U. S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE

A SURVEY OF THE WATERS OF THE SOUTH UMPQUA RANGER DISTRICT

UMPQUA NATIONAL FOREST

By

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Junior Biologist

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INTRODUCTION

Purpose of Survey

The objectives of the present survey of the upper waters of the South Fork of the Umpqua River were to: (1) develop practical and scientifically sound stocking policies; (2) determine the need for stream and lake improvements; and (3) obtain facts to assist in the settlement of the controversy with regard to the South Umpqua Falls. There has been continual demand by sportsmen that the South Umpqua Falls be supplied with fish ladders to permit safe ascent of sea-run species to spawning grounds above the falls. Study of this problem was undertaken as a definite part of the survey work described herein.

The stream and lake survey work was initiated by the Forest Service in cooperation with the U. S. Bureau of Fisheries during the summer of 1937. Emphasis was placed on the detailed studies relating to the physical and biological factors upon which it would be possible to recommend adequate stocking policies. No study of chemical conditions whatsoever was made for two reasons: first, lack of equipment prevented making gas analyses and, second, such studies seemed unnecessary by reason of the fact that there is no pollution present in the streams surveyed and all of them are well aerated, clean, rapid flowing mountain streams. Chemical conditions as shown by general observations werequite suitable and it is only where natural or artificial pollutants occur in great abundance that chemical analyses would aid in determining the basic effects of same on the fishes and their food organisms present in streams.

Close measurement of such biological factors as food, species of fish present and their abundance, predators and parasites, etc., were made and gathered along with information on such physical factors as temperatures, rate and volume of flow, type of bottom, and other conditions. In the recommendations given at the end of this report, every bit of factual information obtained has been brought to focus on the main problem at hand.

Personnel

The personnel of the South Umpqua Lake and Stream Survey consisted of Junior Biologist A. R. Roth, leader; Claybourn Dean, Junior Technician; and from three to five CCC assistants.

Time in Field

Field work was started on July 7, 1937, and continued until September 17, 1937, but was interrupted for a period of 3 weeks by fire conditions in the area. The main stream (South Umpqua River) was accessible by car, while all tributaries were reached by trail or by wading up the stream. The lakes were reached by trail. The base camp was located at the South Umpqua CCC Camp, with side camps located at strategic points. Pack trips were made to several of the remote areas.

Acknowledgments

The writer wishes to express his appreciation of the assistance rendered by many people who have greatly aided in carrying out this survey. Special credit is due Mr. V. V. Harpham, Supervisor of the Umpqua National Forest, and his staff; Dr. Paul R. Needham of the U.S.Bureau of Fisheries, and Mr. E.P.Cliff, of the Regional Office, U.S.Forest Service, who directed the work; District Ranger A. E. Berry, and Forest Guard Earl Duncan of Fish Lake.

Thanks are rendered to the following persons for assistance in identification of aquatic organisms collected: Dr. M. E.Peck, Willamette University, aquatic plants; Professor Trevor Kincaid, University of Washington, crustaceans and moluscs; Dr. George M. Myers, Stanford University, fishes; and Dr. F. F. Fish, U. S. Bureau of Fisheries, Seattle, fish parasites. Help rendered from time to time in the course of the survey by the Oregon Game Commission is also appreciated.

General Description of Area

The Umpqua National Forest is bounded on the south by the Rogue River National Forest and Crater Lake National Park; on the east by the Deschutes National Forest, and on the north by the Willamette National Forest. To the west lies the large and fertile Umpqua Valley. The Cascade Mountain range bounds the eastern edge of the forest. The South Umpqua River and its tributaries drain some 652 square miles of mountainous territory in the southern part of the Umpqua National Forest. It flows west into the main Umpqua River near Roseburg, which in turn flows about 80 miles through the Coast Range mountains before emptying into the Pacific Ocean at Winchester Bay.

The South Umpqua River has its origin at elevations ranging around 6,000 feet. The greater part of the watershed is broken up by rocky canyons which are clothed with fine stands of Douglas fir, pine, cedar and hemlock. Forest fires have burned over some 7,000 acres, but these are rapidly being restocked with excellent stands of reproduction. Bedrock is very close to the surface over the entire area which results in heavy and rapid runoff after early spring rains.

Deep snows cover the higher elevations during the early spring but soon melt away, causing the spring freshets. During the middle and late summer the entire source of water is from springs.

Within the national forest approximately forty miles of roads parallel the South Umpqua River and Elk Creek, one of its important tributaries. Paralleling the tributaries are some 315 miles of secondary trails and 213 miles of way trails that lead to some 22 lookout and guard stations, lakes, and other points of interest in the district. Excellent campgrounds are located at various points of interest along both roads and trails. Fishermen, hunters, campers and visitors find secluded retreats throughout this watershed during the summer season. Excellent fishing for resident cutthroat and rainbow trout is had in the tributaries of the South Umpqua. Steelhead and chinook salmon run into the stream from the ocean offering considerable sport to anglers. Steelhead run mostly in winter and spring while the principal salmon run is in late spring and summer. Above Tiller there are approximately 170 miles of stream available to anglers.

Several excellent lakes are found in the district, the largest and most important of which is Fish Lake. This beautiful lake, covering approximately 90 acres, lies in a rugged area reached only by trail. It is stocked with rainbow and eastern brook trout. Unexcelled fishing may be had in this lake throughout the season. Next in importance is Buckeye Lake, lying three miles southwest of Fish Lake. This lake covers approximately fifteen acres and has also been stocked with rainbow and eastern brook trout. Cliff Lake, having an area of seven acres, has not yet been stocked.

Methods of Procedure

The Bureau of Fisheries "Instructions for Stream and Lake Survey Work" prepared by Dr. A. S. Hazzard were followed with a few slight modifications in making this survey. Field equipment necessary for the examination of both lakes and streams, lake and stream survey sheets, fish collection forms and scale sample books were furnished by the Bureau of Fisheries. Specimen bottles, labels, preservatives, camping equipment and transportation facilities were provided by the Forest Service. Measurements of all fish were made from the tip of the snout to the base of the caudal fin. This is called "standard length" (S.L.). Total lengths (T.L.) from the tip of the snout to the fork of the tail are not recorded in this report.

A further discussion of methods appears under the various sections to which they pertain.

SOUTH UMPQUA RIVER AND TRIBUTARIES

The South Umpqua River and its tributaries were divided into sections, depending on the length, size, and number of tributaries and importance of each. The sections were designated by number and an attempt was made to study each as a distinct ecological unit. Seven main sections were established in the river between Tiller and Camp Comfort. Each section was in turn divided into three stations. The tributaries are listed as supplementary sections of the main stream and are numbered 8 to 31 for convenience. These supplementary sections were divided into from one to three stations each. The accompanying map of the watershed shows all sections and supplementary sections, the beginning and end of each being marked with an X. The approximate length of each station was taken from maps, from speedometer readings, by actually chaining the distance, or by estimates. A complete description of the sections and stations is given in Table 1.

Table 1. - Description of sections and stations on the South Umpqua River and tributaries.

Sec. No.	Name of Creek	Length (Miles)	Location	Stations		
				Lower	Middle	Upper
1	S. Umpqua	5	Tiller to Jackson Creek	Tiller to gravel pit	Gravel pit to CCC Camp	CCC Camp Jackson
2	S. Umpqua	6	Jackson Creek to Dumont Creek	Jackson Cr. to Allen Creek	Allen Cr. to Radford Cr.	Radford Dumont C
3	S. Umpqua	2.2	Dumont Creek to Boulder Creek	Dumont Cr. to bend in river	Bend in riv. to Zinc Cr.	Zinc Cr. Boulder
4	S. Umpqua	4.5	Boulder Creek to Buckeye Creek	Boulder Cr. to Big Bend	Big Bend to Ash Cr.	Ash Cr. Buckeye
5	S. Umpqua	1	Buckeye Creek to S. Umpqua Falls	Buckeye Cr. to log across cr.	Log across cr. to Big Cedar	Big Ceda falls
6	S. Umpqua	3.5	S. Umpqua Falls to Quartz Creek	Falls to large V falls	Large V falls To Russian Pl.	Russian Quartz C
7	S. Umpqua	3.	Quartz Creek to Black Rock Forks	Quartz Cr. to Flood Cr.	Flood Cr. to Skillet Cr.	Skillet Black Ro
Tributaries						
8	Deadman Cr.	6	Mouth to middle fork	Mouth to old cabin	Old cabin to falls	Falls to fork
9	Dumont Cr.	6	Mouth to West Creek	Mouth to miner's cabin	Miner's cabin to Straight C.	Straight to West
10	Boulder Cr.	6.5	Mouth to Last Camp	Mouth to Slick Cr.	Slick Cr. to Malt Cr.	Malt Cr Last Ca
11	Ash Creek	2.5	Mouth to Earle-backs	Mouth to 2nd tributary	2nd trib. to lower meadow	Lower m to hous
12	Buckeye Cr.	3	Mouth to high falls	Mouth to trail crossing	Trail crossing to second falls	2nd fal high fa
13	Buckeye Cr.	5	High falls to main cr. forks	High falls to trail crossing	Trail crossing to upper falls	Upper f main fo
14	Quartz Cr.	5	Mouth to high falls	Mouth to 1st main trib.	1st main trib. to Rock Butte	Rock Bu High Fa
15	Skillet Cr.	1	Mouth to bare cliffs	Mouth to road crossing	Road cross. to 1st main fork	1st mai to bare
16	Black Rock Fork	6	Mouth to French Creek	Mouth to Boze Cr.	Boze Cr. to Prong Cr.	Prong C French

Table 1 (Continued)

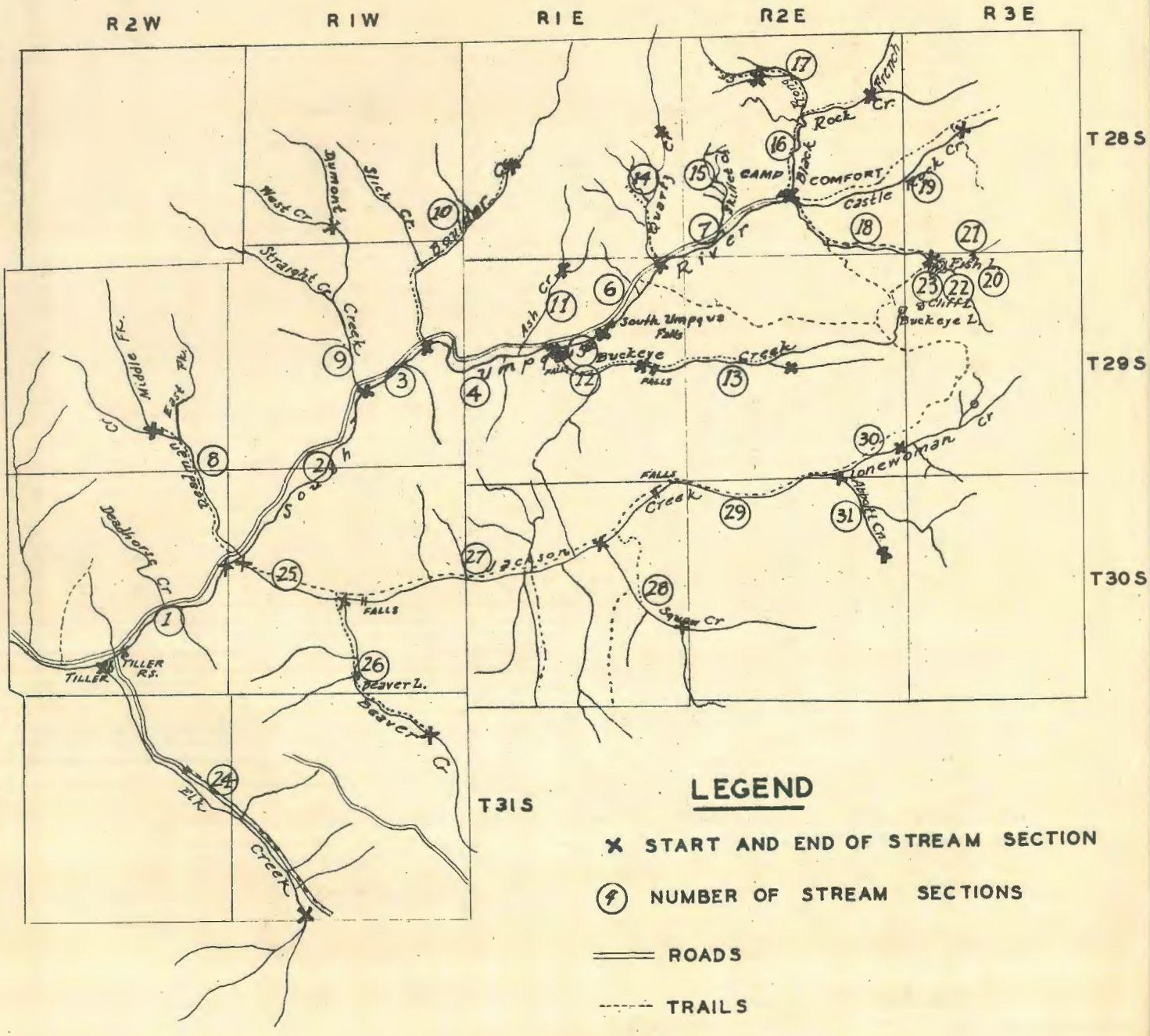
Name of Creek	Length (Miles)	Location	Stations		
			Lower	Middle	
Prong Creek	2	Mouth to Bow Cr.	Mouth to 1st trib. on right	1st trib. on right to 1st trail crossing	1st t to B
Fish Lake Cr	6	Mouth to Fish Lake	Mouth to telephone	Telephone to high Falls	High lake
Castle Rock Cr.	9	Camp Comfort to upper trail crossing	Camp Comfort to 1st trail cross.	1st trail crs. to Buster Sprg.	Buste upper
High Rock Cr	2	Fish Lake to 2 miles	Fish Lake to Corral Camp	Corral Camp to falls.	Falls 1/2
Corral Cr.	0.25	Mouth to $\frac{1}{4}$ mi. up creek	Lower $\frac{1}{4}$ mi.	None	
Box Creek	0.15	Mouth to 800 ft. up cr.	Lower 800 ft.	"	
Duncan Cr.	0.17	Mouth to 900 ft. up cr.	Lower 900 ft.	"	
Elk Creek	10	Mouth to Diamond Cr.	Mouth to Callahan Cr.	Callahan Cr. to Joe Hall Cr.	Joe Diam
Jackson Cr.	4	Mouth to Beaver Creek	Mouth to 3-point Camp	3-Point Camp to 2nd trib. on right	2nd to B
Beaver Cr.	5	Mouth to Devils Knob Cr.	Mouth to Beaver Lake	Beaver Lake	Beav Devi
Jackson Cr.	9	Beaver Cr. to Squaw Cr.	Beaver Cr. to Surveyor Cr.	Surveyor Cr. to Whiskey Cr.	Whis Squ
Squaw Creek	4	Mouth to Huckleberry Cr.	Mouth to trail crossing	Trail cross. to 1st main tr.	1st to H
Jackson Cr.	8	Squaw Cr. to Lonewoman Cr.	Squaw Cr. to Two Mile Cr.	Two Mile Cr. to Cow Camp Cr.	Cow Lone
Lonewoman Cr.	2	Mouth to 2nd trail crossing	Mouth to 2nd main trib.	2nd main trib. to 4th trib. on right	4th to 2
Abbott Cr.	3	Mouth to 2nd main fork on east	Mouth to Falcon Creek	Falcon Cr. to dry fork on west	Dry to 2

Total length 130.77

FIG. 1

MAP OF WATERS OF THE SOUTH UMPQUA DISTRICT
UMPQUA NATIONAL FOREST

SCALE 1/4 IN. 1 MILE
1937



LEGEND

- × START AND END OF STREAM SECTION
- (#) NUMBER OF STREAM SECTIONS
- ═══ ROADS
- ------ TRAILS

Physical Characteristics

Width, Depth, Velocity and Volume

The average width, depth, velocity and volume of each section of the South Umpqua and its tributaries are summarized in Table 2.

The average width of each section was obtained from six to twelve measurements taken in both narrow and wide places throughout the section. The average depths were obtained from numerous soundings taken across representative riffles in each section. These varied from a few inches deep in some tributaries to over two feet deep in the South Umpqua River near Tiller.

The velocity was found to fluctuate widely in various parts of each section. Where current was slight and the flow less than 1/2 foot per second, the velocity was considered sluggish. Velocity from 1/2 to 2 feet per second was considered moderate. A flow of from 2 to 6 feet per second was considered rapid, and where greater than 6 feet per second, it was classed as being of torrential nature. Due to the many pools in the torrential areas, the South Umpqua drainage provides excellent shelter for native species of fish.

The average volume of flow is the mean of from 6 to 12 readings taken in each section. Volumes are expressed in cubic feet per second or gallons per minute. Due to the sinking of water in many sections, volumes were found to fluctuate a great deal. The waters of the entire South Umpqua watershed are subject to sudden spring freshets that increase the volume from 10 to 20 times the summer volume. Because of the nearness of bedrock to the surface and the steepness of the hills, the precipitation runs off in a very short time. Inasmuch as there were very few U. S. G. S. maps of this area, the gradient was expressed as slight, moderate, or steep, depending on the average per section.

Table 2.--Average width, depth, velocity and volume of sections of the South Umpqua River and its tributaries.

Section Number	Length in Miles	Average Width in feet	Average Depth in feet	Average Velocity	Average Volume* C.F.S.	Gradiant per Section	Date (1937)
1	5.0	86.2	2.1	Slow	445.7	Slight	7-20
2	6.0	68.2	1.5	Slow	113.8	Slight	7-21
3	2.2	51.8	1.3	Slow	124.3	Slight	7-22
4	4.5	50.1	1.2	Moderate	96.4	Slight	7-23
5	1.0	34.3	1.2	Moderate	58.1	Moderate	8-24
6	3.5	33.0	1.0	Moderate	55.2	Moderate	8-25
7	3.0	30.0	1.1	1.8	52.2	Moderate	8-26

Table 2 (Continued)

Section Number	Length in Miles	Average Width in feet	Average Depth in feet	Average Velocity	Average Volume* C.F.S.	Gradient per Section	Date (1937)
Tributaries:							
8	6.0	12.1	.5	Moderate	7.9	Moderate	8-2
9	6.0	15.0	.6	Moderate	9.2	Moderate	8-3
10	6.5	10.1	.6	Moderate	6.4	Moderate	8-10
11	2.5	2.3	.4	Moderate	228.4 g.p.m.	Moderate	8-23
12	3.0	12.3	.4	Moderate	6.1	Moderate	8-11
13	5.0	8.5	.9	Moderate	4.7	Moderate	8-17
14	5.0	26.6	.9	Moderate	7.7	Moderate	8-19
15	1.0	3.2	.3	Moderate	236.3 g.p.m.	Moderate	8-18
16	6.0	10.3	.67	Moderate	10.3	Moderate	8-30
17	2.0	10.1	.6	2.6	7.32	Moderate	8-27
18	6.0	13.0	1.1	Rapid	16.7	Steep	7-16
19	9.0	24.0	.17	Rapid to moderate	38.6	Steep to moderate	8-31
20	2.0	5.8	.4	Rapid	5.03	Steep	7-15
21	.25	2.5	.5	Moderate	1.2	Moderate	7-15
22	.15	2.0	.3	Moderate	1.2	Moderate	7-15
23	.17	2.5	.5	Moderate	1.8	Moderate	7-15
24	10.0	14.2	.62	Moderate	7.6	Moderate	9-1
25	4.0	28.1	1.2	Moderate	43.4	Moderate	8-12
26	5.0	10.7	.58	Slow to rapid	6.2	Moderate	9-13
27	9.0	24.6	1.0	Moderate	30.6	Moderate	9-11
28	4.0	19.4	.86	Rapid to moderate	13.9	Moderate to steep	9-10
29	8.0	15.3	.85	Moderate	13.9	Moderate	9-9
30	2.0	10.4	1.57	Moderate	6.3	Moderate	9-7
31	3.0	10.6	.33	Moderate	4.2	Moderate	9-7

*Given in cubic feet per second unless specifically shown in gallons per minute (g.p.m.).

Bottom Types

Due to the great amount of bedrock and the number of steep canyons throughout this area, there is a predominance of rubble in all streams. An abundance of gravel which provides excellent spawning conditions, and some sand were also found in the riffles below pools.

Shade

The following terms have been used to designate the types of shade existing on the streams throughout this area: exposed,no shade; semi-exposed,not more than a third of the water shaded; arboreal, tall timber along banks, shading most of the stream; low brush, overhanging trees and brush, heavily shading entire stream and making fishing somewhat difficult.

Due to extreme width, the lower sections of the South Umpqua River near Tiller are almost entirely exposed. The upper section of the main stream and most of the tributaries are heavily shaded and hence classed as arboreal or low brush, which makes angling rather difficult. However, these conditions provide lower water temperatures, protection for fish, and a plentiful supply of terrestrial foods.

Riffles

One of the primary reasons for the plentiful food supply existing in the South Umpqua River and its tributaries is the large number of riffle areas throughout the entire system.

Color and Turbidity

The waters of this area are very clear and free from sediment except after heavy rains or during early spring freshets.

Pools

In the lower stretches of the South Umpqua River, pools are of good size but are few and far between. In the upper sections many of the tributaries contain from 20 to 100 pools per mile.

The pools are classified as to size, type, and frequency as follows:

Size - S
1 - Good - 2 times width of stream.
2 - Fair - Equal to width of stream.
3 - Poor - Less than width of stream.

Type - T
1 - Good - Deep, sheltered, boulders.
2 - Fair - Shallow, open, huge rocks.
3 - Poor - Shallow, open, bedrock.

Frequency - F
1 - Good - Continuous.
2 - Fair - Close succession.
3 - Poor - Few.

Table 3 summarizes the data collected on types of bottom, shade, riffles, and size, type and frequency of pools.

Table 3.-- Physical features of the South Umpqua River and its tributaries showing types of bottom, shade, riffles, and pool conditions.

Section Number	Types of Bottom	Shade	Riffles	Pools
1	Bedrock, rubble	Semi-exp.	Short, deep	S1 T2 F2
2	Rubble	Semi-arb.	Short, shallow	S1 T2 F2
3	Gravel, rubble	Semi-arb.	Short, narrow	S1 T1 F1
4	Gravel, rubble	Arboreal	Short, shallow	S1 T1 F1
5	Gravel, bedrock, boulders	Semi-arb.	Long, shallow Short, deep	S2 T2 F2
6	Gravel, bedrock, rubble	Semi-arb.	Long, shallow Short, deep	S1 T2 F2
7	Rubble, gravel	Arboreal, semi-arb,	Long, shallow	S1 T2 F2
Tributaries:				
8	Gravel, bedrock	Arboreal	Narrow, deep	S1 T1 F1
9	Gravel, bedrock	Low brush	Short, deep	S1 T1 F1
10	Gravel, bedrock	Low brush, arboreal	Short, deep Long, deep	S1 T1 F1
11	Sand, silt, bedrock	Partly open, arboreal	Short, shallow Long, shallow	S1 T1 F2
12	Rubble, gravel	Arboreal	Short, rapid Long, shallow	S1 T1 F1
13	Gravel, bedrock, rubble	Arboreal	Short, deep Long, deep	S1 T2 F2
14	Gravel, bedrock, rubble	Arboreal	Short, deep Long, shallow	S1 T1 F1
15	Gravel	Arboreal	Short, deep Long, shallow	S1 T1 F2

Table 3 (Continued)

Section Number	Types of Bottom	Shade	Riffles	Pools
16	Boulders, gravel	Arboreal	Long, shallow Short, deep	S1 T1 F1
17	Gravel, boulders	Arboreal	Long, shallow	S1 T1 F2
18	Gravel, rubble	Arboreal	Long, shallow	S1 T1 F3
19	Gravel, rubble	Low brush, arboreal	Long, shallow	S1 T1 F1
20	Gravel, rubble	Low brush	Short, deep	S1 T1 F1
21	Gravel, rubble	Low brush	Long, shallow	S1 T1 F1
22	Sand, gravel	Low brush	Long, shallow	S1 T1 F1
23	Sand, gravel	Low brush	Long, shallow	S1 T1 F1
24	Gravel, rubble	Semi-exp.	Long, shallow	S1 T1 F1
25	Gravel, rubble	Arboreal	Long, shallow	S1 T1 F2
26	Gravel, silt rubble	Low brush, arboreal	Long, shallow	S1 T1 F1
27	Gravel, rubble	Arboreal	Long, shallow	S1 T1 F2
28	Gravel, rubble	Low brush	Long, shallow	S1 T1 F1
29	Gravel, rubble	Low brush, arboreal	Long, shallow	S1 T1 F1
30	Gravel, rubble	Low brush	Long, shallow	S2 T2 F2
31	Gravel, rubble	Low brush	Long, shallow	S1 T1 F1

Temperatures

Because of the sluggish flow and predominance of shallow, exposed water temperatures in the lower sections of the main stream were rather high. The waters of most of the tributaries were cold. The maximum water temperature of the area was 75° F. (Section 1); the minimum, 44° F. (Section 22). The mean water temperature for the entire watershed was 57.6° F.

It is a well known fact that water temperatures affect the growth, size, and reproduction of fish. Since most of the tributaries in this area originate in springs, the water is very cold, causing a slow growth. The water and air temperatures recorded throughout the season are tabulated in Table 4.

Table 4--Temperature record, South Umpqua River and tributaries, 1937.

Sect. No.	Station	Date 1937	Hour	Sky	Temperatures	
					Air °F	Water °F
	lower	7-20	11 AM	clear	80	70
1	middle	7-20	1:35PM	clear	86	73
	upper	7-20	2:35PM	clear	79	75
	lower	7-21	9:30AM	clear	64	64
2	middle	7-21	11 AM	clear	74	64
	upper	7-21	2 PM	clear	85	64
	lower	7-22	9:15AM	clear	67	60
3	middle	7-22	10:30AM	clear	72	64
	upper	7-22	1:30PM	clear	85	64
	lower	7-23	9:30AM	clear	69	62
4	middle	7-23	11:30AM	clear	72	64
	upper	7-23	1:30PM	clear	86	66
	lower	8-24	9 AM	clear	52	55
5	middle	8-24	11 AM	clear	64	57
	upper	8-24	12 Noon	clear	72	61
	lower	8-25	1 PM	clear	73	61
6	middle	8-25	10:15AM	clear	61	56
	upper	8-25	8:30AM	clear	51	54
	lower	8-26	2:15PM	clear	83	64
7	middle	8-26	11 AM	clear	65	57
	upper	8-26	8:40AM	clear	56	55
Tributaries						
	lower	8-2	4 PM	clear	72	59
8	middle	8-2	1:30PM	clear	76	59
	upper	8-2	10:30AM	clear	63	52
	lower	8-3	2 PM	clear	62	73
9	middle	8-3	3 PM	clear	59	73
	upper	8-3	12:30PM	clear	56	74
	lower	8-10	9 AM	P. C.	67	61
10	middle	8-10	3 PM	P. C.	79	67
	upper	8-10	11 AM	P. C.	72	60
	lower	8-23	3 PM	P. C.	65	58
11	middle	8-23	2:30PM	P. C.	64	56
	upper	8-23	12:30PM	P. C.	61	56
	lower	8-11	2:30PM	P. C.	81	62

Table 4 (Continued)

Sect. No.	Station	Date 1937	Hour	Sky	Temperatures Air °F	Temperatures Water °F
12	middle	8-11	12 Noon	P. C.	76	60
	upper	8-11	10:30AM	P. C.	72	59
	lower	8-17	2 PM	clear	80	58
13	middle	8-17	12 Noon	clear	77	58
	upper	8-17	11 AM	clear	69	55
	lower	8-19	1 PM	clear	77	61
14	middle	8-19	12:30PM	clear	71	57
	upper	8-19	10 AM	clear	59	54
	lower	8-18	11 AM	clear	72	56
15	middle	8-18	1 PM	clear	81	57
	upper	8-18	3 PM	clear	75	60
	lower	8-30	3 PM	cloudy	57	50
16	middle	8-30	1 PM	cloudy	58	50
	upper	8-30	10 AM	cloudy	53	48
	lower	8-27	11:30AM	cloudy	61	52
17	middle	8-27	10:45AM	cloudy	59	50
	upper	8-27	10 AM	cloudy	57	50
	lower	7-16	3:30PM	clear	78	64
18	middle	7-16	2 PM	clear	79	68
	upper	7-16	9 AM	clear	62	66
	lower	8-31	3:15PM	cloudy	57	50
19	middle	8-31	12:45PM	cloudy	55	49
	upper	8-31	10 AM	cloudy	54	48
	lower	7-15	1:45PM	clear	74	48
20	middle	7-15	10 AM	clear	57	46
	upper	7-15	9 AM	clear	49	46
21	lower	7-15	12 AM	clear	68	44
22	lower	7-15	2 PM	clear	68	44
23	lower	7-15	4 PM	clear	67	46
	lower	9-1	9 AM	S-Cl.	57	56
24	middle	9-1	11 AM	S-Cl.	62	58
	upper	9-1	12:30PM	S-Cl.	74	58
	lower	8-12	8:30AM	P. C.	70	66
25	middle	8-12	11:30AM	clear	78	68
	upper	8-12	1 PM	clear	80	60
	lower	9-13	4 PM	clear	70	60
26	middle	9-13	2:45PM	clear	83	65
	upper	9-13	10:30AM	clear	69	56
	lower	9-11	1:45PM	clear	70	61
27	middle	9-11	10:45PM	cloudy	69	59
	upper	9-11	1:30PM	P-Cl.	75	59
	lower	9-10	10:45AM	clear	62	51
28	middle	9-10	12:45PM	clear	63	52
	upper	9-10	3 PM	clear	65	52
	lower	9-9	1:30PM	P-Cl.	70	56

Table 4 (Continued)

Sect. No.	Station	Date 1937	Hour	Sky	Temperatures Air °F	Water °F
29	Middle	9-9	11a.m.	P-Cl.	61	52
	Upper	9-9	3 p.m.	P-Cl.	64	53
	Lower	9-7	12	P-Cl.	64	50
30	Middle	9-7	11 a.m.	P-Cl.	60	50
	Upper	9-7	9 a.m.	P-Cl.	52	50
	Lower	9-7	4:30 p.m.	P-Cl.	56	52
31	Middle	9-7	3:30 p.m.	P-Cl.	59	52
	Upper	9-7	2:45 p.m.	P-Cl.	59	51

Biological Characteristics

Plants

Algae are common in all the waters of the South Umpqua watershed. Brown algae are found on rocks, gravel and the sides of banks. Long, green algae are found in the upper sections of the main river. Nostoc, a species of a small, gelatinous, dark-green alga, was found growing in all the streams of this region. A small midge larvae was found growing inside the Nostoc examined.

Moss is rare to common in all streams. In a few of the upper sections of the tributaries, moss was seen in abundance. None of the higher types of aquatic plants, weeds, or grasses were found in the South Umpqua or its tributaries above Tiller. The heavy seasonal freshets and high velocity of streams prohibit such growth.

Fish

Some 22 collections of fish were made throughout the area. In addition, 120 scale samples were taken for study of growth rates. Fish were caught by bait and fly fishing and seining.

The following species of fish were taken in the streams of the South Umpqua drainage:

Common Name	Scientific Name
Chinook salmon	Oncorhynchus tschawytscha
Steelhead or rainbow	Salmo gairdnerii
Cutthroat trout	Salmo clarkii
Squawfish or chub	Ptychocheilus umpquae
Suckers	Catostomus macrocheilus
Eels	Entosphenus tridentatus (?)
*Bullheads	Cottus gulosus
Red-sided shiner or minnow	Richardsonius balteatus balteatus
*Black-sided dace or minnow	Apocope oscula nubila

*Found also in Fish Lake.

Table 5 -- Summary of the species of fish observed in each section.

Section:	Species	Size	Abundance	Remarks
1,2,3, 4 & 5	Steelhead or rainbow	1-8"	Abundant	Salmon and steelhead
	Suckers	1-14"	Common	
	Chubs	1-14"	Common	
	Bullheads	1-3"	Common	
	Eels	1-18"	Rare	
	Minnows	1-4"	Abundant	
	Salmon	Adults	Abundant	During migration periods
	Steelhead	Adults	Abundant	During migration periods
6 & 7	Same as section 1, except no chubs or suckers	Same as Section 1	Same as Section 1 except no chubs or suckers	Falls act as barrier to squawfish or chubs and suckers only. Many salmon and adult steelhead above.
8 & 9	Cutthroat Steelhead or rainbow	6-10" 1-3"	Common Common	Some salmon reported in lower station only.
	Bullheads	1-3"	Rare	
	Minnows	1-3"	Common	
10	Cutthroat Steelhead or rainbow	1-12" 1-4"	Common Common	Minnows are seen only in lower and middle sections.
	Bullheads	1-3"	Rare	
	Minnows	1-3"	Abundant	
11	Cutthroat	1-14"	Abundant	
	Bullhead	1-3"	Rare	
12	Steelhead or rainbow	1-3"	Abundant	
	Cutthroat	1-14"	Abundant	
	Chubs	1-16"	Rare, lower section only	Few rainbow or steelhead seen above first falls
	Suckers	1-16"	Rare, lower section only	
	Minnows	1-3"	Abundant	
	Bullheads	1-3"	Common	
13,14 & 16	Steelhead or rainbow	1-8"	Rare	
	Cutthroat	1-14"	Abundant	
	Bullheads	1-3"	Rare	
15	Cutthroat	1-10"	Abundant	
	Bullheads	1-3"	Rare	
17	Cutthroat	1-7"	Common	
	Rainbow	1-7"	Common	
	Bullheads	1-3"	Rare	
18	Rainbow	1-10"	Common	
	Cutthroat	1-10"	Common	
	Minnows	1-3"	Abundant	
	Bullheads	1-3"	Rare	
19	Salmon	36"	Rare	
	Cutthroat	1-14"	Abundant	Sea-run steelhead reported
	Bullheads	1-3"	Rare	

Table 5 - Continued

Section:	Species	Size	Abundance	Remarks
20	Rainbow	1-16"	Abundant	
	Bullheads	1-3"	Rare	
21,22, 23	Rainbow	7-16"	Abundant	
24	Rainbow	1-9"	Common	Sea-run steelhead reported
	Cutthroat	1-9"	Common	
	Minnows	1-3"	Rare	
	Bullheads	1-3"	Rare	
25	Salmon	Adults	Common	Sea-run steelhead reported
	Cutthroat	6-10"	Rare	
	Rainbow	6-10"	Rare	
	Minnows	1-3"	Abundant	Many adult sea-run salmon seen.
	Bullheads	1-3"	Abundant	
26	Cutthroat	6-12"	Common	Sea-run steelhead reported
	Rainbow	6-10"	Common	
27	Salmon	Adults	-	
	Cutthroat	6-9"	Rare	Sea-run steelhead reported.
	Rainbow	6-9"	Common	
	Bullheads	1-3"	Common	Adult salmon seen
	Minnows	1-3"	Rare	
28	Cutthroat	6-12"	Abundant	No adult steelhead or
	Rainbow	6-12"	Common	salmon seen or reported.
29	Salmon	Adult	Rare	
	Rainbow	1-3"	Common	
	Cutthroat	1-16"	Abundant	
	Bullhead	1-3"	Rare	
30	Cutthroat	1-10"	Abundant	
	Rainbow	1-8"	Common	
31	Cutthroat	1-12"	Abundant	

The information given under "Remarks" in Table 5 was secured from Mr. T. Cunningham, Tiller, Oregon. Mr. Cunningham has been a resident of this section of the country for the past 33 years, having worked as Forest Service guard at various times, and probably knows as much about fishing conditions in the streams and lakes of the South Umpqua watershed as anyone in the region.

Other Vertebrates

Large specimens of the Pacific terrapin or turtle (Clemmys marmorata) were found at many points along the main stream as well as along some of the tributaries. These are abundant in many coastal streams of the Pacific Northwest and so far as known are not serious predators on trout or salmon.

Beaver signs were noted on Jackson Creek near the 21-mile trail mark and also at Beaver Lake. Large numbers of beaver existed a few years ago at Beaver Lake. However, signs indicated that very few are left at the present time due to illegal trapping. The few remaining are incapable of having any effect on the trout waters observed.

Fish Food Organisms

A quantitative stream bottom sampler was used to take food samples in the riffles from areas covering exactly one square foot. Sand, gravel, and rubble from depths of 3 to 6 inches were thoroughly washed, the organisms collecting in the back of the sampler. These were then sieved, strained and counted. From 3 to 12 samples were taken in each section and the numbers of each group of organisms averaged to show average food conditions.

In Table 6, all stream bottom samples taken are summarized as to numbers of food organisms collected and average volume in cubic centimeters per square foot. The quantity or bulk of organisms collected varied from 1 to 70 cc. Sections 5, 6, and 7 of the main river, immediately above and below the South Umpqua Falls, were the most productive in terms of numbers of fish food organisms taken. The stream and its tributaries as a whole might be classed as moderately rich in food. There is an abundance of mayflies, caddisflies, stoneflies, truefly larvae, snails, clams, crayfish and other forms.

The most common aquatic organisms found in the streams of this area are illustrated in Figure 4. These sketches have been drawn to provide a ready means of identification for the average layman. Some sketches were made from actual organisms, others were taken from drawings by other authors.

Table 6 -- Bottom food organisms taken in quantitative food samples, South Umpqua drainage.

Sec. No.	Date Taken	No. samples Taken	Average number per sq. ft.			Av. Vol. in cc. per sq. ft.
			Aquatic Insects	Snails & Clams	Miscellaneous	
South Umpqua						
1	7-20	9	133	197	37	70.0
2	7-21	9	57	38	8	5.0
3	7-22	9	45	29	7	5.0
4	7-23	9	86	31	6	5.0
5	8-24	9	555	20	11	14.0
6	8-25	9	342	33	19	8.0
7	8-26	9	223	11	14	3.0
Tributaries						
8	8-2	9	108	55	7	9.0
9	8-3	9	121	45	9	5.0

Table 6 - Continued

Sec. No.	Date Taken	No. Samples Taken	Average number per sq. ft. Aquatic Insects	Snails & Clams	Miscellaneous	Av. Vol. in cc. per sq. ft.
Tributaries - Continued						
10	8-10	9	205	61	25	25.0
11	8-23	9	131	49	12	7.0
12	8-11	9	170	14	10	5.0
13	8-17	9	140	3	11	1.0
14	8-19	9	103	10	9	5.0
15	8-18	9	106	6	10	3.0
16	8-30	9	251	0	40	4.0
17	8-27	9	201	0	14	2.0
18	7-16	9	338	0	55	4.0
19	8-31	9	315	0	46	7.3
20	7-15	9	458	0	42	15.0
21	7-15	3	77	0	1	2.0
22	7-15	3	63	0	16	2.0
23	7-15	3	48	0	10	2.0
24	9-1	9	302	32	26	8.0
25	8-12	9	264	51	21	12.0
26	9-13	9	183	14	19	5.0
27	9-11	9	396	9	30	5.0
28	9-10	9	225	0	18	8.0
29	9-9	9	335	1	18	7.1
30	9-7	9	156	0	44	3.0
31	9-7	9	119	0	25	3.0
TOTAL		261	6,256	709	620	259.4

Stomach Content Analyses

Approximately 150 fish stomachs were examined during the survey. The foods eaten by 11 rainbow trout and 13 cutthroat trout caught in the tributaries of the South Umpqua River are recorded in Table 7. The dominant food eaten was beetles, which formed 27.2% of the 136 items eaten by the 24 trout. True-flies (Diptera) formed 14%; leaf hoppers, 12.5%;mayflies, 8.8%; grasshoppers and crickets, 8.8%; ants, bees and wasps, 8.1%; caddisflies, 7.4%; crayfish, 2.9%, and small fishes and miscellaneous items, 10.3%. Since the average length of these fish was 5.83 inches, the foods were also small in size. Due to the fact that they were collected at the height of the summer season, a large proportion of foods were typical land forms that had fallen into the water from the bank vegetation. Past examination of the stomachs in the winter time during cold weather periods shows that trout depend largely on submerged foods during this season of the year.

An interesting observation made in connection with the stomach examinations was that crayfish claws were noted to have punctured trout stomachs in three different instances. Apparently the stomach walls were pierced during the death struggles of the crayfish. The claws were also noted to have injured the body walls, though not piercing them, after passing through the stomach walls. The fish when caught were lively and in apparently health condition despite the severe injury inflicted on them.

Table 7.--Foods eaten by 11 rainbow and 13 cutthroat trout caught in tributaries of South Umpqua River above Tiller, Ore.*

Kind of Food	No. Eaten	Per cent of Total
Land beetles	37	27.2
True-flies (Diptera)	19	14.0
Leaf hoppers	17	12.5
Mayflies	12	8.8
Grasshoppers and crickets	12	8.8
Ants, bees, and wasps	11	8.1
Caddisflies	10	7.4
Crayfish	4	2.9
Fishes	4	2.9
Miscellaneous	10	7.4**
TOTAL	136	100.0

*Length of fish, maximum 8.0 inches, minimum, 4.5 inches; average 5.83 inches. Caught on rod and line between August 2 and August 30, 1937.

**Inc. water mites, algae, debris, and other miscel. items of food.

Fish Parasites

Comparatively few parasites were found in or on stream fish. This, perhaps, was due to low water temperatures and other environmental conditions. Young rainbow examined were occasionally found to

be infected by parasitic copepods. These occurred on the bodies at the base of the fins. Large numbers were seen on the gills of adult salmon. Suckers caught below the South Umpqua Falls were found to contain hundreds of long, white cestodes in the stomachs and intestines.

Crayfish throughout the streams of the entire drainage were found to be heavily parasitized by a species of leech. This parasite was identified as belonging to the Hirudinea, sub-order Rhynchobdella, family Ichthyobdellidae, genus and species undescribed. Some crayfish were found dead as a result of heavy parasitization.

South Umpqua Falls

During the past several years there has been a constant demand by the fishermen and sportsmen of the South Umpqua area for the installation of fish ladders at the South Umpqua falls to enable migratory fish to ascend easily and safely to the spawning beds above. Rumors indicated that very few fish were able to get over the falls and that great numbers were killed trying to do so. A thorough investigation of this problem was made as an integral part of this survey.

The South Umpqua Falls are located on the South Umpqua River approximately twenty miles above Tiller. The width of the falls is approximately 200 feet, with most of the water flowing over the north side, below which a deep pool has been eroded by the constant water flow. A shallow sheet of water only a few inches in depth flows over the south half, making a gradual descent over some 300 feet of gently sloping bedrock. The north half of the falls forms a crescent which ranges from 8 to 12 feet in height, over which the water flows at a depth varying from 3 to 20 inches, depending upon the season and climatic conditions. At the beginning of the falls is a moderate drop, approximately 10 feet long, causing the water to gather velocity before dropping abruptly to the large pool below.

During the survey special attention was given to food conditions in the river for several miles above and below the falls. Bottom samples taken in these areas indicated an abundance of aquatic food organisms both above and below, thus insuring a plentiful food supply for the young steelhead and salmon which abound throughout this entire area. Terrestrial foods were also found to be abundant along this section of stream.

A detailed survey of the spawning areas was made by chaining the area above and below the falls for a distance of two miles each way. Ideal spawning beds, made up of sand, gravel and small rubble, were found to compose approximately 15% of the stream below the falls and over 10% above the falls. Excellent spawning conditions were also found for many miles in both directions.

Reliable reports showed that steelhead were seen spawning near Camp Comfort, which is 7 miles above the falls, during the months of February and March. This would indicate that steelhead negotiate the

falls during the winter and early spring months before the spring freshets. Many salmon were also seen spawning 6-1/2 miles up Castle Rock Creek on August 31, 1937, and approximately the same distance up Black Rock Fork on August 30, 1937, by members of the survey party.

In seining operations carried on three miles above the falls on June 30 by Dr. P. R. Needham, U. S. Bureau of Fisheries, Mr. E. P. Cliff of the Regional Office, U. S. Forest Service, and the survey party, many young steelhead and salmon were obtained and large numbers were seen in the sheltered areas of the section. This would indicate that both salmon and steelhead ascend the falls successfully during those times of the year when stream flow makes ascension possible. During a small freshet the latter part of June many steelhead and salmon were seen attempting to jump the falls, many of them succeeding. The main run of steelhead was over by July 10, while that of salmon continued until the latter part of that month.

Observations during the survey of this section revealed only seven dead salmon below the falls instead of the hundreds previously reported by sportsmen. From all indications, these salmon were killed either by predators such as mink and otter, or possibly from injuries received from illegal gaffing. It is possible, too, that some were injured by their repeated attempts to jump the falls.

Seining above and below the falls conclusively proved that the South Umpqua Falls form a barrier to squawfish or chubs and suckers, as many of these were observed below the falls but not one was taken above. These two coarse fish are known to be serious competitors of small game fish for food organisms, and their absence above the falls leaves more available food for the fry and fingerlings of game fish.

It is reported that there has been considerable illegal gaffing of salmon and steelhead at the falls in the past. Several gaff hooks were found in the vicinity of the falls by the survey party, which would seem to indicate this report to be true. Conditions at the pool, lying just below the falls, make such practises comparatively easy. Illegal gaffing probably accounts for the death of some of the fish seen.

From the preceding data, it is concluded that the construction of fish ladders or the blasting out of part of the falls is unnecessary and totally unwarranted inasmuch as numbers of salmon and steelhead were seen spawning above the falls. Since the falls also act as a barrier to chubs and suckers, it seems inadvisable to make changes which would enable these coarse fish to migrate to the upper sections of the stream.

Improvements Recommended

A few improvements might well be made on the tributaries of the South Umpqua River in order to better fishing conditions. No improvements are recommended for the main stream (South Umpqua River) because the cost of such improvements would be prohibitive as compared to the value received.

The inaccessibility of Dumont, Ash, Castle Rock, Squaw, and Abbott Creeks, as well as parts of Quartz Creek, prevents many fishermen from reaching these excellent fishing streams. The improvement of existing trails and construction of additional ones would permit these streams to be reached with less difficulty. Such trails would also be of great advantage during fire seasons.

Many of the tributaries are so overhung by low brush that angling is practically an impossibility. Certain excellent fishing holes along these tributaries could be opened up at little expense by brushing them out. Such work, however, should be done at only a few points, leaving the brush throughout most of the area to provide shelter and maintain the present supply of terrestrial foods.

During the past summer a holding pond was constructed on Skillet Creek by CCC labor. A few improvements should be made to this pond to increase its capacity. The entire south bank of the pond should be reinforced to prevent seepage from the pool. Sand and small gravel should be added to the bottom, and the banks around the pond cut down to from three to five inches above the water level to permit easy seining of fish when transplanting is necessary. The dam above the pond should be reinforced and strengthened so that spring freshets will not wash it out. Since many of the small trees surrounding the holding pond were cut during its construction, the systematic planting of additional trees would provide necessary shade and shelter.

Stocking Recommendations for Streams of the South Umpqua Drainage.

In Table 8 will be found the stocking program recommended for the South Umpqua River and its tributaries above Tiller, Oregon.

Chinook salmon and steelhead trout are the only species recommended for planting in the main stream. Definite recommendations as to numbers of these fish to be planted have not been made by reason of the fact that the young of this species are already exceedingly abundant in the main river and due to its rich food supply, as many of these species can be stocked annually as are available from hatcheries without danger of overstocking. With the excellent natural spawning facilities available for both sea-run and resident trout it is evident that not a great deal of improvement would be gained by stocking with excessively high numbers from hatcheries at present. If these species are stocked in large numbers it would be well to put them into the better tributaries as predators are fewer, shelter is abundant, and their chances of survival there would be greater than in the main stream.

It will be noted in Table 8 that most of the tributaries in their present condition are not in need of artificial stocking. Natural spawned cutthroat and young steelhead and salmon are quite abundant in most of them and but little improvement could be made at present. Where the intensity of fishing is slight and where good natural spawning conditions occur, nature can often do a far better job in maintaining stream populations through natural propagation than fish planted from hatcheries are able to do.

It will be noted that steelhead or cutthroat have been recommended for the tributaries that seem in need of restocking. This choice of species is suggested in view of the fact that a supply of young cutthroat for restocking is sometimes hard to obtain and in the event that this species is not available steelhead might well be substituted as they are also native to the stream. Many cutthroat up to 12 inches in length are caught in the upper tributaries of this stream. These fish evidently are a non-migratory resident form and are the species that furnish much sport to anglers fishing the upper tributaries of the South Umpqua River. The young chinook salmon are not available to anglers as they go to sea very soon after emerging from the gravel or at any time during the following 12 to 15 months. The returned sea-run adults with the sea-run steelhead trout form the basis for the commercial fishery at the mouth of the Umpqua River on the Pacific Ocean. Young steelhead ordinarily go to sea when two or three years old, but few remaining in the stream long enough to reach the size of 8 inches. Summer fishing for young steelhead that have

remained in fresh water furnishes a considerable portion of the catches of anglers in coastal streams generally. Catching young steelhead before their seaward migration naturally cuts down on the number of sea-run adults that will return to spawn. Inasmuch as the fishing for the large returned adults furnishes unexcelled sport and if it is desired to build up these runs, it could be done by affording further protection to young steelhead by reducing bag limits or establishing size limits to allow a higher survival to reach the ocean to mature.

Since young steelhead and resident cutthroat furnish most of the fishing in the South Umpqua tributaries, it is urged that emphasis be laid on the planting of these species as recommended in Table 8. Non-native species such as eastern brook trout and loch leven trout should not be planted in the streams of the South Umpqua drainage. Stocking recommendations have been made only for those tributaries which, by reason of the intensity of angling and rate of natural propagation, seemed in need of restocking in order to maintain continued good angling conditions. Steelhead thus planted would not remain much longer than two or three years when they would go to the ocean and hence would be available to anglers only when young and for a comparatively short period of time. The cutthroat planted, however, if from a native, resident strain, would remain resident in the tributaries in which planted, and afford sport to anglers during their entire life span.

The stocking recommendations herein submitted with regard to the South Umpqua River and its tributaries must be considered purely as tentative until further work produces facts that will show wherein the suggestions made are in need of revision and what procedures must be followed to develop further the sport fishing possibilities of this drainage system.

Table 8.--Recommended stocking program for the South Umpqua River and its tributaries.

Stream Section	Name of Stream	Average Width in Feet	Length to be Stocked (Miles)	Places to Stock	Food Grade	Pool Grade	Species Recommended	Size in Inches	Number and Freq
1	S. Umpqua	86.2	5	No stocking	1	B-	Steelhead Chinook salmon		Natural spawnin
2	S. Umpqua	68.2	6	As above	3	B-	As above		cellent. Stock
3	S. Umpqua	51.8	2.2	As above	3	A	As above		many as availab
4	S. Umpqua	50.1	4.5	As above	3	A	As above		annually in bet
5	S. Umpqua	34.3	1	As above	1	B	As above		tributaries. S
6	S. Umpqua	33	3.5	As above	1	B-	As above		Stocking Recomm
7	S. Umpqua	30	3	As above	2	A-	As above		
TRIBUTARIES:									
8	Deadman	12.1	6	Between middle fork and old house	1	A	Steelhead or Cutthroat	2"	8,000 annually
9	Dumont	15	--	No stocking	2	A	No stocking	Natural	spawning adequa
10	Boulder	10.1	6	Between Slick Cr. and last camp			Steelhead or Cutthroat	2"	12,000 annuall
11	Ash	2.3	--	No stocking	1	B-	No stocking	Natural	spawning adequa
12	Buckeye	12.3	3	Between 2nd and 3rd falls	1	A-	Steelhead or Cutthroat	2"	8,000 annually
13	Buckeye	8.5	--	No stocking	2	A-	No stocking	Natural	spawning adequa
14	Quartz	26.6	--	As above	3	A	As	above	
15	Skillet	3.2	--	As above	3	A-	As	above	
16	Black Rock	10.3	--	As above	2	A	As	above	
17	Prong	10.1	--	As above	3	A-	As	above	
18	Fish Lake Creek	13	--	As above	3	B-	As	above	
19	Castle Rock	24	--	As above	1	A	As	above	
20	High Rock	5.8	--	As above	1	A	As	above	
21	Corral	2.5	--	As above	1	A	As	above	

Table 8.--(Continued)

ream tion	Name of Stream	Average Width in Feet	Length to be Stocked (Miles)	Places to Stock	Food Grade	Pool Grade	Species Recommended	Size in Inches	Number and Frequen
2	Box	2	--	No stocking	1	A	No stocking.	Natural	spawning adequate
3	Duncan	2.5	--	As above	1	A	As	above	
4	Elk	14.2	10	At Drew and near Diamond Creek	1	A	Steelhead	2"	20,000 annually
5	Jackson	28.1	--	No stocking	1	B/	No stocking.		Squawfish and othe coarse fish too ab
6	Beaver Cr.	5	--	No stocking	2	A	No stocking	Natural	spawning adequate
7	Jackson	9	9	At Freezeout Cr.	2	A-	Steelhead or Cutthroat	2"	12,000 biennially
8	Squaw	4	--	No stocking	1	A	No stocking	Natural	spawning adequate
9	Jackson	8	8	Between falls & Five Sticks Camp	1	A	Steelhead or Cutthroat	2"	10,000 biennially
0	Lonewoman	2	--	No stocking	1	A	No stocking	Natural	spawning adequate
1	Abbott	3	--	As above			As	above	

LAKES OF THE SOUTH UMPQUA WATERSHED

General Description

Detailed physical and biological surveys were made of each of the three main lakes in the South Umpqua drainage. These lie in huge, rocky, wooded basins to the west of Rocky Ridge and were formed years ago by rock slides damming up canyons. Cold springs and small creeks flow into all three lakes.

A detailed map of Fish Lake, Figure 2, was made by triangulation. The dimensions of the other two lakes were measured and small sketches of them were drawn on the lake survey sheets. Table 9 gives the location, area, accessibility and altitude of the lakes in the South Umpqua drainage.

Table 9.--Location, area, accessibility, and altitude of lakes.

Name of Lake	Location	Area	Accessibility	Altitude
Fish	T. 29 S., R. 3 E., Secs. 5 & 6	90 A.	6-3/4 miles by trail from Camp Comfort	3,353'
Buckeye	T. 29 S., R. 2 E., Sec. 12	15 A.	7 miles by trail from Camp Comfort	4,100'
Cliff	T. 29 S., R. 3 E., Sec. 7	7 A.	8 miles by trail from Camp Comfort	4,400'

Physical Characteristics

Environmental conditions around each of the three lakes are quite similar. There is considerable fluctuation in the volume of the tributaries flowing into the lakes. All of them are spring-fed but during low water stages some of them sink in the gravel and dry up before reaching the lake shores. Others flow directly into the lakes at all seasons of the year. A summarized description of the drainage basin of each lake is given in Table 10.

Table 10.--General description of lakes at headwaters of the South Umpqua River

Name of Lake	Type of Shoreline	Type of Watershed	Volume of Tributaries (Approx. Tot.)	Number of Tributaries
Fish	Rocky, boggy, wooded	Canyons, mountainous, wooded	10 c.f.s.	5 main tributaries
Buckeye	Rocky, boggy, wooded	Mountainous, wooded, rocky	1 c.f.s.	3 springs
Cliff	Rocky, boggy, meadow, wooded	Mountainous, wooded	1 c.f.s.	1 tributary 2 springs

Depths

Approximately 200 depth readings were taken in Fish Lake, making it possible to contour the entire lake bottom. (See map of Fish Lake). From 20 to 30 soundings were taken on the other two lakes. The water levels of the lakes fluctuate from 6 to 18 inches. The depths found are listed in Table 11.

Table 11.--Depths of lakes at headwaters of the South Umpqua River

Name of Lake	Approximate Depth 100' from Shore	Approximate Depth 200' from Shore	Maximum Depth	Fluctuations in Water Level
Fish	30'	50'	141'	Approximately 18"
Buckeye	35'	40'	50'	6" rise, due to surface runoff
Cliff	15'	16'	17'	12" rise due to melting snow

Bottom Types

The greater part of the bottom areas of all three lakes, both in deep areas and shoals, was made up of silt. There is a small percentage of gravel bottom in each of the lakes in which eastern brook trout might spawn where spring water seeps up through the bottoms. Approximately 10 per cent of Fish Lake was classed as shoal areas, i.e., less than 20 feet deep; 30 per cent of Buckeye Lake; and 100 per cent of Cliff Lake.

A summarization of bottom types is shown in Table 12.

Table 12.--Summary of Lake bottom types.

Name of Lake	Shoal Areas (under 20' deep)		Deep Areas		Color	Turbidity	Date (1937)
*Fish	Silt	70%	Silt	80%	Greenish, due to algae		
	Mud	20%	Mud	10%			
	Gravel	10%	Detritus	10%		**3'-18'	7-10
Buckeye	Silt	80%	Silt	91%			
	Bedrock	12%	Bedrock	8%			
	Gravel	8%	Gravel	1%	Clear	14'	7-13
Cliff	Silt	80%	Silt	80%			
	Gravel	5%	Gravel	5%	Slightly		
	Bedrock	10%	Bedrock	10%	milky	3'	7-9

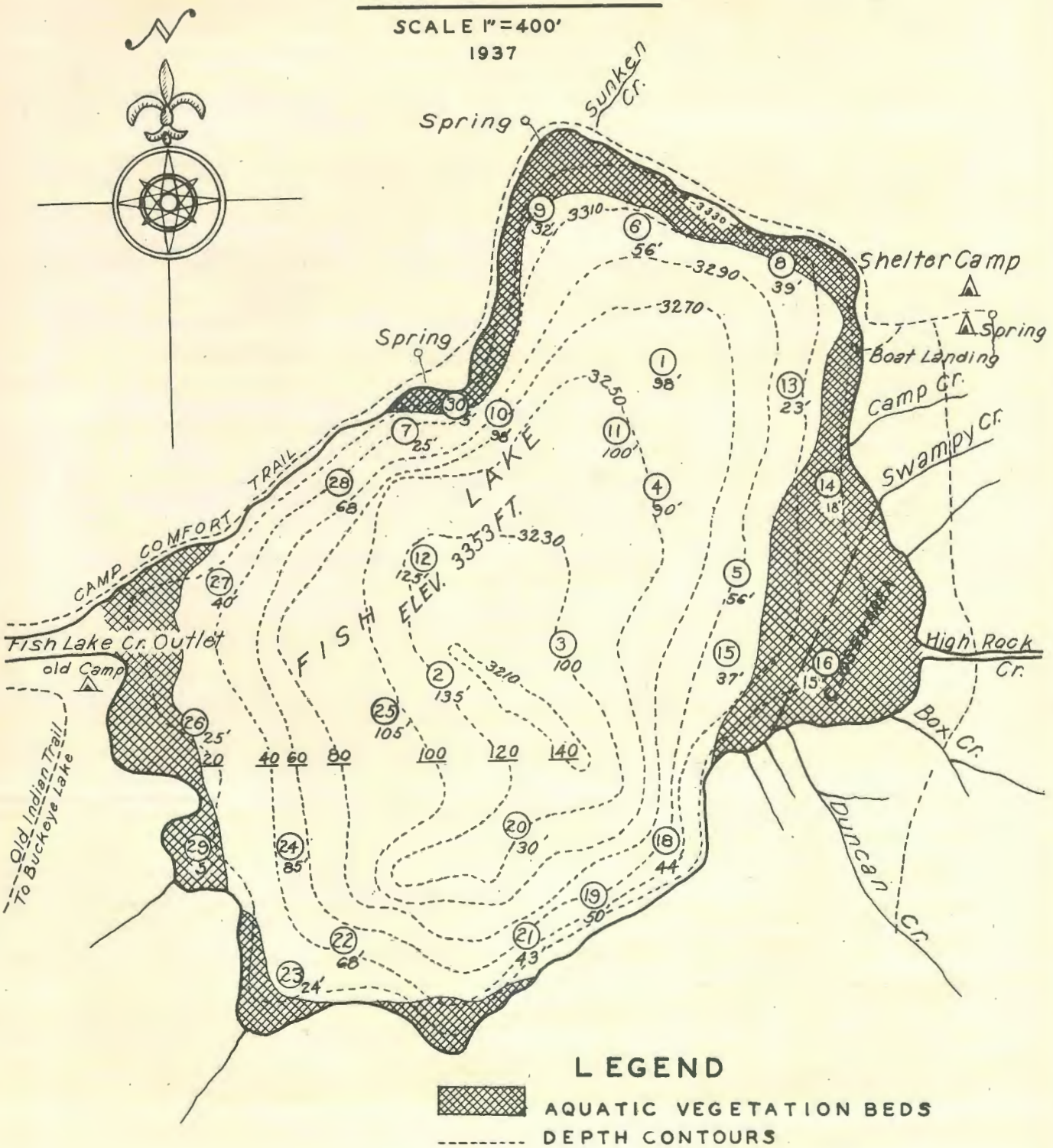
*See bottom samples.

**Amounts of algae in water and disturbance by wind gave fluctuating transparency readings.

FIG. 2

MAP OF FISH LAKE
UMPQUA NATIONAL FOREST
DOUGLAS COUNTY, OREGON
T. 29S. R. 3E. SEC. 5&6

SCALE 1" = 400'
1937



Temperatures

Surface water temperatures of the three lakes vary to a considerable degree, depending on climatic conditions. A minimum temperature of 40° F. was recorded in Fish Lake at depths ranging from 60 to 141 feet (the latter being the greatest depth found). All lakes are fairly cold, due to the very cold springs flowing into them. A summary of temperatures of the lakes is shown in Table 13.

Table 13.--Summary of lake temperatures.

Name of Lake	Inlets	Outlet	Surface	Air	Hour & Date	Weather
Fish	48°	66°	66°	62°	9:00 A. M. 7-10-37	Clear
Buckeye	40°	64°	65°	64°	10:10 A. M. 7-13-37	Clear
Cliff	58°	66°	66°	64°	9:30 A. M. 7-9-37	Clear

Two curves of water temperatures plotted against depths as taken in Fish Lake on July 8 and July 12, respectively, are shown in Figure 3. Thermal stratification of the lake waters is quite evident. Surface waters were warmed up as high as 75° F. by the sun's rays during short periods of the day. Water temperatures decreased gradually with increased depth to a minimum of 40° F. between 60-foot and 140-foot depths. Good growing temperatures for trout, in the summer at least, would therefore be found approximately at depths between 10 and 40 feet. Observations of fishermen confirm these data. In the spring when the water is cooler many trout are taken on flies and by trolling at the surface. However, as the water warms up, trout seek the cooler, deeper layers and deeper fishing is required to catch them. In future work it would be desirable to determine the amounts of oxygen present at various depths to supplement the temperature data.

Biological Characteristics

Aquatic Plants

In the shoal areas of Fish lake may be found luxuriant beds of submerged plants. Potamogeton lucens and Ceratophyllum demersum grow in such vast quantities as to hide the bottom of the lake. An aquatic moss, Fontanalis sp., is abundant in shallower depths. Algae, Spirogyra sp., and Vaucheria sp., may be found in abundance in the shoal areas as well as in waters to a depth of 50 feet. Emergent plants are numerous along some parts of the shores of Fish Lake. One of the most abundant is Equisetum talmateia. The yellow waterlily, (Nymphaea adventa) is found only over a few scattered areas in the lake.

In Buckeye Lake a single pond weed, Potamogeton richardsonii, was found growing sparsely in a few shoal areas. Algae, Nitella sp. and Cladophora sp., are found only rarely throughout the lake. Fontanalis sp. is found growing sparsely along the shores. Two common shore plants, Scirpus microcarpus and Equisetum talmateia, are found growing scattered around the edge of the lake.

The pond weed Potamogeton richardsonii is found growing rarely in the shallower depths of Cliff Lake. A single alga, Nitella sp., was found to be very rare in the lake. A sedge, Carex rostrata, and two other shore plants, Scirpus microcarpus and Equisetum talmateia, were common along the shores of Cliff Lake.

A summary of aquatic vegetation found in the three lakes is shown in Table 14.

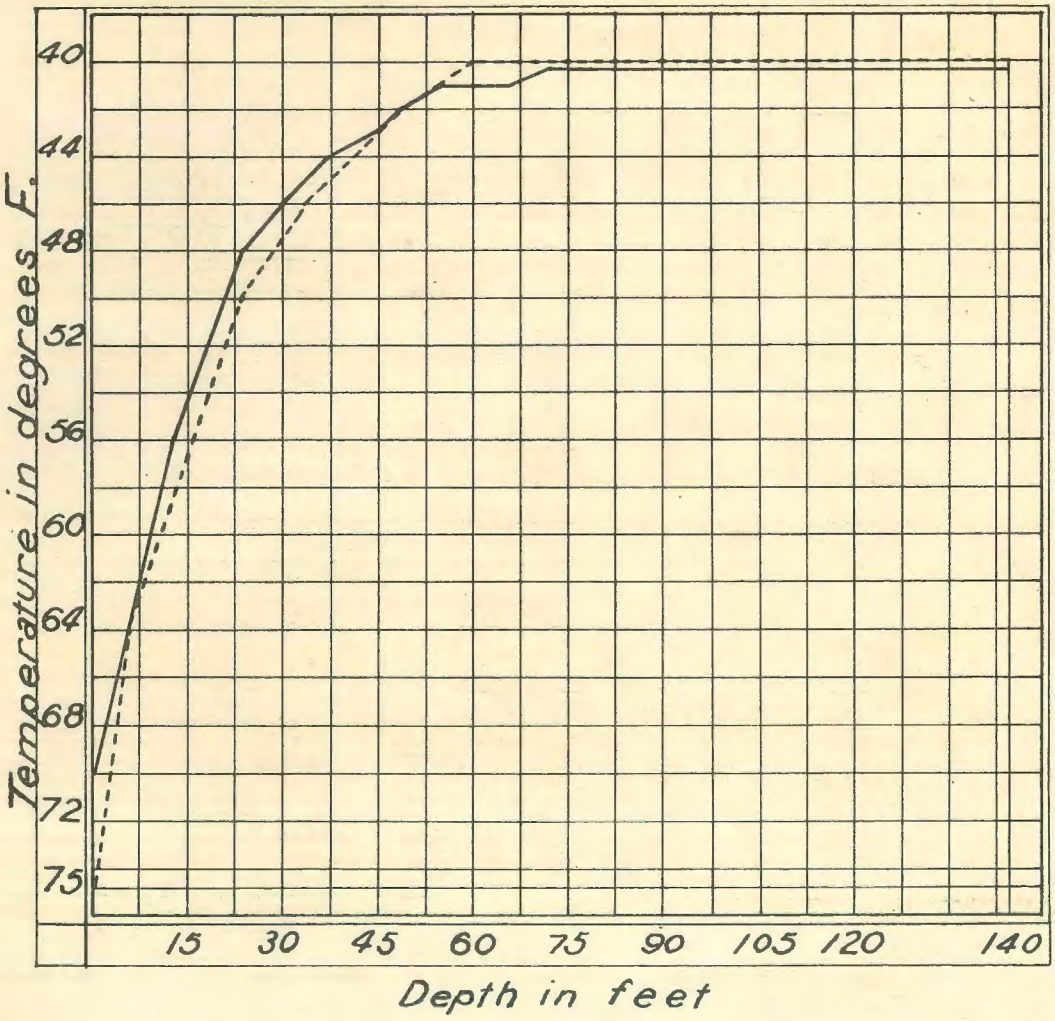
Table 14.--Types of aquatic vegetation found in lakes at headwaters of the South Umpqua River

Name of Lake	Emergent Plants		Submergent Plants		Algae	
	Kinds	Abundance	Kinds	Abundance	Kinds	Abundance
Fish	Pondlily Nymphaea adventa	Common	Moss Fontanalis sp.	Common	Spirogyra sp. Vaucheria sp.	Common Abundant
	Horsetail Equisetum talmateia	Abundant	Coontail Ceratophyllum demersum	Abundant		
			Pondweed Potamogetons lucens	Abundant		
Buckeye	Bulrush Scirpus microcarpus	Rare	Pondweed Potamogetons richardsonii	Common	Nitella sp.	Rare
	Horsetail Equisetum talmateia	Rare			Cladophora sp.	Rare
Cliff	Sedge Carex rostrata	Common	Pondweed Potamogetons richardsonii	Common	Nitella sp.	Rare
	Bulrush Scirpus microcarpus	Abundant				
	Horsetail Equisetum talmateia	Abundant				

FIG. 3

TEMPERATURE OF FISH LAKE

AT VARIOUS DEPTHS



——————— JULY 8, 1937 · AIR TEMP. 66° 10 A.M. CLEAR, NO WIND.

---------- JULY 12, 1937 · AIR TEMP. 85° 3:30 P.M. CLEAR, NO WIND.

Aquatic Organisms

Shore Foods. The abundant vegetation, both submerged and emergent, along the shores of the lakes provides a plentiful supply of rich organic material which harbors large numbers of vertebrates and invertebrates. Numbered among the vertebrates were water snakes, toads, frogs, and salamanders (Dicamptodon ensatus) the last three being found in the stomachs of eastern brook trout. Black-sided dace and bullheads were also found in some of the stomachs.

Among the most numerous of food organisms were the invertebrates such as crayfish, water beetles, water striders, back swimmers, mayflies, caddisflies, dragon flies, midges, snails and scuds (frosh water shrimp). These are found in abundance in all three lakes surveyed. Thousands of pollywogs, swimming in schools, were seen in Buckeye Lake.

Plankton. The microscopic, drifting plants and animals found in the open water of lakes are called plankton. These small organisms make up a great percentage of the food of fry and adult lake fish during different seasons of the year. Temperaturos, light, wind, depth, and size of lake are all factors which govern the number and distribution of plankton.

Plankton hauls were made at various stations in the lakes to determine abundance and distribution. These hauls indicated a good supply of plankton in all three lakes. Numbered among the living organisms found were: copepods, ostracods, rotifers, water-fleas, and protozoans. At times the microscopic, one-celled green plants appeared in the lakes in such numbers as to turn the water green. However, they lasted only a few weeks. The most important found was Anabaene flos-aquae.

Table 15.--Summary of plankton collected in Fish Lake

	Open Water Stations				
	1	2	3	4	5
Duration of haul in min.	15	20	20	5	20
Depth in feet	6'	2'	3'	2'	3'
Where taken	North end	East end	North end	South end	Center
Length of haul	900'	40'	20'	40'	1,000'
Quantity in cc	3 cc.	2 cc.	4 cc.	1.5 cc.	1 cc.

Bottom Samples. Thirty quantitative bottom samples were taken in Fish Lake and five in Cliff and Buckeye Lakes by means of an Ekman dredge. The 30 bottom samples taken in Fish Lake yielded 2,470 animal organisms, or an average of 329.2 organisms per square foot of bottom area. Of these organisms, over 85% were taken in areas over 25 feet deep. Phantom midge larvae formed the greater portion of the organisms found, with midge larvae and pupae, bristleworms, frosh water shrimp, snails and clams, and alder-fly larvae following in the order named. By recalculations based on the average number of organisms found per square foot, it was estimated that there were approximately 14,000,000

food organisms per square acre of bottom area in Fish Lake. It is obvious, from the above figures, that this lake is exceedingly rich in available food organisms. Buckeye and Cliff Lakes are also rich in natural fish food. Table 16 summarizes the quantity and kinds of bottom foods found in Fish Lake. A summary of the aquatic organisms found in those lakes is shown in Table 17.

Table 16.--Quantity and kinds of bottom foods found in Fish Lake, 1937*

Food Organisms	No. Organisms per ¼ sq. ft. from bottoms less than 25 ft. deep (9 samples)		No. Organisms per ¼ sq. ft. from bottoms over 25 ft. deep (21 samples)		No. Organisms per ¼ sq. ft. for lake as a whole (30 samples)		Calcula No. Organism acre of b
	Total No.	Av. No. per Sample	Total No.	Av. No. per Sample	Total No.	Av. No. per Sample	
Midge larvae and pupae (Chironomus group)	63	7.0	707	33.7	770	25.7	4,477,9
Phantom midge larvae (Chaoborus group)	36	4.0	938	44.7	974	32.5	5,662,8
Alder-fly larvae Sialis (Neuroptera)	28	3.2	18	0.8	46	1.5	261,3
Scuds (Shrimp)	126	14.0	0	0.0	126	4.2	731,8
Snails & clams	68	7.5	0	0.0	68	2.3	400,7
Bristleworms (Oligochaetes)	68	7.5	402	19.1	470	15.6	2,735,5
Miscellaneous	16	1.8	0	0.0	16	0.5	87,1
TOTAL	405	45.0	2,065	98.3	2,470	82.3	14,357,3

*Based on a total of 30 quantitative samples taken with an Ekman dredge as follows: 9 in bottoms 25 feet or less in depth and 21 in bottoms over 25 feet in depth. Types of bottom sampled were as follows: 23 from silt, 3 from mud, 3 from gravel, and 1 from decayed debris.

Table 17.--Summary of aquatic fish food organisms found in Cliff and Buckeye Lakes.

Plankton	Buckeye Lake					Cliff Lake			
Open water stations	1	2	3	4	5	1	2	3	4
Duration of haul in sec.		No time	kept.			200	100	180	180
Depth in feet	2'	6'	1'	10'	1'	1'	2'	3'	6'
Where taken	Center	Along shore	Along shore	Center	Near shore	Center	Near shore	Near shore	Center
Length of haul	800'	50'	50'	50'	50'	400'	200'	330'	400'
Quantity in cc.	1/2 cc.	4 cc.	2 cc.	3 cc.	1 cc.	1 cc.	3 cc.	3 cc.	1 cc.
Bottom food									
Depth in feet	42'	10'	15'	1' from shore	Near shore	17'	10'	8'	6'
Type of bottom	~~Silt~~	Silt	Silt	Gravel	Silt	Silt	Silt	Silt	Silt
Midges (No. per $\frac{1}{4}$ sq.ft.)	2	42		25	18	36	60	11	26
Annelids		13	Nothing	5		365	7	15	35
Snails	14	1	found in	2	3		3	8	14
Clams			sample.	19			72	15	74
Amphipods						1		16	
Miscellaneous	2	Sialis-1 Mayfly-1		15	Caddis-10 Sialis-1	Mite-1	Sialis-11	1	6
Volume in cc.	1/2 cc.	1 cc.		1 cc.	1/2 cc.	4 cc.	3 cc.	2 cc.	3 cc.

Fish Present in Lakes

Only four species of fish, eastern brook and rainbow trout, bullhead and minnows, are found in Fish and Buckeye Lakes. Cliff Lake has no fish at the present time. Three of the species found are native to Fish Lake. Of these, one is the bullhead, (Cottus gulosus) and one the black-sided dace or minnow (Apocope oscula nubila). The rainbow trout (Salmo gairdnerii) is the only game fish native to this lake. Eastern brook trout (Salvelinus fontinalis) were planted in Fish and Buckeye Lakes in 1935 and 1936.

It may be well to mention here that the weed fish present in Fish Lake are undoubtedly of great food value to the larger trout during the winter season. Table 18 summarizes the fish present in the lakes.

Table 18.--Fish present in the lakes of the South Umpqua Drainage, 1937.

Name of Lake	Eastern Brook				Rainbow				Coarse Fish**			
	Size		Abundance		Size		Abundance		Size		Abundance	
	Adult	Fry	Adult	Fry	Adult	Fry	Adult	Fry	Adult	Fry	Adult	Fry
*Fish	Av. 12"	1-2"	Rare	Common	Av. 7-12"	1-2"	Abundant	Abundant	2-4"	1"	Abundant	Abundant
Buckeye	Av. 14"	1-3"	Common	Abundant	16-20"	None	Rare	None		None		
Cliff		None				None				None		

*See catch records.
**Bullheads and minnows.

Post-mortem Examination of Trout from Fish Lake

Careful examinations were made of 44 rainbow trout caught in Fish Lake on July 15, 1937. Their maximum length was 15.5 inches, while the minimum was 6 inches and the average 8.7 inches. Examination of the color of flesh of these rainbow showed a predominance of pink-meated fish. This was particularly true of the larger specimens. There was a somewhat higher percentage of white flesh shown by the smaller fish. Of the 44 fish examined, only 17 were males. Examination of the gonads of females gave indications that some of them would spawn later this season.

In the examination of the stomach contents, it was noted that practically every fish had eaten numbers of large water-fleas (Cladacerans), Daphnia pulex and Daphnia longispina. Following these, the organisms, listed in the order of their importance in numbers,

were: bloodworms (Chironomus), mayfly adults and nymphs (Hexagenia), scuds or shrimp (Hyalella azteca), and miscellaneous forms such as caddisfly adults and larvae; water mites; snails (Physa), and various other aquatic organisms.

Eight of the 44 fish were found to be infested around the outside of the stomach wall and intestines by a long, white cestode tapeworm, Order: Pseudophyllidea of the species, Dibothrium cordiceps. While this parasite was found in large numbers in these fish, it seemed to have little effect on the quality of its flesh for eating. The adult of this tapeworm is found in gulls, mergansers, and pelicans. An undescribed trematode (sub-order Distoma, Genus: Crepidostomum) was found in eastern brook trout (Salvelinus fontinalis). These small leechlike worms were found attached to the inner wall of the stomach and intestine, but apparently affected the fish but little. A closely allied form, Crepidostomum cornutum, has been recorded from eastern brook trout taken in New York State and were also noted to have but little effect on the hosts.

Spawning Conditions

Excellent spawning conditions are found in three cold tributaries of Fish Lake. During one day, at the height of the 1937 spawning season, 1,000 rainbow were counted in Box, Duncan, and High Rock Creeks. However, much of the effectiveness of High Rock Creek, the largest tributary, is lost as the water sinks into the gravel in midsummer leaving the spawn stranded along about one-quarter mile of the stream bed. There appears to be little possibility of remedying this situation through stream improvement. Some stream improvement work which bettered spawning conditions was carried out this year on Box and Duncan Creeks. Further improvements such as straightening the channels and the addition of riffle bars are necessary on all three creeks to provide additional spawning areas. With these improvements further stocking of Fish Lake might become unnecessary as the number of spawning fish might possibly supply more than enough fish to replace those caught from the lake each year by anglers.

Buckeye and Cliff Lakes have a few under-water springs which may aid spawning of eastern brook trout. The Diamond Lake rainbow which were stocked in Buckeye Lake in 1929 have attained a great size, but there were no indications of rainbow fry in the lake. Fair spawning areas could be provided if the inlets and outlets of these two lakes were cleaned out and some gravel added to the tributaries. Spawning conditions in the three lakes are summarized in Table 19.

Table 19.--Summary of spawning conditions in lakes of the South Umpqua drainage.

Name of Lake	For Eastern Brook Trout	For Rainbow Trout
Fish	Good spawning grounds in springs in lake, and 3 tributaries of Fish Lake.	Good spawning conditions in 3 main tributaries. Some of the spawning areas dry up. Spawning bed improvements needed.
Buckeye	Fair spawning grounds in springs in lake. Four springs on shore.	Do not spawn at present. Might do so if outlet and springs cleaned out.
Cliff	No fish in lake at present time. Springs in lake, and one small tributary.	No spawning grounds. Not a good rainbow lake.

Egg Counts

A few female rainbow trout were examined to determine the number of eggs in the body cavity. The number of eggs counted ranged from a minimum of 450 to a maximum of 564. Some very large rainbow were observed in Fish Lake which would probably contain more eggs than the maximum number recorded. A number of females were observed which had from 2 to 50 last year's eggs enclosed in the egg roll with the new eggs. Information obtained from these egg counts is summarized in Table 20.

Table 20.--Egg counts made from rainbow trout at Fish Lake, 1937.

Species	Date (1937)	Condition of Eggs	Number of Eggs	Length of Trout	Weight of Trout
Rainbow	5-24	Green	564	11¼"	6½ oz.
Rainbow	5-23	Spawned out	6	15 "	11 "
Rainbow	5-20	Green	450	11 "	7 "
Rainbow	5-20	Green	440	11 "	7½ "
Rainbow	5-18	Very green, too small to count	(19 last year's eggs)	15 "	20 "
Rainbow	5-19	Very green, too small to count	(3 last year's eggs)	11 "	6 "
Rainbow	5-20	Green	499	11 "	6 "
Rainbow	5-20	Green	468	11 "	6½ "
Rainbow	5-14	Very green, too small to count		11½"	9 "
Rainbow	5-20	Green	458	11½"	6 "

Creel Census, Fish Lake

A complete record of the fish caught by anglers in Fish Lake during the 1937 season was obtained by Forest Guard Duncan. The records of fish taken up to August 24 are summarized in Table 21.

A total of 5,253 trout were taken in 488 catches. Of these 99.4% were rainbows while eastern brook trout formed only 0.6%. The average number of trout per catch was approximately 11 fish. Over the period covered, over 43%, or 2,272 trout, were caught in the month of July. This percentage would undoubtedly be lowered if records through September and October were available and included in these data.

As shown by the average number of trout per catch, the fishing was apparently best in the month of June when the average was slightly better than 13 fish per catch. The poorest fishing was evident in August when the catches averaged approximately 9 fish each.

In terms of fish produced per acre of water area, the records submitted here show that Fish Lake produced approximately 58 trout of all sizes per acre of water area. (Area of Fish Lake, 90 acres). Complete records of the entire season will probably increase this figure considerably. When these are available, much additional information can be submitted showing pounds of fish produced per acre of water, average catch per individual angler, total catch for the season, average weight and length of fish, and other pertinent information.

Table 21.--Summary of trout caught by anglers
Fish Lake, 1937 season.*

Month	No. of Catches	Av.No.Trout per catch	No. Trought Caught		Total	
			Rainbow	Eastern brook	Number	Per cent
May	64	11.1	703	10	713	13.57
June	62	13.58	819	23	842	16.03
July	208	11.01	2,272	18	2,290	43.60
August	154	9.14	1,399	9	1,408	26.80
TOTALS	488	10.76	5,193	60	5,253	

*Records from May 8th to August 24th. A complete report covering the entire season will be made elsewhere. These records were taken by Forest Guard Earl D. Duncan under the direction of District Ranger A. E. Berry.

Improvements Recommended

Stream bed improvements in High Rock Creek, Box Creek, Duncan Creek and the two smaller tributaries to Fish Lake would greatly increase and improve the available spawning areas. Cleaning out excess brush, sticks and small logs would make these streams more accessible to spawning fish.

The drying up of some sections of these tributaries, particularly High Rock Creek, during the late summer causes a great loss of small fry. These streams have little velocity and all have rubble, gravel, and sand bottoms into which the water tends to sink during low stages. This condition, together with the slight fluctuation of the lake itself, makes it extremely difficult to maintain water in the available spawning areas. Straightening of the creeks would lessen the amount of seepage through gravel and sub-soil, adding both to volume and velocity.

The installation of riffle bars across the beds of Box and Duncan Creeks would increase the size of the available spawning areas if properly filled with loose gravel on the upstream sides. Riffle bars should be embedded deeply in the banks and stream beds approximately 50 to 100 feet apart, depending upon local conditions. Closing and posting of all tributaries would greatly increase protection for large numbers of spawning fish. Similar improvements to Buckeye and Cliff Lakes would greatly improve spawning conditions on these lakes.

Stocking Recommendations

Past Stocking Records

The number and species of fish planted in Fish and Buckeye Lakes in recent years are listed below:

Buckeye Lake

1929 - 20,000 rainbow
1934 - 10,000 cutthroat
1935 - 10,000 eastern brook
1936 - 10,000 eastern brook

Fish Lake

1934 - 20,000 cutthroat
1935 - 20,000 eastern brook
1936 - 20,000 eastern brook
1937 - 20,000 rainbow

Earlier stocking records for these two lakes are not available. Cliff Lake is unstocked at present.

Recommendations for Future Stocking

Since fairly complete catch records are now being obtained on the catches made in Fish Lake, it is evident that an excellent opportunity exists on this lake to obtain complete returns from marked fish planted. It is therefore recommended that a plant of 10,000 two-inch rainbow trout be made in the summer of 1938 and that all of these fish be marked by removal of the left ventral and adipose fins to permit recognizing them when caught by anglers. The object of planting marked trout in Fish Lake would be to determine the survival to anglers' creels after planting a given number. The facts obtained would be extremely useful and serve as a definite guide for the proper management of this lake.

Only rainbow trout should be planted in Fish Lake. With the improvements of the spawning tributaries of this lake, natural propagation is materially aiding in maintaining the population. If catch records are taken annually these may serve as a guide in pointing out the necessity for further stocking, and so for the present only 10,000 marked rainbow are recommended as an experimental plant to be made in the summer of 1938.

Since Cliff Lake now lacks trout, an initial plant of 1,000 two-inch eastern brook trout is recommended. Spawning conditions in the form of springs in the lake bottom of this lake are better for eastern brook than any other species and no other fish should be planted, at least for the present.

Buckeye Lake is now inhabited by a few large, adult rainbow trout over 12 inches in length, and a few eastern brook. No natural reproduction of rainbow has taken place apparently, though if springs flowing into the lake and the outlet were cleaned out it is possible that this species might spawn naturally. However, since fair spawning grounds for eastern brook trout exist in the lake bottom, only this species has been recommended. Eastern brook trout are well known to spawn in spring holes and over gravel bars in lake bottoms where water seeps up from below. Until better spawning conditions are made for rainbow trout, only eastern brook are recommended.

These recommendations should be considered tentative until facts from further work indicate wherein modifications are necessary in order to maintain good angling conditions in these lakes.

Tentative stocking recommendations for the lakes of the South Umpqua drainage are listed in the following table.

Table 22.--Tentative stocking recommendations for lakes of the South Umpqua drainage

Name of Lake	Location	Acreage	Food Grade	Species	Number	Size and Frequency
Fish	T 29 S, R 3 E, Secs. 5 & 6	90	B/	Rainbow	10,000	2", marked fish Experimental
Buckeye	T 29 S, R 2 E, Sec. 12	15	C	Eastern brook	1,000	2", biennially
Cliff	T 29 S, R 3 E, Sec. 7	7	B/	Eastern brook	1,000	2", biennially

Explanation of Figures

Fig. No.	Common Name	Scientific Name	Distribution	Approximate Magnification
1	Caddisfly larvae and case	Mystacides sp.	General in lakes	Natural size
2	Caddisfly case	Glossosoma sp.	General in streams	Natural size
3	Caddisfly larvae and case	Halesus sp.	General in streams	1¼ x nat.size
4	Mayfly nymph	Ephemerella sp.	General in streams	2 x nat. size
5	Burrowing Mayfly nymph	Hexagenia sp.	Fish Lake only	1½ x nat.size
6	True-fly (Diptera larvae)	Chaoborus sp.	General in lakes	2½ x nat.size
7	True-fly (Diptera larvae)	Eriocera sp.	General in streams	Natural size
8	True-fly (Diptera larvae)	Chironomus sp.	General in streams and lakes	1½ x nat.size
9	Stonefly nymph	Pteronarcys sp.	General in streams	Natural size
10	Sonefly nymph	Alloperla sp.	General in streams	2 x nat. size
11	Stonefly nymph	Acroneuria sp.	General in streams	1½ x nat.size
12	Alder-fly (Neuroptera)	Sialis sp.	General in lakes	1½ x nat.size
13	Fish fly (Neuroptera)	Chauliodes sp.	General in streams	2½ x nat.size
14	Damselfly	Enallagma sp.	General in streams	1½ x nat.size
15	Dragonfly	Aeschna sp.	General in streams	1½ x nat.size
16	Crayfish (Crustacea)		General in lakes and streams	Natural size
17	Water-flea (Crustacea)	Daphnia sp.	General in lakes	7 x nat.size
18	Scud (Fresh water shrimp	Hyallella sp.	General in lakes	8 x nat.size
19	Copepod (Crustacea)	Diaptomus sp.	General in lakes	8 x nat.size
20	Freshwater clam (Mollusc)	Pisidium sp.	General in lakes	10 x nat.size
21	Snail (Mollusc)	Physa sp.	General in lakes and streams	1½ x nat.size
22	Snail (Mollusc)	Planorbis sp.	Cliff Lake only	Natural size
23	Snail (Mollusc)	Flumunicola sp.	General in streams	Natural size
24	Snail (Mollusc)	Goniobasis sp.	General in streams	1½ x nat.size
25	Water penny (Coleoptera)	Psephenus sp.	General in streams	10 x nat. size
26	Water mite		General in lakes and streams	10 x nat. size

FIG. 4

COMMON FISH FOOD ORGANISMS OF LAKES AND STREAMS OF THE SOUTH UMPQUA DRAINAGE