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Salmon and Steelhead Investigations Study V:
Anadromous Fish Inventory — Salmon River

Kent Ball
Senior Fishery Research Biologist
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JOB COMPLETION REPORT

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ABSTRACT

Adult spawning surveys and juvenile distribution and density surveys were conducted in Salmon River tributaries between the South and Middle forks. Rainbow trout-juvenile steelhead (Salmo gairdneri) was the dominant species in all tributaries except Cottonwood Creek.

Chinook salmon (Oncorhynchus tshawytscha) are approaching extinction in middle Salmon River tributaries. Chamberlain Creek was the only drainage where chinook salmon were found and numbers may be below the minimum number necessary for perpetuation.

Adult steelhead spawn during late April and May. Although inadequate numbers of spawning adults have been available, the habitat has the potential for accommodating 1,000 spawners and producing about 125,000 smolts.

Author:

Kent Ball
Senior Fisheries Research Biologist

INTRODUCTION

The Salmon River drainage is one of the most important drainages in Idaho for the production of chinook salmon (Oncorhynchus tshawytscha) and steelhead trout (Salmo gairdneri). The headwaters and many major tributary streams have been identified as significant production areas.

Most of the management emphasis to date has been in the more accessible areas of the headwaters and major tributary rivers. There are three hatcheries producing chinook salmon and two hatcheries raising steelhead trout. In the near future, another chinook hatchery and an additional steelhead hatchery will be added. These hatchery programs were implemented to mitigate for losses caused by hydroelectric dams.

The Middle Fork Salmon River drainage has been identified for wild stock management for both chinook salmon and steelhead trout (Idaho Department of Fish and Game, 1984). The South Fork Salmon River has also been recognized for its management potential as a wild steelhead stream. This study was initiated to investigate the fish populations in tributary streams between the South and Middle forks of the Salmon River. A few tributaries downstream from the South Fork were also included. Chinook salmon and steelhead trout were known to occur in some tributaries, but the status of these populations has not been ascertained. Anadromous fish have not been introduced into any of these tributaries.

This study began in 1981 when Reingold (1982) surveyed Horse, Chamberlain, Sabe and Bargamin creeks. In 1983, Ball (1983) investigated Cottonwood, Sabe, Bargamin, Chamberlain and Five Mile creeks.

OBJECTIVES

To determine the relative importance of Salmon River tributary streams for steelhead trout and chinook salmon.

To assess the species present, relative abundance and range in significant streams.

To determine the timing of adult returns to Salmon River tributaries in the study area.

RECOMMENDATIONS

Harvest of adult steelhead trout from the Salmon River downstream of the Middle Fork should be managed to allow adequate escapement of wild fish into tributary spawning streams.

Long-range management plans should address the perpetuation of wild chinook salmon and steelhead trout populations in Salmon River tributaries.

Spawning chinook salmon in Chamberlain Creek and its West Fork should be protected and the population monitored with aerial spawning surveys for five years.

Brook trout (Salvelinus fontinalis) should not be stocked in mountain lakes where they can emigrate to Salmon River tributaries.

DESCRIPTION OF STUDY AREA

The Salmon River, originating in the Sawtooth Mountains of central Idaho, flows in a northerly direction for approximately 288 km to the town of North Fork, Idaho. At North Fork, the river turns directly west for 230 km, cutting through the second deepest canyon on the North American continent, from which came the name "River of No Return." At Riggins, the river again swings north for 48 km and west again at Whitebird for 86 km to its confluence with the Snake River. The drainage area of the Salmon River encompasses some 35,000 km^2, making it one of the largest river systems contained within the boundaries of any one state (Welsh et al. 1965).

From the town of North Fork, a road follows the river for 74 km ending at Corn Creek. From there, the river canyon is roadless for the next 121 km to Vinegar Creek, where a road leads for 40 km to the town of Riggins, Idaho.

Access through the roadless section of river canyon is limited to horse and hiking trails or travel by float craft or whitewater jet boat. Several major rapids within the river canyon reduce casual access by boaters unfamiliar with or underequipped for the hazards involved. A few backcountry airstrips are located in the canyon and are limited to light aircraft. Two unimproved roads enter the canyon from side drainages. The Mallard Creek road enters from Elk City, Idaho, and terminates at Whitewater Ranch at rkm 238. A road from Dixie, Idaho, crosses the river on a suspension bridge at rkm 216 and leads to Mackay Bar. Neither of these roads attract much traffic to the river due to their length and difficulty.

There are 108 named tributary streams between Corn Creek and Vinegar Creek. Over 90% of these are small, steep, intermittent streams and have little or no fishery values (Reingold 1970). During

1981, field work was accomplished in Horse, Chamberlain, Sabe, Bargamin and Big Mallard creeks. These streams were selected on the basis of size, known or suspected presence of anadromous fish and the lack of known barriers to anadromous fish in their lower reaches. Between the Middle Fork and South Fork Salmon rivers, only Chamberlain Creek is known to have supported substantial numbers of both salmon and steelhead in past years. Steelhead trout and salmon have historically been known to spawn in Horse Creek although numbers have never been documented. Adult steelhead are known to spawn in Bargamin Creek. No comprehensive information on juvenile populations or densities or other species present has been documented (Reingold 1982).

Physical data on Horse, Chamberlain, Sabe, Bargamin and Big Mallard creeks were reported by Reingold (1982). Descriptions of Cottonwood and Five Mile creeks were reported by Ball (1983).

French Creek

French Creek enters the Salmon River at rkm 168.6. The lower 14 km is very steep gradient and mostly whitewater. French Creek is about 32 km long and the average gradient is 56 m/km. No flow information is available.

Access to the lower 4 km of French Creek is from a road near the creek. This borders the creek for only a short distance and elsewhere there is a steep climb from the creek to the road. A trail borders the creek from the end of the road to Jenkins' Crossing, 14 km upstream from the mouth.

Sheep Creek

Sheep Creek enters the Salmon River at rkm 187.6. It is 27 km long and has a drainage area of 137 km^2. The average gradient is about 65 m/km. No flow information is available.

There is a trail bordering lower Sheep Creek and the East Fork of Sheep Creek. The Sheep Creek drainage does not contain any roads.

Crooked Creek

Crooked Creek enters the Salmon River at rkm 199.4. The stream is about 48 km long and drains 290 km^2. The average gradient is 31 m/km. No flow information is available.

Access to the Crooked Creek drainage is by aircraft, road or trail. A maintained road borders the stream in the headwaters and terminates at the Halfway House Campground. From the campground to the mouth, a maintained trail borders the creek. Aircraft access is available near the Dixie Guard Station. There is also an unimproved airstrip near the mouth. Lake Creek has a trail from Fish Lake to the mouth. Access to Fish Lake is about 5 km by trail from an unimproved road.

Warren Creek

Warren Creek flows into the Salmon River at rkm 207.4. The stream is about 40 km long and drains 230 km^2. The average gradient is 41 m/km.

Access to Warren Creek is by road, trail or airstrip. The upper drainage has a road adjacent to the creek downstream to the lower end of the Meadow. A trail borders the creek downstream to the Romine Ranch. There is no trail access in the 3 km from the Romine Ranch to the mouth. The town of Warren has an airstrip.

TECHNIQUES USED

Adult Surveys

Aerial surveys were conducted on major steelhead spawning streams during the spawning season. These surveys were conducted by an experienced observer flying at low elevation with a single engine Super Cub. Flights were made during the middle of the day with maximum light on the water. Observations of adult fish and redds were made to document spawning time and location. During the flights, general stream conditions were noted, including barriers, gradient, access, substrate size and spawning gravels.

Juvenile Surveys

Species composition and size distribution were documented by angling and visual surveys. Due to the remoteness of the area, its wilderness classification and low specific conductance, no electrofishing was attempted. All fish caught by hook and line were measured to the nearest 5 mm and released. During these surveys observations of barriers and the condition of spawning gravel were recorded.

Juvenile Density Counts

Underwater counts of juvenile salmonids were made by a diver wearing a wetsuit and snorkel, crawling upstream through sections of typical stream habitat. The downstream section was at least 1 km from the river, and four more sections were selected upstream. All observations were made in the middle of the day in bright sunlight. Fish observed were identified by species.

Sections were measured in length and width with a meter tape. Width was measured each 30 m and the results averaged. Fish counts were converted to densities. Techniques were duplications of those established by Reingold (1982), so densities are comparable.

RESULTS

Adult Steelhead Surveys

The timing of steelhead spawning in the Salmon River drainage can span two months from early April to early June. It appears that adult fish usually enter tributaries after spring freshets. In some years, there may be several small runs of spawning adults. High water flows, turbidity and the lack of periphyton growth on the substrate affect the utility of steelhead spawning surveys.

In the spring of 1983, snow in the lower elevations melted during early April. Mid-elevation snow was beginning to run off, and I attempted to count spawning steelhead and redds before the runoff from high elevation snow precluded any surveys.

On April 22, I attempted to count adult spawning steelhead and redds by aerial reconnaissance on Crooked Creek, Lake Creek (tributary to Crooked Creek), French Creek and Warren Creek. I also checked the lower end of California Creek.

Crooked Creek

The survey began about 0.8 km upstream from the airstrip at the Dixie Guard Station. Adjacent to the landing field, the stream is low gradient with excellent gravel, but no redds or spawning fish were observed. From the lower end of the airstrip downstream to about 5 km from the mouth, Crooked Creek is a high gradient stream and was mostly whitewater and boulders on April 22. No barriers were observed. Stream gradient in the lower 5 km is lower, but gravel size is
moderate to large. Chinook salmon should be able to spawn in this section, and some pockets of smaller gravel are available for steelhead trout. No redds or spawning steelhead were observed during the survey.

Lake Creek

Lake Creek is a major tributary to Crooked Creek and was also surveyed on April 22. The survey began at Fish Lake and ended at the mouth. Fish Lake was just beginning to thaw and the stream was low and clear. There are two areas of excellent spawning gravel in Lake Creek: about 1 km below Fish Lake, and 1 km near Jumbo Canyon. The rest of Lake Creek is very steep gradient. No redds or spawning steelhead were observed.

French Creek

This stream was surveyed from Jenkins' Crossing to the mouth. Near Jenkins' Crossing there is a low gradient reach that should be good spawning habitat, but the entire streambed is covered with sand and silt. No barriers, redds or spawning steelhead were observed.

Warren Creek

Warren Creek was surveyed from the town of Warren to the mouth. The upper 5 km through the meadows has been extensively mined and much of the substrate is sand or silt. However, there are some areas where the sand has been washed away and adequate spawning gravel is exposed. From the meadows to the mouth, Warren Creek flows through a gorge with several waterfalls. There appears to be a barrier to upstream migration near the Romine Ranch, 3 km upstream from the mouth. No redds or spawning steelhead trout were observed in Warren Creek on April 22.

Chamberlain Creek and West Fork Chamberlain Creek

Chamberlain Creek and its West Fork were still clear for surveys in early May, so both streams were surveyed on May 4 and May 14. On Chamberlain Creek, the survey area is from upper Redtop Meadows to the West Fork. On the West Fork, the lower 5 km were surveyed.

On May 4, one adult steelhead was observed in Chamberlain Creek and one in the West Fork. No redds were located in either stream. Three redds were counted in the West Fork on May 14, along with one adult fish. One fish was observed in Chamberlain Creek, but no redds were counted.

Juvenile Surveys

Warren Creek

On July 28, we sampled the lower end of Warren Creek and measured 38 rainbow trout-juvenile steelhead (Table 1). The mean length was 174 mm. No other species were caught or observed.

The lower end of Warren Creek is predominantely boulders and large rubble, and has very little spawning potential. Pools and glides are abundant and provide excellent rearing habitat for juvenile fish.

The upper end of Warren Creek was sampled with hook and line on August 23 through the Meadows downstream from the town of Warren. This low gradient area was mined extensively for gold many years ago, and the riparian area is mostly mounds of gravel. Although much of the substrate is covered with deposits of sand and silt, hydraulic stream development since the mining has produced meanders and pools.

Brook trout and rainbow trout-juvenile steelhead coexist in the same pools. We collected 16 brook trout that averaged 141 mm and 17 rainbow trout-juvenile steelhead that averaged 145 mm (Table 2). Two additional size groups were observed but not collected: fry about 25 mm long, which appeared to be rainbow trout-juvenile steelhead that recently emerged from the gravel, and fingerlings about 65-70 mm long, which were probably sub-yearling brook trout.

Gravel of adequate size for spawning chinook salmon and steelhead trout is abundant through the meadows. Siltation due to mining activity needs to be reduced before the stream will be adequate for spawning.

Crooked Creek

On July 29, we sampled the lower 3 km of Crooked Creek and measured 66 rainbow trout-juvenile steelhead that averaged 159 km (Table 3). We observed mountain whitefish (Prosopium williamsoni), but rainbow trout-juvenile steelhead was the only species caught by hook and line.

The lower end of Crooked Creek has many large boulders and small pools. Spawning gravels are mostly in small pockets rather than in large areas. Rearing habitat for juvenile anadromous fish is more than adequate to accommodate the spawning potential.

We sampled upper Crooked Creek between the Dixie Guard Station and Halfway House Campground on July 15. Although this reach of Crooked Creek is predominantely spawning gravel, every pool appeared to be saturated with fish. In 7 hours of effort, we measured 150 rainbow trout-juvenile steelhead that averaged 135 mm (Table 4). No other species of fish were caught or observed.

Table 1. Length frequency of rainbow trout-juvenile steelhead from the lower end of Warren Creek, July, 1983.

Total length (mm)	No. fish	Sample percent
100	1	3
110	1	3
120	2	5
130	2	5
140	4	10
150	1	3
160	5	13
170	4	10
180	9	23
190	1	3
200	0	0
210	1	3
220	3	8
230	3	8
270	1	3
Total	38	100%

Mean length = 174 mm

Table 2. Length frequency of rainbow trout-juvenile steelhead and brook trout from upper Warren Creek, August, 1983.

Total	Rainbow trout-juv. steelhead		Brook trout	
length (mm)	No. fish	Sample percent	No. fish	Sample percent
110-119	1	6	0	0
120-129	3	19	2	12
130-139	2	12	7	40
140-149	5	31	3	18
150-159	3	19	1	6
160-169	0	0	1	6
170-179	2	13	1	6
180-189	0	0	2	12
Total	16	100%	17	100%

Mean length = 141 mm 145 mm

Table 3. Length frequency of rainbow trout-juvenile steelhead caught from lower Crooked Creek, July, 1983.

Total length (mm)	No. fish	Sample percent
90- 99	1	1
100-109	1	1
110-119	4	6
120-129	2	3
130-139	6	9
140-149	9	13
150-159	11	17
160-169	11	17
170-179	8	12
180-189	4	6
190-199	2	3
200-209	1	2
210-219	3	5
220-229	0	0
230-239	0	0
240-249	2	3
250-259	1	2
Total	66	100%

Mean Length = 159 mm

Table 4. Length frequency of rainbow trout-juvenile steelhead from Crooked Creek downstream from Dixie Guard Station, July, 1983.

Total length (mm)	No. fish	Sample percent
90- 99	4	3
100-109	4	3
110-119	26	17
120-129	23	15
130-139	28	19
140-149	27	18
150-159	17	11
160-169	8	5
170-179	8	5
180-189	1	1
190-199	1	1
200-209	2	1
210-219	1	1
Total	150	100%

Mean Length = 135 mm

Table 5. Length frequency of rainbow trout-juvenile steelhead from Lake Creek (tributary to Crooked Creek), July, 1983.

Total length (mm)	No. fish	Sample percent
110-119	4	5
120-129	4	5
130-139	4	5
140-149	10	12
150-159	2	2
160-169	8	10
170-179	18	21
180-189	17	20
190-199	8	10
200-209	8	10
Total	83	100%

Mean Length = 165 mm

On July 16, we hiked into Lake Creek (tributary to Crooked Creek) and surveyed about 2 km of the stream upstream from Jumbo Canyon. We measured 89 fish of which 83 (93%) were rainbow trout-juvenile steelhead and 6 were brook trout (Table 5). Nine rainbow trout (11%) were precocial males, ranging from 170 to 205 mm in length. We did not observe any cutthroat trout (Salmo clarki), but 9 (11%) of the rainbow trout had faint red marks on their branchiostegal rays, which reflects cutthroat influence in a previous generation.

The spawning gravel in Lake Creek upstream from Jumbo Canyon is of excellent quality and abundant. Adjacent to the spawning gravel, the stream is mostly large pools which are excellent rearing areas.

Access to Lake Creek is by trail only. The riparian zone is very brushy, and too few anglers are using Lake Creek to denote their presence.

Sheep Creek

We sampled the lower 3 km of Sheep Creek on July 29 and caught 70 rainbow trout-juvenile steelhead that averaged 159 mm (Table 6). No other fish species was caught or observed. The lower end of Sheep Creek is high gradient and contains several large pools. Spawning gravel availability is mostly in small pockets within runs.

An improved trail borders Sheep Creek, but the use level is light. There may be some fishermen walking up from the river, but most of the use appears to be by hunters in the fall.

Juvenile Density Counts

On July 28, we selected five transects in Crooked Creek. Using a wet suit, we counted 115 rainbow trout-juvenile Steelhead and 22 mountain whitefish from these 5 transects (Table 7). The surface was measured and we determined the density of rainbow trout-juvenile steelhead to be an average of 13 fish/100 m^2. No young-of-the-year fish were observed.

Snorkel counts in upper Crooked Creek and Warren Creek were aborted due to rainy weather and poor visibility.

Table 6. Length frequency of rainbow trout-juvenile steelhead caught from Sheep Creek, July, 1983.

Total length (mm)	No. fish	Sample percent
100-109	1	1
110-119	1	1
120-129	5	7
130-139	12	17
140-149	9	13
150-159	3	4
160-169	13	20
170-179	10	14
180-189	4	7
190-199	7	10
200-209	3	4
210-219	0	0
220-229	1	1
230-239	0	0
240-249	0	0
250-259	1	1
Total	70	100%

Mean Length = 159 mm

Table 7. Density of rainbow trout-juvenile steelhead in lower Crooked Creek, July, 1983.

Transect no.	Surface Area (m^2)	Rainbow counted	Rainbow per 100 m^2	Whitefish counted
1	197	29	14.7	8
2	137	21	15.3	4
3	330	24	7.3	3
4	63	16	25.4	0
5	161	25	15.5	7
Total	888	115	13.0	22

DISCUSSION

Adult Surveys and Distribution

Chinook Salmon

Chinook salmon are approaching extinction in middle Salmon River tributaries. Chamberlain Creek was the only drainage where we located spawning adults (Ball 1983). No adults or redds were observed, but adult salmon were taken illegally from the West Fork of Chamberlain Creek in August, 1982. The Chamberlain Creek drainage used to be a very important producer of chinook salmon. Ortmann (1965) reported that 155, 149, 278, 46 and 97 chinook redds were counted from 1958 through 1962, respectively. These counts were only of trend areas and are not complete counts of the drainage.

We sampled ten drainages for juveniles, but were unable to document juvenile chinook salmon with any of our methods. Juvenile chinook are usually easily observed while snorkeling, but we found none.

The number of chinook salmon in Chamberlain Creek may be below the minimum threshold for maintaining a viable population. Adult spawning surveys should be conducted for five consecutive years in Chamberlain Creek and its West Fork to document the status of the chinook salmon population. Surveys should be conducted in early September.

Habitat for chinook salmon in Chamberlain Creek is virtually unchanged since the 1950's and 1960's. The entire stream lies within the Frank Church River of No Return Wilderness and has been managed as a wilderness since the 1930's. Chamberlain Creek is an important example of the cumulative effects of offsite mortality. The decline of chinook salmon in Chamberlain Creek is not due to adverse environmental effects or harvest in Idaho. Excessive mortality rates downstream in the Snake and Columbia rivers have reduced this wild population to the brink of extinction. Unless the downstream mortality can be reduced immediately, it is unlikely that wild chinook salmon populations in Idaho will continue to exist.

Steelhead Trout

The distribution of adult steelhead trout is limited by the accessibility to the spawning tributaries in the spring. Large gravel bars at tributary mouths with unconsolidated flows from the tributary streams restrict the migration of adults. Until the river flow increases, adults accumulate in the holes downstream. Spring runoff in the Salmon River usually includes several freshets, and these flow increases are followed by adults migrating into the tributaries.

Consequently, there can be several small runs of fish into each spawning area. Adult steelhead are on the spawning gravel for only a few days.

The spawning period for steelhead trout in middle Salmon River tributaries appears to be very similar to the Salmon River headwaters. Although the mouths of those tributaries are at low elevation, the drainage area includes high elevation watersheds. Vegetation and climate at the mouths are ahead of the climatic season in the spring, but the headwaters are not. Water temperatures reflect the high elevation of the headwater areas. The major period of steelhead spawning begins in mid-April and extends through May when water temperature is above 4.5 C. Unusually high or low snowpacks and early or late spring temperatures can expand the spawning period.

The gradient of most middle Salmon River tributaries is quite steep. Although the middle or upper reaches of several tributaries have excellent spawning gravel, these areas are separated from the river by several kilometers of very high gradient. The average gradient of the study streams ranged from 19 to 41 m/km, but all streams had areas where the gradient and velocity were approaching the upper limit for migration. Welsh et al. (1965) conducted aerial surveys of the middle Salmon River tributaries and stated that the gradient was too high for anadromous fish in most of the streams. Chamberlain Creek was an exception, but it too is a high gradient stream (average gradient: 19 m/km).

The major steelhead spawning streams in order of importance are: Chamberlain, Bargamin, Horse, Crooked, Sabe and Sheep creeks.

Spawning steelhead trout are not abundant, but appear to be much more abundant than chinook salmon. There appears to be an increase in the number of wild adult steelhead compared to the mid-1970's. Techniques to estimate wild steelhead escapement are currently being developed.

Wild adult steelhead are present in the middle Salmon River canyon by early September, and their size is similar to other stocks of A-stock fish (Reingold 1982). Electrophoretic analysis of juveniles from Chamberlain Creek substantiates their similarity with other known A-stock steelhead (Wishard and Seeb 1983).

Juvenile Populations

Rainbow trout-juvenile steelhead is the dominant species in middle Salmon River tributaries. Brook trout are present in Cottonwood, Lake and Warren creeks. Cutthroat trout are few in number and Sabe Creek was the only stream where we found a reproducing population (Ball 1983). Bull trout (Salvelinus confluentus) and mountain whitefish are also rare. No juvenile chinook salmon were found in the ten tributaries we surveyed. The West Fork of Chamberlain Creek may have the only chinook salmon juvenile population.

Densities of rainbow trout-juvenile steelhead in middle Salmon River tributaries ranged from 9.5 to 14.5 fish/100 m^2 (Reingold 1982). Graham (1977) reported densities of 6.8 to 16.0 rainbow trout-juvenile steelhead per 100 m^2 in Lochsa and Selway River tributaries. Both of these

studies were on cold, infertile streams with depressed spawning populations. However, since there are resident rainbow trout populations present, they could fill the niches when steelhead recruitment is insufficient. It appears that Horse, Sabe and Crooked creeks have densities approaching what is expected for infertile high gradient streams, but an unknown faction of the populations may be resident rainbow trout.

The occurrence of adult steelhead and mature rainbow trout in the same stream confirms the coexistence of resident and anadromous rainbow. Reingold (1982) speculated that the rainbow were of steelhead origin and that resident and anadromous behavior may alternate between generations. Methodology for separating resident from anadromous rainbow needs to be developed. With a large spawning population of adult steelhead, their fecundity advantage should give them a competitive edge over rainbow trout. However, small resident rainbow populations would still be available in the drainage to increase when the steelhead population is below saturation. It appears that the spawning number of adult steelhead have been inadequate to seed the canyon tributaries for the past several years and that resident rainbow are occupying much of the available rearing habitat. Emergent steelhead fry are much larger than fry from resident rainbow and can be expected to have a competitive advantage. In the infertile tributaries, most juvenile steelhead would have to rear 2 or 3 years before migrating to the ocean. Few resident rainbow larger than smolt-size juvenile steelhead occupy any of the tributaries we studied.

The long-range objective for Salmon River tributaries between the South and Middle forks is 1,000 spawning steelhead (Idaho Department of Fish and Game 1984). The projected smolt production from these tributaries is 125,000 fish. There is adequate spawning gravels in these tributaries to accommodate 1,000 spawning steelhead, and it is a realistic objective. From 1, 000 adults, 20 to 25 million eggs would be deposited. The quality of the rearing habitat is excellent and should readily support the production of 125,000 smolts annually. Expansion of brook trout populations could have a negative effect on juvenile steelhead production, so they should not be stocked in mountain lakes where they can emigrate to Salmon River tributaries.

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LITERATURE CITED

Ball, K. 1983. Anadromous fish inventory - Salmon River. Job Performance Report F-73-R-5. Idaho Department of Fish and Game.

Graham, P.J. 1977. Juvenile steelhead trout densities in the Lochsa and Selway river drainages. MS Thesis, College of Forestry, Wildlife and Range Sciences. University of Idaho.

Idaho Department of Fish and Game. 1984. Idaho anadromous fish management plan 1984-1990 (Draft). Idaho Department of Fish and Game Report.

Ortmann, D. and M. Richards. 1965. The gathering and compilation of relevant data for Idaho salmon and steelhead runs. Idaho Department of Fish and Game Report. F-49-R-1 (1962).

Reingold, M. 1970. Salmon and Steelhead Investigations, Job No. 8. Rearing and distribution of salmon and steelhead juveniles and temperature relationships.Idah o Department of Fish and Game
Report, F-49-R-7 & 8.

Reingold, M. 1982. Anadromous fish inventory/Salmon River. Idaho Department of Fish and Game, Job Performance Report, F-73-R-4.

Welsh, T.L., S.V. Gebhards, M.E. Metsker and R.V. Corning. 1965. Inventory of Idaho streams containing anadromous fish including recommendations for improving production of salmon and steelhead, part 1. Idaho Department of Fish and Game. 174p.

Wishard, L. and J. Seeb. 1983. A genetic analysis of Columbia River steelhead trout. Pacific Fisheries Research, Seattle, Washington.

Submitted by:

Kent Ball
Senior Fisheries Research Biologist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Jerry M. Conley, Director

Monte R. Richards, Chief
Bureau of Fisheries

David W. Ortmann
Fishery Research Supervisor