DEPARTMENT OF AGRICULTURE
U. S. FOREST SERVICE

LAKE SURVEY OF THE WILLAMETTE NATIONAL FOREST

by

F. C. Ziesenhenne
Junior Biologist

Eugene, Oregon
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INTRODUCTION

PURPOSE OF THE SURVEY

This report is a continuation of the lake survey of the Willamette National Forest which was started in 1936. The survey is being conducted under the joint cooperative agreement between the U. S. Bureau of Fisheries, Department of Commerce, and the U. S. Forest Service, Department of Agriculture, signed March 18, 1935. The survey is sponsored by tentative cooperative program of the U. S. Forest Service and the U. S. Bureau of Fisheries for stream and lake surveys, stream and lake improvements, and detailed fresh water investigations in the National Forests of Region 6, approved June 25, 1937.

The purpose of the survey is:

(1) To develop scientific stocking policies for the lakes of the Willamette National Forest.
(2) To determine the need for lake improvements.
(3) To ascertain whether or not existing regulations are suitable and to recommend such changes as seem advisable in the light of facts determined.
(4) To open up for study, special critical problems existing in various waters.
(5) To locate possible rearing pond and hatchery sites.

During the survey collections of fish, fish scale samples, plants, plankton, crustaceans, mollusks, and aquatic insects were made. These specimens are being sent to specialists for classification so that the species, range, and distribution of lake flora and fauna will be known. This information will be available to other biologists working on similar programs and naturalists in other fields of science. This information is contained in the report.

This report includes the survey data for the lakes surveyed in 1936 and 1937. About 100 lakes are unsurveyed which are not included in this report. The conditions of the lakes recorded in the report were obtained only on the day the lake was surveyed. Because of the great seasonal changes, the data listed for the date of survey, is incomplete. From the data obtained a more sound lake management plan is being made. When it becomes possible to visit each lake several times during the year a more complete survey of the seasonal changes can be made.

PERSONNEL

The survey party consisted of Junior Biologist Fred C. Ziesenhenne, leader of the party; Charles J. Campbell and Millard F. Howe, Technical Assistants, Seniors in the Game Management school of Washington State College, Pullman, Washington. On September 10 both assistants returned to college and the services of Ernie Hebert were obtained for the remaining month of field work. During the summer the party was assisted by numerous volunteers and Forest Service officials.

TIME IN THE FIELD

Four months were devoted to actual field work, June 15 to October 15 inclusive. Due to the heavy snow fall of last winter, many of the lakes could not be reached until late in July. The lower accessible lakes had to be worked early in the season, leaving only the higher lakes to be surveyed. Adverse weather conditions in the high altitudes concluded the field work for the season of 1937. The remainder of the year was devoted to writing the season's report, building the lake management plan, and working on the biological collection.

Mr. E. P. Cliff, of the Regional Office, and Dr. P. R. Needham of the U. S. Bureau of Fisheries, spent July 1 to 3 inclusive, in Eugene, discussing problems and plans for the summer's work. At that time many problems were presented that required experimental work. It was decided that a creel census of fish caught would be taken on lakes where Fire Guards were stationed during the summer. Due to a late start and closed season on some lakes, incomplete returns were received from only two lakes.

The survey party was again visited by Mr. E. P. Cliff on September 21 to 23 inclusive, while working in the Taylor Burn country. During the visit Wahanna and Torrey Lakes were surveyed. The evenings were devoted to a conference in which stocking recommendations, test lakes and streams, improvement work, big game problems and the plans for next year's work were discussed.

EQUIPMENT

The survey equipment was loaned to the U. S. Forest Service by the U. S. Bureau of Fisheries at Palo Alto, California. The apparatus used in the lake investigations were: Ekman bottom dredge, plankton nets, fish nets, water sample bottle, a portable rubber air boat, thermometers, notebooks, sieves, preservatives, and other supplies usually employed in biological field collecting.

In addition to furnishing automotive transportation and a pack string of five burros, the U. S. Forest Service provided complete camping equipment, maps, preservatives, containers, thermometers, camera, collapsible shore sampler, plant press, and a portable rubber air boat.

METHODS OF TAKING AND RECORDING DATA

With the exception of a few improvements recommended by Dr. P. R. Needham and Mr. E. P. Cliff, the method of recording data was carried out as directed by Dr. A. S. Hazzard in his "Instructions for Stream and Lake Survey Work", revised edition, mimeographed by the Department of Commerce, U. S. Bureau of Fisheries, April, 1935.

ACKNOWLEDGMENTS

The writer wishes to express his indebtedness to Mr. P. A. Thompson, Supervisor of the Willamette National Forest, Mr. E. P. Cliff, of the Regional Office, the Eugene office personnel, the District Rangers and their staffs, Dr. Paul R. Needham, of the U. S. Bureau of Fisheries, and numerous friends who assisted the party or contributed information concerning the lakes.

Thanks are due Dr. Morton E. Peck, of Willamette University, for plant identifications; Dr. Fenner Chace of Harvard University for crustacean identifications, and Dr. Trevor Kincaid, of the University of Washington, for the loan of equipment and the classification and mounting of a set of plankton samples for the Willamette National Forest.

NATIONAL FOREST LAKES SURVEYED

The area of the Willamette National Forest is about 1,800,000 acres. The Forest is bounded on the north by the Mt. Hood National Forest, on the east by the crest of the Cascade Mountains, beyond which lies the Warm Springs Indian reservation and the Deschutes National Forest, on the south by the Umpqua National Forest and on the west by the fertile Willamette Valley. The greater part of the forest lies within Linn and Lane Counties, while smaller areas are contained within Douglas and Marion Counties.

The annual average rain fall for the entire forest is about 70 inches. Snow banks were seen on the shores of some of the higher lakes as late as August. The highest mountain peaks of the Cascades are glaciated. Mt. Jefferson a 10,582 ft. peak has a total of about 900 acres of glaciers that drain to the west slope and feed the North Santiam River through numerous tributaries. To the south the Three Sisters, all over 10,000 ft. in elevation, have a total of 1,100 acres of glaciers that drain to the west and feed the McKenzie River and its tributaries. These sources keep most of the creeks and streams flowing throughout the year. During August only a few streams were found drying up, with these exceptions, all of the streams are suited for fishing.

The westward flow of the water from the crest of the Cascade Mountains is drained by five major river systems that eventually reach the Willamette River of the Columbia River drainage system. From the north to the south respectively are the Breitenbush River, the North Santiam River, the South Santiam River, the McKenzie River and the Middle Fork of the Willamette River. These rivers and their tributaries afford many miles of spawning beds for the salmon and steelhead.

Six major roads that cross the Cascade Summit joining Eastern Oregon with the Willamette Valley, parallel the above five rivers. The sixth highway parallels Salt Creek of the Middle Fork of the Willamette River. These roads offer good transportation to thousands of anglers that fish the lakes and streams annually.

The lakes on the Forest are numerous. Over 250 of them are suitable for fishing. Of this number 174 lakes have been surveyed the past two years. The lakes range in size from Waldo Lake 5053 acres to numerous small lakes unsuited for fish. The average size of the lakes is 26.5 acres.

The watershed of the Willamette Forest is good. Virgin stands of timber cover the greater area of the Forest. At the lower altitudes Douglas fir, cedar, hemlock and hardwoods are the dominant trees. At higher altitudes Lodgepole pine, white pine, hemlock and numerous firs are predominant. Only the higher mountain peaks and lava beds are free from dense vegetation.

GENERAL CHARACTERISTICS

With a few exceptions all of the lakes surveyed are of a glacial origin. Terminal and lateral moraines account for the formation of many of the smaller lakes. Some lakes have formed in old cirques. Practically all of the lakes are above 3000 ft. in elevation and lie along the crest of the Cascade Mountains. Evidence of glacial activity can be seen on the rocky shores of many of the lakes. With the exception of Moose Lake, which was formed by a rock slide in Moose Creek Canyon, all of the lakes are above 3000 ft. elevation. Several lakes were found at 7500 ft. elevation on the shoulders of the Three Sisters and one lake exists in the crater on the top of the South Sister. These lakes are not suited for fishing because of the short growing season and the inaccessibility of the lakes. The lakes surveyed were between 3000 and 6100 ft. in elevation. Seventy-five percent of the lakes surveyed were between 4500 and 5500 ft. The majority of these lakes are small and shallow. Only five lakes have a depth of over 100 ft. The average maximum depth of the lakes is 26.5 feet.

Only 26% of the lakes surveyed had running inlets and outlets with good spawning areas. Fair reproduction was observed in most of these lakes. In some lakes the spawning conditions could be improved. Four percent of the lakes had running inlets but no outlets. Spawning conditions were found to be only fair in these lakes. Five percent of the lakes had running outlets but no inlets. There was little, if any, spawning in these lakes.

Lakes without inlets or outlets comprise 65% of the 174 surveyed lakes. These lakes are fed by melting snow and rain and maintain their water levels until the snow is exhausted. About June their outlets ceased to flow and a period of evaporation and seepage begins and continues until the fall rains commence. Many of the smaller lakes dry up completely by fall. Spawning in these lakes is an impossibility. Shoal gravel is soon exposed by a receding water level. In several lakes eastern brook trout were observed spawning in the gravel at a depth of five feet. Since there were no young fish seen in the lake, the eggs probably never hatched at that depth due to the poor aeriation. It was believed that eastern brook trout could spawn in the bottom gravel of these lakes and maintain themselves. During the survey no reproduction was observed in any of these lakes. In the majority of the cases, eastern brook trout taken from these lakes were not spawning but were absorbing the spawn within the body cavity. Two and sometimes three distinct years of spawn could be found in the body cavity. One eastern brook trout had only the remains of the egg cases in the body cavity, the other portions of the spawn were absorbed. The only solution of maintaining a fishable population in these lakes is to stock the lakes artificially every few years with hatchery fish.

Besides the spawning problem the receding lake levels prevent the plants from establishing themselves on the shore. Large lakes with gravel shores are washed free of organic material by wave action and it is impossible to build up soil on the lake shores. In some cases the

wave action on the shore had under-cut the banks preventing the growth of plants. Such wave washed shores are devoid of both plant and animal foods.

Temperature variations of water were great during the survey and ranged from the extreme high of 81° F. on the surface of Davis Lake on July 21, 1936 to Linton Lake which on June 21, 1937 had a reading of 43° F. The average summer temperature ranged from 50° F. to 70° F. during the survey.

Of the five Ranger Districts on the Forest, West Boundary is the only District that does not have any lakes. The lakes of the Detroit, Cascadia and McKenzie Ranger Districts have been completely surveyed. Thirty-four of the possible 100 lakes have been surveyed on the Oakridge Ranger District. Another season will be required to complete the survey of the lakes in the Oakridge District. In addition to the unsurveyed lakes, about 300 miles of streams remain to be surveyed in the five Ranger Districts.

FOOD SUPPLIES

The lake foods consist of four general types: plankton or free swimming microscopic forms, bottom and shoal aquatic insect food organisms, terrestrial insects, which fall into the water, and small forms of vertebrate life, frogs, toads and small fish.

PLANKTON

All of the lakes were relatively rich in plankton. These organisms consist mainly of free-swimming plants and animals that live in the upper layers of water. Many are microscopic in size, but when very abundant or wind drifted, or compacted, they color the water green or red. Copepods and water fleas are the predominant forms. They are large enough to be seen when placed over a white background.

Quantitative samples were taken in several large, deep lakes, but the practice was discontinued in the small shallow lakes. It was hoped that calculations of the standing crop of plankton could be measured quantitatively. Due to the varying depth distribution of the plankton, along with the seasonal population changes, it was impossible to get accurate measurements.

Qualitative samples were taken in each lake for identification and distribution of species. These samples were forwarded to Dr. Trevor Kincaid, of the University of Washington, Seattle, for determination. A reference collection of mounted slides for microscopic study has been presented to the Willamette National Forest by Dr. Trevor Kincaid for 155 of the 174 surveyed lakes. The species of plankton taken and their abundance are as follows:

Copepods			Percent found in the Lakes
Epischura	nevadensis	Lilljeborg	45
Diaptomus	tyrrelli	Poppe	38
Diaptomus	shoshone	Forbes	31
Diaptomus	signicauda	Lilljeborg	14
Diaptomus	franciscanus	Lilljeborg	6
Diaptomus	piscinae	Forbes	4
Diaptomus	washingtonensis	Marsh	3
Cyclops	serrulatus	Fischer	3
Cyclops	prasinus	Fischer	2
Cyclops	albidus	Jurine	1
Diaptomus	pugetensis	Kincaid, Mss	.6
Cladocera or water fleas			
Holopedium	gibberum	Zaddach	48
Daphnia	longispina	(O.F.Muller)	35
Bosmina	longispina	Leydig	21
Polyphemus	pediculus	(Linne)	6
Scapholeberis	mucronata	(O.F.Muller)	3
Chydorus	sphaericus	(O.F.Muller)	2
Daphnia	pulex	(De Geer)	2
Diaphanosoma	brachyurum	(Lieven)	1
Ceriodaphnia	reticulata	(Jurine)	1
Bosmina	obtusirostris	Sars	.6
Ceriodaphnia	quadrangula	(O.F.Muller)	.6
Aquatic insect larvae (free swimming)			
Chaoborus	larvae sp.?		6
Rotatoria (Wheel animalcules)			
Rotifers	Sp.?		4
Keratella	cochlearis	(Gosse)	1
Conchilus	Sp.?		.6
Mastigophora (Flagellate protozoa)			
Ceratium	hirundinella	Muller	1
Blue-green algae			
Anabaena	Sp.?		1
Nostoc	Sp.?		1
Fresh water algae			
Asterionella	Sp.?		.6
Desmids			.6
Volvox	Sp.?		6.

Marion, Lower Erma Bell and Middle Erma Bell lakes had plankton in such abundance that many of the aquatic insects were trapped on the surface of the water. The Secchi turbidity disk could be seen only a few feet below the surface of the water. A plankton net soon became clogged with plankton, which prevented the water from passing through the mesh. Fresh and preserved specimens were sent to Dr. Trevor Kincaid for determination. The plankton were simple blue-green algae belonging to the genera of Anabaena. He also stated, "This algae seems to inhibit the development of other forms of life for the time being".

Along with the plankton in the upper layers of water were numerous forms of terrestrial insect life that had blown or fallen into the lakes. These forms constitute the greater portion of trout food during the summer months in some lakes. To date there is no method by which we can get an accurate quantitative measure of such foods. A qualitative sample can be easily obtained by studying the food contents of a freshly caught trout. During July, 1936, fish taken from Santiam Lake had counts of mosquito pupae as high as 981 per stomach. Rainbow trout caught in Timpanogas Lake in September, 1937 were feeding entirely on winged ants that were found trapped on the surface of the lake by the thousands. Other predominant land forms of insect life found on the lakes during the summer were yellow jackets, elm beetles, grasshoppers, leafhoppers, wasps, and adult flies.

SHORE FOODS

An improvement was made over last year's method of taking shore food samples. A portable 1-foot square shore sampler was constructed of sheet iron. The four sides were held together by an "L" shaped clip. By removing the clips the sides could be easily packed in compact form for carrying. At the selected shore site the shore sampler was forced down into the bottom several inches to prevent leakage of organisms from the outside. A square cornered 30-mesh hand screen was used in sifting out the mud and soil leaving only coarse objects and insect organism. The sifting was continued until 10 consecutive screenings bore no aquatic foods, the sample was then considered complete for one square foot. Large objects within the sampler were washed free of all the organisms. With the 30-mesh screen midge larvae were taken and counted which last year passed through the coarser screen used.

Predominant forms of shoal foods were: Odonata larvae (Zygoptera), midge larvae, beetles, backswimmers, Trichoptera larvae, Neuroptera larvae, mayfly larvae, leeches, clams, snails, segmented worms, round worms, and shrimps. Shrimps of the genera of Hyallella, Gammarus and Eucrangonx were common in many lakes and super abundant in a few lakes. Crawfish, Astacus Strowbridgii (Stimpson), were taken from the shores of Horse Lakes, Erma Bell Lakes, Gordon Lakes, and Copepod Lake.

LAKE BOTTOM FOODS

Lake bottom foods are the animal organisms that are found living in the muck or mud that covers the lake bottom to a depth of a foot or more. The bottom of most of the lakes surveyed consisted of a vegetative muck of dead decaying algae that had settled to the bottom. In depths of 70 feet or more it had a brown appearance. In shallow water the color varied from gray to green.

The most common bottom foods were: midge larvae, alderfly larvae, mayfly larvae, dragonfly larvae, clams, snails, segmented worms, round worms and leeches. These food organisms are most important as they are available the entire year.

Bottom samples were taken in an Ekman dredge of 1/4 cubic foot capacity. These organisms are listed in the chart as the total average number per 1/4 cubic foot. Time does not permit a complete analysis of the bottom organisms either qualitatively or quantitatively. The distribution of midge larvae was interesting. Early in the summer when the water was 50° or less midge larvae were common in the shallow water. When the water reached the summer temperature of 70° only cast skins were found in shallow water. The deeper, colder waters had larger numbers of midges. On October 6, 1937 at a depth of 35 feet in Lower Erma Bell, 1/4 of a cubic foot yielded 626 midge larvae, which was the highest yield of the past two years. In Tumble Lake alderfly larvae taken in the Ekman dredge averaged about one to 1/4 cubic foot. Food contents of freshly caught eastern brook trout contained as high as 890 alderfly larvae per stomach, many larvae were still alive and active. During the survey many trout stomachs contained food organisms which were not taken either in the bottom or shore samples.

Clams were abundant in all of the lakes surveyed, few if any, were actually taken from fish stomachs in food samples. Snails were taken in a few lakes with running inlets, and outlets. Of all the trout sampled, only the cutthroat trout taken from Fish Lake on June 15, 1936 had been feeding on snails. Snails were 80% of the food organisms present by actual count.

Because of the limited amount of equipment carried, quantitative studies of trout foods were not made. Preserved stomachs were sent to the Oregon State College for complete food analysis. Freshly caught fish were always sampled qualitatively for food organisms. Time does not permit working up that data.

PLANT LIFE

A plant press was carried by the survey party of 1937 and all aquatic and shore plants were collected and pressed. These plants were sent to Dr. Morton E. Peck, of Willamette University, who kindly named the entire collection and returned them to the Willamette National Forest. Sedges were the most abundant plants and were found on the shores of practically every lake. The sedges were of the following species: Carex cusickii, Mach.; Carex sitchensis, Press.; C. aquatilae, Wahl; C. exsiccata, Bail.; C. rostrota, Stokes; C. vericaria, L.; Other common shore plants were: Marsh cinquefoil, Comarum palustre, L; Buckbean, Wenyanthes trifoliota, L; and Baltic Rush Juncus balitcua, Willd. The commonest aquatic plants were: Yellow water lillies, Nymphozanthus polysepalus, (Engelm.); water moss, Fontinalis, Sp.; Quillworts, Isoetes Howellii, Engelm.; I. Bolanderi, Engelm.; Narrow leaf Burreed Sparganium angustifolium, Willd.; Creeping spikewart, Eleocharis palustris, (L); Nuttall's Pondweed, Potamageton epihydracra Nuttallii, Nutt.; Common Bladderwort, Utricularia volgaris, L.; Sagittaria latifolia, Wahl.; Callitriche autumnalis, L.; Potomogeton natans; Nitella Sp. and Rannuculus trichophyllus, Chaix..

Only 17% of the surveyed lakes were entirely devoid of plant life other than algae. Many of the shallow, mud bottom lakes had large beds of Potomogeton and Saggitaria in them. In late fall these plants were heavily fed upon by wild ducks. Yellow water lillies were common in many of the shallow lakes. Lakes with cold running inlets had dense growths of Fontinalis moss, Nitella and Dichelyma in which shrimps were found in great abundance.

Some lakes with undercut banks caused by wave action were devoid of plant life. It would be hard to get plants to grow on these shores. In lakes where logs had fallen into the lake at right angles to the shore, a little soil and debris could be found lodged in the corner. Carex grass was found growing in these protected areas while the shore was barren of plants. It may pay to experiment and see if log breakwaters would protect the shore from wave action and encourage the growth of plants. A few lakes had their shores entirely lined with sedge grass. These lakes usually had a good supply of shore foods. In several lakes the sedge grass formed the only cover for the fish.

BEAVER PLANTING SITES

In addition to the survey work, beaver planting sites were located. The following areas have been selected as good beaver colony sites:

Lower Horse Lake. A colony of beaver moved in to the lake this summer and built a check dam at the outlet that flooded over about two acres of sedge meadow. The sheep usually graze this area. The lake has remained at its flood stage instead of drying up to a few acres as it usually did. The beavers should be protected as they have improved the fishing of the lake. The inlets have good spawning areas so the fish will not have to go down stream to spawn.

Middle Horse Lake is suited for beaver. The shores are lined with willow and alder brush. Raising of the lake level by a dam would not flood any meadows or valuable timber land.

Upper Horse Lake is suited for beaver, but since the Guard Station depends on the creek for the domestic water supply, and the campground is being developed, it would be best not to plant beaver there.

Gnat Lake. This lake has gone back to a meadow since the beaver have been removed and the dam washed out. Beaver should be introduced here to restore the lake.

Porky Lake. Beaver could be planted on Porky Lake. Food plants are abundant at both the inlets and outlet. The bottom foods of this lake are very poor. Introduction of beaver may increase the size of the lake and offer shoals for production of trout food.

Pen Lake. This lake had a beaver colony on it at one time. The lake is prominently figured on maps but since the beaver have left it has been reduced to a marsh unsuited for fish. Elk are known to wallow and feed in this lake when the flies bother them. Beaver food trees are abundant.

Corner Lake. This is a large, shallow, brush lined lake. The beavers had a good size colony on this lake several years ago. An old beaver colony site is still to be seen on the east shore of the lake beneath the prominent tree on the shoreline. On the bottom of the lake piles of peeled sticks are still to be seen. This would make an excellent site to re-introduce the beaver.

Goose Lake. At the outlet of this lake are the remains of a beaver dam. Several 20-inch conifer trees were felled by the beaver and many griddled trees remain on the adjacent areas. Since the beaver have been caught out, Goose Lake has been reverting to a meadow. In August the lake averaged only 3 feet in depth and was unsuited for fish.

Horseshoe Lake. There is old beaver signs at the inlet of Horseshoe Lake. The dam has been broken down and the pond has reverted to a meadow. Beaver should be restocked at the inlet of Horseshoe Lake.

Nash Lake. This lake has a running inlet and outlet that could be dammed by the beaver. Food plants are abundant on both the inlet and outlet.

Moolack Lake. This lake has an abundance of food and cover with steep banks. Beaver planted here would improve the lake.

Mud Lake. Below Taylor Burn camp. This lake is rather shallow, not over 5 feet in depth. Food trees line the shore, inlets and outlet. A check dam built by beaver at the outlet would certainly improve this lake. The brush grows up in the inlets and chokes the channel for spawning purposes. Introduction of beaver would not harm any meadows or valuable timber land.

Otter Lake. This lake has an abundance of food trees on the shore and a running inlet. A dam on the outlet would improve this lake.

WINTER KILL

Experimental plants were recommended last year in order to get some information on winter kill of trout in the shallower lakes. Unfortunately it was too late in the year to reach the lake when the fish were available. It is definitely known that the entire fish population of Crown Lake was winter killed in 1935. Fish were taken from a number of shallow lakes this year after last year's heavy snow fall and cold winter. Little is known about winter kill, there are several theories that could be experimented with in order to determine the cause. One theory is that plant life devoid of sunlight remove the oxygen from the water for its own metabolic processes, or the decaying of vegetative debris consumes the free oxygen and the fish are asphyxiated. Chemical analysis of the water in the lakes could be taken several times during the winter to check the oxygen supply. Winter kill may be brought about by shallow lakes freezing solid, or by the weight of accumulating snow forcing the ice surface down in to the lake bottom. Fish found dead in one shallow lake were firmly embedded in the lake bottom, being forced there, no doubt, by the weight of ice or snow. Lakes with running inlets or outlets do not usually have any winter kill as the supply of oxygen always is on hand.

In the East experiments have been conducted to prevent winter kill. In one experiment an outboard motor was set up in an ice hole and run, the theory being to keep the water in circulation. *In another experiment a pump was set up on the ice. The water was pumped from the deepest part of the lake and aireated before it was permitted to return. In one instance boats with outboard motors were continually run up and down a lake to prevent it from freezing over solid. The cost and inaccessibility of the lakes on the Willamette Forest would prohibit such practices.

SPECIES OF FISH PRESENT

None of the lakes are suited to any species of fish other than trout. Unfortunately some careless individual introduced catfish into Dunlop Lake. Trout are unable to compete with catfish, which in time will dominate the lake. During the survey mackinaw trout, Cristivomer namaycush (Walbaum); rainbow trout, Salmo irideus, Gibbons; cutthroat trout Salmo clarkii clarkii, Richardson; Loch Leven trout, Salmo Levenensis, Walker; and eastern brook trout Salvelinus fontinalis (Mitchell) were taken from the lakes. The distribution of species of trout in the various lakes is listed on the chart in the appendix.

Only 13 lakes are known to have native fish in them. These fish were cutthroat or rainbow trout that migrated into the lakes from the streams. The remaining lakes were stocked artificially with native or exotic fish.

The only exotic trout that have done well in the lakes surveyed were the eastern brook trout. Loch Leven trout and mackinaw trout stockings have proved to be failures. Neither of these fishes grow very fast at high altitudes and rarely, if ever, do anglers catch these fish on hook and line. In several lakes a school of Loch Leven trout ate the small rainbow and eastern brook fry as fast as they were planted. Attempts to catch the Loch Leven trout with hook and line failed.

Mackinaw trout taken from Big Lake were feeding on 8" eastern brook trout. A total of seven 8" eastern brook trout were taken from the stomachs of three mackinaw trout that averaged 25" in length. Scale samples of the mackinaw trout were read by a specialist who determined the age of these fish to be over 19 years. During the past 19 years a good share of the fish planted in Big Lake have gone to feed the schools of uncatchable mackinaw trout.

For sport fishing and rapid growth of fish, the only trout suited for these lakes are cutthroat, rainbow and eastern brook. Other trout, bass and coarse fishes should not be planted in the lakes. A hybrid has resulted between the cross of rainbow and cutthroat trout. This hybrid grows to a fair size but the number of eggs spawned is greatly reduced and only a small percentage of those are fertile. Reproduction from this hybrid is greatly reduced yet they are competitors for the same food which pure rainbow and cutthroat trout must depend upon for survival.

* Some Studies of Impounded Waters in Ohio, by E. L. Wickliff, and Lee S. Roach: Transactions, American Fish Soc., 1936, p. 82.

CREEL CENSUS OF LAKES

During the past few years numerous lakes have been stocked with trout. Some of these lakes produced good fishing while in other lakes fishing was poor. Several methods of checking the fish plants have been used. A quantitative sample can be obtained by using a gill net or seine hauling. Since the net is set in one location or hauled at one portion of the lake, the sample of fish is not accurate. Perhaps a school of fish may swim into the net or the fish may be driven away by setting a net. The possibilities for error are too great. A better method of getting a record is to get an accurate count of fish actually caught in the lake by the anglers.

In order to get a better check on stocking policies, fish production and condition of angling on the Willamette Forest, a creel census of the anglers' catch was made on several lakes. Guards on the lakes were supplied with catch recording blanks, scales and rulers for tabulating the returns*. Originally five lakes upon which fire guards were stationed during the summer were selected for creel catch records. Three of the lakes were abandoned during the period the guard was on duty. Unfortunately the fire guards were not on duty on the lakes during the entire summer. When the fire hazard became critical and during the lightning storms, the guards were sent up to the lookouts for duty. The fishing season on the lakes opened before the guards arrived for duty and closed long after they had left their posts.

The following figures are not complete for the entire season. They will serve, however, to show the trend of fishing from year to year; daily catch of fish and effort required to catch them from year to year; facts relating to species, size, growth and pounds of fish caught annually; the need for suitable and balanced restrictive measures.

Upper Horse Lake during the period of July 12 to August 26 had a total of 40 fishermen who fished a total of 215 hours and caught 380 trout. The catch per unit of effort (one hour's fishing by one angler) was 1.7 fish. Forty percent of the trout caught were eastern brook, 25% rainbow and 35% cutthroat.

* "Methods of Measuring Anglers' Catches in Inland Waters". Needham, P. R. Copeia No. 1, April 10, 1937, p. 41

Marion Lake, between July 21 and September 5 had a total of 226 fishermen who fished a total of 1713.5 hours and caught a total of 1394 cutthroat trout for a catch per unit of effort of .8 fish.

TEST LAKES AND STREAMS

During the survey a few test lakes and streams were tentatively selected that were typical of the western slope of the Cascade Mountains. These waters will be used for investigative work to determine: pounds of fish produced per acre, survival rates of hatchery reared trout, growth rates, and to develop scientific stocking and management policies of various species.

The following bodies of water have been selected because: each has problems to be studied, they are heavily fished, they are accessible by auto travel and they are so located that fishermen can be easily contacted on them. Scott Lake, McKenzie Highway; Elk Lake, Elk Lake Road; Clear Lake, Fish Lake Road; Gold Lake, Willamette Highway and Opal and Timpanogas Lakes, Timpanogas Lake Road. Breitenbush River, Breitenbush Road; Marion Creek, North Santiam Highway; Horse Creek, off the McKenzie Highway; South Fork of the McKenzie River, off the McKenzie Highway; Big Fall Creek, Fall Creek Road; and Salmon Creek on the Salmon Creek Road.

LAKE IMPROVEMENTS

Only a few lakes were in need of physical improvements. Scott Lake could be improved by building a check dam on the outlet. In early spring the lake covers eighty acres, evaporation during the summer months reduce the lake to three bodies of water, of less than 40 acres in extent.

The beavers in the inlet of Ann Lake should be trapped and moved. By checking the flow of water; they flood the horse pasture, raise the temperature of the water, and prevent the fish from going into the inlets to spawn. After removal of the beaver, the dam should also be removed, and an inlet channel should be opened and cleared for spawning.

Pamelia Lake has a lava fault near the outlet of the lake. During the spring heavy run-off the lake level is maintained, in summer the lake begins to recede until it is just a few acres in size. Twice the hole has been temporarily blocked with sand bags. This leak should be stopped to improve the lake for fishing.

Lost Lake has a fault in its bottom that drains the lake to a marsh of a few inches of water by fall. Fish Lake has a lava bottom that reduced the lake to a mere meadow by fall. Neither Fish nor Lost Lakes are worthy of improvement at the present time.

A wooden screen should be erected in the outlet of Sunset Lake to prevent the eastern brook trout from going down into Horse Lakes which are stockedwith rainbow and cutthroat trout.

A small check dam should be built in the outlet of Herb Lake to hold the water at a higher level during the summer months.

The screen in the outlet of Vogel Lake should be replaced before this lake is stocked. The fish get caught in the outlet during high water and cannot return to the lake.

The three inlets to Mud Lake should be confined to one channel for spawning purposes. Willow and alder brush has choked the original channel and diverted the inlet into three shallow useless channels.

Downfalls and snags have diverted the water of the east inlet of Lower Erma Bell Lake to numerous channels. The snags should be cut out and the water confined to one channel for spawning.

Rainbow spawn used to be taken from Middle Erma Bell Lake. The old fish traps, troughs, and cabin remain on the site. It has not been used for over ten years. The old creek structures have rotted and have fallen down, choking the main channel and diverting the flow of water. The main channel should be cleared of debris and logs and restored for the spawning of the rainbow trout.

HOLDING AND REARING POOL SITES

In the Detroit Ranger District rearing and holding pools could be constructed at the mouth of Marion Creek near the Guard Station. This site is on the new North Santiam Highway which is open all year to travel. Pools could be constructed at the outlet or inlet of Elk Lake. The road is open to the lake during the summer. The mouth of the Breitenbush River has several possibilities for holding and rearing pools.

In the Cascadia Ranger District rearing and holding pools could be built; in Fish Lake for summer use only, at Lost Lake, and several places along Hackleman Creek.

Rearing and holding pool sites in the McKenzie Ranger District are: Mouth of Smith River near the Smith River Guard Station, Mouth of Horse Creek, near the McKenzie Ranger Station, Frog Camp just off the McKenzie Highway, and East Fork of the McKenzie River near the East Fork Guard Station.

Rearing and holding pool sites of the Oakridge Ranger District are: Timpanogas Lake outlet, Salt Creek near the Gold Lake Guard Station, and Salmon Creek near the Flat Creek Ranger Station.

STOCKING RECOMMENDATIONS FOR LAKE MANAGEMENT

The following stocking recommendations were developed in cooperation with Dr. Paul R. Needham, Associate Aquatic Biologist of the U. S. Bureau of Fisheries, at Palo Alto, California.

The numbers of fish recommended are not absolute or final, but preliminary until more data is obtained. The numbers, species, sizes and frequency of plantings recommended are based on the survey data of 1936 and 1937. The accessibility, fishing intensity, present populations, spawning areas available, and the length of the growing seasons were also taken into consideration in order to produce and maintain the largest possible fish population in relation to the food supply.

Native fish, rainbow and cutthroat, have been recommended for lakes where the conditions are suitable. Eastern brook trout have been recommended in lakes where shoal or spring gravel is available for spawning. Loch Leven and brown trout are not suited to the higher lakes. Former plantings have been unsuccessful in producing large fish. For best results only one species of fish should be planted in a lake. Several lakes have three species of trout in them. These mixtures should be avoided for the best interests of fishing.

Detroit Ranger District

Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
Upper Twin	8S	6E	19-30	10	2000	2"	EB	Triennially
Lower Twin	8S	6E	29	12	5000	2"	EB	"
Elk	9S	6E	6	63	16,000	1"	RB	Annually
Dunlop	9S	6E	5	3	1000	2"	EB	"
Opal	9S	5E	17	8	--	2"	EB	Present population adequate
Mildred	9S	8E	29	4	--	2"	EB	" stock sufficient, resurv 3 years
Slideout	9S	8E	29	8	3000	2"	EB	Biennially
Bear	9S	8E	33	6	3000	2"	EB	"
Crown	9S	8E	30	12	5000	1"	RB	Experimental plant to determi winter kill
Claggett	9S	8E	31	4	1000	2"	EB	Triennially
Sheep	9S	8E	31	1	None			Too shallow
Leone	9S	7E	31	3	2000	2"	EB	Biennially
Tumble	9S	5E	32	10	--	2"	EB	No stocking at present, popula adequate due to goos spawnir
Russell	10S	8E	11	8	5000	2"	EB	Biennially
Bays	10S	8E	14	12	--	2"	EB	None, overpopulated, resurvey in three years
Scout	10S	8E	14	6	None			No food
Rainbow	10S	6E	28	6	2000	2"	EB	Triennially
Pamelia	10S	8E	32-33	25			CT	Present reproduction adequate
Hunts	11S	8E	7	6		1"	RB	None present planting of 16,000 RB adequate
Hanks	11S	8E	7	7	4000	2"	RB	Triennially
Bingham	11S	7½E	15	5	1500	1"	RB	"
Lake of the Woods	11S	8E	30	5		1"	RB	Present population adequate resurvey in three years.
Shallow	11S	8E	31	5	None			Too shallow
Lake Ann	11S	7½E	35	20	8000	2"	EB	Biennially
Marion	12S	7½E	1-2	353	36,000	2"	CT	Annually
Frill	12S	8E	6	8	2000	2"	EB	Biennially
Fir	12S	7½E	3	12	2500	1"	RB	"
Pine	12S	7E	2	16		1"	RB	Overstocked no planting for 3

Detroit Ranger District (Cont'd)

No.	Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
29	Davis	12S	7½E	10	6	1200	1"	RB	Biennially
30	Temple	12S	7½E	10	4	None			Too shallow, planted unsuccessfully
31	Pine Ridge	12S	7½E	10	2.5	None			Too shallow, excessive temp.
32	Melis	12S	7½E	11	8		1"	RB	Present stocking adequate, resurvey in 3 years.
33	Teto	12S	7½E	14	12		1"	RB	Present stocking adequate, resurvey in 3 years.
34	Chiquito	12S	7½E	24	8.5		2"	EB	Present population adequate, resurvey in 3 years.
35	Blue	12S	7½E	23	7.5	3000	2"	EB	Biennially
36	Little Bowerman	12S	7½E	24	2		1"	RB	Present stocking adequate, resurvey in 3 years.
37	Bowerman	12S	7½E	24	11	1500	2"	EB	Biennially
38	Jorn	12S	7½E	23	47	8000	2"	EB	"
39	Red Butte	12S	7½E	23	11	6000	1"	RB	"
40	Mowich	12S	7½E	27	54	15,000	2"	EB	"
41	Duffy	12S	7½E	34	45	18,000	2"	EB	"
42	Santiam	13S	7½E	3	22	8000	2"	EB	"
43	Fay	12S	7E	21	5	1500	2"	EB	"
44	Midget	11S	8E		3/4	None			Too small
45	Slide	11S	8½E		1/2	None			" "
46	Papoose	11S	8½E		1/2	None			" "

Cascadia Ranger District

Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
Don	12S	6E	3	2.5	2500	2"	EB	Experimental plant, resu 3 years.
Thompson	12S	6E	10	5	2000	2"	EB	Exp/ plant, resurvey in
Daly	12S	6E	11	8			CT	Reproduction adequate
Parish	12S	6E	15	14	6000	2"	EB	Biennially
Upper Burley	13S	7½E	10	5	2000	2"	EB	"
L. Burley	13S	7½E	11	12	10,000	2"	EB	"
Craig	13S	7½E	15	7	4000	2"	EB	"
Moose	13S	4E	7	4	3000	2"	CT	"
Couger	13S	6E	16-21	4	2000	2"	EB	Experimental plant resu
Lost	13S	7½E	21	4-50	None			Lake dries up every sum a bottom fault.
Fish	14S	7E	5	0-55	None			Lake dies up every summe
Big	14S	7½E	2,11,10	410	20,000	3"	EB	Annually
Clear	14S	7E	5-8	166	15,000	2"	CT	"
Heart	14S	6E	3	12	8000	2"	EB	Experimental plant, to later.
U. Patjens	14S	7½E	15	3	None			Too shallow, unsuccessf before.
M. Patjens	14S	7½E	15	5	None			Present stocking adequa
L. Patjens	14S	7½E	15	5	1500	2"	EB	Triennially
L. Gordon	14S	4E	12	8	6000	2"	CT	"
U. Gordon	14S	4E	12	5	6000	2"	CT	"
Robinson	15S	7E	13	8	5000	2"	EB	"

McKenzie Ranger District

Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
Craig	15S	7½E	25	2	None, too shallow			
Huckleberry	15S	8E	30	2	" " "			
Hand	15S	7½E	27	1 to 50	" " "			
Lower Tenas	15S	7E	25	1.5	1000	2"	EB	Biennially
Middle Tenas	15S	7E	25	1.5	1000	2"	EB	"
Upper Tenas	15S	7E	25	3.5	1500	2"	EB	"
Campers	15S	7½E	34	4	None, too shallow			
Elf	15S	7E	36	2	1000	2"	EB	Experimental plant, biennial successful
Island	15S	7E	36	2.5	1600	2"	EB	Experimental plant, resurvey 3 years.
Glaze	15S	7E	36	2	1200	2"	EB	Experiment plant, resurvey in
Benson	15S	7E	36	30	15,000	2"	EB	Biennially
Scott	15S	7½E	31	40-70	15,000	2"	EB	Annually
Melakwa	16S	7E	1	30	12,000	2"	EB	Biennially
Irish Camp	16S	7E	2	2	2000	2"	EB	"
Spring	16S	7½E	9	5	3000	2"	RB	"
Linton	16S	7½E	16-21	30	8000	2"	RB	"
Eileen	16S	7½E	26	7	None, too shallow			
Husband	16S	7½E	35	5	None, too shallow			
Honey	17S	7E	10	18	6000	2"	RB	"
Kidney	17S	7E	10	20	6000	2"	EB	Initial plant, if successful, 6000 biennially
Square	17S	7E	10	5	3000	2"	EB	Initial plant, 3000 biennial if successful
Tokatee	17S	7E	7	5	None, too shallow			
Little Tokatee	17S	7E	7	3	" " "			
Dew	17S	8E	18	3	" " "			
Separation	17S	6E	24	12	3000	2"	RB	Triennially
Ash	18S	7E	3	30	15,000	2"	RB	Biennially
Burnt Top	18S	7E	2	20	9000	2"	RB	Triennially
Guinevere	18S	7E	1	5	3000	2"	EB	Biennially

McKenzie Ranger District (Cont'd)

No.	Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
229	Lancelot	18S	7E	1	3	1500	2"	EB	Triennially
230	Sisters Mirror	18S	7E	1	5	None, too shallow			
231	Camelot	18S	7E	12	3	1500	2"	EB	"
232	Denude	18S	7E	12	15	6000	2"	EB	Biennially
233	Dulac	18S	7E	12	1	2000	2"	EB	Triennially
234	Moonlight	18S	7E	16	10	6000	2"	EB	"
235	Lower Horse	18S	7E	21	25	6000	2"	CT	"
236	Middle Horse	18S	7E	21	15	4000	2"	CT	"
237	Upper Horse	18S	7E	22	60	15,000	2"	CT	"
238	Hidden	18S	5E	8	24	10,000	2"	CT	Triennially
239	Colt	18S	7E	23	None, too shallow				
240	Sunset	18S	7E	26	40	8000	2"	EB	Biennially
241	Park	18S	7E	28	3	None, too shallow			
242	Mile	18S	7E	27	15	5000	2"	EB	Triennially
243	Reeder	18S	7E	28	5	3000	2"	EB	"
244	West Fisher	18S	7E	27	4	3000	2"	EB	"
245	East Fisher	18S	7E	27	4	3000	2"	EB	"
246	Platt	18S	7E	27	20	3000	2"	EB	Biennially
247	Herb	18S	7E	27	5	2000	2"	EB	Initial plant when check screen are installed, 2 ennially if successful
248	Dillon	18S	6E	35	2	None, too shallow			
249	McBee	18S	7E	33	8	3000	2"	RB	Initial plant, if succes 3000 triennially
250	Dumbbell	19S	7E	3	18	3000	2"	EB	Biennially
251	Island	19S	7E	10	8	3000	2"	EB	"
252	Spy	19S	7E	4	20	6000	2"	EB	"
253	Pen	19S	7E	5-8	None, too shallow				
254	Corner	19S	7E	8	60	15,000	2"	RB	Biennially
255	Goose	19S	7E	8-9	8	None, too shallow			
256	Copepod	19S	7E	9	20	5000	2"	EB	Initial plant, if succes 6000biennially
257	Question Mark	19S	7E	10	26	6000	2"	EB	Biennially

McKenzie Ranger District (Cont'd)

No.	Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
258	Vera	19S	7E	10	5	3000	2"	EB	Initial plant, if successful 3000 biennially
259	Ledge	19S	7E	10	5	None, too shallow			
260	Plumb	19S	7E	7	15	6000	2"	EB	Biennially
261	Junction	19S	7E	7	50	6000		RB	"
262	Mud	19S	7E	8-17	2	None, too shallow			
263	Gnat	19S	7E	16	6	None, too shallow			
264	Rock	19S	7E	18	40	None, too shallow			
265	Marten	19S	7E	18	18	3000	2"	EB	Biennially
266	Mink	19S	7E	18-19	360	40,000	2"	EB	"
267	Porky	19S	7E	17-16	60	6000	2"	EB	"
268	Cliff	19S	7E	15-16	40	6000	2"	EB	"
269	Moody	19S	7E	16	12	3000	2"	EB	"
270	Horseshoe	19S	7E	16	60	6000	2"	EB	"
271	Trapper	19S	7E	15	12	4000	2"	EB	Initial plant, if successful 6000biennially
272	Vogel	19S	7E	15-16	25	5000	2"	EB	Initial plant, if successful 5000 biennially
273	Merrill	19S	7E	21	15	5000	2"	EB	Biennially
274	Mac	19S	7E	21	70	15,000	2"	RB	"
275	"S"	19S	7E	20	15	None, too shallow			
276	Desane	19S	7E	20	6	" "		"	
277	East Desane	19S	7E	20	4	" "		"	
278	Top	19S	7E	19	5	" "		"	

Oakridge Ranger District

Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
Otter	20S	6E	8	12	6000	2"	EB	Initial plant, if successfu 3000 biennially
L. Erma Bell	20S	6E	17	55	15,000	2"	RB	Biennially
M. " "	20S	6E	17	60	15,000	2"	RB	"
U. " "	20S	6E	20	25	6000	2"	RB	"
Williams	20S	6E	20	7	3000	2"	RB	Triennially
Moolack	20S	5½E	24	9	3000	2"	EB	"
Mud	20S	6E	20	8	3000	2"	RB	Biennially
Edna	20S	6E	29	3	2000	2"	RB	"
Helen	20S	6E	28	18	6000	2"	RB	Triennially
Clara	20S	6E	28	3	None, too shallow			
Eastern Brook	20S	6E	29	15	5000	2"	EB	"
Emma	20S	6E	29	4	3000	2"	EB	"
Edward	20S	6E	32	3	None, too shallow			
Whig	20S	6E	33	15	6000	2"	EB	Initial plant, if successfu 6000 triennially
Torrey	20S	6E	33	70	9000	2"	RB	Biennially
Wahanna	20S	6E	32	60	9000	2"	RB	"
Harvey	21S	6E	5	20	6000	2"	RB	"
Cervus	21S	6E	4	24	6000	2"	RB	Initial plant, if successfu 6000 biennially
Kiwa	21S	6E	6-5	40	9000	2"	RB	Triennially
Ernie	21S	6E	6	4	2000	2"	RB	Initial plant, if successfu 3000 triennially
L. Rigdon	21S	6E	6-5	20	4000	2"	RB	Initial plant, if successfu 9000 triennially
U. Rigdon	21S	6E	8	50	5000	2"	RB	Initial plant, if successfu 15,000 triennially
Canim	21S	6E	7	3	None, too shallow			
Betty	22S	6E	8	24	10,000	2"	RB	Biennially
Gold	22S	6E	29-30	38	8000	2"	RB	Annually
L. Marilyn	22S	6E	31	25	5000	2"	EB	"
U. Marilyn	22S	6E	31	18	5000	2"	EB	"
Opal	22S	5½E	9	35	3000	2"	RB	"

Oakridge Ranger District (Cont'd)

No.	Name of Lake	Location T.	R.	Sec.	Estimated Acreage	Number	Size	Species	Frequency
329	Timpanogas	25S	5½E	15	70	15,000	2"	RB	Annually
330	L. Timpanogas	25S	5½E	15-16	8	2000	2"	RB	"
331	Andy	25S	5½E	14	12	None, too shallow			
332	Amos	25S	5½E	14	8	3000	2"	RB	Triennially
333	Indigo	25S	5½E	22	30	9000	2"	RB	"
334	June	25S	5½E	21	20	3000	2"	RB	"

Detroit Ranger District

Name of Lake	Elev. Ft.	Date Surveyed 1936	Ave. No. bottom organisms per ¼ cu. ft.	No. samples taken	Species of Trout Present	Hyalella & Gammarus Shrimps	No. Shor organi sq.
Upper Twin	3750	Aug. 13	2.8	5	EB	13	
Lower Twin	3750	" 14	5.6	5	EB	2	
Elk	3690	June 5	0	5	RB EB	18	
Dunlop	3700	" 4	0	5	EB RB Catfish reported	0	
Opal	3250	Aug. 12	2	5	EB	2	
Mildred	4250	" 10	.6	5	RB	0	
Slideout	4250	" 9	8	5	LL	0	
Bear	5325	" 10	1.2	5	LL	0	
Crown	4840	" 8	.4	5	None	0	
Claggett	4850	" 8	2.2	5	LL	0	
Sheep	4860	" 8	0	5	None	0	
Leone	3550	June 24	4.8	5	EB LL	4	
Tumble	3621	" 9	1	5	EB	8	
Russell	6170	Aug. 6	3.4	5	LL EB	6	
Bays	5867	" 6	1.6	5	EB	0	
Scout	5860	" 6	0	5	None	0	
Rainbow	3325	" 15	.2	5	EB	0	
Pamelia	3900	" 4	18.6	5	CT	10	
Hunts	5310	July 31	7	5	RB	18	
Hanks	5200	" 30	48.4	5	RB	18	
Bingham	4670	" 30	7.8	5	CT	26	
Lake of the Woods	4950	" 29	0	5	RB	0	
Swallow				Too shallow to survey			
Ann	3900	June 25	5.4	5	EB CT	78	1
Marion	4107	July 1,3	27.4	11	CT	42	
Prill	5225	" 2	1.6	5	EB	0	
Fir	4320	" 23	3.8	5	None	0	
Pine	4500	" 22	8	5	RB	0	
Davis	4450	" 21	1.6	5	RB	0	
Temple	4550	" 21	.4	5	None	0	
Pine Ridge	4700	" 22	.8	5	None	0	

Detroit Ranger District (Cont'd)

No.	Name of Lake	Elev. Ft.	Date Surveyed 1936	Ave. No. bottom Organisms per $\frac{1}{4}$ cu. ft.	No. Samples taken	Species of Trout Present	Hyalella & Gammarus Shrimps	No. Shore Food organisms per sq. ft.
32	Melis	4750	July 20	1.8	5	RB	2	20
33	Teto	4750	" 10	70.6	5	EB	56	104
34	Chiquito	4780	" 10	4.8	5	EB	6	17
35	Blue	5350	" 9	9	5	EB	0	0
36	Bowerman	5063	" 8	3.8	5	EB	7	20
37	Lava	3406	Aug. 27	Too shallow to survey				
38	Jorn	5100	July 7	13.6	5	EB	8	63
39	Red Butte	5200	" 13	27.4	5	RB	25	108
40	Mowich	5100	" 15	29.8	5	EB	6	118
41	Duffy	5230	" 14	31.8	5	EB	27	45
42	Santiam	5210	" 17	37.6	5	EB	111	128
43	Fay	4000	Aug. 27	0	5	EB RB	7	10

Cascadia Ranger District

Name of Lake	Elev. Ft.	Date Surveyed 1936	Ave. No. bottom organisms per ¼ cu. ft.	No. Samples taken	Species of Trout Present	Hyalella & Gammarus Shrimps	No.Shor organi sq.
Don	3900	Sept. 10	7.4	3	None	86	161
Thompson	3650	" 10	7.8	5	"	400	1110
Daly	3590	" 1	7.6	5	CT	75	97
Parish	3280	Aug. 31	4	5	CT	50	62
U. Burley	5400	Sept. 8	24	5	EB	0	44
L. Burley	5420	" 4	26.2	5	EB	4	15
Craig	5230	" 3	8.4	5	None	13	18
Moose	1550	June 15,1937	13.2	5	CT	9	41
Couger	3850	" 11	2	5	CT	24	60
Lost Lake	5000	Aug. 21	0	5	CT	30	50
Fish	3189	June 15	4	5	CT	3	31
Big	4645	Aug. 19	14.8	5	LT, EB	0	13
Clear	3012	June 17	10.2	5	CT	21	57
Heart	4960	Sept.19	24.8	5	None	18	33
U. Patjens	4550	Aug. 20	0	5	None	0	20
M. Patjens	4550	" 20	142	2	EB	0	65
L. "	4550	" 20	.6	5	EB	0	24
L. Gordon	3900	Oct. 12,1937	27	6	CT	186	199
U. Gordon	4000	" 13 "	29	5	CT	186	224
Robinson	3950	" 27	12.4	5	None	0	21

McKenzie Ranger District

No.	Name of Lake	Elev. Ft.	Date Surveyed	Ave. No. bottom organisms per ¼ cu. ft.	No. Samples Taken	Species of Trout Present	Hyalella & Gammarus Shrimps	No. Shore Food organisms per sq. ft.
201	Craig	5150	June 23, 1937	Too shallow to survey				
202	Huckleberry	5240	" " "					
203	Hand	4770	" " "	8.2	5	None	0	4
204	Lower Tenas	5400	Sept. 25, 1936	6	3	None	0	14
205	Middle Tenas	5410	" " "	9	3	LL	0	69
206	Upper Tenas	5440	" 24 "	8.4	5	LL	0	35
207	Campers	4810	June 23, 1937	Too shallow to survey				
208	Elk	5300	Sep. 24, 1936	6.6	3	None	0	95
209	Island	5300	" 23, "	37.4	5	None	0	23
210	Glaze	5300	" 23, "	36.6	5	None	0	23
211	Benson	5300	" 23, "	14.6	5	LL	0	2
212	Scott	4800	Aug. 24, "	42	9	EB	16	35
213	Melakwa	4950	Sep. 21, "	12.6	5	LL	0	15
214	Irish Camp	4600	" 22, "	14.3	3	None	0	32
215	Spring	5110	June 24, 1937	50	5	LL	0	24
216	Linton	3575	" 21 "	19.8	5	LL	2	2
217	Eileen	6200	Aug. 27, "	Too shallow to survey				
218	Husband	6200	" " "	" " "				
219	Honey	5100	July 8, "	13.4	5	RB	0	10
220	Kidney	5550	" 9, "	6.2	5	None	0	8
221	Square	5570	" 9, "	4.3	3	None	0	7
222	Tokatee	4900	" 7, "	1.6	5	None	0	9
223	Little Tokatee	4890	" 7, "	Too shallow to survey				
224	Dew	5800	Aug. 27, "	" " "				
225	Separation	3250	" 30, "	23.3	3	RB	30	47
226	Nash	4950	" 26, "	33.6	5	RB	108	156
227	Burnt Top	5200	" 25, "	14.2	5	RB	0	23
228	Guinevere	6000	" 25, "	13.5	4	EB	0	6
229	Lancelot	6000	" 25, "	3.3	3	EB	0	1
230	Sisters Mirror	5960	" 28, "	Too shallow to survey				
231	Camelot	6000	" 26, "	4.5	4	EB	0	9
232	Denude	6000	" 24, "	17.4	5	EB	0	5

McKenzie Ranger District Cont'd

Name of Lake	Elev. Ft.	Date Surveyed 1937	Ave. No. bottom organisms per ¼ cu. ft.	No. Samples Taken	Species of Trout Present	Hyalella & Gammarus Shrimps	No. Sh organ sq.
Dulac	5970	Aug. 28,	48	3	EB	0	11
Moonlight	4590	July 15	1.3	3	None	83	86
Lower Horse	4580	" 14	19.3	3	CT	19	33
Middle Horse	4685	" 14	14	4	CT	9	21
Upper Horse	4970	" 12	3.6	5	EB RB CT	4	13
Hidden	5350	June 29	22	3	CT	7	31
Colt	5100	July 16	Too shallow to survey				
Sunset	5110	" 16	24	3	EB	0	6
Park	5100	" 22	1	3	None	0	24
Mile	5070	" 23	14	5	EB	0	41
Reeder	5400	" 21	2	3	EB	0	14
West Fisher	5540	" 20	1.3	3	EB	0	10
East Fisher	5540	" 20	22.7	4	EB	0	15
Platt	5350	" 17	7.2	5	EB	0	12
Herb	5390	" 19	9	3	None	0	7
Dillon	4600	" 28	Too shallow to survey				
McBee	5700	" 27	3	5	None	0	7
Dumbbell	5520	" 31	3.4	5	EB	0	6
Island	5500	Aug. 4	1	5	EB	0	4
Spy	5230	July 28	2.2	5	EB RB	0	8
Pen	4800	" 29	Too shallow to survey				
Corner	4800	" 29	1.6	5	RB	168	177
Goose	4830	" 30	Too shallow to survey			0	17
Copepod	5360	Aug. 6	1.6	5	None	76	81
Question Mark	5390	" 5	.2	5	EB	3	10
Vera	5390	" 6	2.8	5	None	0	40
Ledge	5350	" 5	0	3	None	47	72
Plumb	4850	" 2	4	5	None	148	352
Junction	4950	" 20	1.3	5	RB	0	11
Mud	5120	" 9	Meadow too shallow to survey				
Gnat	5100	" 9	" " " "				
Rock	5060	" 17	Too shallow to survey				

McKenzie Ranger District (Cont'd)

No.	Name of Lake	Elev. Ft.	Date Surveyed 1937	Ave. No. bottom organisms per ¼ cu. ft.	No. Samples Taken	Species of Trout Present	Hyalella & Gammarus shrimps	No. Shore food organisms per sq. ft.
265	Marten	5020	Aug. 20	4.4	5	EB	9	16
266	Mink	5040	" 18	4.9	10	EB	0	5
267	Porky	4900	" 9	.4	5	EB CT RB	63	76
268	Cliff	5190	" 10	1.3	5	EB	53	88
269	Moody	5110	" 12	4	5	EB	8	11
270	Horseshoe	5160	" 12	1.4	5	RB EB	2	16
271	Trapper	5300	" 11	3.3	5	None	0	1
272	Vogel	5240	" 10	.8	5	None	0	8
273	Merrill	5200	" 13	1.4	5	"	9	27
274	Mac	5200	" 13	2.8	5	RB	22	32
275	"S"	5190	" 16	2.8	5	None	0	6
276	Desane	5250	" 16	10.3	3	None	0	15
277	East Desane	5240	" 16	Too shallow to survey				
278	Top	5250	" 17	1	4	None	0	6

Oakridge Ranger District

ame of Lake	Elev. Ft.	Date Surveyed 1937	Ave. No. bottom organisms per $\frac{1}{4}$ cu. ft.	No. Samples Taken	Species of Trout Present	Hyalella & Gammarus shrimps	No. Sh orga sc
tter	4600	Oct. 8	8	4	None	332	
ower Erma Bell	4500	" 6	223.9	5	RB	92	
iddle " "	4700	" 7	73.8	5	RB	46	
pper " "	4800	" 8	16.6	5	RB	26	
illiams	5100	Sept.14	5	5	RB	0	
oolack	4600	" 28	10.8	5	RB	46	
ud	4950	" 29	24.2	2	RB	72	
dna	5000	" 29	5.6	5	None	6	
elen	5260	" 30	14.6	5	RB	0	
lara	5170	" 28	Too shallow to survey				
astern Brook	5020	" 27	22.2	5	EB	266	
mma	5190	" 25	33	3	None	216	
dward	5026	" 25	Too shallow to survey				
hig	5350	" 23	23	5	None	133	
orrey	5290	" 22	3.6	5	RB	8	
ahanna	5180	" 21	5.2	5	RB	38	
arvey	5300	" 21	3.8	5	None	29	
ervus	5370	" 24	10.8	5	None	0	
iwa	5400	" 20	5.4	5	RB	134	
rnie	5430	" 18	48.5	4	None	0	
. Rigdon	5470	" 17	60.8	5	None	34	
. Rigdon	5500	" 16	16.8	5	None	0	
anim	5460	" 16	12	3	None	0	
etty	5550	" 17,1936	2.4	5	RB	0	
old	4900	" 16, "	0	5	RB	22	
. Marilyn	4850	" 14 "	0	5	EB	30	
. Marilyn	4930	" 16 "	.4	5	EB	35	
pal	5490	" 7,1937	3	5	RB	46	
impanogas	5319	" 8,1937	23.3	8	RB	107	
. Timpanogas	5305	" 4,1937	1.4	5	RB	59	
ndy	6000	" 3,1937	2.6	5	None	0	
mos	6010	" 3,1937	5.4	5	RB	0	
ndigo	6050	" 9,1937	14	5	RB	0	
une	5700	" 2.1937	.6	5	RB	0	

emporary numbers, survey to be completed in 1938