IDAHO

FISH & GAME DEPARTMENT

John R. Woodworth, Director

FEDERAL AID IN FISH AND WILDLIFE RESTORATION JOB COMPLETION REPORT

Project F-49-R-7 & 8

SALMON AND STEELHEAD INVESTIGATIONS

Job No. 5. Rearing Area Distribution of Salmon and Steelhead Juveniles and Temperature Relationships

Period: March I, 1969 to February 28, 1970

Job No. 8. The Relationship of Maximum Water Temperatures to Chinook Salmon Spawning Areas

Period: March I, 1968 to February 28, 1969 By
Melvin Reingold Fishery Research Biologist January, 1970

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JOB COMPLETION REPORT

RESEARCH PROJECT SEGMENT

State Idaho

Project F-49-R-7 & 8

Job Nos. 5 & 8

Name: SALMON AND STEELHEAD INVESTIGATIONS

Title: (8) The Relationship of Maximum Water Temperatures to Chinook Salmon Spawning Areas

(5) Rearing Area Distribution of Salmon and Steelhead Juveniles and Temperature Relationships

Period Covered: (8) March 1, 1968 to February 28, 1969
(5) March 1, 1969 to February 28, 1970

ABSTRACT:

Reconnaissance study results from 1968 and 1969 indicated that juvenile chinook salmon do not rear in the main Salmon River in significant numbers in areas where summer water temperatures exceed 70 degrees F. Very few juveniles were found below Challis, Idaho, where degradation of the river by domestic and agricultural pollution and high summer water temperatures have made the river unsuitable.

Author: Melvin Reingold

Fishery Research Biologist

RECOMMENDATIONS:

We recommend that a series of temperature and pollution monitor stations be maintained in selected areas to note chemical-physical changes that might further reduce salmon and steelhead rearing areas.

OBJECTIVES:

The headwaters and tributaries of the Salmon River, Idaho are major spawning and rearing areas for spring and summer chinook salmon and steelhead trout. Studies conducted in recent years have shown that large numbers of chinook fry move downstream shortly after emergence in early spring. We wondered if these fish distribute themselves in the middle portion of the river to rear to smolt size.

Earlier observations by Department biologists have shown that saimonids do not rear in the lower Salmon below Riggins, probably because of high summer water temperatures.

The objectives of this study were to delineate important juvenile chinook salmon and steelhead trout rearing areas; in the Salmon River above Riggins; in the Middle Fork of the Salmon, and in small tributaries not used as spawning areas; and relate rearing area fish densities to water temperature extremes.

This study was assigned as a low priority project to be accompiished "as time allows".

TECHNIQUES USED:

Estimation Methods

Three techniques were used to estimate relative abundance of juvenile salmonids in selected river sections: (I) daytime SCUBA observations, (2) night observations with lanterns and, (3) daytime observations from boat.

On the main Salmon River, higher counts of juveniles were made with shoreiine counts at night using a double-mantle gas lantern than with the other two methods. Daytime observations from a boat were used on the Middle Fork of the Salmon whe[r]e clear water allowed good visual observation.

Counts were conducted monthly, as work loads permitted, on the main Salmon River. Observations in the Middle Fork were made periodically on float trips in conjunction with other studies during the summer and fail.

Selection of Sample Areas

Eight "night-light" observation stations selected along the main Salmon River were located at large holes approximately 50 miles apart from Sawtooth Valley to the confluence of the Middle Fork (Figure I.). Observations were made throughout the entire length of the Middie Fork of the Salmon.

Selected small tributary streams in the Salmon River Canyon between North Fork and Riggins, Idaho, were sampled with explosives during August, 1969, to note the presence of juvenile salmonids. Larger Salmon River tributaries with known runs of salmonids and good quality rearing areas were not sampled.

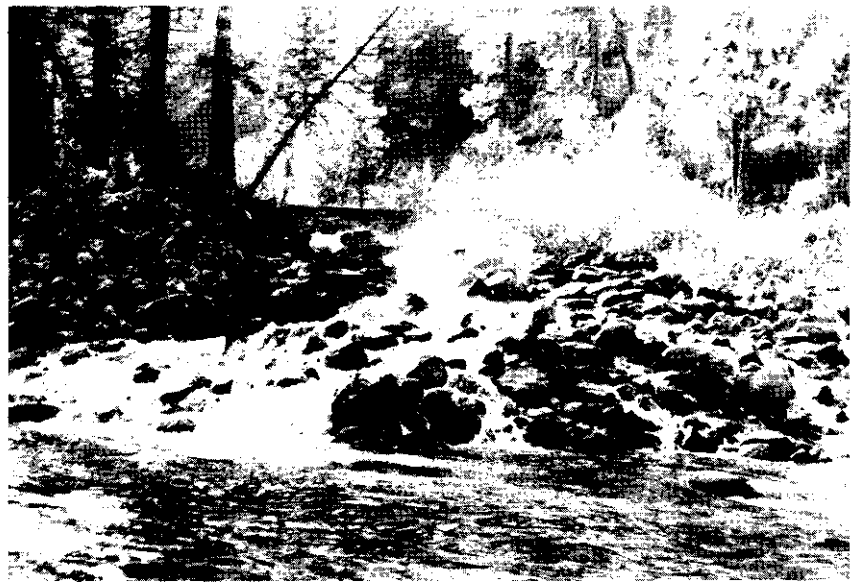

Figure 2. Most streams such as Cottonwood (above) are inaccessible to adult or juvenile anadromous fish during summer levels due to steep alluvial fans and percolation loss.

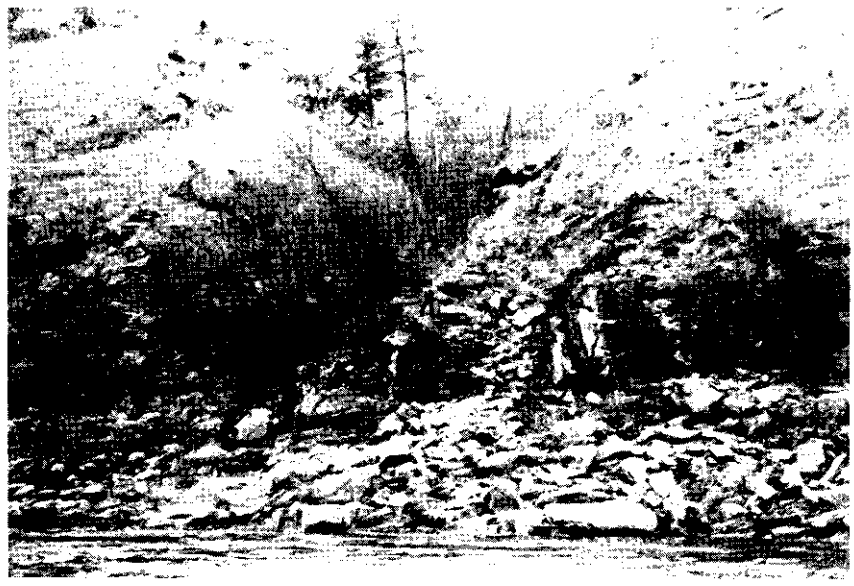

Figure 3. Over 90 percent of the 108 named tributaries in the Salmon River Canyon between Corn Creek and Vinegar Creek are small steep intermittent streams such as Alder Creek (above).

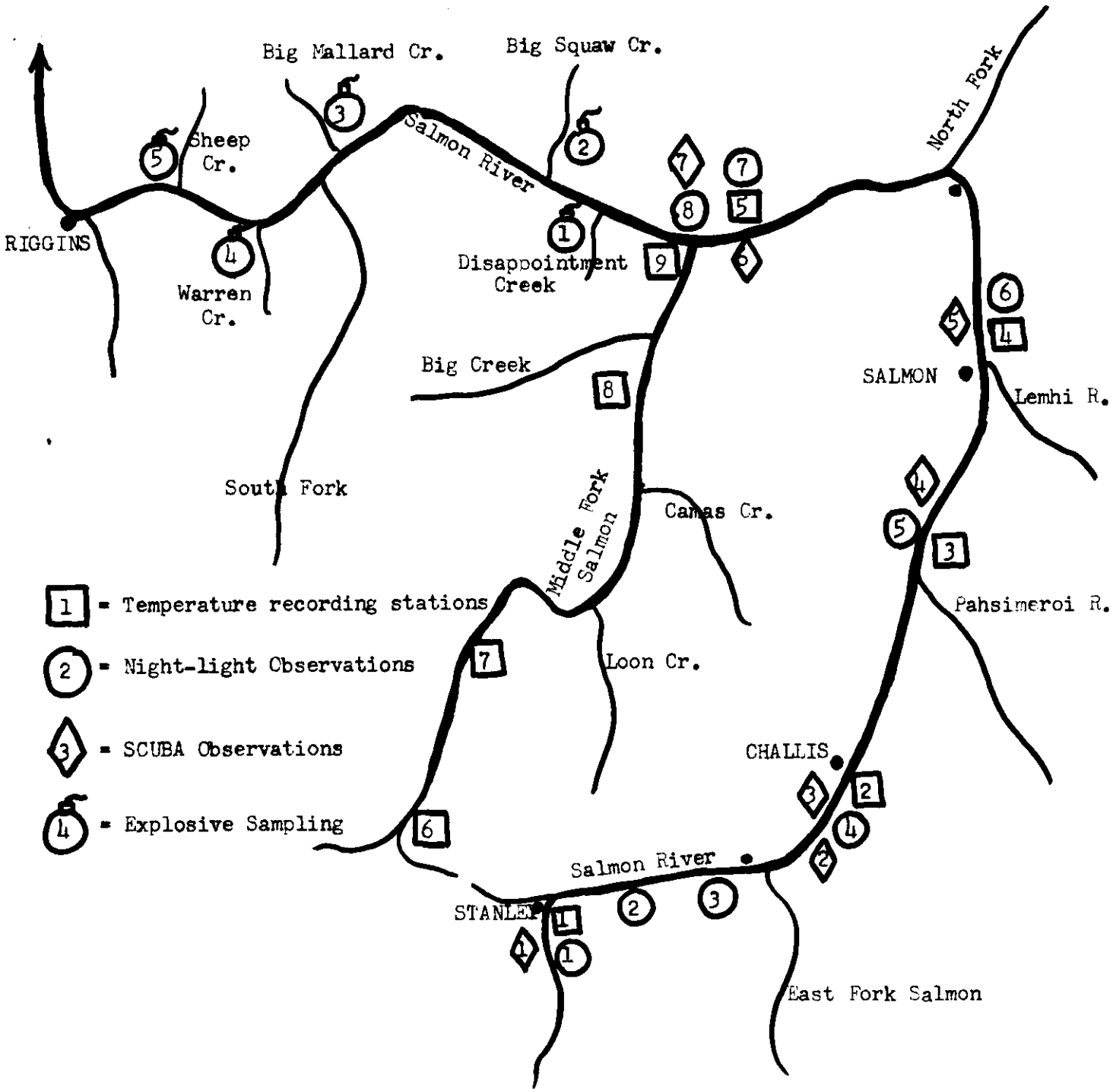

Figure 1. Map of the main Salmon River and Middle Fork of the Salmon River showing locations of temperature recording stations and various sampling and observation areas used for anadromous fish rearing study in 1968 and 1969.

Temperatu[r]e Data

Seven-day recording thermographs were located at 30 to 50 mile intervals along the main Salmon River from Sawtooth Valley to the confluence with the Middle Fork. Thermographs were also maintained at the head and mouth of the Middle Fork.

Maximum-minimum recording thermometers were monitored at five day intervals by U. S. Forest Service personnel at guard stations at Little Creek and Bernard Bar on the Middle Fork of the Salmon River.

FINDINGS:

Main Salmon River

Original project plans ca!ied for evaluation of both steelhead and chinook rearing area preferences. However, while chinook juveniles were readily observed, juvenile steeihead were not. Because of this, the study relates almost entirely to chinook salmon.

in the main Salmon River, juvenile chinook were found rearing almost exclusively from Mali's upstream to the headwaters of the river. Below Challis *very few* juvenile chinook were found (Table i.).

The Challis area marks the first major area where Salmon River water is used for irrigation. Water quality, clarity and water temperatures suitable tor rearing salmon and steeihead deteriorate from Chair is downstream. Water temperatures over 70^0 F. are common during the summer months. Domestic sewage and irrigation water return enter the river in increasing amounts until the river enters the Salmon River Canyon near North Fork, Idaho, approximately 80 miles downstream f[r]om Challis.

Summer water temperatures remain high and water quality remains low through the Salmon River Canyon to Riggins, where additional agricuitural, industria (lumber mills), and domestic pollution is added. Use of the lower Salmon River by rearing juvenile anadromous fish is nil. Small streams in this lower canyon support limited anadromous fish populations.

Only one float trip was scheduled to survey the main Salmon River and tributaries in the 90 mile roadless section below the Middle Fork of the Saimon. Alli08 named tributaries in this area could not be surveyed so eight streams representative of the small tributaries were selected. Earlier surveys reported in "Inventory of Idaho Streams Containing Anadromous Fish - Park i" show that salmonids have access to and rear in limited to large sections of the following creeks: Horse, Cottonwood, Chamberlin, Sabe, Rattlesnake, Bargamin, Big Mallard, Lemh (Creek), Comstock, and Crooked River. Streams with steep gradients or migration blocks at the mouths include Fall, Five Mile, Warren, Indian, Rugged, Rabbit, Polly, California, Elk, and Wind River. Other named streams are so small that they are of minima) rearing value even if accessible (most are not) (Figures 2 and 3). Simultaneous spot checks of water temperatures of 10 streams at their mouths and the main Salmon River between August 4 and 8 show the river to be 4^0 to 16° F. warmer than small side streams (Table 3). Even the South Fork, a major tributary, was six degrees cooler than the main River.

Six to ten-inch rainbow trout (steelhead?) and Dolly Varden were collected with explosives in five streams sampled while chinook fingerlings were present in only two streams. Steelhead adults enter small streams during high spring flows while chinook are excluded by low summer flows. Chinook fry which are noted leaving

Table 1. Counts of juvenile chinook salmon and steelhead trout made at main Salmon River observation stations during the summer and fall of 1968.

Date	Night-light Station Number 1	2	3	4	5	6	7	8	Species
7/28	+100	25+	50+	50+	3	-*	-	-	Chinook
7/29	0	0	0	0	1	-	-	-	Steelhead
8/3	-*	-	-	-	-	2	0	3	Chinook
8/3	-	-	-	-	-	0	0	0	Steelhead
9/11	+100	-	-	50+	4	-	-	-	Chinook
9/11	0	-	-	0	0	-	-	-	Steelhead
9/20	-	-	-	-	-	2	0	5	Chinook
9/20	-	-	-	-	-	0	0	0	Steelhead
10/24	25+	-	-	+100	2	-	-	-	Chinook
10/24	0	-	-	0	0	-	-	-	Steelhead
11/1	-	-	-	-	-	3	8	0	Chinook
11/1	-	-	-	-	-	0	0	0	Steelhead

Date	SCUBA Station Number 1	2	3	4	5	6	7	Species
7/28	50+	-	-	0	0	0	0	Chinook
7/31	0	-	-	0	0	0	0	Steelhead
8/3	-	50+	50+	-	-	-	-	Chinook
8/3	-	0	0	-	-	-	-	Steelhead

Refer to Figure 1. for location of stations.

* Zeros signify that no fish were seen; dashes signify that the area was not checked.

major tributary spawning area streams probably die in the unfavorable environment of the main Salmon River below Challis during the summer. Limited refuge is offered in the cool side streams since most are too small and/or too steep. The lower reaches of larger, suitable tributaries such as the Middle Fork and South Fork appear to be well stocked by fry drifting from their own tributaries.

The main Salmon river below Challis has maximum temperatures in the 70's (°F.) for month-long periods in the summer (Table 4) while even its large tributaries (Middle and South Fork) seldom exceed 65°F.

Holes near the mouths of five small tributaries were biasted with prima-cord to ascertain the presence and abundance of juvenile chinook in streams without adult runs. My professional opinion is that juvenile salmonids could not enter most of these streams because of the steep aluvial fans and percolation loss of low flows. Blasting results help substantiate this opinion (Table 2). Only Sheep Creek, of the streams sampled, had a moderate gradient at its mouth. Aithough access into Warren Creek appeared difficult, one chinook was collected.

Table 2. Survey data for small Salmon River tributaries sampled in 1969 below the Middle Fork showing the relative temperatures of each stream and the number of rainbow (steelhead?) and chinook juveniles sampled with explosives.

Name of Creek	Date	Approx. C.F.S.	No. Holes Sampled	Temperature (°F) River	Temperature (°F) Creek	Number of Trout	Number of Chinook
Disappointment	8/4	8	3	68	56	3	0
Big Squaw	8/4	10	3	70	66	4	0
Big Mallard	8/6	20-30	1	64	54	4	0
Warren	8/7	35-45	1	66	60	4	1
Sheep	8/8	25-35	2	65	55	3	1

Middle Fork of the Salmon River

Juvenile chinook salmon and steelhead trout are abundant throughout the entire length of the Middle Fork of the Salmon River. Juvenile chinook are readily observed either from boats, shore, or with SCUBA, and both chinook and steelhead juveniles are caught by anglers throughout the river. Large numbers were visible in all holes and the river appeared to be saturated with juvenile chinook salmon.

Unlike the main Salmon River, the Middle Fork and most of its feeder streams lie in the Salmon River Primitive Area and have little or no domestic or agricultural use or pollution. Middle Fork water is clear for the entire length of the stream. A marked difference in turbidity is apparent at its confluence with

Table 3. Water temperature data collected on the main Salmon River and selected tributary streams during float trip, August, 1969.

Date	Tributary	Temperature °F. Stream	Salmon River	Time of day	Miles below Middle Fork
Aug. 4			68'	0930	8
Aug. 4	Disappointment Creek	56'	68'	1100	19
Aug. 4	Big Squaw Creek	66'	70'	1300	25
Aug. 4	Smith Gulch	(dry)	70'	1600	27
Aug. 5	Smith Gulch		68'	0900	27
Aug. 6			64'	0800	40
Aug. 6	Big Mallard Creek	54'	66'	1000	44
Aug. 7	Five Mile Creek	52'	68'	0830	58
Aug. 7	South Fork Salmon	60'	66' above	1130	62
Aug. 7	Warren Creek	60'	64' below	1300	67
Aug. 7	Crooked Creek	64'	66'	1500	70
Aug. 8	California Creek	52'	65'	0830	76
Aug. 8	Sheep Creek	55'	66'	0900	78

Table 4. Summary of weekly maximum water temperatures of the main Salmon and Middle Fork of the Salmon rivers, July through October, 1968.

Station #	Main Salmon River					Middle Fork			
	#1	#2	#3	#4	#5	#6	#7	#8	#9
July 1 - 7	64	66	70			62			
8 -15	66	68	73			63		65	
16-23	66	70	73		72	62	59	64	63
24-31	67	64	74		72	62	68	66	66
Aug. 1 - 7	66	66	74	72	74	62	66	68	66
8 -15	64	68	73	68	72	60	66	61	60
16-23	58	68	62	64	65	56	60	56	60
24-30	62	68	66	66	63	57	58		58
Sept 1 - 7	58	67	63		64	55	60		
8 -15	58	62	64		64	54	59		
16-23	54	62	63		66	49	57		55
24-30	52	62	60	58	62	48	52		53
Oct. 1 - 7	48	48	58			44			
8 -15	48	52	56			41			
16-23	46	48	53						
24-31	44	43	50						

Refer to Figure 1. for locations of temperature recording stations above.

the main Salmon River. The highest Middle Fork water temperature recorded (68°F.) was during the first part of August, 1968. It rarely exceeded 66°F. (Table 4).

In mid-summer, at low flows, and without recent rains, the main Salmon River at the confluence is discolored and has a pungent, organic smell.

The main Salmon River probably reared chinook for Its entire length before man's use of the land and river affected it. The diversion of water for irrigation use and subsequent return water additions are a major contributing factor to the poor water quality of the main Salmon River below Challis. There are 66 diversion ditches on the main Salmon River alone. The city of Salmon presently dumps most of its low sewage into the river. The East Fork of the Salmon, Pahsimeroi and Lemhi Rivers and the North Fork of the Salmon all are heavily diverted.

The Middle Fork of the Salmon, which is over 100 miles long and still relativey cool and clear rears chinook and steelhead its entire length. The main Salmon River was once probably just as clear and clean.

Submitted by:

Melvin Reingold
Fishery Research Biologist

Approved by:

IDAHO FISH AND GAME DEPARTMENT

John R. Woodworth, Director

James C. Simpson, Chief
Fisheries Division

Vernon B. Rich, Coordinator
Idaho Federal Aid