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Stream Flow Needs for Anadromous Salmonids in the Scott River Basin, Siskiyou County - A Summarized Report

I. Introduction

At the request of the State Water Resources Control Board, Division of Water Rights, the California Department of Fish and Game conducted a study in the Scott River Basin to determine minimum flow needs for preserving fishery values in this drainage. This report is being submitted to fulfill this request. It represents a brief summary of the findings, which are dealt with in more detail in a typewritten report filed at the Department of Fish and Game, Region 1 Headquarters in Redding, California.

The study was restricted to flow needs for anadromous salmonids, because the numbers of these fishes have, and continue to be, in a state of decline. The study encompassed the needs of silver salmon, king salmon (two runs), and steelhead rainbow trout (three runs, two races). It did not encompass the stream systems in this area that have already been adjudicated, i.e., the French Creek drainage, and the Shackleford-Mill Creek drainage, nor those streams with value only as resident trout streams, e.g., Clark Creek. The streams considered have current anadromous values. Two streams, Patterson Creek, near old Meamber School, and Indian Creek, were deleted from consideration even though they had recent value for anadromous use. They are currently extremely deteriorated due to stream channel manipulations and heavy off-stream consumption of water.

II. The Study Area - Scott River Basin Watershed

The area encompassed by this study is outlined on Figure 1. The tributary streams descend a gradient from 150 - 400 feet per mile to join and

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ETNA, CALIF

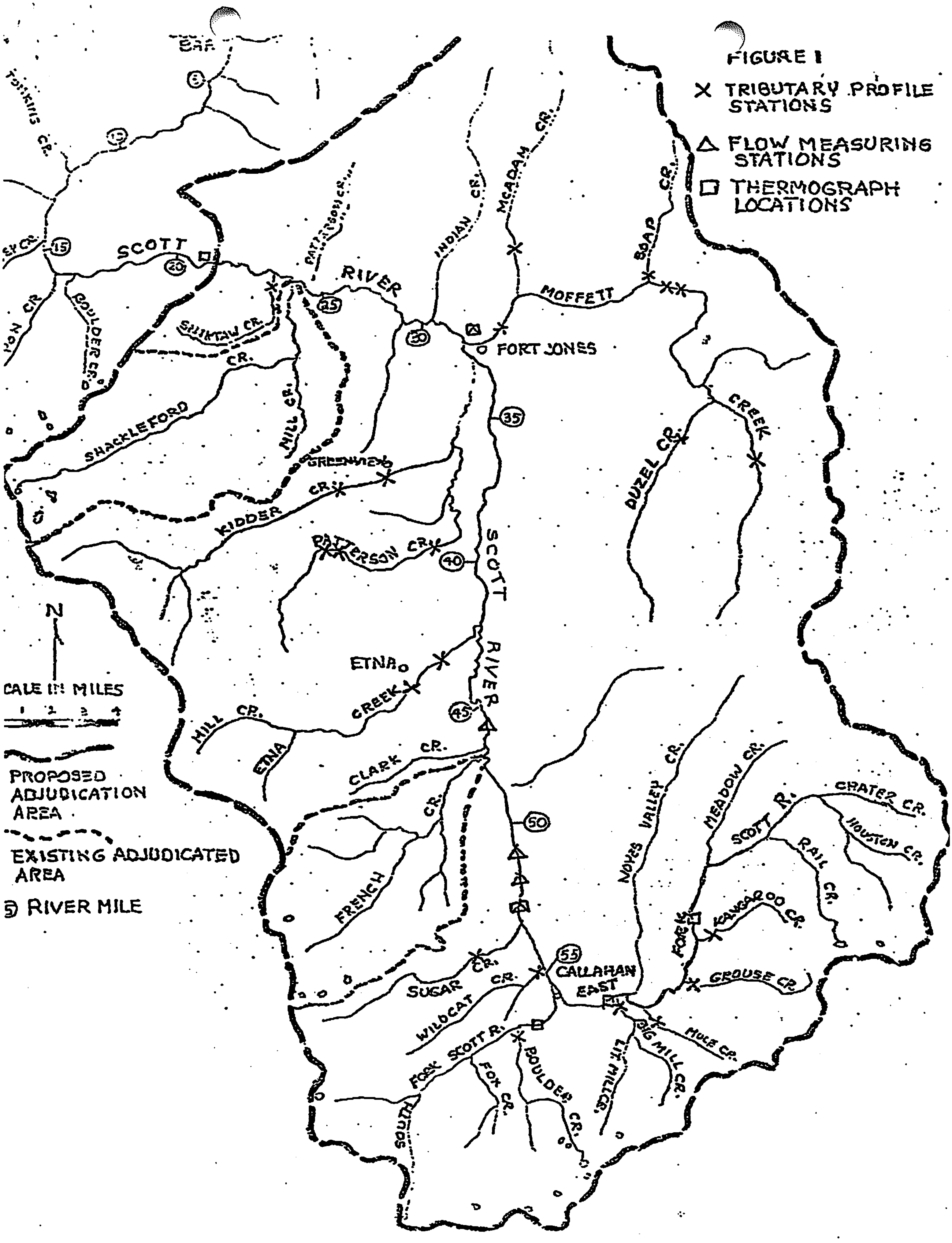
FIGURE I
TRIBUTARY PROFILE STATIONS
FLOW MEASURING STATIONS
THERMOGRAPH LOCATIONS
CALE IN MILES
1 2 3 4
PROPOSED ADJUDICATION AREA
EXISTING ADJUDICATED AREA
RIVER MILE
N
SCOTT RIVER
SCOTT RIVER
FORT JONES
ETNA
CALLAHAN
EAST FORK
SOUTH FORK SCOTT R.
SCOTT R.
TOMKINS CR.
BOULDER CR.
SHACKLEFORD CR.
MILL CR.
KIDDER CR.
GREENVIEW
PATTERSON CR.
INDIAN CR.
MCADAM CR.
MOFFETT
SOAP CR.
DUZEL CR.
CREEK
ETNA CREEK
HILL CR.
ETNA
CLARK CR.
FRENCH CR.
SUGAR CR.
WILDCAT CR.
FOX CR.
BOULDER CR.
LIT. MILL CR.
BIG MILL CR.
MULE CR.
GROUSE CR.
KANGAROO CR.
RAIL CR.
HOUSTON CR.
CHATER CR.
MEADOW CR.
NOYES VALLEY CR.
15
20
25
30
35
40
45
50
55

form the Scott River on the Valley floor. Many of these streams show a rapid decrease in gradient at the valley's edge, and these areas suffer the greatest amount of interrelated natural and artificial stream channel disturbances.

The streams in the study area to the west and south of the Scott River mainstem and thence the East Fork, drain areas of similar patterned precipitation, as well as higher levels of precipitation than the streams to the north and east. The McAdam Creek watershed to the north, is intermediate in terms of rainfall, between the low area drained by Moffett Creek, and the higher level areas to the west and south.

III. Status of the Anadromous Salmonid Populations

The California Fish and Wildlife Plan (1965) gives estimates for the annual adult spawning escapement into the Scott River as follows:

King salmon	8,000
Silver salmon	800
Steelhead	5,000

A fish counting fence was installed near the mouth of the Scott River during the summer of 1975 to enumerate the salmon escapement. The fence was lost in high November waters. The king salmon count can be considered as complete, with an adult enumeration of 1,847 fish. The river was also sampled by methods normally used to provide an index of population numbers. This index showed that this was the lowest escapement on record for the ten years that the river has been sampled in this manner. The silver salmon run was near its peak when the fence was washed out by high waters, so no count can be given. A second and larger flood occurred in early January, which removed any opportunity to estimate numbers of adult steelhead.

California Fish and Wildlife Plan. Volume 3. Supporting data. Part B. Inventory of salmon, steelhead, and Marine Resources. October 1, 1965.

The Fish and Wildlife Plan escapement estimates do not break down into runs or races for each species of fish. The following approximations were made on a judgmental basis:

King salmon, fall-run	7,800
King salmon, spring-run	50-200
Steelhead, winter race, winter-run	3,500
Steelhead, summer race, fall-run	1,500
spring-run	50-200

Table 1 is presented to qualitatively show various limiting conditions due to flow volume and stream temperature on the stream-associated life history events for these fishes. In general, all of the anadromous runs are still declining in the Scott River system. The spring-run king salmon, which may have been a dominant run in the Klamath system, is presently a remnant run in the Scott River. The spring and fall-run steelheads are probably the most reduced of the steelheads, with the former suffering the heaviest. These population declines reflect the conditions shown in Table 1.

V. Some Economic Considerations of the Scott River Anadromous Runs

This section follows the methodology used by Everest [1]. Catch/escapement ratios for both the silver salmon and king salmon are taken from figures derived for southern Oregon rivers by the National Marine Fisheries Service. The catch/escapement ratio for both salmons is given as five to one. The catch is subdivided into 29 percent sport and 71 percent commercial. The following table was constructed to

1/ Everest, Fred H. 1973. An Economic Evaluation of Anadromous Fishery Resources of the Siskiyou National Forest. (Mimeographed Report-U.S.F.S.)

Table 1. A qualitative summary of how current stream flow and/or temperature conditions meet flow and/or temperature needs for various freshwater life history aspects of the anadromous salmonid populations in the Scott River system

Species and Run	Holdover of Adults Prior to Spawning	Spawning	Juvenile Rearing
Steelhead			
Summer			
Spring-run	Poor	Good	Poor
Fall-run	Fair	Good	Poor
Winter			
Winter-run	Good	Good	Poor
Silver Salmon	Fair	Fair	Poor
King Salmon			
Spring-run	Poor	Poor	Fair
Fall-run	Poor to Fair	Poor to Fair	Fair

give the constants used in calculating the economic values of these fishes:

Table 2. Table of Constants for determining economic values (derived from Everest's text)

Sport Fish	Catch	Value	
King salmon	29% of total	$28/angler day,	1.3 days/fish
Silver salmon	29% of total	$28/angler day,	1.3 days/fish
Steelhead	15% of escape.	$20/angler day,	2.2 days/fish
Commercial			
King salmon	71% of total	$1.10/lb.,	10.2 lbs./fish
Silver salmon	71% of total	$ .90/lb.,	5.9 lbs./fish

Using the escapement size estimates given earlier and the values from Table 2, the following table was constructed:

Table 3. Annual economic values of Scott River anadromous fishes

Fish	Sport	Commercial	Species Total
Steelhead	$ 33,000	--	$ 33,000
King salmon	422,240	$318,648	740,888
Silver salmon	42,224	15,080	57,304
		Total	$831,192

V. Distribution and Life History Aspects of the Anadromous Salmonids Utilizing the Scott River Basin

Many of the major factors which affect population numbers of these anadromous salmonids occur in the freshwater stream habitat. The adult fish ascend the rivers and tributary streams to spawn in the stream gravels.

Adequate flows must remain following spawning to provide enough circulation of oxygen-rich water through the gravels to the incubating eggs and pre-emergent fry. Following emergence, the young salmons and steelheads depend on the stream habitat for growth to smolt size when seaward migration begins.

The steelhead fry will spend from one to three years in the streams where spawned before smolting at an average size of approximately seven inches in length. They will then spend from one to three years at sea before initiating their first spawning run. Not all of the steelheads die after spawning. A portion re-descend to the sea and later return again. The geographic distribution of spawning areas utilized by steelhead is delineated on Figure 2. The rearing area generally incorporates the upstream reach of the spawning activity and most of the stream system below.

The silver salmon fry generally spend one full year in the stream system where spawned before smolting in the spring at a size of five to seven inches in length. They spend two to three years at sea before maturation and stream reentry to spawn and die. The upstream extent of the silver salmon spawning areas are delineated on Figure 3. Rearing can be assumed to occur from the upstream extent of the spawning, down through the stream reach. Additionally, some of the fry will ascend the stream from the point of emergence.

The king salmon fry usually spend from four to eight months in the streams growing to a size of three to four inches in length before descending the stream system to the ocean. They spend two to five years (major portion three years) at sea before maturation and reentry to the stream system to

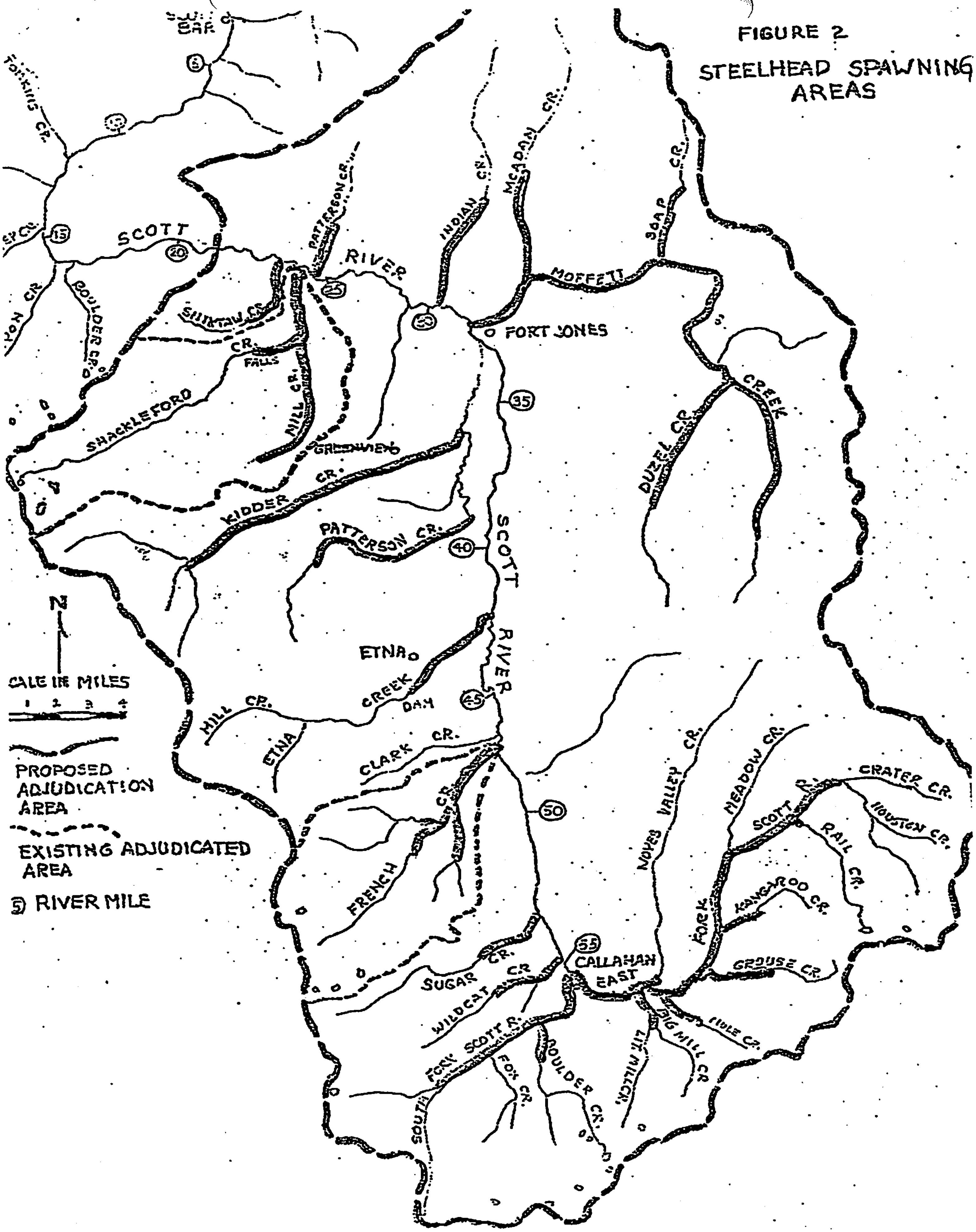

FIGURE 2
STEELHEAD SPAWNING AREAS

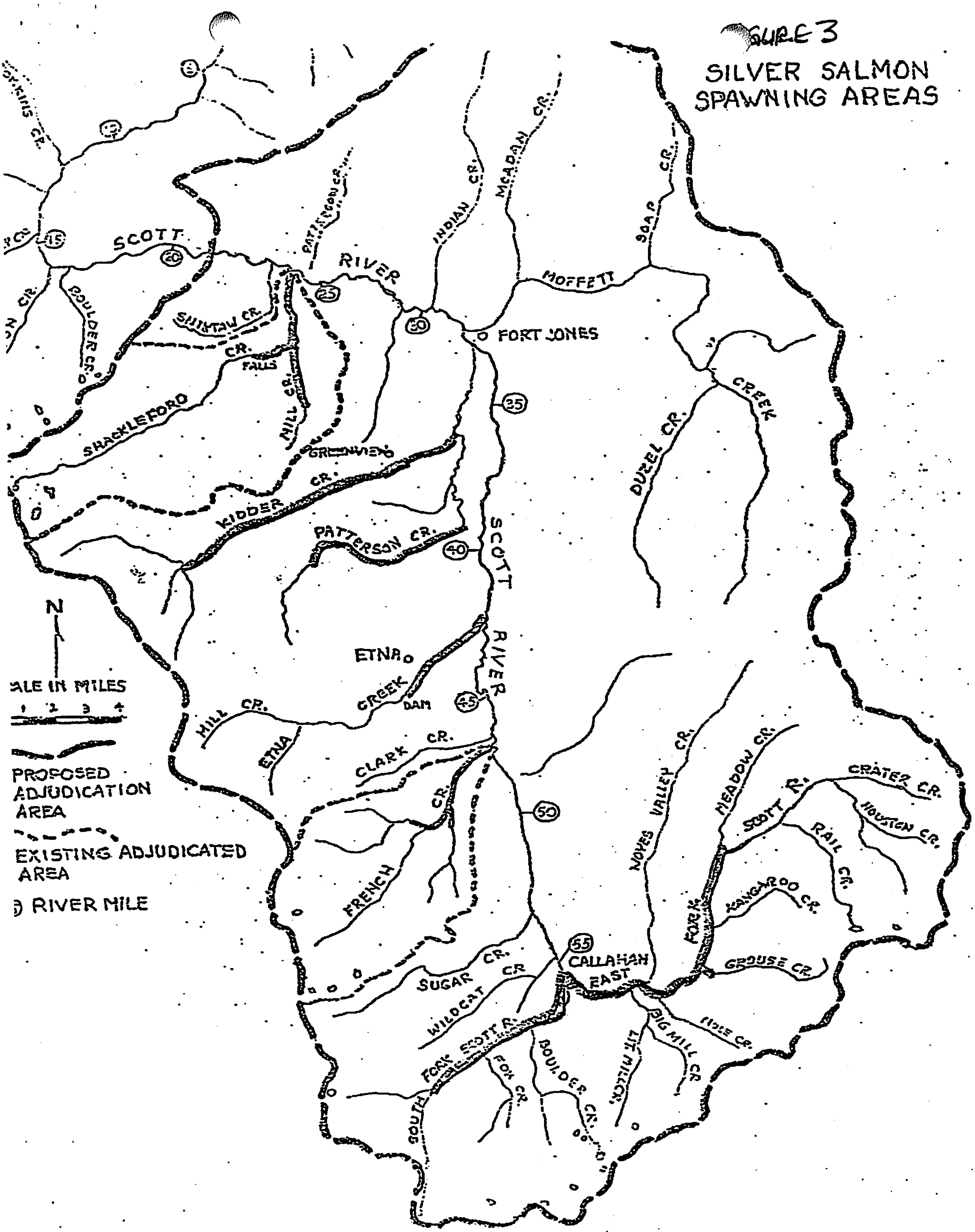

FIGURE 3
SILVER SALMON SPAWNING AREAS

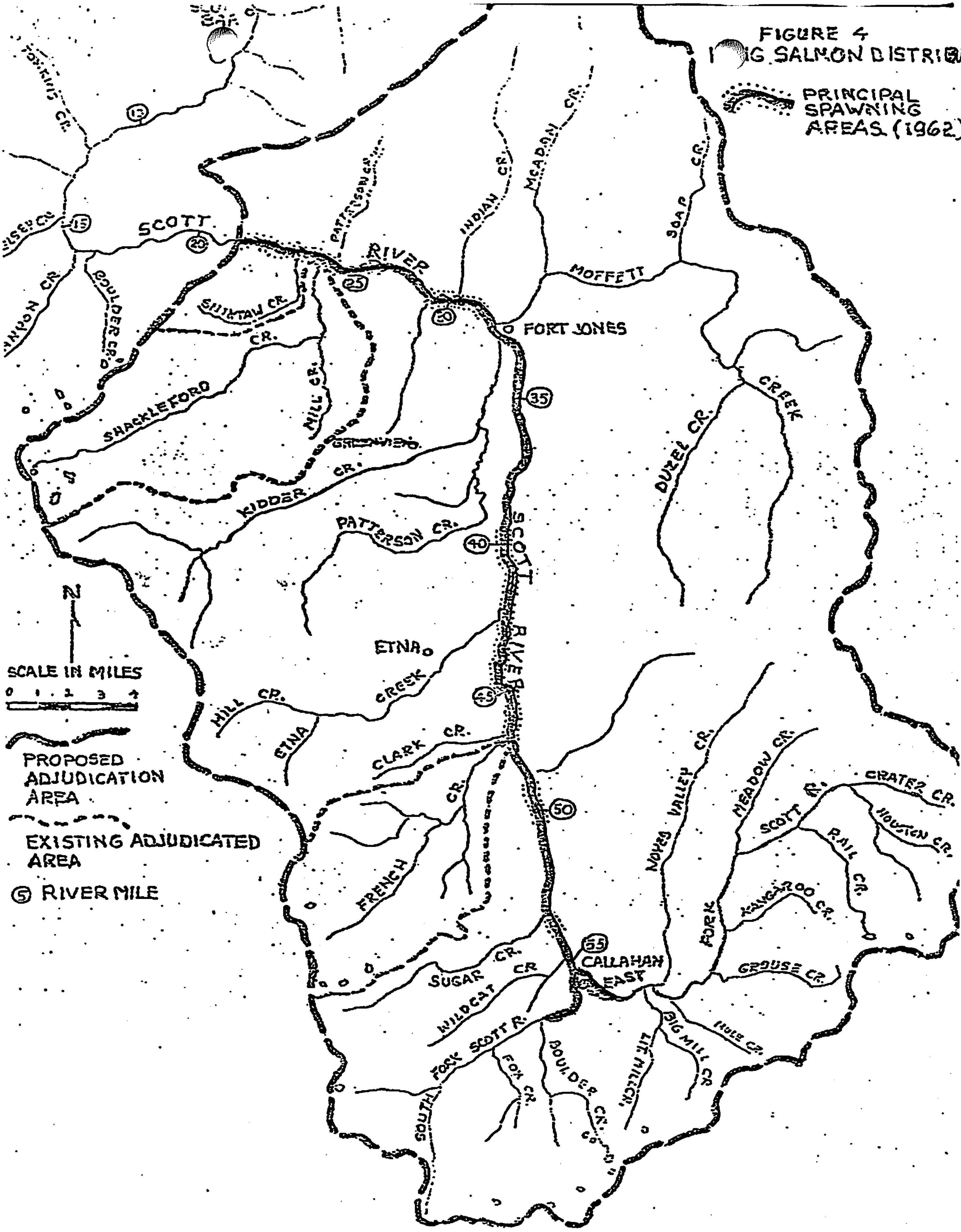

FIGURE 4
…IG SALMON DISTRI…

spawn and die. Upon stream reentry, they require adequate flows and suitable water temperatures for both holding in the stream system and later spawning. The bulk of the spawning area for these fish is delineated on Figure 4. Some will ascend side streams if enough flow is present. The nursery area for the king salmon ranges from at least the upstream extent of the spawning activity (some fry will move upstream) down through the stream reaches.

Figure 5 is given to diagrammatically show the timing of the spawning runs, spawning, egg incubation, and juvenile downstream migration for these salmonids. The summary diagram shows that adult salmonids are running in the Scott system to a lesser or greater degree, eleven months of the year, and adults are present in the system twelve months of the year.

VI. Definitions and Methods Used for the Determination of Flow Needs

For purposes of determining flow needs for spawning and rearing, cross sectional stream transects were made on the tributaries at sites denoted by x's on Figure 1. For spawning, a single cross sectional profile was established through the "best" or "key" area over a potential spawning bar that was considered as representative of that stream section. Flows and resultant velocities for flows larger and smaller than the one measured on the field sampling date were determined by assuming and incorporating the power functional relationship between flow volume and mean velocity. The range in stream velocities present in the profile were assumed to be a reasonably constant fraction of the mean velocity at any flow volume for a given cross section. The values for these variances were determined from the profile data. A normal distribution was assumed for the cross section velocities, and a usable spawning fraction of the

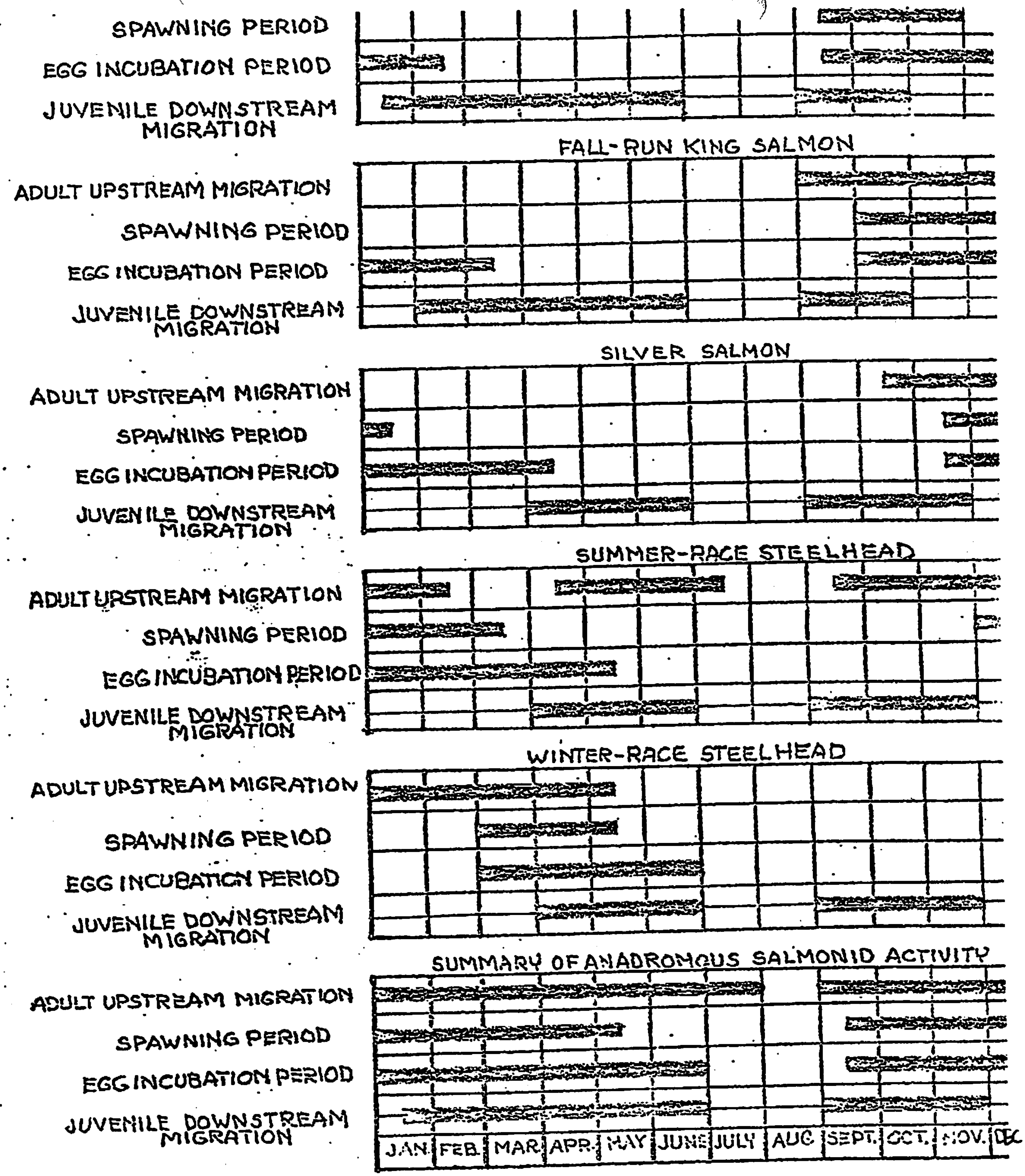

FIGURE 5.

SPAWNING, EGG INCUBATION, AND MIGRATION PER
SCOTT RIVER BASIN, SISKIYOU COUNTY.

... as the area under a normal c[illegible]e that would include the velocity range required for the species of fish in question. The usable fraction values were plotted against their corresponding calculated flow volumes. Minimum spawning flow need for each stream was then defined as that flow present where the spawning area gain is not significant in terms of the increase in flow volume that is required for that gain.

For rearing, a single cross sectional profile was established through a deep-fast cover area, at the "best" or "key" use point. Similar data handling and assumptions were utilized for rearing flows as with spawning flows, except that the rearing flow minimum was defined as one which had a representation of the entire velocity range defined in the literature, as required for the range in size of juvenile salmonids normally occurring in these rearing streams. This resulted in the calculation of a single flow value which is lower than an optimum flow. An optimum rearing flow can be considered as the mean annual flow, i.e., a "bank full". The values later recommended here ranged from a high of 54 percent of the mean annual flow to 41 percent of the mean annual flow on the two gaged tributary streams, Sugar Creek and Etna Creek, respectively. An overview of the data obtained appears to reveal that as the streams became larger in size, a decreasing percentage of the mean annual flow was required to provide minimum rearing flow. This relationship has also been shown to hypothetically occur when examining the hydraulic geometry of streams and rivers, i.e., a general increase in mean velocity proceeding down a given stream reach. These minimal summer or lowest water rearing flows and the minimized spawning flows obtained as outlined earlier are tabulated in Table 4 for the tributary streams.

Table 4. Scott River tributary rearing and spawning flow needs for anadromous salmonids

Stream	Location	Stream Mile	CFS Summer Rearing	CFS Spawning SH	CFS Spawning SS	Approximate age Area (SqMi)
Moffett Cr.	Near Fort Jones	0.5	8.2	45	(a)	125.0
Moffett Cr.	Hwy. 3 bridge	7.3	7.4	(a)	(a)	70.0
Moffett Cr.	Sissel Gl.	18.6	2.4	17.7	(a)	17.3
McAdam Cr.	Near mouth	0.0	12.0	34.0	(a)	28.2
Soap Cr.	Near mouth	0.0	1.7	7.0	(a)	8.8
Duzel Cr.	Near mouth	0.0	2.2	5.5	(a)	18.0
Boulder Cr.	Near mouth	0.0	8.5	26.0	(a)	12.6
Etna Cr.	Etna City diversion	7.3	23.0	110.0	65	20.25
Etna Cr.	Hwy. 3 bridge	2.6	23.0	90.0	51	25.1
Grouse Cr.	Near mouth	0.0	7.2	23.0	(a)	11.0
Kangaroo Cr.	Near mouth	0.0	4.4	16.0	(a)	6.5
Kidder Cr.	Hwy. 3 bridge	5.0	25.0	80.0	55	31.2
Mill Big Cr.	Near mouth	0.0	5.5	17.0	(a)	9.2
Mule Cr.	Near mouth	0.0	2.5	12.0	(a)	3.9
Patterson Cr.	Hwy. 3 bridge	6.3	10.0	30.0	20.0	14.4
Sniktaw Cr.	One mile from mouth	1.0	4.5	9.2	(a)	-
Sugar Cr.	Hwy. 3 bridge	0.6	10.0	32.0	(a)	13.2
Wildcat Cr.	Hwy. 3 bridge	0.01	5.0	23.0	(a)	8.2

(a) No spawning determinations made.

SH: Steelhead
SS: Silver salmon

Flow recommendations for the East and South Fork of the Scott River were not obtained by stream transect data because of generally high flows during the periods when the transects were taken. Judgmental reductions in the fraction of the mean annual flow required on the tributary streams for rearing and spawning were made for these larger streams. These fractions and resulting flows are tabulated on Table 5. The flow in the Scott River mainstem was monitored during the summer of 1973 at critical points along the river. These flow stations are denoted by triangles on Figure 1. The transect-flow data for the gaging site at Farmer's diversion, river mile 53, supports the flow values for rearing obtained arbitrarily by a percentage of the mean annual flow.

The flow requirements for rearing and spawning were combined with the seasonal life history events given in Figure 5 to give a table of flow needs by month (Table 6). The steelhead normally ascend the tributary streams from the Scott River to spawn on rain freshets and snow melt peaks. To add realism to the flows Table 7 was prepared to give minimum flow values that should be maintained between these naturally fluctuating peaks. They are considered to be incubation flow volumes which is 2/3 of the spawning minimum, a value currently used by the Oregon Fish Commission biologists.

VII. Stream Temperature Conditions

Thermographs were installed along the East Fork, South Fork, and Scott River mainstem to determine stream temperature conditions during the summer of 1973. These sites are denoted by squares on Figure 1. The minimum and maximum temperatures are graphically depicted on Figures 6 and 7. A sustained mean value of 68°F. (or less), with daily maximums

Table 5. Flow requirements for spawning and rearing in the Scott River and East and South Forks

				Spawning - CFS				
Stream	Mean Annual Flow - CFS	Rearing	% Mean Annual Flow	King Salmon	% Mean Annual Flow	Silver Salmon	% Mean Annual Flow	S:
South Fork	93.34 (a)	31	33.3	93	100	93	100	Call:
East Fork	94.93 (b)	32	33.3	95	100	95	100	Call:
Scott River	206.77 (c)	62	30.0	155	75	155	75	Rive: 53
Scott River	638.50 (d)	192	30.0	426	67	426	67	U.S.(Stat: Fort

(a) U.S.G.S. Records 10/56 - 9/60
(b) U.S.G.S. Records 10/59 - 9/68
(c) The sum of East Fork, South Fork, and Sugar Creek; does not include Wildcat Creek runoff.
(d) U.S.G.S. Records 10/59 - 9/68

Table 6. Minimum Streamflow Recommendations by the Month for the Scott River Basin Streams

um	Location	River or Stream Mile	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
;ct Cr.	Near Ft. Jones	0.5	45.0	45.0	45.0	45.0	38.0	30.0	8.2	8.2	8.2	8.2	30.0	45.0
ɛtt Cr. (a)	Stream gage	7.31	22.0	22.0	22.0	22.0	15.0	15.0	7.4	7.4	7.4	7.4	15.0	22.0
ɛtt Cr.	Sissel Gl.	18.6	7.7	7.7	7.7	7.7	6.4	5.1	2.4	2.4	2.4	2.4	5.1	7.7
Adam Cr.	Near mouth	0.0	34.0	34.0	34.0	34.0	28.0	23.0	12.0	12.0	12.0	12.0	23.0	34.0
ıp Cr.	Near mouth	0.0	7.0	7.0	7.0	7.0	5.9	4.7	1.7	1.7	1.7	1.7	4.7	7.0
;el Cr.	Near mouth	0.0	5.5	5.5	5.5	5.5	4.6	3.7	2.2	2.2	2.2	2.2	3.7	5.5
ier Cr.	Near mouth	0.0	26.0	26.0	26.0	26.0	22.0	17.0	8.5	8.5	8.5	8.5	17.0	26.0
Cr.	City diversion	7.3	110.0	110.0	110.0	110.0	92.0	73.0	23.0	23.0	23.0	23.0	43.0	65.0
Cr.	Hwy. 3 bridge	2.6	90.0	90.0	90.0	90.0	75.0	60.0	23.0	23.0	23.0	23.0	34.0	51.0
;e Cr.	Near mouth	0.0	23.0	23.0	23.0	23.0	19.0	15.0	7.2	7.2	7.2	7.2	15.0	23.0
ɛr Cr.	Hwy. 3 bridge	5.0	80.0	80.0	80.0	80.0	67.0	53.0	25.0	25.0	25.0	25.0	37.0	55.0
Big Cr.	Near mouth	0.0	17.0	17.0	17.0	17.0	14.0	11.0	5.5	5.5	5.5	5.5	11.0	17.0
Cr.	Near mouth	0.0	12.0	12.0	12.0	12.0	10.0	8.0	2.5	2.5	2.5	2.5	8.0	12.0
aroo Cr.	Near mouth	0.0	16.0	16.0	16.0	16.0	13.0	11.0	4.4	4.4	4.4	4.4	11.0	16.0
erson Cr.	Hwy. 3 bridge	6.3	30.0	30.0	30.0	30.0	25.0	20.0	10.0	10.0	10.0	10.0	13.0	20.0
taw Cr.	1 mile from mouth	1.0	9.0	9.0	9.0	9.0	7.7	6.1	4.5	4.5	4.5	4.5	6.1	9.2
; Cr.	Hwy. 3 bridge	0.6	32.0	32.0	32.0	32.0	27.0	21.0	10.0	10.0	10.0	10.0	21.3	32.0
eat Cr.	Hwy. 3 bridge	0.01	23.0	23.0	23.0	23.0	19.0	15.0	5.0	5.0	5.0	5.0	15.3	23.0
Scott R.	Callahan	0.0	95.0	95.0	95.0	95.0	95.0	63.0	32.0	32.0	32.0	63.0	95.0	95.0
Scott R.	Callahan	0.0	93.0	93.0	93.0	93.0	93.0	62.0	31.0	31.0	31.0	62.0	93.0	93.0
t R.	Farmer's diversion	53.4	155.0	155.0	155.0	155.0	155.0	103.0	62.0	62.0	62.0	103.0	155.0	155.0
t R.	Stream gage station	21.0	426.0	426.0	426.0	426.0	426.0	284.0	192.0	192.0	192.0	284.0	426.0	426.0

(a) No spawning recommendations used.

Table 7. Minimum flows required between spawning peaks (natural flow peaking) for steelhead in the Scott River and tributary streams

			CFS					
Stream	Location	Stream Mile	Dec.	Jan.	Feb.	Mar.	April	
Moffett Cr.	Near Ft. Jones	0.5	30.0	30.0	30.0	30.0	30.0	
Moffett Cr. (a)	Hwy. 3 bridge	7.3	22.0	22.0	22.0	22.0	22.0	
Moffett Cr.	Below Sissel Gl.	18.6	5.1	5.1	5.1	5.1	5.1	
McAdam Cr.	Near mouth	0.0	23.0	23.0	23.0	23.0	23.0	
Soap Cr.	Near mouth	0.0	4.7	4.7	4.7	4.7	4.7	
Duzel Cr.	Near mouth	0.0	3.7	3.7	3.7	3.7	3.7	
Boulder Cr.	Near mouth	0.0	17.0	17.0	17.0	17.0	17.0	
Etna Cr.	Etna City diversion	7.3	65.0	73.0	73.0	73.0	73.0	
Etna Cr.	Hwy. 3 bridge	2.6	51.0	60.0	60.0	60.0	60.0	
Grouse Cr.	Near mouth	0.0	15.0	15.0	15.0	15.0	15.0	
Kangaroo Cr.	Near mouth	0.0	11.0	11.0	11.0	11.0	11.0	
Kidder Cr.	Hwy. 3 bridge	5.0	55.0	53.0	53.0	53.0	53.0	
Mill, Big Cr.	Near mouth	0.0	11.0	11.0	11.0	11.0	11.0	
Mule Cr.	Near mouth	0.0	8.0	8.0	8.0	8.0	8.0	
Patterson Cr.	Near mouth	0.0	20.0	20.0	20.0	20.0	20.0	
Sniktaw Cr.	One mile from mouth	1.0	6.0	6.0	6.0	6.0	6.0	
Sugar Cr.	Near mouth	0.0	21.0	21.0	21.0	21.0	21.0	
Wildcat Cr.	Near mouth	0.0	15.0	15.0	15.0	15.0	15.0	
E. F. Scott R.	Callahan	0.0	95.0	63.0	63.0	63.0	63.0	
S. F. Scott R.	Callahan	0.0	93.0	62.0	62.0	62.0	62.0	
Scott R.	Farmer's diversion	53.4	155.0	103.0	103.0	103.0	103.0	1
Scott R.	Stream gage station	21.0	426.0	284.0	284.0	284.0	284.0	2

(a) No spawning habitat determinations made.

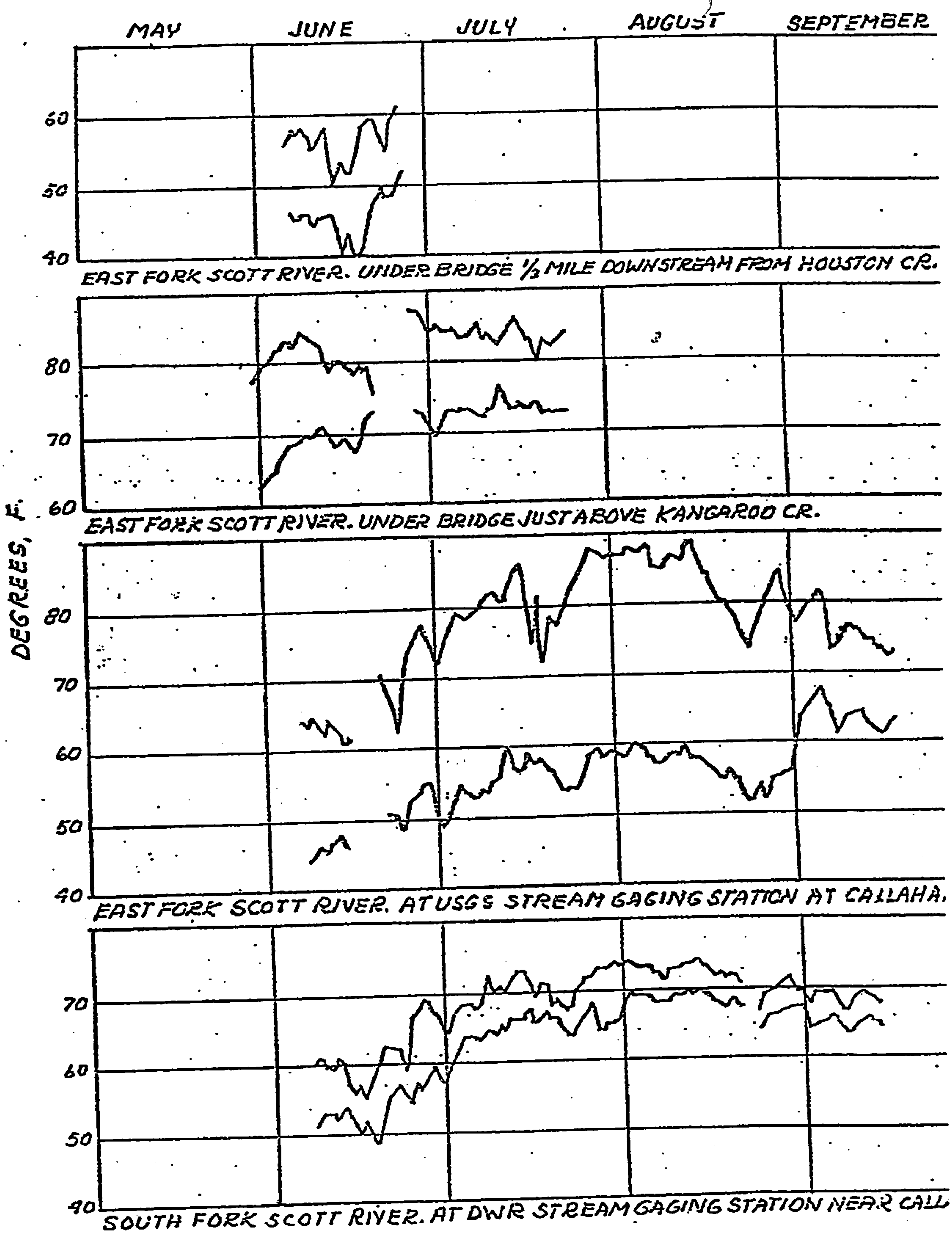

FIGURE 6. 1973 MAXIMUM AND MINIMUM WATER TEMPERATURE. EAST FORK AND SOUTH FORK SCOTT RIVERS

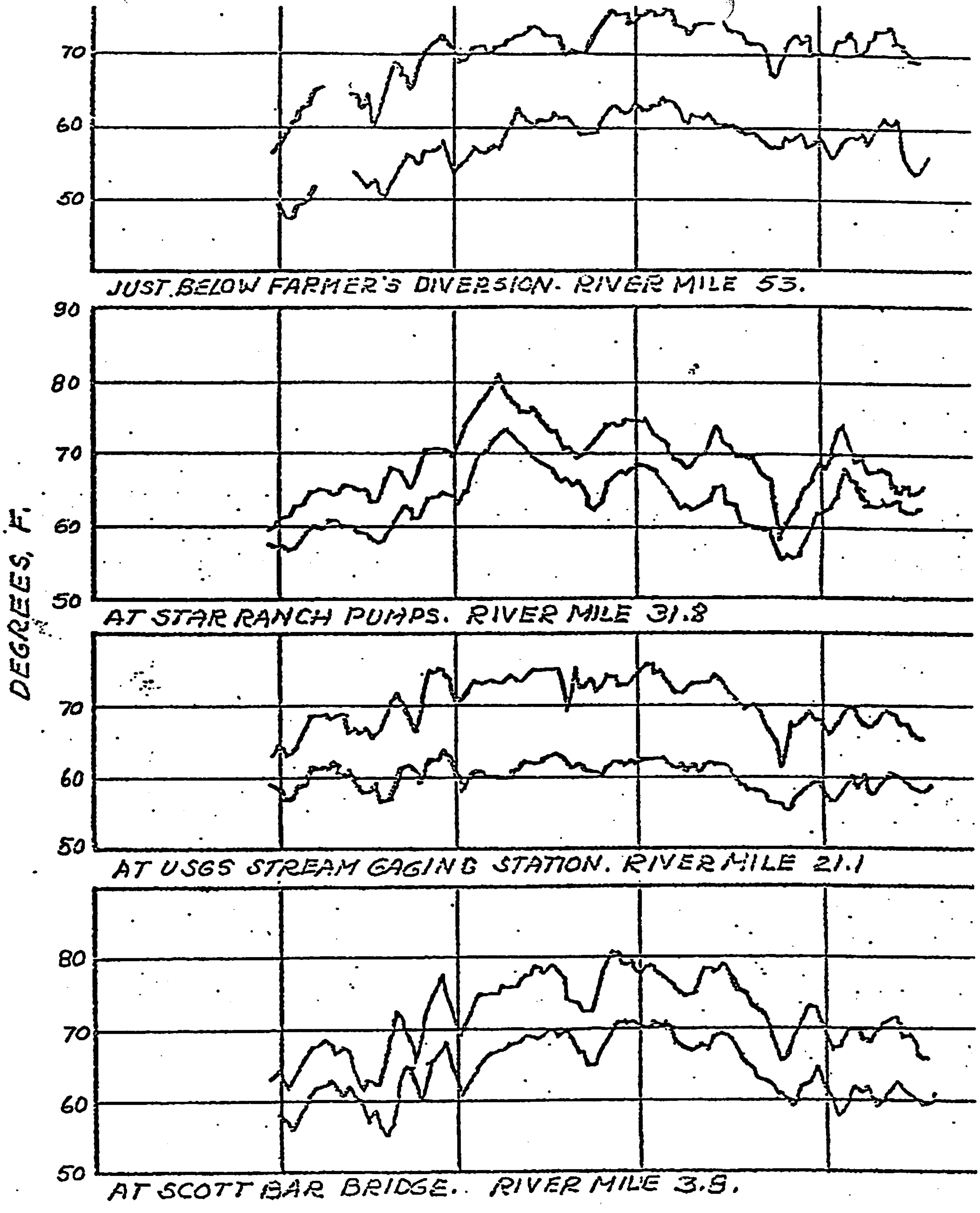

FIGURE 7. 1973 MAXIMUM AND MINIMUM SCOTT RIVER WATER TEMPERATURES.

not exceeding 75°, gives a realistic criteria for an upper limit of temperature for sustaining salmonids in this river system. While this upper maximum as a mean value was not frequently exceeded, several areas had too severe an amplitude in daily temperatures, and lethal conditions existed. In summary, the South Fork of the Scott provided the best overall temperature conditions and the lower East Fork, the worst. The amplitude of daily temperature fluctuation, which caused the lethal conditions, was the most severe at the East Fork U.S.F.S. gaging station near Callahan. Severe conditions also existed above Kangaroo Creek on the East Fork. Figure 8 gives the means of the daily amplitude of temperature fluctuations and a confidence interval about each mean. It could not be determined if the extremes noted for the East Fork were due to its east-west exposure, flood irrigation practices, i.e., return of warm irrigation water, or both. The Department was denied access to much of the upper East Fork area for purposes of obtaining data for this adjudication.

VIII. The Department of Fish and Game's Activities and Expenditures in the Scott River Basin

Due to extensive diversion activity in the Scott River basin the Department has a continuous program of screening diversions and salvage trapping of juvenile salmonids from the Scott River and tributaries. These activities are summarized in Tables 8 and 9.

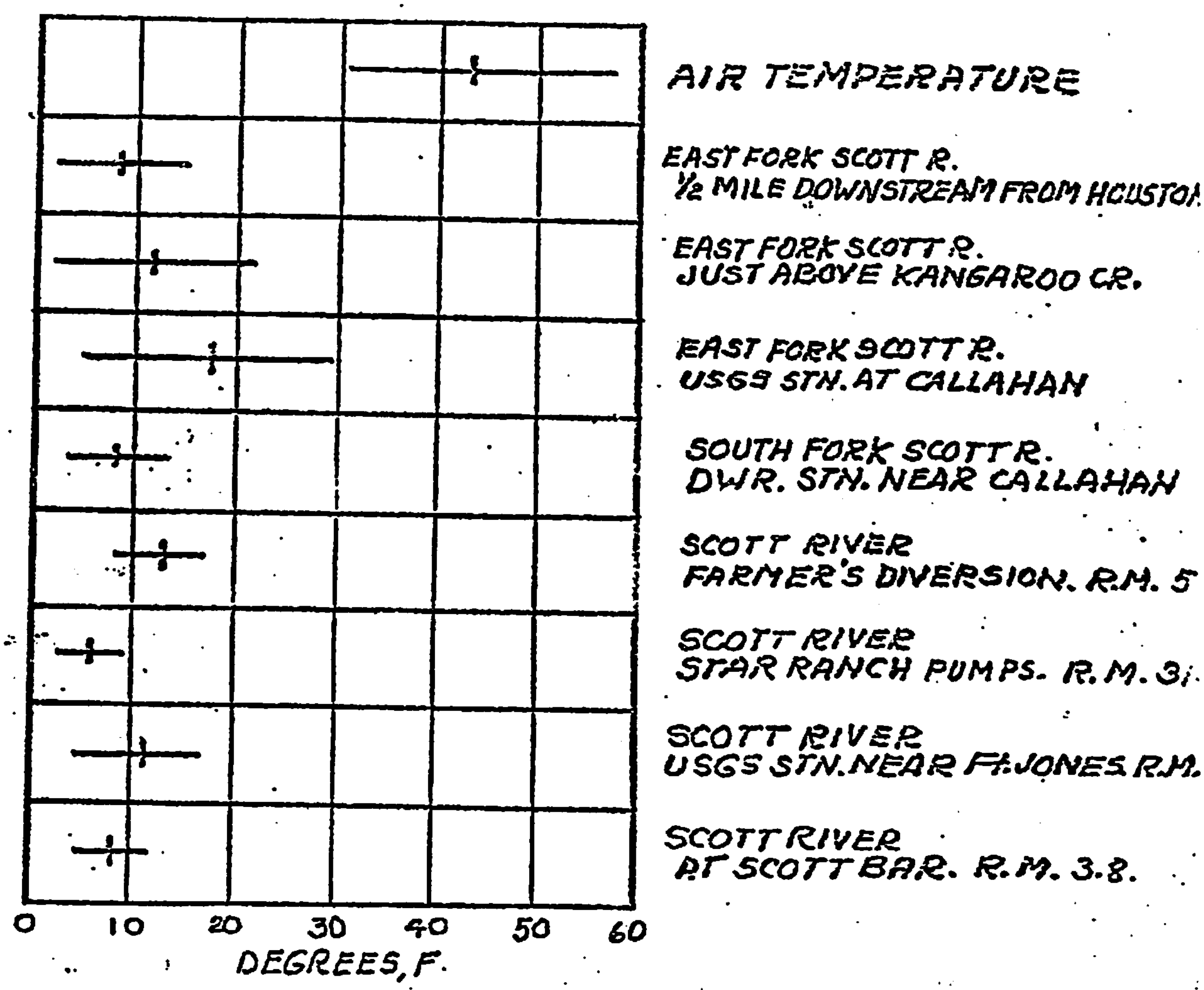

FIGURE 18. MEAN AMPLITUDE OF DAILY TEMPERATURE FLUCTUATIONS (VERTICAL BARS) DURING THE SUMMER OF 1973. HORIZONTAL BARS REPRESENT A RANGE OF ± 2 UNITS OF THE STANDARD DEVIATION.

Table 8. Numbers of juvenile salmonids rescued from drying streams in the Scott River basin in 1971 and 1972.

Water Course	Numbers of Fish 1971	1972
Kidder Creek	77,519	28,351
Shackleford Creek	115,058	131,763
McAdams Creek	44,884	111,210
Etna Creek	7,610	6,432
French	21,460	10,164
Scott River	28,644	30,028
	295,175	317,948

Table 9. Percentage distribution of Yreka Screen Shop expenditures in the Scott River Basin 1973.(1)

	Percent
New Construction	7
Construction and Maintenance of fishways	1
Fish Salvage	8
Operation and Maintenance of Fish Screens	18.5
Fisheries Management Activities	1.5
Scott River Fish Counting Rack(2)	10
Total	45

(1) The annual budget for this facility was $100,000 of which 45 percent or $45,000 was spent in the basin.

(2) During most years, this time would be spent on the other listed activities.

Table 8 provides the number of juvenile salmonids trapped and salvaged from drying stream sections in 1971 and 1972. The rescued fish are transported downriver and released into the river below Meamber Bridge, river mile 24. In addition to these fish an average of 264,390 juvenile salmonids are trapped at some of the fish screens and transported and released downriver.

Table 9 gives a percentage breakdown of the expenditures by the Yreka Screen Shop whose activities include fish protection and salvage in Siskiyou County. Out of an annual budget of $100,000, approximately $45,000 is allotted to fish salvage and fish screens in the Scott River basin.

The Department has 16 permanent fish screen installations in the basin. The cost of fabrication and installation amounts to $139,444. Additional installations are planned in the future. Table 10 provides information on the location and cost of each fish screen.

IX. An Overview

In general, many of the methods and extent of diversion and irrigation currently in practice in the Scott River Basin have created a large degree of incompatibility between agriculture and fisheries. The flows required to maintain fishery values and support heavy agricultural diversions clearly are not in the system during the latter part of July, August, and often in September. Many of the streams would have critical level flows (less than minimum) during this time period even if no water is diverted.

Table 10. Fish screens installed and maintained by the California Department of Fish and Game, Yreka Screen Shop, which are currently in use in the Scott River Basin.

Name	Date of Installation	Location	Cost
Lower Tozier	1956	Shackleford Cr.	$ 863
Upper Tozier	1965	" "	3,475
Burton	1966	" "	6,283
Berrys	1969	" "	5,100
Elliot	1968	" "	5,650
Lower Dangle	1965	Mill Creek	3,075
Upper Dangle	1965	" "	2,675
Perreira	1954	" "	812
Young	1958	Patterson Creek	990
East French	1970	French Creek	4,550
West French	1966	" "	3,400
Scott Valley I.D. and Star Ranch pumps	1966	Scott River	71,000
Scott Valley I.D.	1950	" "	12,000
Denny	1973	" "	6,700
Farmers	1963	" "	10,096
Messners	1964	" "	3,075
			$139,744

There are presently many pronounced problem areas in the basin. The Scott River at approximately river mile 50, goes dry or intermittent for one to three miles annually during the month of June or early July, due to the heavy upstream consumptive use of water. The East Fork is routinely reduced to a wet stream bottom, with intermittent dry sections below diversion dams during the summer months. Etna, Kidder, and Patterson Creeks are rendered dry over several miles of their lower reaches. Sniktaw and Shackleford Creeks are dried annually near their mouths on the Scott River. The mouth of Shackleford Creek often is still dry during the major portion of the king salmon runs which prevent their entrance and utilization of the spawning gravels in this stream. Summer dams and diversions in other streams are left in place and divert unneeded water during the spawning season which may prevent the entrance of salmon to those tributaries. Some irrigation practices involve diversion of water in the early spring prior to snow-melt runoff and the growing season presumably to exercise their water rights and exploit the flows before seasonal depletion limits availability. Such practices interfere with steelhead spawning activity. Kidder Creek is an example.

During the water-short period the stretching of the water supply for irrigation requires maximum conservation. Water economies in irrigation are possible. These potentials lie largely in greater efficiency of water application to the soil, in reduction of conveyance losses, in recapture and reuse of excess water and in general efficiency in the layout of the whole irrigation system. Soil nutrients are lost by using too much water. The use of sprinklers in the valley economizes in water use. According to McCreary-Koretsky Engineers (1967) 1/ most of the irrigated acreage in the drainage is irrigated by the flooding method which usually uses excessive amounts of water in relation to the moisture needs of the plants and low irrigation efficiencies result. Their report noted a wide application of water ranging from 1 to 50 acre-feet per acre. Conveyance losses are high, especially from the many canals and ditches. While solutions for satisfying instream and offstream water needs are seemingly intractable at the present time, answers may probably be had. It will, however, require a cooperative effort between agricultural interests and several resource management agencies at municipal, county, state, and federal levels.

1/ Report on comprehensive planning study - Siskiyou Soil Conservation District. McCreary-Koretsky Engineers. March 1967.