IDAHO
DEPARTMENT OF FISH AND GAME

Jerry M. Conley, Director

FEDERAL AID IN FISH RESTORATION

Job Performance Report

Project F-71-R-15

REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS

Job No. 6(SAL)-a	Salmon Subregion Mountain Lake Investigations
Job No. 6(SAL)-b	Salmon Subregion Lake and Reservoir Investigations
Job No. 6(SAL)-c[1]	Salmon Subregion Rivers and Streams Investigations
Job No. 6(SAL)-c[2]	Salmon Subregion Rivers and Streams investigations-Middle Fork Salmon River Snorkeling Transects and Creel Census
Job No. 6(SAL)-d	Salmon Subregion Technical Guidance
Job No. 6(SAL)-e	Salmon Subregion Salmon and Steelhead Investigations-Middle Fork Salmon River Adult Steeihead Lengths

By

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November 1992

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JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fishery Management Investigations

Project No.: F-71-R-15

Title: Region 7 Mountain Lake Investigations

Job No.: 6(SAL)-a

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

No mountain lakes were surveyed this year. We stocked 26 lakes in the Challis National Forest (north) and 37 lakes in the White Cloud Peaks. A Hughes 500D helicopter was used to stock the lakes at a cost of $65.62 per lake ($4,134 total cost). A total of 10,750 fry were stocked in Challis National Forest (north) lakes: 9,000 cutthroat trout, 250 rainbow trout and 1,500 grayling (Table 1). In the White Cloud Peaks, 20,000 fry were stocked: 17,250 cutthroat trout, 1,750 rainbow trout, and 1,000 grayling (Table 2).

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R7DJ90-1

Table 1. Alpine lakes in the Challis National Forest (north) stocked with fry, 1990.

Lake name	Number stocked	Species[a]
Challis Creek #2	250	CT
Challis Creek #3	250	CT
West Fork Bear Creek #1	250	CT
Twin Creek 12	250	RB
Castle #2	250	CT
Castle #1	250	CT
Martindale #2	750	CT
Martindale #1	500	GR
Woodtick Creek #2	500	CT
Woodtick Creek #3	250	GR
West Fork Camas #1	500	CT
West Fork Camas #3	750	CT
West Fork Camas #5	500	CT
Cache Creek #5	250	GR
Cache Creek 13	250	CT
Cache Creek #1	250	CT
Pole	500	CT
Liberty 12	500	CT
Rock #1	500	CT
Rock #2	500	CT
Falconberry	500	CT
Nelson 11	500	CT
Nelson #2	500	CT
Nelson #2	500	GR
Mystery #3	250	CT
China #3	500	CT
Total: Cutthroat	9,000	
Rainbow	250	
Grayling	1,500	
Grand Total:	10,750	

[a]CT=cutthroat
RB=rainbow
GR=grayling

R7DJ90-1

Table 2. Alpine **lakes** in the White Cloud Peaks stocked with fry, 1990.

Lake name	Number stocked	Species[a]
East Basin Creek #1	500	CT
Elk	500	CT
Garland #1	500	CT
Garland #2	500	CT
Garland #3	250	CT
Ocalkens #1	500	CT
Ocalkens #2	750	RB
Crater	750	CT
Gunsight	500	CT
Tincup	500	GR
Slide	500	CT
Sheep	500	CT
Cirque	750	CT
Snow	250	CT
Genetian	250	RB
Island	250	CT
Goat	250	CT
Big Frog	250	RB
Big Frog	250	GR
Little Redfish	250	CT
Castle	500	CT
Drift (Shallow)	500	CT
Glacier	500	CT
Hope	250	GR
Honey	500	CT
Heart	1,000	CT
Chamberlain	500	CT
Castleview	250	CT
Fourth of July	1,000	CT
Washington	500	RB
Six Lakes #1	1,500	CT
Six Lakes #3	500	CT
Lightening	1,000	CT
Thunder	250	CT
Phyllis	1,000	CT
Blackrock	500	CT
MacRae (Deer)	1,000	CT
Total: Cutthroat	17,250	
Rainbow	1,750	
Grayling	1,000	
Grand Total:	20,000	

[a]CT=cutthroat
RB=rainbow
GR=grayling

RECOMMENDATIONS

1. Survey some of the lakes prior to stocking for growth, overwinter survival and reproduction of stocked fish, presence of competing species, and angler use.

JOB PERFORMANCE REPORT

State of: **Idaho** **Name:** **Regional Fishery Management Invstigations**

Project No.: **F-71-R-15** **Title:** **Region 7 Lake and Reservoir Invstigations**

Job No.: **6(SAL)-b**

Period Covered: **July 1, 1990 to June 30, 1991**

ABSTRACT

Kokanee densities, estimated by trawling, were 597 fish/hectare in Alturas Lake and 64 fish/hectare in Redfish Lake. Kokanee from Redfish Lake averaged 101.1 mm long, and those from Alturas Lake averaged 87.4 mm.

Mean summer Secchi transparencies averaged 8.4 m in Stanley Lake, 12.5 m in Redfish Lake, and 11.0 m in Alturas Lake.

Yellowbelly Lake was chemically renovated and restocked with pure-strain westslope cutthroat trout to establish a broodstock source and quality fishery. A release of incompletely neutralized water resulted in a fish kill in the upper Salmon River. A summary is included in Appendices A and B.

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R7DJ90-8

METHODS

Kokanee Evaluation

Kokanee populations in Alturas and Redfish lakes were sampled on August 19-21 with a midwater trawl. Sampling and data summary methodologies are described by Rieman and Meyers (1990). Fish were aged by otolith examination.

Secchi Transparencies

Secchi transparencies in Stanley, Redfish, and Alturas lakes were measured once each month during June, July, and August. Measurements were made during midday (0900 to 1500) and only when the sun was shining. We measured transparencies at two locations in Stanley Lake, three in Redfish Lake, and two in Alturas Lake.

Secchi transparency is the mean of the depths at which a Secchi disk disappears when lowered from the shaded side of a boat and reappears when pulled back up (Wetzel 1983; Wetzel and Likens 1979). The Secchi disk was 20 cm in diameter, painted black and white, weighted, and suspended from a metered brass chain.

RESULTS AND DISCUSSION

Kokanee Evaluation

The total kokanee density estimate for Alturas Lake was 597 fish/hectare. This is considered high compared to other kokanee lakes (Rieman and Meyers 1990) and for a lake of such low productivity. The standing crop (5 kg/hectare) is considered maximum for a lake of such low productivity (B.E. Rieman, Idaho Department of Fish and Game, personal communication). Kokanee in the Alturas Lake samples ranged from 30 mm to 220 mm long and averaged 87.4 mm (Figure 1). Kokanee sampled from Alturas Lake were comprised of three age classes: 2+, 3+, and 4+ and averaged 123, 135, and 220 mm, respectively (Table 1).

The kokanee density estimate for Redfish Lake was 64 fish/hectare and is considered low. The standing crop of 1.21 kg/hectare is approximately 20% of the estimated system capacity. Kokanee sampled from Redfish Lake ranged from 40-230 mm long and averaged 101.1 mm (Figure 1). Age classes 1+ to 4+ were represented and averaged 100 mm, 150 mm, 188 mm, and 232 mm, respectively (Table 1).

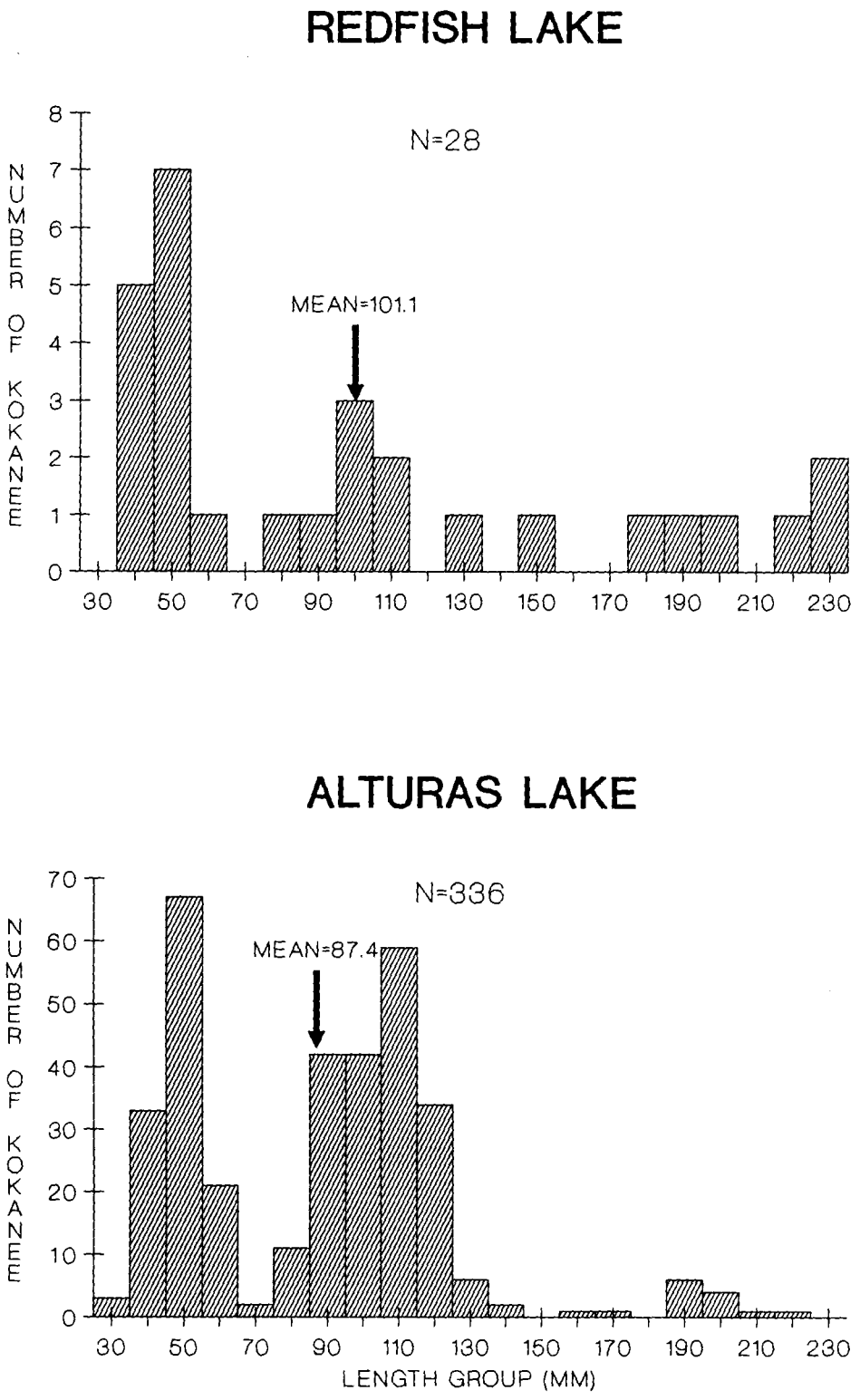

Figure 1. Length frequencies of kokanee sampled with a midwater trawl from Redfish and Alturas lakes, August 1990.

Table 1. Mean and range of lengths (mm) by age class for kokanee sampled by trawling Alturas and Redfish lakes, 1990.

Age	N	Mean length	Range
		ALTURAS	
2+	14	123	95-165
3+	5	135	123-140
4+	4	200	190-220
		REDFISH	
1+	5	100	85-110
2+	2	150	140-160
3+	2	188	185-190
4+	3	232	225-240

Secchi Transparencies

Summer secchi transparencies for Stanley Lake ranged from 6.4-8.9 m and averaged 8.4 m (Table 2). For Redfish Lake, secchi transparencies ranged from 9.8-15.4 m and averaged 12.5 m. Transparencies in Alturas Lake ranged from 6.2-13.8 m and averaged 11.0 m.

Rieman and Meyers (1990) found through modeling that kokanee growth was density-dependent and strongly influenced by productivity. Further, they found significant correlations between several indices of productivity, including summer mean secchi transparency, chlorophyll "a," MEI, and total phosphorus. Since secchi transparency is easily measured, this is probably the best index of productivity, particularly for ultra-oligotrophic lakes.

RECOMMENDATIONS

1. Continue monitoring kokanee densities in Alturas Lake by trawling and in Redfish Lake by acoustics (due to constraints of potential Endangered Species Act listing for sockeye).

2. Evaluate fertilization potential of a Stanley Basin Lake to enhance fish production.

3. Identify interactions between kokanee/sockeye and catchable rainbow trout in Stanley Basin lakes (particularly Redfish Lake) to determine if impacts occur.

4. Investigate factors contributing to the kokanee density in Redfish Lake being well below that predicted.

Table 2. Secchi disk transparencies for Stanley, Redfish, and Alturas lakes, June, July, and August, 1990.

Lake	Date	Time	Station	Average depth (m)
Stanley	June 25	1050	West	6.4
		1110	East	6.8
	July 21	1205	West	9.4
		1215	East	9.6
	August 28	1215	West	9.2
		1225	East	8.9
			Mean	8.4
Redfish	June 25	1500	West	10.4
		1450	Middle	10.1
		1445	East	9.8
	July 21	1345	West	13.0
		1330	Middle	12.4
		1410	East	13.4
	August 28	1330	West	14.9
		1345	Middle	15.4
		1400	East	13.1
			Mean	12.5
Alturas	June 25	1335	West	6.2
		1345	East	7.2
	July 21	1500	West	11.8
		1450	East	13.2
	August 28	1500	West	13.8
		1450	East	13.7
			Mean	11.0

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A P P E N D I C E S

Appendix A. The Yellowbelly Lake Rehabilitation Project and The Upper Salmon River Fish Kill.

THE YELLOW BELLY LAKE REHABILITATION PROJECT

AND

THE UPPER SALMON RIVER

FISH KILL

A report to the Idaho Fish and Game Commission

August 31, 1990

This report was prepared by the Bureau of Fisheries of the Idaho Department of Fish and Game. It is based on site inspection, review of water volume and chemical level applications, and discussions with individuals that planned and participated in the project.

INTRODUCTION

Yellow Belly Lake was programmed for rehabilitation almost a year prior to the treatment on August 9, 1990. Planning started in early October, 1989. This program's objective was to remove undesirable fish:

1. to create a catch-and-release alpine lake fishery in the Stanley area to meet public desires for better fishing in the area; and

2. to provide a source of brocdstock for Department programs to re-establish and enhance native westslope cutthroat trout populations.

Yellow Belly Lake is a 203-acre lake containing 7,430 acre feet of water. It is located about 1/4 mile downstream from McDonald Lake (13 acres, with 78-acre feet of water) on Yellow Belly Lake Creek. Yellow Belly Lake Creek enters Alturas Lake Creek about two miles below Yellow Belly Lake (Figure 1). Alturas Lake Creek flows into the Salmon River about 3/4 mile below the point where the streams converge.

The treatment of Yellow Belly Lake appeared to be a routine lake rehabilitation project. The Department had treated several hundred lakes in the last 35 years without incident. In fact, Yellow Belly Lake was treated in the early 1960s without a fish kill in the creek or the Salmon River.

Because Yellow Belly Lake is **a** high-elevation lake, with a very short period during which water temperatures are suitable for treatment, it was scheduled for August. The toxicant is most effective and detoxifies faster when water temperatures are warmer. Because of past histories in Yellow Belly Lake, other Idaho lakes, and lakes in other states, there was confidence that the chemical could be neutralized in Yellow Belly Lake Creek and would not affect fish downstream in the Salmon River. Despite the fact that there were adult and juvenile chinook salmon downstream from the project, the chemicals were not considered a threat to fish populations downstream.

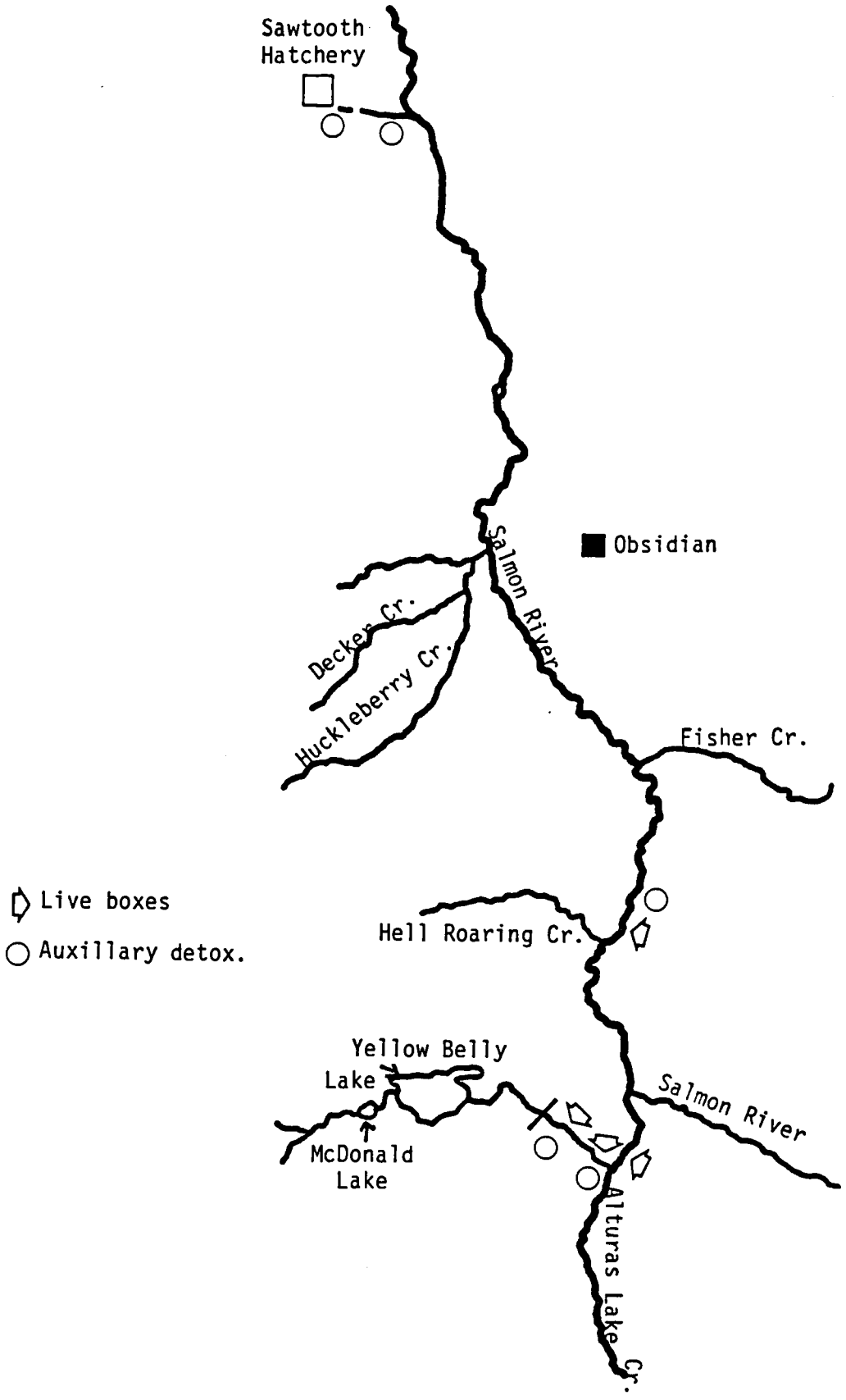

Figure 1. Yellow Belly Lake treatment area with detoxification and live box locations.

PUBLIC INVOLVEMENT

Public and agency interaction took place on numerous occasions prior to the lake treatment. On December 14, 1989, Department personnel met with the Stanley Chamber of Commerce (Chamber) to discuss a plan to improve fishing in the Stanley area. The proposed chemical treatment of Yellow Belly Lake was a topic of discussion and received a favorable response from the Chamber.

On January 29, 1990, a letter was sent to Carl Pence, Sawtooth National Recreation Area, explaining the project and asking for his comments. His response was received on March 22, 1990, and was favorable. He had concerns regarding regulations and media releases, which were addressed.

Posters notifying the public of the treatment were posted in Stanley during the summer. A news release was prepared and sent to the Salmon radio station and the Challis and Stanley newspapers on August 1. These were not printed in the newspapers until August 9 (the day of the treatment).

All public comment was in support of the project throughout this overall period of public notification and review.

'IHE TREATMENT

The lake was prepared for treatment by obtaining water-volume determinations for Yellow Belly and McDonald lakes and calculating flow at the outlet of Yellow Belly Lake. Water volume calculations were determined from a hydrographic map provided by the U. S. Forest Service. Field checks prior to the treatment proved this map to be in error, so new depth soundings were taken and the volume recalculated on the morning of August 9, delaying start of the project until 10:30 AM. The outflow `from the lake was measured at 16 cubic feet per second at the migration barrier below the lake.

The lake was chemically treated with rotenone. Rotenone is a "non-restricted use" pesticide derived from the root of the derris plant. Guidelines for rotenone allow for concentrations up to 10.0 parts per million (ppm). The toxicant is normally applied at concentrations of 0.5 to 1.0 ppm.

Yellow Belly and McDonald lakes were treated at a concentration of 0.7 ppm and 1.0, respectively. The treatment started at 10:30 AM on August 9, 1990, and continued past dark. Yellow Belly Lake had been divided into grids, delineated by marker buoys. Each grid had volumes calculated and rotenone was applied accordingly. Rotenone was applied to the lakes by Venturi pumps through the propeller wash of motorboats. It was also injected into the lower levels of the lake by means of a manually operated pump and a weighted 50-foot hose. A drip station was put in the outlet of McDonald Lake to eliminate fish from the stretch of Yellow Belly Lake Creek between the two lakes.

DETOXIFICATION

The migration barrier below the lake (one mile downstream) was selected as the primary detoxification station. This provided an ideal treatment and mixing site. To detoxify the treated water, potassium permaganate, which is a strong detoxifying agent, is applied at a ratio of 1:1 to 3:1 to treated water. Once mixing is complete, detoxification occurs almost immediately. Three backup detoxification stations were placed at strategic sites to be operated in case of failure by the primary detoxification station prior to the time the rotenone treatment began. Live boxes of fish were placed at various locations below the detox station in Yellow Belly Lake Creek, Alturas Lake Creek, and the Salmon River to monitor detoxification of the stream.

To accomplish the detoxification, a piece of equipment was used that augered potassium permanganate through an adjustable metering device and flows into a mixing chamber, where it is dissolved and then pumped through **a** manifold into the water to be treated. The auger is driven by a generator and the manifold is filled by a pump. This system has worked flawlessly on many projects and did so on this project. All detoxification equipment was on station and field tested prior to application of the toxicant.

Detoxification was begun prior to the time rotenone application reached the detox site. Initial treatment was 1.0 ppm. This should have been sufficient to detoxify the flow at this station, even if lake volume had been substantially overestimated. When rotenone-treated water arrived and began affecting fish in live boxes, the detoxification level was set at 2.5 ppm. This concentration of detoxicant has prevented any fish loss below the treatment area except for the period when the kill occurred. The detoxification station is still in operation to neutralize the toxic water flowing out of the lake. Rotenone has;a normal effective life of only a few days in warm water. Rotenone remains toxic longer in soft water and where cold water retards breakdown.

THE FISH KILL

At the end of the chemical treatment of Yellow Belly Lake, after dark on August 9, live boxes were checked below the detoxification site and fish were alive and well in live boxes below the confluence of Yellow Belly Lake Creek and Alturas Lake Creek and the Salmon River. The Department anticipated that fish would be killed in Yellow Belly Lake Creek in the mixing zone, but did not anticipate a kill below the confluence of Yellow Belly Lake and Alturas Lake creeks. The detox station was operating properly and the crew retired for the night, leaving one individual to monitor the detox equipment to insure proper operation throughout the night. At that point, the objectives of the lake treatment had been met and the detoxification process was going well.

The individual operating the detox station reported that the equipment was working well and no irregular activity occurred during the night.

At approximately 9 AM on August 10, personnel coming on duty to monitor live boxes detected the kill in progress in the Salmon River near Hell Roaring Creek. Fish were dying at Hell Roaring Creek, already dead above Hell Roaring Creek, and stressed below that point. Emergency detoxification procedures were begun to contain the kill and were successful in limiting it to the area above Obsidian.

Treatment at the primary detox station was increased to 5.0 ppm to ensure that if a concentrated "slug" of rotenone was being discharged, it would be detoxified. Test fish in live boxes in Yellow Belly Lake Creek and at the confluence of Alturas Lake and Yellow Belly Lake creeks began to die, so the detoxification was reduced to 3.0 ppm. New test fish in live boxes survived at the Yellow Belly and Alturas test sites after the high concentration of potassium permanganate passed or was oxidized.

All personnel on site on August 10 were busy with activities to contain the area affected and. ensure the security of the hatchery water supply. There was no opportunity at that time to begin investigating what had gone wrong. From the time the kill was discovered until the situation was stabilized, each live box was monitored 24 hours per day by a person with a radio. By Sunday, August 12, continual monitoring of all but the uppermost live boxes was suspended. All stations were (and are) still being monitored daily.

ASSESSMENT CF FISH KILL

Cn Saturday, August 11, and Sunday, August 12, a comprehensive assessment of the extent of the kill was done. Department personnel canoed and/or walked the entire length from Alturas Lake Creek to the hatchery and collected all adult chinook. Ground crews did total counts of other fishes in the entire kill area. Based upon the extent of kill of sedentary species such as sculpin, the area of the kill was determined to be from the lake downstream to the confluence of Huckleberry Creek near Obsidian. While some dead fish were retrieved below that point, they probably drifted into the downstream areas.

Surveys completed Sunday, August 12, confirm the following fish were killed in the Salmon River and Alturas Lake Creek as a result of the renovation project August 9 at Yellow Belly Lake in the Sawtooth Valley:

65	Adult chinook salmon
5,157	Salmon fry and fingerlings
93	Rainbow trout over six inches
377	Rainbows less than six inches (some of these are juvenile steelhead)
146	Other trout
8,053	Rough fish, including suckers, sculpins, squawfish, and dace
4,564	Whitefish

Survey results show that the fish loss was not total. Follow-up surveys beginning August 13 showed limited numbers of live fish of various species in the affected zone above Fisher Creek. A short distance below Fisher Creek, species variety and densities were normal. Chinook continue to move upstream in normal migration activity and are utilizing the affected stretch.

As soon as the fish kill occurred, a Department spokesman notified the press of the kill and supplied preliminary kill figures. As soon as Department personnel were able to make a detailed accounting of the types and numbers of fish killed, this was included in a "FACT SHEET" that was distributed to the press.

ECONOMIC VALUE OF FISH LOST

The economic value of the fish killed in Alturas Lake Creek and the Salmon River as a result of the escape of unneutralized rotenone from Yellow Belly Lake was $14,859. This value was calculated using the same methodsand values used by the State in the Little Salmon River case and values set by Idaho Code. They include both replacement costs and lost recreation value, where appropriate.

Replacement Cost of Fish

One of the most frequently used methods for assessing damages for the destruction of fish and wildlife is replacement cost. As of 1982, one-third of the states were using replacement cost for determining damages in fish kill cases.

The reliability of replacement-cost figures will diminish with regard to species that are not bred in captivity and are not generally similar, especially in their breeding habits, to species which are bred. For example, in the case of the lost wild rainbow/steelhead, the wild steelhead have a survival rate double that of hatchery raised steelhead and therefore are not comparable to the hatchery fish.

The American Fisheries Society (AFS), in its publication, Monetary Value of Freshwater Fish and Fish-Kill Counting Techniques Guidelines, Special Publication 13, Maryland, 1982, the AFS assigns a monetary value to fish by inch class. AFS bases its monetary values of freshwater fish on the premise that in assessing the value of fish destroyed in fish kills, as well as fishery mitigation efforts, hatchery production costs provide a reasonable source of fish value information. This concept has been widely used since 1980. The monetary values were derived from comprehensive surveys by fishery experts. Where actual production costs in Department hatcheries are available (i.e., steelhead, rainbow trout) those costs were used (Hutchinson, 1990).

The following table sets forth the size distribution and monetary value calculation for each species, based on the AFS publication or actual production costs. The numerical loss and AFS replacement cost or monetary value of all species lost in Alturas Lake Creek and the Salmon River as a result of the escape of unneutralized rotenone is given.

All 1982 AFS values are adjusted to 1990 dollars by applying an adjustment factor of 1.319 (U.S. Dept. Labor, 1990).

Values for adult chinook salmon in Table 1 are based on the reimbursement value for an adult chinook salmon set by the Idaho Legislature (Idaho Code Section 36-1404). While this value is established in law and has been repeatedly used in court, it is recognized that considerably higher values could be assigned. In assessing the economic value of chinook pre-smolts killed in the Little Salmon River, the state calculated replacement costs for the smolts and projected the number of adults that might have returned.

The value of the lost recreational fishing opportunity which one adult chinook would have provided was estimated to be $152.35 or $170.18 adjusted to 1990 dollars. While there is no recreational chinook fishery in the Salmon River, this higher value could be used as well. For adult steelhead losses on the Little Salmon River, where no values are stipulated in Idaho Code, the state has used these recreational values to assess the economic value of adult steelhead.

The value of the 65 adult chinook lost may arguably range from $6,500, based on Idaho Code, to $11,062, based on potential recreational value.

Table 1. Numbers and sizes of fished killed in Alturas Lake Creek and Salmon River, August 10, 1990 and their replacement value.

Aqe	Mean size	Number killed	Value/ fish	Total value
Wild xainbow/Steelhead:				
0	2″	203	.004 (2)	$2
I	4″	139	.03 (2)	8
II	7"	67	.17 (2)	23
III+	10"	8	.51	4
		417		$37
Hatchery Rainbow/Steelhead:				
I	4″	35	.03	$1
adults	9″	13	.34	4
adults	11"	5	.75	4
		53		$9
Bull Trout:				
	8"	1	.67 (1.319)	$1
	9″	1	.83 (1.319)	1
	13"+	13	1.89 (1.319)	32
		15		$34
Brook Trout:				
	3"	20	.25 (1.319)	$7
	5"	65	.39 (1.319)	33
	8"	45	.67 (1.319)	40
	12"	1	1.60 (1.319)	2
		131		$ 82
Redside Shiners:				
	3"	2	.06 (1.319)	$0
Sculpins:				
	1-4"	7,820	.06 (1.319)	$619
Dace:				
	1-4"	135	.06 (1.319)	$11
Squawf ish:				
	3-12"	8	.06 (1.319)	$1
Suckers:				
	3-8"	25	.10 (1.319)	$3

Table 1. (Continued)

Age	Mean size	Number killed	Value/ fish	Total value	
Whitefish:					
0	3"	737	.20 (1.319)	$194	
Adults	12"+	3,827	1.20 (1.319)	6,057	
		4,564		$6,251	
Chinook **Pre-smolts:**					
0	3"	4,202	0.14 (1.319)	$776	
I	5"	955	0.27 (1.319)	340	
		5,157		$1,116	
Subtotal					$8,163
Chinook Adults:		65	100.00[2]/	$6,500[3]/	
Total All Species					$14,663

[1]/ Values are based on AFS values for all species except rainbow/steelhead and adult chinook; rainbow/steelhead values are based on actual 1990 costs in Department-operated hatcheries. These values are doubled for wild steelhead pre-smolts, as they exhibit twice the return rate as hatchery fish. All values are adjusted to August 1990 dollars based on the C.P.I. U.S. Dept. of Labor, 1990)

[2]/ Value set by Idaho Code section 36-1404

3/ An alternate value which could be assigned to adult chinook is $170 each for their potential recreational value ($11,050 total).

Lost Recreational Value

The replacement-cost method alone does not reflect the total loss for a fish kill when the kill results in a loss of future recreational fishing opportunity.

Two reliable methods of estimating recreational value for fishing at a particular site are the travel-cost method and the contingent-value method. They both attempt to measure net willingness to pay or the net amount in excess of their actual expenditures that consumers are willing to pay for a resource. (Dannelly, et. al., 1985)

The travel-cost method uses cost of travel as **a** proxy for an entrance fee at a particular recreational site. That is, it relies on variations in travel costs to trace out a demand curve. The area under the demand curve, but above actual travel costs, is called consumer surplus or net willingness to pay. The calculation of travel cost includes time, cost of vehicle operation, and availability of substitute sites. It is designed to measure the net benefits derived from the experience.

The contingent-value method also derives values for the angling recreation at the particular site. The contingent-value method asks users directly to indicate their net willingness to pay. This willingness to pay is expressed in the form of bids for specified recreational conditions. It uses all travel expenditures for a specific site and then asks the recreational user to indicate his or her willingness to pay higher increments over the expenditures to measure net willingness to pay to fish at a particular site. The object is to determine the net willingness to pay, relative to some alternative site.

Neither of these methods overlaps the monetary values presented by the AFS. The AFS figures represent the hatchery replacement cost of the fish. The travel-cost method and contingent-value method measure the lost recreational value.

Values for recreational fishing directed at steelhead are available (Donnelly, et. al., 1985). Values were calculated by the Department in a similar manner for anglers targeting chinook and these values were used in assessing the Little Salmon River kill. There is no recreational chinook fishery on the Upper Salmon, however.

There are no values available specific to resident trout species or whitefish. No values were assigned to recreational fishing for resident fish in the Little Salmon case.

Most of the resident fish recreational fishing in the affected reach occurs in the vicinity of Hell Roaring bridge and is supported by hatchery catchables. Hatchery catchables were restocked at this site on August 11, with little disruption of recreational fishing. Accordingly, as in the Little Salmon River loss assessment, no values have been assigned to opportunity loss associated with the kill of whitefish or other resident species.

Lost Recreational Value of Adult Steelhead

The Idaho Department of Fish and Game utilized the figures derived by Donnelly, et. al., (1985) to derive the figures used to calculate the lost recreational value of adult steelhead. Their study incorporates both the travel-cost method and the contingent-value method and has data specific to the Salmon River fishery in the Stanley area.

No adult steelhead were killed, but the equivalent number of adults that would have returned from the nuirber of juveniles killed was calculated.

Monthly pre-smolt survival rates from Everest (1986) (.8835 to .945) were used to project the number surviving to smolt. The estimated .8259 rate of smolting estimated for the Little Salmon was used to calculate the total number of smolts. The estimate of .03 return of wild smolts-to-adult used for the Little Salmon was also used here.

Numbers of returning adults were thus calculated as follows:

1. a. Age 0 steelhead lost August 1990 (203) X monthly survival to September 1991 (.8835)[13] X monthly survival to April 1992 as Age II (.945)[7] X the percent that smolt at Age II (.8259) = 23 smolts.

   b. Surviving Age 0 steelhead lost August 1990 that would not smolt at Age II (4) X monthly survival to April 1993 (.945)[12] X percent that smolt (.8259) = 2 smolts.

2. a. Age I steelhead lost August 1990 (139) X monthly survival to Aril 1991 (.945)[8] X percent that smolt at Age II (.8259) = 73 smolts.

   b. Surviving Age I steelhead lost August 1990 that would not smolt at Age II (15) X monthly survival to April 1992 (.945) [12] **x** percent that smolt at Age III (.8259) = 8 smolts.

3. Age II steelhead lost August 1990 (67) X monthly survival to April 1991 (.945)[8] X percent that smolt at Age III (.8259) = 35 smolts.

AND:

la + lb + 2a + 2b + 3 (66 smolts) X adult return rate (.03) = 2 adult steelhead lost.

The Donnelly study gives a value of $27.50 per fishing trip to the Stanley area. An average trip is reported as 1.50 days in duration and 7.00 angling hours per day. This is equal to 10.50 angler hours per trip. Kent Ball, biologist for the Department involved in annual steelhead surveys, reported that during the 1984-86 steelhead seasons, the average fishing effort per steelhead caught was 28 hours. It would therefore require 2.66 (rounded to 2.7) *trips* to catch a steelhead. The net value per steelhead caught is *then* calculated to be $74.25.

Adjusted to 1990 dollars, the value of a returning steelhead is $74.25 (1.319) or $97.94. Thus, the value of the lost adult steelhead is: 2 fish x $97.94 or $196.00

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WHAT CAN BE DONE TO MITIGATE FOR FISH LOSSES?

The Department began replacing game fish in the kill area on August 12, when 500 catchable-sized trout were stocked. Since the kill, 79 additional adult salmon have been passed above the weir and salmon have been observed spawning in the impacted area. Two-thousand yearling chinook and 1,000 more rainbow trout from Sawtooth Hatchery were restocked on August 14 and 10,000 eyed salmon eggs will be buried in the gravel in the impacted area later this fall. Those eggs will come from adult salmon now being spawned at the hatchery. The impacted area was not a prime steelhead rearing area and colonization from adjacent streams has already occurred. Over 1.5 million steelhead smolts will **be** released **in** the Upper Salmon next spring.

Sculpin, dace, shiners, suckers, whitefish, and other species, including brook trout and bull trout, have already begun to recolonize the kill area. By next spring, normal densities of all species, including invertebrate life, are expected. The affected area will be monitored by snorkel surveys to document recolonization.

WHAT WENT WRONG?

The operation has been reviewed from start to finish to try to determine the cause of the toxic materials reaching the Salmon River and killing fish. This review has included review of calculations of water volume in the two lakes, review of calculations of rotenone levels applied, and review of operation of the detoxification station. Each individual involved in the treatment has explained his role in the treatment. Eased upon this review and analysis, there are two probable causes of the fish kill:

1. It is possible that there was an undetected or unreported problem at the primary detoxification site.

2. It is possible that an area near the outlet was over-treated or wind and current accumulated a heavy (3 ppm or greater) concentration of rotenone near the outlet, which was not completely detoxified.

The information available does not lead to a conclusive finding in regard to the cause of the fish kill. This project, for all practical purposes, appears to have been handled in the same manner that has resulted in hundreds of successful operations over the last 35 years. The actual cause of the kill will probably never be determined.

This project was generally well planned and conducted. Had that not been the case, the kill would have been far more extensive. There were organizational deficiencies specific to the Yellow Belly Lake treatment that did not figure in the fish kill, but must be improved upon in the future.

1. Leadership was divided among three or more individuals. A single leader should have been in charge and a centralized control center established. Prior to the project, the designated project leader should be responsible to see that all phases of planning are completed. During the project, he should assign and control all activities.

2. Personnel monitoring the live boxes below the project were pulled off their stations once the main detoxification station was determined to be working adequately. In retrospect, personnel should have monitored the live boxes at Alturas Lake Creek for at least 48 hours after the detoxification process was begun.

3. The individual monitoring the detoxification station during the first night after treatment was a relatively inexperienced temporary employee. At least two individuals should have manned this station and included an experienced permanent employee. According to the employee manning the station, there was never a problem with the process on his watch.

WHAT CAN BE DONE IN THE FUTURE?

The Department needs to utilize this bad experience to look more closely at the process and improve it in order to minimize chances of a similar occurrence in the future. Specific steps should include:

1. Development of a lake and stream rehabilitation manual. This "cookbook" will include all information necessary to carry out a successful chemical treatment project.

2. The Fisheries Bureau will conduct a classroom session on lake and stream rehabilitation this winter for all fishery biologists and regional supervisors. This basic refresher course will supplement the manual.

3. The Fisheries Bureau should use the next rehabilitation project as a field training session to enhance those lessons learned in the classroom session and from the manual.

4. Future treatments will include fishery personnel from adjacent regions as part of the team. This will allow fish managers to gain far more experience in rehabilitation projects than they would if they only participated in their own programs.

5. Permits from the Department of Health and Welfare will be applied for and received before any future treatment projects are undertaken.

CONCLUSION

Lake rehabilitation is a vital tool that is used to provide better fishing for the public. The last 35 years have provided many instances where chemical treatment of undesirable fish and restocking of desirable fish species has provided great benefits to the fishing public. Something obviously went wrong at Yellow Belly Lake and the exact cause will probably never be known. This project should result in tightening of procedures in such a way that future treatment projects can proceed without undesirable kills occurring. Over-reaction that would stop future rehabilitation programs would severely hamper the Department's ability to produce better fishing for the public.

Appendix B. A summary of detoxification of Yellowbelly Lake.

State of Idaho
Department of Fish and Game
Salmon, Idaho

November 13, 1990

M E M O R A N D U M

FROM: Jim Lukens

TO: Al Van Vooren

SUBJECT: Yellowbelly Lake Detoxification

C: Herb Pollard, Bill Schrader

As per DEQ Consent Order the following is a summary of the measures taken to neutralize the rotenone applied to Yellowbelly Lake on August 9, 1990.

Lake Outlet Detoxification

Beginning on the treatment day, a potassium permanganate drip station was operated at the fish barrier on the outlet of Yellowbelly Lake. The following table outlines the operation schedule and application rates:

Dates	Potassium permanganate application rate (ppm)
8/10-9/7	2.5
9/7-9/20	1.0
9/20-9/25	0.5
9/25	Equipment turned off but left in place

In addition, four live cages containing 2-4 fish each were monitored at the following sites and times:

Location	Installed	Removed
Fisher Creek	8/10	9/12
Hell Roaring Bridge	8/9	9/12
Alturas/Yellowbelly confluence	8/9	10/17
Barrier	8/13	10/17

At intervals of 1-4 days, the time to loss of equilibrium was recorded for fish in the live cage at the barrier. Time to loss of equilibrium was defined as the average time, in minutes, required for all fish to lose normal position in the water column. The following table summarizes those results:

Date	Time checked	Time to loss of equilibrium (min)	Temp (C)
8/13	2200	<30	-
8/14	1017	10	-
8/14	2141	10	20
8/16	1157	15	-
8/19	1451	15	16
8/21	1450	15	19
8/23	1115	15	-
8/25	1300	<30	16
8/27	1533	15	-
8/29	1442	15	21
9/2	1405	30	22
9/4	1342	18	20
9/5	1142	22	17
9/6	1122	26	16
9/10	1105	55	-
9/11	1700	20	-
9/11	1750	27	-
9/12	1530	25 hours	21
9/15	1100	-	14
9/15	1630	-	22
9/16	1100	-	13
9/17	2000	-	-
9/18	1030	-	12
9/22	2200	-	-
9/23	1225	-	-
9/25	1345	-	-
9/25	1620	-	16
9/26	1630	-	-
9/27-10/17	No additional rotenone mortalities incurred.		

Rotenone Concentration Analysis

On September 4, Department personnel collected water samples throughout the lake, inlet and outlet streams to determine rotenone levels. The samples were shipped via overnight express mail to Dr. Pat Davies at an independent water quality lab in Fort Collins, Colorado. Dr. Davies is a rotenone expert with Colorado Division of Wildlife (303-484-2836). The samples were analyzed on September 5 using a high-performance liquid chromatography (HPLC) procedure as outlined by Dawson et al. (1983)*. Samples were collected at six different

locations with one pure methanol control. The samples were identified by numbers only so that the lab did not know which was the control. Bioassays were conducted at the time of sampling and subsequently throughout September and October. The procedure involved transferring 7-9 liters of water with a Kemmerer bottle to a 19 liter bucket. Two fish were placed in each bucket and observed until both lost equilibrium. The average time to loss of equilibrium was recorded for each sample. Oxygen was monitored during the bioassays with a YSI model 51B oxygen meter. Sufficient oxygen levels were maintained throughout all bioassays. The following table summarizes the data collected on September 4.

Sample #	Station	Depth (m)	Tem (C)	Sample time	Time to loss of equilibrium (min)	Rotenone concentration (ppm)
2	Inlet stream	0	12	1045	-	<0.020
1	Middle	0	16	1110	- 19	0.137
3	Middle	20	9	12000	89	0.029
4	Outlet	0	17	1215	15	0.205
5	Outlet	12	10	1255	22	0.185
6	Barrier	0	20	1350	18	0.203
7	Control			1400	-	<0.020

Bioassay Results

Bioassays were conducted (as previously described) on September 4, 12, 15, 18, 23, 24; October 2, 11 and 16. The following table summarizes the results:

	Time to loss of equilibrium (min.)																	
	9/4		9/12	9/15			9/18			9/23			9/24	10/2			10/11	10/16
Depth (m)	M	O	M	I	M	O	I	M	O	I	M	O	M	I	M	O	M	M
0	19	15		--	--	--												
1																		
2																		
3																		
4								--[a]										
5								<23hr[a]			--[a]							
6								79										
7													--[a]					
8				36											--			
9			<21hr[a]		<125[a]					<21hr[a]	<60[a]	<21hr[a]	<23[a]	59	--	--	--	
10							21	21	25						45		--	
11														33	29	30	--	
12		22				31									32		45	--
13								<60[a]					<42[a]	32	40	37	34	--
14								<23hr[a]			60-120[a]				84		45 1/2	--
15								--							55		--	--
16															--		--	--
17															--			--
18			--[a]		--[a]													
19																		
20	89				--													
21																		
22								--[a]										
23								--[a]										
24			--[a]		--[a]													

[a]Results from live cages suspended in lake.
I=inlet station
M=middle station
O=outlet station

Temperature and Oxygen Profiles

Temperature and oxygen was measured with a YSI model 51B oxygen meter on August 19, September 14, October 2 and 11. Temperature was also measured on August 18 and October 16. The following table summarizes the results:

	8/18	8/19		9/14		10/2		10/11		10/16
Depth (m)	T	T	0	T	0	T	0	T	0	T
0				16.9	7.7					
1	18.0	17.2	7.3	16.9	7.5	14.0	8.0	11.2	8.3	9.0
2	18.0	17.2	7.4	16.7	7.0	14.0	7.9	11.0	8.4	9.0
3	18.0	17.2	7.4	16.5	7.4	14.0	7.8	11.0	8.4	9.0
4	18.0	17.2	7.3	16.2	7.4	14.0	7.8	11.0	8.4	9.0
5	18.0	17.2	7.4	16.0	7.4	14.0	7.8	11.0	8.4	9.0
6	18.0	17.0	7.7	15.8	7.6	14.0	7.7	11.0	8.3	9.0
7	16.5	15.6	8.1	15.5	7.4	14.0	7.8	11.0	8.3	9.0
8	13.5	13.3	9.3	14.6	7.6.	14.0	7.8	11.0	8.3	9.0
9	12.0	11.0	9.7	12.5	9.1	12.5	8.2	11.0	8.2	9.0
10	10.4	9.7	9.6	10.2	9.8	12.0	8.8	10.5	8.3	9.0
11	9.2	8.6	9.4	9.9	9.8	9.0	9.0	10.0	8.7	9.0
12	8.1	7.7	9.4	9.0	9.6	9.0	8.7	9.0	8.8	9.0
13	7.1	7.1	9.0	8.0	9.3	7.0	8.7	8.0	8.6	8.0
14	7.0	6.7	8.5	7.1	9.0	7.0	8.6	7.5	8.1	7.5
15	6.1	6.2	8.6	7.0	8.6	6.5	8.2	7.0	8.0	7.0
16		6.0	7.8	6.6	8.5	6.5	8.0	6.5	7.3	6.5
17		5.8	7.9	6.3	8.1	6.0	6.8	6.2	7.0	6.5
18		5.4	7.2	6.0	7.6	6.0	6.0	6.0	6.4	6.5
19		5.2	6.6	6.0	7.0	5.5	5.8	6.0	6.2	
20		5.0	5.9	5.5	6.2	5.5	5.4	5.8	5.6	
21		5.0	5.6			5.5	5.2	5.8	5.3	
22						5.5	5.2	5.8	5.4	

T=temperature (C)
0-oxygen (mg/1)

Lake Neutralization

On September 7, IDFG personnel rechecked lake volume calculations and placed buoys in the lake to divide surface acreage into quarters. For a lake volume of 7,500 acre-feet, it was estimated that 4,050 pounds of potassium permanganate would achieve a concentration of 0.2 ppm (the highest concentration of rotenone observed in the analyzed samples). The application commenced on the morning of September 11 with 12 IDFG personnel and Ward Harshman (DEQ). A total of 5,070 pounds of potassium permanganate was applied to the lake: 4,020 pounds to the middle two sections, 500 pounds each to the inlet and outlet sections and 50 pounds to the cove. Dispersal methods involved towing burlap sacks containing 55 pounds of chemical behind boats with 30 and 70 foot ropes. Fish placed in live cages at the barrier at 1530 on September 12 survived more than 24 hours.

Subsequent bioassay results indicated that the first treatment failed to thoroughly neutralize the thermocline, so a second treatment was planned to target this strata. An additional 1,375 pounds of potassium permanganate was applied to the four lake sections by six IDFG personnel on September 22, 23 and 25. The same application techniques were utilized with the exception that the rope lengths were adjusted to 40 and 55 feet to target the thermocline.

JOB PERFORMANCE REPORT

State of: **Idaho** **Name:** **Regional Fishery Management Investigations**

Project No.: **F-71-R-15** **Title:** **Region 7 Rivers and Streams Investigations**

Job No.: **6(SAL)-c**[1]

Period Covered: **July 1, 1990 to June 30, 1991**

ABSTRACT

We surveyed the mainstem Salmon, Lemhi, and Pahsimeroi rivers and nine tributaries during summer 1990 to assess fish populations, angler harvest, and habitat conditions. In the mainstem Salmon River near Salmon and Challis, mountain whitefish were the predominant species found in electrofishing samples (72%). Rainbow/steelhead trout were relatively rare (2-5%) and included four marked Kamloops released as fingerlings the previous fall. The fingerlings grew an average of 100 mm. In 17 km of river, we captured only 17 rainbow/steelhead trout of catchable size (>150 mm). Suckers (14%), dace (6%), shiners (2-4%), squawfish (<1-2%), and sculpins (0-1%) were also present. No salmon (sockeye or chinook), cutthroat trout, or bull trout were sampled.

In the mainstem Lemhi River near Leadore, wild rainbow/steelhead x cutthroat hybrid trout were the predominant species sampled by electrofishing (57%), followed by mountain whitefish (39%), juvenile chinook salmon (3%), dace (1%), and sculpin (<1%). No bull or brook trout were encountered. Few trout were larger than 300 mm total length, and the largest fish was almost 500 mm. Minimum estimated game fish (trout and whitefish) densities were 12.5 fish/100 m^2. Movements of trout tagged the previous year were minimal.

In the lower mainstem Pahsimeroi River, annual fishing mortality for large (>275 mm) wild rainbow trout tagged at the weir was an estimated 9%. However, additional fish were caught in the mainstem Salmon River throughout the year. At least 14 (17%) tagged fish returned to the weir the following spring (1991).

R7DJ90-4

Only wild trout (rainbow/steelhead, cutthroat, and bull) were observed in the three Lemhi River and six Pahsimeroi River tributaries that we electrofished. Some tributaries contained only bull trout, and no rainbow x cutthroat hybrids were observed in any tributrary. Mean total lengths ranged from 130-204 mm. Only one tributary had trout >300 mm. Estimated densities of age 1 and older (>70 mm) fish ranged from 0.2-25 fish/100 m^2. Water temperatures ranged from 9-16°C, pool habitat from 0-80%, riffle habitat from 0-20%, and sand/silt substrate from 2-63%.

Authors:

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James R. Lukens
Regional Fishery Manager

OBJECTIVES

Salmon River

1. Determine species composition, relative abundance, and size structure of fish populations in the Salmon River near Salmon and Challis.

2. Evaluate growth and survival of stocked Kamloop rainbow trout fingerlings.

Mainstem Lemhi River

1. Determine species composition, relative abundance, and size structure of fish populations at different stations in the mainstem Lemhi River.

2. Continue monitoring movements of trout jaw-tagged the previous year (May 1989).

Mainstem Pahsimeroi River

1. Estimate exploitation and describe movements of large (>275 mm) rainbow trout in the mainstem Pahsimeroi River.

Lemhi and Pahsimeroi River Tributaries

1. Determine species composition, relative abundance, and size structure of fish populations in tributaries of the Lemhi and Pahsimeroi rivers.

2. Measure physical habitat characteristics and estimate amount of available fish habitat.

STUDY AREA AND METHODS

Salmon River

To determine species composition, relative abundance and size structure, and evaluate Kamloop rainbow trout releases in the Salmon River, we electrofished two stations in July 1990. The Shoup Bridge station began at Shoup Bridge (river mile 265.8) and ended downstream at the U.S. Highway 93 bridge at Salmon City (river mile 259.4). This station was sampled July 17, 1990. The Bruno Bridge station began at Bruno Bridge (river mile 311.8) and extended downstream to the BLM Cottonwood Access Site (river mile 307.5). Sampling was conducted on July 18, 1990.

Fish were captured using direct-current (DC) electrofishing equipment (Coffelt VVP-15 powered by a 5,000-watt Honda generator) mounted in an aluminum drift boat. We attempted to capture all sizes of game and nongame fish. We electrofished while floating downstream using about 300 volts and 5 amps non-pulsed DC.

After capture, fish were identified and measured to the nearest millimeter (total length). Rainbow/steelhead trout were also anesthetized with tricaine methane-sulfonate (MS-222), weighed to the nearest gram, and examined for marks.

We assumed capture probabilities did not vary with species, and we estimated relative abundance using proportions of all fish captured. Small wild rainbow (<225 mm) could not be distinguished from steelhead trout. Although capture probabilities can vary with fish size, length frequencies were developed from all fish captured.

Mainstem Lemhi River

To describe fish communities and estimate fish population parameters in the mainstem Lemhi River, we electrofished one station (Powers Ranch) and attempted two others in late July 1990 (Table 1). We were unable to sample the latter two due to high runoff. The Powers Ranch station began just above the mouth of Big Springs Creek and extended upstream 300 m. It was sampled July 25, 1990. We chose this station because it was representative of the high-quality fishery habitat in the upper Lemhi River.

Fish were captured using direct-current (DC) electrofishing equipment (Coffelt VVP-15 powered by a 5,000-watt Honda generator) mounted in an aluminum canoe. We attempted to capture all sizes of game and nongame fish. Two passes were made going upstream using about 150 volts and 3 amps non-pulsed DC. The second pass was made immediately after and with similar effort as the first. Though the station was not blocked at each end, we assumed fish would not move beyond natural habitat boundaries.

After capture, fish were anesthetized with tricaine methane-sulfonate (MS-222), identified, weighed to the nearest gram, and measured to the nearest millimeter (total length). Fish from each electrofishing pass were allowed to recover in separate holding pens until capture probabilities were calculated. Fish were not marked, although we checked for rainbow and bull trout jaw-tagged the previous year.

We assumed capture probabilities did not vary with species, and we estimated species composition using all fish captured. Smaller wild rainbow (<225 mm) could not be distinguished from steelhead trout. Size structures were developed from all fish captured. We used the two-pass Seber-LeCren method to estimate abundance and probability of capture (Seber and LeCren 1967; Seber 1973):

Table 1. Location of mainstem Lemhi River stations and Lemhi and Pahsimeroi tributaries that were surveyed during 1990.

Stream	Date surveyed	Location	IDFG catalog number	Ownership
Mainstem Lemhi				
Powers Ranch	7/25	T16N R25E S11	07-43-00-003	Private
Lemhi tribs				
Yearian	6/27	T18N R24E S25	07-43-18	BLM
E. Fk. Hayden	6/29	T16N R23E S12	07-43-16-0003	FS
Basin	7/11	T17N R23E S02	07-43-16-0001	BLM
Pahsimeroi tribs				
Mahogany	6/18	T10N R23E S10	07-53-12	BLM
Burnt	6/19	T10N R24E S17	07-53-11	BLM
Donkey	6/20	T11N R24E SO4	n/a	BLM
W. Fk. Pahsimeroi	8/01	T10N R23E S34	07-53-13	FS
E. Fk. Pahsimeroi	8/01	T09N R23E S02	07-53-14	FS
Big	8/02	T13N R24E S21	07-53-09	BLM

$$N = \frac{(n_1)^2}{n_1 - n_2} \qquad p = \frac{n_1 - n_2}{n_1} \qquad SE(N) = \frac{n_1 n_2 (n_1 + n_2)^{1/2}}{(n_1 - n_2)^2}$$

where N = estimated number of fish; p = estimated probability of capture; SE(N) = standard error; n_1 = number of fish captured on the first pass; n_2 = number of fish captured on the second pass.

Density estimates were reported as fish sampled per 100 m^2 of transect surface area (Table 2).

Mainstem Pahsimeroi River

We used $5 reward jaw tags to estimate exploitation and describe movements of large (>275 mm) rainbow trout during the 1990 fishing season. They were trapped and tagged at the Pahsimeroi Hatchery in February and March as they migrated up the Pahsimeroi River to spawn. We began tagging on March 9 and ended on March 30. Because trapping was incidental to normal adult steelhead trapping, we probably missed some smaller rainbow trout that could swim through the weir.

After anesthetized with tricaine methane-sulfonate (MS-222), rainbow trout were measured to the nearest millimeter total length, and fish larger than 275 mm were tagged with numbered $5 reward tags. We allowed fish to recover in holding pens before release above the weir.

A sign was posted at the Pahsimeroi Hatchery to alert anglers to the presence of tagged fish and to provide reporting instructions.

The rate of exploitation (u) is the annual fishing mortality rate (Ricker 1975). Recaptures of tagged rainbow trout throughout the 1990 fishing season (R) were compared to the number tagged and released before the season (M) to estimate this parameter (u=R/M). We assumed equal catchability of tagged versus untagged fish, a 100% reporting rate for the tags, and mortality associated with the tagging process was insignificant (Everhart and Youngs 1981).

Lemhi and Pahsimeroi River Tributaries

To describe fish communities and estimate fish population parameters, we electrofished three Lemhi River and six Pahsimeroi River tributaries between June and August 1990 (Table 2). Fish were captured using backpack DC electrofishing equipment (Coffelt BP-1C powered by a 120-watt

Table 2. Physical characteristics of mainstem Lemhi River stations and

Stream	Date surveyed	Slope (X)	Channel center length (m)	Mean wetted width (m)	Surface area (m^2)[a]	Water temp (C)
Mainstem Lemhi						
Powers Ranch	7/25	--	300	18.0	5,400	--
Lemhi tribs						
Yearian	6/27	1.4	110	4.0	437	14
E. Fk. Hayden	6/29	0.7	83	6.1	506	10
Basin	7/11	2.0	115	2.9	328	16
Pahsimeroi tribs						
Mahogany	6/18	--	90	1.7	152	12
Burnt	6/19	1.8	97	2.0	190	16
Donkey	6/20	--	90	1.6	146	--
W. Fk. Pahsimeroi	8/01	--	200	6.0	1,195	9
E. Fk. Pahsimeroi	8/01	1.7	115	4.3	489	12
Big	8/02		100	6.6	655	11

[a]Product of channel center length and mean wetted width.

generator). We attempted to capture all sizes of game and nongame fish. Two passes were made going upstream, and the second pass was made immediately after and with similar effort to the first. Though electrofishing stations were not blocked at each end, we assumed fish would not move beyond natural habitat boundaries. Stations varied in length from 83-200 m (Table 2).

After capture, fish were anesthetized with tricaine methane-sulfonate (MS-222), identified, weighed to the nearest gram, and measured to the nearest millimeter (total length). Fish from each electrofishing pass were allowed to recover in separate holding pens until capture probabilities were calculated.

We assumed capture probabilities did not vary with species, and we estimated relative abundance using all fish captured. We could not distinguish smaller wild rainbow (<225 mm) from steelhead trout. Although capture probabilities can vary with fish size, length frequency distributions were developed from all fish captured. We used the two-pass Seber-LeCren method to estimate abundance and probability of capture (Seber and LeCren 1967; Seber 1973):

$$N = \frac{(n_1)^2}{n_1 - n_2} \qquad p = \frac{n_1 - n_2}{n_1} \qquad SE(N) = \frac{n_1 n_2 (n_1 + n_2)^{1/2}}{(n_1 - n_2)^2}$$

where N = estimated number of fish; p = estimated probability of capture; SE(N) = standard error; nl = number of fish captured on the first pass; n_2 = number of fish captured on the second pass.

Density estimates were reported as fish sampled per 100 m^2 of transect surface area (Table 2). Because trout 70 mm and smaller were not efficiently sampled, only larger fish were used in the calculations. Also, all trout species were combined to make each density estimate.

We measured physical habitat characteristics and estimated amount of available fish habitat for the same transects that we electrofished. Measurements and estimates were generally made the same day the stream was electrofished. Four or more transects, perpendicular to the thalweg and 20 m apart, were located in each station. Each transect was divided into 1/4, 1/2, and 3/4 intervals. We measured water depth, habitat type (Bisson et al. 1981), and substrate type (Platts et al. 1983) at each interval. Wetted width of the transect and channel center length, slope, and water temperature of the station were also measured (Table 2).

RESULTS AND DISCUSSION

Salmon River

At least six fish species were captured at the Shoup Bridge station in July (Table 3). In decreasing order of abundance, they were: mountain whitefish *Prosopium williamsoni*, suckers *Catostomus* spp., dace *Rhinichthys* spp., redside shiner *Richardsonius balteatus*, rainbow/steelhead trout *Oncorhynchus mykiss,* and northern squawfish *Ptychocheilus Oregonensis*. The majority of fish captured (72%) were mountain whitefish.

The same species plus sculpin *Cottus* spp. were captured at the Bruno Bridge station in July (Table 3). Relative abundance was similar to that at Shoup Bridge, except more rainbow/steelhead trout and fewer shiners and squawfish were present. This may be related to the colder water temperatures at Bruno Bridge.

Trout species included wild rainbow/steelhead, marked hatchery Kamloops, rainbow x cutthroat hybrids, and residualized hatchery steelhead. Some young-of-the-year (YOY) rainbow/steelhead were captured which indicated successful natural reproduction is occurring.

Other fish species that are known to occur in the Salmon River near Salmon but were not captured include: Pacific lamprey *Entosphenus tridentatus*, sockeye salmon *Oncorhynchus nerka*, chinook salmon *O. tshawytscha*, cutthroat trout *O. clarki*, bull trout *Salvelinus confluentus*, and chiselmouth *Acrocheilus alutaceus* (Simpson and Wallace 1982). Some of these are migratory or rare and may not have been in the river when we were electrofishing.

Mountain whitefish ranged in size from 80-410 mm at Shoup Bridge (Appendix B) and from 70-480 mm at Bruno Bridge (Appendix C). Most of the fish were 250-350 mm from both stations. Rainbow/steelhead trout ranged from 70-340 mm at Shoup Bridge and from 60-350 mm at Bruno Bridge. Only 3 fish at Shoup Bridge (1% of all species and sizes captured) and 14 at Bruno Bridge (4%) were catchable size (>150 mm) rainbow/steelhead trout.

In September 1989, about 25,000 Kamloop strain rainbow trout fingerlings (75-150 mm total length) were stocked at Shoup Bridge, and another 25,000 were stocked at Bruno Bridge. All fish had left pelvic fin clips. Hatchery steelhead with coded wire tags are distinguished by a left pelvic and adipose fin clip. The goal of the program is to establish a summer resident trout fishery using fish that grow well, do not successfully reproduce or hybridize, and do not consume juvenile anadromous salmonids.

Only one Kamloop (251 mm total length) was captured at the Shoup Bridge station and three (217-237 mm total length) were captured at Bruno Bridge. We estimate these fish grew an average of 100 mm from September 1989 to July 1990. Although population estimates were not made, densities and survival appeared low.

Table 3. Fish species composition for mainstem Salmon River stations that were surveyed during 1990.

	Station	
	Shoup Bridge	Bruno Bridge
Date surveyed	July 17	July 18
Water temp (°C)	23	19
Total number captured	269	394
Relative abundance (X):		
whitefish	72	72
sucker	14	14
dace	6	6
shiner	4	2
rainbow	2	5
squawfish	2	<1
sculpin	0	1

Mainstem Lemhi River

At least five different fish species were captured at the Powers Ranch station in July (Table 4). In decreasing order of abundance, they were: rainbow/steelhead x cutthroat hybrids, mountain whitefish, juvenile chinook salmon, dace, and sculpin. Rainbow/steelhead x cutthroat hybrid trout probably included residualized steelhead trout as well as rainbow x cutthroat trout hybrids. Although the extent of hybridization is unknown, few fish exhibited red or orange slashes on the underside of the lower jaw. The river is not stocked, and neither hatchery rainbow/steelhead trout nor adult chinook salmon were observed.

Other fish species known to occur in the Lemhi River near Leadore (Simpson and Wallace 1982) but that were not captured include bull trout, brook trout, and pure-strain cutthroat trout. Bull trout are migratory and may not have been in the river when we were electrofishing. Although we did not capture any bull trout or brook trout at the Powers Ranch in May 1989, they were captured a short distance downstream at that time (Lukens and Schrader 1991).

Historic relative abundance by weight above the Lemhi weir was also much different than our estimates of relative abundance by number. On June 8, 1969, 80% of the fish biomass was whitefish, 14% rainbow/steelhead, 3% sculpin, 2% chinook, 0.5% brook trout, and 0.5% dace (Bill Goodnight, Idaho Department of Fish and Game, memo to Don Corley 2/3/70). There was no mention of cutthroat or bull trout. Some difference in rank by weight vs. rank by number would be expected, however.

Fish species composition and estimates of relative abundance for the Lemhi River were much different than for the Salmon River. In contrast to the latter, where over 70% of the fish captured were mountain whitefish, most (57X) fish in the mainstem Lemhi River were rainbow/steelhead x cutthroat hybrid trout. No suckers, shiners, or squawfish were captured in the Lemhi River. These differences may be due to colder water temperatures in the Lemhi River.

Rainbow/steelhead x cutthroat hybrid trout ranged in size from <50 mm to almost 500 mm total length and were the largest fish captured (Appendix D). Mountain whitefish ranged in size from 70-420 mm and juvenile spring chinook from 90-130 mm. Size structures of nongame fish species were not estimated.

Rainbow/steelhead x cutthroat hybrid trout adults in the mainstem Lemhi River spawn in the spring and fry emerge from late spring to early summer. From January to May, there are probably no YOY fish of this species in the river (Figure 1). YOY chinook salmon, however, were captured in May 1989 (Lukens and Schrader 1991). Adults of this species, as well as mountain whitefish, spawn in the fall, and their fry emerge at an earlier date than rainbow/steelhead trout. Hence, differences in swim-up times explain much of the differences in average length-at-age 0 in July for rainbow/steelhead x cutthroat hybrid trout (about 50 mm), mountain whitefish (about 90 mm), and spring chinook (about 100 mm).

Table 4. Fish species composition and estimates of relative abundance at mainstem Lemhi River stations that were surveyed during 1990.

	Station
	Powers Ranch
Date surveyed	July 25
Water temp (°C)	---
Total captured	755
Relative abundance (X):	
rainbow	57
whitefish	39
chinook	3
dace	1
sculpin	<1

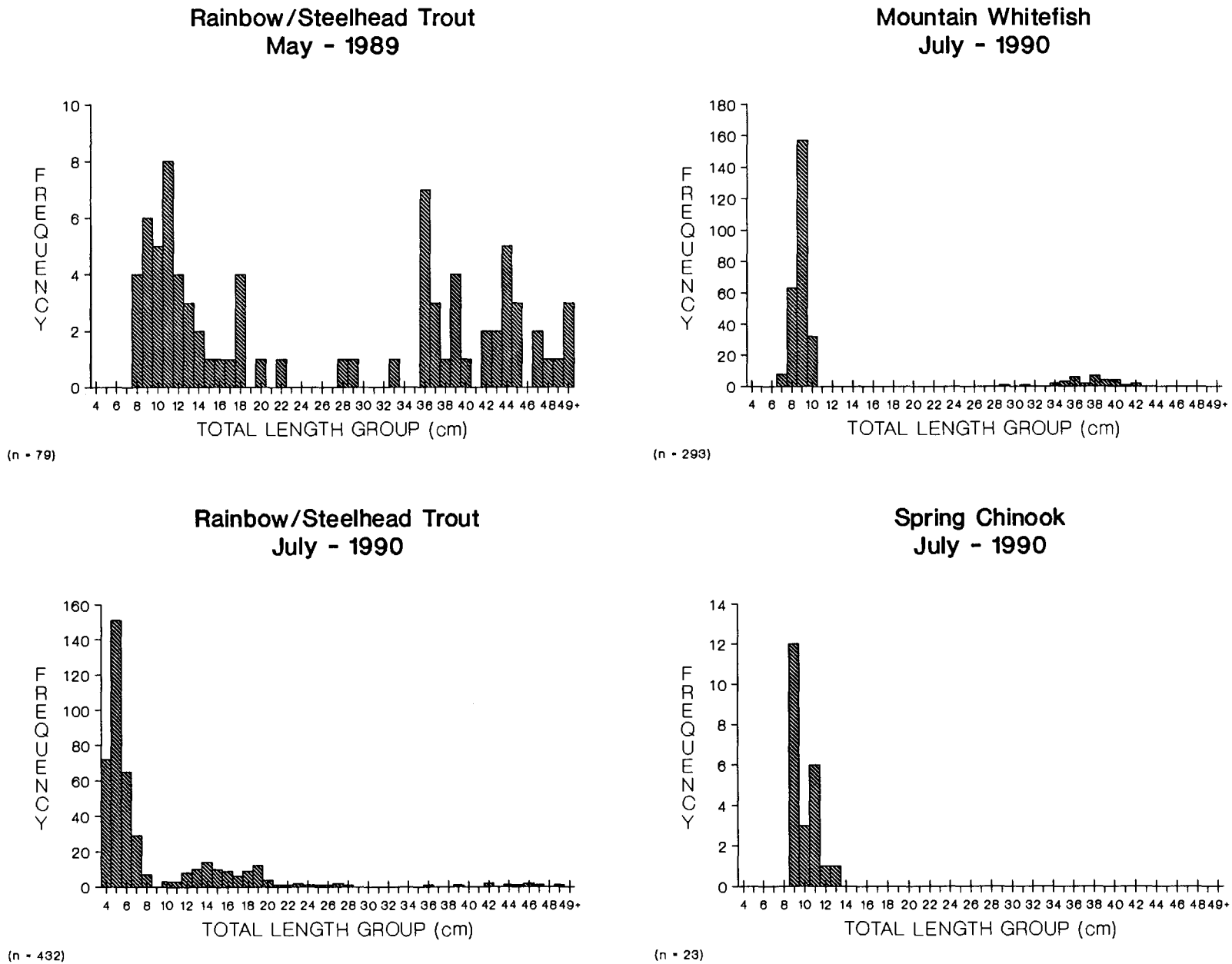

Figure 1. Length frequency distributions of game fish captured at the Lemhi River Powers Ranch Station in 1989 and 1990.

In contrast to the Shoup and Bruno Bridge stations on the Salmon River, where less than 5% of all species and sizes of fish captured were catchable size trout (>150 mm), almost 10% at the Powers Ranch were trout of this size. In addition, the majority (77%) of all fish captured at the Powers Ranch were YOY (<80 mm) rainbow/steelhead x cutthroat hybrid trout and YOY (≤100 mm) mountain whitefish.

Density of age 1 and older (>80 mm) rainbow/steelhead x cutthroat hybrid trout combined with all ages of mountain whitefish was an estimated 12.5 fish/100 m^2 (Table 5). Estimates ranged from 0.6 fish/100 m^2 for age 1 and older whitefish (>100 mm) to 9.4 fish/100 m^2 for YOY whitefish (≤100 mm). Valid estimates could not be made for other ages and species as their capture probabilities (p) were less than 0.30.

Considering fish size structures, densities, and stream habitat (over 75% riffle with associated spawning gravels), we believe this station is used primarily as a salmonid spawning, incubating, and rearing area. These data also attest to the high productivity of the river.

Of 124 large (>225 mm) rainbow/steelhead x cutthroat hybrid trout tagged and released in the mainstem Lemhi River in May 1989, 14 were caught and had the information returned during 1989 for an exploitation rate of 11% (Lukens and Schrader 1991). Of the remaining 110 tagged fish, 7 more were caught by anglers and 4 were electrofished during 1990. Ten were caught or captured during summer (May to August) and one was caught in the fall (September to November).

Based on recapture locations, movements of large rainbow/steelhead x cutthroat hybrid trout were minimal. All tagged fish were caught in the Lemhi River and within 38 km of the release sites.

Mainstem Pahsimeroi River

Of 87 rainbow trout trapped at the Pahsimeroi Hatchery weir, we tagged and released 83 above the weir. Of these 83, 3 died of unknown causes and were found against the weir. One was found in March, one in September, and one in October. Trapped fish ranged in total length from 287-533 mm. Most fish (53%) were tagged the first day (March 9, 1990). Timing of the rainbow trout run is generally earlier than the steelhead run and we were easily able to separate the two stocks based on size.

Of the remaining 80 tagged rainbow trout, 7 were caught by anglers in 1990 for a minimum estimated exploitation rate (u) of 9%.

Not all fishing mortality occurred in the Pahsimeroi River, and not all occurred during summer (May to August). Although three fish were caught within 1 km of the release site, three others were caught in the Salmon River downstream of the Pahsimeroi confluence, and one was caught in the Lemhi River (at least 75 km downstream). Six of the seven tagged fish were caught during summer, and one was caught in September.

Table 5. Estimates of fish density and capture probability at mainstem Lemhi River stations that were surveyed during 1990.

Species	Date surveyed	Density (fish/ 100 m^2)	95% CI	Capture probability (p)	Total captured
Powers Ranch					
YOY rainbow steelhead[b]	7/25	a	---	-1.72	324
Age 1 and older rainbow/ steelhead	7/25	2.5	0.6	0.54	108
YOY mountain whitefish[c]	7/25	9.4	4.5	0.30	260
Age 1 and older mountain whitefish	7/25	0.6	0.1	0.78	33
YOY spring chinook	7/25	a	---	-5.67	23
Total		12.5	5.2		748

[a]Valid estimates could not be made as $p<0.30$.
[b]≤80 mm
[c]≤100 mm

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Additional tagged fish returned to the Pahsimeroi weir or were caught in the Salmon River during winter and spring 1991. At least 14 fish returned to the weir in March and April. Two others were caught by anglers in February and two were caught in March. The majority of the Salmon River is open to fishing during the winter, whereas the Pahsimeroi River is closed.

Based on tag recovery locations, we conclude that a fluvial population of large rainbow trout exists in the Pahsimeroi and Salmon rivers. We believe these fish move up the Pahsimeroi River in the spring to spawn and perhaps remain through summer. Timing of the spring run coincides with the early portion of the steelhead run. These large rainbow trout then move downstream, maybe in the fall, to overwinter in the main Salmon River. Although we did not electrofish near the Pahsimeroi confluence, this might explain why few trout were captured in the main Salmon River while electrofishing during July.

Lemhi and Pahsimeroi River Tributaries

Only trout species were observed in the three Lemhi River and six Pahsimeroi River tributaries that were surveyed during 1990 (Table 6). Four of the nine tributaries contained only rainbow/steelhead trout, four contained only bull trout, and one contained cutthroat and bull trout. Although brook trout, chinook salmon, mountain whitefish, and nongame species (sculpin and dace) were not observed in any of the tributaries, they are known to occur in the drainages. No rainbow x cutthroat hybrids were observed, and none of the streams are currently stocked.

Although sample sizes were small, mean total lengths of all trout species captured ranged from 130-204 mm (Table 7, Appendices D-L). Only one tributary, the East Fork Pahsimeroi River, contained fish larger than 300 mm. In contrast, both Salmon River stations as well as the mainstem Lemhi River station contained trout this large. Also, none of the Lemhi River tributaries surveyed in 1989 contained wild trout >300 mm (Lukens and Schrader 1991).

Estimated densities of age 1 and older (>70 cm) trout ranged from less than 2 to more than 25 fish/100 m^2 (Table 8). Although sample sizes were small, estimates were considered good as capture probabilities (p) were >0.60. Estimated trout densities in Lemhi tributaries in 1989 ranged from 2 to over 46 fish/100 m^2. We expected higher densities in streams with sympatric trout populations (e.g. Big Creek), but this was not the case.

Average water depths ranged from 13.1 to 54.3 cm (Table 9). Although wetted widths were measured, water velocities were not, and estimates of discharge could not be made.

Pool habitat ranged from 0-17% for the stations surveyed and riffle habitat ranged from 0-20% (Table 10). Run habitat was the only type observed at 7 of the 11 stations.

Table 6. Fish species composition and relative abundance estimates for Lemhi and Pahsimeroi River tributaries that were surveyed during 1990.

Stream	Date surveyed	Sample size	Relative abundance (X)		
			RB	CT	DV
Lemhi tribs					
Yearian	6/27	11	100		
E. Fk. Hayden	6/29	19			100
Basin	7/11	22	100		
Pahsimeroi tribs					
Mahogany	6/18	17			100
Burnt	6/19	56	100		
Donkey	6/20	9	100		
W. Fk. Pahsimeroi	8/01	12			100
E. Fk. Pahsimeroi	8/01	30			100
Big	8/02	21		76	24

RB=rainbow trout
CT=cutthoat trout
DV=bull trout

Table 7. Minimum, maximum, and mean total lengths (TL) of trout (all species) captured in Lemhi and Pahsimeroi River tributaries, 1990. One YOY fish (<7 cm) in East Fork Hayden and four in Basin were not measured or included.

Stream	Date surveyed	Min TL (mm)	Max TL (mm)	Mean TL (mm)	Sample Size
Lemhi tribs					
Yearian	6/27	104	223	173.1	11
E. Fk. Hayden	6/29	110	224	176.3	18
Basin	7/11	118	210	155.1	18
Pahsimeroi tribs					
Mahogany	6/18	105	245	162.1	17
Burnt	6/19	67	209	130.3	56
Donkey	6/20	52	176	136.1	9
W. Fk. Pahsimeroi	8/01	65	220	136.5	12
E. Fk. Pahsimeroi	8/01	98	349	187.1	30
Big	8/02	80	297	203.5	21

Table 8. Estimates of trout (all species) densities and capture probabilities in Lemhi and Pahsimeroi River tributaries, 1990. Estimates are for trout >70 mm total length only.

Species	Date surveyed	Density (fish/ 100 m^2)	95% CI	Capture probability (p)	Sample Size (>7 cm)
Lemhi tribs					
Yearian	6/27	2.9	1.4	0.63	11
E. Fk. Hayden	6/29	4.2	1.7	0.62	18
Basin	7/11	5.6	0.4	0.88	18
Pahsimeroi tribs					
Mahogany	6/18	11.7	1.8	0.79	17
Burnt	6/19	25.8	2.3	0.79	47
Donkey	6/20	4.9	0.9	0.83	7
W. Fk. Pahsimeroi	8/01	1.1	0.5	0.63	11
E. Fk. Pahsimeroi	8/01	6.3	0.5	0.85	30
Big	8/02	3.4	0.6	0.76	21

Table 9. Mean water depths for Lemhi and Pahsimeroi River tributaries, 1990.

Stream	Date Surveyed	Mean water depth (cm)
Lemhi tribs		
Yearian	6/27	24.1
E. Fk. Hayden	6/29	54.3
Basin	7/11	21.0
Pahsimeroi tribs		
Mahogany	6/18	14.9
Burnt	6/19	21.3
Donkey	6/20	13.1
W. Fk. Pahsimeroi	8/01	24.1
E. Fk. Pahsimeroi	8/01	27.1
Big	8/02	29.9

Table 10. Estimates of habitat and substrate types in Lemhi and Pahsimeroi tributaries, 1990.

Stream	Date surveyed	Habitat type (%)			Substrate type (%)			
		Pool	Run	Riffle	Sand/ silt	Gravel	Cobble	Boulder
Lemhi tribs								
Yearian	6/27	0	100	0	59	27	12	2
E. Fk. Hayden	6/29	17	83	0	51	39	1	9
Basin	7/11	0	100	0	43	23	28	6
Pahsimeroi tribs								
Mahogany	6/18	0	100	0	38	42	12	8
Burnt	6/19	0	100	0	63	33	4	0
Donkey	6/20	0	100	0	31	18	37	14
W. Fk. Pahsimeroi	8/01	80	0	20	2	57	41	0
E. Fk. Pahsimeroi	8/01	0	100	0	7	55	32	6
Big	8/02	0	100	0	0	16	54	30

Sand/silt substrate ranged from 0-632, gravel from 16-572, cobble from 1-54%, and boulder from 0-30%.

RECOMMENDATIONS

Salmon River

1. Continue stocking marked Kamloop rainbow trout fingerlings in September at Shoup and Bruno bridges. Increase plants to 50,000 or more at each site if possible (done in 1990). Current plans are to stock 25,000 at each site in September 1991.

2. Continue evaluating growth and survival of Kamloop rainbow trout and relative abundance of all species by electrofishing. Consider electrofishing in spring and fall to sample fluvial species such as bull trout and Pahsimeroi River rainbow trout.

3. Evaluate angler utilization of stocked fish and approximate benefit:cost.

4. Stock and evaluate other strains of rainbow trout to establish a summer resident trout fishery.

5. Graph water temperatures to determine which portion of the year temperatures may be limiting.

6. Encourage harvest of mountain whitefish and promote this under-utilized species.

Mainstem Lemhi River

1. Continue to manage the mainstem Lemhi River for naturally-produced wild fish.

2. Maintain general season dates and possession limits for trout and whitefish. Encourage harvest of whitefish and promote this under-utilized fishery.

3. Improve angler access.

4. Electrofish at least one station each in the middle and lower sections of the river to further identify fish distribution and abundance.

5. Evaluate extent of cutthroat trout hybridization with rainbow/steelhead trout.

Mainstem Pahsimeroi River

1. Continue to manage the mainstem Pahsimeroi River for naturally-produced wild fish.

2. Maintain general season dates and possession limits for trout and whitefish. Encourage harvest of whitefish and promote this under-utilized fishery.

3. Improve angler access.

4. Electrofish at least one station each in the upper and lower sections of the river to further identify fish distribution, abundance, and species composition.

Lemhi and Pahsimeroi River Tributaries

1 Continue to manage the Lemhi River and Pahsimeroi River tributaries (except Hawley Creek) for naturally-produced wild fish.

2. Maintain general season dates and possession limits for trout.

3 Conduct fish population surveys on additional tributaries to determine species composition, relative abundance, and size structure. Increase sample sizes to make more accurate estimates.

4 Conduct habitat surveys on additional tributaries to measure slope, channel center length, water temperature, and discharge.

5 Survey the following Lemhi River tributaries: Hayden, Big Timber, Bear Valley, Texas, Little Eightmile, Mill, Wimpy, Peterson, and Sandy creeks.

6. Survey the following Pahsimeroi River tributaries: Morgan, Tater, Morse, Falls, Patterson, North and South Forks of Big, Goldburg, Big Gulch, Doublespring, Grouse, Meadow, Sulphur, Trail, Lawson, and Anderson Spring creeks.

7. Evaluate extent of cutthroat trout hybridization with rainbow/steelhead trout in Big Creek.

LITERATURE CITED

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A P P E N D I C E S

Appendix A. Length frequency distributions of fish captured at the Shoup Bridge station, July 17, 1990. Sample size is in parentheses.

TL range (mm)	Whitefish (194)	Sucker	Dace (39)	Shiner (17)	Rainbow (5)	Squawfish (4)
<50						
50- 59			2			
60- 69			1			
70- 79			3	1	1	
80- 89	1		7	2	1	
90- 99	2		2	3		
100-109	2		1	1		
110-119				1		
120-129			1	2		
130-139						
140-149						
150-159		1				
160-169		3				
170-179		1				
180-189		4				
190-199	2	2				
200-209	2	1				
210-219	3	1				
220-229	1					
230-239	4					
240-249	3					
250-259	6				1	
260-269	10					
270-279	21					
280-289	20					1
290-299	23					
300-309	25					1
310-319	15	1				
320-329	17					
330-339	11	2			1	
340-349	8	1			1	2
350-359	10	1				
360-369	3	1				
370-379	4	5				
380-389		5				
390-399		2				
400-409		1				
410-419	1					
420-429		1				
430-439		1				
440-449		3				
450-459						
460-469						
470-479		1				
480-489						
490-499						
> 500		1				

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Appendix B. Length frequency distributions of fish captured at the Salmon River Bruno Bridge station, July 18, 1990. Sample size is in parentheses.

TL (mm)	Whitefish (284)	Sucker (53)	Dace (24)	Shiner (8)	Rainbow (20)	Squawfish (2)	Sculpin (3)
<50							
50- 59							
60- 69			4				2
70- 79	1	2	8	1	2		1
80- 89	10		5	1	3		
90- 99	12	3					
100-109	2	2	5	3			
110-119		5	2				
120-129		4					
130-139		2					
140-149		1					
150-159		2			2		
160-169		1					
170-179	1	2					
180-189	4						
190-199	9				4		
200-209	9	1					
210-219	5	1			2		
220-229	1						
230-239	1				2		
240-249	4						
250-259	10						
260-269	18						
270-279	11						
280-289	24						
290-299	29						
300-309	27						
310-319	20						
320-329	19	1				1	
330-339	28						
340-349	18	2					
350-359	11	2				1	
360-369	6	1					
370-379		1					
380-389	1	2					
390-399		2					
400-409		2					
410-419	1	1					
420-429		2					
430-439		1					
440-449							
450-459		1					
460-469							
470-479	1	2					
480-489	1	3					
490-499							
> 500		4					

R7DJ90-4

Appendix C. Length frequency distributions of fish captured at the Lemhi River Powers Ranch station, July 15, 1990. Sample size is in parentheses. Dace and sculpin and an additional 279 YOY rainbow and 227 YOY whitefish were not measured.

TL (mm)	Rainbow (153)	Whitefish (66)	Chinook (25)	Dace (6)	Sculpin (1)
<50	10				
50- 59	21				
60- 69	9				
70- 79	4	1			
80- 89	1	8			
90- 99		20	12		
100-109	3	4	3		
110-119	3		6		
120-129	8		1		
130-139	10		1		
140-149	14				
150-159	10				
160-169	9				
170-179	6				
180-189	9				
190-199	12				
200-209	4				
210-219	1				
220-229	1				
230-239	2				
240-249	1				
250-259	1				
260-269	1				
270-279	2				
280-289	1				
290-299		1			
300-309					
310-319		1			
320-329					
330-339					
340-349		2			
350-359		3			
360-369	1	6			
370-379		2			
380-389		7			
390-399	1	4			
400-409		4			
410-419		1			
420-429	2	2			
430-439					
440-449	1				
450-459	1				
460-469	2				
470-479	1				
480-489					
490-499	1				
>					

R7DJ90-4

Appendix D. Length frequency distributions of fish captured in Yearian Creek, June 27, 1990. Sample size is in parentheses.

TL range (mm)	Rainbow trout (11)
<50	
50- 59	
60- 69	
70- 79	
80- 89	
90- 99	
100-109	1
110-119	1
120-129	1
130-139	1
140-149	
150-159	
160-169	1
170-179	
180-189	1
190-199	
200-209	1
210-219	2
220-229	2
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

R7DJ90-4

Appenxix E. Length frequency distributions of fish captured in the East Fork of Hayden Creek, June 29, 1990. Sample size is in parentheses. Note that one YOY bull trout (<70 mm) was not measured.

TL range (mm)	Bull trout (18)
50- 59	
60- 69	
70- 79	
80- 89	
90- 99	
100-109	
110-119	1
120-129	3
130-139	1
140-149	1
150-159	
160-169	
170-179	
180-189	4
190-199	4
200-209	
210-219	3
220-229	1
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

R7DJ90-4

Appendix F. Length frequency distributions of fish captured in Basin Creek, July 11, 1990. Sample size is in parentheses. Note that four YOY rainbow trout (<70 mm) were not measured.

TL range (mm)	Rainbow trout (18)
<50	
50- 59	
60- 69	
70- 79	
80- 89	
90- 99	
100-109	
110-119	1
120-129	3
130-139	2
140-149	2
150-159	2
160-169	4
170-179	
180-189	2
190-199	1
200-209	
210-219	1
220-229	
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

R7DJ90-4

Appendix G. Length frequency distributions of fish captured in Mahogany Creek, June 18, 1990. Sample size is in parentheses.

TL range (mm)	Bull trout (17)
<50	
50- 59	
60- 69	
70- 79	
80- 89	
90- 99	
100-109	1
110-119	
120-129	4
130-139	4
140-149	
150-159	1
160-169	1
170-179	1
180-189	
190-199	
200-209	1
210-219	1
220-229	
230-239	1
240-249	2
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

Appendix H. Length frequency distributions of fish captured in Burnt Creek, June 19, 1990. Sample size is in parentheses.

TL range (mm)	Rainbow trout (56)
<50	
50- 59	
60- 69	1
70- 79	8
80- 89	
90- 99	1
100-109	4
110-119	7
120-129	4
130-139	8
140-149	7
150-159	3
160-169	5
170-179	4
180-189	2
190-199	
200-209	2
210-219	
220-229	
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

R7DJ90-4

Appendix I. Length frequency distributions of fish captured in Donkey Creek, June 20, 1990. Sample size is in parentheses.

TL range (mm)	Rainbow trout (9)
<50	
50- 59	1
60- 69	
70- 79	1
80- 89	
90- 99	
100-109	
110-119	
120-129	
130-139	3
140-149	
150-159	
160-169	
170-179	4
180-189	
190-199	
200-209	
210-219	
220-229	
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

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Appendix J. Length frequency distributions of fish captured in the West Fork of Pahsimeroi River, August 1, 1990. Sample size is in parentheses.

TL range (mm)	Bull trout (12)
<50	
50- 59	
60- 69	1
70- 79	
80- 89	1
90- 99	
100-109	1
110-119	2
120-129	1
130-139	2
140-149	
150-159	
160-169	1
170-179	1
180-189	
190-199	
200-209	1
210-219	
220-229	1
230-239	
240-249	
250-259	
260-269	
270-279	
280-289	
290-299	
300-309	
310-319	
320-329	
330-339	
340-349	
350-359	
360-369	
370-379	
380-389	
390-399	
400-409	
410-419	
420-429	
430-439	
440-449	
450-459	
460-469	
470-479	
480-489	
490-499	
> 500	

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Appendix K. Length frequency distributions of fish captured in the East Fork of Pahsimeroi River, August 1, 1990. Sample size is in parentheses.

TL range (mm)	Bull trout (30)	R7DJ90-4
<50		
50- 59		
60- 69		
70- 79		
80- 89		
90- 99	1	
100-109		
110-119	2	
120-129	7	
130-139	5	
140-149	1	
150-159	2	
160-169		
170-179		
180-189	2	
190-199		
200-209		
210-219		
220-229	1	
230-239		
240-249		
250-259	1	
260-269		
270-279	1	
280-289	1	
290-299	1	
300-309	2	
310-319	1	
320-329		
330-339	1	
340-349	1	
350-359		
360-369		
370-379		
380-389		
390-399		
400-409		
410-419		
420-429		
430-439		
440-449		
450-459		
460-469		
470-479		
480-489		
490-499		
> 500		

Appendix L. Length frequency distributions of fish captured in Big Creek, August 2, 1990. Sample size is in parentheses.

TL range (mm)	Cutthroat trout (16)	Bull trout (5)
<50		
50- 59		
60- 69		
70- 79		
80- 89	1	
90- 99		
100-109		
110-119	1	1
120-129	1	
130-139	2	
140-149		
150-159	1	
160-169		1
170-179		1
180-189		
190-199		
200-209	1	
210-219		
220-229		1
230-239	2	1
240-249	1	
250-259		
260-269	2	
270-279	1	
280-289	2	
290-299	1	
300-309		
310-319		
320-329		
330-339		
340-349		
350-359		
360-369		
370-379		
380-389		
390-399		
400-409		
410-419		
420-429		
430-439		
440-449		
450-459		
460-469		
470-479		
480-489		
490-499		
> 500		

JOB PERFORMANCE REPORT

State of: Idaho Project No.: F-71-R-15 Job No.: 6(SAL)-c[2]

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fishery Management Investigations

Project No.: F-71-R-15

Title: Region 7 Rivers and Streams Investigations – Middle Fork Salmon River Snokeling Transects and Creel Census

Job No.: 7(SAL-c^2

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

Mean densities of cutthroat trout, rainbow/steelhead and chinook salmon counte Middle Fork Salmon River transects in 1990 were 0.3, 0.2, and 0.05 fish/100 respectively. In Middle Fork Salmon River tributary transects, rainbow/steelhead densi averaged 6.1/100 m^2, chinook 0.5/100 m^2, and cutthroat trout 1.3/100 m^2. Middle Fork Sa River anglers reported catches comprised of rainbow trout (31X), cutthroat trout (6 bull trout (0.2X), and miscellaneous nongame species and whitefish (0.92). The ave catch rate was 1.8 fish/hour. Anglers comprised 22% of the floaters interviewed expended an estimated 18,459 hours fishing the Middle Fork Salmon River in 1990.

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INTRODUCTION

The Middle Fork Salmon River (MFSR), part of the Wild and Scenic Rivers System, flows through a remote area in central Idaho. Most of it is within the Frank Church River-of-No-Return Wilderness Area. The MFSR originates at the confluence of Bear Valley and Marsh creeks near Cape Horn Mountain. The river flows 171 km to its confluence with the main Salmon River 92 km below Salmon, Idaho (Figure 1).

Road access exists to Dagger Falls and the Salmon River confluence. Headwaters of some tributaries are accessible **via** primitive roads. The lower 156 km of the MFSR is accessible only by aircraft, float boats, or horse/foot trails. The MFSR is a major recreational river that offers a wide variety of outdoor and backcountry opportunities. The number of people floating the river has increased from 625 in 1962 to 9,841 in 1990 (U.S. Forest Service data).

The earliest MFSR study was conducted in 1959 and 1960 and evaluated westslope cutthroat trout Oncorhynchus clarki lewisi life history and seasonal movements (Mallet 1963). In 1971, additional studies were initiated to monitor MFSR cutthroat trout abundance and to evaluate catch-and-release regulations which were established in 1972. Similar regulations were adopted for major tributaries in the early and mid-1980s.

Part of the studies initiated in 1971 included establishment of snorkeling transects which were surveyed periodically (Corley 1972; Jeppson and Ball 1977, 1979). In 1981, a project was initiated on the MFSR to evaluate wild steelhead trout Oncorhynchus mykiss (Thurow 1982, 1983, 1985). In 1985, another study was initiated to determine juvenile steelhead, chinook salmon O. tshawytscha, and cutthroat trout densities in the MFSR and its tributaries (Reingold and Davis 1987a, 1987b, 1988; Lukens and Davis 1989; Lukens et al., in press).

This report is a continuation of the 1985 study and presents data collected in July and August 1990 pertaining to fish densities, angler effort, catch rates, and catch composition in the MFSR drainage.

OBJECTIVES

1. To monitor juvenile steelhead trout, cutthroat trout, and chinook salmon densities within the MFSR, its tributaries, and Salmon River tributaries.

2. To monitor the effects of catch-and-release regulations on resident fish populations in the MFSR drainage, particularly cutthroat trout.

3. To determine level of angling effort, catch rates, length, and species composition of catch and compare with earlier data to identify changes, particularly in angler effort.

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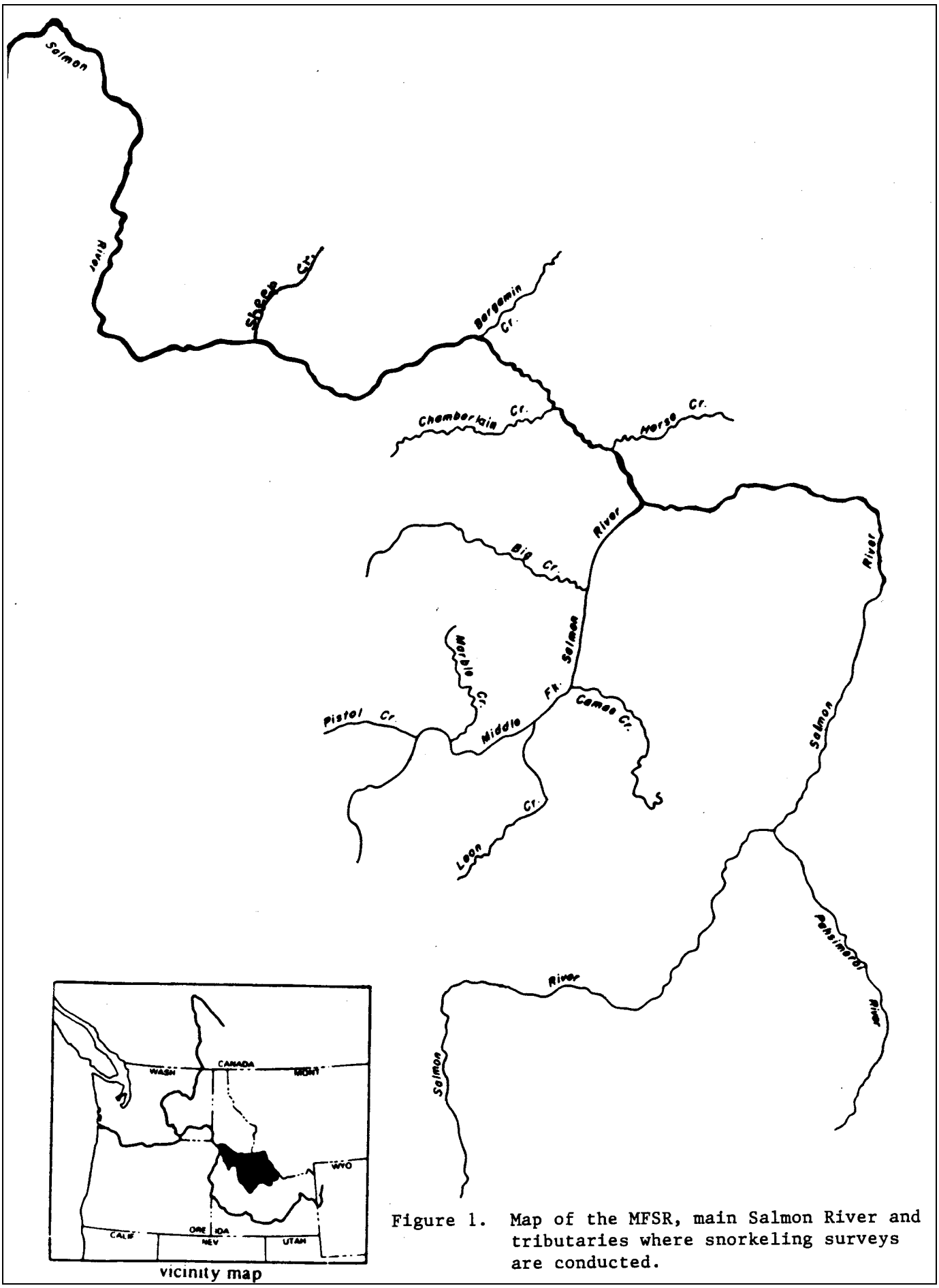

Figure 1. Map of the MFSR, main Salmon River and tributaries where snorkeling surveys are conducted.

METHODS

In 1990, 27 of 29 MFSR transects (Table 1) and 7 tributary transects (Table 2) were surveyed via snorkeling. The main Salmon River tributary transects were not surveyed. The MFSR and tributary transects were snorkeled July 16 to 23, 1990.

The techniques used to survey these transects are described by Reingold and Davis (1987a, 1987b) and Scully et al. (1988).

MFSR floaters were interviewed at the Cache Bar boat ramp (approximately 3 miles downstream from the MFSR confluence on the main Salmon River) at the completion of their trip. Each party was interviewed for the proportion of anglers, average number of hours fished per day, trip length, and whether anglers fished tributaries. Data was recorded separately for commercial and private groups.

Angler diaries were mailed to selected MFSR outfitters that cater primarily to floaters that fish. The outfitters were asked to distribute the diaries to interested anglers so that size and species composition of catch and catch rates could be recorded.

Angler data was combined with MFSR use data and compiled yearly by the U.S. Forest Service, Middle Fork Ranger District, to calculate estimates of total angler use for the season.

All data was compared to previous information to identify trends.

RESULTS

Middle Fork Salmon River Snorkeling Transects

The total number of cutthroat trout, juvenile rainbow/steelhead, and juvenile chinook salmon counted in MFSR transects was 97, 75, and 15, respectively (Table 3). Mean densities were 0.3, 0.2, and 0.05 fish/100 m^2 for cutthroat trout, rainbow/steelhead, and chinook salmon, respectively (Table 4).

Middle Fork Salmon Tributary Snorkeling Transects

Juvenile rainbow/steelhead densities ranged from 1.4 to 15.0 fish/100 m^2 and averaged 6.1 (Table 5). Mean juvenile chinook density was 0.5 fish/100 m^2 and ranged from 0 to 1.6. Cutthroat trout densities averaged 1.3 fish/100 m^2 and ranged from 0.2 to 2.4

Table 1. Locations and dimensions of MFSR snorkeling transects, July 1990.

Fish type[a]	Location (river km)[b]	Transect name	Length (m)	Visibility (m)	Visible corridor (m)	Area (m)	Passes
Sh	0.3	Boundary	128	5.8	11.6	1,485	1
Ch/Ck	4.3	Gardell's Hole	174	3.7	7.4	1,288	1
Ct/Ck	8.8	Velvet	--	--	--	--	-
Sh	13.6	Elkhorn	91	4.6	9.2	837	1
Sh	21.3	Sheepeater	105	4.9	9.8	1,029	1
Ct/Ck	24.5	Greyhound	--	--	--	--	-
Sh	29.6	Rapid River	215	3.4	6.8	1,462	1
Sh	40.0	Indian	247	4.4	8.8	2,174	1
Ct/Ck	44.3	Pungo	128	5.2	10.4	1,331	1
Ct/Ck	51.0	Marble Pool	197	4.6	9.2	1,812	1
Sh	52.3	Ski-jump	165	5.6	11.2	1,848	1
Ct/Ck	60.6	Lower Jackass	210	4.6	9.2	1,932	1
Sh	64.6	Cougar	155	4.3	8.6	1,333	1
Ct/Ck	73.9	Whitey Cox	152	4.6	9.2	1,398	1
Sh	74.1	Rock Island	123	4.3	8.6	1,058	1
Ct/Ck	82.9	Hospital Pool	139	4.0	8.0	1,112	1
Sh	84.3	Hospital Run	151	5.5	11.0	1,661	1
Ct/Ck	92.6	Tappan Pool	326	3.4	6.8	2,217	1
Sh	92.8	Lower Tappan Run	137	4.6	9.2	1,260	1
Ct/Ck	106.6	Flying B	119	4.9	9.8	1,166	1
Sh	108.6	Airstrip	144	4.3	8.6	1,238	1
Sh	119.7	Survey	197	4.0	8.0	1,576	1
Ct/Ck	124.6	Big Creek Bridge	192	4.6	9.2	1,766	1
Sh	127.8	Love Bar	151	4.9	9.8	1,480	1
Ct/Ck	135.8	Ship Island	114	3.4	6.8	775	1
Sh	144.0	Little Ouzel	110	5.5	11.0	1,210	1
Ct/Ck	144.6	Otter Bar	151	3.8	7.6	1,148	1
Ct/Ck	151.5	Goat Creek Pool	114	4.0	8.0	912	1
Sh	151.8	Goat Creek Run	105	2.7	5.4	567	1

[a]Sh-steelhead, Ct-cutthroat, Ck-chinook salmon.
[b]River km starts at Dagger Falls.

Table 2. MFSR tributary transects.

Transect name	Location
Pistol Creek #1 (lower)	At mile marker 16
Pistol Creek 12 (upper)	Above mile marker 16
Marble Creek	Above pack bridge
Loon Creek #1 (lower)	Below pack bridge
Loon Creek #2 (upper)	400 yards above pack bridge
Camas Creek	From pack bridge downstream
Big Creek	400 yards above mouth

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Table 3. Total number of cutthroat trout, rainbow/steelhead, and chinook salmon, by length group (mm), and other fish species counted in MFSR transects, July 1990.

	Cutthroat			Rainbow/steelhead								
Transect	150-230	230-300	>300	<75	75-150	150-230	230-300	>300	Age I chinook	Bull trout	White-fish	Other[a]
Boundary	0	1	6	0	0	1	1	0	2	1	9	0
Gardell's Hole	0	7	7	0	0	0	7	0	0	0	1	0
Velvet	-	-	-	-	-	-	-	-	-	-	-	-
Elkhorn	0	1	0	0	0	3	0	0	0	0	7	0
Sheepeater	0	0	0	0	0	1	0	0	0	0	5	0
Greyhound	-	-	-	-	-	-	-	-	-	-	-	-
Rapid River	0	5	5	0	3	12	0	1	0	3	22	0
Indian	1	2	4	0	0	2	1	0	0	0	9	0
Pungo	0	6	2	0	1	3	0	0	6	0	3	1
Marble Pool	0	4	4	0	1	0	0	0	0	0	5	2
Ski-jump	0	2	1	0	0	1	0	0	0	0	15	0
Lower Jackass	0	0	0	0	0	0	0	0	0	0	4	0
Cougar	0	1	1	0	1	0	0	0	0	0	8	3
Whitey Cox	0	0	0	0	0	0	0	0	0	0	3	2
Rock Island	0	0	4	0	0	1	1	0	0	0	6	1
Hospital Pool	0	1	5	0	0	0	0	0	2	0	7	4
Hospital Run	0	0	0	0	1	0	0	0	0	0	3	0
Tappan Pool	0	1	2	0	3	2	0	0	1	0	13	13
L. Tappan Run	0	2	0	1	2	1	1	0	1	1	12	5
Flying B	0	3	2	0	0	0	0	1	0	0	1	4
Airstrip	0	0	1	0	0	0	0	0	0	0	6	1
Survey	0	1	1	0	1	0	0	0	0	0	10	24
Big Creek Bridge	0	2	0	0	0	0	4	0	0	0	2	11
Love Bar	1	1	3	0	3	3	0	0	1	1	15	2
Ship Island	0	0	2	0	0	0	0	0	0	0	7	10
Little Ouzel	1	1	2	0	3	0	0	0	0	0	6	26
Otter Bar	0	0	0	0	3	0	1	0	0	0	0	200
Goat Cr. Pool	0	0	0	0	0	2	0	0	0	0	2	30
Goat Cr. Run	0	0	1	0	0	2	0	0	2	0	7	12
Column total	3	41	53	1	22	34	16	2	15	6	188	351
Grand total		97				75			15	6	188	351

[a]Suckers, squawfish, and shiners.

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Table 4. Densities of cutthroat trout, rainbow/steelhead and chinook salmon (fish/100 m^2) in MFSR transects, July 1990.

Transect	Cutthroat	Rainbow/ steelhead	Chinook	Total fish[a]
Boundary	0.5	0.1	0.1	1.4
Gardell's Hole	1.1	0.5	0	1.7
Velvet	--	--	--	--
Elkhorn	0.1	0.4	0	1.3
Sheepeater	0	0.1	0	0.6
Greyhound	--	--		
Rapid River	0.7	1.1	0	3.5
Indian	0.3	0.1	0	0.9
Pungo	0.6	0.3	0.5	1.7
Marble Pool	0.4	0.1	0	0.9
Ski-jump	0.2	0.05	0	1.0
Lower Jackass	0	0	0	0.2
Cougar	0.2	0.1	0	1.1
Whitey Cox	0	0	0	0.4
Rock Island	0.4	0.2	0	1.2
Hospital Pool	0.5	0	0.2	1.7
Hospital Run	0	0.1	0	0.2
Tappan Pool	0.1	0.2	0.05	1.6
L. Tappan Run	0.2	0.4	0.1	2.1
Flying B	0.4	0.1	0	0.9
Airstrip	0.1	0	0	0.6
Survey	0.1	0.1	0	2.3
Big Cr. Bridge	0.1	0.2	0	1.1
Love Bar	0.3	0.4	0.1	2.0
Ship Island	0.3	0	0	2.5
Little Ouzel	0.3	0.2	0	3.2
Otter Bar	0	0.3	0	17.8
Goat Cr. Pool	0	0.2	0	3.7
Goat Cr. Run	0.2	0.4	0.4	4.2
Average	0.3	0.2	0.05	2.2

[a]Total fish also includes suckers, squawfish, shiners, whitefish, and bull trout.

Table 5. Number of rainbow/steelhead and cutthroat trout by length group (mm), juvenile chinook salmon and miscellaneous species (Wf=whitefish, Bt=bull trout) counted in MFSR tributary transects, July 1990.

		Rainbow/steelhead					Cutthroat								
	Area										Chinook				
Location	(m)	<75	75-150	150-230	230-300	Rb/100m²	150-230	230-300	>300	Ct/100m²	Age 0	Age I	Ck/100m²	Wf	Bt
Pistol Cr. #1 (lower)	174	0	0	6	5	6.3	0	2	0	1.1	0	0	0	0	1
Pistol Cr. #2 (upper)	567	1	3	3	4	1.9	3	3	4	1.8	9	0	1.6	11	0
Marble Cr.	488	0	6	0	1	1.4	0	0	1	0.2	0	0	0	2	0
Loon Cr. #1 (lower)	369	2	7	9	9	7.3	1	3	4	2.2	0	2	0.5	7	0
Loon Cr. #2 (upper)	455	0	10	11	6	5.9	2	1	0	0.7	0	0	0	8	0
Camas Cr.	533	1	14	7	4	4.9	0	0	5	0.9	1	3	0.8	10	0
Big Cr.	206	3	15	9	4	15.0	0	3	2	2.4	0	1	0.5	16	0
Mean						6.1				1.3			0.5		
Weighted mean						5.0				1.2			0.6		

Creel Census

Anglers that recorded catch information in diaries reported catching 1,086 fish which were comprised of rainbow trout (31%), cutthroat trout (68%), bull trout (0.2%), and miscellaneous nongame species and whitefish (0.9%) (Figure 2). Cutthroat trout averaged 277 mm and rainbow/steelhead 178 mm. Catch rates averaged 1.8 fish/hour.

A total of 373 floaters were interviewed at Cache Bar during July and August and anglers comprised 22% (Table 6). A slightly higher proportion of private floaters (25%) fished compared to guided floaters (19%). An estimated 1,841 anglers spent 10,858 days floating the MFSR in 1990. Each angler expended an average of 1.7 hours fishing per day for a season estimate of 18,459 hours fished. A small proportion (15%) of floaters fished tributary streams, and only one angler reported harvesting a fish from a tributary under consumptive regulations.

DISCUSSION

Middle Fork Salmon River Transects

With the exception of 1988, steelhead parr densities have declined steadily since the mid-1980s (Figure 3). This has been primarily the result of poor downstream smolt survival due to low spring runoff and high mortality in the eight Snake and Columbia river hydroelectric impoundments, which has resulted in reduced spawning escapement.

From 1989 to 1990, chinook densities declined from the largest to the smallest recorded since 1985 (Figure 4). Redd numbers, counted in MFSR index areas the previous year, show a similar trend (Figure 5).

Cutthroat trout densities decreased to the lowest levels recorded since 1985 (Figure 6). The density of large cutthroat also decreased, but only slightly and to levels similar to those observed in 1988.

Since the establishment of snorkeling transects by Department personnel in the early 1970s and catch-and-release regulations in 1972, cutthroat numbers increased until reaching a peak in the early 1980s. Since then, numbers have fluctuated but generally declined (Figure 7). It was suspected that decreasing numbers of cutthroat trout in the MFSR drainage may have been the result of increased fishing effort and resulting increases in hooking mortality, but creel census data did not support this theory. Despite harvest protection, it is possible that fish are being lost in the main Salmon River overwintering area due to intense catch-and-release pressure by steelhead anglers, noncompliance, or inadequacy of the protected area.

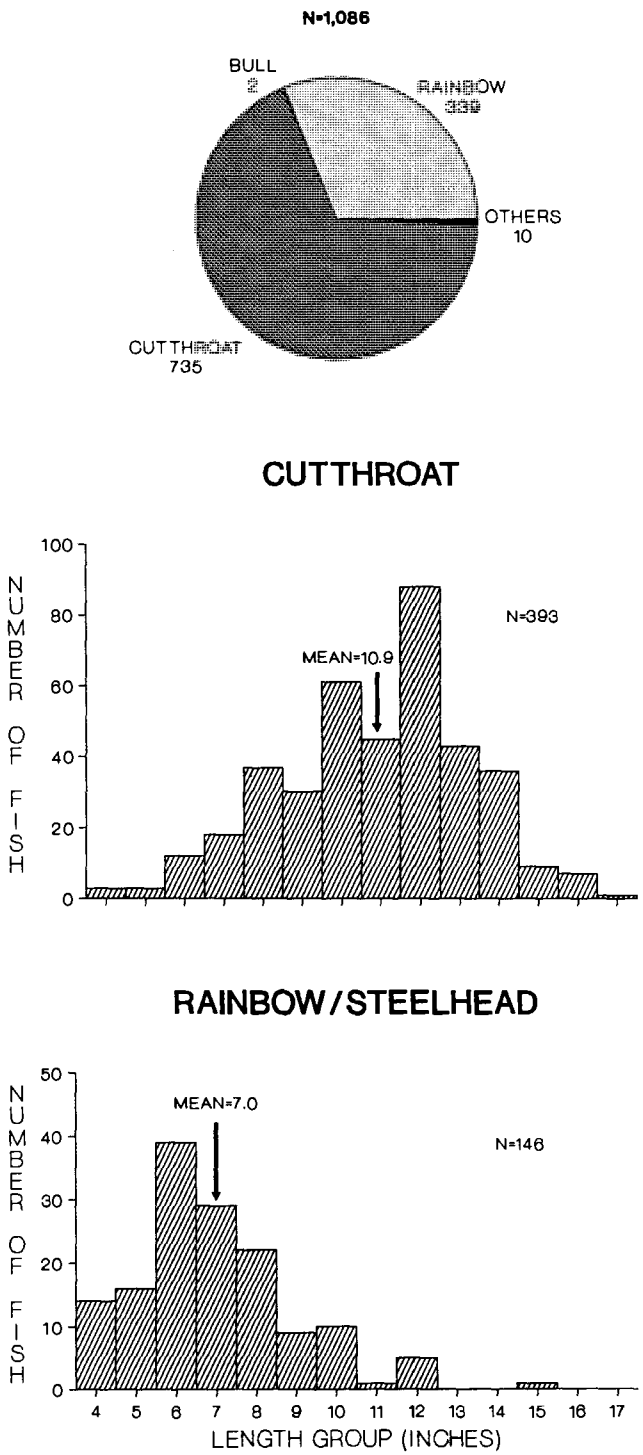

Figure 2. Length frequencies of rainbow/steelhead and cutthroat trout and species composition of fish caught by anglers fishing the MFSR, 1990.

Table 6. MFSR float use data (U.S. Forest Service) and estimated angler use data for 1969 (Ortmann 1971), 1985 (Reingold and Davis 1987a), and 1990.

	Year		
	1969	1985	1990
Number of passengers[a]	1,624	6,430	8,366
Percent passengers that fished	43	33	22
Commercial	--	37	19
Private	--	12	25
Total number of anglers	698	2,143	1,841
Passenger use days	--	36,672	49,354
Angler days	3,490[b]	12,102	10,858
Average hours fished/day	--	--	1.7
Angler hours	--	--	18,459
Percent anglers that fished tributaries	--	13	15

[a]Excluding commercial boatmen.
[b]Based on an estimated average trip length of 5 days.

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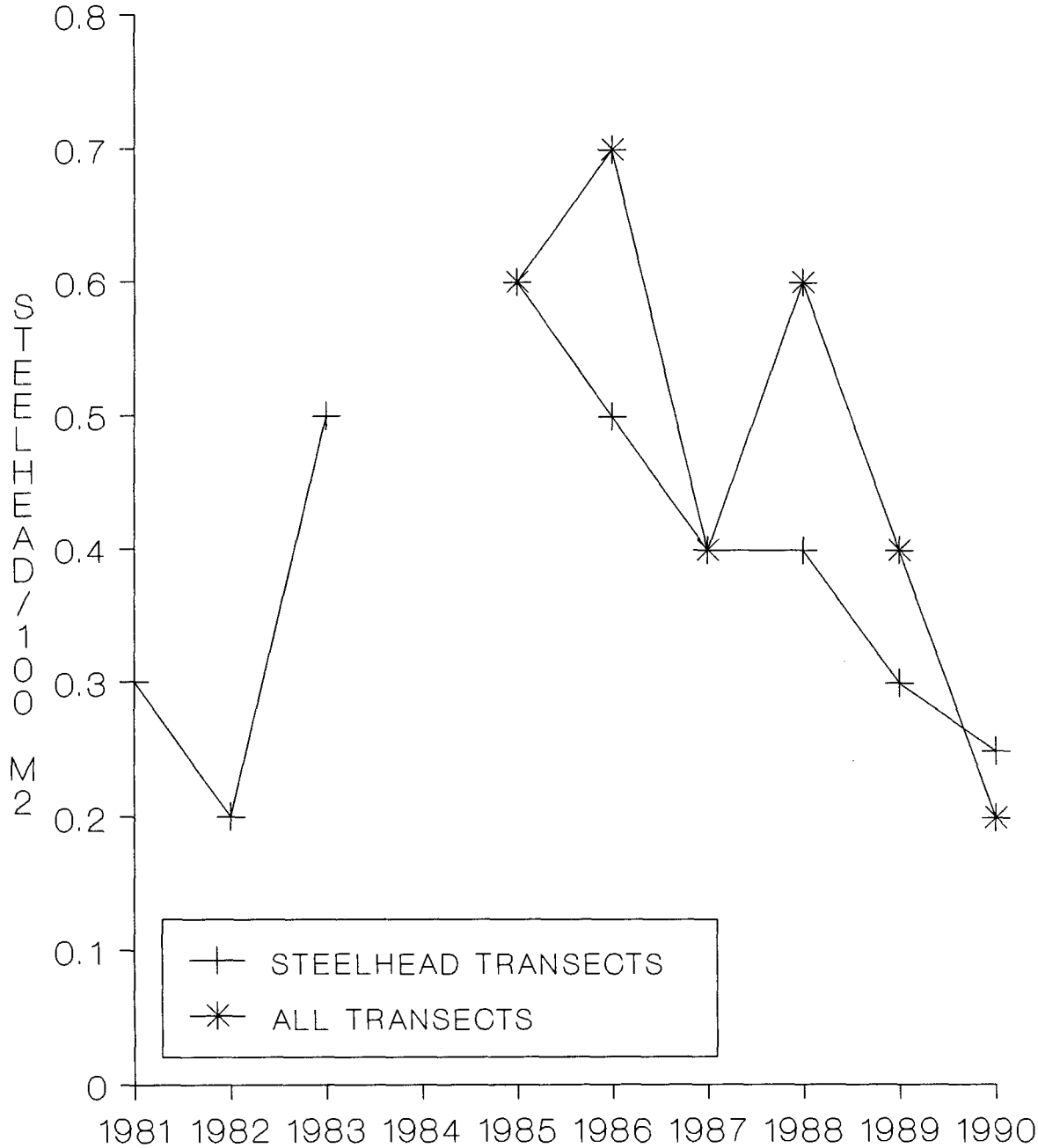

Figure 3. Densities of juvenile steelhead counted in all MFSR snorkeling transects and in steelhead only transects (see Table 1), 1981-90. Data for 1981-83 from Thurow (1982, 1983, 1985).

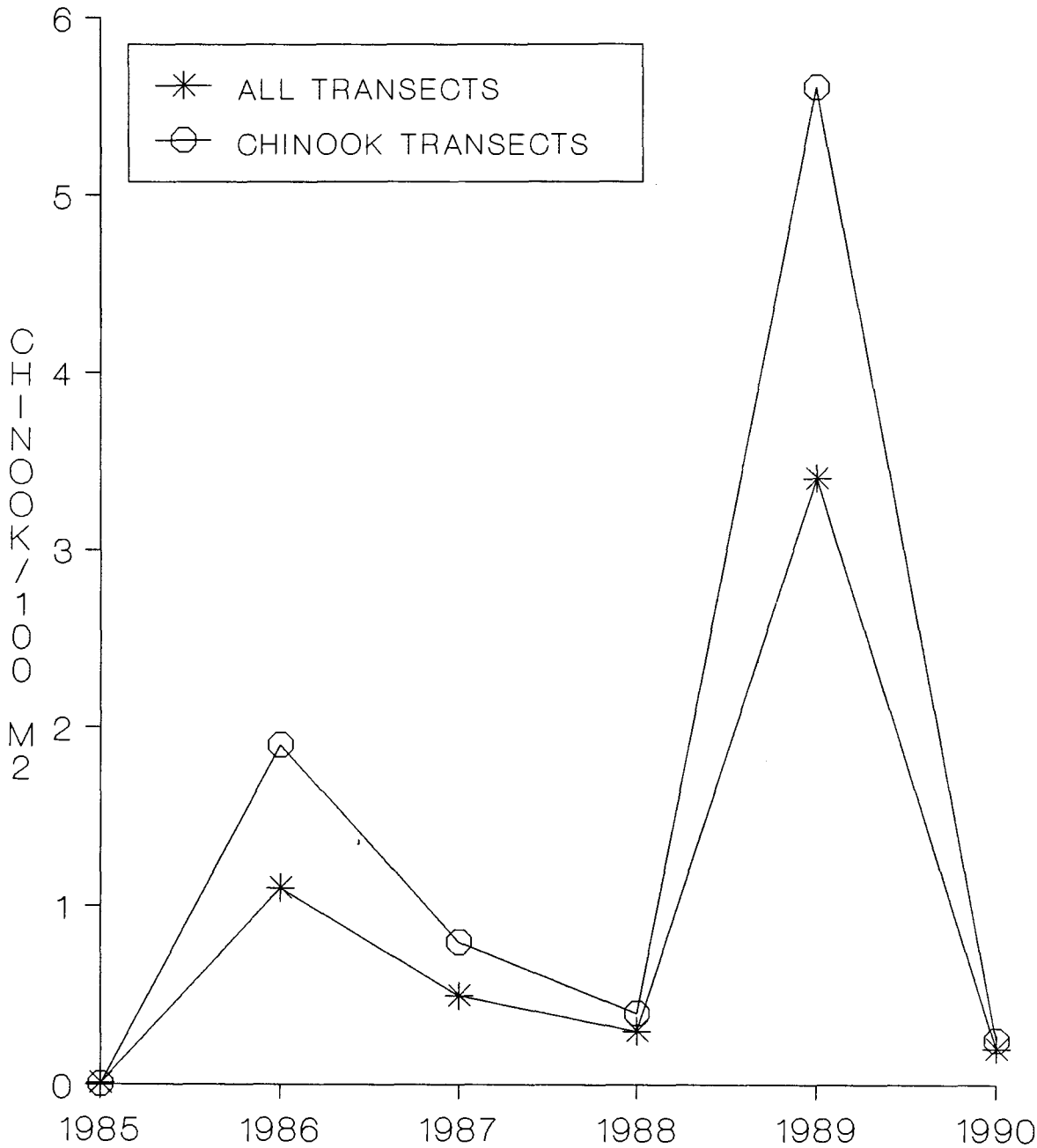

Figure 4. Densities of chinook salmon counted in all MFSR transects and in chinook/cutthroat only transects (see Table 1), 1985-90.

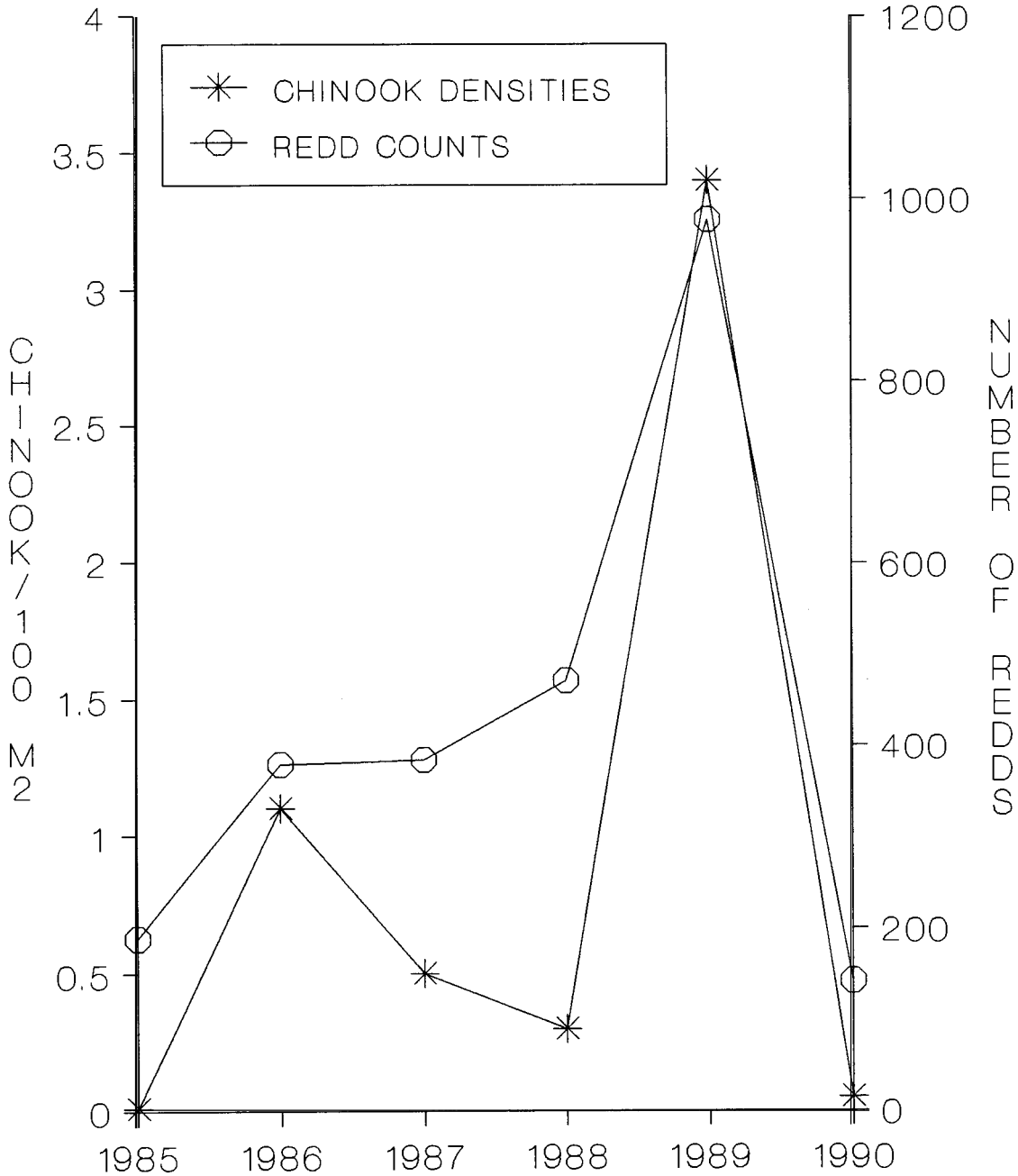

Figure 5. Densities of chinook salmon counted in all MFSR transects, 1985-90 and chinook redd counts in key MFSR tributary index areas for corresponding year classes (White and Cochnauer 1989; Idaho Department of Fish and Game, unpublished data).

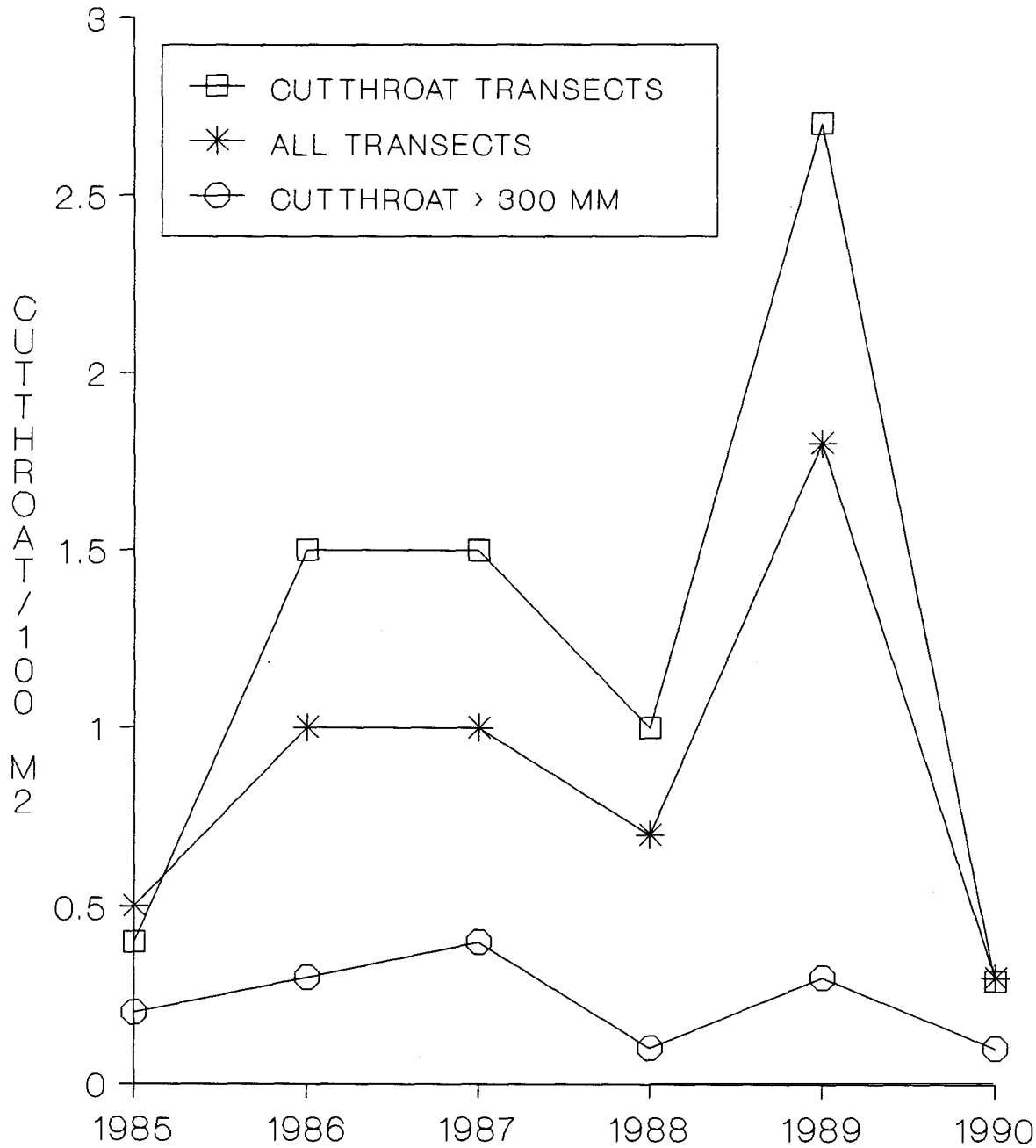

Figure 6. Densities of cutthroat trout counted in all MFSR transects, in cutthroat/chinook only transects (see Table 1) and of cutthroat trout larger than 300 mm in all transects, 1985-90.

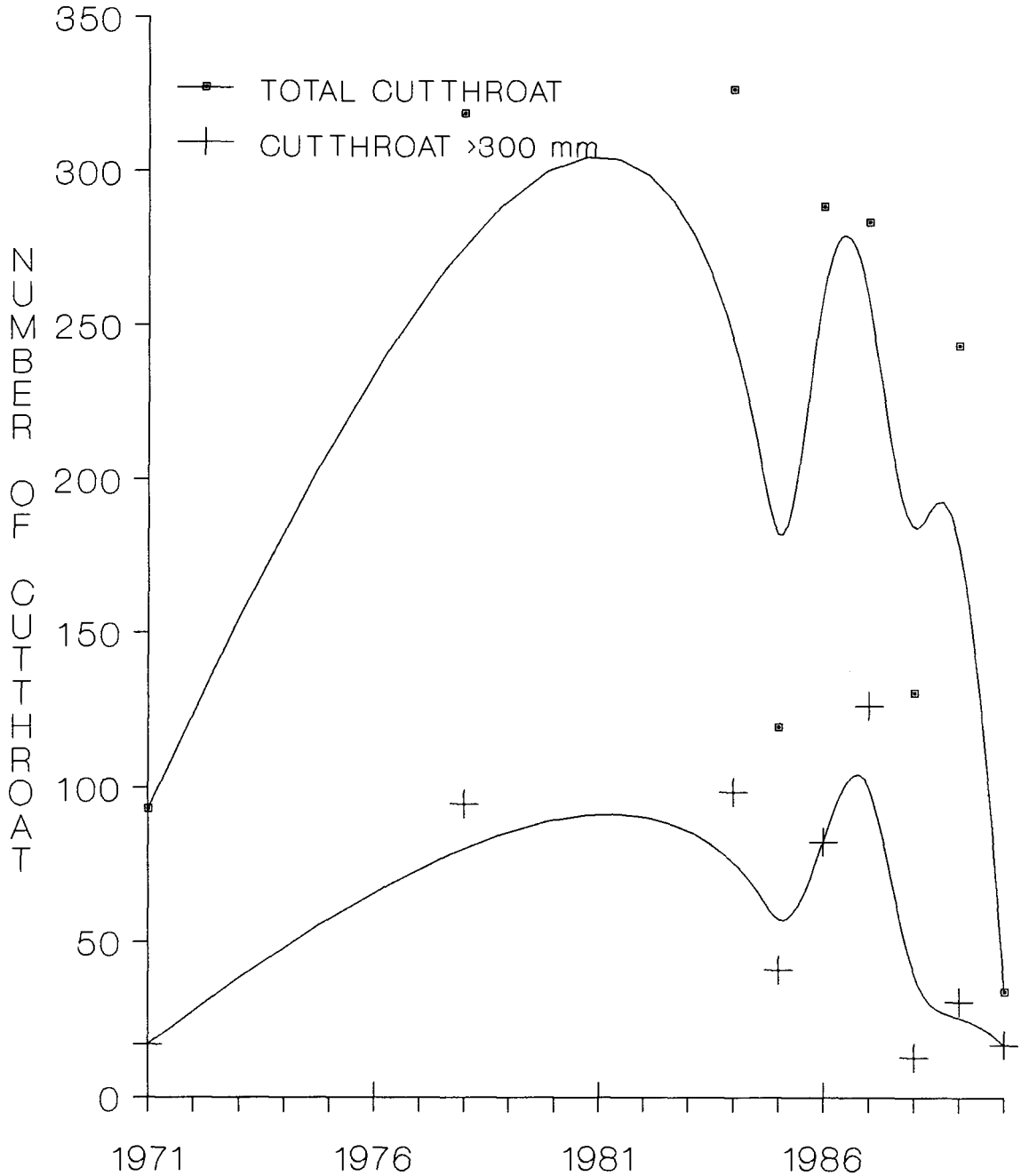

Figure 7. Numbers of cutthroat trout counted in traditional MFSR snorkeling transects (Pungo, Marble Pool, L. Jackass, Whitey Cox, Hospital Pool, Tappan Pool, Flying B, Big Cr. Br., Ship Island, Otter Bar and Goat Cr. Pool), 1971-90.

Middle Fork Salmon River Tributary Snorkeling Transects

Densities of cutthroat trout and steelhead increased in all five tributaries snorkeled with the exception of steelhead in Pistol Creek (Figure 8). This does not appear to have been the result of a particularly strong year class. It may have resulted from several successful spawnings or an avoidance of the warmer temperatures of the main river due to drought-related low water levels.

Creel Census

Less than optimum densities of cutthroat trout, obvious hooking injuries of fish observed while snorkeling, and steadily increasing numbers of floaters (Figure 9) concerned fishery managers that hooking mortality may be limiting population numbers. While this may be true, creel census results indicated that, although numbers of floaters have increased, the number of anglers decreased in 1990. The estimated number of anglers was 698 in 1969, increased to 2,143 in 1985, and decreased to 1,841 in 1990 (Table 6). The proportion of floaters that fished decreased from 43% in 1969 to 33% in 1985 and 22% in 1990.

RECOMMENDATIONS

1. Monitor densities of juvenile steelhead, cutthroat trout, and chinook salmon in the MFSR via snorkeling between the second week of July and the third week of August.

2. Determine total annual mortality of cutthroat trout and compare to other westslope cutthroat trout populations.

3. Snorkel transects in that portion of the MFSR between the confluence of Marsh and Bear Valley creeks and Dagger Creek and compare to results from downstream transects.

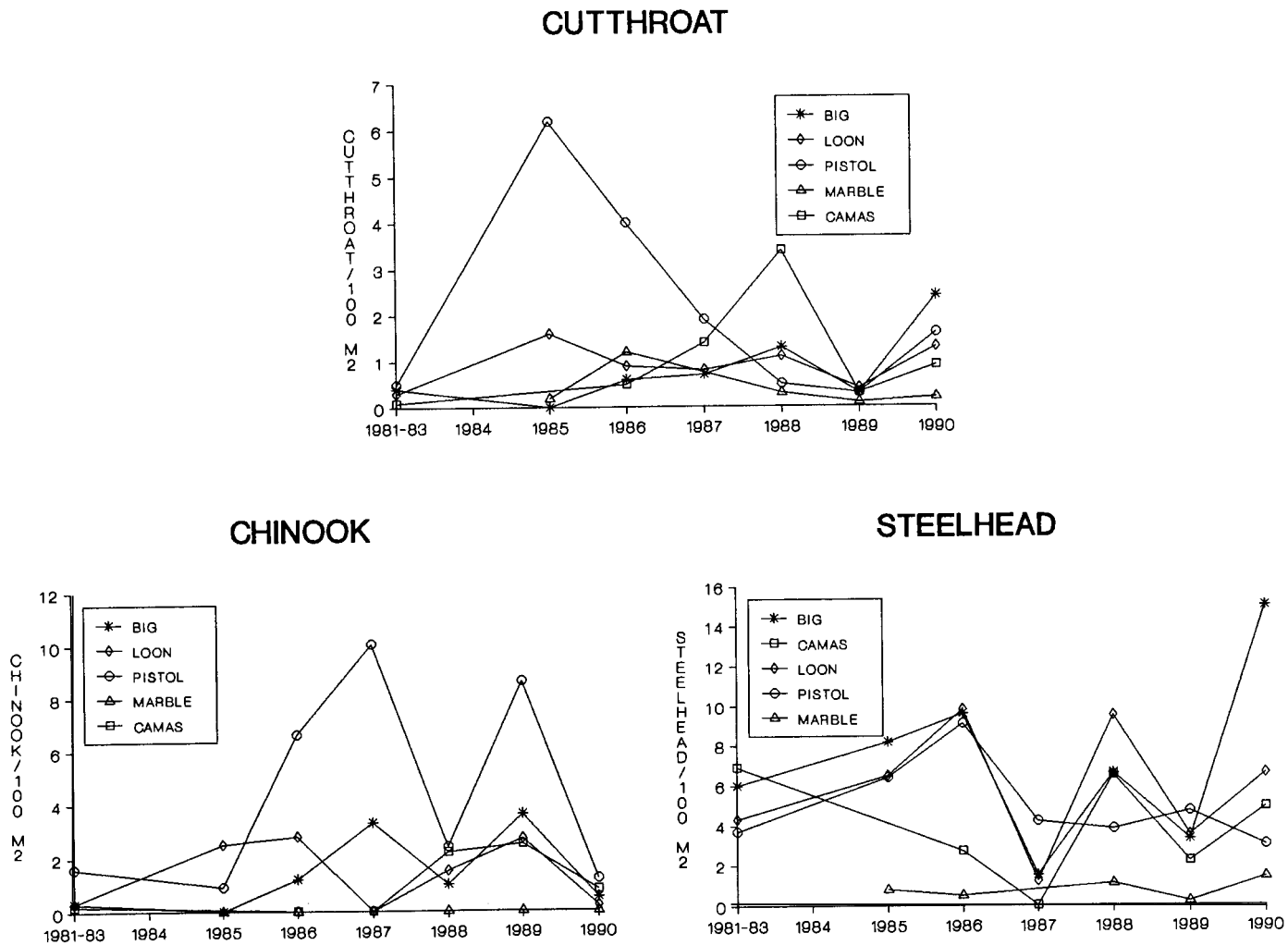

Figure 8. Densities of cutthroat trout, chinook salmon and steelhead in MFSR tributary snorkeling transects, 1981-90. Data for 1981-83 from Thurow (1982, 1983, 1985).

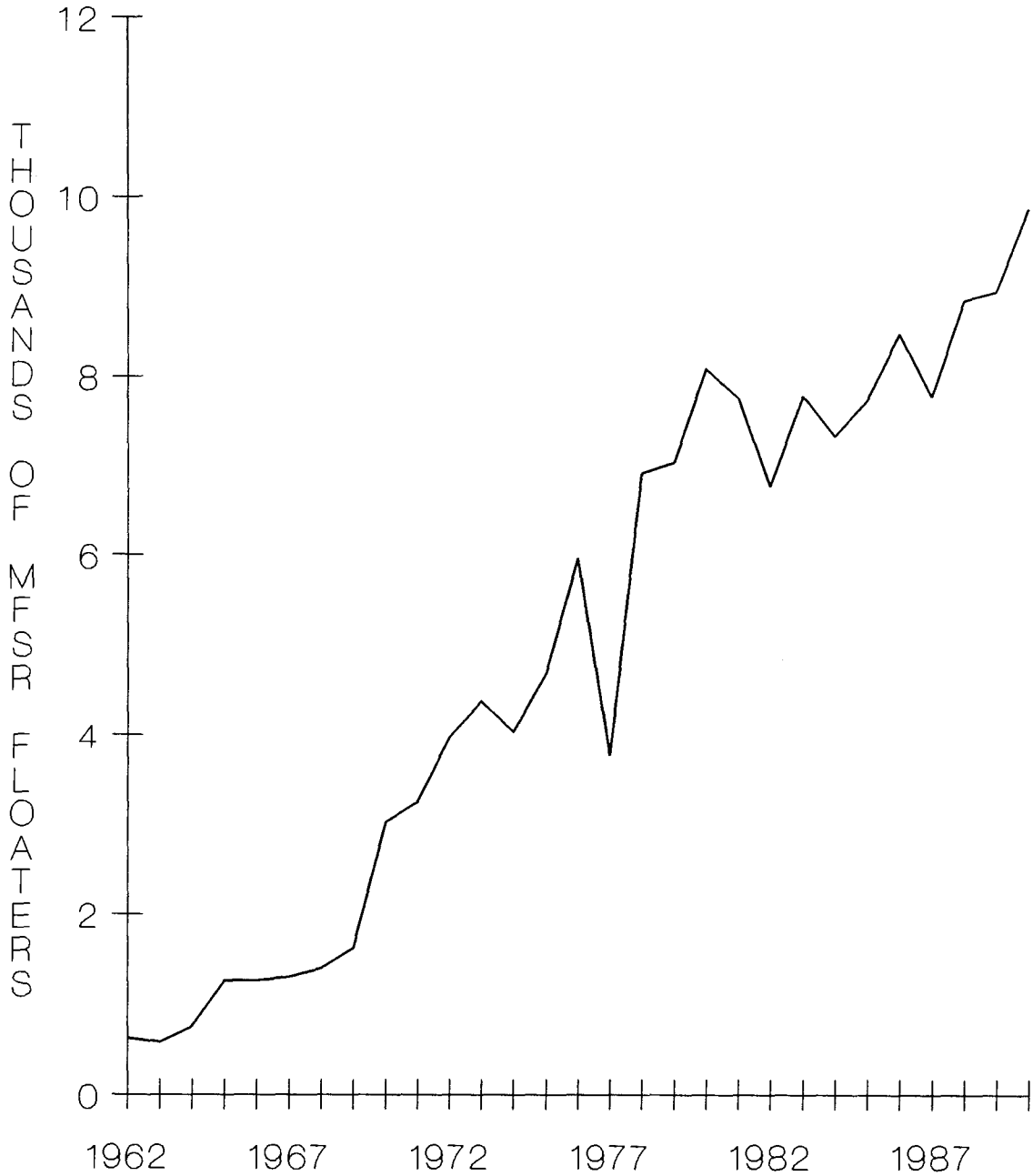

Figure 9. Number of MFSR floaters, 1962-90 (U.S. Forest Service data).

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JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fishery Management Investigations

Project No.: F-71-R-15

Title: Region 7 Technical Guidance

Job No.: 6(SAL)-d

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

During 1990, technical assistance was provided to all state and federal agencies upon request. Comments were submitted to various agencies and private entities concerning stream alterations, bank stabilizations, mining operations and reclamation plans, fish rearing proposals, private ponds, water right applications, gravel removal projects, grazing allotments, timber sales, highway reconstruction, habitat improvements, bridge construction, and hydropower projects. On-site inspections of proposed, on-going, and completed projects were conducted.

We also responded to the general public in person, by telephone, and by mail to inquiries about fishing opportunities, techniques, regulations, and area specifics.

Authors:

James R. Lukens
Regional Fishery Manager

William C. Schrader
Regional Fishery Biologist

R7DJ90-7

OBJECTIVES

1. To assist the Department of Water Resources, the Department of Lands, the U.S. Army Corps of Engineers and other state, federal, local, and private entities in evaluating the effects of habitat manipulation on fish and fish habitat.

2. To recommend procedures that minimize adverse effects of stream course alterations on aquatic habitat and fish.

3. To provide information on all aspects of fisheries and aquatic habitat as requested.

TECHNIQUES

We responded to all requests for data, expertise, and recommendations from individuals, government agencies, and corporations. Meetings were attended, field inspections conducted, and responses generated as appropriate.

RESULTS

During 1990, we responded in writing to requests for technical assistance or comments on various water and fishery-related matters as follows:

Agency	Number of requests
U.S. Forest Service	8
Idaho Department of Water Resources	24
U.S. Department of Transportation	1
Private and Miscellaneous	17

Telephone communication was the major mode of inter-agency contact. Commonly, we responded to stream alteration proposals by meeting with the applicant on-site, determining the nature of the situation, and sending written comments to the appropriate agency. Due to the remoteness of the Salmon Region, we were often the only agency representatives available to conduct on-site inspections.

We worked closely with representatives of Meridian Gold Company and the Salmon National Forest to resolve a water right conflict on Napias Creek and tributaries for the operation of the proposed Beartrack Mine. We negotiated an agreement that will provide adequate water for mine operation and insure an adequate baseline flow in Napias Creek.

We defended the protest of a water right application for the Lemhi River at a formal hearing. We produced evidence for the economic value of the anadromous resource, the importance of resident fish populations, and demonstrated that no surplus water is available during the irrigation season in most years. A final decision is pending.

We organized an effort with local anglers, Idaho Steelhead and Salmon Unlimited, and Challis Rod and Gun Club to catch hatchery steelhead larger than 31 inches from the Salmon River below the East Fork to enhance our B-strain steelhead egg-take for the East Fork program. Approximately 122 anglers fished four days (two weekends) which resulted in seven viable females transported to the East Fork facility for subsequent spawning. The program was extremely successful from the standpoint of angler participation and support.

We responded to numerous inquiries from the public (by telephone, letter, and in person) about when, where, and how to participate in various fisheries in the region, ranging from steelhead angling to alpine lake fishing.

We reported weekly steelhead fishing results on the local radio station throughout the season.

R7DJ90-7

JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fishery Management Investigations

Project No.: F-71-R-15

Job No.: 6(SAL)-e

Title: Region 7 Salmon and Steelhead Investigations -- Middle Fork Salmon River Adult Steelhead Lengths

Period Covered: July 1, 1990 to June 30, 1991

ABSTRACT

In the spring of 1990 and 1991, Department and volunteer anglers caught 229 adult wild steelhead from the lower Middle Fork Salmon River which averaged 72.8 cm fork length. Approximately 30% of the fish sampled were larger than 77.5 cm compared to 64% for a statewide average.

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R7DJ90-2

INTRODUCTION

Separation of A-strain steelhead from B-strain at Bonneville Dam has been based on run timing. Fish crossing prior to August 25 were considered A-strain and those crossing after were considered B-strain. This was the strategy used to estimate escapement into and out of the Zone 6 fishery and eventually to Lower Granite Dam. With the development of more sophisticated marking techniques, it became apparent that substantial numbers of known A-strain steelhead were crossing Bonneville Dam after August 25. This resulted in overestimates of B-strain numbers, which was of particular concern to Idaho fishery managers since wild B-strain steelhead are consistently underescaped in Idaho spawning streams. The U.S. v. Oregon Columbia River Fish Management Plan goal for Lower Granite Dam wild steelhead is 20,000 A's and 10,000 B's.

A new method of separation, based on size, was developed from hatchery stocks of known origin and employed at Lower Granite Dam to more accurately estimate escapement into Idaho. The data indicated that most A-strain steelhead were smaller than 77.5 cm fork length and most B-strain fish were larger. However, since it has been primarily wild stocks that have been underescaped, this project was initiated to gather length data for the wild B-strain steelhead in the Middle Fork Salmon River (MFSR).

OBJECTIVES

1. Collect biological data for known B-run wild adult steelhead in the MFSR.

2. Use the data to develop a stock separation technique and apply the technique in the Columbia Basin harvest management process to achieve wild B-run spawning escapement objectives.

METHODS

Department and volunteer anglers utilizing conventional fishing tackle fished the lower MFSR (below Goat Creek) during March and April 1990 and 1991 for adult steelhead. Terminal gear consisted of various types of lures and flys with single, barbless hooks. Each fish was measured to the nearest mm fork and total length, marked with a caudal fin punch (for identification of recaptures), and sampled for scales prior to release. The data was recorded separately for males and females.

RESULTS AND DISCUSSION

In 1990, anglers caught 45 wild male steelhead and 87 females at an average rate of 3.5 hours of effort per fish caught. The males averaged 71.9 cm long and the females 72.7 cm (Figure 1). Approximately 29% of the fish sampled exceeded 77.5 cm fork length. In addition to the wild fish, 16 hatchery fish were caught which comprised 11% of the total sample. It is believed that these fish temporarily stray into the lower MFSR to seek preferred temperatures or lower velocities since hatchery fish are not observed in spawning areas and hatchery fish have not been stocked into the drainage.

In 1991, anglers caught 28 wild male steelhead that averaged 74.1 cm long and 69 females that averaged 73.1 cm (Figure 1). The average catch rate was 5.4 hours per fish. Only seven hatchery fish were caught which made up 7Z of the total sample. The proportion of fish longer than 77.5 cm fork length (31%) was similar to that observed in 1990.

Using a pooled (baseline years and 1990) B-run wild steelhead database from drainages throughout the state, 36Z of the fish are less than 77.5 cm fork length and 64% are longer (P.F. Hassemer, Idaho Department of Fish and Game, personal communication). Fish measured from the MFSR in 1990 and 1991 were smaller. Therefore, to manage MFSR stocks for adequate escapement it would be advantageous to look at other stock separation parameters, particularly run timing. This could be accomplished by PIT tagging smolts as they emigrated from the drainage and monitor the movements of the resulting adults through the Columbia and Snake rivers.

RECOMMENDATIONS

1. Mark steelhead smolts in the MFSR drainage with PIT (Passive Integrated Transponder) tags for later identification of adult run timing over Columbia and Snake river dams.

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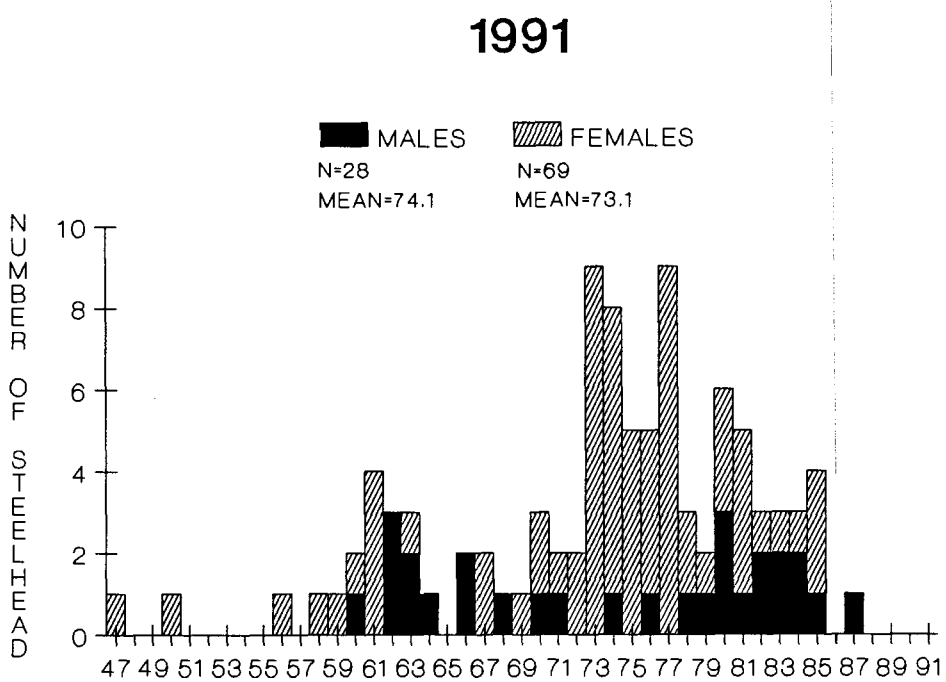

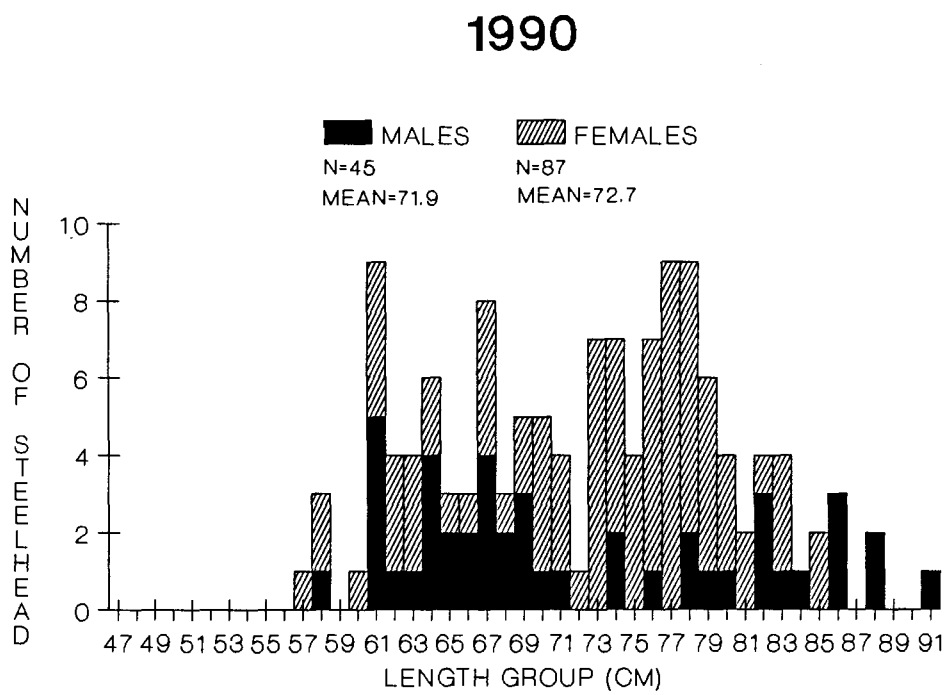

Figure 1. Length frequencies (fork length) for adult, wild steelhead caught in the lower MFSR, 1990 and 1991.

Submitted by:

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IDAHO DEPARTMENT OF FISH AND GAME

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