrated after one winter and 64.6, 66.8 and 50.1 percent after two winters in 1982.

Analysis of length (FL) data indicated that the coho salmon were larger in 1982 than in 1981. Age 4_3 fish, the dominate age class, averaged in 1981 males 519 mm and females 530 mm at Susitna Station (RM 26). In 1982, the average length was 561 mm and 544 mm respectively. At Yentna Station (RM 04) the male and female age 4_3 fish averaged, in 1981, respectively 541 mm and 540 mm; in 1982 the males averaged 549 mm and the females 544 mm. The age 4_3 males and females sampled at Sunshine Station (RM 80) in 1981 averaged 541 mm and 542 mm respectively while in 1982 the males averaged 564 mm and the females 551 mm. Larger lengths also exhibited for other age class coho salmon in 1982 suggests that the ocean rearing environment in 1981 was more favorable than in 1980 with a greater growth rate for these coho salmon returning to spawn in 1982.

Sex composition data indicated that females were generally more abundant than males at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1981 than in 1982. The 1981 male to female ratios were 0.8:1, 0.9:1 and 1.2:1, respectively. In 1982, the corresponding ratios were 0.6:1, 2.4:1 and 1.4:1.

4.2.5.1.2 Main Channel Spawning

The Susitna River main channel from RM 7 to 98.5 was surveyed for coho spawning at 280 and 811 sites respectively in 1981 and 1982. These sites were surveyed between July 15 and October 7 in 1981 and between August 1 and October 13 in 1982. Coho salmon catches and observations indicated that main channel spawning did not occur between RM 7 and 98.5 in 1981 or 1982.

4.2.5.2 Talkeetna to Upper Devil Canyon

4.2.5.2.1 Main Channel Escapement

The coho salmon escapement to Talkeetna Station (RM 103) was an estimated 3,300 fish in 1981 and 5,100 fish in 1982 (Table 2-4-2). At Curry Station (RM 120) the 1981 escapement was approximately 1,100 coho salmon and in 1982, 2,400 coho salmon. These estimates were calculated by the Petersen method.

The coho salmon migration at Talkeetna Station (RM 103) occurred earlier in 1982 than in 1981 as determined by fishwheel catches. The 1981 migration began on August 4, reached a midpoint on August 26 and ended on September 3. In 1982, these dates were August 5, August 13 and September 2.

Fishwheel catch data established the migration timing of coho salmon at Curry Station. In 1981 the migration started on August 6, reached a midpoint on August 23 and ended on September 5. These dates in 1982 were August 5, August 18 and September 2.

The migrational preference by coho salmon in 1981 and 1982 was for movement along the west bank at Talkeetna Station (RM 103) and based on a 60 percent average catch for both years with the west bank fishwheel. Bank preference could not be established at Curry Station with the highest percentage of fishwheel catches occurring with the east bank fishwheel (64.8%) in 1981 and the west bank fishwheel (53.3%) in 1982.

The average coho salmon travel rate between Sunshine (RM 80) and Talkeetna (RM 103) stations increased from 4.0 mpd in 1981 to 5.3 mpd in 1982. The 17 mile distance between Talkeetna and Curry (RM 120) stations was travelled by coho salmon at an average rate of 10.0 miles per day (mpd) in 1982. In 1981 the same distance was travelled in an average of 1.5 days for a mean speed of 11.3 mpd.

Age analysis of the escapement sampled at Talkeetna Station (RM 103) indicated the percent contribution of age 3_2 coho salmon increased from 11.6 percent in 1981 to 59.0 percent in 1982. Age 4_3 fish comprised 84.8 percent of those sampled in 1981 and 41.0 percent in 1982.

Curry Station (RM 120) coho salmon age analysis revealed the percent contribution of age 3_2 fish increased from 27.3 percent in 1981 to 54.0 percent in 1982. Age 4_3 coho salmon totalled 68.8 percent of those sampled in 1981 and 46.0 percent in 1982.

Coho salmon scale analysis of the escapement sampled at Talkeetna Station (RM 103) in 1981 indicated that 12.8 percent and 85.4 percent respectively of the adults had smolted after rearing one and two winters in freshwater. In 1982 these percentages were 59.0 and 41.0, respectively.

Curry Station (RM 120) coho salmon age analysis indicated that in 1981 27.3 percent and 68.8 percent of the escapement sampled had smolted after rearing one and two winters respectively in freshwater. In 1982 the percentages were 54.0 and 46.0, respectively.

Length (FL) analysis of coho salmon from Talkeetna (RM 103) and Curry (RM 120) station indicated that in all age classes the fish were larger in 1982 than in 1981. At Talkeetna Station in 1981 the age 3_2 males and females averaged respectively 484 mm and 510 mm; in 1982 these average lengths for age 3_2 males and females were 546 mm and 555 mm. The age 4_3 fish at Talkeetna Station in 1981 averaged males 534 mm and females 538 mm; and in 1982 the males averaged 562 mm and females 554 mm. At Curry Station in 1981 the age 3_2 fish averaged males 484 mm and females 492 mm; in 1982 males averaged 501 mm and females 534 mm. The age 4_3 fish at Curry Station in 1981 averaged 519 mm males and 541 females; in 1982 the males averaged 544 mm and females 558 mm.

Male coho salmon were more abundant than females at Talkeetna (RM 103) and Curry (RM 120) stations in both 1981 and 1982. The male to female ratio in 1981 was 1.5:1 at Talkeetna Station and 1.9:1 at Curry Station. In 1982 the ratios were 1.5:1 and 1.3:1, respectively.

4.2.5.2.2 Radio Telemetry

In 1981 and 1982 the majority of radio tagged coho salmon released at Talkeetna Station (RM 103) were fish that were milling as evident by 3 of 6 fish released there in 1981 and 10 of 11 fish in 1982 that descended to spawning areas downstream of Talkeetna Station including Birch Creek (RM 88.4), Talkeetna River (97.0), Chulitna River (RM 98.5), and Whiskers Creek (RM 101.3). The remaining fish, 3 of 6 in 1981 and 1 of 11 1982, spawned above Talkeetna Station in tributaries including Gash Creek (RM 111.6) Fourth of July Creek (RM 131.1) and Indian River (RM 138.6).

In 1981, spawning destinations were not determined on all radio tagged coho salmon released at Curry Station (RM 120). Evidence was that at least three of the four fish tagged at Curry Station in 1981 spawned in tributaries below Curry Station, primarily in Gash Creek (RM 111.6). Eighty percent of the five fish sample released at the station in 1982 spawned above Curry Station in tributaries including Portage Creek (RM 148.9) and Indian River (RM 138.6). The one remaining coho salmon entered the Talkeetna River (97.0) and presumably spawned in that drainage.

In 1981 and 1982, the most common habitats used by radio tagged coho salmon that milled in the Susitna River main channel were semi-placid areas and tributary confluences including slough habitats such as Wiggle Slough (RM 98.0), Slough 5 (RM 107.6), Slough 6A (RM 112.3), Slough 11 (RM 135.3) and Slough 15 (RM 137.2).

None of the radio tagged coho salmon released at Talkeetna (RM 103) and Curry (RM 120) stations in 1981 (14 fish) or 1982 (16 fish) entered lower Devil Canyon (RM 150-151) based on radio tracking observations.

4.2.5.2.3 Lower Devil Canyon Milling

In 1981, gill nets were fished a of 30.2 hours in lower Devil Canyon (RM 150-150) from July 29 through September 9. A total of two coho salmon were caught. One fish was caught on August 26 and the second fish on September 2. No coho salmon were caught on July 29, August 5, September 2, 10 or 19. In 1982, 19.6 net hours were fished in in lower Devil Canyon from August 10 through September 12. The effort produced three coho salmon. The three fish were caught on August 28. No catches were made on August 10, 16 and 22 or September 12. Electroshocking was also conducted in lower Devil Canyon on August 8, 18, September 5 and 23, 1982. Only one coho salmon was caught. The catch occurred on September 5.

The test fishing results in 1981 and 1982 indicated that coho salmon generally occupy lower Devil Canyon (RM 150-151) in the last week of August and the first week of September.

4.2.5.2.4. Spawning

4.2.5.2.4.1 Main Channel

The Susitna River main channel was surveyed for coho salmon spawning from July 15 to October 15 in 1981 and from August 7 to October 7 in 1982. A total of 37 sites were monitored in 1981 and 397 were surveyed in 1982.

In 1981 two main channel coho salmon spawning sites were reported. The sites were at RM 117.6 and RM 129.2.

In 1982 no main channel spawning sites were identified. Spawning was observed at RM 117.6, a site defined in 1981 as a main channel spawning habitat. The site was misclassified in 1981. The area, although used for coho salmon spawning, is within the influence of Little Portage Creek and therefore it is not a true main channel Susitna River habitat any more than known spawning areas below the mouth of Fourth of July Creek (RM 131.0) or Indian River (RM 138.6).

4.2.5.2.4.2 Sloughs and Streams

A total of 33 and 34 sloughs were surveyed for coho salmon respectively in 1981 and 1982. Survey results indicated that adult coho salmon did not occupy slough habitats in 1981. In 1982, coho salmon were observed in three of the 34 (8.8%) sloughs surveyed. These were sloughs: 6A (RM 112.3), 8A (RM 125.1) and 15 (RM 137.2).

In 1982, coho salmon spawning was recorded only in Slough 8A (RM 125.1). Coho salmon observed in sloughs 6A (RM 112.3) and 15 (RM 136.2) were milling fish and did not spawn in these sloughs. Peak spawning in slough 8A occurred between the fourth week of September and the first week of October.

Stream surveys found coho salmon occupying 8 of the 15 streams (53.3%) surveyed in 1981 and 12 of the 19 streams (63.2%) surveyed in 1982. In 1981 coho salmon were observed in Whiskers Creek (RM 101.4), Chase Creek (RM 106.9), Gash Creek (RM 111.6), Lane Creek (RM 113.6), Lower McKenzie Creek

(RM 116.2), Fourth of July Creek (RM 131.0), Indian River (RM 138.6) and Portage Creek (RM 148.9). In addition to the above streams, coho salmon were observed in Slash Creek (RM 111.2), Little Portage Creek (RM 117.7), Gold Creek (RM 136.7) and Jack Long Creek (RM 144.5) in 1982.

Peak spawning counts of live and dead coho salmon for streams habitats totalled 458 and 633 fish in 1981 and 1982, respectively. Based on percent contribution, coho salmon were most abundant in Gash Creek (30.8%), Indian River (18.6%), Chase Creek (17.5%), Whiskers Creek (15.3%) and Lower McKenzie Creek (12.2%) in 1981, and Whiskers Creek (27.8%), Lower McKenzie Creek (21.0%), Indian River (16.0%), Portage Creek (13.9%) and Gash Creek (11.5%) in 1982. Survey counts were index counts and did not reflect the total number of spawning coho salmon present in the streams surveyed.

Survey results indicated the peak coho salmon spawning occurred in stream habitats during the second and third weeks of September in 1981. In 1982 the peak coho salmon spawning occurred between the second week of September and the first week of October.

4.3 Bering Cisco

4.3.1 Estuary to Talkeetna

4.3.1.1 Main Channel Escapement

Bering cisco were originally documented in the Susitna River basin by ADF&G Su Hydro staff in 1981. Discovery of this species in late August allowed escapement sampling only at Sunshine Station (RM 80) in 1981, however, in 1982 escapement sampling was conducted at Susitna (RM 26), Yentna (RM 04) and Sunshine stations.

Susitna Station (RM 26) fishwheels intercepted a total of 42 Bering cisco in 1982. The migration essentially began August 7. Migration midpoint and termination were not determined as fishwheels were removed for winter storage prior to their occurrence. A Bering cisco movement preference along the east bank was evident with 76.2 percent and 23.8 percent of the catches distributed in east and west bank fishwheels, respectively. The 1981 whitefish catch were recorded only to the taxonomic level of Family and therefore Bering cisco catch data were not available.

Yentna Station (RM 04) fishwheels captured four Bering cisco in 1982. It is probable that these captures represented milling activity and not spawning migration. Again, 1981 fishwheel whitefish catches were recorded only to the taxonomic level of Family.

Sunshine Station (RM 80) fishwheels intercepted 165 and 392 Bering cisco in 1982 and 1981, respectively. The entire catch was made with east bank fishwheels in both years. The Bering cisco migration began at Sunshine Station on September 4 in 1982 and on September 8 in 1981 as determined by fishwheel catches. The peak fishwheel catches occurred on September 21 and September 27 in 1981 and 1982, respectively. In 1981 and 1982 the Bering cisco migration extended beyond October 1; the last day of fishwheel operations at Sunshine Station.

The Bering cisco relative abundance using Sunshine Station (RM 80) fishwheel catches as an index, was approximately 2.4 times greater in 1981 than 1982.

Bering cisco scale samples collected from fishwheel catches at Susitna (RM 26), Yentna (RM 04), and Sunshine (RM 80) stations in 1982 were analyzed collectively and the 1981 age composition was derived from only Sunshine Station fishwheel catches. In 1982 Bering cisco age class composition segregated to 62.0 percentage age 5_1, 34.0 percentage 4_1 and 4.0 percent age 6_1 fish. Observations during scale analysis suggested the occasional presence of a developing annulus on the scale's outer margin. This partially developed outer annulus was considered to represent the beginning of the current winters growth. Based on these findings 1981 Bering cisco ages were redetermined and the results presented in Table 2-4-3. This analysis of 1981 scales revealed that 74.4 percent were age 5_1, 16.5 percent age 4_1 and 9.1 percent age 6_1 fish.

Table 2-4-3. Analysis of Bering cisco age data by percent from escapement samples collected at all sampling locations in 1981, Adult Anadromous Investigations, Su Hydro Studies, 1982.

Year	Collection Site	Sample Size	Age Class 1/			Brood Year			
			4_1	5_1	6_1	1976	1977	1978	1979
1981	All locations	121	16.5	74.4	9.1	9.1	74.4	16.5	--
1982	All locations	100	34.0	62.0	4.0	--	4.0	62.0	34.0

1/ Gilbert-Rich Notation

Fishwheel caught Bering cisco were measured for length (TL) at Susitna (RM 26), Yentna (RM 04) and Sunshine (RM 80) stations in 1982 and Sunshine Station in 1981. Lengths, non-segregated by age class or sex averaged 335.3 mm and 337.6 mm, in 1982 and 1981, respectively. Age 4_1 and 5_1 Bering cisco had mean lengths of 318.9 mm and 342.3 mm in 1982 and 304.9 mm and 337.5 mm in 1981. Age 6_1 Bering cisco mean lengths remained constant at 365.0 mm for both years.

The Bering cisco male to female (m:f) sex ratio remained relatively stable for the two year period 1.0:1 and 1.4:1 in 1981 and 1982, respectively.

4.3.1.2 Main Channel Spawning

Main channel surveys for Bering cisco extended from RM 7.0 to 98.5 in 1981 and 1982. These surveys resulted in the identification of five spawning and probable spawning areas. Three Bering cisco spawning areas were documented in 1981. They were located at RM 75, RM 76-77.5 and RM 78-79. Main channel surveys in 1982 established two probable Bering cisco spawning sites; one located at RM 76.8-77.6; and the other located at RM 81.2. The 1982 main channel survey observations also indicated that small concentrations of Bering cisco spawned throughout the RM 75-85.2 reach although not in numbers required to be called, by definition as discrete spawning sites.

Peak spawning occurred during the second week of October in 1981 as substantiated by 100 percent of the females examined between October 13 and October 16 being completely spawned out. Peak spawning in 1982 also occurred during essentially the same time period. On October 13, 66.7 percent, 26.7 percent and 6.6 percent of the females were ripe, spawned out and not ripe, respectively.

ADF&G, Su Hydro staff tagged 713 Bering cisco in 1981. A 1982 main channel survey crew recovered one tagged Bering cisco at RM 31.1 on September 13.

Records indicated this Bering cisco had been tagged on October 5 at RM 77, a documented spawning area. A discussion of the significance of this recapture, as being a potential repeat spawner, is presented in report Section 3.3.1.2.

4.3.2 Talkeetna to Upper Devil Canyon

4.2.3.1 Main Channel Escapement

In 1982 Talkeetna Station (RM 103) fishwheels intercepted a single Bering cisco on September 13. The 1981 fishwheel catch of whitefish were recorded to the taxonomic level of Family and no Bering cisco catch data were available.

Curry Station (RM 120) fishwheels did not intercept any Bering cisco in 1982. Fishwheel catches of whitefish were recorded to the taxonomic level of Family in 1981 and no Bering cisco catch data were available.

4.3.2.2 Main Channel Spawning

A total of 37 and 421 Susitna River main channel sites were examined for Bering cisco spawning in 1981 and 1982, respectively. The sites were surveyed between July 15 and October 16 in 1981 and August 1 and October 13 in 1982.

No Bering cisco spawning was observed between RM 98.5 and 150 in 1981 or 1982. A single Bering cisco catch at RM 101.9 on October 1 in 1982 and captures of one Bering cisco at RM 99.6 and 100.5 in 1981 were the only catches recorded in the Susitna River main channel, RM 98.5 to 150.0 in both years.

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