

SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES - Part VIII

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SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES - - PART 8

Area VII. Snake River, above Payette River to
upper Salmon Falls

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Fishery Research Biologist

Special Scientific Report - - Fisheries No. 57

CONTENTS

	Page
Introduction	1
List of Streams	2
The Survey	5

ILLUSTRATIONS

Figure

1. Columbia River System	3
2. Area VII	4

INTRODUCTION

The purpose of the Columbia River Stream Survey has been to provide data for the evaluation of each stream, or portion of stream, from the standpoint of its present and potential value in relation to the maintenance of the salmon resources of the Columbia River. The Columbia River watershed has been divided into several survey areas or units as shown in Figure 1. This report deals with the streams in Area VII.

Area VII includes the Snake River and its tributaries from a point above the mouth of the Payette River to Upper Salmon Falls. The area begins approximately 357 miles above the mouth of the Snake River and extends for a distance of approximately 216 miles upstream.

It has been reliably reported that in the early days salmon and steelhead trout ascended the Snake River for a distance of approximately 600 miles to the impassable Augur Falls opposite the town of Jerome, Idaho, and that there was a good salmon run into Rock Creek, a minor tributary just below Augur Falls. There have been no salmon reported in the upper part of this area for many years, although an occasional steelhead trout has been reported.

Because of the present depleted condition of the former runs of salmon into the area and its slight potential value to anadromous fish due to water-use developments, the area was not given as complete a survey from the standpoint of fisheries rehabilitation as was accorded the lower Columbia River system.

List of Streams

	Page
Main Snake River	5
1. Malheur River	7
A. Willow Creek	12
B. Bully Creek	12
C. North Fork	13
D. South Fork	14
2. Boise River	14
A. South Fork	15
B. Middle Fork	16
C. North Fork	16
3. Owyhee River	16
A. Crooked Creek	18
B. Jordan Creek	18
C. South Fork	18
(1) East Fork	18
(2) Little Owyhee River	18
D. Middle Fork	18
E. North Fork	18
4. Sucker Creek	18
5. Jump Creek	18
6. Squaw Creek	18
7. Reynolds	18
8. Rabbit Creek	18
9. Sinker Creek	18
10. Castle Creek	18
11. Birch Creek	18
12. Shoo Fly Creek	18
13. Bruneau River	18
14. Canyon Creek	19
15. Rattlesnake Creek	19
16. Big Wood River (or Malad River)	19
A. Little Wood River	19
B. Camas Creek	19

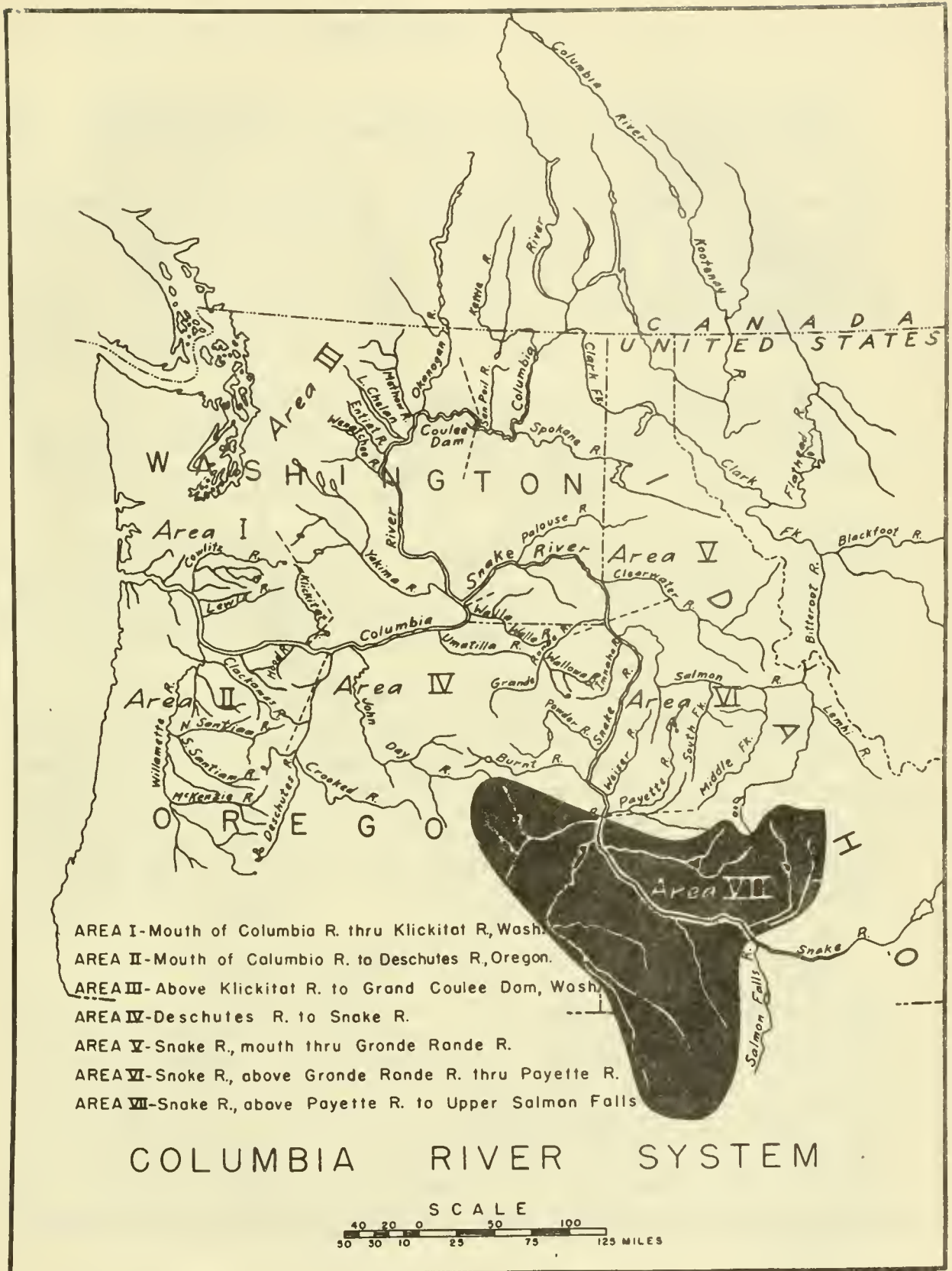


Figure 1.--Columbia River System

AREA SEVEN

LEGEND

- Dam, with fishway
- Dam, proposed
- Dam, partial barrier
- Dam, total barrier
- Stream surveyed
- Stream not surveyed
- Stream inaccessible to fish
- Waterfall

Diversions

- Unscreened, capacity less than 10 cfs
- Unscreened, capacity 10-100 cfs
- Unscreened, capacity 100-500 cfs

0 5 10 15
SCALE IN MILES

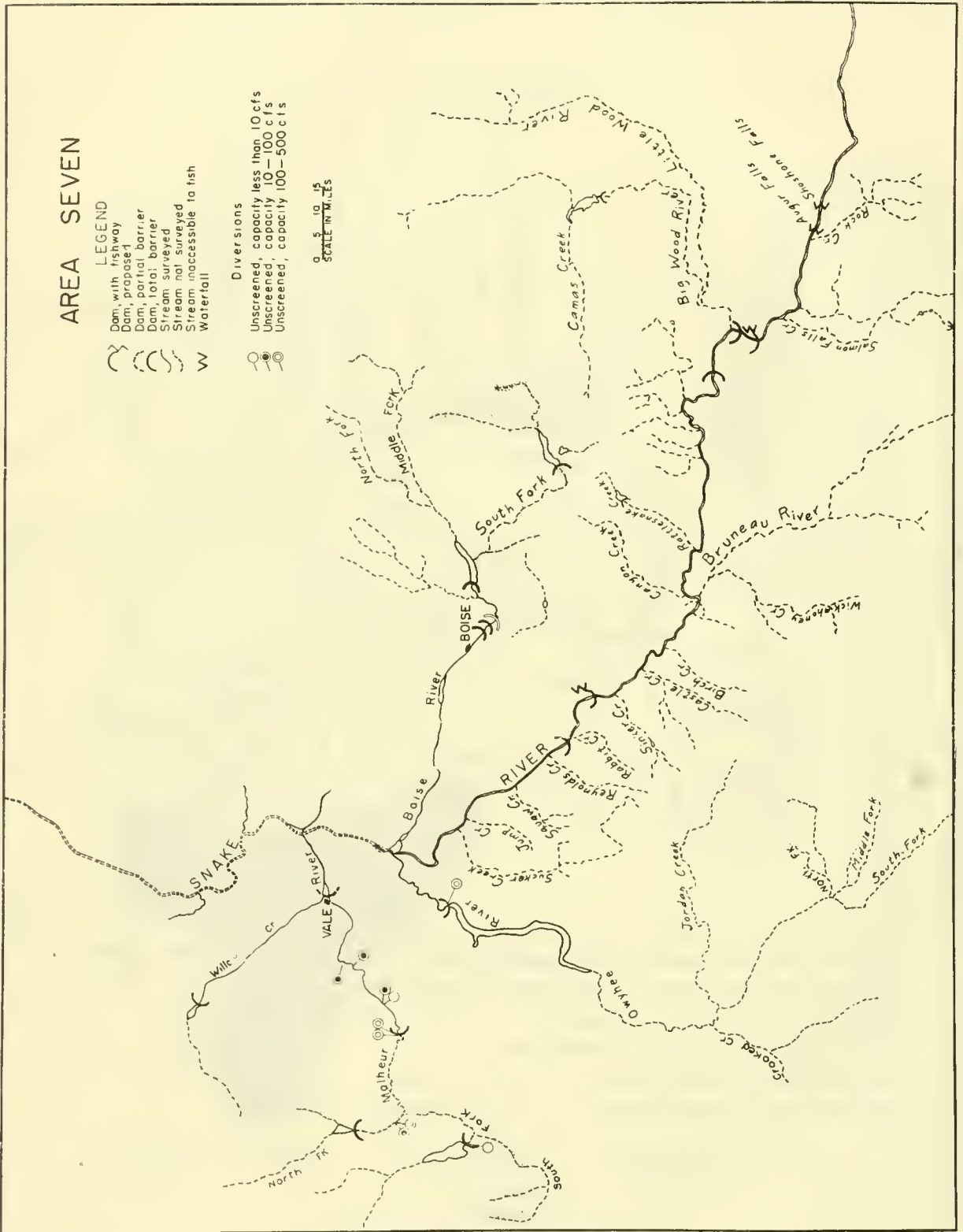


Figure 2.--Area VII

The Survey

Main Snake River.-- (October 3-7, 1942; Parkhurst and Bryant.) The Snake River is 200-300 yards wide in the section extending from the vicinity of Ontario, Oregon up to a point below Marsing, Idaho, a distance of about 55 miles. The stream gradient is slight to moderate. There are few good riffle areas, but miles of river where the water is 3-6 feet deep and running at a fair velocity. There is little large rubble in this section, and almost half of the river bed is composed of mud and sand. The river banks are generally steep, about 10 feet high, and composed of earth. Marginal vegetation is moderate, with some dense patches of willow, some large cottonwoods, poplar, alder, cattails, grasses and sedges.

In the early years of the century the river was racked in the vicinity of Ontario, and large numbers of chinook salmon were taken for artificial propagation by the Oregon Fish Commission. In one year of record more than 20 million eggs were taken in the fall season at this station, indicating the former large size of the run.

The river valley is 15 or more miles wide near Ontario, gradually decreasing upstream to about 2 miles in width below Marsing. Most of the valley is under cultivation, being in hay, pasture, grain, sugar beets, soft fruits, corn, and truck gardens. The watershed is bounded by low, moderately sloping hills having a sparse cover of sage.

In the 20 mile section from Marsing up to Walters Ferry the river gradient is moderate and the banks are generally of gradual slope, about 6 feet high, and composed mainly of earth, with some gravel. Marginal vegetation is sparse, consisting of sedge, cattails, and sagebrush. The valley is saucer-shaped, about 2 miles wide, and mostly covered with sage brush and grass, although there is some cultivation of hay, grain, hops, and corn in spots where irrigation is supplied by a few small tributaries. The gradually rising series of low hills in the watershed is covered with sage and some grass, and is used for grazing in the spring.

From Walters Ferry upstream to where the road to Melba, Idaho approaches the river, a distance of about 5 miles, there is found the best spawning gravels in this area. This section formerly accommodated a large run of fall chinook salmon, the last good run occurring in 1929 or 1930, according to local residents. A few spawners were observed in this section in 1941 and 1942. Spawning occurred in the latter part of September and in October. The river bed is composed of more than 75 percent medium and small rubble. Spawning riffles are numerous and of excellent quality. The river has an average width of about 400 feet and a moderate gradient in this section. Resting pools are few and of poor quality. Marginal vegetation is moderate below, but becomes sparse in the upper part of the section. The valley is 1/4 to 2 miles wide,

and at the upper end of the section is characterized by long, flat bench lands. There is no cultivation along the river banks, but the benches are used for stock grazing in the spring. These bench lands are bounded by high cliffs and steep hills which are surmounted by a high flat plateau on which are located several small towns such as Melba, Idaho.

The Guffey Project of the Idaho Power Company is located at a site about 12 miles downstream from the Swan Falls dam, or approximately 432 miles above the mouth of Snake River. The development of this project is now underway, and includes the construction of a dam about 10 feet high. Present project plans do not include the installation of a fishway.

From a point opposite Melba up to the town of Grand View, Idaho, a distance of 35 miles, the Snake River flows through a deep canyon where the walls are often precipitous and in some places, as in the vicinity of Swan Falls, rise over 1,200 feet above the river bed. There are a few narrow benches along the river where the banks are 6 to 15 feet high and composed of earth and rock, but in most places the banks are formed by the high canyon walls. The canyon is surmounted by wide expanses of flat, almost barren, sandy, sage-covered plateaus. There is no cultivation in this section. Except for the pool area extending three or four miles above Swan Falls dam, the stream gradient is fairly steep. The river bed is composed mainly of bedrock and large rubble. Shallow riffles are few and generally of poor quality, and there is little suitable spawning area in this section, especially above Swan Falls. Large excellent resting pools are numerous. Marginal vegetation is sparse, consisting of sage, elderberry bushes, and a few grasses.

The Swan Falls dam and power plant of the Idaho Power Company is located 10 miles above a point opposite Melba or approximately 444 miles above the mouth of Snake River. This dam is 30 feet high. It is understood that a dam at this point first obstructed the passage of anadromous fish about the year 1907. A poor fishway was provided, but the runs above the dam were exterminated. The fishway was improved about the year 1940, and it is now possible for fish to ascend. The power plant is equipped with low-speed, reaction type turbines operating under a head of 24 feet.

From a point above Grand View up to Hammett, Idaho, a distance of 45 miles, the canyon opens into a valley which widens upstream.

The C. J. Strike Project of the Idaho Power Company has been recently granted a preliminary permit by the Federal Power Commission, and it is understood that construction is to be started in the near future. The project would include a dam across the Snake River at a point about 1 mile downstream from the mouth of the Bruneau River. The dam would be about 120 feet in height, and would not be provided with fishways.

From Hammett upstream to Bliss, Idaho, a distance of about 40 miles, the valley is from six to two miles wide, flat in the lower part and gently rolling above. There are some suitable spawning areas contained in this section.

The Bliss project of the Idaho Power Company includes a recently constructed dam 104 feet in height located across Snake River at a point approximately 5 miles downstream from the town of Bliss. The dam is not provided with fish-passage facilities.

From Bliss upstream to Upper Salmon Falls, a distance of about 18 miles and the upper terminus of the survey, the gradient is moderate to fairly steep. The river has an average width of about 320 feet in this section, although it is narrower in the lower canyon portion. The river bed is composed mainly of bedrock and large rubble, and there is little suitable spawning area. There are numerous good resting pools. The stream banks are steep, 12-30 feet high, and composed mainly of bedrock and boulders. The marginal vegetation along the river banks is sparse, consisting mainly of sage and a few willows.

Lower Salmon Falls and a power dam of the Idaho Power Company is located about two miles downstream from Hagerman, Idaho, or approximately 565 miles above the mouth of Snake River. The natural falls at this point, 10-12 feet high, are surmounted by a power dam. The combined falls and dam formerly constituted the upstream limit of possible anadromous fish migration in the Snake River. This migration limit has been moved downstream by the previously described power projects.

Upper Salmon Falls and another power dam of the Idaho Power Company is located about 9 miles above Lower Salmon Falls. The natural falls or rapids at this point are very low, but are surmounted by a concrete dam 10 feet high. A fishway is located near the center of the dam, and is passable at all times.

Although this section of the Snake River is inaccessible to anadromous fish, it retains considerable value for resident trout. It is assured of a large constant supply of cold water by the discharge of the "Thousand Springs" a short distance above Upper Salmon Falls.

1. Malheur River.-- (July 19-25, 1942; Parkhurst.) The Malheur River enters the Snake River just below the town of Ontario, Oregon, or approximately 359 miles above the mouth. The main river extends for a distance of about 167 miles. The entire watershed drains an area of more than 4,750 square miles in eastern Oregon, principally in Malheur County and the Malheur National Forest. The headwaters are high on the eastern slope of the Blue Mountains.

The numerous dams and diversions obstruct the passage of fish and utilize the flow of the Malheur river system for irrigation to such an extent that this river system is no longer of any possible value to salmon. Where formerly large runs of chinook salmon and steelhead trout utilized the extensive spawning areas there have been so few of these fish for so many years that the capture or even the appearance of a single one is a most unusual and rare occurrence.

This report divides the Malheur drainage basin into five sections. Proceeding upstream these are (1) the Vale or Lower Malheur Valley. (2) the canyon below the town of Harper, (3) the Harper Valley, (4) the canyon below the town of Jantura, and (5) the Jantura Valley and the headwaters section.

(1) Vale or Lower Malheur Valley:-

In the lowermost section the river extends for 30 miles through the wide, flat, fertile Vale Valley. In this section the river varies from 135 feet to 45 feet in width, the average width being about 90 feet. The gradient is slight throughout. The river bed is composed of at least one half silt with smaller amounts of medium and small rubble, all heavily silted. This entire valley section was considered of no value for salmon spawning. Resting pools are numerous, but the sparse marginal vegetation affords little stream cover, and the high summer water temperature, 71.0°F. near the mouth at the time of observation, are not suitable for salmon.

There are a number of irrigation diversions and two fair sized tributaries in the lower Malheur valley. The Nevada dam and irrigation canal is located $1\frac{1}{2}$ miles below Vale. The dam is 6 feet high and 90 feet long. It is passable to fish except at low water stages during the irrigation season. The irrigation canal carries about 200 c.f.s., and like all other water diversions on the Malheur at the time of observation, is not provided with any fish protective devices.

The Ricker Irrigation Canal, about 8 miles below the upper end of the valley, withdraws about 50 c.f.s.

The Gillerman and Frohman Irrigation Canal, about 5 miles below the upper end of the valley, withdraws about 50 c.f.s.

The McLaughlin Irrigation Canal, about $\frac{3}{4}$ mile below the upper end of the valley, withdraws about 20 c.f.s.

The entire lower Malheur valley is a highly cultivated, irrigated region, receiving the benefits of the water stored in the Warm Springs and Agency Valley reservoirs of the Vale Project (U.S. Bureau of Reclamation). Among its agricultural products are alfalfa and clover for hay and pasture, several grains, including wheat, oats, and barley, diversified truck gardens, sugar beets, and a small amount of soft fruits. The valley is bounded by low, barren hills having a sparse cover of sage.

(2) Canyon below Harper:-

At the upper end of the Vale valley the river extends for 11 miles through a canyon about 1/4 mile wide. The river has an average width of 54 feet and a moderate gradient throughout this section.

More than half of the stream bed is composed of medium and small rubble, together with a large amount of silt. There are numerous shallow riffle areas, but the entire section is so heavily silted that it was considered of little possible value to salmon. Water temperatures are also unsuitable for salmon during the summer, being 71.0°F. at the time of observation. There is an adequate number of resting pools, but the sparse marginal vegetation affords practically no stream cover.

There are two principal irrigation diversions in this section. The first is the Farmer's Canal, located 1/2 mile above the upper end of the Vale valley, and withdrawing about 50 c.f.s. at the time of the survey. There is a temporary dam of loose rock 3 feet high and 60 feet long in connection with this diversion. No fish protective devices are provided.

The Vines Canal is located 2 miles above the upper end of the Vale valley. It was carrying about 30 c.f.s. at the time of the survey. The irrigation flow is maintained by another loose rock dam about 3 feet high and 60 feet long. There are no fish protective devices. These dams would be passable to fish except at low water stages.

There is no cultivation in this section. The watershed consists of a series of low, rolling hillocks having a sparse cover of sage.

(3) Harper Valley:-

Proceeding upstream, the river extends for six miles through the flat Harper Valley. The stream in this section has an average width of 60 feet and a slight gradient. At least one-half of the river bed is composed of mud and silt, with lesser amounts of medium and small rubble, all heavily silted. This section was considered of no possible value to salmon. There are few shallow riffles and numerous resting pools, but the sparse marginal vegetation affords almost no stream cover. The water temperature was 71.0°F. at the lower end of the valley. At the upper end of Harper Valley the river flow was 480 c.f.s. at the time of observation.

There are two principal irrigation diversions in Harper Valley. Proceeding upstream, the first, known as the Lower Harper Ditch is located about 4 miles above the town of Harper. The ditch was carrying about 15 c.f.s. at the time of observation. The diversion dam, extending diagonally upstream, is about 3 feet high, and is not a barrier to fish except at low water stages. There are no fish protective devices.

The Upper Harper Ditch is located about 1/4 mile above the lower ditch. It was carrying only 3 c.f.s. at the time of observation. The diversion dam is of temporary, loose rock construction, 2 feet

high, and is not a barrier to fish except at extreme low water stages. There are no fish protective devices.

The Harper Valley is 1 to 2 miles wide, and largely in alfalfa grain, and pasture. The valley is bounded by low hills having a sparse cover of sage.

(4) Canyon below Juntura:-

Above the Harper valley the river extends for 32 miles through a steep, v-shaped canyon 100 to 400 yards wide. The canyon is bounded by steep, rocky foothills 200-400 feet high having a sparse cover of sage. There is no cultivation in this section. The river has an average width of 60 feet and a moderate gradient throughout. The river bed is composed of two-thirds medium and small rubble and one-third silt. There are numerous shallow riffle areas, but due to the heavy layer of silt deposited throughout it was judged that not more than 10 percent of the bottom should be classified as suitable spawning area. There are numerous small resting pools, but the extremely sparse marginal vegetation, principally sage, provides no stream cover. The water temperature was 69.0°F. at the lower end of the canyon. The river flow just below the confluence of the north fork was 685 c.f.s. at the time of observation.

There is a small unscreened irrigation diversion located 1 mile above the upper end of Harper valley. The ditch was carrying about 2 c.f.s. at the time of the survey. The temporary, 1 foot high rock wing dam was considered passable to fish.

The Harper dam and reservoir and the Vale-Oregon Irrigation Canal are located 11 miles above the town of Harper. This dam and reservoir constitute the diversion works of the Vale Project, constructed by the U. S. Bureau of Reclamation for the control and diversion of water impounded above in the Warmsprings and Agency Valley reservoirs. The diversion canals in connection with the Harper dam have a carrying capacity of 604 c.f.s. At the time of the survey the Vale-Oregon canal was withdrawing 200 c.f.s. The dam is 17 feet high, 702 feet long, and is a barrier to fish. There are no fish protective devices in connection with the diversions.

(5) Juntura Valley and headwaters:-

Proceeding upstream, the main Malheur River extends for 2 miles across the lower end of the Juntura valley, and then extends for 20 miles through a steep canyon 1/4 mile wide up to the Riverside dam and the Warmsprings reservoir. This canyon is bounded by low foothills having a sparse cover of sage and a few small jack pines. There is no cultivation in this section except for a narrow strip of pasture

and hay extending from the confluence of the South Fork at the village of Riverside for a distance of 3 miles upstream. The river has an average width of 90 feet and a moderate gradient below the Riverside dam. The stream bed is composed of approximately 30 percent large rubble, 50 percent medium rubble, and 10 percent each of small rubble and sand. There are numerous shallow riffles containing suitable spawning areas. Resting pools are few, and almost entirely without cover. The water temperature was 57.0°F. at the village of Riverside. The river was turbid at the time of the survey, due to the discharge from the Riverside dam.

The Riverside dam and Warm Springs reservoir were completed in the year 1919. The reservoir has a drainage area of 1,100 square miles, and extends for 10½ miles up the river channel. The dam is the concrete arch type, rising 91 feet above the stream channel and having a crest length of 549 feet. At the time of the survey the discharge through the two outlet gates near the base of the dam was 406 c.f.s. The maximum discharge through the outlets is 700 c.f.s. There are no fish protective devices, and the dam is a total barrier. The reservoir is of some value to resident rainbow trout, and it also supports a large undesirable population of rough fish.

The stream volume above the Riverside dam is subject to great seasonal variation. Gaging station records of the U. S. Geological Survey taken at the village of Drewsey, 21 miles above the dam, show discharges ranging from no flow at times to a maximum of more than 4,000 c.f.s. ^{1/}

The small streams which form the Malheur in the headwaters section some 65 miles above the Riverside dam all have steep gradients, descending rapidly from the south slope of the Blue Mountains. The greater part of this section was not surveyed in detail because it is inaccessible and of no possible value to anadromous fish.

^{1/}

U. S. Geological Survey, water-supply paper No. 1093, for the year 1947.

1A. Willow Creek.-- (July 20, 1942; Parkhurst.) Willow Creek enters the Malheur River approximately 15 miles above the mouth, and extends for a distance of about 35 miles to the Willow Creek reservoir. The stream is under regulation by the reservoir dam, and is used extensively for irrigation. It was 18 feet wide and discharging 27 c.f.s. at the mouth. The gradient is moderate, and there are numerous shallow riffles and resting pools. The water was extremely turbid, due to the returns from many small irrigation diversions. The stream bed was heavily silted, and was considered to be of no value to anadromous fish. The water temperature was 66.5°F. There were no barriers to the migration of fish below the reservoir. No fish screens were found on any of the irrigation diversions.

1B. Bully Creek.-- (July 19, 1942; Parkhurst.) Bully Creek enters the Malheur River approximately 16 miles above the mouth, and extends for a distance of about 30 miles.

The U. S. Bureau of Reclamation has planned the construction of an irrigation dam and storage reservoir on Bully Creek at a point 12.5 miles above the mouth. The proposed dam would be about 100 feet high and would be a total barrier to fish. The reservoir would extend 2 miles upstream and would have a normal high pool area of 1,200 acres. Details of the effects of the proposed project on fish and wildlife are contained in the preliminary evaluation report of the U. S. Fish and Wildlife Service, Office of River Basin Studies. 2/

At the time of the survey the stream was 22 feet wide near the mouth and discharging 60 c.f.s. The water temperature was 67.0°F. The gradient is slight to moderate. Although there was some suitable spawning area, the stream bed was heavily silted from numerous small irrigation diversion returns. The stream was considered to be of no value to anadromous fish and only of slight value to resident trout.

2/

Bully Creek Extension of the Vale Irrigation Project, Oregon. Preliminary evaluation report on fish and wildlife resources. U.S. Fish and Wildlife Service, Office of Regional Director, Region 1, Portland, Oregon. 1949.

1C. North Fork, Malheur River.-- (July 20-21, 1942; Parkhurst.) The North Fork enters the main Malheur River just below the town of Juntura, or approximately 79 miles above the mouth. It extends for a distance of more than 50 miles, of which the lower 15.7 miles up to the impassable Beulah dam were surveyed.

The lower $5\frac{1}{2}$ miles of the stream extends through the flat Juntura valley. The valley is $\frac{1}{2}$ to 2 miles wide, and largely utilized for hay and pasture. It is bounded by moderately steep hills 300-400 feet high having a sparse cover of sage. The stream in this section has an average width of 51 feet and a slight gradient. The discharge at the confluence with the main Malheur was 285 c.f.s. The stream bed was covered with a heavy layer of silt, and was considered of little possible value to anadromous fish. There are few shallow riffle areas. Resting pools are numerous, but the sparse marginal vegetation of willow and sage affords poor stream cover. The water temperature was 67.0°F. throughout the section.

Above the Juntura Valley the North Fork extends through a narrow, rocky canyon 50 to 200 yards wide for a distance of 3 miles. There is no cultivation or grazing in this section. The stream has an average width of 40 feet and a fairly steep gradient. There is some possible spawning area and adequate resting pools. However, the stream was considered of no present or potential value to anadromous fish. The water temperature was 67.0°F. There are two irrigation diversions in this section. The lower diversion is located about $6\frac{1}{2}$ miles above the mouth, and was carrying about 10 c.f.s. at the time of observation. There is no dam in connection with this diversion, the controlled flow from the Agency Valley reservoir and the steep gradient rendering wing dams unnecessary. There are no fish protective devices. The next diversion is about 200 yards farther upstream. It is somewhat larger, and was carrying about 15 c.f.s. at the time of observation. It likewise has no dam nor any fish protective devices.

Above the canyon the North Fork extends for a distance of 7.2 miles to the Beulah dam and the Agency Valley reservoir. In this section the stream runs through a valley $\frac{1}{4}$ to $\frac{1}{2}$ mile wide which is largely utilized for pasture and hay. The stream has an average width of 30 feet and a moderate gradient. There are numerous shallow riffles and good resting pools. However, the stream bed is heavily silted, and was considered of no present or potential value to anadromous fish. The water temperature was 65.0°F. just below the dam.

The Beulah dam and Agency Valley reservoir were completed in 1935. The dam is an earth-fill, rock-faced structure having a crest length of 1,867 feet, and rises 89 feet above the stream channel. The spillway is a concrete chute at the right abutment fitted with three 18 foot steel cantilever gates. The discharge over the spillway at the time of the survey was 310 c.f.s. There are no fishways, and the dam is impassable

to the upstream migration of fish. The Agency Valley reservoir extends for about $3\frac{1}{2}$ miles above the dam, and has a drainage area of 420 square miles. The reservoir is of some value to resident rainbow trout. It also supports a large, undesirable population of squawfish and other rough fish.

The North Fork was not surveyed in detail above the reservoir because it has little potential value for anadromous fish.

1D. South Fork, Malheur River.— (July 22-23, 1942; Parkhurst.) The South Fork enters the main Malheur about 4 miles below the River-side dam, or approximately 97 miles above the mouth. The stream extends for a distance of 24 miles, and in addition its principal tributary, Camp Creek, extends another 21 miles to the south. There are many minor intermittent tributaries. The barren foothills included in the watershed of over 650 square miles have only a sparse cover of sage and grass. The barren nature of the watershed is no doubt responsible for the great natural fluctuation in discharge. It was quite evident from the nature of the banks and the outwash plains at the mouths of the tributaries that the South Fork was subject to flash floods. Although the stream channel had an average width of more than 20 feet, the discharge at the mouth at the time of observation was only 3 c.f.s. The gradient is moderate, and under more favorable flow conditions there would be a considerable amount of spawning area. Further, there is not sufficient flow at low water stages to maintain adequate resting pools as a refuge for trout or salmon. The water temperature was 86.0°F. near the mouth at the time of the survey. Under these conditions the stream must be considered of no value to trout and salmon.

2. Boise River.— (Inspected at various times; not surveyed in detail.) The Boise River enters the Snake River approximately 379 miles above the mouth. The main stem extends for a distance of 76 miles to Arrowrock Dam. The Arrowrock reservoir is 12 miles long. Above the reservoir the river extends for an additional 12 miles to the confluence of the North and Middle Forks.

The Boise River formerly supported good runs of chinook salmon and steelhead trout. These runs have been exterminated for 40 years, due to the early extensive diversion of the flow for irrigation and the intense pollution of the stream by cities and towns along the course.

There are numerous irrigation dams and diversions in the Boise River system, of which only the most important are mentioned briefly in this report. Detailed reports on the fish and wildlife aspects of the several federal irrigation and power projects have been made by the U. S. Fish and Wildlife Service, Office of River Basin Studies.

3/

The Barber dam and power plant is located about 4 miles above the city of Boise or approximately 54 miles above the mouth. It is 21 feet high and is a barrier to fish.

The New York canal diversion dam located 7 miles upstream above Boise is 28 feet high and equipped with a poor fishway which was impassable at the time of inspection.

Arrowrock Dam, 22 miles above Boise, has an effective height of 253 feet when the reservoir is filled to capacity, and is a barrier to fish.

These and numerous minor obstructions and diversions render the Boise River system of little possible value to anadromous fish. However, the reservoir areas are capable of maintaining a greatly increased sport fishery for suitable resident species.

2A. South Fork.-- (Not surveyed in detail.) The South Fork enters the Arrowrock reservoir approximately 4 miles above the Arrowrock dam. The reservoir extends 10 miles up the South Fork. The South Fork extends for a distance of approximately 110 miles. A large part of the course is through a narrow, steep, rocky canyon, which gradually widens above Lime Creek, entering 10 miles above Anderson Ranch Dam, to form a valley about 1/2 mile wide.

The Anderson Ranch dam, constructed by the U. S. Bureau of Reclamation on the South Fork approximately 41 miles above Arrowrock Dam, is nearing completion with the installation of power generating facilities. This dam was designed primarily for supplemental irrigation in conjunction with Arrowrock Dam as a part of the Boise project. However, it has additional benefits for power production and flood control. The dam raises the water level a height of 322 feet, and is impassable to fish. The reservoir extends for 14 miles.

2/

Arrowrock Division Boise Project, Boise River, Idaho. Report on fish and wildlife resources. U.S. Fish and Wildlife Service, River Basin Studies, Washington, D.C. 1950.

The river supports a sport fishery of considerable recreational value for resident trout. That portion of the stream below the Anderson Ranch dam may have its fishery value adversely affected by power-peaking operations. However, a greatly increased trout sport fishery has been provided by the reservoir area. The South Fork both below and above the Anderson Ranch dam has been of no value to anadromous fish for many years, for the same reasons as previously stated for the main Boise River below the project.

2B. Middle Fork.— (Not surveyed in detail.) The Middle Fork joins the North Fork to form the main Boise River at a point 24 miles above the impassable Arrowrock Dam or approximately 14 miles above the upper end of the reservoir area. The stream is inaccessible and of no present or potential value to anadromous fish. It extends for approximately 50 miles in a mountainous region, and is of considerable value to resident trout.

2C. North Fork.— (Not surveyed in detail.) The North Fork extends for a distance of approximately 45 miles through rugged mountainous terrain from its confluence with the Middle Fork. Its fishery aspects are similar to the Middle Fork, and it is of no present or potential value to anadromous fish.

3. Owyhee River.— (July 12-18, 1942; Parkhurst. Inspected at various times; Parkhurst; Gangmark, and Dawson.) The Owyhee River enters the Snake River approximately 380 miles above the mouth. It extends for more than 150 miles, of which the main portion is in Malheur County, Oregon. The headwaters, however, are in Idaho and Nevada.

The lower 12 miles of the course extends through a flat, fertile valley 1/2 to 5 miles wide and bounded by low, rolling hills having a sparse cover of sage. The valley section is under irrigation, and is utilized intensively for the raising of hay, grain, fruit, and pasture. The stream channel in this section is 130-160 feet wide, but at the time of the survey in July the stream bed was mostly uncovered. The discharge near the mouth was only 15 c.f.s. The gradient is slight and the stream bed is heavily silted. There are few shallow riffles, but almost continuous pools. The sparse marginal vegetation affords little stream cover. The water temperature was 74.0°F. - 76.0°F. There is no suitable salmon spawning area in this section. There are several small, unscreened irrigation diversions withdrawing 2-3 c.f.s.

At the upper end of this section where the valley converges into the Owyhee Canyon at a point approximately 12 miles above the mouth there is the "Old Owyhee" irrigation dam and diversion. This loose rock dam is only 2 feet high, and although there is no fishway, it is not a barrier except under low flow conditions. The irrigation canal is 20 feet wide, withdrawing 190 c.f.s. at the time of observation in

July, and is unscreened. The maximum capacity of the canal is 235 c.f.s.

Above this point the river extends for 14 miles through a narrow, steep, rocky canyon to the Owyhee dam and reservoir, the upper terminus of the survey. There is almost no cultivation in this section, except on several small terraces where there is some hay and pasture. The stream bed has an average width of 120 feet and a slight to moderate gradient. There are a fair number of shallow riffles containing a considerable amount of spawning area. However, the stream was heavily silted, due to the turbid discharge from Owyhee Dam. There are numerous resting pools with slight stream cover. The water temperature ranged from 67.5°F. at the lower end of the canyon to 47.0°F. at Owyhee Dam.

There is a small irrigation dam and diversion about 16 miles above the mouth. The unscreened ditch carries about 2 c.f.s. The temporary, loose rock diversion dam is not a barrier to fish except under low flow conditions.

The Owyhee Dam, located approximately 26 miles above the mouth, was completed by the U.S. Bureau of Reclamation in 1933. It is primarily a storage dam for irrigation, and has been used exclusively for that purpose. However, it was designed with penstock lines so that it may be converted to produce hydro-electric power. The dam is 330 feet high, and is a total barrier to fish. The reservoir extends 23 miles upstream. At the time of observation the North Canal diversion from the reservoir, running 70 miles northward, was carrying 1,000 c.f.s. The South Canal diversion at the same time was carrying 1,400-1,500 c.f.s. a distance of 37 miles into Owyhee County in southern Idaho. Sufficient discharge from the outlet gates is maintained to supply the "Old Owyhee" diversion 14 miles downstream, the discharge on the date of observation being 207 c.f.s. However, there is usually an inadequate flow for fish in the lower 12 miles from the Old Owyhee canal to the mouth. Further, during the season of water impoundment from October through March the entire stream bed below Owyhee Dam is mostly uncovered. Gaging station records of the U.S. Geological Survey for the water year 1946-47, ^{4/} taken at a station 3/4 mile below Owyhee Dam, show a discharge of 8 c.f.s. from October 6 through April 5. Under such flow conditions the Owyhee is of no present value to anadromous fish.

^{4/} U.S. Geological Survey, Surface Water Supply of the United States, 1947. Part 13, Snake River Basin. Water-supply paper No. 1093. U.S. Government Printing Office, Washington: 1950.

The Owyhee River system once supported a good run of chinook salmon. However, many factors contributed to the depletion of this run, in common with the runs in other tributaries of the Snake River, long before the Owyhee Dam was constructed.

Although it is not heavily fished, the Owyhee reservoir has a considerable sport fishery value for both resident trout and warm water species, such as bass.

In addition to more than 100 miles of the main stream above Owyhee reservoir, there are a number of upper major tributaries having a total stream length of more than 400 miles entering above the reservoir, many of which also support resident trout populations. In upstream order the principal tributaries are 3A. Crooked Creek, 51 miles long, entering 82 miles above the dam, 3B. Jordan Creek, 57 miles long, entering 89 miles above the dam, 3C. the South Fork, 90 miles long, entering approximately 126 miles above the dam, and which in turn has several large tributaries, including 3C-(1) the East Fork, 72 miles long, and 3C-(2) the Little Owyhee River, 43 miles long. The South Fork, Middle Fork, and North Forks come together approximately 126 miles above the dam to form the main stream. 3D. the Middle Fork, 18 miles long, and 3E. the North Fork, 24 miles long, are both much smaller than the South Fork.

There are a number of small streams entering the Snake River upstream from the mouth of the Owyhee River. None of them is of value to anadromous fish, and it is considered that they do not warrant a detailed survey. Below Swan Falls several small streams enter the Snake River from the southwest. Proceeding upstream above the Owyhee River, the first of these are 4. Sucker Creek and 5. Jump Creek, both used for irrigation between the towns of Homedale and Marsing, Idaho. In the canyon section below Swan Falls there enters 6. Squaw Creek, 7. Reynolds Creek, and 8. Rabbit Creek. None of these is passable to anadromous fish. 9. Sinker Creek enters the Swan Falls reservoir, and is used for irrigation. 10. Castle Creek enters the Snake River a short distance above Swan Falls reservoir, and is utilized for irrigation. 11. Birch Creek and 12. Shoo Fly Creek are small streams entering below and above the town of Grand View, Idaho. Both are used for irrigation in the lower portions of their courses.

13. Bruneau River.-- (Not surveyed in detail.) Enters the Snake River 8 miles upstream from the town of Grand View. The Bruneau was formerly a fair sized stream, but it is now utilized extensively for irrigation, and is of no value to anadromous fish. Gaging station records taken by the U.S. Geological Survey at a station 1 mile above the mouth and 0.8 mile downstream from the Grand View irrigation diversion dam show mean flows for the water year 1946-47 ranging from 629 c.f.s. in May to 4.6 c.f.s. in September. There are several reservoirs and numerous unscreened irrigation diversions in the Bruneau River system.

14. Canyon Creek.-- enters the Snake River from the north about $2\frac{1}{2}$ miles above the mouth of the Bruneau River. Its flow is largely diverted for irrigation in the vicinity of the town of Mountain Home, Idaho, and at times there is no flow in the lower portion of the stream.

15. Rattlesnake Creek.-- enters the Snake River approximately 12 miles upstream from Canyon Creek. Its flow is impounded in the Mountain Home reservoir for irrigation in the vicinity of the town of Mountain Home.

There are several other small streams entering the Snake River from the north in the vicinity of the towns of Hammett, Glenns Ferry, and King Hill. All of them are utilized extensively for irrigation, and are of no value to anadromous fish.

16. Big Wood River.-- (or Malad River. Not surveyed in detail.) Enters the Snake River 2 miles downstream from Lower Salmon Falls. It is a large stream, extending well over 100 miles, with several major tributaries including 16A. Little Wood River and 16B. Camas Creek. The lower portion of the course is generally known as the Malad River. The upper portion of the stream is impounded in Magic Reservoir, the discharge being regulated according to irrigation demands. Magic Reservoir supports a good population of rainbow trout. The lower portion of the stream also receives water from canals diverting from the main Snake River at the Milner dam. There are numerous impassable irrigation dams and unscreened diversions as well as a number of storage reservoirs in the complex water distribution system. The entire stream system is of no value to anadromous fish, but in some sections supports good populations of resident trout.

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