Hugh Ross Newcomb

U. S. DEPARTMENT OF AGRICULTURE

Forest Service

LAKE SURVEY
MOUNT HOOD NATIONAL FOREST

by

Charles J. Campbell
Junior Biologist

Portland, Oregon
October, 1940.

C O N T E N T S

TABLES

APPENDIX

MAPS

INTRODUCTION

During the field seasons of 1939 and 1940 a biological survey was conducted on the lakes of the Mt. Hood National Forest. This work was carried out under a cooperative agreement between the U. S. Bureau of Fisheries, Department of Commerce, and the U. S. Forest Service, Department of Agriculture, signed March 19, 1935. It is a part of the cooperative program of the U. S. Bureau of Fisheries and the U. S. Forest Service for stream and lake surveys, detailed fresh-water investigations, and stream and lake improvement in the National Forests of Region 6, approved June 25, 1937. The Oregon State Game Commission also cooperated in the work and furnished help and advice as needed and as facilities permitted.

PURPOSE OF THE SURVEY

(1) To develop a practical, scientific fish planting program for the Mt. Hood National Forest.

(2) To determine the need for stream and lake improvement.

(3) To determine whether present regulations and restrictions on fishing are satisfactory and to recommend such changes as seem advisable.

(4) To open for study special problems of the National Forest waters, and

(5) To locate possible hatchery or rearing pond sites.

During the survey collections were made of scale samples, fish, aquatic plants, plankton, insects, crustaceans, and molluscs, and these collections for the most part were sent to various specialists for classification so that important data on distribution of various lake fauna and flora could be ascertained. Most of this material is included in the report, except for the data from fish scales which are still in the possession of the Bureau of Fisheries (Fish and Wildlife Service). It is all available to biologists doing similar work as well as to naturalists in other fields.

All the lakes of the Mt. Hood Forest have been surveyed and are included in the report with the exception of four or five comparatively small, unimportant ones that had to be omitted due to termination of the survey. In all, 116 lakes were checked and 112 were surveyed.

As nearly as possible an attempt was made to visit all water areas shown on the Forest Service topographic map of the Forest, but some of these are unnamed and so small as to be unworthy of mention, and, of course, other lakes are included that have been found since the map was made. The various data are for the date upon which the lake was visited only and leave much to be desired as far as seasonal variation goes. In fact, such a survey is only a small beginning for what should be done if we are to learn more about our inland fisheries. Winter investigations at least on a few key lakes should be made to learn more of snow and ice and other winter conditions on the lakes and their effect on fish life.

PERSONNEL

The survey party consisted of Charles J. Campbell, Junior Biologist, and from three to five CCC enrollees. The number and personnel varied somewhat because of frequent changes in camp personnel and emergency work. Only one, Glendon Carter, was continuously with the survey during both seasons.

TIME IN THE FIELD

The field season of 1939 got off to a late start due to a change in supervising personnel. Actual survey work started the 24th of July and continued until October 20. Freezing weather in the higher altitudes where most of the lakes are located makes this type of work impractical after that date.

In 1940 a much earlier start was made and the first lake was surveyed on May 21. The work was uninterrupted from then until the 1st of July. Fire and other emergency work consumed the time between July 1 and 26 on which date survey work was again resumed. From then until September 12 the work was uninterrupted. Field work was terminated on that date to allow time for writing the report.

AREAS COVERED

All of the known lakes on the Mt. Hood National Forest were covered in the course of the two seasons. The greatest concentration of lakes is found in the Lakes Ranger District where it was possible to set up a base camp for six weeks. The lakes on the other districts are fewer and more scattered, necessitating frequent moving of camp. The Hood River Ranger District has fewest lakes, with only two.

Except in the Clackamas River District the lakes could all be reached by truck and short backpack trips, so base camps could be located on roads. The south end of the Clackamas River District, however, has never been opened up with roads and it was necessary to cover this area with pack stock.

EQUIPMENT

Most of the actual survey equipment and the scientific instruments were loaned to the Forest Service by the Fish and Wildlife Service. Some of the various pieces of equipment used are: Ekman dredge, plankton nets, fish nets, water sample bottle, portable rubber air boat, thermometers, sieves, preservatives, notebooks, pH and chemical determination kits, and other supplies commonly used in biological field work.

METHODS USED IN THE SURVEY

In general, the method of conducting the work and recording the data was that described by Dr. H. S. Davis in "Instructions for Making Stream and Lake Surveys", Fisheries Circular No. 26, put out by the Bureau of Fisheries in 1938. Areas were determined by traversing rather than by plane table work as traverse notes can be kept in a notebook and the map plotted later. This method tends to speed up field accomplishment and after a little experience, two CCC men can run such a traverse reasonably fast and accurate.

ACKNOWLEDGMENTS

The writer wishes to express thanks to Mr. Glenn Mitchell of the Regional Forester's office; Mr. Waha, Supervisor, and Mr. Steele, Assistant Supervisor of the Mt. Hood National Forest; the District Rangers and their staffs; and Mr. Mills, Principal Foreman of the CCC Camp; for assisting in various ways and furnishing information concerning the lakes. Thanks are due to Dr. Paul R. Needham, Bureau of Fisheries, and Dr. Francis P. Griffiths, Oregon State Game Commission, for valuable suggestions and willing cooperation.

The cooperation of Dr. Trevor Kincaid of the University of Washington in identifying plankton and mounting a set of slides for the forest, and of Miss Helen Gilky and others of the Herbarium Staff of Oregon State College in plant identification, is sincerely appreciated.

GENERAL CHARACTERISTICS OF FOREST AND LAKES

The Mt. Hood National Forest comprises 1,099,507 acres. It is bounded on the south by the Willamette National Forest, on the north by the Columbia River, on the east by the Warm Springs Indian Reservation and cessation of timber, and on the west by the Willamette Valley. The forest lies in Clackamas, Multnomah, Hood River, Wasco, Jefferson, and Marion counties. The majority of the lakes are in Jefferson, Marion, and Clackamas Counties with a few in each of the others.

The average annual rainfall for the forest as a whole is about 60 inches. There is considerable variation however, as part of the area lies on the east side of the mountains and receives from 20 to 25 inches of rainfall while parts on the west side receive as much as 75 inches. Snow banks were found near some of the higher lakes as late as the middle of August in 1939. The winter of 1939-1940 was very mild with much less than the usual amount of snow so all the lakes were clear a month earlier than usual. Mt. Hood is the highest peak on the forest being 11,245 feet high and has eight glaciers, furnishing a constant supply of water to many streams of the forest.

The four largest rivers on the forest are the Clackamas, Sandy, Hood, and Bull Run. Some of the headwaters of the Breitenbush and Deschutes Rivers are also located in this forest. The entire watershed of the Bull Run River, together with some contiguous territory, approximately 140,000 acres in all, is closed to the public as it is from here that the City of Portland gets its water supply. Except for necessary fire protection work, this large area is left untouched, forming a true wilderness area. Fishing and hunting are prohibited. In this closure are several lakes that were surveyed as they offered a rare opportunity to study conditions while practically unaltered by man.

The Mt. Hood Forest is crossed by the Mt. Hood Loop and the Wapinitia Cut-off surfaced highways. The Columbia River Highway extends along the north edge of the forest. Except for the south end of the Clackamas River District the Forest Service maintains numerous secondary roads during the summer which make most of the lakes and streams available by motor transportation to the angler.

This system of roads coupled with the proximity of Portland, the largest center of population in the state and only 45 miles from the forest boundary, is in a large measure responsible for the present fishing conditions on the forest. In most cases anglers can, and thousands of them do, drive to or within easy walking distance of the streams and lakes they wish to fish. Availability and large population make for heavy fishing, heavier than many of the small lakes and streams can support. The problem is to keep the waters producing fish at their highest sustained capacity and to furnish as much fishing as possible for the fishermen. The day when large fish were the accepted thing is gone in most places, as a given amount of water can support only so many pounds of fish. If this poundage is concentrated in a few large fish, fewer anglers will be successful. The same poundage divided into smaller packages can grace many more creels and satisfy more people.

There are approximately 120 named lakes on the forest. The majority of these have been stocked at some time and furnish fishing, but the number containing trout native to the country is surprisingly low. There are many lakes in the Lakes Ranger District that have not been named. The surveyed lakes range in size from 455 acres (Bull Run Lake in the Bull Run District) down to 1 acre. The average of all lakes surveyed is 17.3 acres. There are three lakes of over 200 acres however, which materially raise the average. In general the lakes are shallow although lakes from 2 feet to 222 feet in depth were found supporting fish. The average maximum depth for all lakes is 20.9 feet.

Nearly all of the lakes are located above the 3000 foot level. Some are well above 5000 feet, but none were found above 5600 feet. Many of the lakes were formed by glaciation, some being caused by lateral or terminal moraines, and some occupying old cirques. Others have been formed by beaver, and some are mere basins that catch and hold the spring runoff.

Many of these small shallow lakes have no continuously running inlets or outlets. That some of these support fish at all, however, would indicate that they have running water during the winter. This would be an interesting point to check upon during the winter. Of the lakes surveyed, 50 or 44.5% had running water, either inlets or outlets or both. Some surveyed early in the year had water entering in many places but it is doubtful if that would be true later in the season. Some of the lakes with running water have

spawning possibilities, and in these young fish were found. The majority of the lakes have no spawning facilities and fishing can be maintained in them only by repeated stockings. Frequently gravel shoals in lakes fed by the runoff might be suitable for Eastern Brook spawning, but they are soon exposed by lowering water levels, making spawning impossible or unsuccessful. Eastern Brook are known to spawn in gravel beds of lakes if spring water is coming through the gravel, but this condition is rare. In some cases Eastern Brook have been found that instead of spawning "were absorbing the spawn within the body cavity. Two and sometimes three distinct years of spawn could be found in the body cavity". (Lake Survey of the Willamette National Forest by F. C. Ziesenhenne, 1937). On August 7, 1940 in Skookum Lake this phenomenon was found among the Loch Levon trout. In one in particular was the present year's spawn, and nothing but the empty egg cases of that from the year before.

Fluctuating water levels also make it difficult or impossible for aquatic and emergent plants to become established. Wave action removes all organic material from the shore gravel, making it much less productive and giving vegetation little chance to exist. Aquatic vegetation is important as it furnishes shelter and food for many organisms that are food for fish. Also it furnishes needed shelter and protection for small fish. In a number of lakes vegetation is common or abundant and these are generally more productive but generally it is scarce or absent.

TEMPERATURE OF THE LAKES

Temperatures of the lakes varied greatly, but as they were taken on only one day for each lake, the seasonal variation could not be determined. The extreme high surface temperature recorded was 80° in Lower Goodfellow Lake on July 26, 1939, and the extreme low surface temperature was 45° on Hidden Lake on October 16, 1939. Surface temperatures, of course, vary considerably with the weather conditions, but most of the lakes fell between 60 and 70°. In general, there was little difference between surface and bottom temperatures in shallow lakes (See charts in appendix), but in a few cases it was marked as in the lake with 80° surface water. The bottom of this lake was 66° and it is only nine feet deep. This was no doubt due to inflowing springs which make the lake habitable for fish.

The deeper lakes showed distinct thermal stratification, and Table 1 shows the data taken on this phenomenon. As can be seen, the temperature of all the deep lakes was 39° F. (4°C.) or very close to it by the time a depth of 75 feet was reached. It is at 4° C. that water is at its heaviest and, of course, the bottom will always be this temperature if the lake is deep enough. The thermocline or zone of rapid temperature drop varied somewhat but usually extended 10 to 20 feet and started from 10 to 20 feet below the surface. In Lost Lake, for instance, the water temperature dropped only 5° in the first 20', but in the next 10 feet dropped 9.6°. Below this thermocline the temperature again drops slowly until the 4°C. is reached.

TABLE NO. 1. THERMAL STRATIFICATION

Date of Reading	May 28, 1940	June 4, 1940	June 11, 1940	June 13, 1940
Name of Lake	LOST LAKE	BULL RUN LAKE	BLUE LAKE	WAHTUM LAKE
Depth of Reading	Temperature of Water			
Surface	60°	56°	60°	60°
10'	58°	55°	53°	59°
20'	55°	54°	49°	54°
25'	48°			
30'	45.5°	48°	42°	48°
35'	44.5°			
40'	44°	44°	41°	45°
50'	43°	43°	40°	43°
60'	41°			
70'	40°			
75'		41°	39°	41°
80'	40°			
90'	40°			
100'	39.5°	40°		40°
150'	39°	39.5°		39°
Thermodine	20' to 30'	20' to 35'	10' to 30'	20' to 35'

TROUT FOODS

Trout foods naturally fall into four classifications. These are: (1) plankton forms, (2) bottom and shoal organisms, (3) terrestrial food, and (4) vertebrate foods. These four classes will be taken up separately.

PLANKTON

Plankton is the term applied to those small forms of life found free swimming in the water but at the will of the currents. They are independent of the bottom, but are incapable of moving in a definite direction for an indefinite time. Some form of plankton is present in nearly all lake waters, but is seldom noticed by casual observers because most forms are very small and some almost colorless. In size the forms vary from microscopic up to the one insect larvae included in plankton, which may be nearly 1/2 inch long. Many forms can be seen with the naked eye if placed over a black background. Some, particularly among the copepods, may be brilliantly colored. Algae, numerous crustacea, and a few other forms make up the plankton population.

Plankton is important as it is one of the links in the base of the food chain. Young fish feed directly on planktonic food, and the adults of some species continue to do so. Also animal plankton converts plant material to animal material and are then eaten by larger animal forms which in turn are fed upon by fish. That plankton is a natural and good food for fish, particularly young ones, is shown by the fact that forms such as water fleas are cultivated and used as food in some hatcheries. Such forms reproduce with great rapidity under satisfactory conditions and have resistant stages that can survive long periods of adverse conditions.

Planktonic abundance varies considerably with the seasons and other factors, and as the lakes were visited on only one day no quantitative determinations were attempted. However, the mountain lakes are generally rather rich in plankton, in numbers of individuals if not in species. Collections were made with a silk tow net in all lakes surveyed to get qualitative and distribution data. In some cases plankton would be found so abundant as to clog the net after only a few feet of towing, and in other lakes so scarce that securing a satisfactory sample was difficult. Clackamas Lake, for example, has almost no plankton. This would be expected from the character of the lake as it is very cold (46°) and has a large amount of water running through it.

Dr. Trevor Kincaid of the University of Washington identified the various species of plankton and also furnished the forest with a reference collection mounted on microscope slides. The various species and the percentages of lakes in which they were found is presented in Table Two. As can be seen, copepods are the most common types and are also the most widespread. The most common organism found was a copepod, Epischura nevadensis, Lilljeborg. It was present in 65 of the lakes surveyed. Second was a water flea, Daphnia longispina, Muller. It was interesting to note that some species found frequently during one season were rare the next and vice versa. This may mean that certain species are more numerous some years than others or it may be a local seasonal change. More research is necessary to determine this point.

Plankton is a necessity for fish production in lakes and as such should be encouraged where possible. Various methods of increasing the basic fertility of lakes with plankton might be tried in some of the more accessible mountain lakes.

TABLE NO. 2

Species and Distribution of Plankton

Scientific Name	No. lakes where found	Percentage of lakes in which found.
Cladocera - Water Fleas		
1. Daphnia longispina O.F. Muller	41	39.4
2. Holopedium gibberum Zaadisch	34	32.6
3. Bosmina longispina Leydig	34	32.6
4. Bosmina longirostris O.F. Muller	10	9.7
5. Chydorus sphaericus O.F. Muller	10	9.7
6. Alond affinis Leydig	7	6.7
7. Diaphanosoma brachyurum Lieven	6	5.7
8. Ceriodaphnia reticulata Jurine	5	4.8
9. Daphnia pulex De Geer	3	2.8
10. Pleuroxus denticulatus Birge	3	2.8
11. Polyphemus pediculus Linne	3	2.8
12. Alona guttata Sars	2	1.9
13. Alonella excisa Fischer	2	1.9
14. Diaphanosoma leuchtenbergianum Fischer	1	.9
15. Simocephalus serrulatus Koch	1	.9
16. Alona rectangula Sars	1	.9
Copepoda		
1. Epischura nevadensis Lilljeborg	65	62.5
2. Diaptomus signicauda Lilljeborg	30	28.8
3. Diaptomus Franciscanus Lilljeborg	23	22.1
4. Diaptomus tyrelli Poppe	16	15.3
5. Diaptomus Washingtonensis Marsh	10	9.7
6. Diaptomus shoshone Forbes	9	8.6
7. Cyclops bicuspidatus Claus	2	1.9
8. Diaptomus sp. (immature)	7	6.7
9. Diaptomus lintoni Forbes	4	3.8
10. Diaptomus wardi Pearse	2	1.9
11. Diaptomus lintoni Forbes	4	3.8
Rotatoria - wheel animalcules		
1. Keratella cochlearis Gosse	4	3.8
2. Conochilus unicornis Rousselet	2	1.9
Protozoa - one celled animals		
1. Ceratium hirundinella Muller	1	.9
2. Dinobryon sp.	1	.9
Desmids		
1. Staurastrum arctiscon Ehrenberg	2	1.9
2. Myalotheca sp.	1	.9
3. Closterium ralfsi Breb.	1	.9
4. Xanthidium antilpaeum Breb.	1	.9
5. Micrasterias laticeps	1	.9
Ostracoda		
1. Ostracod sp.	1	.9
Diptera - Flies (larvae)		
1. Corethra sp.	3	2.8

BOTTOM AND SHOAL ORGANISMS

The bottoms of most of our mountain lakes consist of from a few inches to a foot or more of muck or silt. In and on this layer of muck many organisms make their homes. These organisms form a large part of the food of fishes and are especially important as they are present all the year around. They are available when other sources of food are not. The most common types of organisms in the bottom foods category are: midge larvae, alderfly larvae, scuds (fresh water shrimp), mayfly nymphs, odonata nymphs, clams, and segmented worms. All these and others were found in fish stomachs as well as in dredge samples.

These samples are taken with an Ekman dredge that picks up 1/4 cubic foot of bottom material, which is then put through a 30-mesh screen and the organisms removed and counted. In some cases it was found that allowing the dredge to sink much below the surface of very soft bottoms gave distorted results as the upper layer contained most of the organisms. Several samples were taken from each lake, and the charts in the appendix give the average number of organisms per 1/4 cubic foot. Sometimes scuds, annelid worms, or midge larvae are very abundant, raising the average considerably. In Lower Goodfellow Lake, 211 small midge larvae were found in one sample. In a lake of the Willamette Forest, 626 midge larvae were found in 1/4 cubic foot of bottom muck (Lake Survey of the Willamette Forest, Department of Agriculture, by Fred C. Ziesenhenne, 1937). Also in a single 1/4 cubic foot sample from another lake were 282 clams.

Qualitative samples were taken from all lakes, but time and space does not permit the inclusion of all this data. Lack of equipment made weight determinations impossible in the field, but numbers of all forms were recorded to give such quantitative information as possible to supplement the qualitative data.

Shoal foods are those forms found in the shallow water along the shore. Trout feed in the shallows a great deal because it is here that a large variety of foods are found. These organisms were collected by means of a sheet metal bottom sampler, one square foot in cross section. This sampler is forced into the bottom deep enough to prevent leakage of organisms under it, and the bottom material is then sifted through a 30-mesh hand screen. When ten screenfuls have been removed successively with no organisms in them, it is considered that all the organisms in the square foot have been removed. This is sometimes a lengthy process, prohibiting the taking of many samples, but at least one and as many more samples as possible were taken from each lake. The average number of organisms per square foot will be found in the charts in the appendix.

The shore foods are very similar to bottom foods, but odonata nymphs, scuds, beetles, and caddisfly larvae are apt to be more common. Water boatmen, backswimmers, and beetles may often be seen near shore in large numbers, but are seldom taken in the sampler as they are very active and avoid it. Shrimp may be very abundant along shore as shown by the sample from Round Lake which had 516 shrimp in a single square foot. Caddisflies are frequently common along shore also and are a preferred food of trout, being eaten case and all.

 Hugh Ross Newcomb

Shrimp or scuds deserve special mention as they are considered a very good fish food. The past season's experience did not show them in fish stomachs to the extent that might be expected, but there is no doubt as to their importance. Many people claim that fresh-water shrimp are not native to this area, and it is true that they have been planted in several lakes. However, in the light of what has been learned from this survey it can safely be said that fresh-water shrimp are found naturally in the waters of this area. They were found in lakes that have never had fish in them and in lakes that are so difficult of access and barren of fish that no one would attempt to plant them with shrimp. In all, shrimp were found in 61.6% of the lakes surveyed, and the lakes in the area fartherest from roads in the south end of the Clackamas River District had shrimp in all but 2 of them.

Crayfish are found in a few of the lakes, and the young of these are excellent trout food. In one lake in 1939 where crayfish were abundant every trout examined contained evidence of this food.

TERRESTRIAL FOODS

The third category of food is that furnished from the land or air. It consists of all sorts of insects, spiders, etc., that fall or are knocked onto the water. During the seasons they are available, they furnish a large proportion of the food taken by trout. Fish, as is the case with most wildlife, feed most extensively on food easiest obtained. At times the surface of a lake may be covered with flying ants that have become exhausted over the lake or have been blown there, and at such times the trout will feed upon them extensively. A large variety of spiders can be found on alpine lakes; often they are seen skating across the surface drawn by a long strand of web as a sail, and these are frequently taken by trout. Where the water is overhung by brush or grass, leaf hoppers, grasshoppers, terrestrial beetles, and other land forms fall into the water in large numbers and furnish a considerable quantity of food.

Much of the food falling upon the water surface is really aquatic in origin. Mayflies, caddisflies, stoneflies, midges, and similar forms furnish food during their immature aquatic existence and are taken in quantities as they rise to the surface to emerge and continue to furnish food as adults. They must lay their eggs in or on the water, and in their dipping flight over the surface for this purpose, many are taken. After fulfilling this mission, they fall exhausted on the water and are eaten by trout. The great swarms of mayflies seen over the water are familiar to all anglers, and the large amount of food they furnish at such times can readily be appreciated. The large odonata fall into this category also. A common sight is that of a large dragonfly swooping over a lake, dropping every few yards to release eggs, only to have a trout leap for it at every descent. When they have lived their span they fall upon the water and trout only six or seven inches long may be found with one or more of these large insects jammed and folded in its stomach.

The amount of food furnished from this source is very difficult to measure, particularly on lakes, but it is considerable and its importance should not be overlooked.

VERTEBRATE

In this category fall such small vertebrates as frogs, salamanders, small fish, and more rarely small terrestrial vertebrates such as mice or young birds which have been known to be taken by large trout. Our alpine lakes seldom contain forage fish so small trout form a part of this diet for larger fish - a fact which accounts for the loss of a considerable proportion of planted fingerlings. Larval or gilled salamanders when present are taken to some extent. Larger fish are principally benefitted by this source of food.

FOODS FOUND IN TROUT STOMACHS

During the season of 1940, a series of trout stomachs were analyzed. No microscope was available but a hand lens was used. Under these conditions all that could be learned was numbers of organisms and a broad classification. In Table 3 this data is presented in much condensed form. A numerical basis is not the most satisfactory as organisms vary much in size. A single caddis-fly larvae, for instance, would have more volume than many midge larvae or gnats.

The various collections are shown chronologically as to dates, and the higher percentages of terrestrial food generally show in midsummer when flying insects are most abundant. In this table all organisms that spend any part of their life cycle in the water are considered aquatic even though they may have been taken on the surface. As some mosquitoes hatch in damp soil near melting snow, they are considered as terrestrial in this study. Where it was known it is indicated whether forms of aquatic origin were in the adult, larval, or nymphal stage.

These figures show thetruth of the statement that trout feed principally on what is most available. For instance, the trout in Pansy Lake on August 12, 1940 were feeding almost entirely on the surface. On this date nine Eastern Brook from 7 to 11 inches in length were examined and found to contain among other things 747 gnats. Only eight or nine organisms were found in the entire series that had not been taken on the surface. On the other hand a series of ten Eastern Brook from Welcome Lake on August 14, 1940 had taken 95.2% aquatic foods. The totals of all the stomachs - 170 - show that 4186 organisms were taken of which 2771 or 66.1% were aquatic in origin and 1415 or 33.8% terrestrial. This shows the basic need of aquatic foods and also shows the value of terrestrial foods during the seasons when they are available.

Of interest is thefact that trout with a very high percentage of aquatic foods in their stomach were often taken on an artificial fly. Most of the fish specimens were taken on hook and line as the gill net was set in only 3 lakes during the season. At least 90% of the hook and line fishing was done with artificial fly.

Table 3 is self-explanatory and any further deductions from it will be left to the reader. It is quite obvious that trout will, at times, eat almost anything that falls on the surface of the water or exists beneath it, even to fir needles. (These fir needles were not parts of caddis cases.)

AQUATIC AND TERRESTRIAL FOODS FOUND IN
STOMACHS OF TROUT TAKEN FROM LAKE ON MT. HOOD
NATIONAL FOREST.

TABLE #3.

Name of Lake	Date	Species	No.	Size Range	Food, No. & Kinds. Aquatic	Terrestrial	Percentage Aquatic	Terrestrial	Method of Capture
Lost	May 29, 1940	Loch leven	11	6" to 11"	33 damsel fly,n. 44 caddis,larvae 1 salamander 1 crayfish 23 dragon fly,n. 44 alder fly, larvae. 1 stone fly 5 midge larvae 2 leeches 2 shrimps 156	24 beetles 13 ants 1 neuroptera 38	80.4	19.5	Sample gill net
Bull Run	June 5, 1940	Cutthroat	5	7" to 14"	24 shrimp 132 midge pupae 18 dragon flies 14 caddis lar. 4 mayflies 2 alder flies 194	12 beetles 1 bee 1 grub 2 ants 16	92.3	7.6	Hook & Line
Wahtum	June 13, 1940	Eastern Brook	20	6" to 11"	113 dragon flies,n. 1 damsel fly,ad. 492 midge, L. & pupae 79 alder flies,L. 67 trout eggs 752	13 salmon eggs 3 ants 40 beetles 45 spiders 1 fish cleanings 102	88.0	11.9	Sample gill net

Name of Lake	Date	Species	No.	Size Range	Food, No. & Kinds Aquatic	Terrestrial	Percentage Aquatic	Terrestrial	Method of Capture
Mud	June 14,1940	Rainbow	10	7" to 10"	183 caddis,L. 1 dragon fly,L. 4 midge pupae 188	3 spiders 8 beetles 9 ants 20	90.3	9.6	Hook and Line
North	June 19,1940	Eastern Brook	1	7"	143 midge,L. 1 crayfish 1 caddis 145	7 ticks (?) 3 beetles 1 unidentified 11	92.9	7.0	Hook and Line
Bear	June 20,1940	Eastern Brook	5	5" to 9"	2 alder fly 4 midge, L.& pupae 7 dragon fly,L. 20 caddis 33	1 mite 6 beetles 7	82.5	17.5	Hook and Line
Black	June 21,1940	Eastern Brook	9	6" to 12"	34 shrimp 5 caddis,L 21 damsel flies,ad. 1 crayfish 17 midge pupae 1 water strider 79	6 beetles 2 spiders 1 hemiptera 9	89.7	10.2	Hook and Line
Warren	June 25,1940	Eastern Brook	7	5" to 7"	34 midge pupae 2 shrimp 5 caddis 51 clams 4 alder fly,L. 3 dragon fly,L. 99	11 beetles 141 small hemiptera 2 spiders 1 wood borer 5 aphis 160	38.2	61.7	Hook and Line
Rainey	June 26,1940	Eastern Brook	8	5" to 7½"	3 midge pupae 2 alder fly,ad. 5	5 spiders 3 grasshoppers 4 beetles 1 aphid 13	27.7	72.2	Hook and Line

Name of Lake	Date	Species	No.	Size Range	Food, No. & Kinds Aquatic	Food, No. & Kinds Terrestrial	Percentage Aquatic	Percentage Terrestrial	Method of Capture
Scout	June 27,1940	Eastern Brook	21	5" to 7"	22 caddis,L. 16 shrimp 43 midge,L. 5 dragon flies 4 mayfly,ad. 1 waterstrider 1 backswimmer 92	37 mosquitoes 20 diptera 9 beetles 5 spiders 3 undetermined 1 hemiptera 3 neuroptera 78 (22 fir needles)	54.1	45.8	Hook and Line
Harriet	July 30,1940	Loch leven	2	16" to 13"	3 alderflies,L. 14 caddis,L. 1 stonefly,L. 11 clams 14 snails 43	3 mosquitoes 3	93.4	6.3	Sample gill net
		Eastern Brook	4	8" to 12"	14 caddis,L. 2 fingerlings 1 frog 1 shrimp 1 snail 1 alderfly 20	4 beetles 1 mosquito 5	80	20	Sample gill net
		Rainbow	8	6" to 12"	1 frog 140 snails 11 caddis 12 alderfly,L. 81 midge pupae 245	3 mosquitoes 2 unidentified 5	98	2	Sample gill net
High	Aug. 6,1940	Eastern Brook	12	7" to 9"		34 beetles 2 flies 69 ants 16 gnats 1 spider 122 4 fir needles		100	Hook and Line

Name of Lake	Date	Species	No.	Size Range	Food, No. & Kinds: Aquatic	Food, No. & Kinds: Terrestrial	Percentage: Aquatic	Percentage: Terrestrial	Method of Capture
Pansy	Aug. 12,1940	Eastern Brook	9	7" to 11"	1 dragon fly 54 mayflies,ad. 8 alderflies 63	747 gnats 7 beetles 2 unidentified 756	6.5	93.4	Hook and Line
Welcome	Aug.14,1940	Eastern Brook	10	8" to 14"	81 mayflies 11 dragonflies,n. 41 midge 1 caddis,L. 2 shrimp 88 copepods 1 alderfly 225	1 fly 3 beetles 1 unidentified 5	95.2	4.7	Hook and Line
West	Aug.15,1940	Eastern Brook	1	10"	4 dragonflies,n. 2 mayflies 6	4 ladybugs 1 mosquito 5	54.5	45.4	Hook and Line
Big Slide	Aug.20,1940	Eastern Brook	5	7" to 8"	7 dragonflies 1 mayfly 3 waterstriders 11	1 spider 1 beetle 2	84.6	15.3	Hook and Line
Round	Aug.25,26, 1940	Loch leven	6	8" to 15"	218 caddis,L. 9 dragonfly,n. 40 mayflies 3 alderflies 270		100%		Hook and Line
		Eastern Brook	10	7" to 14"	30 mayflies 13 caddis 11 alderflies 54	42 salmon eggs 2 beetles 1 oat 45	54.5	45.4	Hook and Line
Teacup	Sept.9,1940	Eastern Brook	6	4" to 5"	1 caddis 80 midge,L. 1 damsel fly 3 dragonflies 3 alder flies 3 mayflies 91	8 gnats 1 bee 2 beetles 2 ants 13 (1 fir needle)	87.5	12.5	Hook and Line
TOTAL FOODS & PERCENTAGE			170		2771	1415	66.1	33.8	

PLANT LIFE

As previously stated, plant life in many of the lakes is limited by highly inorganic shore-lines, wave actions, and fluctuation of water levels. Any of these conditions make life difficult or impossible for the emergent plants found along the shore-line. Plant life is a valuable asset to a lake as it increases food production and furnishes shelter to young fish. Lakes with an adequate growth of plants are generally better producers than lakes barren of plant life, and for this reason it would be advisable to aid the establishment of aquatic plants in lakes not having them.

During the course of the survey a collection of plants found in and around the lakes was made, and these specimens were identified by members of the staff of the Oregon State College Herbarium. Table 4 shows the various species that were found.

Algae were found in all the lakes. Vancheria was present in some, and in a few a filamentous green algae was abundant. In Clackamas Lake which has very cold, clear water were a great many individuals of a colonial nostoc. These are a giant form with some of the globes as large as a man's head.

TABLE NO. 4 — AQUATIC PLANTS FOUND IN LAKES on Mt. Hood National Forest

Scientific Name	Common Name	Remarks
Potentilla palustris scop.	Marsh Cowberry	Along shore, emergent
Isoetes howellii	Howell's quill wort	Submerged, small
Equisetum kansanum	Snake or joint grass	Found in up to 1' of water.
Eleocharis palustris	Creeping spike rush	Along shore, emergent
Carex exicata	Western inflated sedge	" "
Carex aquaticus	Water Sedge	" "
Carex retrorsa	Retrorse sedge	" "
Carex spp	Sedges	" "
Potamogeton epihydrous	Nuttall pondweed	Floating leaves
Potamogeton natans	Common floating pondweed	Leaves reddish, float.
Potamogeton amplifolius	Pondweed	
Potamogeton pusillus	Pondweed	
Potamogeton heterophyllus	Pondweed	
Potamogeton spp	Pondweed	
Utricularia vulgaris	Bladderwort	Submerged
Menyanthes trifoliata	Buckbean, bog bean	Along shore, emergent
Dichelyma capillaceum	Moss	Found 56' deep
Fotinalis gigantea	Moss	Submerged
Ranunculus aquatilis	White water buttercup	Submerged, dissected leaves
Trautvetteria grandis		
Senecio triangularis	Triangled groundsel	Found near water
Caltha biflord	Marsh marigold	Found near water
Sparganium californicum	Bur-reed	Emergent
Glyceria occidentalis	Western manna grass	Emergent
Sagittaria latifolia	Arrowhead, wapato	Emergent, duck food
Veratrum caudatum		
Philotria columbiana	Water weed	Submerged
Sparganium simplex	Narrow leaf bur-reed	Long narrow floating leaves.

Smaller forms, ear-like in shape, were found attached to rocks near cold spring inlets, and each of these forms examined contained a midge larva within it. It seems reasonable to expect that these larvae upon emergence would furnish some food.

Sometimes planktonic algae become so thick in the water that it is detrimental, but this condition was not found in any of the lakes in the Mt. Hood Forest. One lake did have such a heavy growth of duck weed, a small floating plant, that fishing was made difficult, and at times a large percentage of light was cut off from the water. This was the only case of a heavy growth of this plant found.

CHEMISTRY OF THE LAKES

There is little or no trouble from pollution in the lakes of the Mt. Hood Forest. Because of the difficulty involved in carrying chemical equipment in the field little water testing was done. During 1939 the only chemical data taken was the pH value in the lakes surveyed, but due to unavoidable difficulties this part of the chemical investigation was not carried on in 1940, although more extensive dissolved gas and carbonater tests were made.

During the 1939 season a LaMotte colorimetric set was used for pH determinations and all lakes were found to be quite close to neutral or a pH of 7. The lowest pH value found was 6.3 and the highest 7.5. Nothing in the data taken during 1940 would indicate that other lakes would vary more than this. Fresh water shrimp are said to prefer waters slightly on the alkaline side, but in the light of this survey seem to stand a slight acidity as they were found once in water with a pH of 6.5, once in 6.6, six times in 6.7, and in all other cases over 6.7 during the 1939 season. As shrimp were found commonly in 1940 it would indicate that those lakes were approximately the same.

During the season of 1940 more extensive chemical data was taken as long as it was possible to work from base camps on roads. When it became necessary to use pack stock such equipment was impractical to handle. Without a laboratory to check the chemical reagents used at intervals and to replace them when necessary the work cannot be considered accurate. However, dissolved oxygen, dissolved carbon dioxide, and alkalinity tests were made on 18 lakes and the results are summarized on Table 5.

Oxygen is of course necessary for respiration of fishes and trout require a relatively large amount. None of the lakes showed O_2 to be seriously low at the time tested. The lowest O_2 content found was 7 parts per million, and this is sufficient, at least large and healthy trout were in the lake. Carbon dioxide in too large amounts is detrimental to fish life, but the highest concentration found was 6.5 parts per million and again large and healthy fish were present.

In all cases the phenophthalein alkalinity tests showed negative as they regularly do on the west side of the Cascades. The methyl orange alkalinity test showed from 5 to 16 parts per million of dissolved calcium carbonate present in the lakes. As this test depends on recognizing an almost imperceptible change of color in a liquid its accuracy when carried out in the field is open to doubt. Carbonates are necessary to fish life for bones as for any other form of life and are also necessary for hard parts of other aquatic organisms and the tests made show that the mountain lakes are fairly well supplied.

Although the hairline accuracy of this chemical data is open to question, it gives the general idea and so is presented for the comparison of others engaged in this type of work.

TABLE NO. 5 CHEMICAL DATA

Name of Lake	Date	Dissolved O_2	Dissolved CO_2	Phenophthalein Alkalinity	Methyl Orange Alkalinity
Palmer	May 21,1940	8.2 ppm	1.5 ppm	negative	
Talapus	May 23,1940	7.4 ppm	4 ppm	negative	7 ppm$CaCO_3$
Latourell	May 24,1940	7 ppm	6.5 ppm	negative	15 ppm$CaCO_3$
Lost (10')	May 28,1940	8.3 ppm	3 ppm	negative	8 ppm$CaCO_3$
" (125')	May 28,1940	9.5 ppm	3 ppm	negative	6 ppm$CaCO_3$
Bull Run (8')	June 4,1940	8.4 ppm	2 ppm	negative	9 ppm$CaCO_3$
" " (100')	June 4,1940	10.6 ppm	1.5 ppm	negative	8 ppm$CaCO_3$
Blue	June 11,1940	9.2 ppm	7 ppm	negative	10 ppm$CaCO_3$
Dublin	June 12,1940	7.6 ppm	2 ppm	negative	5 ppm$CaCO_3$
Wahtum	June 13,1940	8.4 ppm	2.5 ppm	negative	7 ppm$CaCO_3$
Mud	June 14,1940	7.2 ppm	4 ppm	negative	8 ppm$CaCO_3$
Hicks	June 18,1940	7.6 ppm	2.5 ppm	negative	6 ppm$CaCO_3$
North	June 19,1940	7.4 ppm	1.5 ppm	negative	7 ppm$CaCO_3$
Bear	June 20,1940	7 ppm	2 ppm	negative	8 ppm$CaCO_3$
Black	June 21,1940	8 ppm	3 ppm	negative	15 ppm$CaCO_3$
Warren	June 25,1940	7.6 ppm	4.5 ppm	negative	3.5ppm$CaCO_3$
Rainy	June 26,1940	8 ppm	3 ppm	negative	15 ppm$CaCO_3$
Scout	June 27,1940	7.25ppm	2 ppm	negative	11 ppm$CaCO_3$
Jean	July 26,1940	8 ppm	2 ppm	negative	
Harriet	July 30,1940	8.8 ppm	4.5 ppm	negative	16 ppm$CaCO_3$

WINTER KILL

The matter of winter kill has been the subject of many publications and the theories as to its cause have been widely discussed. Therefore, this phase of the matter will not be gone into here. Several lakes were found that because of their shallowness one would not expect them to hold fish but which did contain fish that had survived at least one winter. This raises the question, "What is the least depth of water in which fish may be planted?" Some shallow lakes were recommended for planting in order to get information that may answer this question.

SPECIES OF FISH PRESENT

The lakes of the Mt. Hood forest are most suitable for salmonoid fishes, and none were found with fish other than trout in them. Four species of trout were found during the survey: eastern brook trout, Salvelinus fontinalis; rainbow trout, Salmo gairdnerii; cutthroat trout, Salmo clarkii; and Loch Leven trout, Salmo trutta. Of these the rainbow and cutthroat are native fish, and the eastern brook and Loch Leven exotic. Their distribution can be seen in the charts in the appendix.

In all, 12 lakes were found that had cutthroat or rainbow in them, although some of the rainbow have been planted. Loch Leven were found in five lakes. Eastern brook are the most common as they have been the most available for planting and prove the most satisfactory for growth and condition in the mountain lakes. In some instances, mackinaw or lake trout, Cristivomer namaycush, have been introduced into Cascade lakes but did not prove satisfactory as they make very slow growth under such conditions and tend to become cannibals almost exclusively and defy all attempts to take them on hook and line. The Loch Leven in some mountain lakes have proven fairly good but on the whole are not to be recommended. Generally they are very difficult to take on hook and line and become cannibalistic. Also they tend to become thin as they get older as shown by a 17½-inch Loch Leven caught in Round Lake that weighed only 1-3/4 pounds. When possible it is best to encourage the native species, and in other cases in our mountain lakes the eastern brook seem to be the best species to stock.

PARASITES

Fish, like most forms of life, are commonly afflicted with parasites of one kind or another. In general a normal infestation of parasites does the host little if any harm, as it is to the best interests of the parasite that its host stays in good shape. However, in the case of certain parasites, or of very heavy infestations, the result can be very serious. As no microscope or other laboratory facilities were available, parasitological investigations were necessarily superficial.

The tapeworm, Dibothrium cordiceps, is carried by water birds and spends one of its larval stages in a fish. This worm was first found in Elk Lake (Deschutes forest) and was determined to have been brought in by pelicans. Since then it has been found in several Cascade lakes and a number of other birds have been convicted of carrying it. During the 1939 season a rather heavy infestation of this parasite was found in Olallie Lake. A fifteen-inch trout was picked up dead and given to the writer. Upon examination it proved to be heavily infested with the larval form of this worm, the organisms almost covering the outside of the intestines and lining of the body cavity. This may not have been the direct cause of death but it was certainly a strong contributing factor. The majority of the fish examined from this lake (all eastern brook) proved to be infested to some degree by this tapeworm.

During the 1940 season D. cordiceps was again found in Lost Lake infesting Loch Levon as well as eastern brook. The infestation in this lake did not appear to be nearly as heavy, however, and the fish did not seem to be at all bothered by it. Also a small rainbow from this lake had a round worm of the genus Philometra encysted on the wall of the body cavity. Otherwise the trout was in good condition and appeared to be suffering no ill effects from the worm.

On two occasions parasitic round worms were found in the stomachs of trout. Both were eastern brook, one from Scout Lake and one from Boulder. Seemingly the presence of these was doing the fish no harm.

In Triangle Lake which was planted for the first time this past summer a 3-inch eastern brook was captured while alive, but obviously near death. It was badly bloated, one eye was somewhat popped, and three small black leeches were attached to the gills. This fish was sent in to the Bureau of Fisheries station at Clackamas and a partial report received from Mr. Reid Neilson. Upon dissection the swim bladder was found to be greatly distended. The leeches were in all probability a secondary infestation attacking the fish after it had become weakened and slowed down by whatever caused the distention of the swim bladder and other symptoms. Nevertheless it shows that the leeches are ready and waiting to get in their share of harm on any fish they can catch.

WATER DOGS

Almost without exception the lakes surveyed had large populations of Pacific newts (Triturus), locally known as "water dogs". They are lizard-like in superficial appearance, and are an air-breathing amphibian. They are light to dark brown on the dorsal surface and a bright yellowish orange on the ventral side. They are found in surprisingly deep water at times, having been observed coming to the surface in 35 feet of water. One was seen about 10 feet down in a place that was 111 feet deep, although it is possible that it had merely moved out from shallow water near shore. As they breathe air and can get around quite well on hand, they may make extensive migrations and so are very widespread. When obtaining air they break the surface of the water and frequently flip their tails as they start down again and so are sometimes mistaken for rising fish. The writer has never seen them eaten by fish or found them in fish stomachs, and has heard only one report of their being so taken. It is therefore concluded that they furnish no fish food. Also it is known that, particularly at certain seasons of the year, they are poisonous if eaten. Cases are known where chickens and cats have been killed, and one, supposedly true, of a man dying from accidentally boiling one while making coffee. Besides being inedible they will consume young fish. In this way they are detrimental, and also they compete with fish for food as they can be seen rooting around in the bottoms after the same organisms that trout feed upon, as well as feeding on the surface. There is no method developed as yet to eradicate these creatures. Such a method would be of much value, as in addition to the above mentioned harmful characteristics they certainly add nothing of an esthetic nature to the lakes.

CREEL CENSUS

During the 1939 and 1940 seasons an attempt was made to make a creel census on four lakes with the help of forest guards stationed on these lakes. The lakes chosen were Olallie, Breitenbush, Lost, and Badger as these all had guards stationed there who could secure the information. However, the guards are at their stations only from July to September on the average and so miss the most productive parts of the fishing season. However, a good check kept regularly from year to year even for this short period would prove valuable. The difficulties are that the guards have many other duties and frequently are called away on fires. The marked lack of cooperation from the fishermen is also a deterrent. More and better figures were obtained in 1939 than in 1940 as less time was lost because of fires in that year. In fact no reports from Badger Lake for 1940 have been received.

Tables 6 and 7 show the essential data obtained for both seasons so that they can be compared. As can be seen, the results per man hour of effort showed no improvement, or even a decrease in 1940 over 1939. However, the figures are so few and the accuracy of some so open to doubt that these results cannot be taken too seriously. The length and weight figures for 1939 and those for length for 1940 are fairly good, but the weights for 1940 are not so accurate. However, the figures, for what they are worth, are presented.

This creel census would be a worthy project if it could be carried out thoroughly but it does not appear that the guards, while they are willing and interested, have the time to devote to it. Unless it can be conducted more thoroughly it is not recommended for continuation.

FISHING CONDITIONS IN GENERAL

Considering the forest as a whole the fishing cannot be considered very good. This does not mean that it is bad everywhere and all the time, but good catches of fair-sized fish are difficult to obtain. Of course better catches are made early in the spring and in the fall when conditions in the woods are such as to discourage all but the more hardy fishermen.

This condition can be blamed primarily on the heavy fishing drain. The contrast between the lakes easily accessible and those closed to the public or 15 or 20 miles from a road is striking. In the back country of the south end of the forest fishing is good. Generally not a great number of fish can be caught but they are of good size and not many of them are needed to satisfy the angler. On the other hand in lakes near roads, 6" or 7" trout make up the catch, and with fish of this size the angler is usually not satisfied with less than the limit or more if the fish are biting good as they sometimes do.

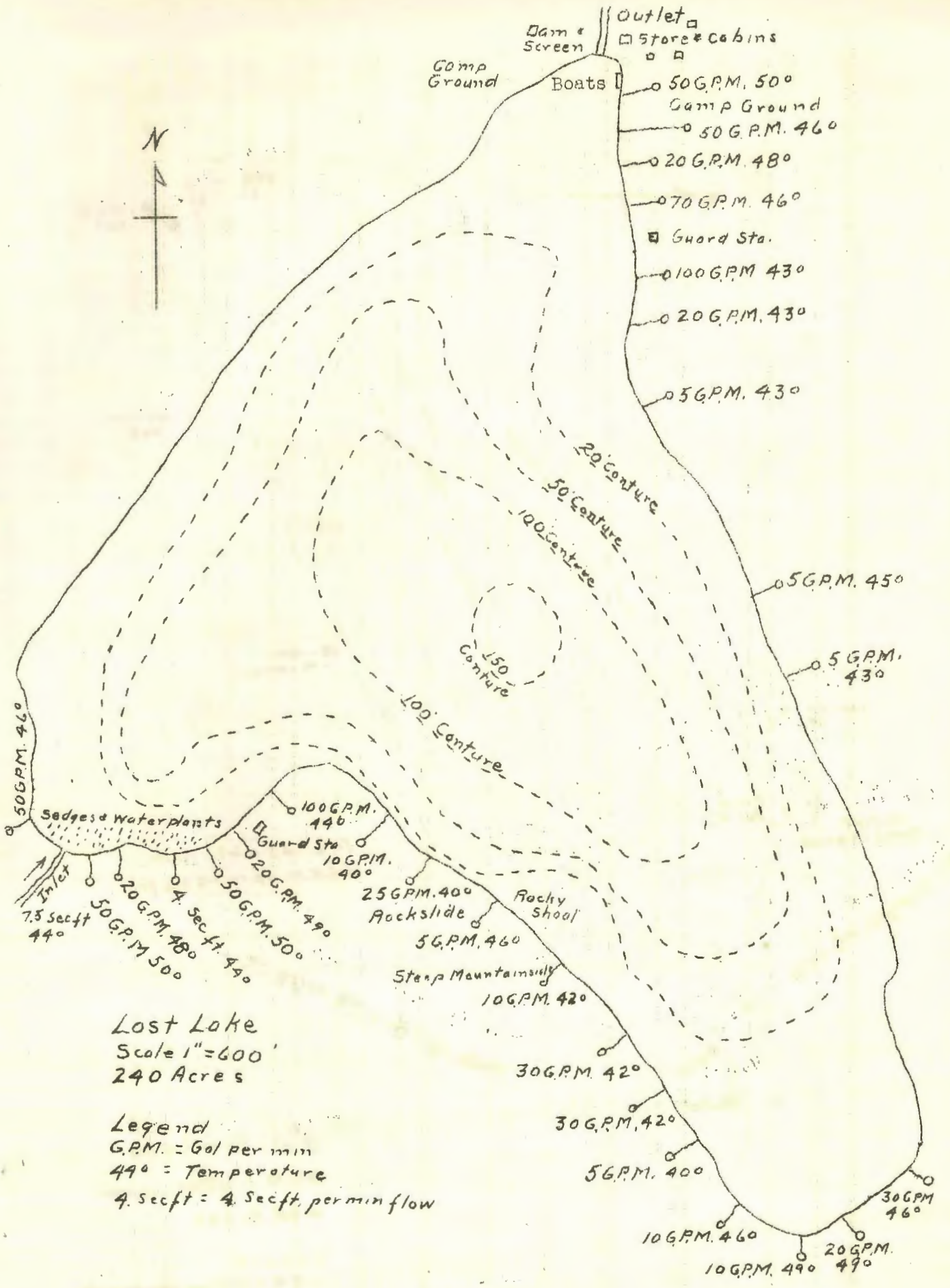
As a case in point two large lakes, Lost and Bull Run, may be pointed out. These lakes are quite similar in general characteristics and both large, containing 240 and 455 acres respectively. They are both rather inorganic with little vegetation and a small proportion of shallow water. Maps 1 and 2 show the lakes with depth contours and inlets and outlets. In both cases a number of the inlets probably dry up later in the year as they were surveyed in the spring. Lost Lake has a road in to it, a concession with store, cabins, and boats, and a large campground.

TABLE NO. 6 CREEL CENSUS - MAN HOURS DATA

Name of Lake	Time Covered	No. of Anglers	Fish Caught	Man-hours Fishing	Catch per man-hour.
Olallie 1939	7/9/39 - 8/29/39	78	414	405.5	1.02
1940	7/4/40 - 9/2/40	39	261	253.5	1.02
Breitenbush 1939	7/9/39 - 9/4/39	215	1309	812	1.61
1940	7/18/40 - 9/1/40	7	44	39	1.12
Lost 1939	7/16/39 - 8/7/39-8/31/39	15	170	154.25	1.10
1940	6/30/40 - 9/2/40	10	36	48	.75
Badger 1939	7/13/39 - 8/24/39	227	506	1340	.37
1940					

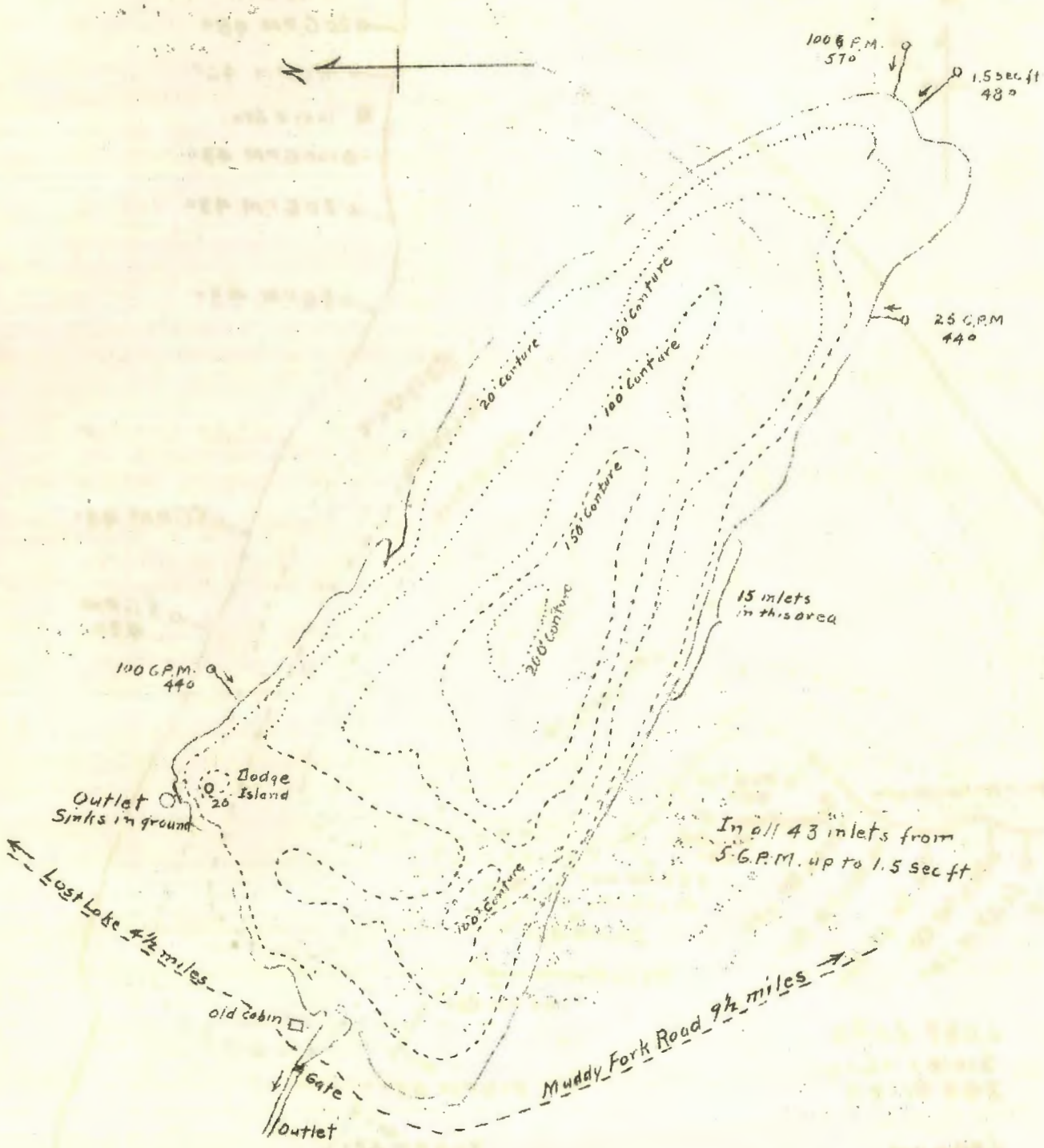
TABLE NO. 7 CREEL CENSUS DATA ON CATCH

Name of Lake	No. of Fish	Longest	Shortest	Av. of all Catches	Total Weight	Species & %	Av. wt. per fish
Olallie 1939	414	14"	6"	8.29"	--	Eb 100%	--
1940	261	15"	6"	8.8"	weights	Eb 100%	given less than hair or catch
Breitenbush 1939	1309	11"	6"	7.25"	156.5#	Eb 100%	1.92 oz.
1940	44	10"	5"	7.6"	15#	Eb 100%	5.4 oz. (mistaken wts.)
Lost 1939	170	14"	5.5"	7.74"	29.5#	Rb 41.17% Eb 56.47% Ll 2.35%	2.77 oz.
1940	36	20"	7"	9.3"	weights incorrectly recorded.		
Badger 1939	506	17.5"	5"	8.3"	139.04#	Rb 100%	4.4 oz.
1940							



Lost Lake
Scale 1"=600'
240 Acres

Legend
G.P.M. = Gal per min
49° = Temperature
4. Secft = 4. Secft. per min flow



Bull Run Lake
Scale 1" = 1200' (approx)
455 Acres

Legend
G.P.M. = gallons per minute

As can be expected, the fishing is heavy on this lake. However, the returns are very low (see under Creel Census heading) in spite of hundreds of thousands of small fish that have been planted there in the last few years. On the other hand, Bull Run Lake is in the Bull Run Division and closed to the public so there is no fishing drain. In the course of the survey no difficulty was encountered in securingthe necessary fish specimens without resorting to a gill net--and the fish are all native cutthroat up to 14 inches.

These two lakes form a good natural experiment as they are nearly the same in all respects except those introduced by man. It makes a good piece of evidence that overfishingdue to a large center of population close to the lakes is the chief cause of our declining fresh-water sport fisheries. Perhaps part of the solution could be found in planting legal-sized fish in waters that can be easily reached.

BEAVER PLANTING SITES

During the survey a lookout was kept for locations where beaver might be advantageously planted. A number of lakes were chosen where such projects might be profitable.

Hickman Lake on the Bull Run Division formerly had a colony of beaver and would be a place to reintroduce them. If they would dam the outlet and raise the lake it would be an improvement. Perhaps an area down the outlet would be good. The headwaters of the Bull Run Watershed, while closed to fishing, are good places for beaver as their activities would tend to conserve water and so help insure this valuable water supply. The effect of beaver, however, on the purity of water for domestic use should first be determined.

Burnt Lake is also so situated that a small dam would raise the water considerably and perhaps incorporate some small ponds with their fish food into the main lake. This would be advantageous if the lake is to be opened to fishing although technically in the Bull Run Division.

Salmon Lake is a shallow lake recommended for an experimental plant. It is well supplied with potential beaver food and has a running outlet, but is very shallow. If introduced beaver would dam this outlet and so deepen the lake it would be much improved and no damage done.

Surprise Lake on the Lakes Ranger District formerly had beaver but at present the outlet dries up in late summer and the lake becomes very shallow and swampy. If beaver were brought back and dammed the outlet the lake would be raised, water conserved, and the lake generally improved.

Anvil Lake is a small beaver-made lake furnishing cutthroat fishing. There are no recent signs of beaver and their reintroduction would improve the lake.

Cripple Creek Lake is a fairly shallow lake that would be improved by having the level raised by damming the outlet. Beaver might accomplish this task.

Palmer Lake is in the Bull Run Division and is well suited to beaver. Beaver in this location would help conserve the water supply in the Bull Run Watershed.

The lakes in the south end country that would be attractive to beaver already have colonies on them. The outlet from one of these, West Lake, has a series of dams down it making a fresh stand of alder available to the beaver as they have denuded the shores of the lake itself.

HOLDING AND REARING POND SITES

One of the objects of the survey was to locate possible holding and rearing pond sites. Zigzag, headquarters of the Bull Run District, is one good location and two holding ponds have been completed on Bear Creek at that location.

High Rock Spring on the Lakes District has a fairly good flow of water suitable for holding ponds. As this is the only available water for some distance and is within striking distance of a number of lakes, it is valuable for this purpose.

Clackamas Lake has a large flow of spring water but it is so cold that it would be unsuitable for rearing ponds unless some method were devised by which the water could be warmed. For holding ponds or live boxes it would be quite satisfactory.

Breitenbush Lake has a continuously running inlet and this could be used as a water supply for holding ponds. As this lake is quite high, 5500', the growing season would be too short for rearing ponds. This is the nearest constantly running water supply to the concentration of lakes in the Olallie area so good arrangements for holding fish here would be advantageous.

At Oak Grove Ranger Station is a meadow and stream where a holding pond could be developed. Fish have been held here in the past under rather makeshift arrangements. A good holding pond could be built with little trouble. The stream, which has a tendency to be warm, might be improved to over come this condition. As Oak Grove is the distributing point for a large territory it would be an advantageous place for a holding pond.

IMPROVEMENTS

The lakes are in little need of physical improvements as most of them are quite well supplied with rock or log cover. Some could be bettered by installation of cover, but this should not be attempted unless sufficient cover devices are put in to avoid concentrating the fish in a few places. If only a few devices are put in they tend to draw small fish to those points; these are followed by larger fish, and those in turn by anglers. A situation like this represents poor management practice as it does not make full use of the resources at hand.

Where possible the introduction of aquatic plants into lakes having none should be tried. Such plantings should be placed to avoid strong wave action, or to be protected from it, perhaps by staking logs parallel or at a slight angle to the shore. Bottom forms may often be planted in balls of muck, or in containers such as strawberry boxes filled with soil and fertilizer. This gives the plant a chance to get a start before the boxes break away.

Pyramid Lake has a small inlet that forks before entering the lake. If the lake is planted and this inlet confined to one chanel, it might furnish some spawning areas.

There is a screen at the outlet of Olallie Lake to prevent loss of fish during the early spring freshets, but it has not proved satisfactory and large numbers of the fish planted here have gone down the stream into the Warm Springs Indian Reservation. Plans are under way to have men on hand next spring to see that the screen is kept functioning.

There are other lakes in this area that have running outlets in the spring through which fish may migrate. Some provide spawning facilities and the hatched fish return to the lakes. Where the outlets become dry either the young fish go downstream or are lost.

Some improvement work on several of the inlets at Lost Lake would give added possibilities for spawning. Some could be cleaned out and perhaps several small ones confined to one channel and so made to offer natural propagation possibilities.

There is some possibility that a little improvement on the small inlet to Hicks Lake might pay dividends. This inlet is very short but is good spring water and could furnish some spawning area.

Rainy Lake has many dead snags around a large part of its shoreline, some of which are well out in the water. Some logs and snags are an advantage but here they should be thinned out to some extent to give the angler more opportunity.

The outlet to Badger Lake should be cleaned out and the stream improved to furnish more spawning areas but if a proposed irrigation dam is put in here, such improvement work will be lost.

The bars before the intake at Harriet Lake Reservoir are so spaced that fairly large fish can be drawn through them. It should be determined if fish are being lost here, and if so the screen improved to stop such a loss.

At Round Lake the inlets and outlet are used for spawning but a little improvement work done on these streams will provide more spawning area. Natural propagation is worth much more to a lake than artificial stocking.

STOCKING RECOMMENDATIONS

Before the stocking recommendations were made up for the lakes surveyed in 1939, one and one-half days were spent with Dr. Paul Needham discussing stocking policies and their formation. The recommendations in this report should not be considered final as they will undoubtedly require alteration in the light of facts that will be learned in the future. There is much yet to be learned about the controlling factors of fish production under natural conditions.

The data collected during the survey tend to show that most of the lakes do not have sufficient food to support the large numbers of fish that have been put into them in the past. For this reason the recommendations usually call for smaller numbers of fish than have been planted in the past. The small lakes are capable of supporting a certain number of fish just as a pasture is capable of supporting just so many head of stock. When possible, the best way to provide fishing in such lakes is to plant legal sized fish, preferably at intervals during the season. In this way the fisherman's money is spent to raise poundage of trout in the hatchery, and this poundage is returned directly in catchable fish. Where lakes are located on a road such plantings are relatively simple, and while native reared fish are usually preferred, the increasing army of anglers makes the supply inadequate. This is being practiced some places in the east and sooner or later may have to be resorted to here. For lakes situated on roads a recommendation is given for legal size fish and an alternative of fingerlings.

When the recommendations were determined for the lakes surveyed in 1939, two-inch fish were the most available and stocking tables were based on that size. Upon word from the state that three-inch fish were in prospect for next season, the recommendations for the lakes surveyed during 1940 are made on that basis. A group of small lakes may sometimes all be stocked from one pack train load, and this was taken into consideration in the stocking policy.

In lakes recommended for cutthroat, no other species should be planted, even if the lake has to be skipped. These lakes furnish some fishing from natural propagation and cutthroat fishing is too scarce to be spoiled by introducing other species. Best results are usually obtained from planting only one species in a lake.

Where the chart indicates biennial stocking, stocking plans should list the lakes to be stocked on even or odd years as their location may facilitate the work of planting.

TABLE NO. 8 STOCKING CHART FOR LAKES OF THE LAKES RANGER DISTRICT

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
5	Breitenbush	9S 8E 25	5500'	55	Eb	1500 or	Legal	Annually	On road, plant
						10000	2"	Annually	from truck
6	Pyramid	9S 8E 27	5390'	4.8	Cut.	1000	3"	Annually	Exper. continue if successful.
7	Horseshoe	9S 8E 34	5400'	14	Eb	500 or	Legal	Annually	On road
						1500	2"	Annually	
8	Nup-te-pa	9S 8E 12	4950'	1.5	Eb	1000	2"	Annually	Continue if successful.
9	Mangriff	9S 8E 13	4960'	1	Past experience indicates lake unsuitable for fish.				
10	Monon	9S 8E 13-14	4970'	91	Eb	2000	Legal	Annually	On road
						10000	2"	Annually	
11	Head	9S 8E 2	4950'	4.1	Eb	400	Legal	Annually	On road
						1000	2"	Annually	
12	Gibson	9S 8E 23	5600'	5	Eb	1000	2"	Annually	If successful
13	First	9S 8E 2	4900'	2.8	Eb	400	Legal	Annually	On road
						1000	2"	Annually	
14	Rod	9S 8E 8	4520'	5.8	Eb	2000	2"	Biennially	
15	Averill	9S 8E 4-5	4600'	11.6	Eb	2500	2"	Biennially	
16	Wall	9S 8E 4	4800'	4.8	Eb	1000	2"	Annually	
17	Sheep	9S 8E 3	4810'	3.6	Eb	1000	2"	Annually	
18	Lyden	8S 8E 4	4900'	.9	Eb	1000	2"	Biennially	
19	Boosters	8S 8E 4	4900'	1.1	Eb	1000	2"	Biennially	
20	Upper	9S 8E 15	5380'	7.3	Eb	1000	2"	Annually	Poor food supply
21	Eloise	9S 8E 10	5350'	4.3	Eb	1000	2"	Annually	
22	Vee	9S 8E 10	5300'	1.3	Eb	100	2"	Experimental. Stock lightly next 2 years if successful.	
23	Indian	9S 8E 16	5250'	1.5	Eb	1000	2"	Triennially	If successful
24	Ring	9S 8E 10	5225'	1.8	Eb	1000	2"	Biennially	If successful
25	Top	9S 8E 16	5250'	2.5	Eb	1000	2"	Annually	
26	Timber	9S 8E 14	5180'	9.75	Eb	2000	2"	Annually	
27	View	9S 8E 14	5260'	7.1	Eb	1500	2"	Annually	
28	Lower	9S 8E 2-3	4750'	11.9	Eb	1500	2"	Annually	Food supply poor
29	Middle	8S 8E 3	4990'	1.8	Eb	1000	2"	Biennially	

TABLE NO. 8 Continued. Lakes District

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
30	Gifford	8S 8E 3	4990'	7.8	Eb	1500	2"	Biennially	Start 1942
31	Jaybird	8S 9E 3	4990'	1.5	Eb	1000	2"	Biennially	Food abundant
32	Pear	8S 8E 3	4995'	.75	Eb	Try extras from nearby lakes - continue if successful			
33	Si	8S 8E 21-22	4270'	3	Eb	1000	2"	Biennially	
34	Olallie	9S 8E 11-12	4936'	238.7	Eb	25000	2"	Annually	
35	Fish	8S 8E 22	4400'	18	Cut	2000	2"	Biennially	Cut. Only
36	Surprise	8S 8E 22	4370'	4	Cut	1000	2"	Biennially	Cut. Only
37	Finley	8S 8E 3	5000'	1.5	Eb	1000	2"	Biennially	Remove the few large fish present first.
38	Russ	8S 8½E 26	4600'	6	Eb	2000	2"	Annually	
39	Jude	8S 8½E 26	4590'	1.7	Eb	1000	2"	Annually	
40	Brook	8S 8½E 26	4590'	4	Eb	2000	2"	Biennially	
41	Clackamas	5S 8½E 36	3340'	7	Cut	500	Legal	Annually	Slow growth in lake
						1500	2"	Biennially	
42	Bear	5S 7E 11	4000'	5.1	Eb	1000	2"	Biennially	
43	Rock, Upper	5S 7E 17	4290'	4.1	Eb	1000	2"	Biennially	
44	Rock, Middle	5S 7E 8	4250'	12.5	Eb	2000	2"	Annually	
45	Rock, Lower	5S 7E 8	3900'	7.8	Eb	2000	2"	Biennially	
46	Serene	5S 7E 7	4200'	22	Eb	5000	2"	Biennially	
47	Shellrock	5S 7E 17	3850'	15	Eb	3000	2"	Annually	
51	Buck	5S 8E 30	3940'	9.1	Eb	1000	2"	Triennially	Con.if successful
52	Shining	4S 6E 36	4170'	13.7	Eb	3000	2"	Annually	
53	Dinger	5S 8E 9	4050'	15	Cut	3000	2"	Annually	
54	Anvil	5S 8E 17	3950'	1.7	Natural stocking sufficient.				
64	Frog	4S 9E 17	4000'	11.4	Eb	3000	2"	Annually	
66	Triangle	8S 8E 13		3	Unsuitable for stocking				
67	Frying Pan	4S 8E 26		3	Unsuitable for stocking				
108	Twin	4S 9E 9	4150'	18.5	Eb	2000	3"	Annually	
109	Upper Twin	4S 9E 9	4250'	12	Not suitable for stocking				

TABLE NO. 9 STOCKING CHART FOR THE CLACKAMAS RIVER RANGER DISTRICT

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
48	Hideaway	5S 7E 21	3950'	14.9	Eb	3000	2"	Annually	
89	Surprise #1	5S 6E 27	1430'	4.1	Eb	1000	3"	Biennially	
90	Harriet	6S 7E 4	2600'	23	Rb	3000	3"	Annually	1500 legal if possible
91	Cottonwood	5S 7E 28	4050'	8.2	Eb	1000	3"	Biennially	Con.if 1940 plant successful
92	Memaloose	5S 5E 31	4000'	3	In Oregon City Watershed. Not to be stocked.				
93	High	6S 6E 5	4600'	2	Eb	2000	3"	Biennially	
94	Skookum	6S 5E 35	4500'	4.5	Eb	2000	3"	Biennially	Large Loch Leven should be removed.
95	Surprise #2	8S 8E 22	4050'	4.1	Rb	2000	3"	Triennially	Not advisable to plant till area more accessible.
96	Lilly	7S 6E 20	4500'	1	Eb	1000	3"	Biennially	
97	Pansy	8S 6E 18	3980'	6.3	Eb	1000	3"	Biennially	Natural stocking sufficient at present. Check at intervals.
98	Dickey	8S 6E 17	4380'	1	Not recommended for stocking				
99	Welcome	8S 6E 15	4250'	5.3	Eb	2000	3"	Biennially	
100	West	8S 6E 16	4350'	2	Eb	1000	3"	Biennially	
101	Jiggs	8S 6E 15	4500'	1	Eb	1000	3"	Biennially	Virgin Lake - Continue if successful
102	Big Slide	8S 6E 10	4500'	4.3	Eb	1000	3"	Biennially	Start 1942.
103	Upper Big Slide	8S 6E 10	4600'	1	Eb	1000	3"	Biennially	
104	Round	8S 7E 5	3750'	9	Rb or Eb	2000	3"	Biennially	
105	Beth	8S 6E 9	4500'	4	Eb	2000	3"	Biennially	Virgin Lake. Watch for signs of overstocking.
106	Lenore	8S 6E 11	4500'	3	Eb	1000	3"	Biennially	Virgin Lake. Continue if successful.
107	Triangle	7S 6E 24	2500'	1.2	Eb	1000	3"	Biennially	Determine success of 1940 plant before continuing.
50	Cripple Creek	5S 7E 19	4340'	11.8	Eb	1500	3"	Biennially	

Table No. 9 Continued. Clackamas River District.

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
112	Cub	8S 6E 10	4900'	Too small, shallow. Unsuitable for fish.					
113	(Not named)	8S 6E 9	4650'	" "	"	"	"	"	
114	Upper Big Slide #2	8S 6E 10	4600'	" "	"	"	"	"	Small experimental plant might be made.

TABLE NO. 10 STOCKING CHART FOR THE LAKES OF THE BARLOW RANGER DISTRICT.

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
85	Jean	3S 10E 17	5350'	6	Eb	1000	3"	Annually	
86	Badger	3S 10E 20-21	4500'	34.5	Rb	10000	3"	Annually	
87	Boulder	4S 10E 5	4600'	13	Eb	10000	3"	Biennially	
88	Little Boulder	4S 10E 4	4800'	5	Not recommended for stocking				
111	Spinning				Not suitable for stocking.				

TABLE NO. 11 STOCKING CHART FOR LAKES OF THE COLUMBIA GORGE RANGER DISTRICT.

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
68	Palmer	1N 7E 18	2750'	6	In Bull Run Division. Not to be stocked.				
69	Latourell	1N 6E 24	3100'	6	" " " "			" " " "	
70	Little Latourell	1N 6E 24	3100'	1	" " " "			" " " "	
72	Hicks	1N 8E 5	3950'	2.3	Eb	1000	3"	Biennially	
73	Mud	1N 8E 2	3700'	1	Rb	1000	3"	Triennially	Does not require stocking at present.
74	Wahtum	1N 8E 11	3660'	57	Eb	2500	3"	Annually	
75	Dublin	1N 7E 2	3470'	2	In Bull Run Division. Not to be stocked.				
76	McCord	1N 7E 7	3050'	3	" " " "			" " " "	
77	North	2N 8E 24	3900'	6.2	Eb	1000	3"	Biennially	
78	Black	2N 8E 36	3850'	7.5	Eb	1000	3"	Annually	
79	Bear	2N 9E 18	3980'	2.7	Eb	1000	3"	Biennially	
80	Pollywog	2N 7E 17	3500'	1.5	Eb	500	3"	Annually	Exper. Follow up if successful.
81	Talapus	2N 7E 17	3500'	1	Eb	500	3"	Annually	" " " " "
82	Rainy	2N 8E 25	3930'	9.6	Eb	1000	3"	Annually	
83	Scout	1N 8E 14	4000'	3.2	Eb	500	3"	Annually	
84	Warren	2N 9E 16	3750'	5	Eb	1500	3"	Biennially	

TABLE NO. 12 STOCKING CHART FOR LAKES OF THE BULL RUN RANGER DISTRICT

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
1	Big Goodfellow	2S 7E 4	3150'	18.5	Leave for experimental purposes.				
2	Middle Goodfellow	2S 7E 5	2900'	9	" "	"		"	
3	Lower Goodfellow	2S 7E 5	2880'	19	" "	"		"	
4	Hickman	2S 7E 2	3380'	11.8	" "	"		"	
49	Plaza	4S 7E 17-18	3800'	6	Eb	3000	2"	Annually	
55	Salmon	4S 7E 16	3900'	2	Cut	1000	2"	Annually	Exper. plant. follow lightly for 2 years.
56	Veda	4S 8E 1-2	4200'	2.9	Eb	1000	2"	Annually	4-5 inch fish better.
57	Kinzel	4S 8E 5	4250'	1	Eb	1000	2"	Triennially	Start 1941
58	Burnt	2S 8E 34	4075'	6.4	Cut. (lbs)	1500	1½"	Annually	Continue pres. exper. plant.
59	Dumbbell	2S 8E 32-33	4480'	4.6	Eb	1000	2"	Annually	
60	Devils	3S 8E 8	4090'	1	Eb	1000	2"	Biennially	
61	Hidden	3S 8E 14	3800'	1.2	Eb	1000	2"	Biennially	
62	Mirror	3S 8E 23	4150'	6.9	Eb	2500	2"	Annually	
63	Eena	3S 8E 14	3600'	1.1	Eb	200 or 1000	Legal 2"	Annually Biennially	(Start 1941) 1/8 mi. from road.
65	Wind	3S 8E 27	4300'	2.3	Eb	1000	2"	Annually	Exper. Continue if successful.
71	Bull Run	1S 8E 28	3160'	455.	In Bull Run Division. Not to be stocked.				
110	Blue	1S 8E 7	3780'	30	" " " "			" " " "	

TABLE NO. 13 STOCKING CHART FOR LAKES OF THE HOOD RIVER RANGER DISTRICT.

No.	Name of Lake	T. R. S.	Elevation	Size-Acres	Species	Number	Size	Frequency	Remarks
66	Teacup	3S 9E 13	4100'	1.7	Eb	1000	3"	Biennially	
67	Lost	1S 8E 9-10	3140'	240	Rb	15000	3"	Annually	

A P P E N D I X

TABLE NO. 14 FOOD CHART OF THE LAKES RANGER DISTRICT.

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per $\frac{1}{4}$ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per Sq. ft.	pH	Shrimp (Pres. X)
5	Breitenbush	Aug. 1, 1939	5500'	12	6	Eb	27	7.1	x
6	Pyramid	Aug. 2, 1939	5390'	46	5		66	6.9	
7	Horseshoe	Aug. 6, 1939	5400'	5	7	Eb	15	6.7	
8	Nup-te-pa	Aug. 7, 1939	4950'	40	3		63	6.5	
9	Mangriff	Aug. 7, 1939	4960'	2	3		5	6.7	
10	Monon	Aug. 4, 1939	4970'	7	7	Eb	20	6.9	x ?
11	Head	Aug. 9, 1939	4950'	13	2		39	6.25	
12	Gibson	Aug. 11, 1939	5600'	18	4	Eb	3	6.7	
13	First	Aug. 14, 1939	4900'	5	3	Eb	12	6.7	
14	Red	Aug. 15, 1939	4520'	28	5	Eb	11	6.7	
15	Averill	Aug. 16, 1939	4600'	12	5	Eb	23	6.9	
16	Wall	Aug. 17, 1939	4800'	10	5	Eb	19	6.7	
17	Sheep	Aug. 18, 1939	4810'	4	5	Eb	15	6.8	
18	Lyden	Aug. 18, 1939	4900'	16	5	Eb	21	6.3	
19	Boasters	Aug. 21, 1939	4900'	17	3	Eb	11		
20	Upper	Aug. 22, 1939	5380'	2	5	Eb	2	6.7	
21	Eloise	Aug. 22, 1939	5350'	34	5	Eb	20	6.7	
22	U	Aug. 23, 1939	5300'	28	3		7	6.5	
23	Indian	Aug. 24, 1939	5250'	11	5		11	6.6	
24	Ring	Aug. 24, 1939	5225'	6	3		10	6.7	
25	Top	Aug. 25, 1939	5250'	21	5	Eb	32	6.7	
26	Timber	Aug. 28, 1939	5180'	10	5		7	6.7	
27	View	Aug. 29, 1939	5260'	19	4	Eb	12	6.9	
28	Lower	Sept. 1, 1939	4750'	1	5	Eb	24	6.9	x
29	Middle	Aug. 30, 1939	4990'	6	4	Eb	34	6.9	x
30	Gifford	Aug. 30, 1939	4990'	18	5	Eb	15	6.9	x
31	Jaybird	Sept. 11, 1939	4990'	79	3	Eb	31	6.4	
32	Pear	Sept. 11, 1939	4995'	15	3		62	6.5	
33	Si	Sept. 6, 1939	4270'	30	5		223	6.5	x
34	Olallie	Aug. 8, 1939	4936'	23	6	Eb	20	6.7	x
35	Fish	Sept. 6, 1939	4400'	6	6	Cut	41	7.4	x
36	Surprise	Sept. 7, 1939	4370'	113	3	Cut	280	6.7	x
37	Finley	Sept. 8, 1939	5000'	83	3	Eb	11	6.7	
38	Russ	Sept. 12, 1939	4600'	4	5	Eb	66	7.3	x

Table No. 14 Continued Lakes Ranger District.

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
39	Jude	Sept.13, 1939	4590'	9	3	Eb	116	7.5	x
40	Brook	Sept.12, 1939	4590'	108	4		305	7.1	x
41	Clackamas	Sept.14, 1939	3340'	258	2	Eb - Cut.	20	7.1	x
42	Bear	Sept.18, 1939	4000'	12	3	Eb	143	6.7	x
43	Rock, Upper	Sept.20, 1939	4290'	5	4	Eb	52	6.6	x
44	Rock, Middle	Sept.19, 1939	4250'	16	5	Eb	97	6.9	x
45	Rock, Lower	Sept.22, 1939	3900'	32	3	Eb -Cut.	38	7.3	x
46	Serene	Sept.21, 1939	4200'	17	5	Eb	62	7.1	x
47	Shellrock	Sept.22, 1939	3850'	28	5	Eb	23	7.0	x
51	Buck	Sept.29, 1939	3940'	4	4		51	6.9	
52	Shining	Sept.30, 1939	4170'	27	7	Eb	443	7.1	x
53	Dinger	Oct. 2, 1939	4050'	28	5	?	81	7.2	x
54	Anvil	Oct. 2, 1939	3950'	40	2	Cut	Common	7.1	x
64	Frog	Oct. 18, 1939	4000'	48	5	Eb	263	7.1	x
108	Twin	Sept.11, 1940	4150'	14	10	Eb	114		
109	Upper Twin	Sept.12, 1940	4250'	4	5		76		

TABLE NO. 15

FOOD CHART OF CLACKAMAS RIVER RANGER DISTRICT

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
48	Hideaway	Sept.25, 1939	3950'	69	6	Eb	83	7.0	x
50	Cripple Creek	Sept.28, 1939	4340'	25	5	Eb	115	7.3	x
89	Surprise #1	Aug. 2, 1940	1430'	3	4	Eb	143		x
90	Harriet	July 30, 1940	2600'	59	5	Eb, Rb, Ll, Cut.	17		
91	Cottonwood	July 31, 1940	4050'	9	3	Eb	283		x
92	Memaloose	Aug. 1, 1940	4000	3	4		78		x
93	High	Aug. 6, 1940	4600'	62	5	Eb, Ll	150		
94	Skookum	Aug. 7, 1940	4500'	100	5	Ll	96		x
95	Surprise #2	Aug. 8, 1940	4050'	23	3		157		x

Table No. 15 Continued Clackamas River District

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
96	Lilly	Aug. 10, 1940	4500'	21	3	Eb	99		x
97	Pansy	Aug. 12, 1940	3980'	65	8	Eb	414		x
98	Dickey	Aug. 13, 1940	4380'	54	3		64		x
99	Welcome	Aug. 14, 1940	4250'	68	8	Eb	354		x
100	West	Aug. 15, 1940	4350'	26	5	Eb	135		x
101	Jiggs	Aug. 15, 1940	4500'	18	3		237		x
102	Big Slide	Aug. 20, 1940	4500'	9	6	Eb	479		x
103	Upper Big Slide	Aug. 21, 1940	4600'	34	5	Eb	102		x
104	Round	Aug. 26, 1940	3750'	25	10	Eb, Ll, Rb	586		x
105	Beth	Aug. 22, 1940	4500'	11	5		504		x
106	Lenore	Aug. 23, 1940	4500'	9	5		60		
107	Triangle	Aug. 28, 1940	2500'	7	3	Eb	320		x

TABLE NO. 16 FOOD CHART OF THE BARLOW RANGER DISTRICT

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
85	Jean	July 26, 1940	5350'	34	5	Eb	173		x
86	Badger	Sept. 3, 1940	45000'	178	6	Rb	97	7.2	x
87	Boulder	Sept. 5, 1940	4600'	193	4	Eb	298		x
88	Little Boulder	Sept. 6, 1940	4800'	60	3		106	6.8	x

TABLE NO. 17 FOOD CHART OF THE HOOD RIVER RANGER DISTRICT

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
66	Teacup	Sept. 9, 1940	4100'	35	8	EB	486	6.6	
67	Lost	May 22, 1940	3140'	20	14	Ll, Eb, Rb.	68		x

TABLE NO. 18 FOOD CHART OF THE COLUMBIA GORGE DISTRICT

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
68	Palmer	May 21, 1940	2750'	73	4	Eb	60		x
69	Latourell	May 24, 1940	3100'	32	5	Eb	38		x
70	Little Latourell	May 23, 1940	3100'	42	3	Eb	25		
72	Hicks	June 18, 1940	3950'	15	7	Eb	66		
73	Mud	June 4, 1940	3700'	38	3	Rb	476		x
74	Wahtum	June 13, 1940	3660'	5	5	Eb	37		x
75	Dublin	June 12, 1940	3470'	3	5		72		x
76	McCord Lake	May 22, 1940	3050'	48	2		59		x
77	North	June 19, 1940	3900'	.04	5	Eb	4		x
78	Black	June 21, 1940	3850'	18	5	Eb	10		x
79	Bear	June 20, 1940	3980'	54	6	Eb	194		
80	Pollywog	May 23, 1940	3500'	58	2		9		
81	Talapus	May 23, 1940	3500'	32	3		123		
82	Rainy	June 26, 1940	3930'	6	8	Eb	64		x
83	Scout	June 27, 1940	4000'	5	7	Eb	61		x
84	Warren	June 25, 1940	3750'	47	5	Eb	72		

TABLE NO. 19 FOOD CHART OF THE BULL RUN RANGER DISTRICT

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
1	Big Goodfellow	July 24, 1939	3150'	10	6		21	6.7	x
2	Middle Goodfellow	July 25, 1939	2900'	5	6		27	6.9	x
3	Lower "	July 26, 1939	2880'	65	4	Eb ?	29	6.5	x
4	Hickman	July 27, 1939	3380'	18	5		27	6.9	x
49	Plaza	Sept. 27, 1939	3800'	27	5	Eb	78	6.7	x
55	Salmon	Oct. 3, 1939	3900'	38	5		252	6.95	x

Table No. 19 Continued Bull Run District

No.	Name of Lake	Date Surveyed	Elevation	Bottom Forms per ¼ cu. ft.	No. of Samples	Species of Trout Present	Shore Forms per sq. ft.	pH	Shrimp (Pres. X)
56	Veda	Oct. 9, 1939	4200'	10	5	Eb	77	7.1	x
57	Kinzel	Oct. 10, 1939	4250'	17	2	Eb	8	6.3	
58	Burnt	Oct. 11, 1939	4075'	24	5		59	7.0	x
59	Dumbbell	Oct. 12, 1939	4480'	25	5	Eb	65		x
60	Devils	Oct. 13, 1939	4090'	52	5	Eb	49	6.4	
61	Hidden	Oct. 16, 1939	3800'	90	3	Eb	86	6.7	x
62	Mirror	Oct. 17, 1939	4150'	41	5	Eb	77	7.1	x
63	Eena	Oct. 17, 1939	3600'	9	3	Eb	18	6.5	
65	Wind	Oct. 20, 1939	4300'	69	5	Eb ?	38	6.8	
71	Bull Run	June 4, 1940	3160'	10	11	Cut	44		x
110	Blue	June 11, 1940	3780'	6	7	Cut	88		x

TABLE NO. 20

ADDITIONAL DATA ON LAKES OF MT. HOOD NATIONAL FOREST

Name of Lake	Date Surveyed	Size-Acres	Maximum Depth	Secchi disk Turbidity	Surface Temperature	Bottom Temperature
Middle Goodfellow	July 25, 1939	9	12'	12'	75°	72°
Lower Goodfellow	July 26, 1939	19	9'	9'	80°	66°
Hickman	July 27, 1939	11.8	15'	15'	74°	69°
Breitenbush	Aug. 1, 1939	55	23'	23'	65°	64°
Pyramid	Aug. 2, 1939	4.8	9'	9'	67°	65°
Horseshoe	Aug. 3, 1939	14	17'	17'	70°	68°
Nup-te-pa	Aug. 7, 1939	1.5	24'	20'	69°	64°
Mangriff	Aug. 7, 1939	1	14'	14'	71°	70°
Monon	Aug. 4, 1939	91	39'	39'	70°	68°
Head	Aug. 9, 1939	4.1	8'	8'	66°	63°
Gibson	Aug. 11, 1939	5	15'	15'	66°	65°
First	Aug. 14, 1939	2.8	20'	20'	70°	68°
Red	Aug. 15, 1939	5.8	6'	6'	70°	70°
Averill	Aug. 16, 1939	11.6	13'	13'	70°	68°
Wall	Aug. 17, 1939	4.8	12'	12'	64°	61°
Sheep	Aug. 18, 1939	3.6	10'	10'	67°	66°
Lyden	Aug. 18, 1939	1	10'	10'	70°	68°
Boasters	Aug. 21, 1939	1	10'	10'	65°	64°
Upper	Aug. 22, 1939	7.3	14'	14'	64°	63°
Eloise	Aug. 22, 1939	4.3	8'	8'	67°	64°
U	Aug. 23, 1939	1.3	10'	10'	65°	64°
Indian	Aug. 24, 1939	1.5	12'	12'	66°	63°
Ring	Aug. 24, 1939	1.8	11'	11'	67°	64°
Top	Aug. 25, 1939	2.5	6'	6'	63°	57°
Timber	Aug. 28, 1939	9.7	16'	16'	60°	59°
View	Aug. 29, 1939	7.1	10'	10'	62°	59°
Gifford	Aug. 30, 1939	7.8	56'	56'	64°	63°
Jaybird	Sept.11, 1939	1.5	7'	7'	59°	47°
Lower	Sept. 1, 1939	12	73'	54'	61°	50°
Middle	Aug. 30, 1939	1.8	21'	21'	66°	60°
Pear	Sept.11, 1939	1	7'	7'	57°	49°

Table No. 20 Continued Additional Data

Name of Lake	Date Surveyed	Size-Acres	Maximum Depth	Secchi disk Turbidity	Surface Temperature	Bottom Temperature
Si	Sept. 6, 1939	3	10'	10'	60°	59°
Olallie	Aug. 8, 1939	238.7	48'	48'	68°	64°
Fish	Sept. 6, 1939	20	68'	30'	64°	39°
Surprise (Lakes Dist)	Sept. 7, 1939	4	4'	4'	62°	58°
Finley	Sept. 8, 1939	1.5	11'	11'	65°	59°
Big Goodfellow	July 24, 1939	18.5	49'	36'	70°	48°
Russ	Sept.12, 1939	6	18'	18'	60°	49°
Brook	Sept.12, 1939	4	9'	9'	58°	52°
Jude	Sept.13, 1939	1.7	13'	13'	57°	55°
Clackamas	Sept.14, 1939	7	5'	5'	46°	44°
Bear	Sept.18, 1939	5.1	6'	6'	65°	61°
Upper Rock	Sept.20, 1939	4.1	25'	25'	57°	55°
Middle Rock	Sept.19, 1939	12.5	34'	34'	60°	49°
Lower Rock	Sept.22, 1939	7.8	14'	14'	61°	56°
Serene	Sept.21, 1939	22	51	29'	62°	52°
Shellrock	Sept.22, 1939	15	12'	12'	60°	52°
Hideaway	Sept.25, 1939	15	37'	37'	62°	57°
Plaza	Sept.27, 1939	6	13'	13'	59°	52°
Cripple Creek Lake	Sept.28, 1939	11	4'	4'	55°	49°
Buck Lake	Sept.29, 1939	9.1	30'	30'	62°	58°
Shining	Sept.30, 1939	13.7	28'	24'	58°	53°
Dinger	Oct. 2, 1939	15	4'	4'	52°	45°
Anvil	Oct. 2, 1939	1.7	4'	4'	50°	45°
Salmon	Oct. 3, 1939	2	4'	4'	50°	48°
Veda	Oct. 9, 1939	2.9	17'	17'	50°	48°
Kinzel	Oct. 10, 1939	1	5'	5'	54°	51°
Burnt	Oct. 11, 1939	6.4	30'	25'	55°	51°
Dumbbell	Oct. 12, 1939	4.6	20'	20'	51°	48°
Devils	Oct. 13, 1939	1	5'	2.5'	51°	49°
Hidden	Oct. 16, 1939	1.2	14'	14'	45°	40°
Mirror	Oct. 17, 1939	6.9	20'	20'	51°	48°

Table No. 20 Continued Additional Data

Name of Lake	Date Surveyed	Size-Acres	Maximum Depth	Secchi disk Turbidity	Surface Temperature	Bottom Temperature
Eena	Oct. 17, 1939	1.1	5'	5'	48°	45°
Frog	Oct. 18, 1939	11.4	6'	6'	50°	49°
Wind	Oct. 20, 1939	2.3	3'	3'	48°	47°
Bull Run	June 4, 1940	455	222'	47'	56°	39°
Blue	June 11, 1940	30	84'	29'	60°	39°
Teacup	Sept. 9, 1930	1.7	6'	5'	60°	60°
Lost	May 28, 1940	240	167'	45'	60°	39°
Palmer	May 21, 1940	6	5'	5'	68°	66°
Latourell	May 24, 1940	6	5'	5'	65°	62°
Little Latourell	May 23, 1940	1	5'	5'	74°	59°
Hicks	June 18, 1940	2.3	5'	5'	69°	69°
Mud	June 14, 1940	1	2'	2'	58°	
Wahtum	June 13, 1940	59	184'	50'	60°	39°
Dublin	June 12, 1940	2	9'	9'	69°	66°
McCord	May. 22, 1940	4	4'	4'	71°	64°
North	June 19, 1940	6.2	7'	7'	64°	64°
Black	June 21, 1940	7.5	6'	6'	58°	58°
Bear	June 20, 1940	2.7	12'	12'	62°	62°
Pollywog	May 23, 1940	1.5	4'	4'	72°	70°
Talapus	May 23, 1940	1	4'	4'	67°	67°
Rainy	June 26, 1940	9.6	8'	8'	60°	59°
Scout	June. 29, 1940	3.2	7'	7'	64°	62°
Warren	June 25, 1940	5	8'	8'	67°	62°
Jean	July. 26, 1940	6	22'	5'	61°	60°
Badger	Sept. 3, 1940	34.5	33'	16'	60°	58°
Boulder	Sept. 5, 1940	13	18'	18'	58°	58°
Little Boulder	Sept. 6, 1940	5	3'	3'	65°	65°
Surprise #1 (Clack. R. Dist).	Aug. 2, 1940	4.1	14'	14'	67°	64°
Harriet	July 30, 1940	23	39'	39'	52°	48°
Cottonwood	July 31, 1940	8.2	4'	4'	64°	63°
Memaloose	Aug. 1, 1940	3	6'	6'	61°	61°

Table No. 20 Continued Additional Data

Name of Lake	Date Surveyed	Size-Acres	Maximum Depth	Secchi disk Turbidity	Surface Temperature	Bottom temperature
High	Aug. 6, 1940	2	12'	12'	63°	61°
Skookum	Aug. 7, 1940	4.5	15'	15'	74°	52°
Surprise #2 (Clack. R. Dist.)	Aug. 8, 1940	4.1	3'	3'	74°	72°
Lilly	Aug. 10, 1940	1	3'	3'	68°	64°
Pansy	Aug. 12, 1940	6.3	6'	6'	70°	64°
Dickey	Aug. 13, 1940	1	3'	3'	68°	66°
Welcome	Aug. 14, 1940	5.3	11'	11'	68°	66°
West	Aug. 15, 1940	2	6'	6'	65°	61°
Jiggs	Aug. 15, 1940	1	6'	6'	70°	65°
Big Slide	Aug. 20, 1940	4.3	12'	12'	66°	64°
Upper Big Slide	Aug. 21, 1940	1	12'	12'	68°	66°
Round	Aug. 26, 1940	9	28'	23'	66°	59°
Beth	Aug. 22, 1940	4	34'	34'	66°	56°
Lenore	Aug. 23, 1940	3	10'	10'	66°	64°
Triangle	Aug. 28, 1940	1.2	24'	20'	65°	50°
Twin	Sept.11, 1940	18.5	18'	18'	62°	62°
Upper Twin	Sept.12, 1940	12	3'	3'	62°	62°