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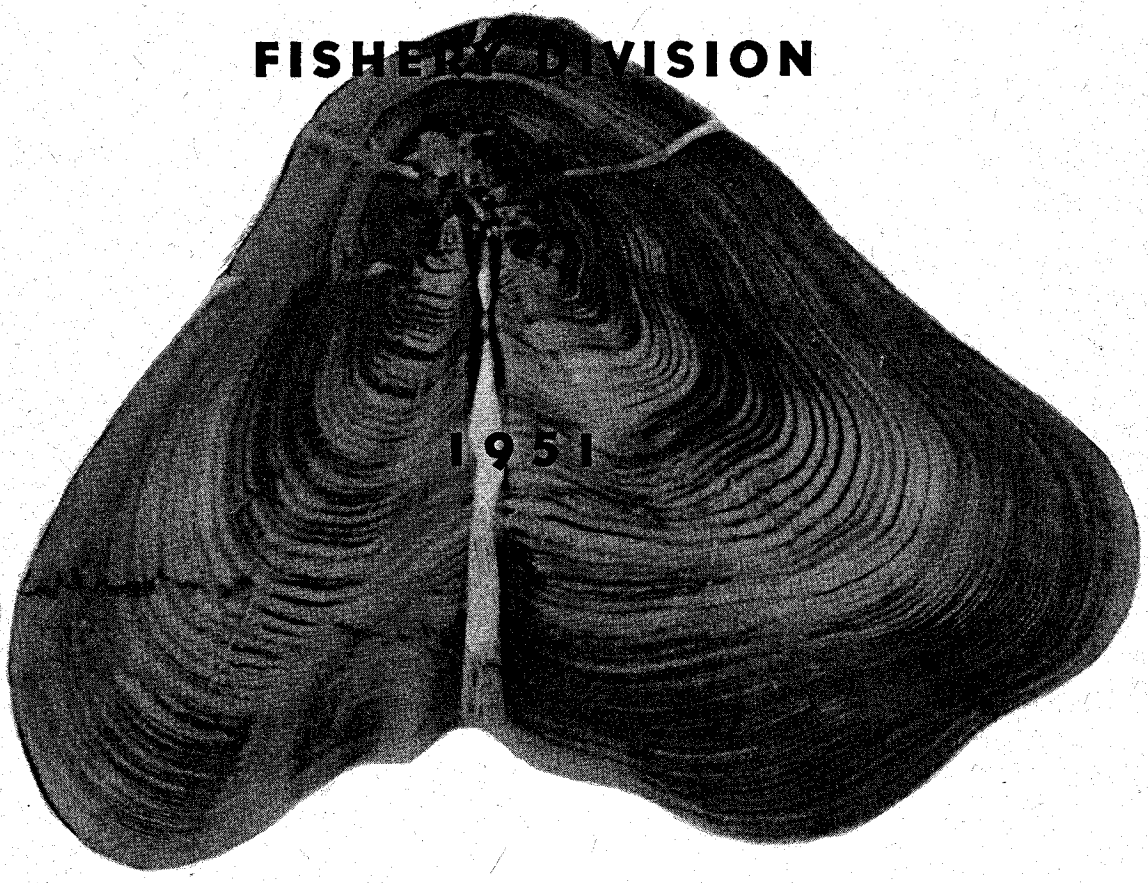
Annual Report

OREGON STATE GAME COMMISSION

FISHERY DIVISION



1951

The cover photograph of a pectoral fin ray cross-section from a Columbia River white sturgeon was supplied through the courtesy of Ivan Donaldson, Fishery Biologist, Corps of Engineers. The fish weighed approximately 750 pounds and was 81 years of age. It was caught by an Indian in 1951 near The Dalles.

ANNUAL REPORT

FISHERY DIVISION

1951

OREGON STATE GAME COMMISSION
P. W. Schneider
State Game Director

January, 1952

INTRODUCTION

Research, management and production were the activities pursued by the Fishery Division of the Oregon Game Commission in 1951.

The reports of fishery personnel which make up the Annual Report follow generally the pattern of 1949-50. Summaries of work preceding that accomplished in 1951 are included wherever pertinent.

A program of obtaining public access to fishing waters was started as a result of the advent of funds accruing from the passage of the Dingell-Johnson Act. The Butte Creek adult spring chinook salmon holding pond, designed to prevent losses resulting from prolonged confinement of green fish, was built and used with marked success. The percentage of hatchery fish in the catch on the Nestucca River, as an example of a generally typical coast stream, has doubled in two years as a result of the new policy of stocking rainbow trout. The return of hatchery rainbow trout to the angler on the Alsea River, a coast stream, was shown to have exceeded that of hatchery cutthroat by 11.7 per cent where the two species were stocked in equal numbers. The Atlantic salmon was introduced and is being reared for stocking in inland lakes. The white catfish was brought into the State for an experimental stocking. A general policy of the cessation of stocking of trout of sub-legal length was begun. Planting methods were refined through improvements in planting boats and in the invention of the "trout trolley". The passage of downstream migrant fish through turbines has been examined for the purpose of obtaining belt screen installations where necessary. Orders for turbine screening were issued to two companies on the Rogue River. The sport catch of salmon and steelhead was measured through an analysis of data resulting from the use of the salmon and steelhead tag card. Much fishery research has been relegated to the Oregon Cooperative Wildlife Research Unit at Corvallis.

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UMPQUA RIVER INVESTIGATIONS

FISHERY RESOURCE INVENTORIES

Winchester Dam counts

All upstream migrating fish in the North Umpqua River are counted at Winchester Dam. The work was started in late 1945 for the purpose of maintaining an inventory of the spawning populations. In 1951, the first return of spring chinook salmon was recorded. It showed a 49 per cent increase over the 1946 parent run. The current silver salmon run will not be complete until December, but a gain of more than 160 per cent is certain. The 1950 migration was 27 per cent greater than its parent. Sea-run cutthroat, or salmon trout, are up 52 per cent on an incomplete count, but the 1950 cycle showed a 42 per cent loss. The 1951 summer steelhead were down 34 per cent from their 1947 parents, and the 1950-51 winter run lost 63 per cent.

The annual inventories of rough fish reveal a definite downward trend. This cannot be interpreted as a general decline of squawfish and sucker populations throughout the Umpqua watershed, but certainly indicates a reduction in the numbers inhabiting the lower North Umpqua River.

Table 1

Winchester Dam fish counts, 1946-51

Species	1946	1947	1948	1949	1950	1951 (1)
Spring chinook, adults	1,974	2,994	2,245	2,109	2,044	2,939
Spring chinook, jacks	533	817	248	484	277	677
Fall chinook, adults	---	---	---	13	22	13
Silver salmon, adults (2)	1,380	1,010	737	1,330	1,284	2,098
Silver salmon, jacks (2)	58	28	53	82	91	161
Summer steelhead	3,361	5,113	2,762	1,672	2,835	3,361
Winter steelhead (3)	6,563	11,220	9,700	9,225	7,008	4,188
Sea-run cutthroat	1,138	974	437	493	664	1,508
Other trout	82	69	79	157	360	266
Squawfish (chub)	726	1,692	471	487	256	336
Suckers	5,158	12,856	6,192	4,930	3,050	972

(1) Counts through December 31, 1951. All species considered complete.

(2) Figures for 1950 contain an estimated 194 adults and 14 jacks that are presumed to have passed through the counting station while it was out of operation after flood damage.

(3) Figures represent the runs ending in the calendar years listed.

South Umpqua River resting hole counts

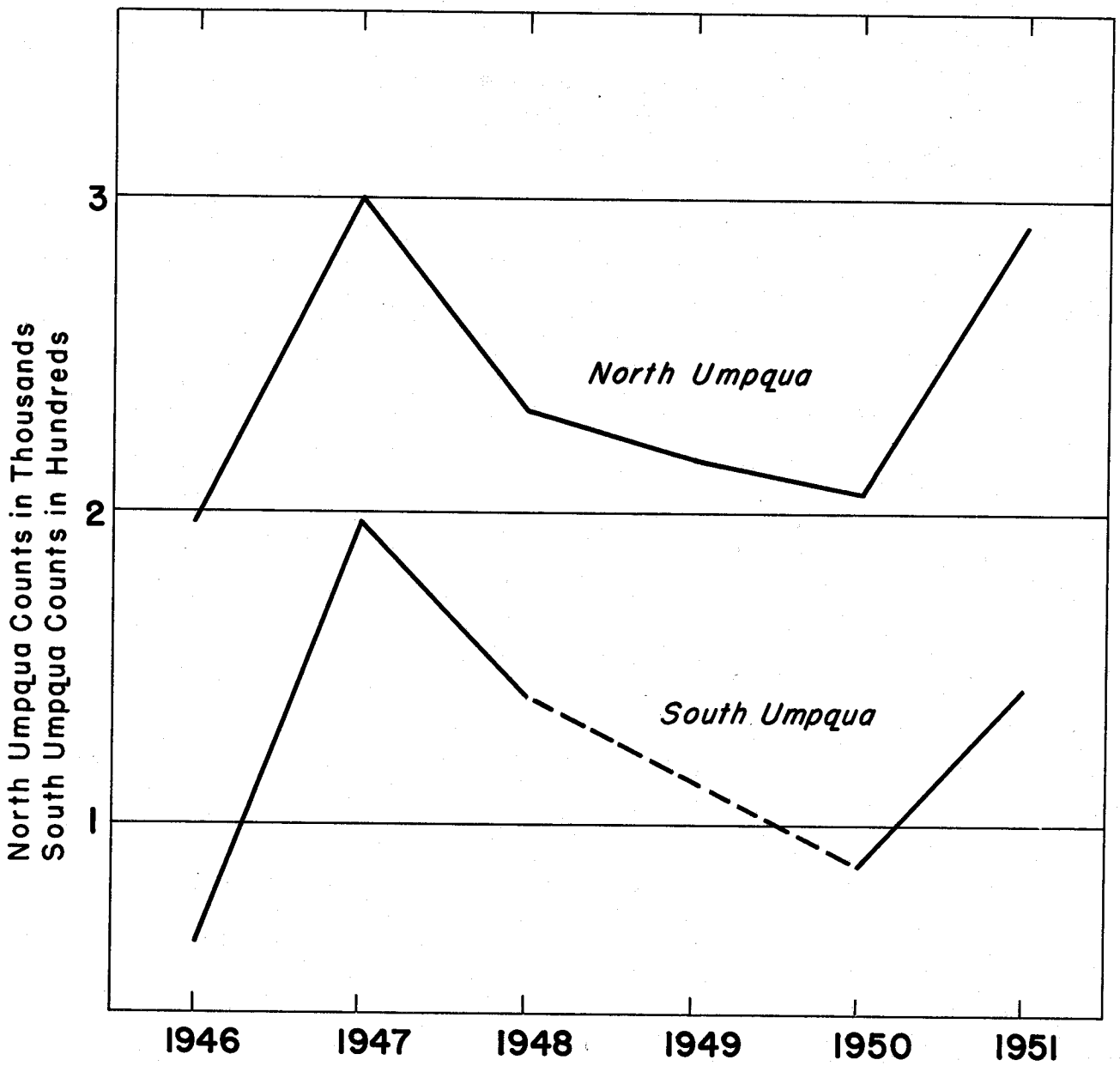
The fifth yearly count of spring chinook in the resting holes of the upper South Umpqua was accomplished in late August. The purpose of the inventories is to determine the population trend of the species in that river. In 1951 the work was hampered by rainfall and turbid water; as a result the total of 142 adults and 16 jacks must be considered to be minimal. The counting area extends from the confluence of Black Rock and Castle Rock Creeks downstream to the mouth of Boulder Creek, a distance of some 13.5 river miles. In the same area, 70 adult fish were found in 1946, 198 in 1947, 141 in 1948, and 92 in 1950. No count was made in 1949.

Following a study of tag recoveries, previous workers expressed an opinion that the resting hole counts give approximately 40 per cent of the total number of fish in the area. This percentage, of course, will vary with the physical conditions that exist at the time of the counts and with the experience of the counters. The 1946 and 1950 surveys were made by inexperienced personnel, and the 1951 count was conducted under adverse weather conditions. The probable result was that smaller percentages of fish were tabulated in those years than in 1947 and 1948. Even so, the annual variations of the South Umpqua counts closely parallel those obtained at Winchester Dam on the North Umpqua. The two sets of counts are compared in Figure 1.

Lower Umpqua tributary spawning ground counts

Mature salmon are counted on the spawning grounds of sixteen sample streams each fall in order to determine the population trends of fish using the lower Umpqua tributaries. The 1950 work was hampered by erratic weather and unsettled water conditions throughout the spawning season. Recurring freshets and muddy water caused postponement of the surveys on several streams until after spawning had been completed. As a result, many fish probably were not counted.

The figures obtained indicate that fewer silver salmon were in the sample streams in 1950 than had been in the 1947 parent year. Some tributaries did have an increase, but the over-all total was less. It is believed that had it been possible to make good counts in 1950, gains over the parent cycle would have probably resulted. The records of 1948 and 1949 reveal fourfold increases over the respective parent runs. Table 2 outlines the information gathered in the six years the study has been conducted.



Comparisons between the Annual Fluctuations of Spring Chinook Salmon Runs in the North and South Umpqua Rivers

Fig. 1

Table 2

Silver salmon spawning ground counts, Lower Umpqua tributaries
(Adults - Jacks)

Stream	Miles surveyed	1945	1948	1946	1949	1947	1950
Schofield Creek	2.0	28-1	104-3	50-1	114-23	211-8	145-14
Brush Creek	1.0	1-0	13-0	6-0	13-0	25-1	No count
Buck Creek	3.0	16-0	95-0	28-13	115-17	290-8	74-12
Paradise Creek	3.0	0-0	15-0	4-2	23-3	19-0	19-3
Little Paradise Creek	2.0	0-0	10-1	5-0	3-0	0-0	20-1
Mehl Creek	3.0	13-1	26-4	9-7	30-4	2-0	No count
Spencer Creek	3.0	16-2	39-0	5-0	35-1	16-0	20-2
Miller Creek	1.0		51-3	7-0	93-20	85-9	98-5
Dry Creek	0.25		5-0	10-1	40-19	37-3	33-8
Alder Creek	0.5		16-1	4-0	42-13	11-2	24-2
Dean Creek	1.5		8-2	0-2	16-6	2-0	25-5
Chapman Creek	2.0		9-0	5-11	13-3	32-3	No count
Charlotte Creek	2.0		3-1		7-5	2-0	8-3
Hancock Creek	1.0		9-0		2-0	12-2	7-0
Wells Creek	1.5		5-3		1-0	6-0	6-2
Little Mill Creek	1.5		0-0		4-1	87-0	6-0

SEAWARD MIGRATIONS

Recently a two-year study of the seaward migrations of immature salmonoids was completed. Data were collected by seining at various points along the main and North Umpqua Rivers on approximately a biweekly schedule. It was thought that the fish movements could be plotted by determining the relative abundance of young fish in the different parts of the river system at different seasons. That supposition was borne out for chinook salmon, the fish of primary interest, but collections of other species were spotty.

There are two distinct downstream migrations of chinook salmon in the Umpqua River. The first is largely in June, shortly after the fry emerge. Presumably most of the fall chinook move out at that time. It appears that the greater number of spring chinook summer-over in the North Umpqua and pass downstream in October and November. Throughout the summer, many young fish were observed in the deep holes beyond the reach of the seine, but collections were small. After the first fall freshets, when the water temperatures drop, the fingerlings start to move downstream. A sharp build-up of the population in the main river results, as is shown in Table 3.

The time required for an individual fish to make the journey, once the general movement is underway, seems to depend on its size. In November, when the greatest number of chinook fingerlings occur in the main Umpqua, the average individual length is considerably greater than during most of the succeeding months. After that peak, the average length and the over-all length range remains almost constant. This phenomenon is interpreted to mean that the biological urge motivating the migration develops in close relationship to the size of the individual.

Table 3

Occurrence and size of chinook salmon fry and fingerlings in the Umpqua River system

Month	Average number of fish per seine haul		Average length (fork length in millimeters)	
	North Umpqua	Main Umpqua	North Umpqua	Main Umpqua
March	3.25	0.08	41.1	43.8
April	7.00	0.14	42.0	52.3
May	9.50	2.52	50.0	57.2
June	13.75	4.48	47.1	73.0
July	10.00	0.89	66.0	73.9
August	0.99	0.0	88.9	-
September	4.67	0.0	90.3	-
October	10.77	0.83	94.6	101.7
November	1.44	5.27	92.7	111.4
December	0.0	2.06	-	97.6
January	0.0	1.67	-	99.7
February	0.0	1.27	-	98.1
March	0.50	1.00	96.5	97.8
April	0.0	0.14	-	97.8
May	0.17	0.08	99.0	131.0

SALMON RESTORATION PROGRAM

The inventories of the spawning migrations have shown that the salmon populations in the Umpqua system are at seriously low levels and a general program of rehabilitation is underway. The wild adult fish have been afforded a high degree of protection since 1946. It is thought that the rate of recovery is perhaps being hastened through artificial propagation. Previous experiences of other fish-cultural agencies have been that salmon propagation, especially in respect to spring chinook, is not overly successful. The Game Commission's program is believed to be superior to the attempts of the past. Under that program, fish are being reared to a large size before being stocked. Most of the yearling fingerlings are marked so that the returns may be identified.

The first releases of salmon were made in March, 1951. A total of 51,850 eighteen-month-old spring chinook was planted in the North Umpqua at Winchester. The fish came from eggs secured from Umpqua, Rogue, and Columbia (Imnaha) River stocks. In September one jack, bearing the Columbia mark, was recovered from an upper river spawning bar. It measured 12.75 inches, fork length. Two jacks from the Rogue River stock were reported to have been taken by an angler in the same month. These fish were 14 inches in length. The fish of each lot averaged between seven and eight inches when released. Most of the adults are expected to return in 1953 or 1954.

To determine the length of time that hatchery-reared fingerlings require to migrate to sea after planting, weekly collections were made at various points along the river between the release area and the bay (Figure 2). It was found that many of the fish moved rapidly and were in tidewater within a month of their stocking. Some straggled downstream over a period of three months, and a few apparently refused to leave the planting site. Trout anglers occasionally reported catching marked salmon at Winchester until midsummer. Table 4 details the collection data.

Table 4

Recovery of downstream migrating hatchery-reared chinook
Umpqua River, 1951

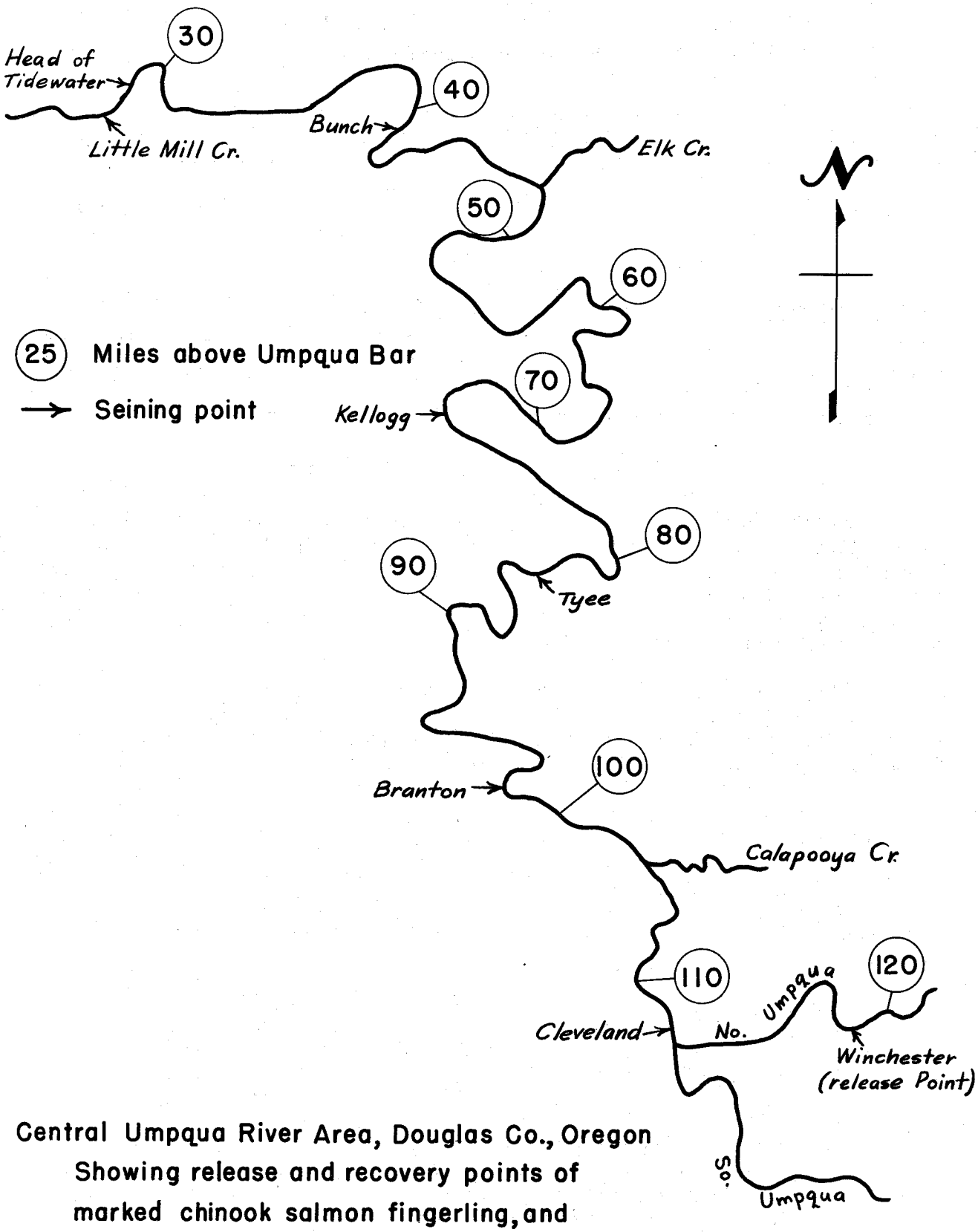
Location	March 13	March 21	March 29	April 4	April 12	April 18	April 25	Miles below release point
Winchester - release point, no seining done								0
Cleveland	0	1	0	0	0			8
Branton	2	0	1	1	0	0	0	20
Tyee	29	7	0	6	0	0	0	35
Kellogg	8	0	0	0	0	0		46
Bunch	9	0	1	0	0	0	0	78
Head of tide - no seining done								90
Little Mill Cr.	0	2	0	0	0	1	0	91
Umpqua Bar - no seining done								119
Total recoveries	48	10	2	7	0	1	0	

The release of marked salmon is to be continued each year in order that the success of artificial propagation can be evaluated. About 32,500 Umpqua-stock fish of the 1950 brood are presently being held at the Rock Creek Hatchery for release in the spring of 1952. Eggs were taken in 1951 for plantings to be made in 1953.

While the emphasis of the restoration program has been on spring chinook, other types of salmon are not being ignored. Some 24,000 yearling silver salmon fingerlings were released in the river in 1951, and 25,000 more are on hand for planting as yearlings in the spring of 1952. More than 416,000 fall chinook fry also were stocked in 1951, and 25,500 yearlings are being held to be stocked in 1952. Eggs from the 1951 broods of silver and fall chinook salmon are to be hatched on the Umpqua for future plantings.

FISH STOCKINGS

Three-quarters of a million fish, weighing nearly 62,000 pounds, were stocked within the Umpqua watershed in 1951. Most of this number was composed of salmon and small trout which were not intended to be caught in the 1951 season, but 220,000 legal trout were also released. Lakes in the upper reaches of the drainage received 43,000 fish by airplane planting; the remainder were released by truck.



Central Umpqua River Area, Douglas Co., Oregon
Showing release and recovery points of marked chinook salmon fingerling, and distances above the Umpqua Bar.

Fig. 2

Table 5

Fish releases in the Umpqua watershed, 1951

Species	Fry	Fingerling	Yearling	Brood	Total
Rainbow	25,559	4,950	208,157	251	238,917
Cutthroat			9,272		9,272
Eastern brook		17,360			17,360
Spring chinook			51,849		51,849
Fall chinook	416,360				416,360
Silver salmon		3,740	20,194		23,934
Total	441,919	26,050	289,472	251	757,692

MISCELLANEOUS TAGGING AND TAG RETURNS

Although tagging and tag recoveries were emphasized in previous years, little effort was expended on the work in 1951. One hundred old brood fish were jawtagged and released in the North Umpqua in mid-April. In the subsequent angling season, ten tags were voluntarily returned by anglers. It is known that other fish were taken, but definite information concerning the dates of capture and tag numbers is lacking.

Tags from five rainbow trout caught in Loon Lake in 1951 were received. These were part of 100 fish released in April, 1950. When added to the thirty-three fish known to have been caught the first season, a return to the angler of at least 38 per cent was determined.

Three very interesting tag returns from the 1950 releases in the North Umpqua were reported. On January 27, Lt. M. R. Coleman, U. S. Navy, caught a 14.5-inch rainbow in the Garcia River of California. The fish came from a plant of 200 tagged fish made at Winchester on April 7, 1950. The lot averaged 7.5 inches at the time of stocking, and the fish grew a possible 7 inches while traveling some 120 miles in fresh water and 300 miles at sea in the 9.5 months it was at liberty.

Another angler turned in a tag taken from a 17.7-inch fish caught in tidewater of the Trask River on April 14. It was stocked on April 5, 1950 at Honey Creek on the North Umpqua, some 150 miles above the ocean. That fish, also, came from a lot that averaged 7.5 inches when planted, so it grew approximately 10 inches in a year while traveling more than 275 miles.

The third return came from the Umpqua. On October 10, Mr. E.O.Jones of Roseburg caught a 5-pound, 21-inch rainbow below Glide. It had been released 12 miles further upstream on April 11, 1950. In the intervening eighteen months the fish is presumed to have grown nearly 14 inches and gained over 4.75 pounds. While it may be possible to make such growth in fresh water, it is highly improbable. It is thought, therefore, that this trout went to sea. Scales were not available, so proof of an ocean journey is lacking.

On September 23, 1951, two cutthroat trout were caught at the head of tidewater on Smith River. Each fish measured 12.5 inches, fork length, and had the left ventral fin removed. A search of the records revealed only one stocking of cutthroat thusly marked could have accounted for these returns. That plant was 3,100 fish released in the Nestucca River in April, 1949. The lot averaged 7.7 inches when planted. Experience indicates that most coastal cutthroat between 12 and 14 inches in length are on their first spawning run. Past recoveries of marked cutthroat show that yearling fish attain that size by either the first or second fall after stocking; therefore, fish of the Nestucca plant should have run in the fall of 1949 or in 1950. Also, it is believed improbable for two fish to be taken at the same place and date so far removed from the release point. The origin of these trout remains in questionable status.

The Winchester Bay fishery was known to have produced at least three tagged chinook salmon in 1951. All three tags originated in California, being placed on fish in February, June and August, 1950 in the San Francisco Bay region. Two fish weighed 18 pounds, and the third 9 pounds, when caught in July, 1951.

FLOOD LOSSES AND SALVAGE

In late 1950 the Umpqua watershed experienced one of its greatest floods of recent times. The magnitude of the freshet was such that many gravel bars were shifted, some being moved several hundred feet. As it occurred shortly after the spring chinook spawning period, it was suspected that some loss of spawn resulted. Subsequent sampling of the fingerlings did not yield catches as large as had the sampling of previous broods. Substantial losses of fingerlings from the 1949 broods of chinook and silver salmon may also have resulted. The flood came at the peak period of downstream migration. After it had receded, many young fish were found to have perished on the lowlands adjacent to the river. All attempts at salvage proved to be futile. The kill of immature rough fish was extremely heavy.

Numerous reports of stranded game fish were received throughout the spring of 1951. All of the reported areas were checked, but salvage was not feasible in many. Several thousand silver salmon fry were recovered from an intermittent stream in the Siltcoos Lake system, and approximately 1,200 fingerlings were taken from an abandoned log pond in the Lookingglass Creek drainage.

Late each winter, much of the lower Coquille valley floor is flooded. When the waters recede, many ponds that abound with fish life remain in the fields. Local interest in saving these fish resulted in cooperative salvage arrangements in 1951. The Game Commission supplied equipment and supervision, while volunteer groups of sportsmen did the work. No counts were made, but it is conservatively estimated that many thousands of game fish were saved. Tentative plans for future salvage operations in the Coquille bottom lands have been made.

SPORT FISHERY CATCH AND EVALUATION

Spring chinook fishery

The 1951 spring salmon season was open between April 15 and May 31, the same as the previous two years. The bag limit remained unchanged, being not more than one fish in any seven consecutive days. Under

these regulations an estimated 5,164 angler trips were made to take 444 adult salmon. In respect to the number of fish per angler trip, the 1951 season was the second poorest in the six years of checking, but the total catch was well above the average annual take. The low catch per angler was primarily due to a heavy influx of new anglers. Most of the old-time fishermen considered 1951 the best season in several years. While much greater angling effort was expended in the section above Tyee, the catch success ratio was the same for the lower and upper river areas. The lower river agent found that it required 11.66 angler trips to bag each salmon, while in the upper area the rate was 11.62 trips per fish. Comparative data of the two river sections for the years 1946 to 1951 are given in Table 6.

Table 6

Spring chinook salmon sport fishery effort and catch, 1946-1951

	Lower River			Upper River			Total		
Year	Anglers	Fish	Fish per angler	Anglers	Fish	Fish per angler	Anglers	Fish	Fish per angler
1946	1,151	233	.202	1,250	250	.200	2,401	483	.201
1947	762	101	.133	1,023	149	.146	1,785	250	.140
1948	550	75	.136	3,103	514	.169	3,653	589	.161
1949	1,000	125	.125	1,500	200	.133	2,500	325	.130
1950	1,573	89	.057	2,564	152	.059	4,137	241	.058
1951	1,539	132	.086	3,625	312	.086	5,164	444	.086
Aver.	1,096	126	.115	2,178	263	.121	3,273	385	.118

Winchester Bay summer salmon fishery

The Winchester Bay salmon fishery was considerably larger in 1951 than any previous season. More than 20,000 anglers caught nearly 11,000 fish for a total weight of over 178,000 pounds. A greater proportion of chinook salmon were landed than had occurred in any earlier catch. The species was dominant in the catch throughout most of the period, but as in past years, was replaced near the end of the season by silver salmon. See Table 7.

Table 7

Angling effort and salmon catch, Winchester Bay

Item	1949	1950	1951
Boat trips	7,243	6,452	8,190
Number of anglers	18,107	16,947	20,475
Number of fish: chinook	1,153	2,482	5,979
silver	3,760	2,826	4,689
Total number of fish	4,913	5,308	10,668
Average weight: chinook	21	19	22
silver	9	10	10
Pounds of salmon caught	58,053	75,418	178,428
Number of fish per angler	0.28	0.31	0.52
Number of pounds per angler	3.21	4.45	8.67
Number of anglers per boat	2.50	2.63	2.50

As in 1950, forage fish did not enter the bay in 1951; consequently, the salmon also stayed outside. The result was that most of the angling took place in the vicinity of the bar and at sea. Completion of a new jetty in early 1951 restricted the river's mouth and thus increased the water turbulence over the bar during low, outgoing tides and stormy weather.

Considerable difficulty was experienced in obtaining proper law enforcement. The State Police maintained a very close watch over the fishery, but were powerless to adequately enforce bag limits and tagging regulations. Inasmuch as most of the angling was done outside of the confines of the bay, many people felt that they were under no restrictions whatever. Actually, the state regulations applied out to the 3-mile limit, which embraced practically all of the angling area. Once word had spread that the law could not be enforced, violations were frequent. It is a situation that has become more serious each year, and can be stopped only by the adoption of an adequate landing law.

Eleven anglers were drowned in pursuing the fishery in 1951. The shocking loss of life can be attributed to three factors: (1) most of the angling took place in the vicinity of the bar, (2) most anglers were inexperienced in handling small boats in heavy seas, and (3) the Coast Guard could not prevent small boats from crossing the bar. If similar losses continue to occur in future years, public sentiment will probably force the adoption of restrictions that will virtually abolish the fishery. The sport is exceedingly important to the State, and action should be taken to protect life and yet allow the fishery to continue.

North Umpqua summer steelhead fishery

A study of the summer steelhead in the Umpqua watershed was inaugurated in 1951. From the partial catch information collected, it was estimated that 450 fish were taken by anglers. Of these, 265 were caught above Winchester Dam, or removed from the 3,361 fish that passed through the counting station. Turbid water conditions frequently prevented angling,

so the catch was probably below the average annual take; yet 13 per cent of the run was known to have been removed, and the population was already down 34 per cent from the 1947 parent cycle.

Summer steelhead of the Umpqua system are peculiar in that practically the entire run enters the Steamboat Creek drainage to spawn. That subsystem is not open to angling, and it has suffered little from the encroachment of man. Within a few years the private and governmental holdings in that area will be subjected to logging. In addition, highway construction now underway will make all of the fishing areas of the middle North Umpqua easily accessible, which will undoubtedly increase the angling pressure greatly. It is of paramount importance, therefore, that the management of this species be given all possible attention.

STREAM IMPROVEMENTS

Barriers and fishways

New fishladders were constructed over five private dams that had been impeding spawning migrations. They are located on Cow, Slide, Buck and Hubbard Creeks in the Umpqua system, and Tahkenitch Creek, tributary to the Pacific Ocean. The dams on Cow and Slide Creeks had completely blocked upstream fish movement for many years. The remainder of the dams were of recent construction. A ladder over a private dam on Wolf Creek in the middle Umpqua area was badly damaged by floods early in 1951. The condition was corrected after the owner had been notified. An obsolete dam, formerly used by the Game Commission to supply water to the Rock Creek Hatchery, was removed.

Fishways are needed at South Umpqua and Steamboat Falls, two serious natural barriers. Miles of excellent spawning areas lie above these falls, and can now be reached only through great effort on the part of the fish. Some work is necessary at Smith River Falls to make the existing fishway operate properly. At low water periods there is insufficient flow through the ladder to allow for passage of fish; consequently, the migrations of coastal cutthroat are detained and serious losses frequently occur. Extensive remodeling of the Game Commission's ladder over Winchester Dam is needed. The present fishway is not of proper design to adequately pass fish at all water stages.

The turbine at Winchester Dam has been frequently reported as a source of loss of many immature fish. Numerous salmon fingerlings were said to perish when passing down through the penstock and wheel. In 1951 tests were conducted, using marked hatchery fish in order to determine the extent of the loss. Recoveries, made by anchoring a fyke net in the turbine discharge, showed that 1.55 per cent of the fish were seriously injured. Observations indicated that a higher loss may have resulted from the action of predatory fish in the turbine effluent. A number of small salmon appeared to have had their equilibrium disturbed after passing through the turbine, and were easy prey for large squawfish in the eddies below the powerhouse.

Pollution abatement

The lumber industry is responsible for most of the industrial pollution existing within the Umpqua basin. Logging debris impedes fish runs in several streams, although operators cleaned up six clogged

waterways in 1951. Correction of two similar situations is still pending, one of which has required legal action. Improper disposal of sawmill wastes is another problem of some magnitude. The construction or repair of waste burners corrected two bad conditions of this type, while a third mill made a general cleanup of their entire grounds and operations.

The flushing of log ponds directly into natural waterways for the riddance of accumulated bark and foul water remains a problem.

Pollution resulting from gravel operations is of minor importance in the Umpqua area. Two operators installed settling basins to remove crusher grit from their wash waters, after being interviewed by Game Commission and Sanitary Authority agents in 1951. The removal of gravel from stream beds occasionally causes turbid water.

Much turbidity in the North Umpqua River resulted from the California-Oregon Power Company's construction in the upper river area. The constant contact maintained with that company by the U. S. Forest Service, the State Sanitary Authority, and Game Commission personnel, has greatly reduced the unnecessary disposition of earth materials into the river. Most of the muddy water in 1951 resulted from a breakdown of the Slide Creek canal and from dam construction at Soda Springs. Canal construction along Fish Creek was responsible for some turbidity. It was unfortunate, recreationally speaking, that much of the mud passed downstream at the height of the summer steelhead season.

A pollution problem with which the Game Commission has not been directly concerned, but one that is of vital interest, is municipal sewage disposal. Information from the State Sanitary Authority indicates that correction is being accomplished as rapidly as can be expected. While progress is not satisfactory at some points, disposal plants that will accommodate the greater part of the area's population will be completed in the near future. Roseburg and the adjacent sewage disposal districts will have their systems in operation by the spring of 1952. Most of the lines have been laid, and complete treatment will be made. The city's storm sewers have been separated from the main sewage system. In the past, when both systems employed common lines, untreated sewage frequently was carried to the river since the treatment plant could not handle the heavy, runoff flows. The town of Myrtle Creek is constructing a disposal plant which should be operating by March, 1952. Riddle has issued bonds to finance their system, but construction has not been started. Canyonville, Winston, Glendale, Drain, and Reedsport are making preliminary studies. Oakland and Sutherlin are apparently doing little at present, although Oakland has been directed to submit financing and building plans to the Sanitary Authority by December, 1951.

Extensive inquiries concerning the various effects of water pollution resulting from Kraft pulp mill operations were made because various paper companies became interested in sites for sulfate pulp mills on the North Umpqua River. Information was received from researchers engaged in the study of Kraft effluents, men of the industry, and from an inspection tour of a Kraft mill. A summation of the data indicates that the North Umpqua would be seriously injured by the establishment of such an industry.

WARM-WATER FISH INVESTIGATIONS

A study of catfish (Ameirus nebulosus) and yellow perch (Perca flavescens) of the Tenmile Lakes was made between November, 1950 and October, 1951. Two principal objectives were sought: (1) to ascertain whether or not the lakes were overpopulated with these fish, and (2) to determine the compatibility between them and the native salmonoids. Samples were secured by the periodic collection of fish with trap nets set at strategic locations about the lakes. Individual lengths were taken, and age determinations and stomach-content analyses were made following the collections. Age classification was determined by a study of the scales of perch and vertebrae of the catfish.

The age-length relationships did not disclose severe stunting of either catfish or perch but a steady advancement of the lower limits of the length range for each successive age group was recorded. The small yearly growth increment may indicate that the occurrence of stunted populations can be expected in the relatively near future. It would be, therefore, expedient to consider methods of reducing the populations of both species. If the fish populations are allowed to decrease in average length, it may be impossible to market the fish in an operation designed to reduce numbers.

Table 8

Age-length relationship of warm-water fish in Tenmile Lakes

Species	Age group	Number of samples	Length range in inches	Average length in inches
Catfish	I	1	- 3.0 -	3.0
	II	6	7.7 - 9.3	8.2
	III	47	8.5 - 11.5	10.1
	IV	99	9.3 - 12.6	10.6
	V	37	10.2 - 12.6	10.9
	VI	1	- 11.4 -	11.4
Perch	I	28	5.1 - 7.1	5.8
	II	68	5.6 - 10.8	7.9
	III	78	6.9 - 12.8	9.5
	IV	48	7.8 - 11.3	9.2
	V	7	9.8 - 12.2	10.9
	VI	1	- 11.6 -	10.6

An endeavor to measure the food relationship between warm-water game fish and salmonoids was made through an analysis of the stomach contents of the warm-water fishes. The high incidence of empty stomachs tends to show that the collection method employed took a low proportion of feeding fish. Those in whose stomachs food occurred indicate that bottom organisms, principally mollusks and crustaceans, were the preferred diet. Most of the food forms commonly found in the stomachs of perch and catfish were also preferred by the native game fish. Competition for food, therefore, must be keen, with the result that the trout and salmon population are probably affected by the abundance of other fish.

The collected samples did not reveal that the ingestion of young salmonoids was a problem, but the occasional occurrence of young fingerlings in the stomachs of angler-caught fish was reported. Even if a very small proportion of perch and catfish are predaceous, a serious loss could result because of the magnitude of the warm-water game fish populations.

Warm-water fish have long been blamed by residents of the area for the decline of yellow mayflies. During the period of emergence of that insect, large numbers of catfish and perch are known to resort to surface feeding. It was, therefore, assumed that at least during specific periods, mayflies entered the diet of both species. The study revealed that 2.5 per cent of the analyzed catfish stomachs contained the insect, and it was found in none of the perch stomachs. It must be noted that the data may not represent the true feeding habits owing to the large number of fish in the sample with empty stomachs.

ROGUE RIVER AND CURRY COUNTY INVESTIGATIONS

Introduction

Investigations continued on the Rogue River basin and Curry County streams in order to analyze and correct factors causing the decline of important migratory fish runs.

Participation in stream improvement work was an important objective for the 1951 season. Stocking improved trout fishing, and new methods were practiced in order to obtain greater returns of stocked trout to the angler. Fish population increases continuing throughout the Rogue Valley and in the Brookings area of Curry County have prompted increased demands for more and better fishing. Additional studies and investigations of angler pressure were included in census programs in order to manage better the resident and migratory fish resources.

Most sportsmen were well satisfied with the angling afforded in the Rogue basin during the 1951 season and particularly so in Curry County streams. Trout fishing was considered good to excellent in all sections. Spring chinook fishing on the Rogue showed no improvement over the 1950 season, but fall chinook angling was definitely better. Angling for silver salmon was considered good to excellent by most anglers. Steelhead angling was generally better than the seasons of the previous four years.

Upstream migrant counts at Gold Ray Dam

The counting station at Gold Ray Dam has been in continuous operation since April, 1942. The fish counted are anadromous species migrating to the upper Rogue River to spawn. The counts have shown a general decrease for spring chinook, silver salmon, and steelhead trout. The return of at least two cycles for each species has been counted. Table 9 presents the annual counts made by species. Table 10 presents the percentage of return in relation to the parent runs.

Table 9

Counts of anadromous fish runs over Gold Ray Dam

Year	Spring chinook	Silvers	Steelhead	
			Summer run	Winter run
1942	43,429 (15.6)	4,608 (4.7)	5,725	16,634
1943	38,052 (11.0)	3,290 (6.1)	5,768	13,855
1944	31,940 (13.1)	3,230 (10.4)	5,282	14,196
1945	33,718 (17.8)	1,907 (4.4)	4,804	11,185
1946	30,065 (16.5)	3,840 (5.5)	3,266	10,754
1947	34,740 (9.5)	5,340 (3.1)	3,431	8,707
1948	27,742 (10.8)	1,764 (4.8)	1,995	8,073
1949	20,028 (10.5)	9,440 (4.3)	2,761	9,667
1950	16,767 (18.8)	2,007 (11.8)	3,717	6,571
1951	21,111 (25.0)	1,460 (8.8)*	2,630	

Figures in parentheses are percentages of jack salmon.
*Incomplete (November 15, 1951).

Until 1951, no attempt had been made to segregate the steelhead count into its component runs, namely, the summer run and winter (and fall) runs. For management purposes, a break in the annual count was found necessary. An arbitrary date of November 15 was chosen to conclude the summer run and start the winter run count. During most years, the middle of November has a low point in the rate of count, and bright, winter-run fish have not yet appeared. The steelhead column in Table 9 shows counts of the individual steelhead runs as separated by the November 15 drawline.

Table 10

Percentage of return of salmon progeny at Gold Ray

Year of return run	Chinooks /1		Silvers /2	
	Parent run	Percentage of return	Parent run	Percentage of return
1945			(1942)	41.1
1946	(1942)	69.2	(1943)	116.7
1947	(1943)	91.3	(1944)	165.3
1948	(1944)	87.2	(1945)	92.5
1949	(1945)	59.4	(1946)	245.5
1950	(1946)	55.8	(1947)	37.6
1951	(1947)	60.8		

Note: 100 per cent return would indicate that the return runs equaled the number from which it originated.

/1 Chinooks considered as all returning in their fourth year.
/2 Silvers considered as all returning in their third year.

A heavy catch of summer-run steelhead was made below Gold Ray in 1950. An abnormally heavy flood which occurred on October 29, 1950 made steelhead angling poor through the remainder of the season. Good escapement of winter-run steelhead to and through the Gold Ray counting station was afforded in late winter. Such information might well explain the lower 1950 summer-run count and larger winter-run count. A heavy sport catch was also made of the 1951 steelhead.

The sample count plan, as developed by Dr. Jerome Li of the Mathematics Department of Oregon State College, continues to be used to calculate the total runs.

A new counting house and barricade panels for the ladders were constructed and installed in the early spring of 1951.

Upper Rogue census study

A much-needed catch study was made on the main Rogue River above Gold Ray during the 1951 season to determine the quantity of spring chinook and summer steelhead caught after the fish were counted at Gold Ray. The work

extended from June 19 to September 30, 1951. The study area was a forty-mile section from Gold Ray Dam to Laurelhurst Bridge. The catch of trout was obtained as well as other information pertaining to angler methods and effort distribution. The census study was made through the use of sample counts of angler presence and by catch interviews. Guided boat trips were reported through the catch reports of guides. Table 11 presents a summary of the catch, and Table 12 presents an analysis of angler success and related data.

Table 11

Catch census of Rogue River
from Gold Ray to Laurelhurst Bridge,
June 19 to September 30, 1951

Source	Salmon	Steelhead	Trout
Census	391	321	4,946
Private parties	51	49	1,479
Guided parties	81	37	1,290
Total	531	407	7,715

Table 12

Upper Rogue catch summary of census
period, June 19 to September 30, 1951

Item	Trout and steelhead	Salmon
Average angler day, hours	2.99	3.90
Fish per angler-day	2.16	1.36
Fish per hour	0.725	0.347
Hours per fish	1.38	2.88
Angler methods, percentage of use		
Shore	48.8	53.3
Wading	49.6	40.0
Boat	1.6 *	6.7 *
Tackle types, percentage of use		
Bait	44.8	13.4
Fly	49.6	0.0
Lure	33.6	86.6
Empty creels, in percentage	64.4	53.4

*Area closed to boats after June 30

With an estimated 50 per cent more salmon, 15 per cent more steelhead and 40 per cent more trout being caught in addition to the catch of the actual census period, an estimated total of 792 salmon, 468 steelhead, and 12,076 trout were caught by anglers in the entire season, April 29 to October 14, from Gold

Ray to Laurelhurst Bridge. A calculated 3,806 angler days were spent on this upper Rogue section during the census period, and an estimated 4,880 angler days for the entire season. All figures are conservative because some minor parts of the catch were immeasurable.

Catch analysis

A total analysis of catch on Rogue River has not been possible for one year, but census studies were conducted on different sections as personnel and time permitted. As additional studies are completed, indicated total catch figures will become more complete. Catch figures from the individual studies completed to date are plotted in Table 13. The 1949 figures were obtained during the cooperative basin investigation with the U. S. Fish and Wildlife Service.

Table 13

Rogue River sport catch

Fish Section of Rogue River	1945	1946	1947	1948	1949	1950	1951
Salmon							
Lower 12 miles	17,605	-	11,300	16,624	10,237	8,276	8,912
Savage Rapids to Graves Cr.	-	2,000*	-	1,315	-	-	-
Gold Ray to Laurelhurst Br.	-	-	-	-	-	-	792
Steelhead							
Entire basin	-	25,000*	-	-	-	-	-
Gold Ray to Laurelhurst Br.	-	-	-	-	-	-	468
Trout							
Union Cr. area	-	-	-	-	5,765	-	-
Entire basin	-	-	-	-	144,000*	-	-
Gold Ray to Laurelhurst Br.	-	-	-	-	-	-	12,076

* Estimates derived from partial census coverage only.

The 1951 catch of spring chinook in the lower Rogue River was 29 per cent less than the 1950 catch. The fall catch was considerably better and was responsible for bringing the 1951 season's total catch to 8,912 fish, or an 8 per cent increase over the 1950 catch. Veteran fishermen have reported they had better fall salmon fishing on the lower river than they had experienced for

Table 14

Lower Rogue salmon catch and angler success

Season / Month	Catch '50	Catch '51	Percentage catch Seasons '50	Percentage catch Seasons '51	Percentage catch Year '50	Percentage catch Year '51	Angler days '50	Angler days '51	Percentage of angler days Seasons '50	Percentage of angler days Seasons '51	Percentage of angler days Year '50	Percentage of angler days Year '51	Average fish per day '50	Average fish per day '51	Fish per angler day '50	Fish per angler day '51
Spring																
April	2,159	814	40	18	26	9	8,275	7,248	38	33	26	23	71.9	27.1	0.26	0.11
May	1,409	1,730	26	37	17	19	7,333	8,176	33	37	23	27	45.4	55.8	0.19	0.21
June	317	313	6	7	4	4	1,467	1,121	7	5	4	4	10.5	10.4	0.21	0.27
July	885	955	16	21	11	11	2,977	3,397	14	16	9	11	28.5	30.8	0.29	0.28
August*	632	788	12	17	7	9	1,838	2,038	8	9	6	7	42.1	52.5	0.34	0.38
Spring total	5,402	4,600	100	100	65	51	21,890	21,980	100	100	68	72	39.4	33.5	0.25	0.21
Fall													**			
August	806	808	28	19	10	9	2,971	2,701	29	31	9	9	50.4	50.5	0.27	0.29
September	1,383	2,336	48	54	17	26	5,549	5,097	53	58	18	16	46.1	77.8	0.25	0.45
October	685	1,168	24	27	8	13	1,832	988	18	11	5	3	22.1	37.6	0.37	1.18
Fall total	2,874	4,312	100	100	35	49	10,352	8,786	100	100	32	28	37.3	46.0	0.28	0.49
YEAR'S TOTAL	8,276	8,912			100	100	32,242	30,766			100	100	38.6	41.6	0.26	0.28

* First 15 days in August.

** Average number of fish per day for August was 46.3 for 1950 and 51.4 for 1951.

Weight of salmon catch:	1950	1951
	155,426 pounds	161,018 pounds

many years. Table 14 shows the monthly catch of salmon and angler success for the lower Rogue River. Comparisons of catch and success are made between 1950 and 1951. Table 15 presents the percentage of catch of all salmon in the lower river for the total known runs since 1945.

Although there was a decrease in the catch of spring chinook during April and May, there was a 16 per cent increase in the total known run over 1950. Nearly all of the spring chinook that are counted over Gold Ray Dam enter the fishery at the mouth before May 31. Table 16 shows the percentage of the entire spring chinook run which was caught in the lower Rogue during 1950 and 1951.

On most years, the peak of the spring chinook catch occurs near April 15, but in the 1951 season, it did not take place until May 14. Figures 3 & 4 illustrate the trend of daily catch of spring chinooks from the lower river during the months of April and May.

Table 15

Annual salmon catch comparisons,
lower Rogue River, 1945 to 1951

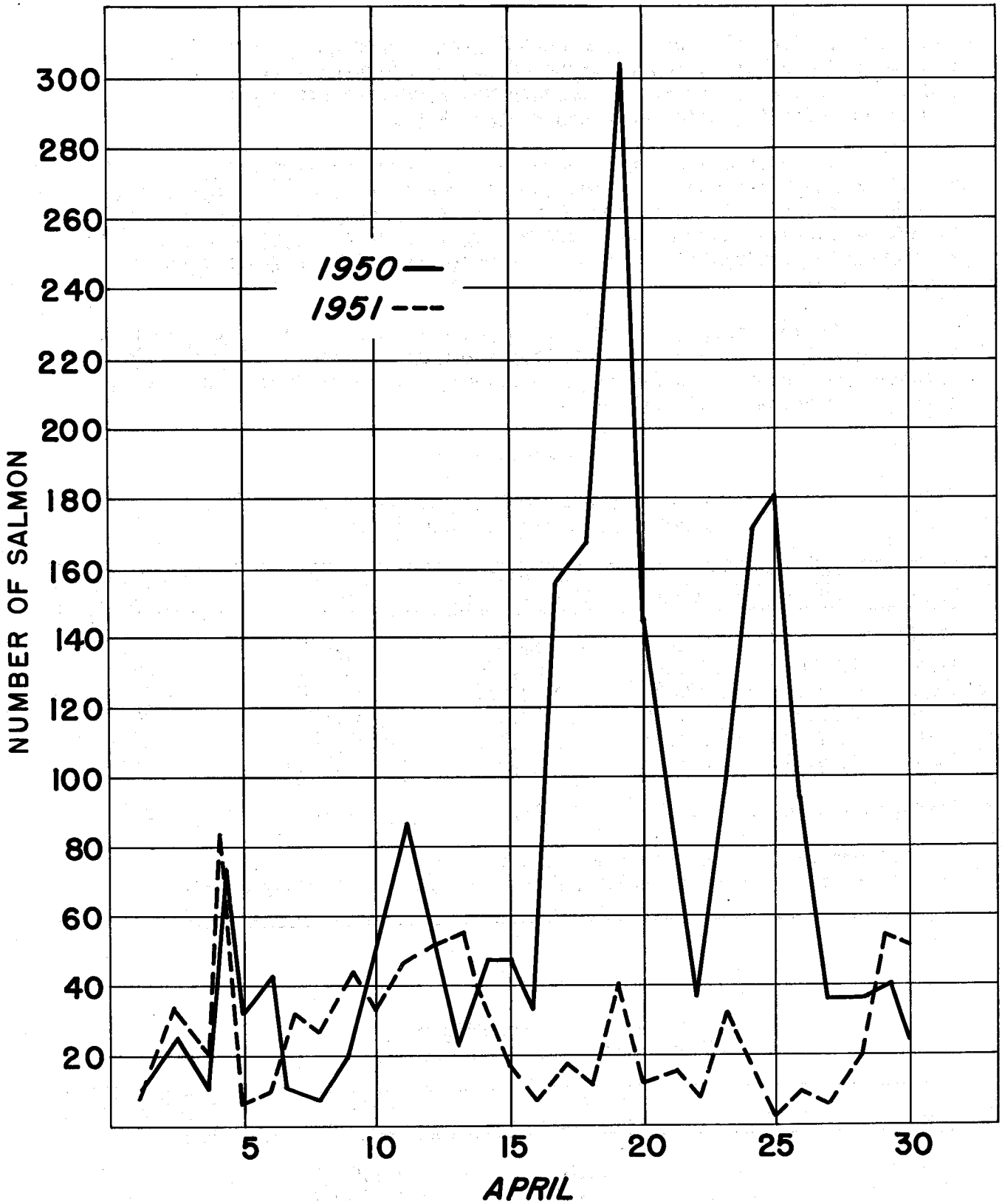
Year	Salmon catch*		Gold Ray escapement*	Total run*	Percentage of run in catch
	Fish	Pounds			
1945	17,605	352,000	35,625	53,230	33
1947	11,300	226,000	40,080	51,380	22
1948	16,652	332,480	29,506	46,158	36
1949	10,237	204,740	29,336	39,573	26
1950	8,276	155,426	16,767	25,043	33
1951	8,912	161,018	25,192**	34,103**	26**
Average	12,164	268,611	29,786	41,949	29

* Combined chinooks and silvers
** Estimate made of total because 1951 counts not complete

Table 16

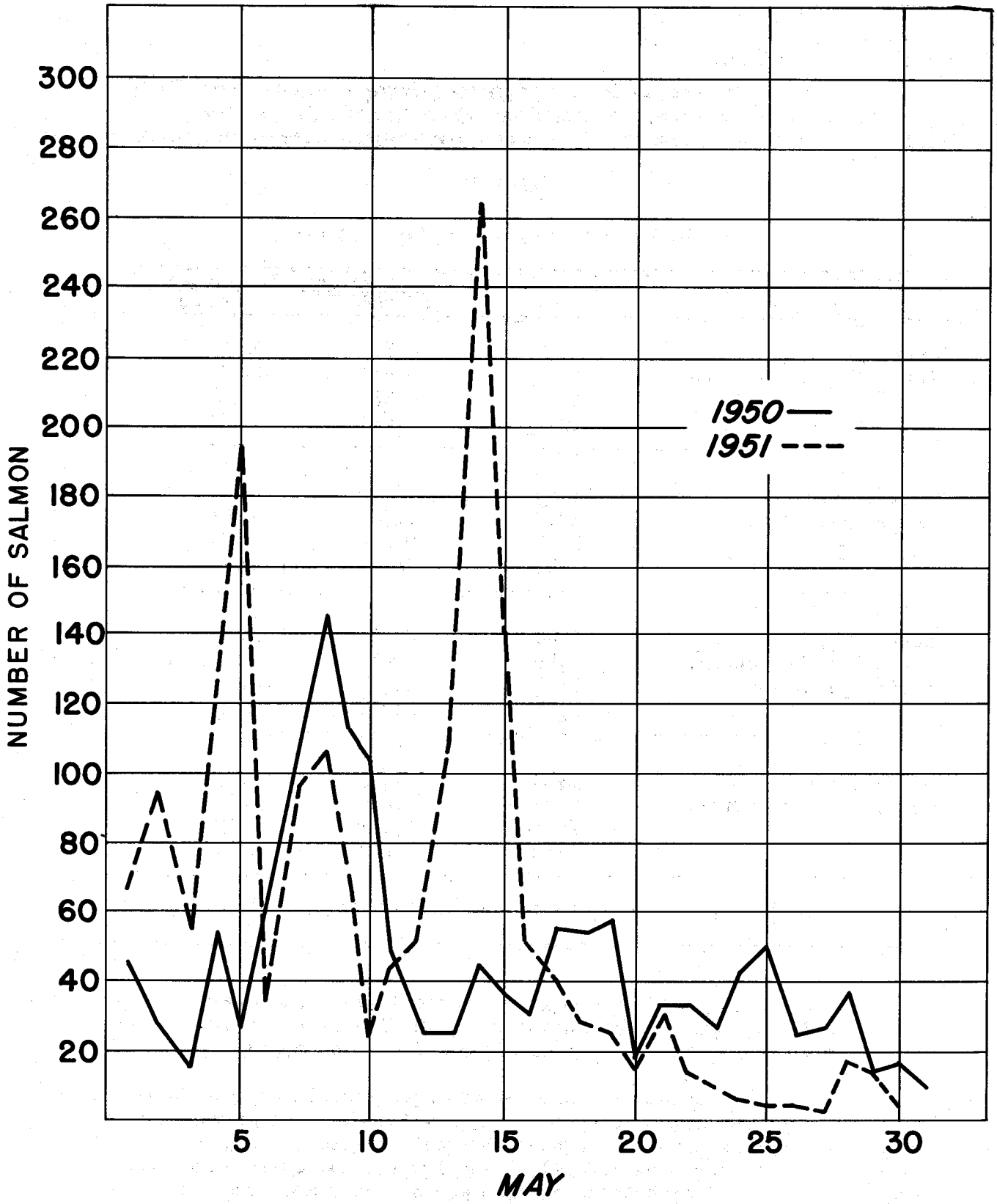
Catch of spring chinook run,
lower Rogue River, 1950 and 1951

Year	Catch	Gold Ray escapement	Total run	Percentage of run in catch
1950	3,568	16,767	20,335	17.5
1951	2,544	21,111	23,655	10.8



DAILY SPRING CHINOOK SALMON CATCH
LOWER ROGUE RIVER

Fig. 3



DAILY SPRING CHINOOK SALMON CATCH
LOWER ROGUE RIVER

Fig. 4

Guided catch success

The catch reports from guides operating on Rogue River in 1951 were obtained, and the information has been added to that of previous years. Table 17 presents information concerning the catch success of guided anglers.

Table 17

Guided catch success, Rogue River

Section	Year	Fish per angler-day effort		
		Salmon	Steelhead	Trout
Lower river (from Illahe to mouth)	1948	0.59	0.76	*
	1949	0.47	1.69	
	1950	0.57	1.38	
	1951	0.55	1.89	
Middle River (from Savage Rapids to Illahe)	1948	*	2.16	1.81
	1949	0.20	0.80	2.96
	1950	0.04*	2.85	4.73
	1951	0.074	1.47	*
Upper river (from Laurelhurst Br. to Savage Rapids)	1948	0.81	1.44	7.16
	1949	0.67	0.81	6.84
	1950	0.30	0.38*	7.60
	1951	0.234	0.298	6.85
Entire river (mouth to headwaters)	1948	0.60	1.40	6.08
	1949	0.53	1.14	6.53
	1950	0.49	1.13	7.47
	1951	0.43	1.13	6.85

* Insufficient number of reports or little angler-effort reported

Guided parties for steelhead on the lower Rogue had an average success of 1.89 fish per man-day effort in 1951 which represents the highest success ratio for steelhead angling since guide reports have been compiled.

Table 12 shows that non-guided anglers on the upper Rogue caught 2.16 trout and steelhead per angler day, and Table 17 shows that guided parties in the same section caught 7.15 trout and steelhead per angler day (steelhead 0.298 plus trout 6.85). Comparing the successes indicates that the guided angler is almost three and one-half times more successful than the non-guided angler.

There were sixty-two guides working on Rogue River in 1951. Return of catch reports was excellent from 21 per cent of the guides, but only an

occasional report was received from 31 per cent. The remaining 48 per cent failed to report any catch records.

Gold Hill turbines

In 1950, two tests were made of the fish losses in the turbines of the Gold Hill power plant of the Pacific Portland Cement Company. At the request of the company, another test was made in June, 1951 in order to recheck claims of fish mortality. The 1950 tests show a 13 per cent mortality of downstream migrant steelhead and salmon passing through the power plant. Of 254 downstream migrants collected in the 1951 test, 27.9 per cent were found injured by the turbines. The 1951 test showed twice as much mortality as the tests made in 1950 because more fish of larger size groups were available for sampling. The high velocity turbines at the Gold Hill plant cause an increased mortality by mutilation in proportion to the increase of the size of the fish. Mortality by size groups is shown in Table 18.

In a letter from the Game Commission in July, 1950, the Pacific Portland Cement Company was asked to screen the turbines of the power plant and improve the fish ladder facilities. A deadline of August, 1951 was suggested for completion of the recommended improvements. Delays have been caused by company officials taking more time to study the loss of fish and to study types of screen installations other than the recommended Link-Belt type screen. The main river channel at their diversion dam above the power plant has received some improvement with an installation of a concrete weir which affords fish passage at low water flows. The weir was observed to be effective during September.

Another delay for the installation of screens at the Gold Hill plant is inevitable now that the Pacific Portland Cement Company is negotiating the sale of their southern Oregon holdings to the Ideal Cement Company of Denver, Colorado. Final merger of stock holdings will not be complete until May, 1952.

Mr. A. L. Snyder, consulting engineer for the Pacific Portland Cement Company, has thoroughly studied the feasibilities of various types of screen installations, and he reported to the company that the Link-Belt type of screen is the most economical type of installation for fish protection problems at Gold Hill. Cost estimates have been requested from the Link-Belt Company.

Gold Ray turbines

A study of fish loss in the turbines at the California Oregon Power Company's plant at Gold Ray was made in June and July. In 41 hours of trapping in two tests, 553 downstream migrants were sampled of which 50 were found with internal hemorrhages caused by release of pressure as the fish passed from the turbines to the tailrace. One fish was collected with the mutilation type of injury. Total mortality of the sample was 9.7 per cent. Table 18 includes the mortality by size groups of downstream migrants sampled from the tailrace at Gold Ray. A special report dated August 6, 1951 describing the power plant at Gold Ray and its operation as affecting fish is on file in the Portland office of the Game Commission.

Table 18

Mortality of downstream migrants sampled from tailraces of the Gold Hill and Gold Ray power plants Rogue River, 1951

Location / Time	Species	Percentage mortality by size groups in inches					
		0 to 2"	2 to 4"	4 to 6"	6 to 8"	8 to 10"	All size groups
Gold Hill							
June							
	Chinook	-	26.0	30.4	-	-	28.0
	Steelhead	9.1	0.0	20.0	100.0	100.0	23.1
	Silvers	-	100.0	34.8	0.0	-	27.0
	Total	9.1	21.8	30.8	81.8	100.0	27.9
Gold Ray							
June and July							
	Chinook	-	8.4	16.7	-	-	9.8
	Steelhead	0.0	5.9	0.0	-	-	4.0
	Silvers	-	0.0	0.0	-	-	0.0
	Total	0.0	10.0	12.5	-	-	9.7

Blank spaces indicate no fish trapped in the size group.

Fish loss from C. columnaris

The degree of losses of salmon and steelhead from the bacterium C. columnaris was of smaller magnitude in the 1951 season than experienced in the past five-year period of observation. In the Gold Hill to Robertson Bridge area, an estimated 120 salmon succumbed in June and July. Little loss occurred in the Gold Ray to Laurelhurst Bridge area from June through September. Figures derived from sample counts and boat trips indicate that only 45 salmon died in the section. Mortality as a result of the disease reached a peak in 1947, and the losses have been less each year since that peak. The onslaught of fish losses is coincident with high water temperatures.

Temperature studies

Summer rainfall and water flows in southwestern Oregon were generally lower in 1951 than at any time in the past ten years, but the maximum summer water temperatures were more favorable for fish life than in the 1949 and 1950 seasons. The 1951 weekly mean maximum water temperatures of the lower Rogue were 70° F., and higher, for a period of six weeks. In 1950, the same temperatures were recorded for a ten-week period. Figure 5 compares weekly mean water temperatures of 1950 with 1951 from June 7 to October 11.

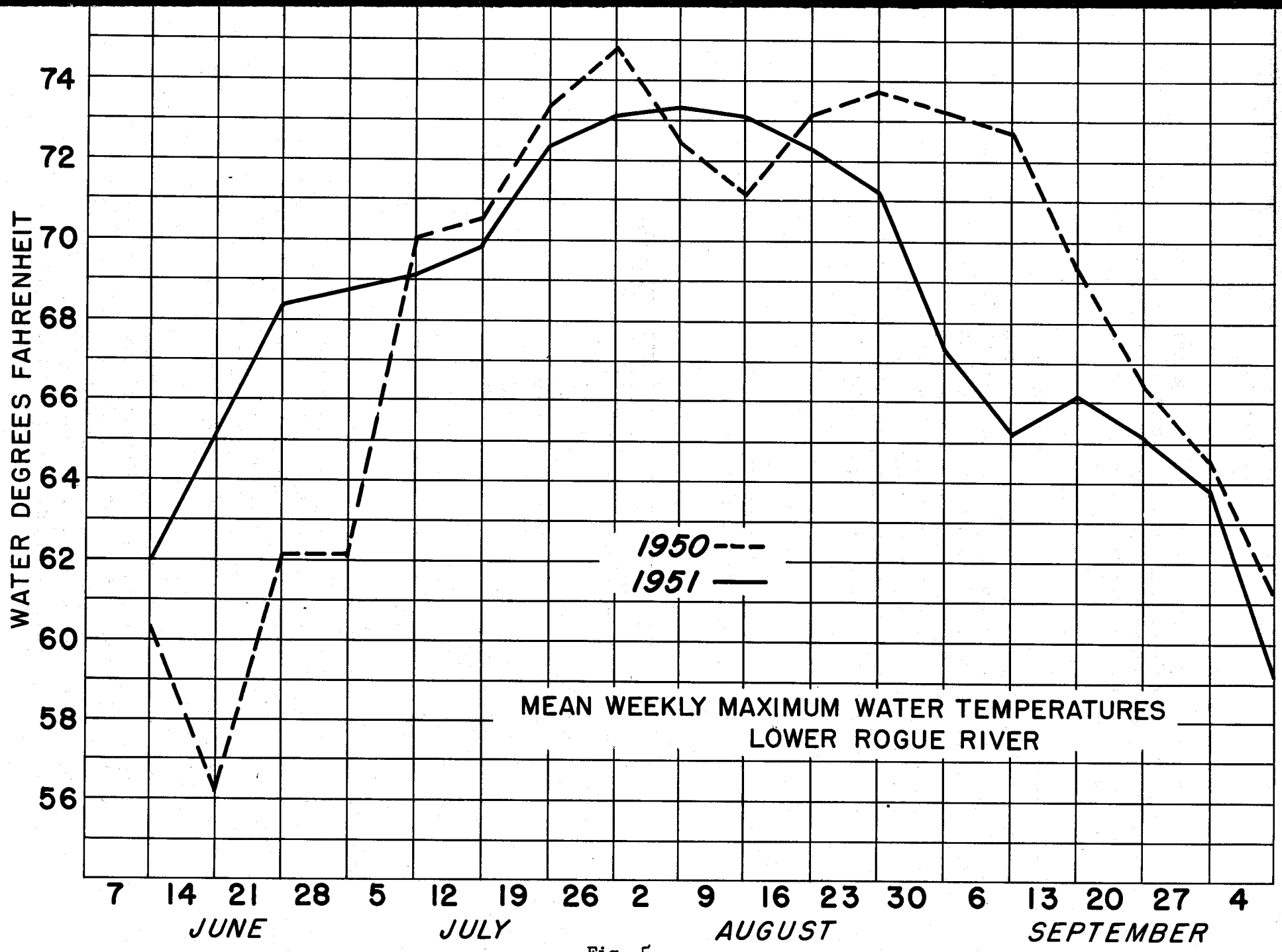

WATER DEGREES FAHRENHEIT
74
72
70
68
66
64
62
60
58
56
1950---
1951 ——
MEAN WEEKLY MAXIMUM WATER TEMPERATURES
LOWER ROGUE RIVER
7 14 21 28 5 12 19 26 2 9 16 23 30 6 13 20 27 4
JUNE
JULY
AUGUST
SEPTEMBER

Fig. 5

Water temperature records from Curry County streams indicate that many of southwestern Oregon streams have high summer temperatures. The warm temperatures do not remain over long periods because there are wide ranges in the daily fluctuations. Temperature ranges for the larger streams are listed in Table 19.

Savage Rapids screens

Officials of the Grants Pass Irrigation District were instructed by the Game Commission in November, 1950, to screen the turbines at their Savage Rapids Dam. Plans and blueprints for the installation were furnished. The board of directors of the District showed marked reluctance in accepting responsibility for fish losses. They have since made request to the U. S. Bureau of Reclamation for a loan to renovate the dam, and to install fish screens. Screen plans have been developed and the Game Commission is in the process of reviewing them and obtaining confirmatory development and installation costs.

Table 19

Summer temperature ranges of
southwestern Oregon coastal streams

1951

Stream	Water temperature	
	Minimum	Maximum
Floras Creek	58	68
Sixes River	60	72
Elk River	59	66
Hunter Creek	62	70
Pistol River	60	73
Chetco River	64	72
Winchuck River	58	63

Seal and sea lion food studies

The collection of sea lion stomachs continued in 1951. Seals and sea lions were shot intermittently from February through July. Eleven sea lions were recovered, but analysis could not be made of five stomachs because of advanced stages of decomposition. A greater number of sea lions were killed in 1951 than 1950, but fewer recoveries were made. Current characteristics at the mouth of the Rogue prevented many carcasses from washing to the beach.

Many people believe that sea lions showing at the mouth of the Rogue during the spring months are feeding primarily on salmon; and that because of their presence and activity, the runs are prevented from entering the river. Observations supplemented by stomach analyses indicate that seals and sea lions are feeding primarily on lampreys and rock fishes through the spring months. Surrounding the mouth of the river are many rocky reefs

which have in them an abundance of rock fish. Sea perch, lampreys, and shad are available in the vicinity of the river's mouth. Such fish and the lamprey provide an abundance of food for sea lions without having to rely on salmon for sustenance. The hauling grounds for the sea lions is located in the Rogue River reef area and one particular rock is favored. Feeding observations and the abundance of food for sea lions would lead to the conclusion that sea lions do not prey upon the salmon populations of the river to the degree generally supposed by the casual observer.

The results of stomach analyses made of the six stomachs obtained in 1951 are combined in Table 20 with the results of those stomachs examined in 1950.

Table 20

Food habit studies of seals and sea lions
mouth of Rogue River
1950-1951

Month and year of recovery		Species	Stomach content
April	1950	Seal	Vertebral column and flesh of small salmonoid
		Sea lion	Empty
	1951	Sea lion	9 lampreys
		Sea lion	8 lampreys
		Sea lion	11 lampreys
		Sea lion	1 vertebrae of a bottom fish
May	1950	Sea lion	4 shrimp, 1 stone
		Sea lion	13 lampreys, 6 shad vertebrae
		Sea lion	20 lampreys, 24 shad vertebrae
	1951	No recoveries	
June	1950	Sea lion	2 lampreys, many shad vertebrae
		Sea lion	Empty
	1951	No recoveries	
July	1950	No recoveries	
	1951	Sea lion	Empty
		Sea lion	Many vertebrae of various bottom fishes

Pollution abatement

No improvements were made of municipal sewage disposal systems in the Rogue basin during 1951. The City of Grants Pass continues to be the major offender.

Millpond wastes are being drained into streams during high water periods only. Permission is granted by the Oregon State Sanitary Authority and/or the Commission. One millpond was illegally drained into Slate Creek in July, but no fish were killed.

In June, a quantity of fish was killed in Bear Creek by the release of ammonia from a defective refrigeration system of the Southern Oregon Sales fruit packing plant located near Medford. The company was warned in September, 1947, for killing fish in Bear Creek with a DDT wash from the fruit vats, but at the time insufficient evidence was available to effect an arrest. The 1951 offense was handled by the State Police.

Stream Improvement

Intense logging operations continue in many creek drainages throughout the Rogue basin. Log jams and debris capable of forming jams necessitate constant vigilance. Game Commission personnel and logging operators, at the request of the Commission, removed jams from Squaw, Murphy, Cheney, and Jump-Off Joe Creeks, the main Applegate River, and the East Fork Illinois River.

All irrigation ditches appreciably affecting fish life in the Rogue watershed are screened. Nearly all screens were in efficient operation during the 1951 season. A few screen efficiency problems remain uncorrected, but they are being studied in order to recommend possible solutions. Relatively large numbers of steelhead migrants have been found on some years in the Medford Irrigation District canal below the South Fork Little Butte Creek screen. A satisfactory explanation has not been found. Where these fish are entering the ditch is still unknown. Possible riding of the screen over into the ditch is an explanation, and another possibility might be that adult steelhead are spawning in small tributaries which intercept the ditch.

Frequent and heavy rains through the 1950-51 winter permitted steelhead to spawn in tributaries which for many years remained unused. Irrigation ditches diverted from these normally unused tributaries took varied quantities of steelhead and silver salmon migrants during the 1951 irrigation season. Because stream and weather conditions preceding the 1951 season were so abnormal, no recommendations will be made to screen the ditches until such can be justified. Tributaries of the Applegate watershed were most affected with the problem.

The Straub Dam (McKee Bridge) on the upper Applegate River has had a fish ladder problem in low and high water flows. The inadequate ladder was replaced by Game Commission crews in October. The new ladder's efficiency of operation will be observed throughout the 1951-52 winter.

The Charles McCann Dam on Cheney Creek, tributary to the lower Applegate, was washed out in the flood of 1950. The old dam presented many problems of fish passage. When Mr. McCann planned to rebuild the dam, a request was made to alter the design to provide better fish passage facilities.

The dam was completed and all features of the request were included.

Ladder improvements on the Gold Ray and Savage Rapids Dams are planned for 1952.

Lake Improvement

Trash fish in Fish Lake, located in Jackson County, were destroyed in October. Since 1947, partial control efforts on roach, Siphateles, bicolor, bicolor, have proved unsuccessful. An estimated 11,000 roach were killed with rotenone in June, but little gain was made on the total population. The lake, an irrigation reservoir, was drawn down to unusually low levels during the 1951 irrigation season. On October 5, fifteen Game Commission employees, assisted by two Forest Service officials, distributed 2,200 pounds of rotenone throughout the lake, and an estimated 800,000 roach, or approximately 64,000 pounds, were killed. Not more than 800 trout were believed present in the lake. Considerable trouble was experienced in killing a few remaining roach which were nosed into spring inlets in the bottom of the lake.

No fish were caught during an overnight gill-net set in November. Live-box holding of rainbow trout on November 9 showed that the lake had lost its toxicity.

A stocking of 100,000 rainbow trout is to be made in the spring of 1952. The lake is to be closed to all angling during the 1952 season and reopened for the 1953 season.

Stockings

The Rogue District received approximately 40,000 yearling chinooks, 50,000 yearling silvers, 306,000 rainbow fingerlings, and 115,000 yearling rainbow. All salmon were fin-clipped for future identification.

Careful planning and additional pond space made it possible to hold 35,000 of the yearling rainbow until June for planting above the Union Creek area on the North Fork Rogue River. The fish were placed in sixty-eight different locations, the largest distribution ever before accomplished with yearling fish on the North Fork Rogue. Many places of heavy angling pressure along the Diamond Lake Highway received yearling fish for the first time. Special law enforcement attention was given the area in order to curtail illegal catches of recently-planted fish.

A project aimed at solving salmon hatchery-stocking problems was begun on the Rogue River. Approximately 40,000 spring chinook were raised to yearling size at the Butte Falls Hatchery. The fish were divided in two groups, each marked in a different manner, and each group was released in a different location. In March, one-half was placed in the Rogue River 8 miles above Gold Beach and the other portion was placed just below Savage Rapids Dam. A check on the return of the marked salmon will provide information concerning the relative survival of both groups. One of the factors which might contribute to the decline of salmon runs on the Rogue is the loss of downstream migrants through the lower canyon in hot summer months.

The stocking of yearling fish in the spring of 1951 met with considerable approval throughout the coastal section of southwestern Oregon. The plantings included fall rainbow, cutthroat, and silver salmon. Excellent fishing success resulted from the plants. The yearling silvers were planted early in March, but they entered into the catch through the fore part of the general trout season. A few of the silvers were caught in the upper streams, but the majority of those taken were from tidewater areas.

Silver salmon that were stocked in the spring of 1951 started their return to coastal streams in the fall. Of thirty-five marked silvers that were checked upon their return to the Chetco, eighteen were jacks and seventeen were females returning in their second year. Similar reports of returning hatchery silvers have been reported from other coastal streams. The percentage return of females in their second year could be small in comparison to the return of the entire run and, if so, would be of no concern. Size of female salmon might be one of the determining factors in their maturity and return in their second year. The returning females ranged in size from 21 to 25 inches.

Two trips were made into the Cascade lake area between Crater and Fourmile Lakes in order to determine the ability of airplane plantings to distribute fishing pressure. One trip into the Seven Lakes basin revealed that heavy fishing pressure is being placed on these lakes from the Klamath and Rogue sides. The Sky Lake group of lakes is visited moderately heavy from the Klamath side and lightly from the Rogue side. Blue Lake Group lakes receive moderately heavy angling pressure from the Rogue side. The lakes which are planted from the air are receiving nearly all of the fishing pressure. Horse pack trips, some with guide service, are becoming popular. Supplemental plants with the use of packstrings is recommended for the adjoining lakes that are not receiving airplane plants so that more equal distribution of fishing pressure can be accomplished. It is hoped that camp site facilities at adjoining lakes can be inaugurated in order to help distribute fishing pressure.

Hatchery site investigations

If a hatchery is found necessary for Rogue River to help solve the problem of declining spring salmon and summer-run steelhead, sites for a good hatchery would be hard to find. Investigations have been made of at least ten sites, but either the water supplies were undesirable or there were no flat lands above high water marks for hatchery buildings and ponds. One site in the lower Rogue canyon was found to have generally adequate water but its location presents a problem of transportation of materials and feed because access is by air, trail, or boat.

Salvage operations

Salvage operations on Dry Creek, tributary to the Sixes River, were carried on from July 9 through August 14. A total of 47,673 fingerling salmon and trout were salvaged and transferred to the Sixes River. In addition, sixty-two trout ranging in size from 3 to 14 inches in length and two steelhead were salvaged. Table compares annual success of the Dry Creek salvage operation since 1949.

Table 21

Dry Creek fish salvage

Year	Number of fish salvaged
1949	20,125
1950	37,454
1951	47,673
Total	105,252

An especially large Rogue River salvage job was conducted following the heavy flood which occurred in late November 1950. With assistance of farmers and sportsmen, five big potholes between Gold Hill and Galice were drained through ditching. Many thousands of downstream migrants, yearling chinooks, and steelhead were afforded opportunity to return to the river.

A few successful operations conducted in June and July on the Applegate River and Evans Creek saved 3,200 downstream migrant steelhead and silver salmon. From the mouth of Murphy Creek, tributary to the Applegate, 3,000 downstream migrants were salvaged in August. Other attempts at salvage were less successful.

At Savage Rapids Dam, the annual salvage of steelhead and salmon was successfully completed on October 4. An estimated 10,500 downstream migrant steelhead and salmon and 50 adult steelhead and cutthroat trout were salvaged and returned to the river. Another 35 adult steelhead and salmon (silvers) were salvaged two weeks later when irrigation district crews had to drain the southside fishway in order to complete additional repairs on the dam.

Law enforcement

A general policy has been followed of conducting cooperative investigations with the State Police. All leads, information, and reports of violations are turned over to the State Police, and independent action has been taken only at times when police officers are not available.

The first pollution arrest and conviction in Josephine County in ten years was made in July. The violation was the draining of a log pond into Slate Creek, tributary of the Applegate.

Four mill operators were warned of offending sawdust and mill waste pollution. Four logging operators were asked to clean up slashing and debris on Slate, Limpy, Sourdough, Murphy, and Jump-off Joe Creeks.

Assistance was given to the State Police on cases involving gaffing and spearing of salmon, dynamiting rocks from Rogue River, illegal netting of salmon, and the selling of salmon eggs. An increase in game law violators was noted in 1951.

River basin investigations

The U. S. Bureau of Reclamation maintained field survey crews in the Rogue Basin during 1951. Their activity has been confined to the non-controversial parts of Plan "A", the plan which was proposed by the Bureau in 1948 and which posed a threat to the Rogue fishery. On September 5, the Rogue Valley Irrigation Association adopted a resolution stating, "..... the Association does hereby agree to withdraw its support of Plan "A" or any plan having to do with the creation of dams upon the main channel of Rogue River, unless said dams have the approval of fish and wildlife organizations having an interest." In withdrawing its support of Plan "A", the Association has decided to channel their efforts toward encouraging a power project in the North Fork Rogue River at Cascade Gorge near Prospect and a power-irrigation project at Howard Prairie which is a plan to collect water from numerous tributaries in the Rogue-Klamath divide area. Profits from the sale of power at the Cascade Gorge project have been suggested for use in developing irrigation in the Illinois Valley.

The Game Commission action on the proposal was one of approval if such proposed development was not to be used as an opening wedge to obtain features of the old Plan "A". In the statement, the Commission reserved the right to reverse its decisions on the alternate plan if features were found to be detrimental to fishery preservation and management.

The abandonment of Plan "A" by the Rogue Valley Irrigation Association resulted in a split of membership. Many supporters of Plan "A" violently opposed the action taken by the Association. The general turn of events can be considered a moral victory to groups striving for fishery consideration in basin development on the Rogue and elsewhere.

After several years of anxious waiting, the U. S. Fish and Wildlife Service was granted another appropriation to conduct additional fishery investigations on Rogue River in relation to proposed basin development. The appropriation is the first one granted the service to start the fishery study during the five-year moratorium provided by the U. S. Department of Interior.

Harbor development

The Ocean View Lumber Company applied for permission to construct a log reloading station at High Water Slough on the lower Rogue. Approval was given for the excavation of a gravel bar and the driving of moorage dolphins. The development would not affect the fisheries of the river.

Early in 1951, the U. S. Army Engineers rejected the harbor development application for shallow draft vessels at the mouth of Rogue River. Requests for reconsideration of the project were granted and it was approved after a rehearing at Gravelly Point, Virginia, on June 5.

Public relations, information and education

Request for information and advice concerning management of private fish ponds continued to be an increasing item of public relations and service. Private ponds are becoming more popular in the Rogue basin. Much demand for stocking ponds prompts considerable attention in order to guard against escapement of warm-water game fish to the Rogue River and tributary systems.

Possible escapement of some kinds of pond fish to streams containing anadromous runs presents a potentially dangerous problem. A majority of the private ponds are being stocked with rainbow trout.

The Merlin School in Josephine County was given assistance in developing a conservation education program. A creek-planting project has been planned for the spring of 1952.

The Ashland Kid's Fish Derby was held at Lithia Park upon the opening of fishing season. Yearling rainbow were planted in Ashland Creek within the boundaries of the park for juvenile anglers 13 years of age or younger.

The Izaak Walton League-sponsored Kid's Fishing Contest was held at a private fish farm near Grants Pass in August. The event had 134 children under 14 years of age participating. The children caught 409 trout.

In August, a conservation education program was conducted on one day per week at the Girl Scout Camp at Lake of the Woods. Conservation talks were given to 480 girls attending the camp. Field trips were made with 120 girls in order to illustrate the practical application of wildlife conservation.

Cooperation and acknowledgments

Excellent cooperation and assistance has been furnished the Rogue River and Curry County investigations by the U. S. Forest Service, State Forest Patrol, U. S. Geological Water Resources Division, California Oregon Power Company, Pacific Portland Cement Company, the caretaker of Savage Rapids Dam, employees of the Medford Irrigation District, and the custom canneries.

MCKENZIE RIVER INVESTIGATIONS

The McKenzie River investigation is in the fourth year of a five-year fishery research program.

To date, the program has been concerned with returns to the fisherman from marked fish released in the study area, trout migration, and with the evaluation of tributaries as feeder streams in supplying trout to the main river. In addition, several temperature recording stations are being maintained in the study area.

Method of study

The determination of the total catch in 1951 was accomplished in much the same manner as in previous years. In addition to conducting an intensive creel census in the study area (from Coburg Bridge to Olallie Recreation Area on the main river and including the three largest tributaries (Blue River, South Fork and Horse Creek--'Figure 6 ') catch record cards were given wide distribution through personal interviews and by posting the cards in conspicuous places along the stream and in business houses. In addition, a survey was conducted to determine the degree of return of the catch cards and to determine the average catch of individuals not reporting. It is from these data that the annual total catch of fish in the study area (excluding guides) is calculated. Catches of guided parties were reported by guides as required by law.

By dividing the study area into ten creel checking zones and gathering data from each zone separately, it was possible to check on the migration of planted fish from one area to another. The movement of fish downstream over the Leaburg Dam was of considerable importance. Two upstream traps located in each of the two fish ladders of the dam were used to gather additional data on the upstream spawning migration of rainbow trout.

Marked fish

From 1947 through 1951, twenty-five differently marked lots of rainbow trout, including two groups of wild fish tagged in the fish ladders of the Leaburg Dam (Table 22) have been liberated in the McKenzie River and Gate Creek. Spring rainbows were used extensively through 1948. For the years 1949 through 1951, fall rainbow trout were introduced for purposes of comparison with the spring stock. Two groups of small fall fingerlings, which were planted in September of 1951, are not listed in Table 22 because they had no bearing on the returns.

RESULTS

General

Calculations based on the methods of study used in the McKenzie area, indicate that 24,371 fishermen caught 77,355 trout during 1951 as revealed in Table 23. This represents an increase of approximately 53.4 per cent over 1950 in fishermen and 52.5 per cent in numbers of fish caught. Marked hatchery fish accounted for 22.16 per cent of the catch. In the three years prior to 1951, the catch was as follows:

1950	15,885 fishermen	50,713 trout	48.74 per cent marked
1949		47,614 trout	41.4 per cent marked
1948		27,837 trout	27.44 per cent marked

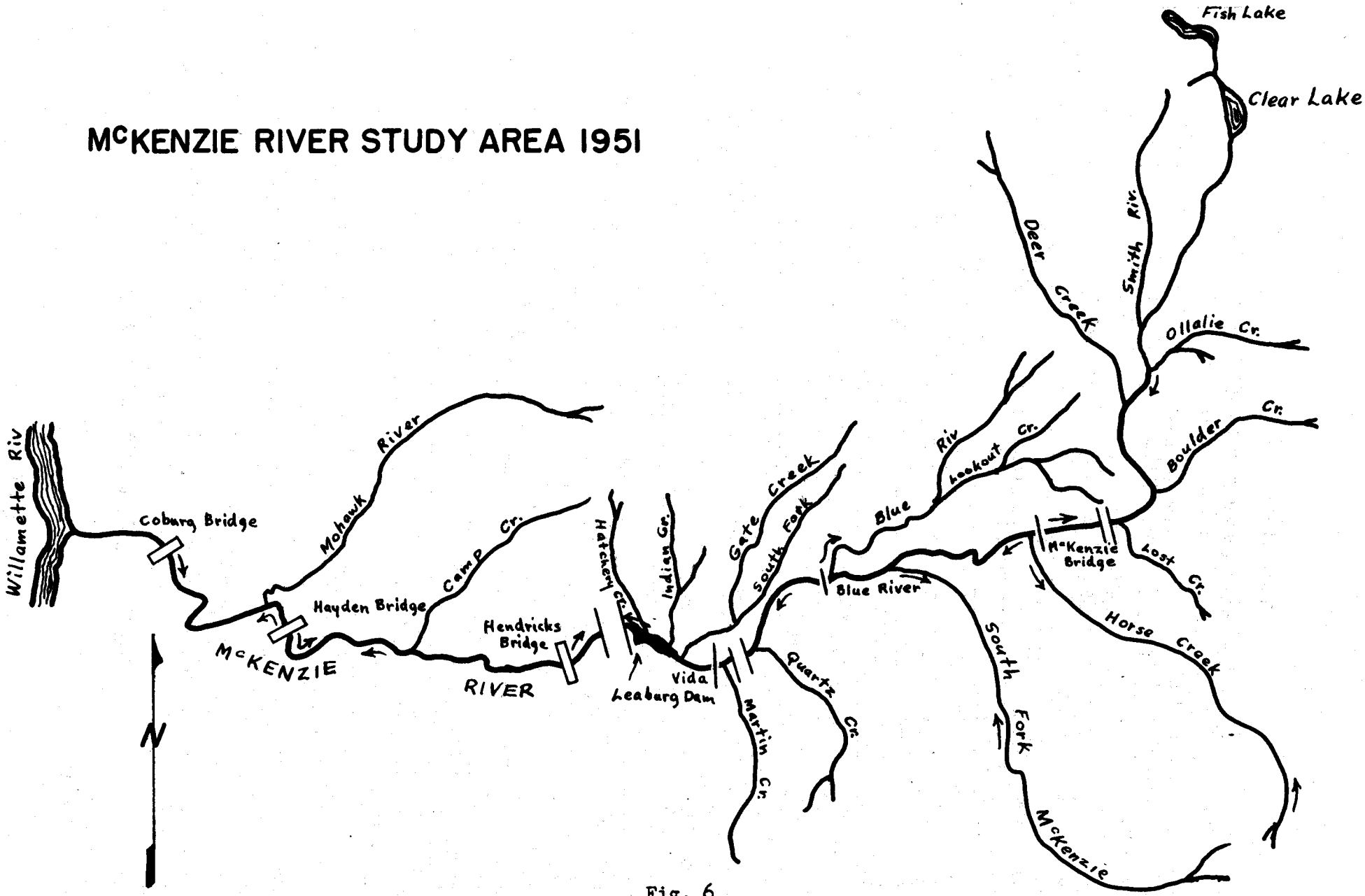

McKENZIE RIVER STUDY AREA 1951
Fish Lake
Clear Lake
Deer Creek
Smith Riv.
Ollalie Cr.
Boulder Cr.
Willamette Riv
Coburg Bridge
Mohawk River
Camp Cr.
Hayden Bridge
McKENZIE
RIVER
Hendricks Bridge
Hatchery Cr.
Indian Cr.
Leaburg Dam
Vida
Gate Creek
South Fork
Blue River
Blue Riv
Lookout Cr.
McKenzie Bridge
Lost Cr.
Horse Creek
Quartz Cr.
Martin Cr.
South Fork McKenzie
N

Fig. 6

Table 22

CALCULATED ANNUAL RECOVERIES FROM MARKED TROUT PLANTINGS

Stocking date	Brood year specie	Mark & group number	Size in inches	Number fish planted	Calculated returns 1947	1948	1949	1950	1951	Returns total and per cent	Theoretical balance
July	1946	BV	7.1	5,810	1,543	722	251	4	11	2,531	3,279
1947	SS	1			26.56	12.42	4.32	0.07	0.19	43.56	
April	1947	LV	6.3	23,095		3,840	330	60	19	4,249	18,846
1948	SS	2				16.63	1.43	0.26	0.08	18.40	
April	1946	BV-Ad	7.6	6,264		716	79	4	0	799	5,465
1948	SS	3				11.43	1.26	0.06		12.76	
Apr.May	1947	Jaw tag	14-22	289		142	2	0	0	144	145
1948	SS	4				49.14	0.69			49.83	
May-July	1947	RV	7.8	16,038		2,219	434	38	37	2,728	13,310
1948	SS	5				13.84	2.70	0.24	0.23	17.01	
Sep.	1948	BV	3.0	38,430			60	68	0	128	38,302
1948	SS	6					0.16	0.18		0.33	
Oct.	1948	BV-Ad	3.4	41,066			187	101	7	295	40,771
1948	SS	7					0.46	0.25	0.02	0.72	
March	1948	Ad	5.0	30,000			1,132	221	67	1,420	28,580
1949	SS	8					3.78	0.74	0.22	4.73	
March	1948	LV-Ad	7.8	29,800			7,636	106	25	7,767	22,033
1949	FS	9					25.62	0.36	0.08	26.06	
April	Mixed	Jaw tag	14-18	101			33	0	0	33	68
1949	SS	10					32.67			32.67	
July	1948	Dorsal	6.9	29,000			1,609	409	106	2,124	26,876
1949	SS	11					5.55	1.41	0.37	7.32	
July	1948	RV-Ad	9.3	29,200			7,944	167	21	8,132	21,068
1949	FS	12					27.21	0.57	0.07	27.85	
Aug.	1949	RP	3.0	28,330				126	158	284	28,046
1949	SS	13						0.45	0.56	1.00	
Aug.	1949	LP	3.0	36,000				212	149	361	35,639
1949	SS	14						0.59	0.41	1.00	
Mar.Apr.	1949	LV- D	5.8	34,750				3,154	388	3,542	31,208
1950	SS	15						9.07	1.12	10.19	
Mar.Apr.	1949	LV-½D	8.5	37,300				10,692	297	10,989	26,311
1950	FS	16						28.67	0.80	29.46	
June	1949	RV- D	7.0	37,000				1,728	245	1,973	35,027
1950	SS	17						4.67	0.66	5.33	
July	1949	RV-½D	9.5	35,000				7,629	252	7,881	27,119
1950	FS	18						21.80	0.72	22.52	
Nov.49	Mixed	Jaw tag	11-22	176				34	0	34	142
May 50	Wild	19						19.32		19.32	
Aug	1950	LP-Ad	3.5	40,100					63	63	40,037
1950	FS	20							0.16	0.16	
Aug.	1950	RP-Ad	3.0	40,027					328	328	39,699
1950	FS	21							0.82	0.82	
Aug.	1950	½D	4.0	11,596					77	77	11,519
1950	FS	22							0.66	0.66	
Mar.	1950	Ad-½D	5.6	13,465					1,460	1,460	12,005
1951	FS	23							10.84	10.84	
Apr.	1950	LM-Ad	7.6	38,458					13,429	13,429	25,029
1951	SS	24							34.92	34.92	
Dec.50	Mixed	Jaw tag	8-21	124					17	17	107
May 51	Wild	25							13.71	13.71	
TOTALS				601,419	1,543	7,639	19,697	24,753	17,156	70,788	530,631

SS-Spring spawners
FS-Fall spawners

In 1951 the percentage of marked fish (22.16) in the total catch is below that of previous years bec use fewer fish were marked and released in the study area.

The daily average catch of bank fishermen and of non-guided boat anglers showed a slight decrease from 1950, while the average catch per trip for guided parties increased slightly.

Table 23

Total catch of marked and unmarked trout on the McKenzie River and tributaries by all anglers and showing the percentage contribution of each group of fish to the total catch, 1951

Group or marked lot of fish	Year stocked and brood year	Number caught by guides	Number caught by other anglers	Total catch	Percentage contribution of each group
BV	1947-46	1	10	11	0.01
LV	1948-47	2	17	19	0.02
RV	1948-47	2	35	37	0.05
BV-Ad	1948-48	2	5	7	0.01
Ad	1949-48	7	60	67	0.09
LV-Ad	1949-48	20	5	25	0.03
Dorsal	1949-48	19	87	106	0.14
RV-Ad	1949-48	21	0	21	0.03
RP	1949-49	2	156	158	0.20
LP	1949-49	4	145	149	0.20
LV-D	1950-49	36	352	388	0.50
LV-½D	1950-49	22	275	297	0.38
RV-D	1950-49	39	206	245	0.32
RV-½D	1950-49	21	231	252	0.33
LP-Ad	1950-50	0	63	63	0.08
RP-Ad	1950-50	1	327	328	0.42
½D	1950-50	10	67	77	0.10
Ad-½D	1951-50	74	1,386	1,460	1.89
LM-Ad	1951-50	2,047	11,382	13,429	17.36
Total marked		2,330	14,809	17,139	22.16
Percentage		(31.91)	(21.14)		
Total unmarked		4,971	55,245	60,216	77.84
Total		7,301	70,054	77,355	
Percentage		(9.45)	(90.55)		

The return of catch cards, approximately 10 per cent, was disappointing and proved to be less than half of that of 1950. Returns were excellent for the first few weeks of the season, but people soon tired of mailing cards. It may have been that the anglers were checked too often, because many of the fishermen could not understand why they should send in a card after their fish had been examined by the creel checkers.

The return to the fishermen of last year's plantings were poor and thus again indicated, as in the past three years, that year to year survival of hatchery trout in the McKenzie river is poor.

The average length of rainbow trout in the 1951 catch was 7.76 inches or slightly under that recorded for 1950 but fish 14 inches and over did not enter the catch as a result of a length limit regulation designed to protect wild brood fish.

Fall rainbow which were stocked in the study area probably accounted for approximately 50 per cent of the catch. Spring fish made excellent growth in the hatchery ponds prior to their stocking, and their contribution to the catch in 1951 was exceedingly important, one group showing an approximate 35 per cent return to the fishermen.

Trout which had been stocked as fingerlings and the few trout that had survived one and two winters in the stream showed the greatest tendency toward downstream migration. Upstream migration was confined mainly to the spawning run of wild fish.

Catch, bank fishermen

Bank fishermen and nonguided boats accounted for 70,054 fish or 90.55 per cent of the total catch, the majority of which were caught in the river above the Leaburg Dam, Table 24. The average catch per fisherman, as computed from the catch cards, was approximately 6.3 fish in the area above the dam, 4.5 in the lower river, 6.2 in Horse Creek, 5.5 in the South Fork, and 5.5 fish in Blue River. When, however, the total catch in the main river and the tributaries is divided by the calculated 23,249 anglers fishing in the whole area, the average catch per day becomes approximately three fish.

From Table 24, it may be noted that the calculated catch for the main river during the first half of the season, April 14 through July, is 31,240 fish as compared to 26,921 fish for the latter half of the season. Inasmuch as only 43,040 fish of legal length were placed in the main river after July 7, as compared to a stocking of 80,167 fish during the early part of the season, the catch during the latter half, approximately 46 per cent, is important in that it indicates a heavy harvest from the midseason stocking of trout in 1951.

The contribution of marked fish, 21.14 per cent or 14,809 fish, to the bank fishermen's catch, is relatively unimportant because fewer marked fish were released in the study area in 1951, as tabulated in Table 25.

Catch, guided parties

Professionally guided boat parties caught 7,301 fish in 1951 in comparison with 8,524 in 1950, 11,718 in 1949 and 8,948 in 1948. Marked fish contributed 31.9 per cent in 1951, approximately 40 per cent each year for 1950 and 1949, and 24.1 per cent in 1948. The average catch per trip, from 1951 back to 1948, was 9.76, 8.9, 10.32, and 8.99 fish respectively. The guides made 748 trips down river carrying 1,234 passengers in 1951.

The upper river from the Leaburg Dam to Blue River proved to be the most popular section with the guides and supplied approximately 89.5 per cent of their total catch. The lower river from the dam to Coburg Bridge, heavily fished during the early part of the season, soon lost its popularity when a large proportion of the stream was diverted into the Leaburg and the Walterville Power Canals. Effluent from the Weyerhaeuser mill entering the

Table 24

CATCH OF TROUT CALCULATED TO HAVE BEEN CAUGHT BY BANK FISHERMEN AND PRIVATE BOATS IN MCKENZIE RIVER AND TRIBUTARIES 1951

Date	Number of cards received (1)	Number of fish reported on cards (2)	Calculated: Number of anglers who did not report (3)	Calculated: Catch of anglers in column 3	Calculated: Total catch	Calculated: Total number of anglers
			Leaburg Dam to Olallie Recreation Area			
Apr. 14 to May 12	551	3,564	1,959	6,802	10,366	2,510
May 13 to June 9	283	1,739	1,889	5,745	7,484	2,172
June 10 to July 7	211	1,422	2,046	4,788	6,210	2,257
July 8 to Aug. 4	349	2,245	4,519	15,961	18,206	4,868
Aug. 5 to Sep. 1	93	479	1,522	4,032	4,511	1,615
Sep. 2 to Sep. 30	51	254	644	1,339	1,593	695
	1,538	9,703	12,579	38,667	48,370	14,117
			Leaburg Dam to Coburg Bridge			
Apr. 14 to May 12	157	697	1,848	3,556	4,253	2,005
May 13 to June 9	88	421	1,557	1,873	2,294	1,645
June 10 to July 7	32	108	493	525	633	525
July 8 to Aug. 4	21	109	406	613	722	427
Aug. 5 to Sep. 1	8	32	659	973	1,005	667
Sep. 2 to Sep. 30	6	44	516	840	884	522
	312	1,411	5,479	8,380	9,791	5,791
			Horse Creek			
Apr. 14 to Sep. 30	71	442	588	1,439	1,881	659
			South Fork McKenzie			
Apr. 14 to Sep. 30	192	1,054	1,602	5,604	6,658	1,794
			Blue River			
Apr. 14 to Sep. 30	105	577	783	2,777	3,354	888
Totals	2,218	13,187	21,031	56,867	70,054	23,249

Table 25

CONTRIBUTION OF MARKED FISH IN PERCENTAGE AND NUMBER TO THE CATCHES OF BANK FISHERMEN AND PRIVATE BOATS ON THE MCKENZIE RIVER AND TRIBUTARIES FOR EACH FOUR-WEEK PERIOD AS COMPUTED FROM THE CREEL CENSUS AND CARD SURVEY, 1951

Date	BV	LV	RV	BV-Ad	Ad	LV-Ad	Dor-sal	RP	LP	LV-D	LV-½D	RV-D	RV-½D	LP-Ad	RP-Ad	½D	Ad-½D	LM-Ad	Total Marked
Leaburg Dam to Olallie Recreation Area																			
Apr. 14 to May 12	0	0	0	0.05 5	0.05 5	0.05 5	0.10 10	0.10 10	0.26 27	0.94 97	1.05 109	0.21 22	1.31 136	0	0.05 5	0	0	51.23 5,311	55.40 5,742
May 13 to June 9	0	0.08 6	0.08 6	0	0	0	0	0.08 6	0	0.25 19	0.57 43	0.08 6	0.41 31	0	0.82 61	0.08 6	0.08 6	37.60 2,814	40.13 3,004
June 10 to July 7	0.16 10	0	0	0	0.16 10	0	0	0	0.16 10	0.63 39	0	0	0.16 10	0	1.25 78	0	0	20.85 1,295	23.37 1,452
July 8 to Aug. 4	0	0	0	0	0.13 24	0	0.20 36	0.07 13	0.20 36	0.07 13	0.20 36	0	0.07 13	0.13 24	0.47 86	0.20 36	0.27 49	3.15 573	5.16 939
Aug. 5 to Sep. 1	0	0	0	0	0	0	0.27 12	0.27 12	0	0.54 24	0.54 24	0	0	0	0.81 37	0	0	2.42 109	4.85 218
Sep. 2 to Sep. 30	0	0.71 11	0	0	0	0	0	0	0	0	2.13 34	0	0	0.35 6	0.35 6	0	0	4.26 68	7.80 125
	10	17	6	5	39	5	58	41	73	192	246	28	190	30	273	42	55	10,170	11,480
Leaburg Dam to Coburg Bridge																			
Apr. 14 to May 12	0	0	0.68 29	0	0	0	0.68 29	2.03 86	1.35 57	2.03 86	0.68 29	0.68 29	0.68 29	0	0	0	20.95 891	14.86 632	44.62 1,897
May 13 to June 9	0	0	0	0	0	0	0	1.28 29	0.64 15	1.28 29	0	5.13 118	0	0	0.64 15	0	16.03 368	17.31 397	42.31 971
June 10 to July 7	0	0	0	0	1.12 7	0	0	0	0	0	0	0	0	1.12 7	0	0	6.74 43	3.37 21	12.35 78
July 8 to Aug. 4	0	0	0	0	0	0	0	0	0	0	0	0	1.72 12	1.72 12	3.45 25	3.45 25	0	1.72 12	12.06 86
Aug. 5 to Sep. 1	0	0	0	0	0	0	0	0	0	3.12 31	0	3.12 31	0	0	0	0	0	3.12 31	9.36 93
Sep. 2 to Sep. 30	0	0	0	0	1.61 14	0	0	0	0	1.61 14	0	0	0	1.61 14	1.61 14	0	3.23 29	0	9.67 85
	0	0	29	0	21	0	29	115	72	160	29	178	41	33	54	25	1,331	1,093	3,210
Horse Creek																			
Apr. 14 to Sep. 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Fork McKenzie																			
Apr. 14 to Sep. 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.28 85	1.28 85
Blue River																			
Apr. 14 to Sep. 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.01 34	1.01 34
	0.01	0.02	0.05	0.01	0.09	0.01	0.12	0.22	0.21	0.50	0.39	0.29	0.33	0.09	0.47	0.10	1.98	16.25	21.14
Totals	10	17	35	5	60	5	87	156	145	352	275	206	231	63	327	67	1,386	11,382	14,809

stream near Springfield, was instrumental in decreasing the fishing activity in the stream section downstream from Hayden Bridge.

Creel census

Table 25, a summary of data collected from 5,918 creels examined, discloses the percentage of marked fish found in the creels during each four-week period of the season. Beneath the percentage figures in the table, are shown the numbers of marked fish computed to have been caught by the anglers during each period and also for the entire season.

Card survey

Of the anglers interviewed on the upper river, it was found that 11.8 per cent mailed in catch cards. In the lower river the return was approximately 5 per cent, while the three tributaries averaged about 11 per cent. Table 26 presents card return information. Actually, the interviews indicated a much higher return than is shown above because many of the fishermen assured the checkers that they had reported their catch on a card, when actually they had not. Thus, when the names of the fishermen, who said they had reported, were checked against the incoming catch cards, it was found necessary to revise the figures downward. The percentage return of cards was much higher in 1950, 1949, and 1948 because anglers were very much concerned about the depletion of trout in the river, and they were willing to do almost anything to improve the fishing. It is apparent now, however, that as the fishing improved, anglers became less cooperative and there was less incentive to turn in cards.

In the last column of Table 26 is shown the average daily catch by four-week periods for those anglers who failed to make a return on a catch card. The daily average catch for this group in 1951 was much higher than it was in 1950, largely because many of the successful fishermen who had reported their fish in previous years, failed to do so in 1951.

Annual recoveries

The calculated total annual return from each group of marked fish planted from 1947 through 1951 is revealed in Table 22. Of general importance is the poor return of fish to the creel in their second and third year in the stream. Fall-spawning rainbow stock is far superior to spring-spawning stock when measured in returns to the fishermen in the season that the fish are planted. An exception, however, is the 34.9 per cent return from one group of spring fish (group 24) which were planted in 1951. These were exceptionally fine fish and measured 7.6 inches in length when they were planted.

When a comparison was made of survival to the creel of fish of legal length which had entered their second fishing season, four groups of fall fish showed a return of from 0.36 to 0.80 per cent of their original numbers, while seven groups of spring fish, which had entered their second season, showed returns to the creel of from 0.66 to 2.70 per cent.

Returns from fall plantings of spring and fall fingerlings have ranged from 0.16 to 0.82 per cent the following season and from 0.18 to 0.56 per cent during their second season. One group of spring fish (group 7) has shown a 0.02 per cent return in the third season.

Table 26

CARD SURVEY OF MCKENZIE RIVER AND TRIBUTARIES SHOWING THE PERCENTAGE OF RETURN OF CATCH CARDS AS REPORTED BY FISHERMEN, 1951

Date	Number of anglers interviewed: Had reported catch on cards (1)	Had not reported catch on cards (2)	Total anglers	Number of fish caught by anglers of column (2)	Average catch per angler of column (2)
		Leaburg Dam to Olallie Recreation Area			
Apr. 14 to May 12	106 21.95	377	483	1,309	3.472
May 13 to June 9	65 13.03	434	499	1,320	3.041
June 10 to July 7	36 9.35	349	385	817	2.340
July 8 to Aug. 4	33 7.17	427	460	1,508	3.532
Aug. 5 to Sep. 1	16 5.76	262	278	694	2.649
Sep. 2 to Sep. 30	13 7.34	164	177	341	2.079
	269 (11.8 per cent)	2,013	2,282	5,989	2.98
		Leaburg Dam to Coburg Bridge			
Apr. 14 to May 12	9 7.83	106	115	204	1.924
May 13 to June 9	10 5.35	177	187	213	1.203
June 10 to July 7	14 6.09	216	230	230	1.065
July 8 to Aug. 4	6 4.92	116	122	175	1.509
Aug. 5 to Sep. 1	1 1.20	82	83	121	1.476
Sep. 2 to Sep. 30	1 1.15	86	87	140	1.628
	41(5.0 per cent)	783	824	1,083	1.38
		Horse Creek			
Apr. 14 to Sep. 30	7 10.77	58	65	142	2.448
		South Fork McKenzie			
Apr. 14 to Sep. 30	26 10.70	217	243	759	3.498
		Blue River			
Apr. 14 to Sep. 30	13 11.82	97	110	344	3.546

From the 176 wild fish which were tagged in the ladder of the Leaburg Dam in 1950 and which showed a return of 19.32 per cent that year, not one specimen was found in the 1951 catch. Of the 124 fish tagged in 1951, 17 or 13.7 per cent were caught. It is believed that additional fish were caught but that they were returned to the stream because of the 14-inch maximum limit.

Inasmuch as there are a few four and five-year-old marked fish showing up in the catches, there is reason to believe that a few of the hatchery fish may be spawning in the McKenzie system. Optimism should not rise too high, because some of the survivors from one year to the next are heavily parasitized. The condition is prevalent among fall stock. On the other hand, some of the fish are fat and are in the best of condition.

Migration

A comparison between the catches of marked fish in the upper and lower river indicates an approximate 11.5 per cent movement of fish from the upper river downstream past the Leaburg Dam as computed from Tables 24 and 25. Generally, the greatest percentage of migration occurs among fingerling plants of both the spring and fall stock. Fish of legal length of the fall variety seem to have less tendency to migrate than do the spring fish.

Upstream migration which occurred among two groups that had been planted below the dam, showed a 13.6 per cent upstream migration in the spring stock and a 4 per cent over-the-dam movement of the fall stock. From the approximate 38,000 marked spring fish which were stocked in the upper river, there was a 0.7 per cent movement up into the South Fork McKenzie and a 0.3 per cent movement into Blue River, computed from Table 25.

The operation of traps in the ladders of the Leaburg Dam from April through the latter part of May, 1951 again disclosed a substantial run of wild spring-spawning rainbow trout. The run remained fairly constant throughout both months. It was necessary to remove the traps the latter part of May because the salmon were starting to use the ladders. Of the 124 trout that were examined and tagged in 1951, three had been previously tagged in 1950 and had returned to spawn again.

Size of fish in catch

The average length to fork of tail of all rainbow trout measured in the study area in 1951, was 7.76 inches. Measurements taken from 1948 to 1950 averaged 8.44 inches in 1950, 8.34 inches in 1949, and 7.74 inches in 1948. The 8.42 average shown in the 1950 report was for unmarked rainbows only, while the 8.4 inch average recorded for 1949 was an error and should have read 8.34 inches. A reason for the decrease in the length of 1951 fish is the lack of fish 14 inches and over in the catch, and the other reason is because the fall stock placed in the McKenzie in 1951 were smaller than those stocked in 1950.

Table 27 is a representation of the seasonal average length of each group of fish caught by fishermen from 1947 to 1951 and shows the number of fish in each sample. Of particular interest is the size attained by seven groups of fingerlings after having spent one winter in the stream. The first four groups, 48BV, 48BV-Ad, RP, and LP averaged approximately 7 inches, while the three groups of fall rainbow LP-Ad, RP-Ad, and 1/2D averaged approximately 6.7 inches.

Table 27

SEASONAL AVERAGE LENGTH OF TROUT EXAMINED FROM CREELS FROM 1948 THROUGH 1951 SHOWING RELATIVE GROWTH PROGRESS FROM YEAR TO YEAR

Identifying mark	Length at time of stocking in inches		Fish examined							
			1948		1949		1950		1951	
			Number	Length	Number	Length	Number	Length	Number	Length
46BV	SS	7.1	37	7.7	10	10.6	1	14.25	1	13.50
LV	SS	6.3	170	7.5	32	9.18	12	8.56	3	9.83
46BV-Ad	SS	7.6	45	8.35	10	10.70	1	11.00	0	
RV	SS	7.8	187	7.82	32	8.83	3	10.00	3	12.50
48BV	SS	3.0			18	7.56	1	9.25	0	
48BV-Ad	SS	3.4			37	6.85	11	9.09	0	
Ad	SS	5.0			213	6.93	41	7.68	4	8.13
LV-Ad	FS	7.8			142	8.68	15	12.17	1	9.50
Dorsal	SS	6.9			248	7.50	72	8.08	7	9.25
RV-Ad	FS	9.3			533	9.78	25	10.64	0	
RP	SS	3.0					23	7.02	8	9.09
LP	SS	3.0					53	6.87	12	8.85
LV-D	SS	5.8					569	7.21	34	8.88
LV-½D	FS	8.5					893	8.58	36	9.45
RV-D	SS	7.0					135	7.33	13	8.94
RV-½D	FS	9.5					992	9.35	32	10.64
LP-Ad	FS	3.5							5	8.30
RP-Ad	FS	3.0							31	7.02
½D	FS	4.0							4	8.00
Ad-½D	FS	5.6							53	8.52
LM-Ad	SS	7.6							1,557	8.18
Rainbow not marked					1,044	8.12	2,759	8.42	4,036	8.61
Totals (all rainbows)			439	7.74	2,319	8.34	5,608	8.44	5,889	8.44
Cutthroats					81	7.35	132	7.40	277	7.39
Dolly Varden					31	9.44	45	11.89	24	14.65
Whitefish							47	10.52	25	11.02
Totals (all fish measured)					2,431	8.32	5,830	8.44	6,166	8.49

SS-Spring spawners
FS-Fall spawners

Table 28

STOCKING OF TROUT FROM THE MCKENZIE HATCHERY 1951

Date	Total pounds	Size fish/lb.	McKenzie River	Misc. & Small tributaries	Blue River	South Fork	Horse Creek	Identifying mark	Total
				Spring rainbows					
Apr. 9-25	6,750	5.71	38,458					LM-Ad	38,458
May 2-18	74.7	2,720		(204,150-Dorena Reservoir)					204,150
	54	1,920		(103,680-Willamette Hatchery)					103,680
July 13-17	3,355	6.23	14,643		1,935	3,270	1,035		20,883
July 14-19	300	4.00		(1,200-Willamette Hatchery)					1,200
	350	4.00	1,400						1,400
July 16	1,100	6.97	7,500						7,500
July 17	400	6.15		(2,460-Middle Fork Willamette)					2,460
	350	4.80	1,680						1,680
Aug. 23-28	955	77.18		(77,161-Dorena Reservoir)					77,161
Aug. 29	25	80.00		(2,000-Gate Creek)					2,000
	13,713.7		63,681	390,651	1,935	3,270	1,035		460,572
				Fall rainbows					
Mar. 27-28	2,429	5.55	13,465					1/2D-Ad	13,465
Mar. 29-Apr. 3	4,430	6.30	23,011			3,984	1,024		28,019
Apr. 4	425	7.45		(3,004-Big Fall Creek)					3,004
	190	7.95		(1,510-Little Fall Creek)					1,510
	65	7.95		(517-Winberry Creek)					517
Apr. 5	80	6.20		(496-Sharps Creek)					496
	81	6.20		(502-Laying Creek)					502
	81	6.20		(502-Frank Brice Creek)					502
	232	8.35		(2,029-Mohawk River)					2,029
May 15	750	7.05	5,233						5,233
July 5-6	1,350	4.43			1,980	2,976	990		5,946
July 9-18	3,480	5.07	17,817						17,817
Aug. 29	119	49.00			2,450	3,381			5,831
	406.5	42.20		17,155-Gate Creek				LM-RV	17,155
	845	35.5	30,000					LM-LV	30,000
	14,963.5		89,526	25,715	4,430	10,341	2,014		132,026
Totals	28,677.2		153,207	416,366	6,365	13,611	3,049		592,598

With the exception of a few groups of fish, where the specimens are too few to provide a good sample, the growth from year to year is relatively slow. It is believed, that inasmuch as the largest fish in any one group are the most voracious feeders, they would be caught first, leaving some of the smaller specimens for survival into the following season.

STOCKING

During 1951, 195,387 rainbow trout weighing 25,739.5 pounds were stocked in the McKenzie River and its tributaries. Approximately 72 per cent of 140,401 fish were of legal length. The remaining 28 per cent were stocked as fingerlings in the main river and tributaries.

The balance of 397,211 fish as in Table 28, were stocked in Dorena Reservoir, Willamette River and tributaries, Row River and tributaries, and a few were transferred to the Willamette Hatchery. Approximately 200,000 advanced fry from spring stock were placed in Dorena Reservoir. The practice of stocking fry in tributaries of the McKenzie was discontinued in 1951.

A planting boat was used to stock fish of legal length in the McKenzie River wherever practicable. It was also used to stock fingerlings in Dorena Reservoir.

MISCELLANEOUS ACTIVITIES

Weekly minimum and maximum temperature recordings in the McKenzie River, South Fork, and Blue River, are shown in Figure 7. The maximum temperature for the McKenzie River, taken at the Leaburg Dam station, was 60 degrees F. during the second week in July, while the lowest temperature, 35 degrees F., was recorded during the latter part of January. From the middle of June to the third week in September, the main river remained fairly stable, seldom dropping below 50 degrees F. and never going above 60 degrees F. The South Fork recordings varied between a low of 37 degrees F. in January to a high of 58 degrees F. in the first week in July. In 1950, the peak of 63 degrees F. was reached during the week ending July 29. Temperatures in Blue River are recorded for the period, January 6 through June 16, and show a variation in temperature from 37 to 64 degrees F.

A new planting boat capable of carrying large loads of fish was developed on the McKenzie. It may be self-propelled with an outboard motor, or it may be used for drifting. It is equipped with a self-bailer. When not in use for stocking, it may be used as a conventional motor boat.

A second drum, installed on the trout trolley, greatly facilitated the return of empty buckets and nets from the stream side to the stocking truck. Several other modifications were made.

A fish hauling experiment using 350 pounds of fish of legal length was conducted with a small portable tank at a time when the air temperature ranged between 90 and 100 degrees F. The 1,860 fish were in the tank for approximately one and one-half hours. Two blocks of ice were used to cool the water before the fish were put in the tank. Water in the tank during the experiment, varied from 42 to 62 degrees F. When the tank was unloaded, the fish were carried dry in a rubber net about forty feet to one pond, and the other half of the load was carried in a bucket with water to the second tank located adjacent to the first tank.

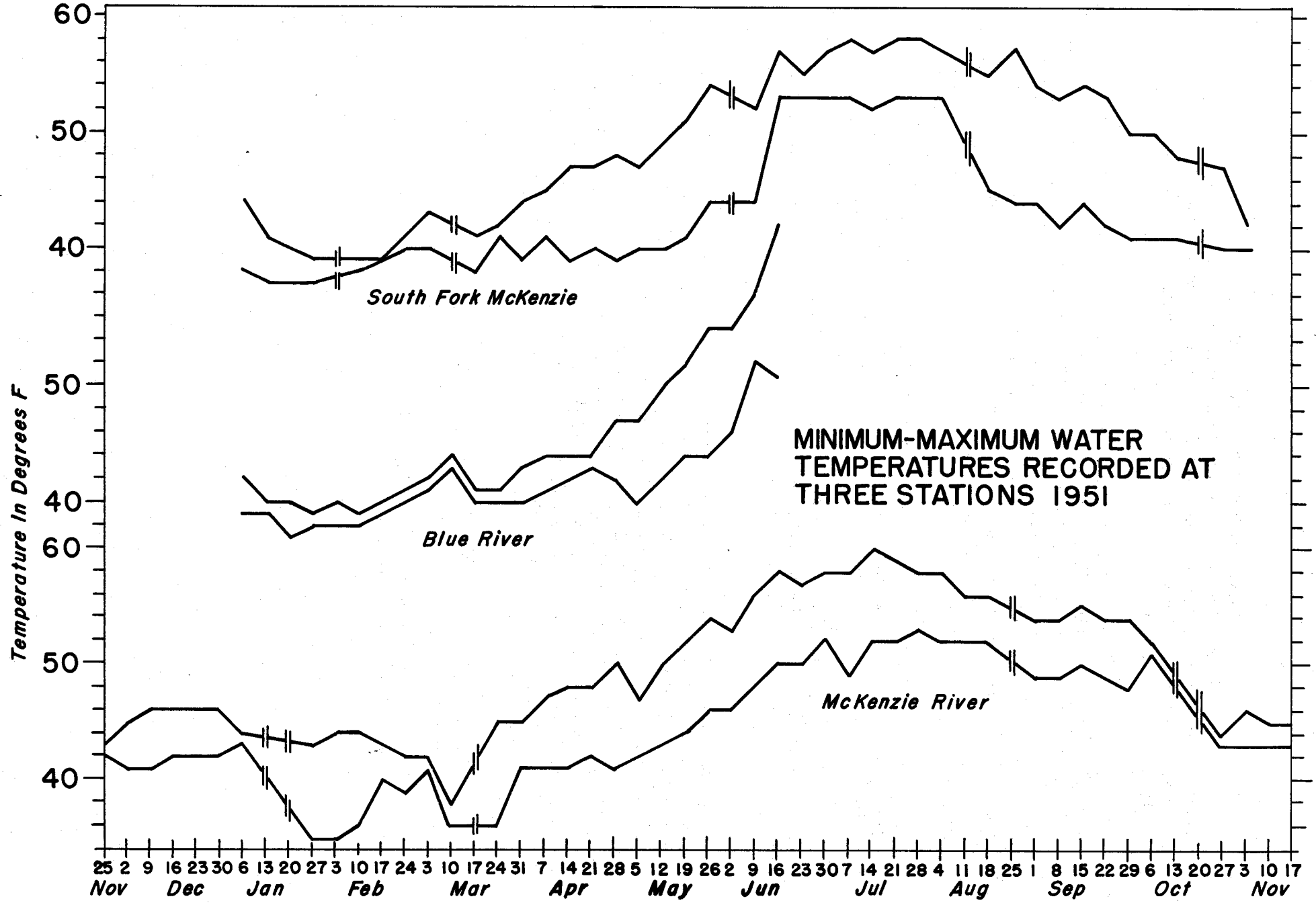

MINIMUM-MAXIMUM WATER TEMPERATURES RECORDED AT THREE STATIONS 1951
South Fork McKenzie
Blue River
McKenzie River
Temperature In Degrees F
60
50
40
50
40
60
50
40
25 2 9 16 23 30 6 13 20 27 3 10 17 24 3 10 17 24 31 7 14 21 28 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov

Fig. 7

The mortality after one week was two fish. One of these had jumped out of the pond, and the other was believed to have been injured during the loading process. Approximately half of the fish were stocked after one week, while the remaining fish were held in the ponds for one month with no additional mortality.

Bottom sampling carried on during and after the test channel operations by the U. S. Engineers below Dorena Reservoir, indicated that a serious depletion of bottom fauna occurred on the riffle immediately below the dam when the discharge from the reservoir was held at 2200 cfs. or better for any length of time. Midge larvae and lake plankters from the reservoir largely replaced the caddis larvae and the mayfly nymphs which were found in the riffle area prior to the operations. Sampling and observations were carried on over a two-week period.

Metal tags, indicating by their shape the type of stocking possible, were posted on trees adjacent to good stocking spots on the McKenzie River and its three main tributaries.

Observations made during the budworm control spraying in the upper McKenzie area indicated that many adult aquatic and terrestrial insects were killed in flight by the spray. Immature forms of the aquatic insects were not killed directly.

Releasing salmon and trout above the Leaburg powerhouse and fyke netting below in the tailrace produced only a little information concerning the survival of fish after passage through the turbines. Of the fourteen trout and eight salmon recovered in the fyke net, four trout and all of the salmon died within four hours after they had been transferred to a hatchery trough. In similar experiments by Holmes, years ago, and with only about one-half of the volume of water, it is reported that 86 fingerlings were captured below the powerhouse in a large fyke net equipped with wings. The fish were transferred to a hatchery trough in the Fish Commission's hatchery and within three weeks all fish had died.

The marking of 51,290 fingerling trout was accomplished by four women in $23\frac{1}{2}$ man days.

Urethane was used to anesthetize the fish and mortality as a result of marking was held to a minimum.

WILLAMETTE SPRING CHINOOK SALMON SPORTS FISHERY

The 1951 spring chinook sports fishery in the Willamette River below Oregon City Falls yielded a catch of 13,266 fish, the greatest since the annual investigations were resumed in 1946 as a joint project of the Oregon Game Commission and the Oregon Fish Commission. Of the total catch, 6,907 were taken below the City of Portland with 6,359 accounted for above that point. (Table 29)

The peak of the catch occurred in the lower river area during the week of April 8-14 and in the upper river from April 22-28. (Table 29)

Fishing conditions were unusually good for practically the entire 1951 season and without exception the most favorable that has prevailed during recent years. The first two weeks in March was the only period that unfavorable angling conditions existed at which time fishing virtually ceased.

The 1951 fishing intensity of 88,144 angler days was the heaviest ever observed. The maximum number of anglers in pursuit of salmon in any single day was 4,570 on April 8.

The average 1951 catch per angler per day amounted to 0.15 fish which represents an average catch of one salmon in 6.7 days of angling effort.

The average weight of all salmon reported caught and weighed at the various boat moorages was 17.2 pounds with a range in weight of two to forty-nine pounds. The most common weight was twenty pounds. The combined weight of the total catch of 13,266 fish was 228,175 pounds or 114 tons.

The first chinook salmon of the season was caught at the mouth of the Clackamas River on February 17 with the last few fish of the run taken during the first week in June.

The majority of the spring chinook salmon entering the Willamette River have a five-year life cycle and are the progeny resulting from a parent run that occurred five years before. The 1951 run resulted from its 1946 parent run. In comparing the parent run of 1946 with the resulting run of 1951, the parent run produced a sport catch of 12,630 salmon with an upstream escapement through the fishway at Oregon City Falls of 53,000 fish. The 1951 run provided a catch of 13,266 fish and an upstream escapement of 34,300. That more fish were caught in 1951 with fewer fish entering the river as compared to the parent run in 1946 when less fish were taken with a larger run in the river, can only be attributed to the increased angling intensity and the near perfect angling conditions that existed throughout most of the 1951 season. (Table 30)

The annual spring catch of Willamette chinook salmon is dependent upon three factors, namely: (1) the size of the run entering the river; (2) angling intensity and (3) weather and water conditions. As indicated by Table 30 the 1947 escapement of 45,000 salmon representing the parent run for the 1952 season compares quite favorably with the 1946 escapement of 53,000 that produced the 1951 catch of 13,266 fish. It therefore is anticipated that the 1952 catch will approximate the 1951 catch providing that the angling intensity and especially the angling conditions are similar or equal to that which existed in 1951.

Table 29

Catch of chinook salmon in the Willamette River by weekly intervals, 1951

Date	Lower River	Upper River	Total
March 11 - 17	0	0	0
18 - 24	26	145	171
25 - 31	411	841	1,252
April 1 - 7	1,372	860	2,232
8 - 14	1,992	947	2,939
15 - 21	1,478	1,098	2,576
22 - 28	845	1,159	2,004
April 29 - May 5	663	959	1,622
6 - 12	120	250	370
13 - 19	0	78	78
20 - 26	0	22	22
Totals	6,907	6,359	13,266

Table 30

Comparison of the Willamette River chinook salmon catch for the eight years of study and the annual escapement upstream through the fishway at the Oregon City Falls.

Year	Total catch	Angling intensity (man-days)	Average catch per day	Angling effort in days to catch one salmon	Average weight in pounds	Escapement upstream through fishway at Oregon City Falls
1941	30,000	-	-	-	-	-
1942	12,000	-	-	-	-	-
1946*	12,630	58,966	0.21	4.8	17.0	53,000
1947	12,000	87,564	0.13	7.7	16.3	45,000
1948	8,330	79,574	0.105	10.0	16.5	30,000
1949	9,100	81,438	0.112	8.9	18.2	27,000
1950	8,839	69,868	0.126	8.0	16.6	14,500
1951	13,266	88,144	0.150	6.7	17.2	34,300

*Studies not conducted during war years of 1943, 1944 and 1945.

NORTHEASTERN OREGON

The high lakes of the Wallowa Mountains

Catch records

The individual catch report cards, used successfully in 1950, were again employed to measure the trend of the fishery of the high lakes area.

A total of 1,265 cards was distributed to guides, agents, and card boxes located on main trails. Anglers used 850 cards. A total of 256 anglers reported their catch. Table 31 includes catch card data recorded for 1950 and 1951.

The catch per angler varied widely at each lake. As in 1950, the more heavily fished lakes produced the highest average catch per angler (Minam Lake produced 35 fish per angler, Unit 40, Horseshoe 18). The average of 22.1 fish per angler trip is considerably higher than the 16.1 fish recorded in 1950. The increased catch may be partially accounted for by an increase of 0.5 days spent per angler trip in 1951 over 1950.

The use of the high lakes fishery as reflected in the use of catch cards does not indicate a heavy angling pressure. The cropping of eastern brook trout is evidently not taking place at a rate calculated to improve the present overcrowded conditions.

Eastern brook

Two high lakes situated on main trails were sampled for the first time since 1946 in order to determine possible changes made in eastern brook trout populations by the increased bag limit. Cheval Lake was inventoried for the first time. Table 32 includes data recorded in 1951 along with 1946 records.

An almost identical situation to that found in 1946 was recorded. Here, again, is corroborative data which strengthens the fact that angler cropping is not controlling eastern brook trout populations in some high lakes. A greater harm would have been done had the bag limit been reduced. Only those lakes which are more heavily fished show a tendency toward increases in the length at maturity of female eastern brook trout.

Cutthroat

Investigations were continued at seven of the nine high lakes experimentally stocked with cutthroat in 1947, 1948 and 1950. The use of the intermountain cutthroat was designed to determine the extent of any differential growth which may be exhibited between cutthroat and eastern brook trout.

The meager samples obtained through the use of gill nets, rotenone, and the rod preclude a direct comparison with eastern brook trout relative to lengths, weights, and the degree of maturity. Table 33 includes data recorded for all cutthroat examined in comparison with eastern brook samples. Two lakes not listed, Hobo and Dollar, are known to be failures in the establishment of cutthroat. No cutthroat were taken at Bear Lake, but angler reports in 1951 indicate their presence in small numbers.

Table 31

Catch card returns

Wallowa Mountain high lakes area

	1950	1951
Cards distributed	2,625	1,265*
Cards used	970	870
Number of anglers reporting	314	256
Per cent return of completed cards	34%	28%
Number of lakes used by reporting anglers	37	37
Average catch per angler trip	16.1	22.1
Average time spent per angler trip	1.3 days	1.8 days
Average number of lakes used per angler trip	1.7	1.3
Total catch reported	4,200	4,442
Estimated number of anglers	5,762	**
Estimated total catch	50,400	

* Many destroyed through vandalism at card boxes.
**No trail-side angler checks were made which would have provided a basis for estimation.

Table 32

A comparison in the maturity and length expectancy of catch of eastern brook trout in some high lakes of the Wallowa Mountains.

Length at maturity of eastern brook				Length expectancy of legal fish	
Lake	Year	Number in sample	Average length (inches)	Number in sample	Average length (inches)
Steamboat	1946	6	6.2	24	7.4
	1951	12	6.2	50	7.2
Long	1946	11	6.5	36	7.7
	1951	16	7.1	55	7.2
Cheval	1951	5	7.8	14	8.4

Although cutthroat made an excellent growth in Duck and Francis Lakes, eastern brook in both lakes also do well. The female cutthroat taken from Francis Lake exceeds the brook trout average in the length at maturity by nearly three inches, but a sample of one fish is not conclusive evidence that all cutthroat females will mature at thirteen inches in length.

Cutthroat taken from Lookingglass and Eagle Lake in 1950 compare favorably in average length with eastern brook trout. Since none of the cutthroat was maturing, it may be assumed that they will surpass the low average length at maturity exhibited by eastern brook trout. The four-year record of growth in Papoose Lake cannot be regarded as typical of the growth pattern exhibited in other high lakes.

About one-fifth of the reported catch from Lookingglass and Bear Lakes was cutthroat. Nearly one-half of the reported catch from Francis Lake was cutthroat. A greater number of cutthroat entered the catch this year than was recorded in 1950.

Investigations should continue until conclusive evidence is obtained relative to the ability of cutthroat to outstrip eastern brook under similar lake conditions. Hawk Lake, stocked in 1950, should be investigated in 1952.

Table 33

Cutthroat - eastern brook comparative data relative to differential growth in some high lakes of the Wallowa Mountains.

		Cutthroat				Eastern Brook			
Lake	Year	Number	Average length	Average weight grams	Length at maturity of females	Number	Average length	Average weight grams	Length at maturity of females
Francis	1950	7	7.3	72	-	5	13.8	79	*
	1951	4	12.6	383	13.0**	44	8.1	130	10.2
Duck	1948	0	-	-	-	11	11.7	385	13
	1949	0	-	-	-	4	10.3	213	*
	1950	5	12.8	*	*	-	-	-	-
	1951	0	-	-	-	33	10.8	300	11.4
Looking-glass	1950	8	7.8	111	*	35	8.0	91	8.07
	1951	1	11.0	209	*	53	8.2	123	8.5
Bear	1951	0	-	-	-	18	7.3	74	7.2
Eagle	1950	1	7.0	54	*	13	7.4	86	*
	1951	1	6.5	45	*	36	7.4	80	6.3
Papoose	1948	10	3.4	-	-				
	1949	42	4.5	-	-				
	1950	20	6.5	-	-	None present			
	1951	5	11.2	270	13.0				

* Insufficient evidence
**Only one female in sample

Hobo Lake

Hobo Lake was chosen for a beginning in the use of rotenone in seriously overpopulated brook trout lakes in the Wallowa Mountains. The elevation (8,300 feet), its small size and outlet, and the poor condition of eastern brook trout provided the necessary combination for the experiment.

A total of 350 pounds of 5 per cent rotenone was transported 6 miles by horses to the lake. Application was accomplished with rubber boats at a rate of 2.37 pounds of rotenone per acre foot of water.*

The numbers of fish destroyed indicated that a small population had overstocked Hobo Lake. Only one fish over 8.75 inches in length was recovered. All eastern brook trout over six inches in length were mature.

Golden trout will be stocked experimentally in 1952 if the species can be obtained.

Management

The development of a suitable management policy for the high lakes area has revealed certain facts which tend to direct future efforts along definite lines.

The fertilization of a high glacial lake cannot induce aquatic growth for any appreciable length of time. The expense involved and the poor results obtained in 1950 precludes its present use in the high lakes.

The use of rotenone in eliminating whole populations of stunted eastern brook trout is confined to lakes having small, controllable outlets. In 1952 at least two lakes will be surveyed to determine the possibilities of further use of rotenone. Lakes cleaned of eastern brook should be restocked with cutthroat, golden, or rainbow trout in order that recruitment of stocks may be controlled.

An increased bag limit has shown only limited results in thinning eastern brook trout to a point where the average length at maturity of females has increased. No change in the present bag limit is recommended.

The policy of not stocking eastern brook trout in overpopulated high lakes should be maintained.

The use of cutthroat in several high lakes indicates that the species will, under certain conditions, outgrow eastern brook trout. A continuance of work on cutthroat-eastern brook relationships in the high lakes is recommended.

A planned use of golden and mackinaw trout might prove advantageous in providing a new fishery in some of the high lakes. An increased interest in the area might develop as a result of the establishment of new species.

*Acre footage calculated by mapping

Wallowa Lake

Catch records

A total of ten days was devoted to the weekend checking of 825 creels in order to sample angler catches from Wallowa Lake. Of the 3,277 fish taken, 14 per cent were rainbow trout and 86 per cent were kokanee or landlocked sockeye salmon. Table 34 includes catch data gathered over a three-year period.

The numbers of fish taken per hour and per angler have been noticeably increasing since 1949. Twice as many fish were taken per unit of effort in 1951 as were taken in 1949.

Table 34

Periodic creel sample totals

Year	Number of days checked	Anglers	Hours	Rainbow	Sockeye	Combined catch	Fish taken per hour of effort	Fish per angler
1949	15	1,235	3,844	1,054	2,028	3,103	0.81	2.5
1950	15	1,329	4,336	539	3,910	4,449	1.02	3.2
1951	10	825	2,038	470	2,807	3,277	1.60	3.9

Landlocked sockeye salmon (kokanee)

As in 1950, two definite catch peaks were recorded in the popular kokanee fishery (Figure 8). The peak reached in late May produced 5.3 fish per angler while the peak of mid-June averaged 6.7 kokanee per angler at a rate of three fish per hour. The catch pattern has roughly been the same since 1949. Weather is not wholly accountable for this phenomenon exhibited by the kokanee fishery.

Kokanee entered the catch in seven of the ten days that creels were checked. For the 7-day period an average of 3.8 fish were taken per angler at a rate of 1.5 fish per hour.

Overnight gill net sets made in October produced ripe kokanee in large numbers from all sections of the lake shore. At the time only a few breeding kokanee had entered tributaries. An assumption that spawning activity takes place along shore is strengthened by gill net returns.

The small catch of rainbow recorded precludes the necessity of proposed regulation changes to favor the kokanee angler.

Rainbow trout

Rainbow stock of legal length released in late April was easily identified in the May catch. Of the 351 rainbow checked in May, 85 per cent were believed to be hatchery fish. Appearance, coloration, and size were the determining factors in identification. The early season rainbow fishery is almost entirely dependent upon hatchery stock of legal length. Of the 470

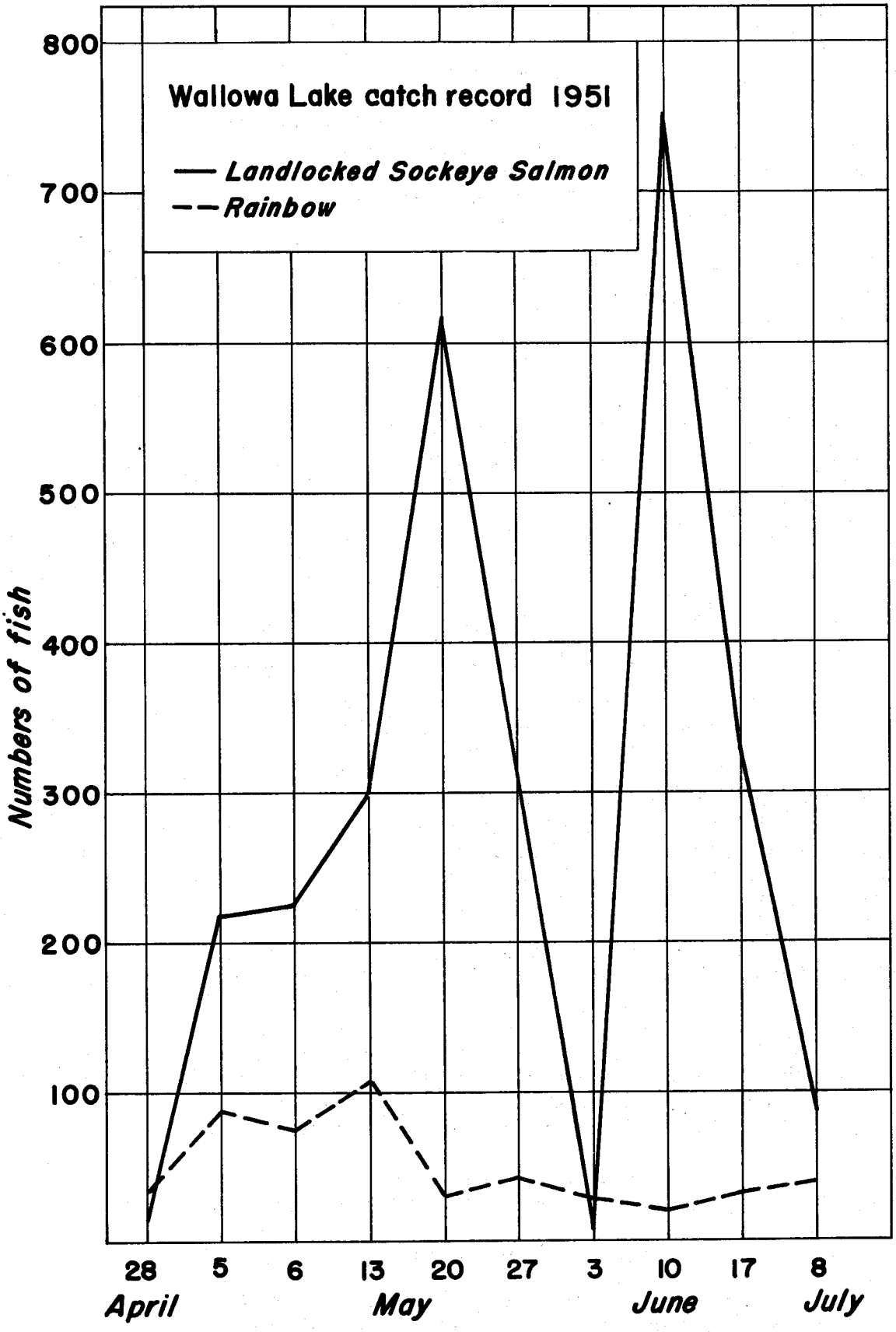

Wallowa Lake catch record 1951
Landlocked Sockeye Salmon
Rainbow
Numbers of fish
800
700
600
500
400
300
200
100
28
April
5
6
13
May
20
27
3
10
June
17
8
July

Fig. 8

rainbow checked, 76 per cent fell in the 6 to 8-inch group. (Table 35).

Table 35

Length group	10-day creel census returns	Gill net returns (7 nets)
6-8	76%	27%
8-10	21	42
10-12	1	21
12-14	1	10
14-16	1	0

None of the marked rainbow released in 1947 and 1948 was checked this year. Using scales from marked rainbow trout of known age taken in Wallowa Lake in 1950, growth comparisons were made with rainbow from other waters. In all comparisons the Wallowa Lake rainbow exhibits a much slower rate of growth than rainbow in the same age group from northeastern Oregon reservoirs. The limits of growth that can be expected from hatchery fish is revealed in the fact that none of the Wallowa Lake rainbow examined reached 12 inches in length before their third year, when released as 6-inch fish.

Since early season angling is largely dependent upon hatchery stock, the use of such fish in limited numbers is justified. More conclusive evidence concerning the importance of hatchery fish could be gathered if 25,000 marked rainbow were stocked in late April, followed by creel sampling.

The high lakes of the Elkhorn Range

Investigations

Of the 15 or more high lakes located in the Elkhorn Mountains, 5 were investigated for the first time and one was revisited in order to determine the growth of hatchery stock. Nearly all of the lakes investigated are comparable to the poorer lakes of the Wallowa Mountains in physical type and in the condition of fish populations. Most of the lakes are readily accessible, but the lack of accommodations has kept the area practically unknown except to local anglers.

Table 36 illustrates the present condition of populations in the six lakes. The evidence presented does not reveal a healthy situation among eastern brook trout. Although large fish are being taken at Baldy and Black Lakesthe recent stocking of eastern brook fingerlings may have lowered average lengths.

The use of hatchery stock in any of the lakes investigated is not recommended for 1952.

An increased bag limit is indicated for most of the lakes, but their geographic location and proximity to Anthony and Grande Ronde Lakes could prohibit any regulation change not applying to all lakes. Further investigation of the remainder of the Elkhorn Lakes group is recommended for 1952 in order to provide a basis for a regulatory and stocking policy.

Table 36

(A) Inventory results from six high lakes in the Elkhorn Mountains

Lake	Species	Number in sample	Averaged data for legal E.B. Length	Weight (grams)	Length at maturity of female eastern brook Number	Length
Baldy	EB	19	8.7	167	*	-
Black	EB	38	7.8	98	*	-
Van Patten	RB	10	6.7	-	-	-
Lost	EB	20	8.3	119	5	8.2
Red Mountain	EB	24	7.8	82	7	6.6
Summit	EB	86	6.8	53	26	6.6

*Insufficient evidence

(B) Stocking record

Lake	Year	Number	Species	Length
Baldy	1949	3,063	RB	2-4
	1950	7,100	EB	0-2
	1951	5,100	EB	0-2
Black	1950	5,250	EB	0-2
Van Patten	1949	1,850	RB	4-6
	1950	4,500	RB	2-4

Table 37

Fish Lake

A four-year comparison in the growth increases of eastern brook trout since the cessation of stocking.

	Year	Number in sample	Average length (inches)	Average weight (grams)
Length at maturity of females	1948	15	7.0	65.2
	1949	26	7.9	85.2
	1950	9	7.9	91.3
	1951	16	8.02	90.0
Length expectancy of legal fish	1948	30	7.1	66.8
	1949	57	7.8	78.1
	1950	45	7.9	104.3
	1951	34	8.05	121.7

Fish Lake

Investigations

Gill net caught samples were obtained from Fish Lake in order to provide a check on the present condition of eastern brook trout. Similar surveys have been made annually since 1948 to determine the effect upon the present population of a policy of stocking no fish. Table 37 includes data recorded over a four-year period.

The 1951 samples were collected at a much earlier date because of an adverse public attitude toward our management policy. Had the data been collected later in the season, when brook trout are in their best condition, greater weight increases, at least, would have been recorded.

Over 50 per cent of the sample were under 8 inches in length, an indication of highly successful natural reproduction. No eastern brook have been stocked since 1947. The stocking of eastern brook trout in Fish Lake is not recommended for 1952.

Catch records

The U. S. Forest Service guard at Fish Lake collected catch information periodically for 16 days from July 28 to September 8, 1951. (Table 38). A decrease is noted in the catch per hour and per angler over the 1950 records. Of the 1951 catch, 42 per cent fell in the 8 to 10-inch group while in 1949 nearly the entire catch was included in the 6 to 8-inch group.

Table 38

Fish Lake

Periodic creel check

Number of days checked	Anglers	Hours	Total catch	Composition of catch				Fish per hour of effort	Fish per angler
				6-8	8-10	10-12	12-14		
16	105	456	435	56%	42%	2%	0	0.9	4.1

Anthony and Grande Ronde Lakes

Catch records

Easily reached by road, Anthony and Grande Ronde Lakes receive a heavy angling pressure. A policy of stocking trout of legal length in the two small lakes has been followed since 1946. Table 39 reveals the high return of recently planted hatchery fish, indicating a great dependency upon legal fish stocked during the angling season.

Table 39

The relationship of planted hatchery species to creel check results

Stocking record			Fish per hour		
Year	Species	Number	of effort	Rainbow	Eastern brook
1949	EB	7,500	1.09	21%	79%
1951	RB	4,000	1.0	71	29

Creel sample data indicate that a high return is being realized from annual stocking. On July 4, a total of 85 anglers caught 257 fish in 254 hours. The average catch per angler was 3 fish. Over 60 per cent of the total catch were in the 6 to 8-inch length group.

A small annual planting of fish of legal length is recommended.

Olive Lake

Investigations

A series of 10 overnight gill net sets were made to determine the present condition of rainbow trout. Data from a previous inventory made in 1947 are comparable in that rainbow are maturing at about 12 inches in length. Table 40 illustrates length grouping of net-caught fish.

Table 40

Composition of catch by gill net

		Length group						Average length
Species	Number	6-8	8-10	10-12	12-14	14-16	16-18	at maturity
Rainbow	52	21	21	5	3	0	2	11.5
Cutthroat	5	5						*
Sockeye	6	1	5					8.5

*Insufficient evidence

Landlocked sockeye salmon, well established in Olive Lake, exhibit a slightly greater length at maturity than the same fish in Wallowa Lake. Trolling accounts for an estimated 20 per cent of the kokanee catch.

Shiner control

The red-sided shiner continues to thrive in large numbers in spite of good annual kills through the use of rotenone. This year 150 pounds of rotenone were used along shore and at inlets for two days during the spawning period. Many thousands of shiners were destroyed. Additional control of the shiner is indicated.

Upper Olive Lake

The upper reservoir, located about one mile above Olive Lake, was investigated in order to determine the condition of cutthroat trout known to exist there. Since two-thirds of the cutthroat sample were in the 6 to 8-inch group, natural reproduction has been successful. Cutthroat females are maturing at about 8 inches. No stocking has been done for at least 7 years.

The mediocre condition of the cutthroat population reflects the presence of tremendous numbers of shiners and an extreme annual drawdown of the reservoir.

Stocking is not recommended. Control of shiners by partial treatment with rotenone is advised.

Strawberry Lake

The condition of eastern brook trout planted biennially in Strawberry Lake was investigated through the use of gill nets. Table 41 illustrates the results obtained in a comparison with a similar inventory made in 1949.

The lengths of net caught fish were from 7 to 17 inches. An excellent condition of the brook trout population is indicated by the length at maturity of females.

Since no stock was added in 1951, the planting of 8,000 eastern brook fingerlings is recommended for 1952.

Table 41

A two-year comparison of the condition of eastern brook trout in Strawberry and Twin Lakes.

Lake	Year	Number in sample	Average length in inches	Average weight in grams	Average length at maturity of females
Strawberry	1949	22	9.9	203	11.7
	1951	36	12.1	469	12.4
Twin	1949	24	9.1	137	8.8
	1951	15	11.9	368	10.5

Twin Lake

The apparent lack of a spawning area for eastern brook is reflected in the condition and size of the remaining population in Twin Lake. Gill net and rod-caught samples were from 10.5 and 12.8 inches in length. No small fish were observed.

Twin Lake was last stocked in 1947. The planting of 5,000 eastern brook fingerlings is recommended for 1952.

Slide Lake

An inventory of the fish populations in Slide Lake was made to determine the necessity of an advocated restocking. A gill net sample of 68 eastern brook trout averaged 9.7 inches in length. Females were approaching maturity at 9.2 inches. A small spawning area has evidently permitted natural reproduction. Angling pressure is relatively light. No stock is recommended for Slide Lake in 1952.

Meacham Lake

Meacham Lake was sampled to determine the growth of rainbow stocked in 1950 as two-inch fingerlings. An average length of 5.7 inches was recorded and as a result, 1951 allocation for Meacham Lake was cancelled. A recommendation for further stocking should be based upon the results of an inventory in 1952.

The impounded waters of northeastern Oregon

Cold Springs Reservoir

A complete drawdown, the first in many years, permitted treatment of the remaining 650 acre-feet * of water through the use of 2,400 pounds of 5 per cent rotenone. An additional 400 pounds of rotenone were used in treating about 5 miles of dead water remaining in the intake canal.

Many tons of carp, suckers, squawfish, crappie and bullhead were destroyed. An estimated ** 90 per cent of the kill was made up of carp. No fish were taken in post treatment net sets or by seining.

A stocking program for the reservoir is being formulated. No stock will be released until 1952.

McKay Reservoir

Investigations

A continued investigation made in 1951 revealed a typically poor situation among game fish populations. The dominance of crappie * taken in the net and in the sport catch indicates an excessive population when an average length at maturity of 7 inches is considered. From all indications the fishery at McKay Reservoir has reached a low ebb. A total treatment with rotenone is now urgent.

A sufficient drawdown that will permit an economical and positive treatment has not yet been reached. The lowest figure over a ten-year period for sump capacity was 10,340 acre-feet of water reached in 1949. An attempt made this year to promote a further drawdown was not successful. About 15,000 acre-feet of water remained in the impoundment.

* Calculated by mapping, plane table method
**By shoreline counts
* See Table 42

Table 42

Composition of catch from thirty gill nets (240 fish) by percentage

Year	Crappie	Suckers	Squawfish	Perch	Chiselmouth	Carp	Bullhead	Trout
1950	67	23	3	3	2	2	0	0
1951	59	19	3.5	5.5	6	1	4	0

Catch records

Creel censusing was done on opening weekend and on several occasions through the season. Only 9 trout and 51 warm water game fish were taken by 44 anglers in 166 hours of effort. The sample check indicates an average of 0.36 fish per hour of effort. Rainbow of legal length stocked over a four-year period have contributed very little to the sport catch. No stocking was done in 1951.

Management

The complete elimination of all fish within the reservoir will permit the re-establishment of game fish with a minimal chance of a later reinfestation of coarse fish. Tributary streams are small and contain suckers, squawfish and shiners to their upper limits.

Effort should be expended largely in seeking a greater drawdown and in establishing a rehabilitation program which meets favor with all groups concerned.

Stocking in 1952 is not recommended.

Unity Reservoir

Good angling was enjoyed at Unity Reservoir for the first time in many years. Creel samples indicate that the catch per hour of effort was low but the large sizes of rainbow entering the catch balanced the return to the anglers. Rainbow up to four pounds in weight were checked at the reservoir. An estimated * 3,000 to 5,000 anglers visited the reservoir this year.

An investigation was made to determine the seasonal growth made by rainbow liberated in 1951. Table 43 includes data recorded from net-caught samples.

* An estimate based on a car count by dam supervisor.

Table 43

Rainbow

Length composition of catch by gill nets

Length group	Per cent	Average weight in grams	Maturity
6 - 8	51	72	immature
8 - 10	30	132	immature
10 - 12	15	265	males maturing
12 - 14	4	413	males mature, females maturing

The large percentage of rainbow in the 6-8 inch group taken in the sample is probably from the 1951 stock. Since separate size groups of rainbow were liberated in 1951, the growth of any specific group cannot be readily followed through gill net returns.

The establishment of growing rainbow populations and a new fishery at Unity Reservoir also marks the beginning of reinfestation. For the first time since total poisoning in 1949, small roach appeared in the gill net catch.

Through periodic creel and net sampling, the condition and return of newly established rainbow can be determined. Close surveillance will be necessary to determine the effect of coarse fish reinfestations upon the rainbow fishery.

Stock in 1952 should be rainbow, available at the Wallowa Station, as fry.

Higgins Reservoir

Catch records

Creel sampling was done on the opening weekend and on May 6 in order to provide a catch sample from the reservoir. Table 44 includes catch data recorded in 1950 and in 1951.

Table 44

Higgins Reservoir

A two-year comparison of creel sampling

Year	Number of days checked	Anglers	Hours	Cutthroat	Rainbow	Combined catch	Fish per hour of effort	Fish per angler
1950	2*	280	1,119	309	321	630	0.6	2.2
1951	3*	304	1,766	1,296	126	1,422	0.9	4.6

*1950 - May 1, 7; 1951 - April 28, 29, May 6.

The average catch per angler was twice as great in 1951 as in 1950. Four times as many cutthroat were taken in 1951 over similar periods by the same number of anglers. Cutthroat comprised 92 per cent of the total catch in 1951 and only 49 per cent in 1950. The increased yield of cutthroat is the result of additional stock released in April of 1950.

Gill net-caught samples provided a more equitable distribution of the two species, an indication that the troll fishery at the reservoir tends to be selective. Table 45 reveals the composition of catch from creel samples and from the gill net.

Table 45

Higgins Reservoir

Composition of catch

Creel sample of 1,422 fish			Gill net returns - 35 fish		
Length group	Percentage cutthroat	Percentage rainbow	Length group	Percentage cutthroat	Percentage rainbow
6- 8	25	3	6- 8	0	8
8-10	55	2	8-10	30	30
10-12	2	1	10-12	19	5
12-14	7	1.5	12-14	0	0
14-16	3	0.5	14-16	2	0
16-18	0	0	16-18	6	0
Totals	92	8		57	43

Investigations

An examination of catch samples revealed the immaturity among cutthroat trout. None of the females examined was mature. Rainbow under 11 inches in length were not mature.

The successful natural reproduction of rainbow in the tributaries (Camp Creek) is reflected in the large percentages of small fish present. No rainbow have been stocked in the reservoir. It is believed that both rainbow and cutthroat do equally well in Higgins Reservoir.

Before additional hatchery fish are released in the privately owned reservoir, an agreement should be reached with the owners whereby some assurance is given for public use of the waters for angling. Urgently needed is an easement for a right of way across private lands to reach the reservoir.

The streams of northeastern Oregon

Imnaha River

Steelhead

Six days were spent collecting steelhead catch data on the lower Imnaha River. Table 46 includes figures recorded periodically on the lower river over a three-year period. Creel sampling indicates a comparatively successful seasonal fishery on the Imnaha River. Nearly all of the steelhead angling is confined to the lower ten miles of the river. No changes in the current regulation are indicated.

Table 46

Imnaha River

Steelhead - periodic creel checks

Year	Period	Days checked	Anglers	Hours	Steelhead	Hours per fish	Fish per angler
1949	March April	5	84	681	54	12.5	0.64
1950	March April	10	144	1,135	50	22.6	0.32
1951	March April	6	121	650	73	8.9	0.60

Salmon

Electrofishing in 1949 and 1950 produced slightly under 30,000 eggs at an expenditure of about thirty-seven man days of effort. The difficulty encountered in transporting and holding green fish is perhaps the greatest drawback in electrofishing. The effort expended has been great for the returns realized.

Late in 1950 it was decided that a rack could be built at little expense to trap salmon moving upstream. On July 17 construction was begun. Poles were used for rack jacks and iron grills and lumber were hauled from the Wallowa Hatchery to construct the rack and trap. No expenditure was made on rack materials. Ten man days were required to construct and install the rack, trap and holding pen.

During the period from July 24 to August 18, 152 males and jacks were taken. Only six females were trapped over the same period. No females were trapped before August 9. On August 7, it was apparent that previously unobserved females were ready to spawn above the trap.

The shocker was again employed and ten females were taken in two days. Only one was ripe. The remaining nine were held in the pen at the rack.

During the following week only 2 females were trapped. A decision to continue electrofishing on August 13 was reached and six ripe females were taken in two days. Several other females were found spawned before being caught.

Of a total of twenty-two females, four died in the pen. No eggs from these fish could be salvaged. The largest females taken were the first to die, apparently from constant battering against the grilled pen. Of the remaining eighteen, three were killed and spawned when their condition became serious. Consequently fifteen good females produced a total of 58,157 eggs laid down at the Wallowa Hatchery. Of this number 18,016 green eggs were lost and the remaining 40,141 eggs were shipped to the Rock Creek Hatchery and Hood River.

Recommendations and Observations

1. If a continuance of the project is indicated, a pen must be so constructed to hold fish for a minimum of thirty days.

2. Electrofishing requires a great expenditure of time and manpower. Although many fish can be taken, no satisfactory method of holding and transporting caught fish has yet been found.

3. A rack and trap installed in the river before July 15 would be a tremendous project in view of high water conditions. It is now obvious that many females passed the site before July 23. The early installation of a rack then demands a pen capable of holding fish until August 5 through August 15.

4. Surveys before August 1 made on the upper river in no way reflect the numbers of salmon present. Only when low water stages are reached and spawning activity begins can salmon be seen in the upper river.

5. Operations this year cut deeply into scheduled field work. Maintenance at the rack should be done in the future by personnel with experience in egg-taking who are assigned specifically for that work.

6. Experience over the past three years on the river reveals the following:

   a. The majority of spring chinook spawn from August 10 to August 20.

   b. Water temperatures, checked at various intervals during the day, range from 49° to 57° F. at the peak of spawning.

   c. A fairly constant distribution of spawning fish is found from the Rapids to Mac's Mine, a distance of about nine miles.

   d. As a result of observation at the rack and electrofishing, it was determined that about one out of seven fish taken was a female (excluding jacks) in 1951.

Table 47

1951 Spring salmon egg-take - Imnaha River

	Man days	Fish and eggs taken		
		Males	Females	Eggs
Rack and trap construction	10			
Rack and trap removal	2			
Rack and trap maintenance	33	152	6	
Electrofishing	19	Many*	16	
Totals	64	152 *	22 **	58,157

* Numbers not recorded
**From seven females only a few eggs could be salvaged.

Grant and Morrow County streams*

Willow Creek

Electrofishing revealed a relatively low population of rainbow in Willow Creek below the town of Heppner. Higher water temperatures and the presence of many coarse fish do not provide a highly suitable habitat for rainbow in midsummer. Paralleled by road its entire length, Willow Creek is easily accessible. The use of hatchery stock, well distributed and of legal length, is indicated. All rainbow samples up to ten inches in length were immature.

Willow Creek once maintained a large run of steelhead. About twenty miles from its confluence with the Columbia an excellent spawning area still exists. High diversion dams have completely blocked the run. Urgently needed is an aggressive program to promote and enforce the laddering of all obstructions in the stream. If access to the spawning area is attained, the screening of all large diversions will be necessary.

Desolation Creek

The percentage of rainbows of legal to sublegal length in Desolation Creek is comparatively good in view of the reported moderate angling pressure. Rainbow samples did not include mature females. Natural reproduction is good. The accessibility of Desolation Creek indicates that limited annual stocking should be done in order to maintain a good percentage of catchable trout in the stream.

Murderers Creek

Electrofishing in the closed portion of Murderers Creek produced 55 rainbow in a 100-foot section. Six per cent were of legal length. In the open area, 215 small rainbow were recovered in a 100-foot section. None of the fish in the sample was of legal length. The abundance of small rainbow is possibly attributable to the fact that females are maturing at 6.25 inches and several mature males were examined whose

*See Table 48

lengths did not exceed 5.5 inches. Reproduction is highly successful. Murderers Creek has not been stocked since 1948.

The cropping of mature rainbow reaching legal length (6 inches) is indicated. The deletion of the regulation closing upper Murderers Creek is recommended.

Stocking is not recommended.

Table 48

Grant and Morrow County

Stream population inventory by electrofishing

Stream	Flow in cubic feet per second	Legal RB	Sublegal RB	Percentage of legal RB per 100' section	Existing regulations
Willow Creek					
Sec. 1	10	3	10	23	open
Sec. 2	12	3	0	100	open
Sec. 3	15	0	0	--	open
Desolation Creek					
Sec. 1	8	4	24	14	open
Sec. 2	18	5	27	18	open
Murderers Creek					
Sec. 1	7	4	55	6	Closed since '48
Sec. 2	8	0	215	0	open
Ditch Creek					
Sec. 1	6	1	1		open
Sec. 2	6	0	1		open

Rotary screen by-pass investigations

The increasing number of rotary screens being installed in the diversions leading from northeastern Oregon streams has prompted an investigation of the numbers, species and frequency of migrants being by-passed. The project was designed to check the comparative usefulness and efficiency of screens by the numbers of downstream migrants by-passed. Sample checks will eventually provide a basis for estimates of a total saving of fish life. Records of the separate species by-passed will indicate spawning success and the abundance of anadromous fish within a stream. Migration peaks located through by-pass checking can be applied to screening schedules.

Methods used

Screen maintenance personnel built a total of twelve small screened live boxes that could be placed under by-pass tile at the point of confluence with the stream. The checking of the numbers and species of trapped fish was done at regular intervals whenever the screen was serviced.

The location of live boxes was dependent upon the type and height of the by-pass outlet. Early summer use of live boxes was limited to diversion by-passes that were not submerged in high water. Fluctuations in diversion flow or a complete shut-off necessitated the moving of some live boxes to other screened diversions.

Results

The project was delayed considerably until screen installation in all areas was completed. Only a few live boxes were installed before July 1. No data were collected relative to the spring movement of downstream migrants.

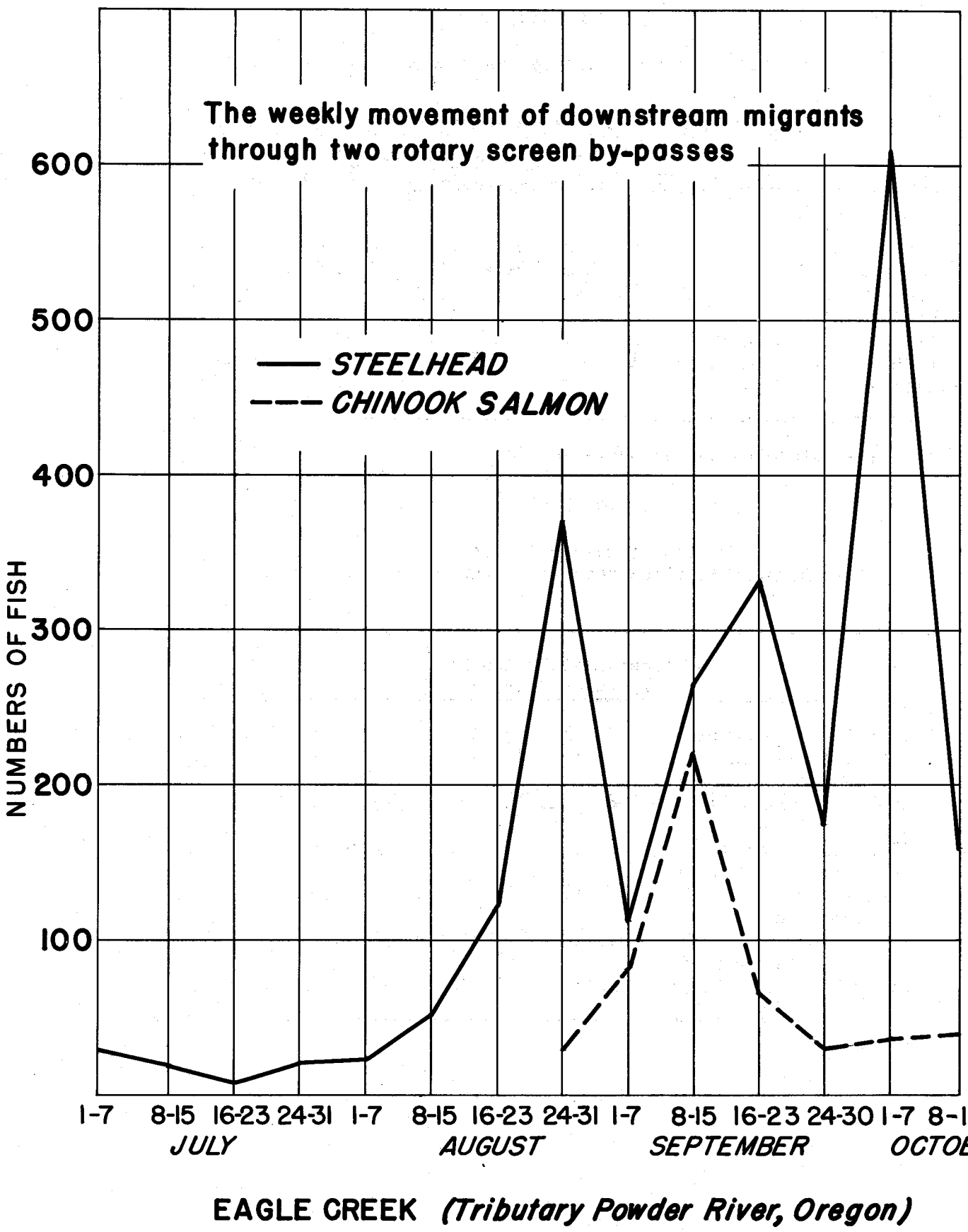
The seasonal results of by-pass checking are recorded in Table 49. Total figures and averages are included in Table 50. The estimated total saving of migrant fishes is included only for the purpose of illustration. Not considered is the size of the various diversions, the volume of flow, diversion velocity, or the location on the stream. Obviously some rotary screens will divert more fish than others. Migrants may be by-passed more than once enroute to the sea. The capacity of each screen for by-passing fish is determined by its size, operation, location, and a multitude of other factors.

A greater cross-sectional sample of screen efficiency to be obtained in 1952 will provide data that will allow more accurate estimates to be made.

Figure 9 illustrates the weekly movement of downstream migrants in Eagle Creek as reflected in counts made at two by-pass live boxes.

Recommendations

The continuation of regular by-pass checking is to proceed until data covering the complete period of irrigational activity are collected. An application of the information obtained can assist a screening program by throwing light on the need or elimination of certain screens, the efficiency of screens under various conditions, and the dates which downstream migrants can be given the most protection.



EAGLE CREEK *(Tributary Powder River, Oregon)*

Fig. 9

Table 49

Live-box check results concerning by-passed downstream migrants

Stream	Number of live boxes	Number of days in operation	Number of by-passed downstream migrants		Date of live box removal from by-pass
			Steelhead	Salmon	
Lower Umatilla River	1	40	5,150*	6	June 16
Eagle Creek	3	116	2,129	455	October 7
Pine Creek	1	54	73	0	July 14
Upper Wallowa River	1	97	272	273	September 14
Lostine River	1	12	18	15	September 14
Catherine Creek	1	10	0	27	June 13

*Nearly 100 spent steelhead by-passed

Table 50

Some totals relative to the numbers of fish by-passed at screened diversions

	Umatilla River	Eagle Creek	Pine Creek	Wallowa River	Lostine River	Catherine Creek
Number of check boxes	1	3	1	1	1	1
Total days checked	40	116	54	97	12	10
Total number of by-passed migrants	5,156	2,584	73	545	33	27
Daily average of by-passed migrants	128	22	1.3	5.6	2.7	2.7
Total number of screens in operation	5	11	30	33	13	12
Total number of days in operation	630	1,848	2,090	2,157	915	835
Estimated total number of fish by-passed	80,640	40,656	3,717	12,179	2,470	2,254

SOUTHEASTERN OREGON

Introduction

Fishery work in the Southeast Region during 1951 was designed to investigate existing conditions in as many lakes, streams and reservoirs as possible in an effort to find a basis for future management policies.

It is evident that a long-range program must be used in order to develop the sport fishery of the region.

Projects are being planned in the impoundment of runoff waters and the rehabilitation of existing reservoirs and lakes.

Delintment Lake

Delintment Lake is outstanding for its food production, but the fish population is periodically lost through winter kill. Because of the small number of fishing waters in this area, it is important that an effort be made to develop this fishery resource.

The best way to accomplish the development seems to be in impounding additional water, thereby retaining enough oxygen to support the fish throughout the winter.

To bring the lake to the desired level, the existing dam must be raised 10 feet. The height of the total structure will be 20 feet above the natural channel floor. The structure will impound 825 acre-feet of water, which will cover 55.5 acres to an average depth of 16 feet.

An important point of safety in constructing the dam to this height is the fact that a natural outlet could be used, located 300 yards west of the dam site.

The lake was stocked in mid-May with 4,974 yearling rainbow. Table 51 shows results of gill net sets taken in mid-August.

Table 51

Population studies, Delintment Lake

Number of fish	Species	Average length, inches	Average weight, pounds
36	Rainbow	11.4	.67

Tip Top Lake

The proposed site for the creation of the lake has been surveyed. A dam 26 feet in height would produce a reservoir of 19.5 acres with a maximum depth of 22 feet. The site is located about 2 miles southwest of Delintment Lake.

No definite plans have been drawn up for construction of the project.

Fish Lake

An oxygen analysis was made at Fish Lake on March 19, 1951. Table 52 is a tabulation of the test.

Table 52

Oxygen analysis of Fish Lake
March 19, 1951

Depth	Oxygen
0	7.4
6	7.6
9	7.9
15	6.6
25	3.6

Creel census was taken on Fish Lake during that part of the 1951 angling season which extended into the 1951 deer season. The reason for such a survey is the voiced local opinion that hunters take excessive amounts of fish from the lake. Table 53 depicts the results.

Table 53

Creel census, Fish Lake, during 1951 deer season

Date	Number of anglers	Number of fish
9/29/51	None	None
10/ 1/51	7	98
10/ 4/51	2	12
10/ 6/51	2	7
10/ 7/51	2	20
10/ 9/51	2	20
10/10/51	4	40
10/13/51	None	None
Totals	19	197

Table 54 presents angling results at the first of the season, and is to be compared to Table 55 , which lists the angling results at end of the season.

Table 54

Fish Lake creel census - June 15, 16, 17, 1951

Anglers checked	13
Hours fished	191
Number of fish caught	107
Fish per angler	8.2

Table 55

Fish Lake creel census -- October 1-10, 1951

Anglers checked	19
Hours fished	43
Number of fish caught	197
Fish per angler	10.4

Deadhorse and Campbell Lakes

Deadhorse Lake received two applications of chemical fertilizer.

Fingerling roach were observed in Deadhorse and found to be northern roach, Hesperoleucus mitrulus. One area was spot poisoned and several thousand roach were killed, indicating the possibility of a large trash fish population.

A creel census was taken at Campbell Lake on July 4, 1951, and the results are given in Table 56. Few anglers were out because of adverse weather conditions.

Table 56

Campbell Lake creel census - July 4, 1951

Anglers checked	18
Hours fished	64
Number of fish caught	26
Fish per angler	1.44

Blue Lake

Blue Lake is located in the Fremont Forest in Lake County about 35 miles north of Bly, Oregon.

A population survey was started on July 6, 1951, and the lake was found to contain large numbers of Klamath roach, Siphateles bicolor bicolor. A physical survey of the lake was made and the water volume determined in

preparation for the complete eradication of the fish population.

The Forest Service gave assistance in transporting the materials to the lake by furnishing pack animals.

Nine hundred pounds of rotenone were used for the poisoning. It was mixed at Lakeview in a ready-mix machine, hauled to the end of the road and then transferred to pack animals.

The lake was revisited two days later and gill net sets were made. Large numbers of dead roach and a few large trout were found around the shore line. Two gill nets were set for four consecutive nights with no fish being taken.

Blue Lake is to be stocked with 5,000 fingerling rainbow in 1952.

Fishhole Mountain reservoirs

The development of the Fishhole Mountain reservoirs is of considerable importance.

It would undoubtedly divert pressure from all other waters in Lake County owing to its accessibility. All of the reservoirs are within 10 miles of the main Lakeview-Klamath Highway.

At present some of the reservoirs of the area are not accessible by road, but the surrounding terrain is quite adaptable to road construction.

All of the reservoirs should support large populations of fish. The existing dams need repairing and the height should be increased.

Lofton Reservoir

Table 57 contains the results of an oxygen analysis taken in February, 1951, at Lofton Reservoir.

Table 57

Oxygen analysis of Lofton Reservoir
February, 1951

Depth	Oxygen
2 feet	4.6
5 feet	2.4

This reservoir was stocked with 7,686 eastern brook fingerling in 1950, but apparently there was very little survival.

Table 58 gives the results of eight gill net sets.

Table 58

Population study, Lofton Reservoir
June, 1951

Number of fish	Species	Average length inches	Average weight pounds
4	Eastern brook	9	.39

Big Swamp Reservoir

Big Swamp presents an excellent opportunity for increasing the fishing potential. At present, it covers an area of thirty acres and has an average depth of 12 feet.

In order to obtain a minimum water level agreement with the owner, it will be necessary for the Commission to add 10 feet of earth fill dam to the present structure. This would enable the holding of 8.5 feet of water, most of which is to be used for irrigation. A natural spillway located about 200 yards west of the dam site could be used.

Table 59 gives results of an oxygen test taken at Big Swamp Reservoir in February, 1951.

Table 59

Oxygen analysis, Big Swamp Reservoir
February, 1951

Depth	Oxygen
2 feet	11.0
5 feet	9.8

Heart Lake

This lake is at present inaccessible by road or marked trail. Arrangements could be made with the Fremont National Forest for trail or road construction.

An oxygen analysis was made at this lake in February, 1951. Table 60 shows the results.

Heart Lake was stocked for the first time with 6,481 fingerling rainbow in 1951.

Table 60

Oxygen analysis of Heart Lake
February, 1951

Depth	Oxygen
2 feet	4.6
5 feet	4.2
12 feet	2.0

Holbrook Reservoir

This reservoir covers 52 acres and has an average depth of approximately 20 feet.

Table 61 gives the results of an oxygen analysis for Holbrook Reservoir.

Table 61

Oxygen analysis of Holbrook Reservoir
February, 1951

Depth	Oxygen
2 feet	10.8
5 feet	9.2
12 feet	7.2

Holbrook Reservoir has a minnow population which is to be eradicated by a complete drawdown and channel poisoning.

A small reservoir of 4 or 5 acres exists above Holbrook which may contain trash fish. If so, it is to be included in the poisoning.

Spatterdock Lake

Here were stocked 4,758 eastern brook in 1950. Gill net sets made in June, 1951, produced no fish.

It is a small body of water with no inlet or outlet and covers approximately 8 acres with an average depth of 6 feet.

It has an exceptionally large population of fresh-water shrimp. Pond lilies and other aquatic vegetation are plentiful.

Malheur Reservoir

The reservoir was stocked with 52,000 advanced fry and 124,192 fingerling rainbow following the eradication of fish by the use of rotenone in 1950.

A gill net set was made November 1, 1951, with one net producing the results shown in Table 62. Some reinfestation has occurred from tributary streams.

Irrigation demands in 1951 reduced the size of the impoundment to 500 acre-feet. By November, the volume had risen to approximately 900 acre-feet.

Easements have been secured from Mr. Carrol Locey and The Orchard Water Comapny for a road across their lands allowing public access to the reservoir.

Table 62

Population studies, Malheur Reservoir
November 1, 1951

Number of fish	Species	Average length, inches	Average weight, pounds
217	Rainbow	6.7	.13
1	Sucker	6.4	.11

STOCKING

A total of 616,321 trout, weighing 11,950 pounds were released in the Southeast Region during 1951.

Distribution was commenced in April and terminated early in August. Whenever possible, district personnel accompanied the liberation truck and made a follow-up check within thirty-six hours in order to observe delayed mortality. Such mortality did not become significant until mid-July at which time water temperatures fluctuated as much as 16° in twenty-four hours.

Early in the summer, fish were showing signs of distress on all long hauls. A loss was sustained on May 21. Thereafter, ice was added to each load with much better results. Beginning July 14, all stockings were made in the early morning hours and losses immediately became negligible. Whenever possible, water was tempered if the two temperatures differed more than 6°.

A total of 13,166 rainbow, weighing 800 pounds were stocked in waters on the Malheur Refuge from the U. S. Fishery Station at Hagerman, Idaho. Two hundred of them were tagged with O.S.G.C. jaw tags and released in Baca Lake in order to check the use of the East Side Canal as a passageway to the Blitzen River for spawners.

Table 63

Water	Water-shed	Species	Number	Weight (pounds)	Size
Myrtle Creek	12	Rainbow	1,002	167	Yearling
Emigrant Creek	12	Rainbow	1,008	168	Yearling
Malheur R. (N. Fork)	10	Rainbow	5,040	960	Yearling
Drainage ditches	10	Rainbow	3,673	621	Yearling
Owyhee River	11	Rainbow	6,235	826	Yearling
Owyhee R. (Three Forks)	11	Rainbow	2,002	285	Yearling
Beulah Reservoir	10	Rainbow	150,700	274	Fingerling
Beulah Reservoir	10	Rainbow	194,400	54	Unfed fry
Malheur Reservoir	10	Rainbow	124,192	287	Fingerling
Malheur Reservoir	10	Rainbow	52,200	14.5	Unfed fry
Blitzen River	12	Rainbow	3,875	820	Yearling
Bear Creek	12	Rainbow	1,003	114	Yearling
Willow Creek	10	Rainbow	2,520	240	Yearling
Silvies River	12	Rainbow	3,999	465	Yearling
Silver Creek	12	Rainbow	2,160	450	Yearling
McCoy Creek	12	Rainbow	1,506	335	Yearling
Delintment Lake	12	Rainbow	4,974	1,023	Yearling
Fish Lake	12	Eastern brook	5,000	1,000	Yearling
Chewaucan River	13	Rainbow	5,200	790	Yearling
Twentymile Creek	13	Rainbow	2,500	250	Yearling
Deep Creek	13	Rainbow	3,000	500	Yearling
Drakes Creek	13	Rainbow	1,500	150	Yearling
Camas Creek	13	Rainbow	2,000	200	Yearling
Dairy Creek	13	Rainbow	3,375	675	Yearling
Cougar Creek	13	Rainbow	375	75	Yearling
Deadhorse Lake	13	Eastern brook	2,850	630	Yearling
Campbell Lake	13	Eastern brook	2,850	600	Yearling
Lofton Reservoir	13	Rainbow	10,620	90	Fingerling
Big Swamp Reservoir	13	Rainbow	10,081	125	Fingerling
Heart Lake	13	Rainbow	6,481	47	Fingerling

ANGLING REGULATION CHANGES

Drews Creek

The opening and closing dates should coincide with the regular Lake County season because a large number of the fish caught between March 15 and May 20 are spawners that could be contributing to the fishery in Drews Reservoir.

Campbell, Deadhorse and Blue Lakes

The opening and closing dates should coincide with the regular Lake County season because the lakes must be stocked to maintain a satisfactory population. There seems to be no reason for the late opening and early closure date. If the fish population is affected by fishing pressure during the proposed season, stockings could be made periodically.

Eastside Canal

(1) The section from the mouth of Bridge Creek to Baca Lake should remain closed because of its extensive use by waterfowl.

(2) The canal should be opened from the Page Dam head gate downstream to Bridge Creek. The canal was supposed to have been used as a by-pass for spawning fish in moving from Baca Lake to the Blitzen River, but no fish have been so observed, only two fish could be taken in nets set in Baca Lake, and there are seven barriers to fish migration in the section between the head gate and Baca Lake. Mr. John Scharff, Malheur Refuge Manager, was interviewed concerning the problem and is in agreement with the proposed change.

CENTRAL OREGON

GENERAL LAKE SURVEY

Population studies of lakes in the region have been necessary in order to determine problems involved in management, influence of present stocking policies, and appropriate game fish species.

Population studies were made with gill nets. Samples of fish were taken by angling in the conventional method, by the use of chemicals, and by checks of the angler's creel.

Composition and length frequency of fish populations

Table 64 is a tabulation of the composition and length frequency of the catch by gill nets in some central Oregon lakes. The length frequency is represented by percentages in one-inch size groups. Measurements were made on all fish from the tip of the snout to the fork of the caudal fin.

Maturity

Fish collected, with the exception of some roach, were dissected in order to determine the degree of maturity. Table 65 is a summary of the degree of maturity of female fish caught in each lake. Degree of maturity is expressed in three stages--immature, maturing, and mature. Fish were classified as immature if the ovaries were small and if there was no indication of development of the granular mass. Fish were maturing if the ovaries were large and to a degree, in some cases, just before spawning. Fish classified as mature showed some evidence of previous spawning. The number of females of each species is represented by the percentage of the total under each stage of maturity in Table 65.

Length at maturity

Length at maturity studies have been made in various lakes from 1949 through 1951. Table 66 is a tabulation of the information compiled to depict the changes by year.

SPECIAL PROJECTS

Special projects in the area include the South Twin Study, East and Paulina Lake Study, Deschutes River Test Area, Blue Lake and Odell Lake. In each case, the waters involved in special projects posed separate management problems. The facts learned from each project have been applied to management of other waters in the area when possible.

South Twin Lake

Seven years of creel census by Game Commission personnel were completed at the close of the 1951 angling season on South Twin Lake. The trout stocked were marked in various ways so that workers could identify separate plantings when anglers brought their catch to the checking station. The project may be reviewed in its entirety in the tables that follow.

Table 64

Composition and length frequency of catch by gill nets in some Central Oregon lakes represented by percentage in one-inch size groups. Fork length measurements.

Lake	Number of sets	Species	Number collected	Percentage of total	Inches																				
					3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23-30
Crescent	8	Rainbow	4	1			25		25	50															
		Whitefish	22	6				23	32	14	23	4			4										
		Roach	364	93		30	45	24	1																
North Twin	4	Rainbow	15	88						7	20	13	47	13											
		Eastern Brook	2	12												100									
Little Lava	8	Rainbow	3	1				33	67																
		Eastern Brook	7	2				43	43	14															
		Roach	290	91		20	79	1																	
		Whitefish	20	6			5	40	15	15	20	5													
Mud Lake	8	Eastern Brook	110	90				7	34	40	15	4													
		Carp	12	10	8	92																			
Elk Lake	12	Eastern Brook	45	60			2	9	7	67	5	4	4	2											
		Rainbow	30	40			3	17	43	23	7	7													
Waldo Lake	8	Rainbow	14	9			44	21	21	7	0	0	7												
		Eastern Brook	129	90			3	12	23	39	13	5	4	1											
		Roach	1	1			100																		
Davis Lake	12	Rainbow	14	3			7	0	14	14	7	7	0	0	0	7	14	0	14	14					
		Kokanee	45	10					2	0	0	0	16	42	18	0	0	2	13	7					
		Whitefish	3	1					33	34	0	33													
		Roach	387	86		42	41	13	4																

Lake	Number of sets	Species	Number colledted	Percentage of total	Inches																					
					3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23-30	
Wickiup Reservoir	10	Rainbow	3	0.5					33	0	0	0	0	33	0	34										
		Eastern Brook	7	1			14	14	15	15	14	14	0	0	14											
		Brown	4	0.5												50	0	25	0	0	25					
		Dolly Varden	7	1												14	0	0	0	0	14	14	0	14	29	14
		Roach	953	95		5	6	89																		
		Whitefish	25	2					4	8	12	0	8	40	16	12										
Ochoco Reservoir	4	Rainbow	39	29				7	70	18	5															
		Large Scale Sucker	93	70			3	9	14	6	2	4	45	17												
		Squawfish	1	1				100																		
Todd Lake	2	Rainbow	41	95			24	61	13	2																
		Eastern Brook	2	5			50	0	50																	
Sparks Lake	2	Rainbow	2	10				50	50																	
		Eastern Brook	121	90			3	9	21	23	11	9	13	9	0	2										
Irish Lake	2	Eastern Brook	38	100			11	15	28	32	14															
Devils Lake	2	Eastern Brook	16	100			7	12	18	63																
Taylor Lake	2	Eastern Brook	41	100			2	13	51	21	13															
East Lake	4	Eastern Brook	19	8						21	16	10	27	16	10											
		Brown	1	1																			100			
		Rainbow	18	7			23	17	5	11	11	5	17	11												
		Roach	197	84				47	21	12	13	7														
Big Lava Lake	2	Eastern Brook	46	72						3	42	50	5													
		Roach	18	28		22	62	11	5																	
Little Cultus	1	Rainbow	12	57			8	8	0	34	50															
		Eastern Brook	9	43				33	11	45	11															
Little Huston	4	Carp	62	98		12	88																			
		Goldfish	1	2			100																			

Table 65

Maturity of female fish in some central Oregon lakes

Lake	Date of collection	Species	Percentage Immature	Maturing	Mature	Number in collection
Crescent	8/ 1/51	Rainbow	100	-	-	2
		Whitefish	17	83	-	12
		Roach	2	36	62	68
North Twin	8/15/51	Rainbow	100	-	-	4
		Eastern brook	-	-	100	1
Little Lava	8/22/51	Rainbow	100	-	-	2
		Eastern brook	100	-	-	4
		Whitefish	30	13	57	7
		Roach	No maturity data taken			
Mud Lake	8/16/51	Eastern brook	65	25	10	68
		Carp	100	-	-	6
Elk Lake	9/ 6/51	Rainbow	100	-	-	8
		Eastern brook	83	13	4	24
Waldo Lake	9/21/51	Rainbow	100	-	-	6
		Eastern brook	56	44	-	80
		Roach	-	-	100	1
Davis Lake	8/21/51	Rainbow	100	-	-	2
	9/16/51	Kokanee	100	-	-	27
		Roach	No maturity data taken			
Wickiup Reservoir	8/19/51	Rainbow	100	-	-	2
	9/12/51	Eastern brook	50	-	50	2
		Brown	-	100	-	3
		Dolly Varden	25	25	50	4
		Whitefish	20	33	47	15
		Roach	No maturity data taken			
Ochoco Reservoir	10/ 5/51	Rainbow	100	-	-	21
		Large scale sucker	100	-	-	23
		Squawfish	100	-	-	1
Todd Lake	9/17/51	Rainbow	100	-	-	23
Sparks Lake	9/13/51	Eastern brook	57	28	15	72
Irish Lake	9/15/51	Eastern brook	60	40	-	22
Devils Lake	9/17/51	Eastern brook	12	78	-	9
Taylor Lake	9/15/51	Eastern brook	33	56	11	18
East Lake	7/25/51	Rainbow	100	-	-	10
		Eastern brook	33	50	17	12
Little Huston	6/20/51	Carp	-	42	58	12
Big Lava	6/29/51	Eastern brook	100	-	-	19
		Roach	-	50	50	12
Little Cultus	7/11/51	Rainbow	100	-	-	5
		Eastern brook	100	-	-	5

Table 66

Length at maturity in some Cascade lakes
1949-1951

Lake	Year	Species	Number in sample	Length in centimeters	Weight in grams
Todd	1950	Eastern brook	7	27.3	301.4
	1951	Eastern brook	0	-	-
Sparks	1950	Eastern brook	8	27.2	282.5
	1951	Eastern brook	11	31.0	394.4
Devils	1949	Eastern brook	6	18.7	-
	1950	Eastern brook	8	20.84	108.56
	1951	Eastern brook	0	-	-
Elk	1949	Eastern brook	8	34.6	591.2
	1950	Eastern brook	8	34.5	589.9
	1951	Eastern brook	1	30.0	309.5
Waldo	1950	Eastern brook	2	47.4	1,756.5
	1951	Eastern brook	0	-	-
Three Creeks	1950	Eastern brook	7	24.9	200.2
	1951	Eastern brook	0	-	-
Mud	1949	Eastern brook	8	21.4	107.3
	1951	Eastern brook	15	22.3	140.0
Taylor	1949	Eastern brook	5	23.2	168.8
	1951	Eastern brook	2	19.1	88.5
Irish	1949	Eastern brook	10	20.9	109.0
	1951	Eastern brook	0	-	-
Little Lava	1949	Whitefish	-	23.0	-
	1951	Whitefish	4	24.0	157.2
North Twin	1949	Eastern brook	6	25.7	197.0
Crane Prairie	1949	Eastern brook	-	28.0	284.0
	1949	Rainbow	-	38.0	-
Wickiup Res.	1951	Eastern brook	1	21.8	122.4
	1951	Dolly Varden	2	59.0	2,090.5
	1951	Brown	7	33.7	422.4
East	1951	Eastern brook	6	32.7	411.0
	1951	Rainbow	1	39.3	736.0
	1951	Brown	1	51.0	1,061.0
Paulina	1951	Rainbow	4	34.6	526.0

Table 67

Seven-year comparison of catch statistics, South Twin Lake

	1945	1946	1947	1948	1949	1950	1951
Days in season	64	64	58	62	62	93	122
Angler trips	3,149	4,729	5,392	6,027	3,343	3,951	2,440
Fish checked	9,365	10,043	8,444	12,525	3,391	12,703	8,497
Total weight in pounds	9,694	6,537	7,020	8,961	2,842	2,701	2,110
Man hours fished	11,989	21,640	25,549	29,589	17,022	14,695	10,155
Average weight of fish, pounds	1.03	0.65	0.83	0.71	0.84	0.21	0.25
Catch/surface acre, pounds	74.6	50.7	54.0	68.9	21.9	20.8	16.23
Average catch	2.9	2.12	1.5	2.07	1.01	3.02	3.5
Hours per fish	1.28	2.15	3.0	2.3	5.0	1.16	1.19
Fish per hour	0.781	0.464	0.330	0.423	0.199	0.864	0.837
Range in size	7-18"	6-18"	7-21½"	6-21"	6-21"	6-24"	6-24"

Previous to the 1951 season, a creel census was made by workers each day of the season with a coverage of at least 90 per cent. The decrease in the number of anglers during the last half of the 1951 season forced the study to be continued on a smaller scale. Creel census during the last half of the season was taken on all Saturdays and Sundays. The weekday catch was calculated and included in the totals for the season.

Catch statistics

Table 67 contains statistical data on the catch at South Twin Lake over a period of seven years.

There were twenty-nine more angling days in 1951 than in 1950 on South Twin Lake. The extended season did not increase the total number of angler trips to the lake. Angling pressure in 1951 was the lowest recorded during the seven-year period. The lack of anglers could not be blamed on the poor fishing success. The average catch and the hours fished were higher and lower, respectively, in 1951 than in any year.

The increased bag limit from five fish to ten fish per day did not increase the catch. The drastic change in catch statistics of the 1951 season can only be attributed to overpopulation. The small size and condition of the trout in South Twin discouraged many anglers and gave the lake a poor reputation.

Size groups

Through the entire South Twin Study, the trout measured at the checking station have been recorded in 2-inch size groups. The length frequency of the catch over a seven-year period is presented in Table 68.

Table 68

Length-frequency catch, South Twin Lake, 1945-1951

Year	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20 & Over
1945	2	426	421	3,089	5,408	19	0	0
1946	134	3,338	4,711	249	1,243	370	0	0
1947	4	1,062	4,737	1,038	966	579	58	0
1948	52	2,726	5,978	1,451	2,052	222	42	2
1949	131	1,155	933	151	664	307	49	1
1950	8,525	1,532	2,274	86	175	83	23	5
1951	3,075	5,263	150	2	2	3	0	2

Table 68 exhibits the marked change in the fishery at South Twin during the 1950 and 1951 seasons. The overpopulated condition that was prevalent in the lake in 1950 carried through to the 1951 season. No additional growth of fish was observed during the period. Over 98 per cent of the season's catch of trout was in the 6-10 inch size group. The last month of the season, trout in the 6-8 and 8-10 inch groups advanced to 8-10 and 10-12 inches, respectively. The above observation was an indication that the fish population in South Twin Lake was being reduced and that more food

was available for the remaining fish.

Total weight of catch

The average weight of fish caught increased .04 pounds in 1951 over the 1950 figure. The catch per surface acre was low for the study period in 1951 when only 16.23 pounds of fish were caught per surface acre compared to 74.6 in 1945. Through the seven-year study, 12,879 pounds of trout have been stocked in the lake and over 39,856 pounds have been removed by anglers. The total production of the lake has been 26,977 pounds of trout or 207.5 pounds per surface acre.

Stocking record

The stocking record for South Twin Lake is included in the report for ready reference when comparing the total number of fish stocked with the returns of various plants. Table 69 includes the information on all trout stocked in South Twin Lake since chemical treatment in 1941.

Table 69

Stocking record, South Twin Lake

Year	Species	Number	Pounds	Size	Marking	Time stocked
1942	Fall rainbow	34,820	887	4	None	Fall
1943	Fall rainbow	35,000	175	2	None	Fall
1944	Fall rainbow	10,375	125	3	None	Fall
1946	Fall rainbow	15,760	2,569	3-18	Adipose	Spring
1946	Fall rainbow	5,032	68	3¼	Adipose-right ventral	Fall
1947	Fall rainbow	13,057	1,572	6-7	Left ventral	Spring
1948	Fall rainbow	26,000	5,720	4-15	Right pectoral	Spring
1949	Fall rainbow	10,113	1,113	6-9	Left ventral	Spring
1949	Fall rainbow	150,000	650	2	None	Spring
Totals		300,157	12,879			

Trout stocked in the lake prior to 1949 were from the Oak Springs Hatchery. The 1949 planting of rainbow was furnished by the Wizard Falls station.

Return to the angler

The return to the angler of various plantings in South Twin Lake in successive years is presented in Table 70. Information concerning the numbers planted is included and returns are represented in numbers of fish and in percentages.

Figure 10 is a graphic representation of the returns to the angler of various plantings in successive angling seasons.

The first five plantings in South Twin Lake gave normal return patterns. The highest percentage of fish was taken during the first year of angling on the plant. Returns to the angler in successive years dropped

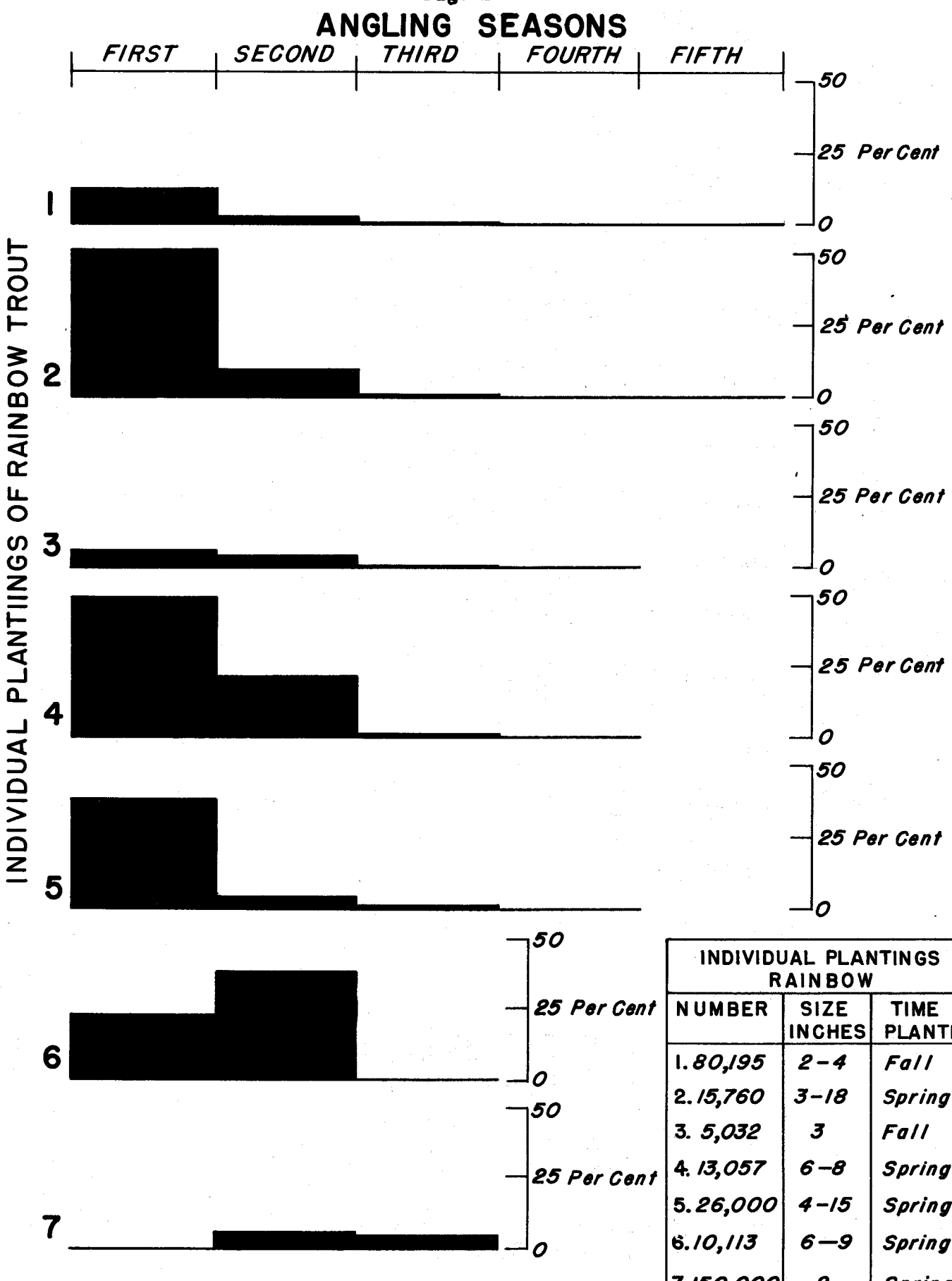
Table 70

Return and percentage of return to the angler of various plantings made in South Twin Lake.

Year stocked	Time planted	Number	1945	Percentage	1946	Percentage	1947	Percentage	1948	Percentage	1949	Percentage	1950	Percentage	1951	Percentage	Total	Percentage
1942-44	Fall	80,195	9,365	11.7	1,862	2.3	350	0.4	108	0.1	8	0.01	0	0	0	0	11,693	14.6
1946	Spring	15,760	-	-	8,181	51.9	1,385	8.8	187	1.2	17	0.1	3	0.01	0	0	9,773	62.01
1946	Fall	5,032	-	-	-	-	262	5.2	179	3.6	27	0.5	4	0.08	0	0	472	9.4
1947	Spring	13,057	-	-	-	-	6,447	49.3	2,690	20.6	224	1.7	42	0.32	0	0	9,403	72.02
1948	Spring	26,000	-	-	-	-	-	-	9,361	36.0	887	3.4	275	1.06	6	0.023	10,529	40.49
1949	Spring	10,000	-	-	-	-	-	-	-	-	2,128	21.28	3,809	38.09	38	0.38	5,975	59.75
1949	Spring	150,000	-	-	-	-	-	-	-	-	99	0.07	8,569	5.71	8,453	5.63	17,121	11.41
TOTAL		300,044															64,966	

Percentage Return to the Angler, in successive angling seasons, of plantings made in South Twin Lake 1945-1951

Fig. 10



INDIVIDUAL PLANTINGS RAINBOW		
NUMBER	SIZE INCHES	TIME PLANTED
1. 80,195	2-4	Fall
2. 15,760	3-18	Spring
3. 5,032	3	Fall
4. 13,057	6-8	Spring
5. 26,000	4-15	Spring
6. 10,113	6-9	Spring
7. 150,000	2	Spring

rapidly until fish disappeared completely from the catch after the fifth season in the lake. The sixth planting, which was made in 1949 and consisted of 10,000 fish of legal length, provided a large return in the second year of angling. One explanation of the result may be that the larger fish were desired by anglers in 1950 when the population of small 6 to 8 inch fish were so numerous in the lake. The low return of the number of trout caught from the sixth planting in the 1951 season is depicted in Figure 10. The planting of fry in 1949 has held up well in two years of angling. No fish were stocked in 1950 and 1951 and the bulk of the angling has been on the fry plant of 1949.

Table 71 contains the percentage that each stocking has contributed to the yearly catch from 1945 through 1951.

Table 71

Percentage contribution of each plant to the yearly catch, 1945-1951

Year	Fall 1942-44	Spring 1946	Fall 1946	Spring 1947	Spring 1948	Spring 1949	Spring (fry) 1949
1945	100	-	-	-	-	-	-
1946	18.5	81.5	-	-	-	-	-
1947	4.1	16.8	3.2	76.3	-	-	-
1948	0.9	1.5	1.4	21.5	74.7	-	-
1949	0.2	0.5	0.8	6.6	26.2	62.8	2.9
1950	0.0	0.02	0.03	0.33	2.16	29.99	67.46
1951	0.0	0.0	0.0	0.0	0.07	0.43	99.5

The general pattern of returns of fish planted in South Twin Lake is complete except for the fry planting in 1949. A discussion of the returns of each planting may be found in the 1950 report.

The fry planting of 1949 has exhibited a higher rate of survival than was originally calculated. At time of planting, a 2 per cent survival of such stockings was expected. At the end of the 1951 season, 11.41 per cent survival had been realized and observations indicate that many fish remain in the lake.

Cost analysis

The percentage of return to the angler's creel must also be correlated with a cost analysis of each stocking. A desirable stocking policy, disregarding biological factors, should be based on angler success and cost per individual fish. Table 72 is a tabulation of the cost per fish caught in relation to cost per fish at planting.

Computation of the figures in Table 72 were based on information received from annual budgets of the stocking department. The cost per fish was computed by using a figure of $1.40 per pound to rear fish and 13.2 cents per pound for stocking. The cost is general and applies to all hatcheries of the state. Rearing costs vary with each station, but the relationship of various plantings to the return should remain the same.

Table 72

Cost at time of planting in relation to cost of fish caught in South Twin Lake

Year stocked	Time stocked	Size at stocking	Cost per fish when stocked (cents)	Cost per fish returned to angler's creel (cents)
1942-44	Fall	2-4	2.26	15.5
1946	Spring	3-18	25.0	40.3
1946	Fall	$3\frac{1}{4}$	2.08	22.1
1947	Spring	6-7	18.4	22.5
1948	Spring	4-15	33.7	83.2
1949	Spring	6-9	16.8	28.5
1949	Spring	2	0.66	11.5

The cost per fish may be considered complete from 1942 through the spring planting of fish of legal length in 1949. The spring planting of 2-inch fish in 1949 may be reduced in the coming 1952 season. Information recorded in Table 72 clearly indicates that it is more expensive to stock fish of legal length that bring higher returns to the angler than to plant smaller fish with lower returns. The returns from South Twin indicate that it is cheaper to plant small fish in the spring than in the fall. In general, stocking of fish of legal length is more expensive.

Oxygen analysis

Oxygen analyses of the water at South Twin Lake were made from 1949 through 1951 before the breakup of the winter ice cover. Table 73 is a record of the results obtained.

Table 73

Chemical analysis of water, March, 1949-1951
South Twin Lake

Depth	Oxygen 1949	1950	1951
Surface	6.9 ppm.	9.2 ppm.	5.8 ppm.
5 feet	-	5.2 ppm.	5.2 ppm.
6 feet	6.55 ppm.	-	-
10 feet	-	3.6 ppm.	4.2 ppm.
12 feet	4.45 ppm.	-	-
15 feet	-	2.8 ppm.	4.0 ppm.
18 feet	1.65 ppm.	-	-
20 feet	-	2.1 ppm.	3.2 ppm.
25 feet	0.65 ppm.	1.3 ppm.	-
39 feet	0.40 ppm.	-	-

Conclusion

Sufficient returns from all fish planted in South Twin Lake have been made to evaluate the results. Additional data could be collected on the 1949 fry plant, but the expense involved to obtain the information would be prohibitive. Periodic checks of angler's creels and gill net sets should suffice for further information.

East and Paulina Lakes

The 1951 East and Paulina Lake Study consisted of a partial creel census of both lakes. Extensive creel censuses were taken during periods of heavy angling pressure, such as on holidays and at the beginning of the season.

Trash fish control, stocking of hatchery fish, measurement of angling pressure, and the collection of management data comprised the remainder of the summer activities.

East Lake

Creel census results

Creel census data were collected for 47 days out of the 122-day season. The information collected was recorded on prepared forms that permitted the classification of trout into species and into 2-inch size groups, the recording of the number of anglers, hours fished, lures, marks, methods of angling, and samples of length and weight measurements. Scale samples were taken of a representative number of fish. Calculation of the total catch and number of anglers was made from information gathered by a daily count of private and resort boats.

The catch statistics for East Lake from 1946 through 1951 are presented in Table 74 for comparison.

The angling pressure on East Lake continues to increase with each year of study. There were approximately 10,500 more anglers fishing in 1951 than in the 1950 season. The number of fish per angler and the hours of angling per fish show that angling success remained high.

The total catch in 1951 was double that of 1950. The weight of the catch was the heaviest ever removed from East Lake in a study period, but the average weight of fish decreased slightly.

The over-all production or catch per surface acre increased 30 pounds in 1951. The increase is a reflection on the large total catch, for the average size of fish was smaller.

The relationship of rainbow to eastern brook trout has remained stable from 1946 through 1950. The 1951 season's results indicate that the rainbow trout provided almost 70 per cent of the catch.

Size groups and species

Catch composition from 1947 through 1950 is represented in Table 75. The 1947 and 1948 data is for the total catch. The information

Table 74

East Lake catch statistics, 1946 through 1951

	1946	1947	1948	1949	1950	1951
Angler trips	14,084	14,720	22,849	26,000	28,000	38,500
Total trout caught	12,933	17,390	37,187	50,000	53,300	109,000
Poundage	23,123	20,610	34,717	37,569	35,645	65,083
Average weight of fish, pounds	1.75	1.19	0.94	0.75	0.67	0.60
Catch per surface acre, pounds	23.8	21.3	35.8	38.7	36.7	67.1
Hours angling per fish	5.0	4.7	3.5	2.5	2.4	1.73
Fish per angler	0.99	1.18	1.63	1.91	1.85	2.56
Percentage catch rainbow	49.0	48.5	56.0	53.0	58.2	70.1
Percentage catch brook	46.0	49.7	43.2	46.4	41.2	29.4
Percentage catch brown	5.0	1.8	0.8	0.6	0.6	0.5

Table 75

Composition of the catch, East Lake, 1947 through 1951

Size groups	1947			1948			1949			1950			1951		
	EB	RB	BR	EB	RB	BR	EB	RB	BR	EB	RB	BR	EB	RB	BR
6- 8	323	785	-	1,951	567	-	151	249	-	20	15	1	283	303	1
8-10	663	2,169	-	4,097	1,943	4	718	1,011	3	967	2,261	1	885	2,402	11
10-12	1,292	2,561	1	4,228	8,157	14	2,449	2,173	2	1,574	2,182	1	1,722	4,817	23
12-14	4,353	861	2	2,753	4,081	14	1,774	1,664	4	1,410	1,232	13	1,004	2,131	22
14-16	1,494	127	8	1,991	474	5	404	970	3	533	584	11	265	473	35
16-18	475	48	4	874	90	19	108	283	2	82	191	7	29	82	35
18-20	54	753	28	164	384	54	8	27	13	4	13	10	-	16	16
20-22	3	976	71	11	118	96	-	24	22	-	6	11	-	1	10
22-24	-	150	93	4	20	50	-	12	6	-	4	13	-	-	2
24 & over	-	3	93	-	-	38	-	1	4	-	-	3	-	-	4
Total	8,657	8,433	300	16,073	20,820	294	5,612	6,414	59	4,590	6,488	71	4,188	10,225	159
Grand total		17,390			37,187			12,085			11,149			14,572	

for the period of 1949 through 1951 is from a sample of 12,085, 11,149, and 14,972 trout, respectively.

Variations in numbers of fish obtained in samples of the catch each year made it necessary to tabulate the frequency of size groups on a percentage basis. Table 76 shows the percentage by 2-inch size groups represented in the catch from 1947 through 1951.

Table 76

Comparison of size groups, 1947-1951, all species - East Lake

Size	1947	1948	1949	1950*	1951
6- 8	6.4 per cent	6.7 per cent	3.3 per cent	0.32 per cent	4.0 per cent
8-10	16.3 "	16.2 "	14.3 "	30.0 "	22.6 "
10-12	22.3 "	24.8 "	38.3 "	33.7 "	45.0 "
12-14	30.0 "	29.3 "	28.5 "	23.8 "	21.8 "
14-16	9.3 "	16.3 "	11.4 "	10.1 "	5.3 "
16-18	3.0 "	3.6 "	3.2 "	2.5 "	1.0 "
18-20	4.8 "	0.8 "	0.4 "	0.24 "	0.2 "
20-22	6.0 "	1.3 "	0.4 "	0.15 "	0.07 "
22-24	1.4 "	0.4 "	0.15 "	0.15 "	0.01 "
24 & over	0.6 "	0.1 "	0.05 "	0.03 "	0.02 "

*9-inch minimum size limit.

The controversial 9-inch minimum length limit in effect during the 1950 season was removed in 1951. The length limit had little effect on the total catch of trout, for without the regulation in 1951 only 4 per cent of the total catch was in the 6 to 8-inch size group. The number of trout in the 10 to 12-inch group increased noticeably in 1951. Fish in the 10 to 14-inch group comprised the bulk of the catch.

Approximately 65,083 pounds of trout were taken by anglers from East Lake during the 1951 season or 67.1 pounds of trout per surface acre. The average weight per fish caught in East Lake has decreased from 1 pound 12 ounces in 1946 to 9.6 ounces in 1951. The size of fish caught by anglers indicated that the trout population is being cropped while fish are in their first year and a half.

Over thirty-two and one-half tons of fish were removed by anglers from East Lake in 1951.

Stocking record

Table 77 is a listing of the trout stocked in East Lake from 1948 through 1951.

Marked fish

Five hundred rainbow of legal length were jaw-tagged in the summer of 1948. Only three tags were returned in 1951, but no intensive recovery program was made. Table 78 is a tabulation of the returns of the jaw-tagged

Table 77

Stocking record, East Lake, 1948 through 1951

Year	Rainbow				Eastern brook			
	Number	Size	Pounds	Time planted	Number	Size	Pounds	Time planted
1948	197,925	2½-3½	1,960	July-October	277,190	1-2	507	June
	21,030	7-9	3,970	June-August	60,300	2-3	465	August-October
					30,000	5-6	1,800	June
	218,955		5,930		367,490		2,772	
Total all species:				586,445		8,702 pounds		
1949	72,000	2-4	400	June	100,500	0-2	150	June
	99,200	4-6	3,096	July-August	399,400	2-4	850	June
	9,970	Legal	1,660	June	101,635	4-6	2,613	August
					8,920		1,210	June
	181,170		5,156		610,455		4,823	
Total all species:				791,625		9,979 pounds		
1950	168,932	2-4	4,476	June-July	250,161	2	785	June
	12,800	4-6	800	June	15,323	6-8	2,770	June
	7,000	8-10	2,071	June				
	188,732		7,347		265,484		3,555	
Total all species:				454,216		10,902 pounds		
1951	18,450	2-4	450	July	103,820	0-2	221	August
	84,550	4-6	3,338	June-July	199,920	2-4	664	July
	10,979	Legal	6,526	July-August	9,699	6-8	1,900	June-July
					5,323	Legal	1,100	June-August
	113,979		10,314		318,762		3,885	
Total all species:				432,741		14,199 pounds		

rainbow placed in East Lake.

Table 78

Returns of jaw-tagged rainbow, East Lake

Time stocked	Size	Number	1948	1949	1950	1951	Total return	Percentage return
Summer, 1948	8-14	500	56	72	35	3	166	33.2

Trash fish control

The trash fish control program was carried on by the use of rotenone, traps, gill nets, and dynamite. The traps did not produce as well in 1951 as in 1950. Possibly the reduced roach population had some effect on the success. Most of the roach were killed with rotenone and gill nets. Total kill of large roach in 1951 was 17,928 at East Lake. During August and September, many chub fry were poisoned and the total kill was estimated to be in the millions. A total of 250 pounds of rotenone was used during the season at East Lake.

An attempt to use explosives as a control agent met with little success since the materials were not secured until the large concentrations of roach had moved into deeper waters. A charge was placed into a school of fish only once. On this occasion, only three sticks of dynamite were used and the entire school of 116 roach was killed. The success of the one experiment may indicate that results might be satisfactory during periods of heavy concentrations of roach.

Roach control must be continued at East Lake in order to protect the present fishery.

Stockings

The stocking of hatchery fish in East Lake was supervised by resident personnel insofar as possible. Larger fish were hosed directly into the lake, while smaller fish were dispersed by means of a planting boat or by distribution in shoal areas.

Value of the 1951 catch

An economic survey conducted in a portion of the Deschutes River near Bend indicated that a pound of trout caught by anglers in the Central Region was worth $14.00 to the State. The figure determined by the study cannot be applied directly to the catch of East Lake, which is in another area, because the unit value would be too low since more nonresident anglers and sportsmen from distant parts of the State frequent East Lake than were present in the study area. If $14.00 per pound is used as a unit value for the 1951 East Lake catch, then the fishery is calculated to be worth $911,161.

Management

The production of game fish to the angler at East Lake is increasing each year. A total of 43,782 pounds of trout has been stocked in East Lake

from 1948 through 1951. During the same period, 173,000 pounds of trout have been caught by anglers. The number of fish stocked per acre during the period has been 45.1 pounds. The lake has produced 133.2 pounds of trout per acre to the angler in the same period.

The decrease in the population of roach has been beneficial to game species. A sufficient number of trout are cropped each year to reduce the total number the lake must support during the winter.

A continuous study is necessary of the fish populations in East Lake.

Paulina Lake

Creel census results

Creel census data were collected on Paulina Lake during 27 days of the 122-day season. A comparison of information available from the catches of past seasons is presented in the following paragraphs to provide a more complete analysis of compiled information.

Catch statistics

Catch statistics available for Paulina Lake from 1939 through 1951 are included in Table 79.

The number of anglers increased at Paulina Lake during 1951 by 5,000 over the 1950 tabulation. Angling pressure was determined from daily boat counts taken at the lake and by a tabulation furnished by the resort operator.

The total catch of trout was approximately 1,000 more than any recorded in the successful year of 1948. Total weight was 7,454 pounds more in 1951 than in 1950 and was only equaled in the study period by the catch in 1948. Average weight of fish remained the same in 1951 as in 1950. The hours required to catch one fish were lower than in 1950 and the number of fish per angler increased slightly. The increase in fish per angler could be a reflection of the limit of ten fish that prevailed on Paulina Lake during the 1951 season. Catch statistics for 1951 display, in general, an improvement over the 1950 season.

The relationship of the three species of trout in the catch has exhibited little change in the last three years.

Catch composition

Table 80 is a record of the composition of the catch in Paulina Lake from 1947 through 1951. Data presented for the 1947 and 1948 catch represent the total catch. The 1949, 1950, and 1951 data are from a sample of the catch.

A comparison of the percentage each size group contributed to the catch from 1947 through 1951 is presented in Table 81.

The removal of the minimum length limit of 9 inches on Paulina Lake caused a significant increase in the number of trout taken in the 6 to 8-inch size group. Approximately 13.2 per cent of the total catch was

Table 79

Paulina Lake catch statistics, 1939, 1946-1951

Item	1939	1946	1947	1948	1949	1950	1951
Angler trips	1,612	7,692	10,743	14,168	13,200	10,720	15,000
Total trout caught	21,126	7,269	19,646	28,487	21,120	15,330	29,400
Poundage	Not calculated	8,070	12,496	16,289	10,857	8,050	15,504
Average weight of fish, pounds	-	1.13	0.63	0.57	0.51	0.53	0.53
Catch per surface acre, pounds	-	6.21	9.61	12.53	8.4	6.2	11.9
Hours angling per fish	.384	5.2	2.48	2.67	2.8	3.16	2.74
Fish per angler	12.09	1.01	1.8	2.03	1.6	1.43	1.78
Percentage catch rainbow	21.5	36.3	53.0	61.2	77.1	76.1	70.8
Percentage catch brook	74.5	49.5	42.7	37.6	21.0	22.0	28.1
Percentage catch brown	4.0	15.2	4.3	1.2	1.9	1.9	1.1

Table 80

Composition of the catch, Paulina Lake, 1947 through 1951

Size groups	1947			1948			1949			1950			1951		
	EB	RB	BR	EB	RB	BR	EB	RB	BR	EB	RB	BR	EB	RB	BR
6- 8	1,512	1,332	-	2,559	2,035	1	251	579	2	7	4	-	120	240	1
8-10	2,678	3,518	-	4,509	4,257	1	441	891	2	353	811	6	379	461	-
10-12	3,346	3,437	2	2,741	6,413	1	229	1,035	10	123	610	1	202	644	1
12-14	681	956	11	812	3,904	-	63	900	3	42	284	4	78	490	-
14-16	186	254	91	105	534	16	9	210	5	6	113	2	5	91	1
16-18	6	196	335	3	98	179	1	17	36	3	16	7	2	8	5
18-20	1	503	327	3	119	96	-	6	26	-	2	7	-	1	2
20-22	-	178	58	-	50	29	-	7	4	-	-	4	-	-	3
22-24	-	15	16	-	7	12	-	-	2	-	1	-	-	-	1
24 & over	-	1	6	-	-	3	-	-	2	1	1	1	-	-	1
Total	8,410	10,390	846	10,732	17,417	338	994	3,645	92	534	1,841	42	786	1,935	15
Grand total		19,646			28,487			4,731			2,417			2,736	

in the 6 to 8-inch sizes. Results from the 1950 season indicated that 79 per cent of the fish caught were under 12 inches, while the 1951 recorded catch disclosed that approximately 75 per cent of the catch was under 12 inches. The slight increase in size of the total catch may not be significant.

Table 81

Comparison of size groups by percentage, 1947 through 1951
Paulina Lake

Size	1947	1948	1949	1950	1951
6- 8	14.5	16.1	17.6	0.45	13.2
8-10	31.6	30.7	28.2	48.4	30.7
10-12	34.5	32.1	26.9	30.4	31.0
12-14	8.4	16.5	20.4	13.7	20.8
14-16	8.6	2.2	4.7	5.0	3.5
16-18	2.7	0.9	1.2	1.5	0.5
18-20	4.2	0.8	0.7	0.37	0.1
20-22	1.2	0.27	0.2	0.17	0.1
22-24	0.2	0.06	0.05	0.04	0.05
24 & over	0.03	0.01	0.05	0.04	0.05

Poundage of catch

The total weight of the catch increased in Paulina Lake in 1951. Production increased from 6.2 pounds per surface acre in 1950 to 11.9 pounds per surface acre in 1951. The average weight of fish remained at 8.4 ounces. The increased number of anglers and the success of individual anglers may account for the added weight of fish produced in Paulina Lake. During 1950, approximately 9.4 pounds of trout were stocked per surface acre, and as can be noted by the catch, only 6.2 pounds per surface acre were taken by anglers. Some change was noted in 1951. Approximately 8.8 pounds of trout were stocked per surface acre and 11.9 pounds per surface acre were caught by anglers. That more pounds of trout were caught than were stocked is encouraging and is indicative of improved production in the lake.

Trash fish control

Rotenone, trap nets, seines, and dynamite were employed in trash fish control at Paulina Lake. The total kill of large chub was estimated to be approximately 54,000 at Paulina Lake. During the months of August and September, many roach fry were poisoned and the total kill was in the millions. Roach fry were killed by the resort operator as late as the middle of October. A total of 500 pounds of rotenone was used in rough fish control at Paulina Lake in the 1951 season.

Explosives were used as a control agent, but the operation was more in the nature of an experiment and no large kills were made. Roach control in 1951 was intensified and success was high.

Stockings

Trout stocked in Paulina Lake were of a sufficient size so that distribution by planting boat was unnecessary. The majority of the fish were stocked near Little Crater Forest Camp to prevent concentrations of newly released fish near the outlet screen. Difficulty has been experienced in past years in that fish congregate in the closed area and cause difficulties when repair work is necessary on the screen.

Stocking record

Table 82 is a listing of the trout stocked in Paulina Lake from 1948 through 1951.

Management

Trash fish control is to be intensified in 1952 since a reduction of the roach population is necessary in order to increase trout production.

Some time is to be spent on trout distribution, growth rate, length at maturity, and the location of production areas in order to facilitate management.

A tabulation of catch and angling pressure is to continue.

The present stocking policy will remain in effect.

Upper Deschutes River test area

An experiment to determine the relative survival of brown trout and rainbow trout in the Deschutes River above the City of Bend was initiated in the spring of 1951. The purpose of the experiment was prompted by the demand of local anglers for a change in the stocking policy of the Game Commission on the Deschutes River. Some sportsmen believed the brown trout would be a more desirable species. Experimental lots of marked trout were set aside for use in the test area. A total of 6,355 spring rainbow were marked adipose and left maxillary. Brown trout were secured at the Roaring River station and a total of 6,203 were similarly marked. All fish were graded before marking so that they would fall within the 6 to 10-inch size group. They were then stocked in equal numbers in the same planting locations in a section of the Deschutes River above Bend bounded on the south by Benham Falls and on the north by Dillon Falls. Wild trout inhabit the same stretch of river. A partial check of angler's creels was made by regional personnel throughout the summer angling season. A more complete check of creels would have been desirable, but lack of personnel and number of anglers available in the test area made creel census rather spotty. The census obtained was sufficient to show the general trend of returns to the angler in the test area.

Table 83 shows creel census data gathered in the test area on the Deschutes River during the 1951 season. The data compiled in 1951 indicate better returns for rainbow than brown trout. The total catch of trout, including marked and unmarked fish, was 66 per cent rainbow and 34 per cent brown trout. Approximately 80.6 per cent of all marked trout caught were rainbow.

Table 82

Stocking record, Paulina Lake, 1948 through 1951

Year	Rainbow				Eastern brook			
	Number	Size	Pounds	Time planted	Number	Size	Pounds	Time planted
1948	194,310	2-4	2,415	August-October	260,575	1½	463	June-July
	24,750	7-8	4,770	May-June	60,300	2-3	465	August-October
					30,000	5-6	1,675	May
	219,060		7,185		350,875		2,603	
Total all species:				569,935			9,788 pounds	
1949	181,010	2-4	1,717	June-July	150,000	0-2	208	June
	36,180	4-6	600	July	295,310	2-4	996	May-July
	35,140	Legal	4,505	May	56,250	4-6	1,250	August
					9,100	Legal	1,300	June
	252,330		6,822		510,660		3,754	
Total all species:				762,990			10,576 pounds	
1950	29,914	2	8	August	14,997	8	2,690	June
	81,407	4-6	2,990	June-July-August				
	26,699	6-10	6,486	May-June				
	138,020		9,484					
Total all species:				153,017			12,174 pounds	
1951	40,135	0-2	65	August	9,548	6-8	1,950	June
	29,943	4-6	1,254	July				
	10,469	6-8	1,529	June				
	10,597	12	6,699	July-August				
	91,144		9,547					
Total all species:				100,692			11,497 pounds	

Table 83

Catch composition and creel census data in
Deschutes River test area - April 28 to September 15, 1951

Length	Rainbow	Brown	Marked rainbow	Marked brown	Whitefish
6- 8	227	65	191	54	0
8-10	122	41	93	15	3
10-12	37	41	12	3	0
12-14	15	45	0	0	0
14-16	4	8	0	0	2
16-18	1	1	0	0	0
Total	406	201	296	72	5

Anglers checked	285	
Hours fished	931	
Fish per angler	2.15	
Hours per fish	1.52	
Trout checked	607	
Trout checked - rainbow	406	66.9 per cent
Trout checked - brown	201	30.1 per cent
Marked trout in catch	368	60.6 per cent
Composition of marked trout checked		
rainbow	296	80.4 per cent
brown	72	19.6 per cent

The results of the study favor the continued stocking of rainbow trout in the Deschutes River. The experiment should be continued in order to assess the relative survival of the two marked species in successive years. One of the points of argument for brown trout propagation is the belief that the species may survive over more angling seasons than rainbow and may eventually provide more return to the angler.

Tagging

One thousand rainbow of legal length were marked with jaw tags and released in two sections of the Deschutes River test area in July, 1950. Approximately 9 miles of river were involved in the stocking.

Figure 11 represents the distribution of tag returns in 1950 and 1951.

The majority of the tagged fish were caught in the vicinity of the planting site in 1950. Four tags were recovered from fish that had moved downstream 1 to 2 miles from stocking location. One tagged fish moved downstream 6 miles from point of release. Only one instance of movement upstream was recorded. The specimen was caught 4½ miles above the stocking site.

The marked trout had migrated long distances by 1951. Individual tagged fish were returned as far downstream as Mirror Pond in Bend. Upstream migrants were caught at Pringle Falls and in Fall River. Greatest downstream migration from point of stocking was 20 miles. Upstream migration limit was

28 miles.

Twenty-three per cent of the tags have been returned by anglers to Game Commission personnel.

Odell Lake

Lake trout

A five-year program of stocking lake trout or mackinaw in Odell Lake started with approximately 76,900 lake trout weighing 8,415 pounds in April, 1951. The eggs were obtained from Lac La Ronge, Saskatchewan. The fish averaged 6 to 8 inches in length when stocked. The distribution was carried out by means of a planting boat and the trout were stocked in depths of water ranging between 50 and 60 feet over a rocky bottom. All trout stocked were marked by the removal of the adipose fin.

Reports from the resort operator indicate that few of the small lake trout were taken in the sport catch during the 1951 season. The operator encouraged anglers to release the small trout in order to enable greater returns in future years.

Lake trout were again trapped for egg-taking purposes in Odell Lake in the fall of 1951 as depicted in Table 84. Trap nets were first placed in Odell Lake on October 15 over a rocky shoal area off Chinquapin point in the same general location where traps were set in 1950. The first lake trout entered the trap on October 16. Water temperatures were taken the same day in order to correlate the results with the frequency of lake trout in trap nets. The migration of lake trout to shallow water and their subsequent spawning activity seems to be correlated with the turnover period beginning when the temperature segment of 48° - 52° F. has been reached throughout depths to 50 feet. Table 85 is a record of temperature readings made in Odell Lake on October 16.

Two additional trap nets were placed in the lake on October 18. By October 24th, a total of 94 lake trout had been caught. Twenty-one females were spawned and 90,000 eggs collected.

All artificially-reared lake trout to be stocked in Odell Lake will be marked.

Blue Lake

Mr. J. H. Bigelow, owner of the Blue Lake Resort, has conducted a creel census of anglers using his facilities since 1948. The data he compiled during the past four years is being used to promote better management of the lake. The results of the study may also be applied to similar waters in the State. Mrs. Bigelow is to be commended for the time and effort she expended in tabulating the information.

Creel census results

Mr. Bigelow collected creel census information for 135 days of the 156-day season in 1951.

The data do not include the many shore anglers and fishermen with private boats. No estimate of the total angler days has been made.

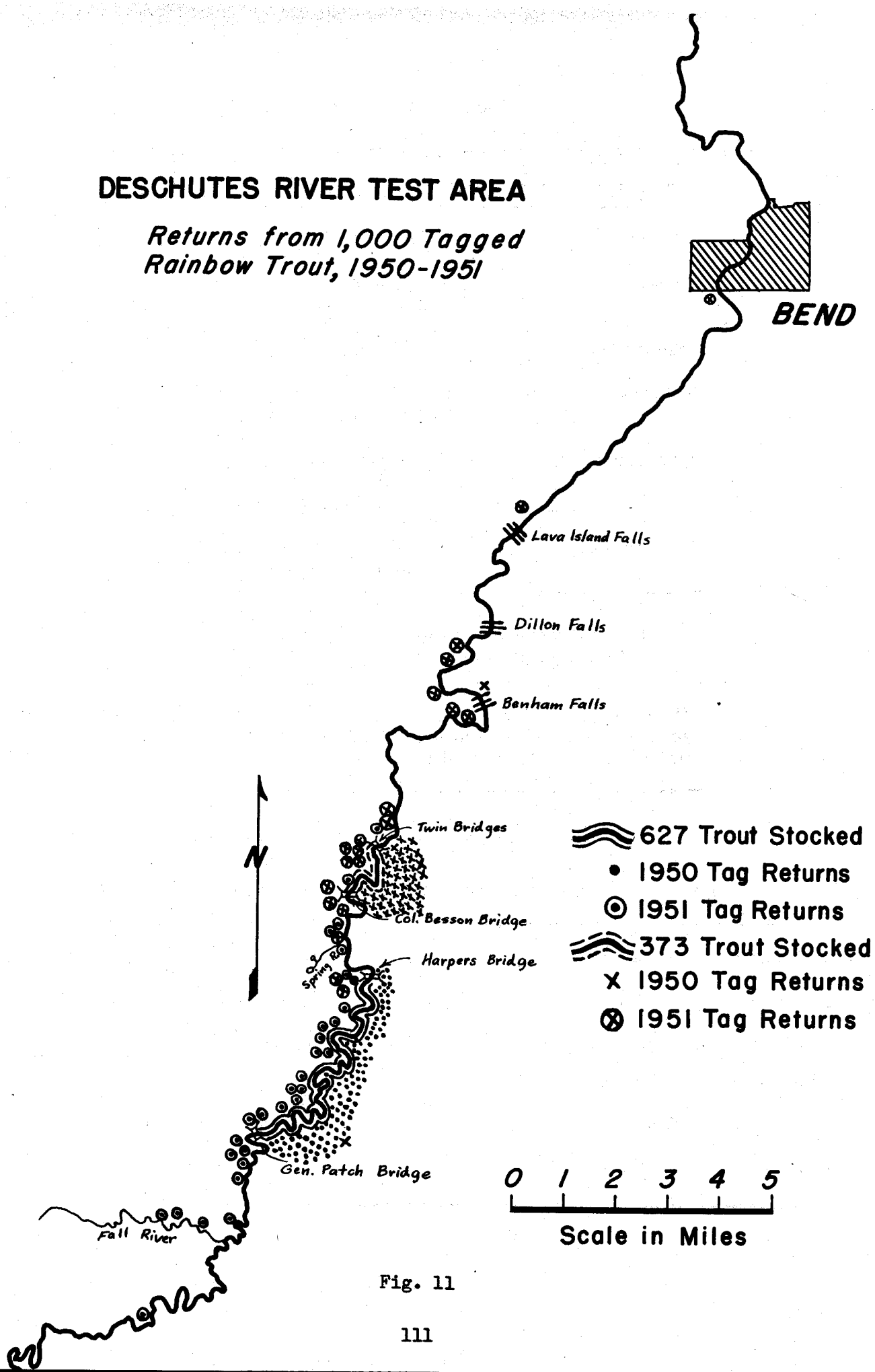

DESCHUTES RIVER TEST AREA
Returns from 1,000 Tagged Rainbow Trout, 1950-1951
BEND
Lava Island Falls
Dillon Falls
Benham Falls
Twin Bridges
Col. Besson Bridge
Spring River
Harpers Bridge
Gen. Patch Bridge
Fall River
N
627 Trout Stocked
1950 Tag Returns
1951 Tag Returns
373 Trout Stocked
1950 Tag Returns
1951 Tag Returns
0 1 2 3 4 5
Scale in Miles

Fig. 11

Table 84

Lake trout catch during egg-taking operations, Odell Lake*

Date	Results
October 18	3 trap nets set
October 19	19 fish caught 2 fish released
October 20	27 fish caught
October 21	20 fish caught 9 females spawned
October 22	18 fish caught 6 females spawned 1 spent fish released
October 23	8 fish picked up 7 females spawned
Total females spawned	22
Total eggs taken	90,000

*Thirty-four females and thirty-one males were released in excess of those used for purposes of fish culture.

Table 85

Temperature readings October 16, 1951 - Odell Lake

Surface	50° F.	60 feet	49° F.
10 feet	52° F.	70 feet	48° F.
20 feet	52° F.	80 feet	46.5° F.
30 feet	52° F.	90 feet	45° F.
40 feet	50° F.	100 feet	44° F.
50 feet	50° F.		

The catch statistics obtained at Blue Lake during the four-year study period are depicted in Table 86.

Table 86

Catch statistics, Blue Lake, 1948 through 1951

Item	1948	1949	1950	1951
Angler trips	2,100	1,784	3,390	4,694
Trout caught	1,522	3,558	8,196	8,923
Hours angling per fish	-	2.38	2.03	2.3
Fish per angler	0.725	2.0	2.42	1.9
Percentage catch eastern brook	29.0	4.8	13.3	0.6
Percentage catch kokanee	48.0	8.8	7.3	14.1
Percentage catch rainbow	22.0	85.9	78.5	84.7
Percentage catch brown	1.0	0.5	0.4	0.1
Percentage catch whitefish	-	-	-	0.5

Size groups and species

The composition of the catch during the four-year study period is shown in Tables 87 and 88. Table 87 is a tabulation of the catch made in 1948 before standard creel census forms were used by the operator.

Table 88 is a compilation of the catch composition from 1949 through 1951.

Table 87

Composition of 1948 catch, Blue Lake

Size (inches)	Eastern brook	Rainbow	Brown	Blueback
5- 7	442			
9-11		337		
12-14				731
Not known			12	
Total catch checked		1,534		

Approximately 85 per cent of the catch in 1951 consisted of rainbow trout. It is assumed that the majority of rainbow caught were from the 1951 plant. Eastern brook in the catch dropped from 13 per cent in 1950 to 0.6 per cent in 1951. A total of 3,000 eastern brook of legal length were stocked in the lake in 1950 and only fifty-one were caught during the entire 1951 season. Rainbow appear to be better adapted to the lake. The catch of kokanee increased during the 1951 season and there is an apparent correlation with the high catch in 1948.

Table 88

Composition of catch, 1949 - 1951, Blue Lake

Size (inches)	1949				1950				1951				
	EB	RB	BR	BB	EB	RB	BR	BB	EB	RB	BR	BB	WF
6- 8	128	138	1	14	162	83	2	13	10	1,020	-	59	1
8-10	36	894	1	24	889	1,062	7	541	34	4,045	7	1,196	17
10-12	6	1,865	3	259	40	4,543	18	47	7	2,249	-	3	21
12-14	-	153	5	17	2	720	2	-	-	242	3	-	1
14-16	-	5	4	-	-	26	2	-	-	6	-	-	1
16-18	-	1	1	-	-	3	-	-	-	-	1	-	-
18-20	-	-	1	-	-	2	1	-	-	-	-	-	-
20-22	-	-	1	-	-	-	-	-	-	-	-	-	-
24 & over	-	-	1	-	-	-	-	-	-	-	-	-	-
Total	170	3,056	18	314	1,093	6,439	32	601	51	7,562	11	1,258	41
Grand total		3,558				8,165					8,923		

Stocking record

A tabulation of trout stocked in Blue Lake is represented in Table 89.

Table 89

Stocking record, Blue Lake, 1948 through 1951

Year	Rainbow				Eastern brook			
	Number	Size (inches)	Pounds	Time planted	Number	Size (inches)	Pounds	Time planted
1948	1,920	Legal	320	August	50,500	0-2	100	August
					5,060	4-6	230	May
					55,560		330	
1949	2,575	Legal	250	May				
	2,970	Legal	1,100	June				
	1,200	Legal	400	August				
	6,745		1,750					
1950	1,350	8	300	July	3,000	8	550	June
	4,042	9	1,120	May-June				
	4,146	10	1,830	July-August				
	9,538		3,250					
1951	18,088	0-2	99	September				
	5,368	6-8	1,057	August-September				
	8,142	9	2,287	May-June-July				
	31,598		3,443					

Stocking procedure

The size of Blue Lake is estimated to be 65 surface acres. The maximum depth is 294 feet. Shoal area is limited. The lake could normally be classed as poor fishing water, but a change in stocking policy has helped to make higher returns to the angler.

The allocation of trout of legal length in 1951 was placed in Blue Lake in five separate plantings, one for each month of the season. Figure 12 graphically represents the success of the stocking policy. The catch of hatchery fish was spread through the entire season and in turn distributed the angling pressure over a longer period.

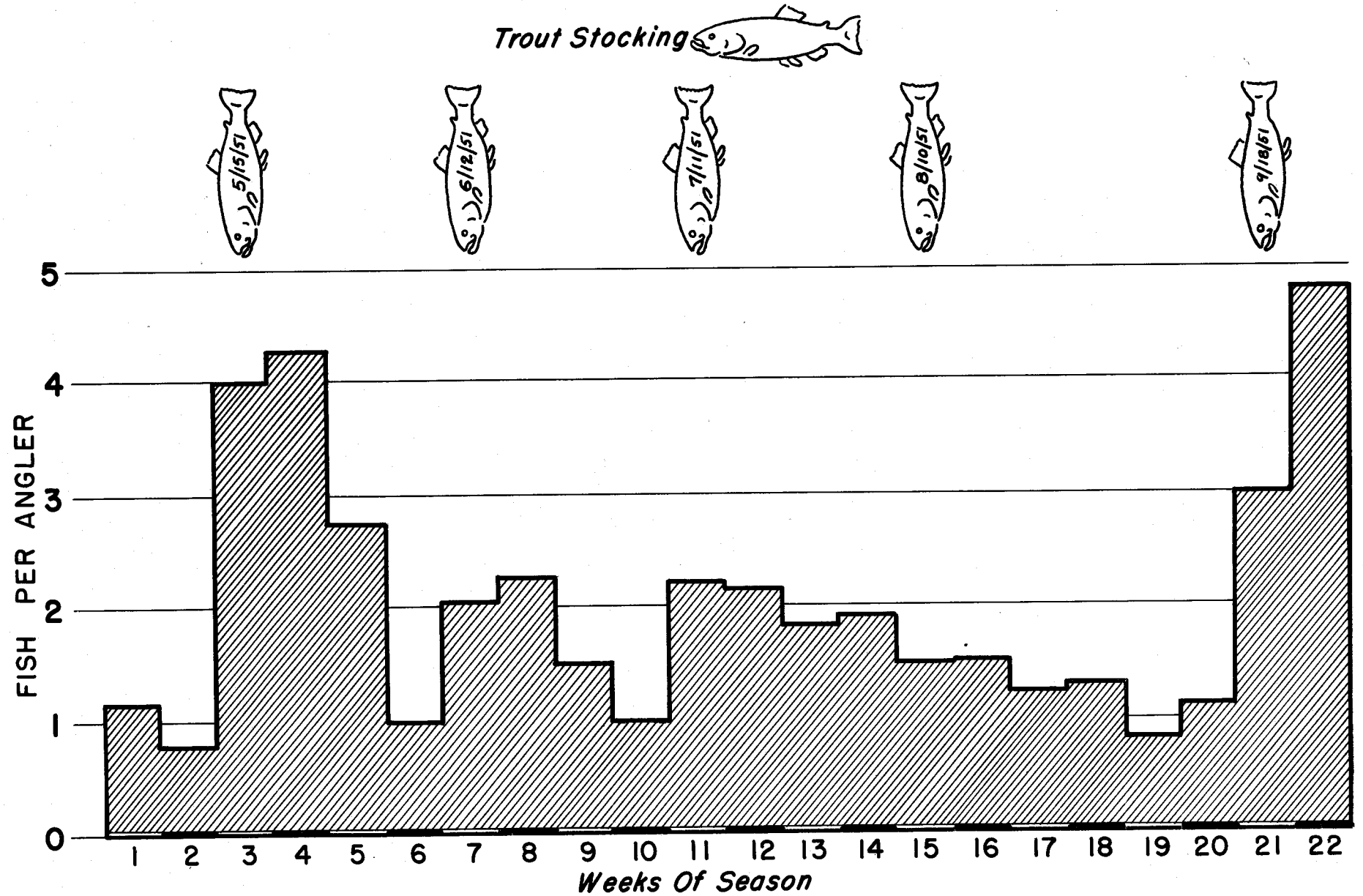
Management

A total of 3,366 adipose marked legal rainbows were stocked in Blue Lake, September 18, 1951. The experiment was designed to learn the ability of the lake to hold trout over the winter period. The migration of trout from Blue to Suttle Lake, if any, should also be known for proper management. Approximately 540 of the marked trout were caught the last

Fig. 12

BLUE LAKE

1951 CORRELATION OF ANGLER SUCCESS WITH STOCKING PERIODS



twelve days of the 1951 season.

Stocking should be continued on a "put-and-take" basis.

Creel census should be continued through 1952 to record the number of marked trout in the catch.

Kokanee should be stocked in 1953 and 1954 to supplement the existing run.

Diamond Lake

The investigation initiated in 1946 concerning the apparent decline in the Diamond Lake trout fishery was carried on through 1951. Since the inception of the project, new management practices have been instituted through regulatory changes making the comparison of data collected difficult to evaluate between years. Table 90 outlines the regulatory changes since 1948.

Table 90

Regulation changes, Diamond Lake
1948-1951

Year	Season	Method	Minimum length
1948	June 15 - September 15	Eggs outlawed	10 inches
1949	No change	No change	No change
1950	June 1 - September 15	No change	6 inches
1951	June 1 - September 30	Bait restricted	No change

Trout populations

Available data indicate that the trout population of Diamond Lake has deteriorated rapidly since 1946. Evidence of the decline is shown in Table 91, where it can be seen that the number of females trapped for egg-taking purposes in the spawning run has markedly decreased.

Table 91

Spawning runs, Diamond Lake
1946 - 1951

Year	Number females	Average length inches	Number of eggs per female	Number of eggs
1946	3,824	18.41	1,350	5,184,960
1947	1,892	17.9	1,420	2,699,364
1948	1,332	17.3	1,550	2,065,000
1949	972	15.5	1,337	1,300,000
1950	1,200	17.4	1,666	2,000,000
1951	600	18	2,050	1,230,000

The decline in the number of females in the spawning run may be attributed to two primary factors: an excessive fry mortality and angling pressure on the brood fish. The large roach population competes with trout for food, and the result is a low survival of rainbow fry. The increased catch of brood fish in the 1940's further reduced the number of fry in later years. The lengths of females and number of eggs produced increased in 1951 and are indications of a high percentage of old fish in the run.

Stockings

The stocking record of Diamond Lake from 1947 through 1951 is depicted in Table 92.

Table 92

Rainbow trout stockings, Diamond Lake
1947-1951

Year	Number	Weight	Size (inches)
1947	3,340,305	1,220	0-2
1948	1,932,164	686	0-2
1949	None	-	-
1950	49,000	4,480	4-8
1951	47,139	6,160	5-8

The change in stocking procedure in 1950 should be noted. Yearling trout were used to stock Diamond Lake in 1950 and 1951 to augment the catchable supply of fish for anglers. The low survival of fry in the face of the increasing roach population was another reason for the change from fry to yearling trout stocking.

Prior to 1949, Diamond Lake was planted with fry raised from eggs taken in the spawning run of mature rainbow in the lake.

Creel census

Other evidences of the decline in the trout fishery are revealed by the creel census that has been conducted since 1946. A presentation of data for the years 1946 through 1951 comprises Table 93.

Table 93 discloses a marked decrease in angling intensity which is a direct reflection of the productivity of the lake. The catch per hour has also steadily declined. There is no difference between the 1950 and 1951 average numbers of fish caught per hour. Greater differences occur in the number of fish checked and the number of angling trips. The average length data is difficult to analyze because of a change in the minimum length law from 10 inches to 6 inches and the stocking of yearling fish rather than fry. A change in the feeding habits of the adult rainbow from normal trout foods to dead roach may be the reason for the increase in average size in 1950. Adult fish examined revealed that on days of successful roach control, the stomachs were filled with dead roach; on other days the stomachs were empty.

Anglers knowing the feeding habits of the adult trout, concentrated on the areas where successful control of roach had taken place. The fishermen

Table 93

Catch statistics, Diamond Lake
1946-1951

Year	Angler trips	Catch	Average length	Catch per hour
1946	14,807	12,807	15.75	0.19
1947	26,800	37,500	13.75	0.33
1948	24,693	27,872	13.0	0.26
1949	10,368	9,660	13.5	0.22
1950	8,588	5,820	15.5	0.17
1951	6,307	3,994	12.0	0.17

using dead roach for bait caught a high percentage of adult trout. Prohibition of bait angling in 1951 eliminated the dead roach method of fishing. The restriction also reduced the percentage of roach-feeding rainbow in the catch.

The high percentage of the 1950 and 1951 plants of yearling fish entering the catch was another factor that caused the decrease in the average length of the trout in 1951.

Table 94 is a tabulation of the length frequency of the catch in 1951.

Table 94

Length frequency of catch, Diamond Lake
1951

Size (inches)	Percentage
6- 8	3.7
8-10	15.5
10-12	47.4
12-14	18.0
14-16	6.2
16-18	4.0
18-20	3.1
22 & over	2.1

Angling success

Other regulatory changes have introduced variables that are difficult to assess. The number of fish checked, the number of angler trips, and the fish per hour might have been greater from 1949 to 1951 had not the use of salmon eggs been prohibited. Bait was prohibited in 1951 except for bank angling and it is probable that the restriction had an effect on the angling pressure.

Another factor that has some bearing on the reduction of the trout population is the kill of adult trout and fry in roach control operations. Adult trout are killed as they come into the treated areas to feed on the distressed and dying roach. Totals of 1,656 trout were recovered in 1950 and

853 in 1951. Recently planted rainbow fry were killed by the action of rotenone used in roach control in the shallow areas in 1948 and as a result, fry planting was discontinued in later years.

Roach populations

An intensive roach control program was started in 1948 after two years of sporadic control when the main emphasis was on creel census.

Evidence at hand does not indicate any decrease in the roach population but on the contrary tends to indicate that the population has increased. General observations in 1951 showed that roach were in all the shallow areas of the lake in great numbers. When the lake was smooth, roach could be seen feeding on the surface over extensive areas.

Gill net sets were made at various depths and in several areas. The sets were made on identical dates and in the same areas each year. Ten net sets made in 1950 took a total of 750 roach and 15 trout. The same number of sets in 1951 took 1,079 roach and 8 trout. The increase was in the greater number of roach taken in the deep water sets in 1951.

Kills made by rotenone have been as great in 1951 as at any time in the past. It is difficult to estimate numbers killed but control operations were not lagging for lack of roach to poison.

There has been an increase in 1951 in the number of roach taken by anglers. Few roach were reported hooked in 1950 except on bait. In 1951 roach were caught on all types of lures.

The egg production of a female roach in the third year was calculated by Carl Bond at Lake of the Woods to be 4,140 eggs and for a female in its sixth year, 25,200 eggs. The productive potential of the roach population in Diamond Lake is tremendous, and no estimation can be made of the millions of young added to the population each year. The shoal areas of the lake are sprayed frequently with rotenone after the fry are hatched in an effort to partially control the increase. Thousands of fry are killed.

Because Diamond Lake is shallow, having a maximum depth of approximately 52 feet, roach inhabit all parts of the lake. Partial control methods have been ineffective in deep water. Several size classes of roach in the lake indicate a heavy escapement each year. Roach over 13 inches in length have been measured in 1951. Fred Locke found that roach from 6 to 8 inches in length were three to four years old. The age was corroborated by Mr. Bond at Lake of the Woods and also by the reading of several hundred scale samples taken at Diamond Lake in 1951.

Roach collected in gill net sets in 1951 averaged 6.4 inches in length indicating a large escapement. The net is selective, excluding fish under 5 inches. Schools of roach averaging 5 inches in length can be seen over much of the shoal area.

More efficient equipment was used in roach control operations in 1951. Pumps were used to dispense the rotenone around the schools of roach. Table 95 outlines the roach control activities since 1947.

Table 95

Roach control activities, Diamond Lake
1947 - 1951

Year	Personnel assigned	Rotenone used pounds
1947	2	2,000
1948	2	4,000
1949	3	7,000
1950	4	9,000
1951	3	8,900

Because of its shallowness, Diamond Lake has 3,000 potentially productive acres. The greater part of that productivity is now used by roach. Table 96 shows the rapid decline in pounds of trout production per acre since 1947.

Table 96

Pounds of trout per acre, Diamond Lake
1947 - 1951

Year	Pounds per acre
1947	15.4
1948	9.2
1949	3.7
1950	1.7
1951	0.8

A rapid decline in the pounds of bottom food per acre has also been noted. The reduction can be seen in Table 97 which gives a comparison of the years 1946 to 1951.

Table 97

Bottom foods per acre, Diamond Lake
1946 - 1951

Year	Pounds per acre
1946	292
1947	-
1948	14.4
1949	10.5
1950	5.5
1951	2.3

There can be no other cause for the rapid decline in food other than the heavy population of roach. Some food forms may completely disappear.

Economic considerations

Diamond Lake has been and will prove to be an expensive lake to maintain in its present condition. Table 98 outlines the cost of operations for the egg-taking station, fish planting, and roach control from 1946 through 1951.

Table 98

Cost of operations, Diamond Lake
1946 - 1951

Year	Hatchery	Stockings	Roach control	Total
1946	$6,812.00	$ -	$ 550.00	$ 7,362.00
1947	8,925.00	-	1,000.00	9,925.00
1948	7,274.00	-	1,500.00	8,774.00
1949	8,594.00	-	4,500.00	13,094.00
1950	5,392.00	5,600.00	7,000.00	17,819.00
1951	4,443.00	5,600.00	6,000.00	16,048.00
				$73,017.00

The $20,500.00 that has been expended for roach control since 1946 has not been the answer to the problem. There remains some trout angling in Diamond Lake and it is possible that control work has delayed the final eclipse of the trout population by roach.

The 100,000 yearling rainbow planted in the lake have provided some angling at considerable expense. The fish that have been planted in the last two years could well have been used to stock heavily fished streams had Diamond Lake been productive enough to maintain itself.

Until recent years, the egg-take at Diamond Lake exceeded three million eggs and at its peak, was in excess of nineteen million eggs. There is little doubt that if the lake were to be returned to its normal productivity, the station could obtain several million eggs each year. Recent operations have, in general, been uneconomical because the low egg-takes make the cost per thousand exceed the price at which the eggs could be purchased. Rainbow eggs can be obtained at $2.00 per thousand and the cost per thousand at Diamond Lake since 1946 has varied from $1.31 to $6.60. Table 99 illustrates the information.

Thousands of anglers who formerly fished Diamond Lake are fishing other waters as for example, East Lake. On opening day, 1951, the boat count on East Lake, a lake about one-third as large as Diamond Lake, was 300, and at Diamond Lake, the count was 65. On opening day of 1948 at Diamond Lake, there were 500 to 600 boats on the lake.

It is difficult to determine the economic loss resulting from poor angling conditions at Diamond Lake. Probably most of the revenue has been shifted to other waters, but there is little doubt that the State of Oregon and the Game

Commission would benefit financially if Diamond Lake were brought back to normal production.

Table 99

Cost of eggs per thousand, Diamond Lake
1946 - 1951

Year	Egg cost per thousand
1946*	$1.31
1947*	4.04
1948*	3.52
1949	6.60
1950	2.69
1951	4.73

* Includes cost to fry stage

Conclusions

1. The roach population at Diamond Lake is not decreasing perceptibly.

2. Angling is almost wholly dependent upon the introduction of catchable sizes of fish.

3. The spawning stock has decreased, making the egg-taking operations uneconomical.

4. Food production has reached the point where there is danger that some organisms may be completely eliminated. Further fry planting would be of no avail because of roach competition.

5. Diamond Lake is not being used to any extent by anglers and will not be used until angling improves.

As a result of the above conditions, a survey is being made in order to determine the feasibility of lowering the lake level and of completely destroying the fish populations. Partial roach control operations are being continued. Consideration is being given to the removal of bait restrictions from Diamond Lake and to the liberalization of the bag limit to a general summer bag limit, thus relieving pressure on other lakes. The annual planting of yearling fish is to be continued in the amount of 50,000 fish until complete control is decided upon or until further developments make stocking a futile effort.

Lake of the Woods

The 1951 Lake of the Woods trout fishery indicates an improvement over past years. Periodic creel census and interview of anglers indicate an increase in the number of fish per hour and a greater average length. The average length of trout in the 1951 catch was 11.7 inches compared to 9.5 inches in 1949. Fish

14 and 16 inches in length were quite common in the creels through the season. An increase in the number of anglers fishing Lake of the Woods was reported.

The principal activity at Lake of the Woods has been the control of trash and warm-water game fish. A permanent fish trap was installed in the outlet to the lake in 1948. The trap was maintained in 1951 but the operation was not efficient in catching the spawning carp. The drainage from the lake must pass through the trap causing the screens to be obstructed by debris, raising the water level in the lake, and threatening to overflow the dyke. The screens then must be removed to allow the water level to recede. During the manipulation of the screens, the spawning carp move out of the lake, spawn, and return. A trap net was placed above the trap in an attempt to catch the carp as they moved. The trap was set too late in the season and very few carp were caught. Several hundred catfish were caught and on one occasion, 600 were counted and removed.

The lake side of the trap was closed after water had receded and before the carp and catfish fry had hatched, preventing the fry from coming into the lake. On July 18, the slough was poisoned to kill the carp and catfish fingerlings. Thousands were killed but some escapement was anticipated as the water in the slough was still quite high. In the poisoning operation, one roach 4 inches in length was recovered. The roach were considered to have been exterminated from the lake as none had been observed since 1948.

On August 28, the slough was again poisoned. Many carp were killed and three roach 4 inches in length were recovered. An application of rotenone was made in the weed beds along the east shore. Several hundred warm-water game fish and carp were killed.

The control measures appear to be effective in the improvement of the trout fishery at Lake of the Woods. The larger average length of the fish and the increased angling pressure tend to indicate the improved productivity of the lake.

The partial control operation cannot eradicate the trash fish from the lake but tend to keep the population so low that its effect on the productivity of trout is negligible.

Improvements should be made in the trap and partial control should be continued.

High lakes of the Cascade area

The high lakes of south central Oregon are receiving greater fishing pressure each year. The pack lakes have been stocked by air since 1949. A survey was carried on in 1951 in order to obtain survival and population data on the trout.

Twelve lakes receiving the heaviest fishing pressure were surveyed. Anglers encountered were interviewed in order to determine the use of the lakes. Several anglers had made as many as five trips to the area during the season. The lakes studied were rich in food organisms with the exception of Harriet Lake.

Harriet, a deep lake for the Cascade area, measured 80 feet along the cliff side with visibility to 65 feet. The bottom composition is

principally rock. The fish taken appeared to be in poor condition. The minimum length of the mature fish was 7 inches and all females examined contained retained eggs.

The survey was begun August 13 and as most of the lakes of the region are shallow, water temperatures were high. Table 100 outlines the temperatures and depths for the lakes studied.

Table 100

Surface temperatures and maximum depths,
Cascade lakes (Rogue River National Forest), August, 1951

Lake	Maximum temperatures	Minimum temperatures	Maximum depth
South Pass	68° F	68° F	8
Harriet	66° F	57° F	80
Paragon	68° F	66° F	14
Island	70° F	70° F	5.5
Big Heavenly Twin	68° F	68° F	8
Little Heavenly Twin	68° F	68° F	16
Isherwood	70° F	70° F	12
Dovetail	70° F	70° F	7
Margaret	71° F	68° F	29.5
Cliff	68° F	68° F	15
Middle	70° F	70° F	8
Grass	70° F	70° F	8

Trout fingerlings were planted in the lakes on July 24 and 25 by air, and were noted in the shallow areas of some of the lakes.

The lakes present a problem of stocking. It is doubtful if the temperatures were much lower when the fingerlings were planted in July, than they were at the time of the survey. Some fish may have been lost because of the temperature difference between the plane tank and the lakes.

Losses of fish are suffered in early season stocking since the overflows from the lakes form intermittent streams that are completely dry by July 15. It is believed that a smaller number of fish would be lost were the lakes stocked not later than July 1. The lakes appeared to be adequately stocked and reports of good catches were received throughout the season.

Samples of trout were taken from each lake by gill netting. Table 101 gives average length and weight of trout in the lakes sampled.

Table 101

Average length and weight of trout in some south central Oregon lakes - August, 1951

Lake	Species	Number in sample	Average length inches	Average weight ounces
Harriet	Eastern brook	8	9	3.7
Big Heavenly Twin	Eastern brook	4	9.6	8
Little Heavenly Twin	Eastern brook	2	13.4	18
Isherwood	Eastern brook	5	10.7	8.6
Dovetail	Eastern brook	-	-	-
Margaret	Eastern brook	1	8.3	2
Island	Eastern brook	5	8.4	4
Cliff	Eastern brook	4	8.2	3
Middle	Eastern brook	6	10.9	9
Grass	Eastern brook	2	9.8	7

Paragon is a barren lake. It is off the main trail and appears never to have been stocked. The lake is rich in food organisms and should be stocked in 1952.

No mature trout were taken in South Pass Lake although it has a good population of eastern brook.

Management

It is felt that the present stocking of the Rogue Cascade lakes is adequate.

The lakes should not be stocked later than July 1 because of the high temperatures of the water later in the season.

Miller Lake

The trout fishery at Miller Lake is nonexistent. No trout were reported to have been caught at the lake in 1951. The depletion has been caused by a parasitic lamprey. Control was attempted in 1949 to prevent the spawning of the lamprey in the tributaries of the lake by building small log dams faced with fine mesh screen. The dams have been kept in repair each year. The life cycle of the lamprey is estimated to be six years; no results of the control are expected until 1954 or 1955. Lampreys were observed to be spawning in the lake in 5 to 20 feet of water in July of 1950 and 1951. The degree of production of ammocoetes from redds in the lake is not known.

Two gill net sets made in the lake took a number of roach. Fifty-six lampreys were collected by taking them off the roach and many more dropped into the water.

The roach problem is not significant because the geographic character of the lake will make control measures possible.

Miller Lake in its present condition should not be stocked with trout for obvious reasons.

More extensive investigation of the lamprey's habits are to be made and more efficient control measures developed.

Klamath system

Although a decline in the trout fishery of Upper Klamath and Agency Lakes has been reported, periodic examinations of angler's creels have disclosed above-average catches. Several limits averaging 3.5 pounds per fish have been checked. Periodic checks on the number of winter fishermen on Upper Klamath Lake disclosed an average of 5.5 anglers per day on the days checked. The maximum length of the fish examined was 23.5 inches and the minimum 13.5 inches.

Trash fish populations appear to remain constant in Klamath Lake. Considerable perch reproduction was noted when the Klamath ditch was drained.

Some lamprey parasitism was noted on the trout taken from the lake.

The tributaries of Klamath Lake are of importance to the fishery as spawning and stocking areas. The main tributaries lie almost entirely within the Klamath Indian Reservation. Fishing regulations on the stream do not apply to Indians, therefore management is limited. Screens were repaired and maintained by the State in the main diversion of Sprague River. Cooperation between the Game Commission and the Agency would be desirable in the development of a screening program on the Sprague and Williamson Rivers.

Klamath River

Klamath River supports an above-average trout fishery. A decrease in size of the fish has been noted in past years, but no specific information is available. Table 102 outlines the data collected in periodic samples taken in 1951.

Table 102

Angling success, Klamath River
1951

Anglers checked	64
Fish checked	460
Average fish per hour	1.7
Average fish per angler	7
Average length, inches	11.2

Pollution

Only a limited part of the Klamath River is accessible to anglers. The lower section near the California line forms a deep canyon partially inaccessible. The upper river has presented a problem in pollution.

In 1950 and 1951, oxygen depletion caused by the decay of lumber mill and other wastes deposited in the river killed the fish in a section of water approximately 3 miles long. The State Sanitary Authority was notified and an investigation was being conducted.

Spencer Creek

Klamath River supplies a number of trout for egg-taking purposes at a station at the mouth of Spencer Creek, a tributary to the Klamath River. A substantial increase over 1950 in the numbers of fish in the spawning run occurred in 1951.

Table 103 presents a comparison of the egg-taking operations for years 1947 to 1951.

Table 103

Spencer Creek egg-take, 1947-1951

Year	Number females	Number eggs	Average length of females
1947	-	1,800,000	-
1948	-	1,500,000	-
1949*	-	250,000	-
1950	315	500,000	17.3
1951**	493	756,000	15.7

* The racks on the trap were removed for one week during the spawning run because of high water.
** Approximately 180 females were released without taking their eggs.

Limited space in the Spencer Creek Hatchery resulted in the release of 180 females without spawning. It is possible that had the females been spawned, the egg-take would have been as great as in 1948. It is planned to eye the eggs at the Fall River station in 1952.

A power dam whose pool may inundate the Spencer Creek egg-taking site has become a factor in plans for the future.

Miscellaneous lakes

Demand for more warm-water game fish has led to the investigation and stocking of several lakes and ponds.

Devils Lake near Bly was investigated and possibilities for stocking such fish were favorable. A population of goldfish, catfish, and brown trout must be removed.

Two small ponds near the airport were investigated and stocked with white crappie from Lost River.

DESCHUTES RIVER

Fishery investigations on the Deschutes River and tributaries below Bend were conducted in 1951. River basin work in relation to dams proposed by the U. S. Bureau of Reclamation and Portland General Electric Company predominated in importance. Management studies included stream surveys, trout, steelhead, spring chinook salmon, creel censuses and a study of irrigation wastewater entering the Deschutes River from the Madras project.

CREEL CENSUS

Trout

Creel census data were collected primarily on weekends for 47 days out of the 170-day season. Limited accessibility to the Deschutes River restricted creel census activities to five major areas. Three additional areas, Maupin, Oak Springs and Sherars Bridge received only periodic checks of 15 days. See Figures 13 and 14.

Table 104 gives the 1951 creel census results by area.

Table 104

1951 Deschutes River trout creel census results

Area	Anglers checked	Fish caught	Fish per angler	Hours fished	Hours per fish
Cove	570	1,078	1.89	1,585	1.47
Grandview Bridge	312	492	1.58	921	1.87
Warm Springs	711	910	1.27	2,232	2.45
Mecca	460	708	1.54	1,648	2.33
Trout Creek	390	680	1.74	1,632	2.40
Maupin	488	770	1.58	1,925	2.50
Oak Springs	124	221	1.78	567	2.57
Sherars Bridge	104	156	1.50	294	1.88
Total	3,159	5,015	1.59	10,804	2.15

Inspection of 3,159 angler creels disclosed a catch of 5,015 trout or 1.59 fish per angler. Fishing a total of 10,804 hours, the Deschutes fishermen required 2.15 hours of effort to catch one fish.

Estimates of the total angling pressure and catch in five areas have been made from the season's creel census results. It is calculated that 24,430 anglers caught 37,866 fish in the Cove, Grandview Bridge, Warm Springs, Mecca, and Trout Creek areas in 1951. Comparative figures of the 1950 study on the upper Deschutes River were used to arrive at these estimates which were based upon the number of anglers checked on week ends. The number of

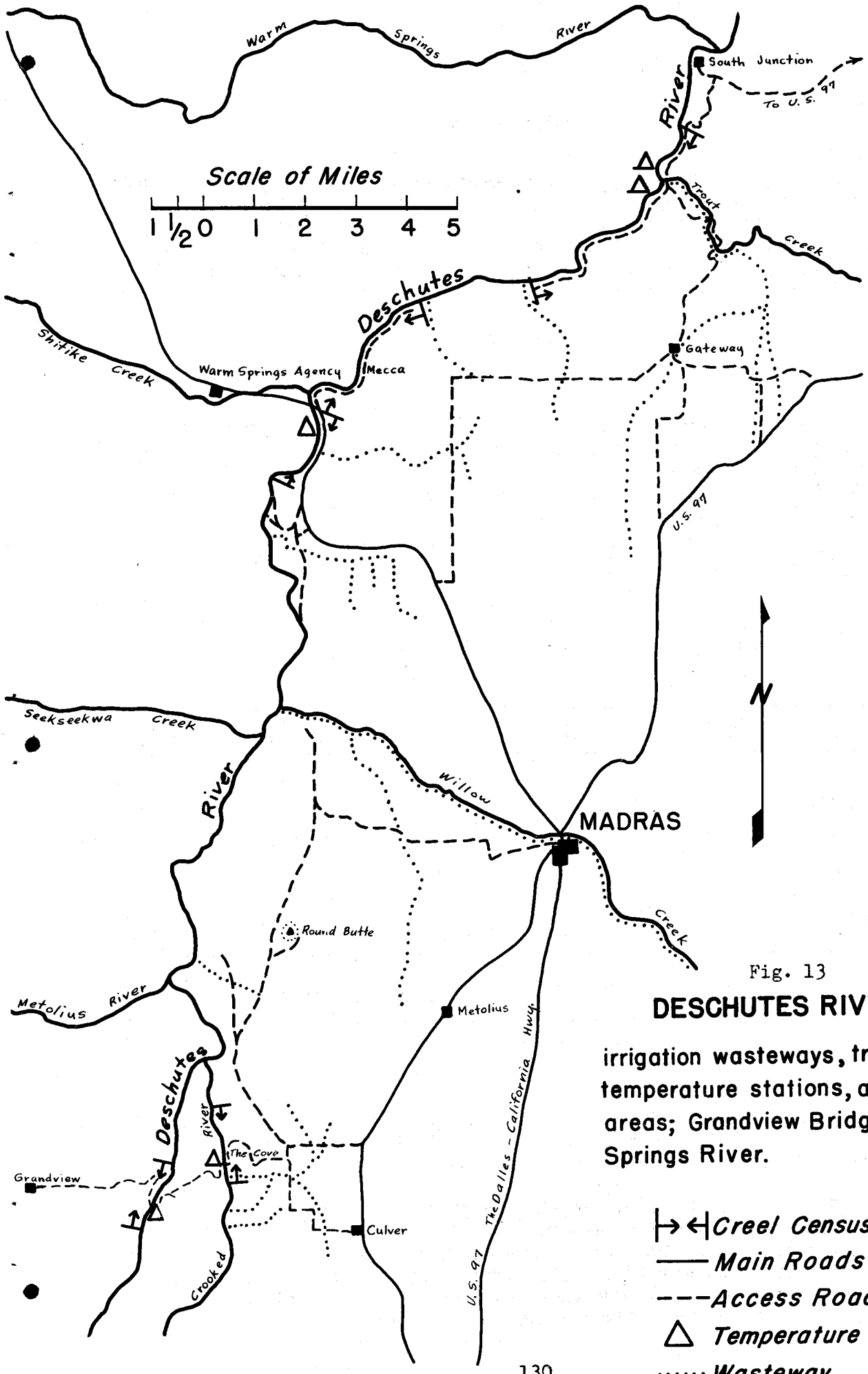


Fig. 13

DESCHUTES RIVER,

irrigation wasteways, tributaries, temperature stations, and creel ce areas; Grandview Bridge to Warm Springs River.

⊢→←⊣ *Creel Census Area*

—— *Main Roads*

- - - *Access Roads*

△ *Temperature Station*

····· *Wasteway*

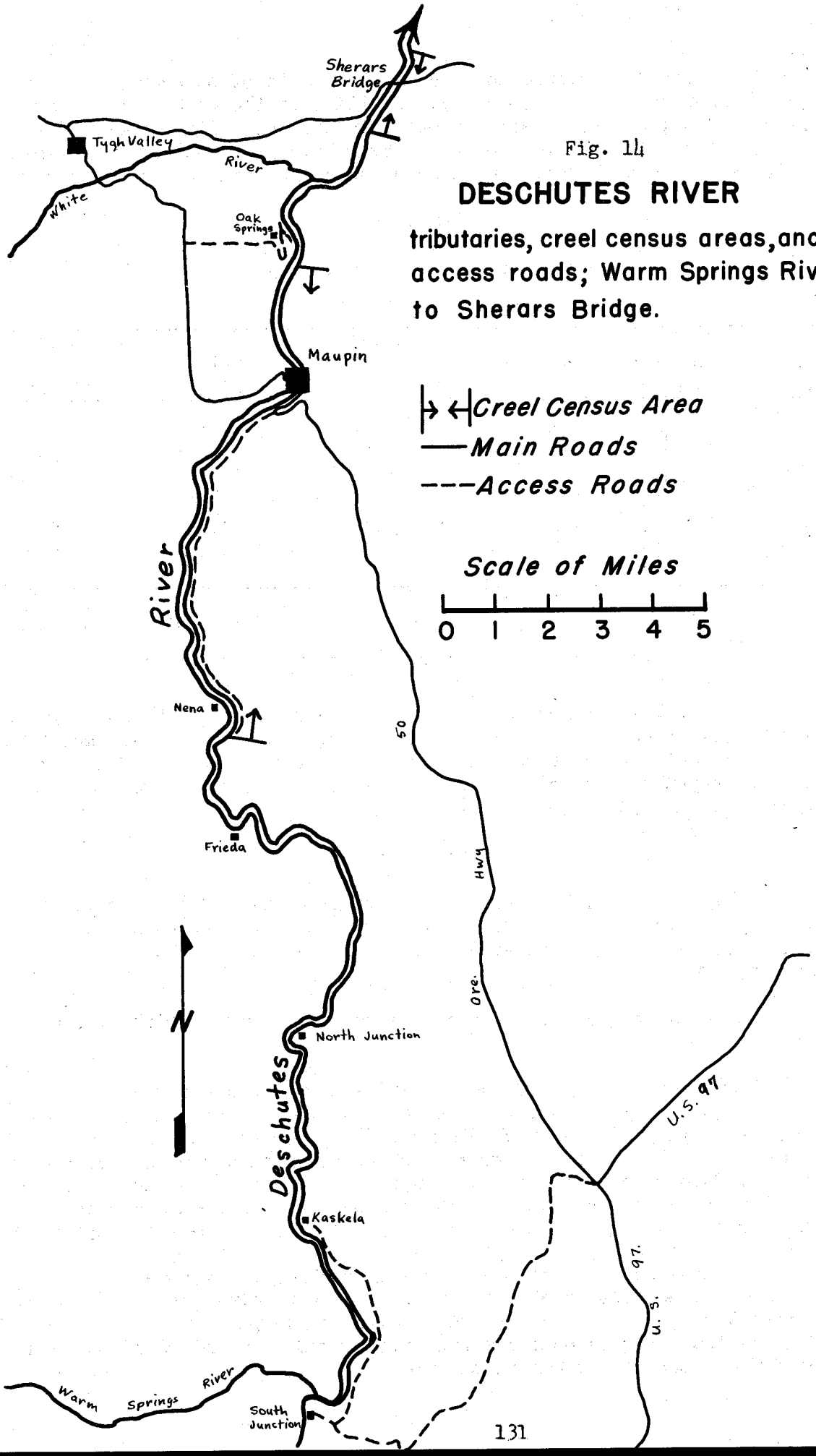


Fig. 14

DESCHUTES RIVER

tributaries, creel census areas, and access roads; Warm Springs River to Sherars Bridge.

weekday fishermen was calculated by using the ratio of weekday to week end anglers determined by the 1950 study. Addition of the weekday and week end totals provided the 1951 season estimates in the above five areas. The calculated fish catch was then obtained by multiplying the angler estimates by the average monthly fishing success measured in terms of fish per angler.

Table 105

Trout creel census estimates

Month	Anglers checked	Fish caught	Fish per angler	Estimated anglers	Estimated fish caught
April	407	683	1.48	4,070	6,024
May	724	1,190	1.64	7,240	11,874
June	363	427	1.18	3,630	4,283
July	339	472	1.39	3,390	4,712
August	277	601	2.17	2,770	6,011
September	333	495	1.49	3,330	4,962
Total	2,443	3,868	1.58	24,430	37,866

Table 106 illustrates the recorded catch for the 1951 angling season divided by size groups and species. During the five and one-half month season, 4,819 rainbow, 44 brown, 151 Dolly Varden and 162 whitefish were caught. Ninety-three per cent thus were rainbow, 1 per cent brown, 3 per cent Dolly Varden, and 3 per cent whitefish.

MARKED FISH

A release of 4,533 yearling rainbow trout marked by clipping the right maxillary bone and the adipose fin, was made in the Deschutes River on April 21, 23, and 24, 1951, near the Warm Springs bridge. The fish varied in size from 8 to 14 inches.

Table 107 depicts the percentage return of marked fish by month in this experiment.

The first two days of the angling season 118 anglers caught 347 fish. Two hundred ninety-seven or 86 per cent were marked fish. In May, 261 anglers caught 337 fish including 276 (82 per cent) marked rainbow. A decided drop in the number of marked fish returned to the creel occurred in June. Only 29 per cent of the fish caught were marked. As the season progressed the percentage of return continued to decrease. Marked fish in September supplied 6 per cent of the trout catch in the Warm Springs area.

Thirteen per cent of the original stocking was accounted for during the limited creel census activities. Ninety-nine per cent of the recoveries took place within one-fourth mile of the planting site. One fish moved three-fourths mile upstream and five marked trout migrated two and one-half miles downstream before capture.

Table 106

Species and size group composition of the catch by area, 1951

Area	Species	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20 & over	Total
Cove	Rainbow	344	472	192	44	9				1,061
	Brown	1				1				2
	Dolly Varden	6	6	1	1					14
	Whitefish	1	5	1						7
Grandview Bridge	Rainbow	248	167	59	4					478
	Brown	3	4	1	1					9
	Dolly Varden		2	3						5
	Whitefish	2	3		1					6
Warm Springs	Rainbow	275	326	211	45	5	2			864
	Brown	3	3	3						9
	Dolly Varden	17	13	3	4					37
	Whitefish	12	22	10	3					47
Mecca	Rainbow	252	262	113	25	7	1			660
	Brown	4	4	2	2	1				13
	Dolly Varden	14	13	5	3					35
	Whitefish	6	32	29	4					71
Trout Creek	Rainbow	233	239	111	39	13	2			637
	Brown	1	3	5						9
	Dolly Varden	18	11	2	2	1				34
	Whitefish		8	1						9
Maupin	Rainbow	218	293	177	52	10		1	1	752
	Brown		1		1					2
	Dolly Varden	8	4	3	1					16
	Whitefish		10	5	2					17
Oak Springs	Rainbow	62	87	51	17					217
	Brown									
	Dolly Varden	3	1							4
	Whitefish	1	2	2						5
Sherars	Rainbow	28	54	49	17	2				150
	Brown									
	Dolly Varden	3	1	2						6
	Whitefish									
					Total					5,176

Table 107

Marked legal rainbow trout survival study

Month	Anglers checked	Fish caught	Marked fish	Unmarked fish	Per cent of marked fish
April*	118	347	297	50	86
May	261	337	276	61	82
June	119	47	14	33	29
July	70	24	5	19	21
August	71	109	10	99	9
September	72	46	3	43	6
Total	711	910	605	305	68

*Season opened April 28

FISH STOCKINGS

The 1951 fish stockings in the eight sections of the river extending from Grandview Bridge on the Upper Deschutes downstream to Sherars Falls totaled 128,065 fish weighing 22,317 pounds. The stockings are summarized as follows:

Table 108

Fish Stockings (rainbow) 1951

Year	Number	Size	Pounds	Time planted
1951	10,509	8-10	2,942	April-May
	15,565	10-12	6,178	
	15,795	4-6	450	
	12,604	6-8	1,743	June-July
	4,474	10-12	1,761	
	944	12-14	740	
	52,680	4-6	2,906	
	8,110	6-8	654	August-September
	3,451	10-12	1,917	
	3,933	12-14	3,026	
Total	128,065		22,317	

Stocking Methods

In the Warm Springs, Mecca, and Maupin areas, better distribution of fish could have been experienced by using either the McKenzie River planting boat or the stocking trolley developed by Chris Jensen. Dispersion of fish from trucks is possible to a limited degree only. Adequate distribution of hatchery raised trout in a river such as the Deschutes is desirable in order to scatter the fishing effort and provide a more equitable return of stocked fish to as many anglers as possible.

Steelhead trout

A summer steelhead creel census was carried on at Stiles at the mouth of the Deschutes River, and at Kloan, seven and one-half miles upstream. (1)

The information obtained from the summer steelhead creel check is set forth in Table 109.

Table 109

Summer steelhead sport catch, Deschutes River, 1951

Month	Anglers checked	Fish caught	Fish per angler	Hours fished	Hours per fish	Estimated anglers	Estimated fish
July	19	13	.68	55	4.23	325	227
August	308	174	.56	1,292	7.42	1,091	611
September	235	175	.74	1,048	5.98	1,035	766
Total	562	362	.64	2,395	6.62	2,451	1,598

The first anglers were checked during the latter part of July, but the majority waited until August before seeking steelhead. A total of 562 steelhead anglers caught 362 fish. They required 2,395 hours of fishing to obtain a return of 0.64 fish per angler, or one fish for every 6.62 hours of fishing. The creel census results represent only a small portion of the total angler effort. On the basis of car counts and the average number of anglers per car, it is estimated that 2,451 anglers utilized the lower eight miles of the Deschutes River. They caught approximately 1,598 summer steelhead. The estimates are conservative since 23 per cent of the fishermen on the Lower Deschutes could not be interviewed with the methods employed and in the time available to district personnel for the activity.

The summer's work reveals the heretofore unknown extensive steelhead sport fishery of the Deschutes River and emphasizes the need for additional study and proper management of this fishery.

Fragmentary information on the summer steelhead catch in the Maupin area was obtained by Mr. Al Richards, operator of a motor court. Mr. Richard's customers landed thirty steelhead in September and fourteen in October in the immediate vicinity of Maupin. The fish varied from 21 to 32 inches in length.

(1) Figure 15

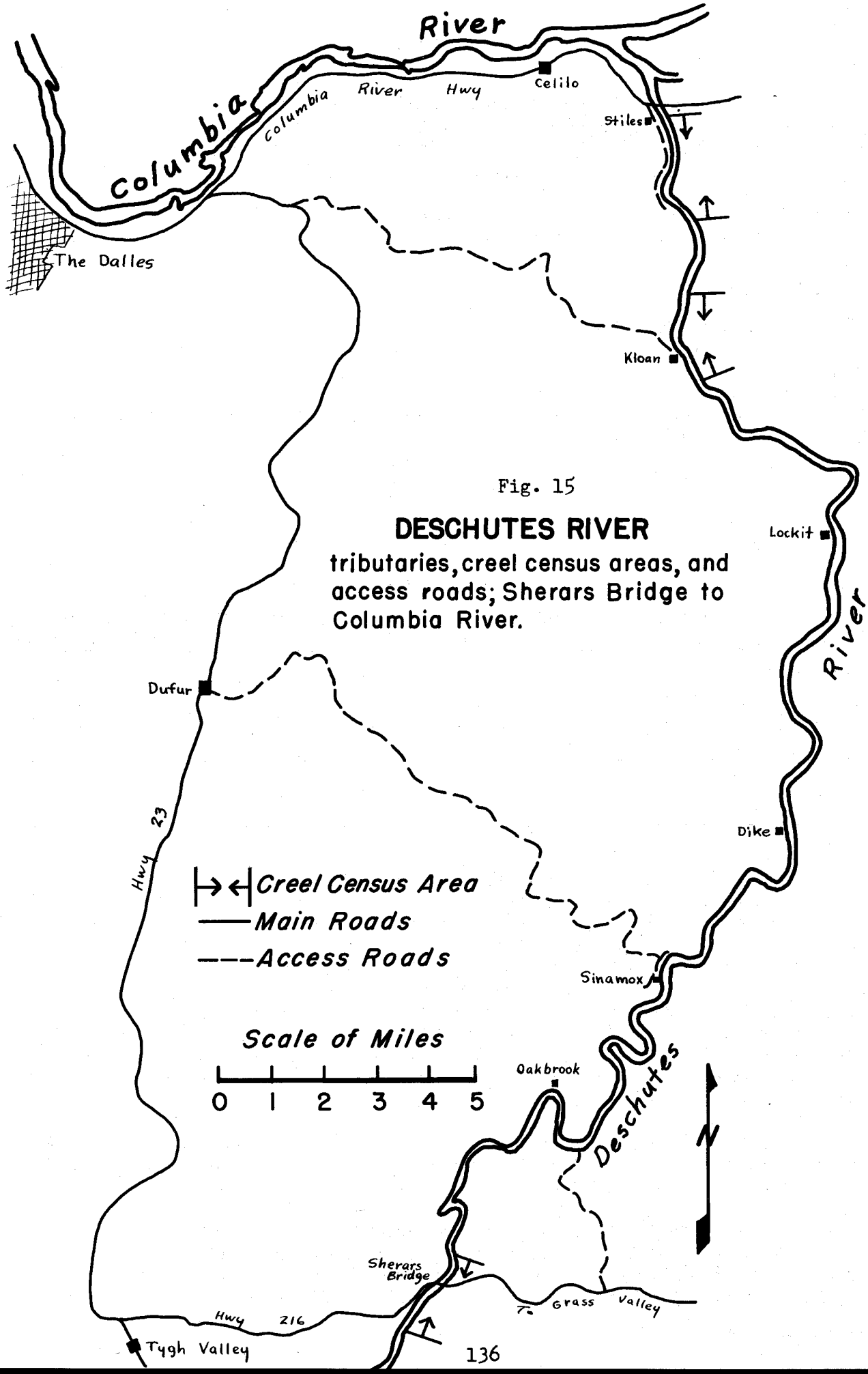


Fig. 15

DESCHUTES RIVER

tributaries, creel census areas, and access roads; Sherars Bridge to Columbia River.

MISCELLANEOUS

During the general trout creel census work nine steelhead were recorded to have been caught in the Mecca to Squaw Creek section of the Deschutes River, as much as 155 miles above the mouth. Steelhead reached Squaw Creek in the early part of July. All of them were caught incidentally to trout fishing. It is anticipated that when the angling public becomes fully aware of the steelhead in the upper Deschutes River the angling pressure will undoubtedly increase.

THE SUMMER STEELHEAD FISHERY

Trip expenditures

Expenditure figures in Table 110 were compiled from personal interviews of anglers. The estimated expenditures were made using car counts as a basis. The average number of anglers per car was multiplied by the total cars (cars checked and estimated) to determine the number of estimated anglers. The average cost per trip was multiplied by the total estimated anglers to obtain the expenditures. The monthly estimates are recorded in column 6, Table 110.

Table 110

Economic evaluation, Deschutes River steelhead fishery, 1951

Month	Anglers checked economic	Total expenditures of anglers checked	Estimated cars	Estimated anglers	Total cost
July	0	$ 0	118	325	$ 2,333.50
August	250	1,866.20	506	1,091	7,833.38
September	174	1,179.20	459	1,042	7,431.30
Total	424	$3,045.40	1,083	2,458	$17,598.18

The 424 anglers checked spent $3,045.10 for an average cost per angler trip of $7.18. The cost per angler trip was low, since the majority of anglers were from The Dalles and vicinity. The cost per trip to the angler from the immediate area was approximately $2.40. The estimated expenditures for the season were $17,598.18.

Angler equipment

Angler investment in equipment was derived by totaling daily reports from individual fishermen. Table 111 is the recorded expenditures of equipment reported by anglers.

Table 111

Reported investments of angler equipment

Month	Anglers checked	Investment by anglers checked	Average investment fishing equipment
August	216	$17,004.00	$78.72
September	86	5,317.00	61.83
Total	302	$22,321.00	$73.91

The total cost of equipment was divided by the number of anglers checked to determine the average cost of equipment per angler. Average investment for fishing tackle was $73.91.

Age and growth studies

A supplemental report on age and growth studies will be submitted upon completion of an examination of scales taken from eighty-six sport-caught steelhead.

SPRING CHINOOK SALMON

The spring chinook salmon fishery on the Deschutes River is confined to a limited area in the immediate vicinity of Sherars Falls. Table 112 shows the results of the spring chinook salmon sport fishery. The census revealed that 414 hours of angling effort were required for sixty-two anglers to catch thirty fish. The average was 0.48 fish per angler and 13.80 hours per fish.

The average weight was 9.84 pounds while the average length of twenty sport-caught salmon was 28.2 inches. The average length of jack salmon was 18.9 inches averaging 3.4 pounds.

There are probably other areas in the lower Deschutes River where spring chinook salmon could be caught. An authorized Indian fishery for spring chinook salmon also exists at Sherars Falls. The known take of the Indians was approximately 1,000 fish in 1951.

TEMPERATURE AND TURBIDITY STATIONS

Consistent disapproval was voiced by anglers throughout the State regarding the amount of muddy water flowing into the Deschutes River in the area adjoining the Madras irrigation project. As a result, a series of six temperature and turbidity stations was established in order to obtain information on the various wasteways. Figure 13 shows the major wasteways entering the Deschutes River and tributaries.

A series of weekly readings on temperature and turbidity was taken at Crooked River, Cove, Grandview, Warm Springs, Trout Creek, and Lower Trout Creek.(1) For the most part, the main channel of the Deschutes River becomes murky for approximately one hundred yards downstream from the major wasteways.

(1) Figure 13

Table 112

Spring chinook salmon sport catch, Sherars Falls, Deschutes River, 1951

Date	Number anglers	Fish caught	Fish per angler	Hours fished	Hours per fish	Estimated anglers
5--6-51	2	2	1.00	9	4.50	30
5--5-51	3	3	1.00	13	4.33	45
5-25-51	5	3	.60	23	7.67	10
5-27-51	4	3	.75	22	7.33	20
6-16-51	4	1	.25	24	24.00	0
5-20-51	2	1	.50	8	8.00	45
6-17-51	7	0	.00	21	.00	0
6--3-51	14	7	.50	84	12.00	2
5-29-51	12	6	.50	120	20.00	0
5-22-51	9	4	.44	90	22.50	3
Total	62	30	.48	414	13.80	155

Table 113 depicts a weight frequency based on twenty sport-caught spring chinook salmon.

Table 113

Spring chinook salmon weight frequency Deschutes River, 1951

Pounds	Number of fish	Per cent
5	1	5
6	1	5
7	4	20
8	1	5
9	3	15
10	3	15
11	3	15
12	3	15
13	0	-
14	0	-
15	1	5

The one exception is the result of the three wasteways entering Trout Creek. Waste water entering the Deschutes River from Trout Creek can be seen approximately two and one-half to three miles below the point of entry. The lower two and one-half miles of Trout Creek are filled with silt carried there by the wasteways entering the stream.

Examinations of the major wasteways entering the Deschutes River showed large silt deposits forming sandbars extending downstream from 50 to 200 feet. In talking to many of the resident fishermen in the area, it was found that the silt or muddy water entering the Deschutes River was less in 1951 than in the previous years or since the inception of the Madras project in 1948. There were no original allowances made for wasteways to carry the surplus water from the fields. Indications are that the lesser amount of silt now being carried by the wasteways is due to the former water action on new channels between the years of 1948 through 1950. Estimates made on the amount of water being carried into the Deschutes River from the wasteways throughout the summer varied from 4 to 12 second feet. At the present time, it is cheaper to buy water than to hire additional help to correctly utilize the available supply.

The U. S. Bureau of Reclamation is now providing funds for demonstration work aimed at better farmer utilization of irrigation water. The problem of waste water entering the Deschutes River may be corrected by better utilization of water on the farm, with farm stock ponds acting as silting basins and with habitat improvement on wasteways.

To date the only known effect of the muddy water on the trout fishery is found in the area immediately below Trout Creek. The condition of the stream in the area was such that in the 1951 angling season, it was almost impossible for the anglers to take fish with artificial fly. The success of anglers using bait did not appear to be affected.

Temperatures

Figure 16 depicts the weekly maximum water temperatures at six stations, two of which were in Crooked River and four in the main Deschutes River channel. The temperature stations were initiated to study the effects of waste water entering the Deschutes River and the effect of proposed reservoirs created by dams. In Figure 16 the temperatures taken at the station designated as Lower Trout Creek illustrate definite warming effects caused by waste water entering the Deschutes River. The higher temperature reading does not affect the main Deschutes River more than one and one-half miles downstream. A drop in maximum water temperature was recorded in June which can be correlated to several days of extremely cold weather.

SPAWNING GROUND SURVEY

Spring chinook

Periodic spawning ground surveys started on August 15 when chinook salmon were first observed in the Metolius River. The main spawning activity did not start until the first week in September. Table 114 illustrates spawning-ground information collected on Squaw Creek, the Metolius River and tributaries in 1951.

Table 114

Spring chinook spawning ground survey totals below Fish Commission racks, Metolius River and Squaw Creek, 1951

Date	Location	Spawning salmon observed	Dead salmon	Redds
8-15-51	Wizard Falls to bridge 99	4	0	4
9--5-51	Wizard Falls to bridge 99	27	0	29
9--6-51	Wizard Falls to bridge 99 (new recordings)	12	0	16
9--6-51	Jack Creek	2	0	2
9--6-51	Fish Commission rack to Canyon Cr.	13	0	12
9-13-51	Squaw Creek	13	1 male unspent	15
9-27-51	Squaw Creek	1	0	1
Total		72	1	79

Fifty-eight salmon were observed on spawning beds in the Metolius River and tributaries with a total of 63 redds recorded. A total of fifteen chinook salmon was found on the spawning beds in lower Squaw Creek where salmon were counted for the first time. It is in this section that many large springs of a temperature of 50° F. enter Squaw Creek. The water temperature of the creek above the point of entrance of the first three springs was 57° F. at the time of salmon population enumeration. Three miles of stream were covered above the springs with no salmon observed. One dead unspent male found in Squaw Creek had been killed by a bullet from a rifle of small caliber. All information obtained during spawning ground survey work on lower Squaw Creek indicates vandalism while the salmon are on the spawning beds.

The Oregon Fish Commission maintained an egg-taking rack for chinook salmon on the Metolius River and it was possible to obtain an accurate check on the salmon arriving at the rack site.

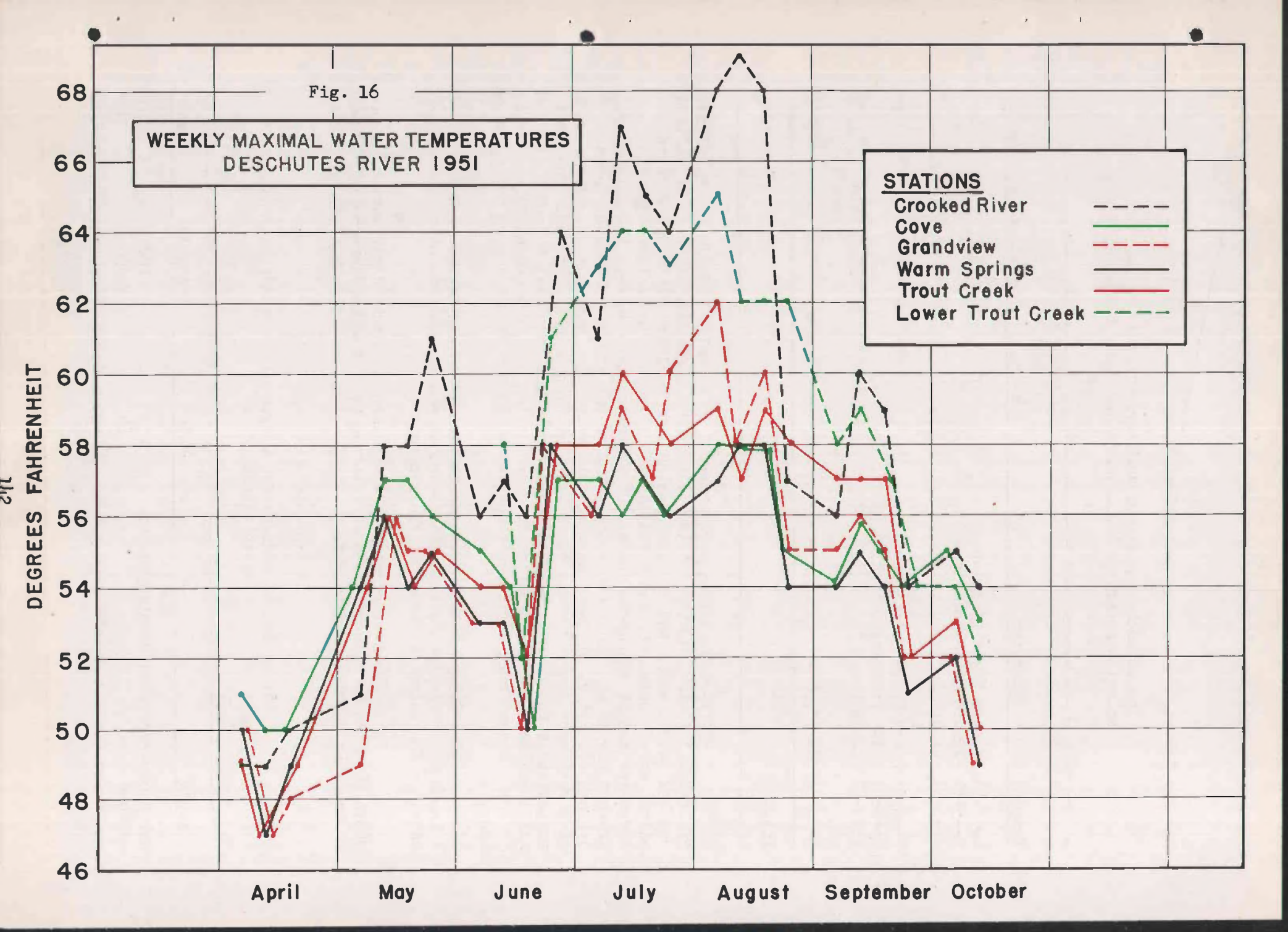
Table 115 is a summary of the salmon spawned and the salmon released above the Fish Commission racks as obtained from Mr. Mel Sharp, Superintendent of the Fish Commission Hatchery.

Table 115

Salmon counts made by the Oregon Fish Commission, Metolius River, 1951

Salmon	Males	Females	Total
Released above Fish Commission rack	203	188	391
Spawned	89	96	185
Total	292	284	576

Fig. 16


WEEKLY MAXIMAL WATER TEMPERATURES
DESCHUTES RIVER 1951
STATIONS
Crooked River
Cove
Grandview
Warm Springs
Trout Creek
Lower Trout Creek
DEGREES FAHRENHEIT
68
66
64
62
60
58
56
54
52
50
48
46
April
May
June
July
August
September
October

With 185 salmon spawned and 391 released above the rack a total of 576 salmon were known to have reached the Upper Metolius River. In addition, 58 spring chinook were observed spawning below the rack. Including the 15 spring chinook found in Squaw Creek, a total of 649 salmon were found in tributaries of the Upper Deschutes River.

Spot checks were conducted throughout the Lower Metolius River and tributaries. Fourteen miles of the main Deschutes River was covered from Steelhead Falls downstream to Grandview Bridge. Eight miles of the Deschutes were covered by boat from Warm Springs to Trout Creek. No spawning salmon were observed but this does not mean that there were no salmon utilizing the available gravel in the area.

STEELHEAD SPAWNING GROUND SURVEY

Steelhead spawning ground surveys were conducted for the first time in the early spring of 1951. Table 116 depicts the information obtained from the survey.

Table 116

Steelhead spawning ground survey, Squaw Creek 1951

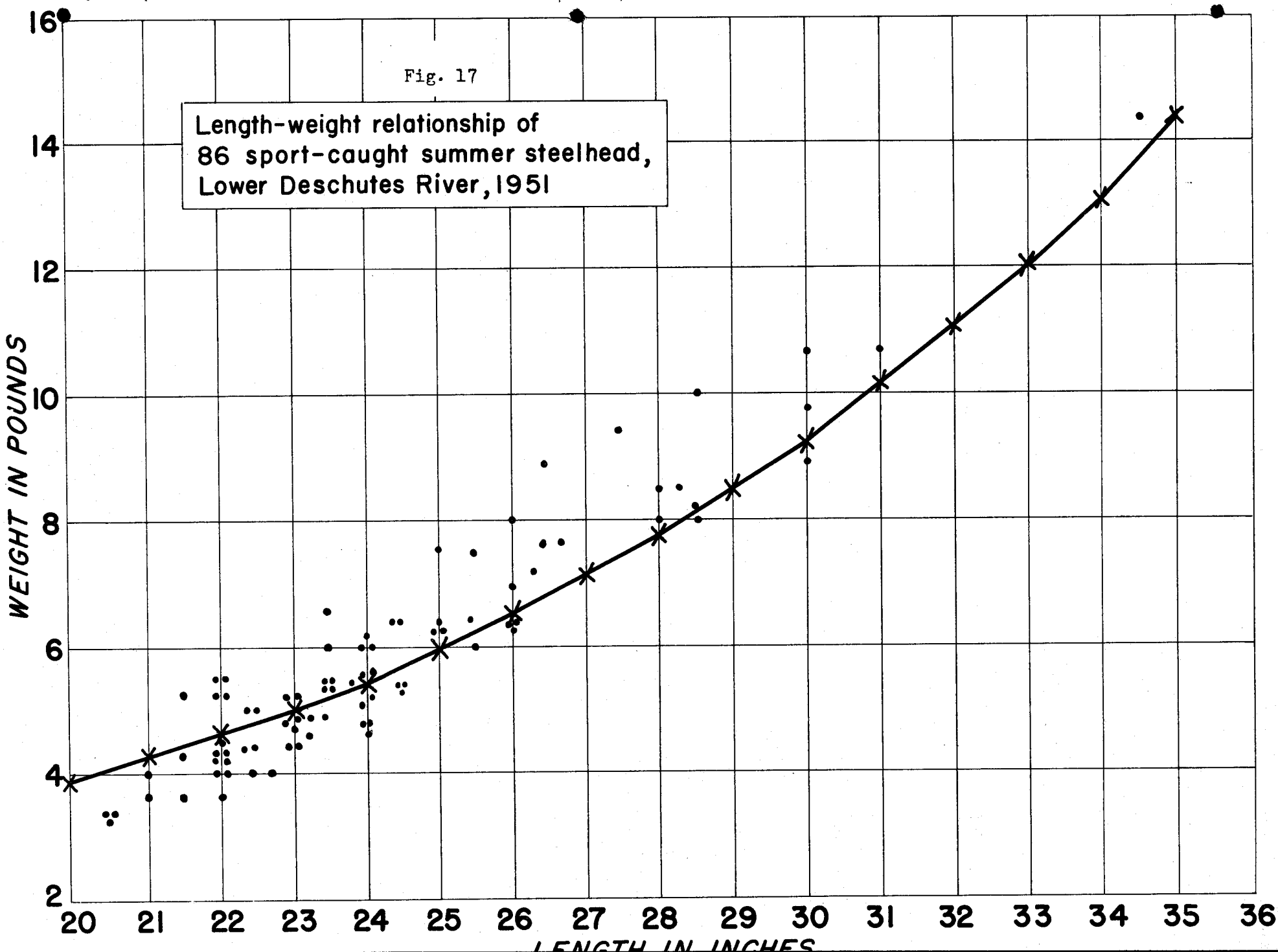
Date	Location	Steelhead	Redds
3-21-51	Squaw Creek	4	2
3-22-51	Squaw Creek	3	1
4--7-51	Squaw Creek	0	1 above rack
4-26-51	Squaw Creek	1	3
4-18-51	Squaw Creek		11
3-26-51	Squaw Creek	10	5
Total		18	23

Spawning steelhead were found only in Squaw Creek. Only 18 spawning steelhead were observed while 23 redds were seen. Thirty-two miles of Squaw Creek were included in the steelhead spawning ground survey. The Metolius River and tributaries were subjected to periodic checks. Investigation failed to disclose any evidence that steelhead were utilizing the Metolius River and tributaries. Steelhead are known to spawn in the Crooked River and tributaries, but muddy water conditions throughout the watershed held observations to a minimum.

LENGTH AND WEIGHT FREQUENCY OF SUMMER STEELHEAD

The length and weight relationship of eighty-six sport-caught summer steelhead in the lower Deschutes River for 1951 is shown in Figure 17. Lengths varied from 20½ to 34½ inches and weights from 4 to 6½ pounds with the largest fish recorded weighing 14 pounds and 3 ounces. The average length was 24.4 inches and the average weight was 6.01 pounds.

Fig. 17


Length-weight relationship of
86 sport-caught summer steelhead,
Lower Deschutes River, 1951
WEIGHT IN POUNDS
LENGTH IN INCHES
2
4
6
8
10
12
14
16
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

STEELHEAD EGG-TAKE

A summer steelhead egg-take on Squaw Creek was initiated in 1951. The following table is a tabulation of the dates the steelhead were removed from the trap, number of steelhead, sex, dates spawned, and total eggs removed.

Table 117

Summer steelhead egg-take, Squaw Creek, 1951

Date steelhead removed from trap	Number		Females spawned	Number of eggs
	Female	Male		
March 21	2	2		
March 22	1	2		
March 24	5			
March 25	3	1	3	9,675
March 26	2			
April 4	1	1	5	18,060
April 6			4	10,750
April 8			12*	6,880
Total	14	6	12	45,365

*Re-spawned females

Twelve females were spawned for a total of 45,365 eggs or an average of 3,780 eggs per female. The eggs were hatched at the Wizard Falls station and will be released in Squaw Creek as yearlings. All of the steelhead will be marked and it is anticipated that information may be obtained on the downstream migrants, the part the young fingerling steelhead have in the trout fishery, and the return to the river.

GENERAL STREAM SURVEY WORK

Figure 18 illustrates the stream areas surveyed, and the general areas in which spawning salmon and steelhead were observed. The study revealed that much spawning ground is available for anadromous and resident fish. Table 118 indicates the available area of gravel in square yards in the portions of streams surveyed. The spawning potential for salmon was determined, in part, by use of information obtained in Clifford J. Burner's publication, "Characteristics of Spawning Nests of Columbia River Salmon".(1)

(1) Burner, Clifford J, "Characteristics of Spawning Nests of Columbia River Salmon" Fishery Bulletin 61 U.S.F.W.S. 1951

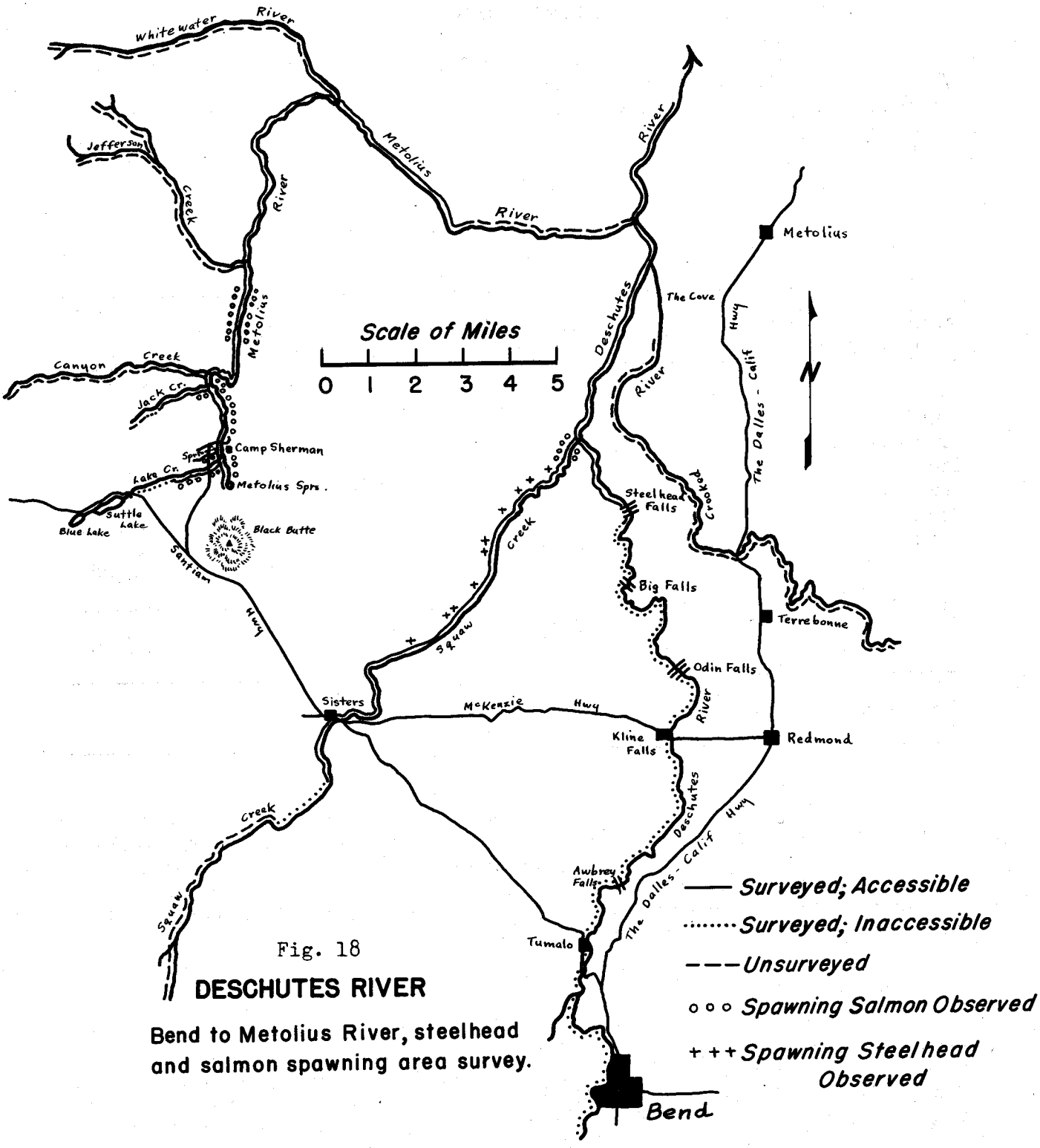


Fig. 18

DESCHUTES RIVER

Bend to Metolius River, steelhead and salmon spawning area survey.

Table 118

Available spawning gravel, Squaw Creek, Metolius River and tributaries, 1951

Stream	Miles surveyed	Square yards available	Spawning potential in numbers spring chinook salmon
Metolius River	31	78,074	5,005
Lake Creek	5.5	11,542	739
Jack Creek	3	5,433	348
Spring Creek	6.5	3,689	237
Canyon Creek	3	4,766	306
Whitewater River	2.5	Trace	Trace
Jefferson Creek	2	1,566	101
Squaw Creek	4	17,983*	1,153
Squaw Creek	28	208,321	13,354
Total	79.5	331,374	21,243

*Potential spawning area above impassable barrier

PUBLIC ACCESS

Figures 13, 14, and 15 outline the number of access roads available to the angling public on the Deschutes River. It is apparent that the areas open to the angling public are decreasing yearly. The only available access to the Lower Deschutes River for steelhead fishermen is at Stiles and Kloan. (1) The conflict between farmer and fisherman is found in the following areas: Warm Springs, Mecca, Stiles, Kloan and Trout Creeks. It was only through considerable effort by Game Commission personnel that the areas remained open for utilization by the angling public.

A close examination of Figures 13, 14, and 15 reveal that only ten access areas can be found in approximately 139 miles of river. The closure of any of the sections must be considered as a serious loss to the anglers of the State of Oregon.

(1) Figure 15

OTHER CREEL CENSUS

Lower Deschutes River

Data gathered during 1951 on the Deschutes River emphasizes the magnitude of the fishery resources of the lower Deschutes and adjacent area.

Hood River

Much of the information on Hood River was obtained by Hood River Hatchery personnel. Anglers park on hatchery grounds when fishing in the vicinity of the Punch Bowl and can be easily interviewed by the hatchery personnel. Scales samples, weights and measurements were obtained from thirty-seven spring-run steelhead and twelve summer-run steelhead.

The spring steelhead received the heaviest angling pressure of the runs which inhabit the river. The run reaches the Punch Bowl in the last part of April and continues through May and the first of June. The reproductive organs of the majority of the steelhead caught during May and June are immature. A few spent or partly spent fish are also caught at this time.

Table 120 is a record of the weights, measurements and classification of condition of the reproductive organs of fish caught in Hood River.

Table 119 represents a weight-frequency chart of the thirty-three steelhead recorded in Table 120. Spawning or spent fish are not included in Table 119. The four spawning or spent steelhead weighed 6 pounds or less while only 6 per cent of the 33 immature fish weighed 6 pounds or less.

Table 119

Steelhead weight frequency Hood River
spring run April 17 to June 14, 1951

Pounds	Number of fish	Per cent
4	1	3
5	0	0
6	1	3
7	13	40
8	9	27
9	6	18
10	2	6
11	0	0
12	1	3

Table 121 is a tabulation of weights, measurements and maturity of summer run steelhead. It is difficult to determine the end of the summer and the start of winter runs. October 31 would be a representative date for the end of the summer run.

Table 120

Steelhead weights and measurement, Hood River spring run April 17 - June 14, 1951

Date	Length inches	Weight pounds	Sex	Degree of maturity
April 17	30	9	F	Immature
April 18	26	6½	F	Immature
April 19	28½	8	F	Immature
April 27	27	8	F	Immature
April 27	24	4	M	Immature
April 28	30	9	F	Immature
May 2	27¼	8	F	Immature
May 2	27½	7½	F	Immature
May 4	20	2¼	M	Spent
May 5	28	8	F	Immature
May 6	27	8	F	Immature
May 6	27	3½	F	Spent
May 8	28	8½	F	Immature
May 11	27½	6	M	Mature
May 12	28	7	F	Immature
May 12	31	10	M	Immature
May 12	28	7	M	Immature
May 13	28	7½	M	Immature
May 13	30	9½	M	Immature
May 14	27½	7	F	Immature
May 15	26	7	F	Immature
May 16	28	7½	F	Immature
May 17	28	8½	F	Immature
May 18	28	8½	M	Immature
May 19	29	9½	F	Immature
May 20	30½	9	M	Immature
May 20	34	12	M	Immature
May 21	27½	7¼	F	Immature
May 21	28	7½	F	Immature
May 21	28½	7½	F	Immature
May 22	27	7½	F	Immature
May 23	27	7	F	Immature
May 24	31	10	M	Immature
June 5	28	7	F	-
June 8	29	8½	M	Immature
June 11	30	9	F	-
June 14	29	5½	M	Mature

Table 121

Steelhead weights and measurements, Hood River summer run - July 9 to October 31, 1951

Date	Length inches	Weight pounds	Sex	Degree of maturity
July 9	28	7½	F	Immature
July 12	29	8	F	Immature
July 13	26	6½	F	Immature
July 13	21½	3½	M	Immature
July 19	27	7	M	Immature
July 19	26	6	F	Immature
July 20	26	6½	F	Immature
July 25	21	3-3/4	F	Immature
August 25	29	7	M	Immature
September 11	34	12½	M	Immature
October 31	25	4-3/4	F	Immature
October 31	22½	3½	M	Immature

Table 122 represents a weight frequency table of the summer run recorded on Table 121.

Table 122

Steelhead weight frequency, Hood River fall run, July 9 to October 31, 1951

Pounds	Number of fish	Per cent
3	3	25
4	1	8
5	0	0
6	3	25
7	3	25
8	1	8
9	0	0
10	0	0
11	0	0
12	1	8

Three distinct salmon runs enter Hood River--the spring chinook in April and May, the fall chinook from September to November, and the silver salmon in the fall. Little is known of the size of the salmon runs or of their spawning grounds.

While fishing for steelhead below the Punch Bowl on October 31, two ripe female silvers were landed and released after examination. On November 2nd, a ripe chinook female weighing approximately 20 pounds was caught at the Pacific Power and Light Company powerhouse. Two more salmon were hooked but never landed.

Trash pollution has been a serious problem in Hood River for many years. The Oregon Lumber Company mill has been the worst offender. Trimmings and sawdust have been dumped along the bank to be burned, but much of the debris rolled directly into the river and strong winds would carry sawdust into the river. During the summer of 1951, during low water, a jam of trimmings blocked the river for 50 yards but it was washed out by high water. A trash burner was completed in October and is now in operation, but there still remain the problems caused by dumping logs directly into the river and of flushing the mill pond periodically.

Two inadequate fish ladders still remain as obstacles to anadromous fish migrations. One is located at the Oregon Lumber Company mill pond and the other at the Pacific Power and Light Company's dam. The ladder at the Oregon Lumber Company mill pond is constructed of wood, and is annually washed out by high water before or during the time when the winter run of steelhead attempt to surmount the dam. When intact and in operation, the flow of water through the ladder is turbulent but attraction at the entrance would be less if the flow were reduced. At low water levels, the bottom step is too high above the water level of the river. A comparable situation exists at the ladder of the Pacific Power and Light Company dam. Summer steelhead, salmon, and cutthroat runs were blocked by the ladder for several weeks in August, 1951.

Olallie Lake

Olallie Lake is located on the Cascade summit approximately 34 miles south of Wapinitia Highway on the Skyline Road.

The lake is accessible by road from approximately the first of July through the summer. Portland residents make up the bulk of the anglers. The number of anglers present at any one time throughout the summer was stable and angling success was good. The estimated number of anglers utilizing the lake on Saturday and Sunday on any one of the three week ends of checking approached 433 anglers.

Table 123 presents catch record data gathered during three week ends of checking.

Table 123

Olallie Lake, catch record data, 1951

Size	Rainbow	Eastern brook
6--8	21	88
8-10	74	58
10-12	88	3
12-14	40	-
14-16	5	-
Total	228	149

Days checked	6
Anglers checked	164
Hours fished	797
Hours per fish	2.11
Fish per angler	2.30
Percentage rainbow	60
Percentage eastern brook	40

Columbia River

Many sturgeon fishermen in Hood River and The Dalles fish in the Columbia River from The Dalles to Cascade Locks. Angling success is dependent upon the turbidity and level of the river.

Commercial fishermen blame the poor condition of sturgeon above Bonneville Dam on the diminishing lamprey run. Bonneville Dam partially blocks the run of lamprey on the upstream migration.

Table 124 presents catch record data on the sturgeon.

Table 124

Columbia River, sturgeon catch record data, 1951

Anglers checked	63
Fish caught	23
Hours fished	194
Hours angled per fish	8.43
Fish per angler	0.37

Miscellaneous creel census

The many small lakes and streams in Columbia District are not exposed to much angling pressure; only a little time could be spent checking creels. Table 125 represents a summarization of the miscellaneous data gathered during the year.

Table 125

Miscellaneous creel census data, 1951

Area	Species	6-8	8-10	10-12	12-14	16-18	Total fish caught	Anglers	Fish per angler	Hours per fish
Gene Lake	Eastern brook	6	5	4			15	4	3.75	1.07
Badger Lake	Rainbow	9	15	2	6		32	12	2.67	2.16
Clear Lake	Rainbow	1								
	Eastern brook	2					3	4	0.75	8.00
Kingsley Res.	Rainbow	2	4	1						
	Cutthroat	1	1				9	6	1.50	2.11
Badger Creek	Rainbow	1	12	3	3		19	2	9.50	0.74
Fifteenmile Creek	Rainbow	10	11	3	1		25	15	1.67	1.92
Chenowith Creek	Rainbow	2								
	Cutthroat	1				1	4	5	0.80	3.00
Green Point Creek	Rainbow	25	1				26	13	2.00	1.70
White River	Rainbow		3	11	1		15	4	3.75	0.93
Hood River	Rainbow	1					1	14	0.07	29.00

Table 126

Hood River irrigation ditch investigations

Name	Size at mouth in inches	Stream	Fish recovered Number	Species	Size	Date	Area sampled
East Fork	192 x 20	East Fork Hood River	17	Rainbow	2-4	6-13-51	1/2 mile of ditch
			13	Trout	-		1 mile below mouth
Mt. Hood	72 x 16	East Fork Hood River	43	Cutthroat	7-11½	6-13-51	1/2 mile of ditch
			26	Cutthroat	3-7		from Loop Highway
			30	Trout	1		
Neal	96 x 20	Neal Creek	1	Cutthroat	2½	6-14-51	3/4 mile of ditch
			1	Trout	1		from mouth down
Farmers	208 x 37	Hood River	17	Rainbow	3-8	6-14-51	1/2 mile of ditch
			6	Rainbow	2-3		3-1/2 miles from mouth
			7	Cutthroat	3-8		
			3	Cutthroat	2-3		
			4	Chinook	2½-3½		
Dee	84 x 16	West Fork Hood River	No toxicant used			6-14-51	
Middle Fork	216 x 72	Evans and Coe Creek	No toxicant used			6-15-51	
Thompson	36 x 9	Mt. Hood Ditch	No toxicant used			6-15-51	
East Fork Sand Trap	192 x 20	East Fork Hood River	1	Steelhead	35	6-24-51	Sand trap 1/2 mile
			25	Rainbow	6-15		below mouth
Farmers	208 x 37	Hood River	4	Chinook	4-5	7-26-51	1/2 mile of ditch
			45	Trout	2-3		3-1/2 miles below mouth
			11	Rainbow	4-8		
			6	Cutthroat	4-9		
East Fork	192 x 20	East Fork Hood River	1	Chinook	26	10-22-51	Sand trap and 300
			13	Salmon	4-6		yards above trap
			216	Trout	1-3		
			18	Rainbow	4-6		
			1	Rainbow	8		
			3	Rainbow	11		
Farmers	208 x 37	Hood River	19	Silvers	3-5	11- 2-51	1/2 mile of ditch
			24	Rainbow	5-7		3-1/2 miles below mouth
			75	Trout	2-4		
			1	Dolly Varden	9		
			4	Trash fish	1½		

IRRIGATION DITCH INVESTIGATIONS

Hood River irrigation ditch investigations

A program of investigation was initiated on all ditches in the Hood River Valley in 1951 with the intention of screening those under eight feet in width that were a definite hazard to the downstream migration of anadromous fish.

Three large ditches, which were over the 8-foot width, proved to be the greatest hazard to the downstream migrants. They were the Farmers, the East Fork and the Neal Creek ditches.

The Farmers ditch, which takes water from Hood River approximately ten miles above the mouth, is one of the two largest ditches in the Hood River Valley.

The East Fork ditch, which takes water from the East Fork of Hood River at a point west of the town of Parkdale, is the third largest ditch in the Hood River Valley. The effect of the ditch on downstream migration is limited by the number of fish able to ascend the Oregon Lumber Company's dam.

The Neal Creek ditch, which takes water from Neal Creek at a point approximately 5 miles above the mouth, is of importance in affecting anadromous fish.

The Middle Fork ditch is the largest in the Hood River Valley but does not directly affect anadromous fish. The water supply comes from a series of small creeks above a point where upstream migrants are believed to spawn. It carries a large volume of water and affects fish migration in the late summer when water levels are the lowest.

Table 126 presents a summarization of spot checks on irrigation channels in the Hood River Valley.

Wasco County irrigation ditch investigations

Investigations in Wasco County were conducted by the screening crew under the supervision of Harry Wickman.

Anadromous runs are restricted to Fifteenmile, Eightmile, Fivemile, Mill and Chenowith Creeks in Wasco County. White River, Badger Creeks, Tygh Creek and Mosier Creek are all blocked by impassable falls.

Table 127 is a listing of information gathered on the irrigation ditches in Wasco County.

STURGEON TAGGING

A sturgeon tagging project was conducted cooperatively with the Oregon Fish Commission on the Columbia River in the vicinity of The Dalles. The Fish Commission furnished equipment and Game Commission personnel did the tagging. One hundred and ninety sturgeon were tagged and released.

Table 127

Wasco County ditches

Name	Size of screen in inches	Stream	Number	Species	Size (inches)	Date
Seufert	66 x 24	Fifteenmile		Trash fish	-	6-29-51
Balch	Stationary	Fifteenmile	12	Trout	1	6-28-51
			1	Sculpin	2	
Ingels	52 x 14	Fifteenmile	3	Trout	1	6-28-51
			1	Sculpin	2	
Sigman	34 x 18	Fifteenmile	7	Trout	1	6-29-51
			1	Sculpin	2	
Slusher	42 x 14	Fifteenmile	2	Trout	1	6-29-51
			1	Cutthroat	$7\frac{1}{2}$	
			10	Rainbow	$3\frac{1}{2}$-$7\frac{1}{2}$	
Galligan	64 x 18	Fifteenmile	18	Rainbow	3-7	6-29-51
			3	Sculpin	-	
Heaverly	46 x 14	Fifteenmile	-	-	-	-
Egust, Abnet and Dean	92 x 14	Fifteenmile	-	-	-	-
Orchard Ridge		Fifteenmile	Had been washed out and water turned off to date.			7- 5-51
Brown #1	46 x 14	Ramsey Creek	1	Cutthroat	3	7-12-51
			1	Rainbow	3	
			7	Trout	1	
Brown #2	34 x 14	Ramsey Creek	48	Trout	1	7-12-51
Wolf Run	82 x 18	Eightmile	1	Rainbow	10	7- 6-51
			38	Rainbow	$2\frac{1}{2}$-7	
Guyton	28 x 14	Eightmile	1	Cutthroat	$3\frac{1}{2}$	7-11-51
			17	Cutthroat	1	
Wagonblast	52 x 14	Eightmile	-	-	-	-
Finney	28 x 14	Eightmile	-	-	-	-
Wong	28 x 14	Eightmile	-	-	-	-
Gossen	28 x 14	Mill Creek	1	Cutthroat	9	7-11-51
			16	Cutthroat	$1\frac{1}{2}$-$6\frac{1}{2}$	
L. W. Sandoz	28 x 14	Mill Creek	1	Cutthroat	$4\frac{1}{2}$	7-11-51
Julius Sandoz	34 x 14	Mill Creek	2	Rainbow	5-$5\frac{1}{2}$	7-11-51

Table 127 (Continued)

Name	Size of screen in inches	Stream	Number	Species	Size (inches)	Date
Wyss	22 x 14	Mosier Creek	-	-	-	-
Shoren	34 x 14	Mosier Creek	-	-	-	-
Reese	34 x 14	Mosier Creek	-	-	-	-
McGargen	28 x 14	Mosier Creek	-	-	-	-
Ashley	94 x 24	White River	1	Rainbow	8	7-18-51
			1	Rainbow	2	
Chastine Volt	64 x 18	White River	1	Rainbow	10	7-18-51
Mays-Dodd	82 x 24	Tygh Creek	-	-	-	-
Mays-Dodd	76 x 24	Tygh Creek	-	-	-	-
Highline	82 x 24	Tygh Creek	1	Rainbow	8	7-18-51
			2	Rainbow	6	
			4	Rainbow	5	
Hauser	46 x 14	Tygh Creek	78	Rainbow	1½-9	7-23-51
Wing	46 x 14	Tygh Creek	-	-	-	-
Conley	34 x 14	Tygh Creek	-	-	-	-
Trasher	28 x 14	Tygh Creek	-	-	-	-
McCorkle	28 x 14	Tygh Creek	-	-	-	-
Spring Branch	58 x 18	Badger Creek	-	-	-	-
Highland	82 x 24	Badger Creek	1	Rainbow	5	7- 9-51
Murray		Under construction				
Threemile Creek Lateral	46 x 14	Threemile Creek	-	-	-	-
Wamic	64 x 18	Threemile Creek	19	Rainbow	2-7½	7-13-51
Round Prairie	64 x 18	Threemile Creek	1	Cutthroat	8	7-13-51
			12	Rainbow	2½-6	
Boulder Ditch	100 x 30	Crane Creek	1	Rainbow	2	7-16-51
Rock Creek	82 x 36 (duals)		-	-	-	-
Balch Ditch	Stationary	Fifteenmile	1	Rainbow	13½	9-11-51
			1	Rainbow	2½	
				Suckers		
Slusher	42 x 14	Fifteenmile	150	Rainbow	2-8	9-13-51
			6	Cutthroat	4-6	
			3	Trout	1	
			42	Rainbow	2-6	

NORTH COAST

STEELHEAD

The principal activity of the North Coast fishery field agent during the past year (October 16, 1950-September 30, 1951) was the accumulation of angling data by interviewing anglers along the Nestucca and Wilson Rivers. The steelhead and trout seasons were covered.

The purposes of the creel checking were:

1. To obtain a picture of the trend in angling intensity and angling success.
2. To determine the contribution of hatchery fish to the total catch.
3. To determine survival, growth and condition after stocking of hatchery fish of different sizes.
4. To determine by returns to the angler the optimum size of fish to stock and the optimum time to stock each species.
5. To obtain data on which general management practices and policies may be based.

Methods of creel checking

Bank anglers have been interviewed on the stream. Questions have been asked in order to determine: fish caught, their numbers, length, weight, sex, presence of marks and tags, number of anglers in the party, approximate number of hours fished, and, in trout checking, numbers of fish of sublegal length hooked.

Steelhead catch records

The checking of steelhead anglers was done equally on week-end days and week days, since it had been found that more steelhead anglers than trout anglers fish on week days, and that the data from both would be necessary for the calculation of a total catch estimate.

An average of between 4.0 and 4.5 hours per day was spent on steelhead checking, between the average hours of 10:00 a.m. and 3:30 p.m.

Nestucca River

Angler checking was carried on in the same areas as in the preceding season, but more attention was paid to the stream section upstream from Beaver to Boulder Creek. On twenty-six days, 1,214 anglers checked had caught 75 fish, for an average of 2.9 fish and 46.7 anglers per day. The numbers of anglers interviewed per day is thus higher by 59 per cent than the average of 29.4 for the season before. Part of the difference is due to greater coverage in the 1950-51 season and partly to an estimated 38 per cent increase

in numbers of anglers. Hours checked per day were noted during the 1950-51 season, but not for the preceding season, hence, the two cannot be compared in that regard; but the average angler is estimated to have fished a 28 per cent shorter day in the 1950-51 season, for an estimated total of angler-hours nearly the same both seasons.

The summary of angling checked (Tables 128 and 129) indicates that angling during the 1950-51 season was little over half as successful in terms of numbers of fish caught per angler-hour, as during the season of 1949-50. Part of the decline in success can be attributed to increased competition; but it is more likely that a smaller steelhead run was the principal factor involved. The same phenomenon was noted on the Wilson River and reported from other streams.

A comparison of monthly records for bank angling in the period 1949-51 shows no apparent consistency in distribution of effort or in return per angler-hour from month to month.

Boat catch records (Table 129), collected mainly from two guides who employ other guides, as well as from anglers directly, cover a much greater proportion of the total effort than do the 1949-50 records. But the numbers of boat anglers per day checked and reported in the 1950-51 season (9.3) is only 29 per cent greater than the 7.2 anglers per day during the 1949-50 season, a smaller difference than in the case of bank angling. Hence, the total catch estimate (Table 130) for boat angling, calculated as for the 1949-50 data, is not as far out of proportion as may appear.

Table 128

Nestucca River steelhead
Checked bank catch

Month	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
November	21	197	748.8	0.107	3.8	0.028	36
December	32	517	1,612.2	0.062	3.1	0.020	50
January	12	261	958.6	0.046	3.7	0.013	80
February	10	239	823.5	0.042	3.4	0.012	82
Totals	75	1,214	4,143.1	0.062	3.4	0.018	55

The estimates of total catch in Table 130 were calculated in the same manner as for the previous season, except that season length was taken as 120 days (November 12-March 11). The number of bank anglers per day is estimated as 51 and of boat anglers 7.6 (40 bank and 5.5 boat anglers per day in 1949-50). The total estimated bank catch is 56 per cent, and the estimated boat catch, 86 per cent, of the 1949-50 estimates. But the differences in rates of catch were close. The bank catch rate was 56 per cent of that in 1949-50, while the catch rate for boats was 53 per cent of the 1949-50 figure. Proportionately

greater numbers of anglers used boats during the 1950-51 season. The estimated total combined catch is 912 fish (1,356 fish in 1949-50).

Table 129

Nestucca River steelhead
Reported and checked boat catch

Month	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
November	22	46	252.5	0.48	5.5	0.087	11
December	79	127	776.5	0.62	6.1	0.102	10
January	69	160	942.5	0.43	5.9	0.073	14
February	106	266	1,580.0	0.40	5.9	0.067	15
March	32	55	334.0	0.58	6.1	0.096	10
Totals	308	654	3,885.5	0.47	5.9	0.079	13

Table 130

Nestucca River steelhead
Estimate of total catch

Method	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
Bank	480	6,150	26,700	0.078	4.3	0.018	55
Boat	432	917	5,450	0.470	5.9	0.079	13
Totals	912	7,067	32,150	0.130	4.5	0.028	35

Steelhead average size and sex ratio

Average fork length of twenty-nine male steelheads was 28.3 inches (20.7-38.5 inches), of thirty-nine females, 29.1 inches (24.2-35.0 inches), and of three jacks, 18.4 inches (16.5-19.6 inches).

Ten males averaging 28.4 inches in length (16.5-38.5 inches) had an average weight of 9.4 pounds (1.7-18.5 pounds) in the round. Thirteen gutted males whose average length was 28.6 inches (25.5-34.2 inches) weighed an average of 8.0 pounds (5.5-12.5 pounds). Loss of weight in cleaning was 15.6 per cent.

Of the female steelheads, sixteen whose average length was 29.2 inches (24.2-33.5 inches) weighed an average of 10.2 pounds (5.7-15.0 pounds) in the round. Seventeen cleaned females averaging 29.0 inches in length (24.5-35.0 inches) weighed an average of 7.9 pounds (4.8-13.3 pounds).

There was a 22.6 per cent loss of weight in cleaning.

The sex ratio of 254 steelheads, most of them not seen, was 1 male:1.06 females.

Wilson River

On the Wilson River, 928 bank anglers who had caught fifty-four steelheads were checked on twenty-six days, for an average of 2.1 fish and 35.7 anglers per day. The numbers of anglers checked per day is higher by 53 per cent than the average of 23.3 anglers per day checked the preceding season. The difference is close to that determined from the Nestucca River records and can be assumed to be based on the same factors. The catch rate (Table 131), unlike that of the preceding season, was almost identical with that on the Nestucca. Boat catch rates (Tables 129 and 132) on the two rivers were also very close.

The total catch estimates (Table 133) were calculated in the same manner as those for the Nestucca River. An estimate of forty anglers per day for bank angling and 1.7 anglers for boat angling was obtained (1949-50: 36 bank anglers, 1.2 boat anglers).

Hatchery steelhead trout

None of the marked steelheads stocked as fingerlings on March 15 and 16, 1950, was seen or reported as a jack during the 1950-51 season.

Steelhead average size and sex ratio

Eight adult male steelheads averaged 26.5 inches in length (20.5-31.2 inches) and 7.9 pounds in weight (3.2-13.1 pounds) in the round. Fourteen female steelheads average 28.9 inches in fork length (25.0-33.5 inches) and 10.1 pounds (6.0-14.9 pounds) whole weight.

The sex ratio of 72 Wilson River steelhead (most of them not seen) was 1.0 male:1.06 females.

Table 131

Wilson River steelhead
Checked bank catch

Month	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
November	5	53	121.5	0.094	2.3	0.041	24
December	17	297	838.8	0.057	2.8	0.020	49
January	13	231	752.1	0.056	3.3	0.017	58
February	14	291	785.4	0.048	2.7	0.018	56
March	5	56	150.0	0.089	2.7	0.033	30
Totals	54	928	2,647.8	0.058	2.9	0.020	49

Table 132

Wilson River steelhead
Reported and checked boat catch

Month	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
December	2	5	35.0				
January	3	8	33.0				
February	22	41	287.0				
Totals	27	54	355.0	0.50	6.6	0.076	13

Table 133

Wilson River steelhead
Estimate of total catch

Method	Number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
Bank	407	4,810	20,350	0.085	4.2	0.020	49
Boat	100	200	1,320	0.50	6.6	0.076	13
Totals	507	5,010	21,670	0.10	4.3	0.023	43

TROUT

Trout catch records, Nestucca River

Random angler-checking along the Nestucca and Wilson Rivers during the 1951 trout season was done almost entirely on week ends and holidays. The estimate of catch on week days was based on the proportion of the catch checked on week days in the 1950 season. Record books were kept by three moorages in tidewater and one resort above tide. Gross data from the bank checking by month and from reports by boat liveries are presented in Tables 134, 135, and 136.

Bank angling

As noted for the 1950 data, variations in monthly catch rate shown in Table 134 reflect increased angling success following stocking of hatchery fish. Average success as reflected in the catch per angler-hour was 25 per cent higher than in 1950 and an estimated 24 per cent more bank anglers were active than in 1950. Good angling in 1951 was more uniformly spread throughout the season. Much of the improvement is to be credited to the stocking of fall rainbow trout, mostly of legal length, in late April which made the May angling 50 per cent better. The June angling was

Table 134

Nestucca River trout season, 1951 checked bank catch

Month	Number of fish: Cutthroat Wild	Cutthroat Hatchery 1949	Cutthroat Hatchery 1950	Cutthroat Hatchery 1951 Ad. & l.pect.	Cutthroat Hatchery 1951 No mark	Rainbow hatchery	Silver salmon hatchery	Steelhead fingerlings	Jacks	Total Number of fish	Number of anglers	Number of angler hours	Number fish per angler	Angler-day in hours	Fish per angler hours	Angler-hours per fish
April	72		5				1	10		88	138	520	0.64	3.8	0.17	5.9
May	41	1	2			110		9		163	173	526	0.94	3.0	0.31	3.2
June	56		1			30		2		89	124	323	0.72	2.6	0.28	3.6
July	63			52		39			1	155	196	486	0.79	2.5	0.32	3.1
August	70			38	82	4				194	150	418	1.29	2.2	0.46	2.2
September	38			6	7	3			1	44	84	191	0.64	2.3	0.28	3.5
Totals	340	1	8	96	89	186	1	21	2	744	865	2,464	0.86	2.8	0.30	3.3

Table 135

Nestucca River trout season, 1951
Reported catch, tidewater boats

Total number of fish	Cutthroat Wild	Cutthroat Hatchery 1950	Cutthroat Hatchery 1951	Rainbow Hatchery	Silver salmon Hatchery	Jacks
2,665	2,371	5	116	48	78	47

Table 136

Nestucca River trout season, 1951
Reported and checked catch, boats above tidewater

Month	Number of fish										Total number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
	Wild	Cutthroat				Rainbow hatchery	Silver salmon hatchery	Steelhead fingerlings	Jacks								
		1949	1950	1951 Ad. & 1. pect.	1951 No mark												
April	255		6			6					267	64	439	4.2	6.9	0.61	1.6
May	126		6			133					265	47	312	5.6	6.6	0.85	1.2
June	59		1			19					79	13	81	6.1	6.2	0.98	1.0
July	45		1								46	10	41	4.6	4.1	1.12	0.9
August	42			10							52	10	75	5.2	7.5	0.69	1.4
September	15			5							20	2	13				
Totals	542		14	15		158					729	146	961	5.0	6.6	0.76	1.3
Corrections	409	1	14	118	5	158	1	21	2								

slightly better in 1950 owing in part to the contribution of cutthroats stocked in May. July also was slightly better in 1950, possibly because cutthroats, about 77 per cent of which were legal, were stocked just before the middle of the month, while during the past season, cutthroats, 84 per cent of which were of legal length, were stocked ten to twelve days later than were the 1950 trout. August was 100 per cent better in 1951 because of the contribution by the July release and by an almost equally heavy plant of cutthroats on August 3 and 4. The August fish were part of an overrun and had not been originally allocated. September also was over 100 per cent better in 1951.

Possibly, the past season should have been even better than it was in comparison with that of 1950, since nearly 300 per cent more trout of legal length were stocked above tidewater in 1951. When the catch rates for hatchery trout are isolated, it is found that the rate for trout released in 1950 was 0.084 fish per angler-hour, while that of 1951 was 0.151 fish per angler-hour, 80 per cent higher. The catch rate for wild trout was 6.1 per cent higher in 1950, indicating that, though the larger stockings may have taken some pressure off the wild trout population, the relief was not in proportion to the increase in stockings. Nevertheless, hatchery fish are becoming increasingly important to the fishery, as is evidenced by the proportions of hatchery trout in the checked catches: 27.7 per cent in 1949, 34.5 per cent in 1950, and 54.3 per cent in 1951.

A comparison of bank-catch rates for trout the past four seasons is given in Table 137.

Boats above tidewater

The catch rate for boats above tide (Table 136) was 9.5 per cent lower than in 1950, and 22 per cent lower than in 1949. Early low water in the 1951 season was hard on boaters, being responsible in part for reducing their estimated numbers by some 40 per cent. The shortened season was also a factor in the reduction.

Table 137

Nestucca River
Annual averages, trout season bank catch

Year	Fish per angler	Angler-day, in hours	Fish per angler-hour	Angler-hours per fish
1948[1]	1.1	4.4	0.26	3.8
1949[2]	0.66	2.9	0.23	4.4
1950[3]	0.63	2.7	0.24	4.2
1951[3]	0.86	2.8	0.30	3.3

1. Includes all Nestucca and Sand Creek angling.
2. Includes Nestucca bank above tidewater.
3. Includes Nestucca bank above and in tidewater.

Boats in tidewater

For the first time in the past three or more years, trout were stocked directly into tidewater in April and July, 1951. Although only some 250 fall rainbows and 500 cutthroats figured in the stockings, they have been given much credit for the improved angling. That the effect of the releases may have been mainly psychological is suggested by the finding that the estimated total catch from the plants, though 52 per cent of the estimated numbers stocked, was only 5.8 per cent of the total estimated catch in tidewater.

Tidewater boats enjoyed a 40 per cent increase in rate of catch over 1950 (from 0.14 to 0.20 fish per angler-hour). The 1951 rate was double that of 1949. Numbers of anglers in 1951 are estimated to have been lower than in 1950 by 15 per cent, and 5 per cent higher than in 1949.

A comparison of trout-season catch rates for tidewater the past four seasons is presented in Table 138.

Table 138

Annual averages for trout-season catch reported by a Nestucca tidewater moorage

Year	Fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
1948	0.55	4.6	0.12	8.3
1949	0.41	4.3	0.10	10.4
1950	0.51	4.2	0.14	6.9
1951	0.70	3.5	0.20	4.9

Total trout-season catch estimate

Estimates of total catch by bank and boat anglers above tidewater were made as reported in the 1950 annual report.

The method of estimation for boats in tidewater was altered to correspond with the finding that the numbers of private boats on the river roughly equal total numbers of moorage boats, whereas in the 1950 report, it was estimated that numbers of fish caught by private boats equaled the average number of fish caught by boats from five moorages.

In Table 139 are given the estimates of total catch by bank and boat anglers above tide and by boat anglers in tidewater, the last calculated on the revised basis. Table 140 revises the 1949 and 1950 tidewater boat estimates in the same manner.

Stockings, Nestucca River

On March 21, 1951, 7,622 silver salmon yearlings, marked both ventrals were stocked at four places on Three Rivers, tributary to the Nestucca River. The fish were 4.9 to the pound, with an average total length of 8.2 inches. Over half of the silvers were in the 5 to 7-inch groups, but a few were 12-14 inches in length. It was expected that the

Table 139

Nestucca River trout season, 1951
Estimates of total catch

Area and Method	Numbers of fish									Total number of fish	Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
	Cutthroat					Rainbow hatchery	Silver salmon hatchery	Steelhead fingerlings	Jacks							
	Wild	Hatchery														
		1949	1950	1951 Ad. & l. pect.	1951 No mark											
Bank	1,994	6	47	567	526	1,098	6	124	12	4,380	5,090	14,500	1.3	4.2	0.30	3.3
Boats above tide	930	2	16	188	10	366	2	42	4	1,560	292	1,922	5.0	6.6	0.76	1.3
Boats tide	5,778	10	12	270	0	118	190	188	114	6,680	7,650	32,732	0.7	3.5	0.20	4.9
Totals	8,702	18	75	1,025	536	1,582	198	354	130	12,620	13,032	49,154	0.97	3.8	0.26	3.9

Table 140

Nestucca River tidewater trout season
Revised estimates of total boat catch

Year	Number of cutthroats: Wild	Hatchery: 1949	Hatchery: 1950 May	Hatchery: 1950 July	Total number of trout	Number of anglers	Number of angler-hours
1949	2,900	37	-	-	2,937	7,200	29,200
1950	4,930	10	15	15	4,970	9,740	35,600

silvers would quickly run out to sea. The purpose of the marking experiment was to assess the return of adult fish to the Three Rivers' racks. Considerable numbers lingered in the river until after the opening of the trout season, three weeks later. Though few silvers were found in creels, since most bank checking was done above Three Rivers, several reports were received of the salmon being taken as trout. The estimate of total catch, being based on checking, shows only six silvers caught by bank anglers and two by boat anglers above tidewater, but probably several times that many were taken, possibly one hundred to two hundred fish. Tidal boat anglers are estimated to have caught 190 silvers, so the total may well be 300 or more. That figure would represent only about 4 per cent of the total number stocked, though 46 per cent of the silvers were of legal length (8 inches in coast waters) when marked.

A few of the silvers have been reportedly taken as jacks, two of them from the ocean close to the mouth of the Nestucca River, and a considerable run of marked silver jacks (including mature females under 20 inches in length) arrived at the Three Rivers' racks.

On April 24 and 25, 1951, 3,783 marked fall rainbow trout were stocked into the main Nestucca River from near Woods in tidewater up to Testament Creek in sixteen places. The run-of-the-pond fish were about 80 per cent of legal length, but those marked were hand picked in order to eliminate runts and were 92 per cent of legal length (three fish per pound, 9.8 inches, average total length).

During the season, the rainbows seemed to stray as little as hatchery cutthroats from stocking points. They were more difficult to catch than cutthroats and thus lasted longer. The condition of the rainbows held up well after their release, not dropping rapidly as in the case of most hatchery cutthroats checked.

Opinion varied as to the fighting and eating qualities of the fall rainbows. In general they were considered superior to cutthroats of equal size. Rainbows did not rise to a dry fly as well as had been hoped, but flies proved more tempting to them than to cutthroats.

On July 23, 1951, 3,000 marked cutthroat post-yearlings were released into the main Nestucca River at nineteen places, including two in tidewater. The trout averaged 9.2 inches in total length (84 per cent were of legal length) when released. While marking, it was noted that the fish

were thinner and more vigorous than were those of the July, 1950, stocking. In the stream, the trout kept their initial condition better, possibly because they had less to lose.

On August 1-4, 1951, 2,856 unmarked cutthroat post-yearlings were stocked into the main Nestucca River above Blaine (Moon Creek). The trout could be recognized for most of the remaining open season by hatchery characteristics, such as bent fin-rays.

Estimated total catch of hatchery fish

Data on the estimated numbers of marked hatchery fish caught by anglers, and their proportion of the stockings (Table 141) are revised for the 1949 and 1950 seasons on the new basis of estimating numbers of tidewater fish caught. It is evident that the survivors from cutthroat stockings of past years are insignificant and cannot be counted upon in stream-management planning.

Tagged trout

No tags from previous years were found or returned during 1951 on the Nestucca River. Only rainbow trout were tagged in 1951. From the 152 tagged rainbows, thirty-two tags were recovered (21.0 per cent). The tagged fish had been mixed in with a load which was scattered from tidewater up to the first bridge above Beaver, and a few in Three Rivers (from which two tags were returned).

Three tags (9.4 per cent of the tags recovered) were reported from the area 0.3-2.2 miles above the highest point of stocking. From tidewater, four tags were recovered, which indicates that downstream movement was no more than, if as much as, upstream movement. But fish that moved downstream may have entered salt water and thus have been relatively unavailable to anglers.

Of tags recovered, only six (18.8 per cent) were from fish seen and measured by Game Commission personnel. Five fish taken on May 5 and 13 had grown an average of 0.06 inch in length since stocking (April 25). Six fish whose lengths were reported by anglers (caught June 2-28) had grown an average of 1.67 inches. Four more angler-reported fish (caught July 22-September 30) had grown an average of 0.25 inch. Some tagged rainbows may be reported as steelhead if they go to sea and return. The degree of straying as steelhead may also be determined.

Length-frequencies of Nestucca River angler-caught trout

Wild cutthroats caught by Nestucca River anglers in the 1951 season exhibit a greater range in length (Table 142) than do hatchery trout. Of the hatchery fish, the April rainbow trout were generally superior in length to the later-planted cutthroats. Only one 1949 hatchery cutthroat was measured; it was 12.3 inches in total length. Seven May, 1950, hatchery cutthroats averaged 10.7 inches in length (9.9-12.2 inches).

Table 141

Nestucca River trout season, 1951
Estimated total catch of hatchery fish

Stocking Year	Stocking Month	Species	Number stocked	Number of fish estimated caught* 1949 Number of fish	1949 Percentage of stocking	1950 Number of fish	1950 Percentage of stocking	1951 Number of fish	1951 Percentage of stocking	Total Number of fish	Total Percentage of stocking
1949	April	Cutthroat	3,069	1,150	37.5	44	1.43	18	0.59	1,212	39.5
1950	May	Cutthroat	9,150			1,078	11.8	75	0.82	1,153	12.6
	July	Cutthroat	2,800			1,056	37.7			1,056**	37.7
1951	April	Rainbow	3,783					1,583	41.8	1,583	41.8
	July	Cutthroat	3,000					1,025	34.2	1,025	34.2

* Revised estimates
** Plus an unknown but probably negligible number taken in the 1951 season.

Table 142

Nestucca River trout season, 1951
Length-frequencies of angler-caught trout

Length-group, inches	Cutthroat						Rainbow	
	Wild		Hatchery				Hatchery	
			July		August			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
8-10	205	57.4	54	63.5	60	64.5	101	46.5
10-12	93	26.1	30	35.3	32	34.4	112	51.7
12-14	30	8.4	1	1.2	1	1.1	4	1.8
14-16	25	7.0						
16-18	4	1.1						

Wilson River trout catch records, bank angling

The checking of bank anglers along the Wilson River in the trout season of 1951 (Table 143) revealed that success, measured in rate of catch, averaged 86 per cent higher than in 1950, being much better in 1951 in all months except April and July and more uniformly distributed by month. The finding parallels that for the Nestucca River and is due to parallel rainbow and cutthroat stockings.

Total bank catch is estimated (Table 145) to have been 56 per cent greater in 1951 than in 1950, and numbers of anglers 46 per cent greater in 1951. The estimated numbers of wild trout taken decreased by 15 per cent of the estimated 1950 catch. Hatchery trout made the difference, being more commonly found in creels than wild trout in all months except April (before the rainbow trout stocking).

The Wilson River average bank catch rate was only 13 per cent less than that for the Nestucca, a great improvement over the 42 per cent lower rate in 1950.

Boat catch

The boat catch by months reported in Table 144 is based on records supplied by a moorage in tidewater which does probably 90 per cent of the boat business. Some of the early-season angling was done above tidewater, but most of the effort was expended in tidewater.

The first striking difference between the 1951 record and that for 1950 is the much greater angling intensity and catch in 1951. It is believed that most of the difference is due to more complete reporting in 1951.

The rate of catch in 1951 was 55 per cent greater than the 1950 rate and 112 per cent greater than the Nestucca tidewater rate.

Total estimated catch (Table 145) was taken as twice the reported catch to make up for private boats not checked or reported.

Wild trout formed 80 per cent of the reported boat catch, though only 20 per cent of the checked bank catch. Seventy per cent of the catch

Table 143

Wilson River trout season, 1951
Checked bank catch

Month	Total	Number of fish						Number of anglers	Number of angler-hours	Number of fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
		Cutthroat			Rainbow hatchery	Steelhead fingerlings	Jacks						
		Wild	Hatchery 1950	Hatchery 1951									
April	15	14	1					105	235	0.14	2.2	0.064	15.7
May	114	13	4		94	3		173	357	0.66	2.1	0.32	3.1
June	76	13			63			111	322	0.68	2.9	0.24	4.2
July	44	11		21	11		1	111	212	0.40	1.9	0.21	4.8
August	104	12		81	10		1	123	253	0.85	2.1	0.41	2.4
September	37	17		19	1			71	130	0.52	3.5	0.28	3.5
Totals	390	80	5	121	179	3	2	694	1,509	0.56	2.2	0.26	3.9

Table 144

Wilson River trout season, 1951
Reported boat catch, mainly tidewater

Month	Total	Number of fish				
		Cutthroat			Rainbow	Jacks
		Wild	Hatchery		Hatchery	
			1950	1951		
April	447	431	1		15	
May	145	113			32	
June	43	22			21	
July	44	6		13	25	
August	180	104		71	4	1
September	109	96				13
Totals	968	772	1	84	97	14

Total number of anglers	422
Total number of angler-hours	2,161
Number of fish per angler	2.3
Angler-day in hours	5.1
Number of fish per angler-hour	0.45
Number of angler-hours per fish	2.2

of wild trout was made in April and May and presumably consisted in large part of downstream fingerlings and spent sea-run cutthroat trout. Thirteen per cent more were caught in August when bluebacks were returning from salt water.

Hatchery trout

On April 24 and May 2, 1951, 4,000 marked fall rainbow trout were stocked for the first time into the Wilson River at sixteen places from tidewater up to Lee's Bridge. The fish were uniform with those released into the Nestucca River. The mark used was adipose and left maxillary tip. The maxillary mark proved to be difficult to make uniformly, the tendency being to clip so short that the straight edge was soon rounded off with new soft tissue, or too close so that the clipped end of the maxillary caught on the corner of the mouth causing a sore, or protruded into the mouth. But the fish seemed to keep up their good condition despite the handicap.

On July 24 and 30, 1951, 3,000 marked cutthroats, uniform with the Nestucca trout as to size and age, were stocked into the Wilson at seventeen places from tidewater up to Lee's Bridge.

Total stockings in 1951 were less than those of 1950 by nearly half, but were about twice as great in numbers of legal fish.

Estimated total catch of hatchery fish

The difference between the return to the angler of the July cutthroats

Table 145

Wilson River trout season, 1951
Estimates of total catch

Area and method	Total	Number of fish						Number of anglers	Number of angler-hours	Number fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
		Cutthroat			Rainbow	Steelhead	Jacks						
		Wild	Hatchery 1950	Hatchery 1951	Hatchery	fingerling							
Bank	2,500	510	35	775	1,150	20	10	2,975	9,620	0.84	3.3	0.26	3.8
Boats	1,936	1,524	2	168	194	20	28	844	4,300	2.30	5.1	0.45	2.2
Totals	4,436	2,034	37	943	1,344	40	38	3,819	13,920	1.16	3.6	0.32	3.1

in 1950 and 1951 (Table 146) is difficult to understand when it is realized that the 1950 trout were almost as large in average length, that they were released two to three weeks earlier, and that the season was longer, permitting a greater angling effort. But the catch of July trout slowed down in September, 1950, to 0.7 per cent of the August numbers in the checked catch, none being recorded in October; while in 1951, the September checked catch of July trout was 23.5 per cent of the August catch. The 1950 trout were unmarked, making recognition less easy after one to two months in the river. Yet numbers of wild trout checked in 1950 were also small in September and October. If all the wild trout checked were hatchery fish, then the total return would still have been only 16.3 per cent of the stocking.

Tagged rainbow trout

Of the rainbow trout stocked in April and May, 150 were jaw-tagged. The tagged fish were mixed in with a load which was distributed between Jordan Creek and Lee's Bridge. Tags recovered numbered twenty-five, or 16.7 per cent of the stocking. Only two of the total were checked by Game Commission personnel. Those examined were caught on May 12 and 26 and showed practically no growth in length. Six lengths from May-caught rainbows reported by anglers had grown an average of 0.5 inch (0-1.6 inches) in length. Three June-caught rainbows averaged 0.7 inch in growth (0.3-1.2 inches). A couple of rainbows taken in August showed zero and 1.9 inches growth.

Three tags were recovered 0.7-2 miles below the lowest release. As in the Nestucca River, there was little apparent migration from stocking sites.

Table 146

Wilson River trout season, 1951
Estimated total catch of hatchery fish

Year and month of stocking	Species	Number stocked	Number of fish estimated caught 1950 Number of fish	1950 Per cent of stocking	1951 Number of fish	1951 Per cent of stocking
1950, March	Cutthroat	10,050	30	0.3	37	0.27
July	Cutthroat	3,812	506	13.3		
1951, April						
May	Rainbow	4,000			1,344	33.6
July	Cutthroat	3,000			943	31.4

Two tags were recovered from cutthroats of the March, 1950, release. All of the tagged trout had been planted at the head of tidewater. One recovery was from a spot about 7 miles above the stocking point on April 14, 1951. The fish had grown from 6.4 to 10.0 inches in length. The second tag was taken from tidewater on April 28, 1951. The length of the fish was not reported.

Length-frequency distribution of Wilson River trout catch

Trout caught by anglers from the Wilson River the past season were fairly uniform in length-distribution (Table 147) with Nestucca River trout.

Three 1950 hatchery cutthroats averaged 10.2 inches (9.8-10.5 inches) in length.

Table 147

Wilson River trout catch, 1951
Length-frequencies of angler-caught trout

Length-group, inches	Cutthroat				Rainbow	
	Wild		Hatchery, 1951		Hatchery	
	Number	Percentage	Number	Percentage	Number	Percentage
8-10	40	48.2	78	69.0	61	49.2
10-12	22	26.5	34	30.1	60	48.4
12-14	10	12.1	1	0.9	3	2.4
14-16	8	9.6				
16-18	3	3.6				

Ratio: legal/sublegal fish

As in 1950, so in the past trout season, bank anglers were asked how many sublegal fish had been hooked and released. Table 148 presents a comparison of results for the last two seasons.

The Wilson River, which showed much variation in ratio from month to month of the 1950 season, was relatively very steady in the 1951 season. A lowered ratio for both streams is probably attributable to a greater abundance of legal fish. The same factor is probably responsible for the reduction in numbers of sublegals per angler.

Nehalem River, trout season

During the summer of 1951, a moorage at Nehalem and another at Mohler on the tidewater of the Nehalem River kept boat catch records of sufficient amplitude to make a summarization (Table 149).

The catch rate is little over half that of Nestucca tidewater boats and about a quarter that on the Wilson.

Fish Commission trout tagging

At the Spring Creek weir of the Oregon Fish Commission, a mile below Lee's Bridge on the Wilson River, sixty-nine cutthroat trout and forty steelhead fingerlings have been tagged between October 10, 1950, and September 30, 1951. Tags were supplied by the Game Commission.

Total numbers of trout in runs for the year, October 1, 1950-September 30, 1951, were: upstream, 95 cutthroats and 212 steelhead fingerlings; downstream, 77 cutthroats, 130 steelhead fingerlings, and 9 trout post-larvae.

Table 148

Nestucca and Wilson Rivers, trout season, 1950-51
Ratio of legal to sublegal fish hooked by bank anglers

Stream	Year	Ratio legal/sublegal	Number of sublegals per angler
Nestucca River	1950	1 : 6.3	3.9
	1951	1 : 3.3	3.3
Wilson River	1950	1 : 7.7	2.3
	1951	1 : 3.6	2.1

Table 149

Nehalem River trout season, 1951
Reported catch, tidewater boats

Place	Number of trout	Number of anglers	Number of angler-hours	Number of fish per angler	Angler-day in hours	Fish per angler-hour	Angler-hours per fish
Nehalem	42	60	428	0.70	7.1	0.098	10.0
Mohler	146	182	1,135	0.80	6.2	0.129	7.8
Totals	188	242	1,563	0.78	6.5	0.120	8.3

In the upstream runs, between October 10, 1950, and March 26, 1951, thirty-seven cutthroats were 5.9-10.4 inches in fork length and twenty-six steelheads 5.9-7.1 inches in length. Fish over 6 inches in length were tagged and those under that size were marked by clipping the upper lobe of the caudal fin.

Of downstream fish examined between March 30 and June 29, 1951, forty-two cutthroats were 5.9-10.6 inches in fork length and thirty-three steelheads were 5.8-7.0 inches in length.

Ten (37 per cent) of twenty-seven upstream tagged cutthroats returned downstream between March 26 and May 4, 1951, and four (57 per cent) of seven upstream-tagged steelhead fingerlings from January 30 to May 4, 1951.

Of downstream tagged cutthroats, 18.8 per cent of all and 33.3 per cent of the legal fish were taken by anglers from the main river,8 within 3 miles below the weir and one near the head of tidewater (April 14-June 2, 1951). More tagged trout were probably caught and not reported. But the above-reported proportion of the trout of legal length caught by anglers is close to the proportions of hatchery trout estimated to have been caught during the 1951 season.

MANAGEMENT

Steelhead trout

The protection afforded to fingerling steelheads by the 8-inch minimum length limit is witnessed to by the finding that, while on the Nestucca River in 1951 an estimated 8,702 wild cutthroats were being taken, the total estimated catch of steelhead fingerlings is only 4.1 per cent as much (354 fish). On the Wilson River, which has a proportionately larger steelhead run, the estimated catch of wild cutthroats was 2,034 fish and that of steelhead fingerlings 2.0 per cent as much (forty fish). And, whereas wild cutthroats were caught during all months of the season, steelheads appeared in creels only in April, May and June on the Nestucca and in May on the Wilson, months during which young steelhead migrate downstream to salt water.

In the 1950 Annual Report, it was stated that: "The 8-inch limit may have begun to fulfill one of its purposes..." since the "winter steelhead bank catch rate on the Nestucca River has increased..." It is reported above, however, that the 1950-51 catch rate shows a severe drop in relation to that of the preceding season. Up to the present, then, it is impossible to determine what effect the 8-inch size limit has had on returns of adult steelhead.

The proportion of adult steelhead runs taken by anglers is a subject demanding further study. For a thorough determination of the proportions, some fool-proof, nature-proof method of trapping fish, regardless of river volume and velocity, is needed. In the absence of such a tool, a couple of rough estimates are offered here.

During the period January 30-February 28, 1942, a total of 802 steelheads were examined in two packing sheds at Bay City on Tillamook Bay. At least two-thirds of the fish (534, or twenty per day on twenty-six days) came from Wilson River gill nets. On the basis of average estimated total catch by anglers the past two seasons, Wilson River anglers took, at the most, 170 fish in the same length of time (6.5 fish per day) or a quarter of the minimum numbers available (net-catch plus estimated angler-catch).

Counts of steelheads trapped at the Three Rivers' racks were made by hatchery personnel between December 1 and 31, 1950. It is estimated that at least 450 steelheads went upstream during that period. Included in the number are a hypothetical 150 fish as the number that passed over the racks uncounted during freshets. Between the same dates, anglers on the main Nestucca are estimated to have caught only 390 steelheads. On the basis of comparative lengths of stream, 10 miles for Three Rivers above the racks and 80 miles for the main Nestucca and its principal tributaries above Three Rivers, the main river would have had a run of 3,600 fish in December. The anglers, then, would have taken but 11 per cent of the run.

Cutthroat trout

All that was said in the 1950 Annual Report concerning the management of the summer trout fishery is as applicable today. Blocking of small streams used by cutthroats for spawning and destruction of spawning beds is still the chief problem in the maintenance of wild trout populations. The

innovation of stocking fall rainbow trout on the coast and its success in filling early season voids have shown us how natural trout production can well be supplemented. That the continuance of hatchery production and even its increase will be necessary for many years to come is the inevitable consequence of the logging off of watersheds and increased angling pressure. Streams in logged-off areas cannot become again the producers of cutthroat trout they once were until, after two or three generations of strict forest management, the damp forest cover is replaced and the water-holding capacity of the forest soil is regenerated.

Distribution of angling pressure

A striking feature of the estimates of total trout-season catch is the preponderance of the estimated tidewater catch over the estimated catch by bank anglers and boat anglers above tide, especially where wild trout are concerned. On the Nestucca tidewater, 59 per cent of the estimated total number of anglers, fishing on 30 per cent of the commonly fished stream-length, took 66 per cent of the estimated total of wild trout for the entire river. On the tidewater Wilson, 22 per cent of the anglers, fishing 17 per cent of the open stream, took 75 per cent of the estimated total of wild trout. It is obvious that tidewaters are areas of concentration used by cutthroats migrating to and from salt water. They are areas of brackish water in which trout may become adjusted to changes in salinity.

Although the rate of catch in tidewater has been lower than the upstream bank rate, the easy trolling by boat attracts a disproportionate number of anglers. Since the release of hatchery trout into tidewater did well and returned at least as high a proportion of hatchery fish to the angler as did stockings above tide, larger releases of hatchery trout into tidal areas might aid in reducing pressure on wild trout. On the other hand, increased angling pressure, attracted by larger releases, could result in still greater total catches of wild trout. In any case, the large proportionate numbers of anglers using tidewater should draw more consideration for the brackish water areas in future stocking plans.

As to the differential catch of hatchery trout, the rainbows returned larger proportions of stocked numbers to the angler above tidewater, while the planted cutthroats came to the creel best in tidewater on both the Nestucca and Wilson Rivers. Hence, a slanting of rainbow stockings to the upper stream, with larger releases of cutthroats into tidal areas, is indicated. But the stockings into tidewaters of both species could be considerably increased.

SAND CREEK WEIR CUTTHROAT TROUT STUDY

Upstream run of 1949

The age of upstream sea-run cutthroats trapped at the Sand Creek weir during the fall and early winter of 1949 (to December 31), not included in the 1950 Annual Report, is summarized below (Tables 156 and 157) in conjuntion with a revision of the age data from the three previous runs (Tables 150 to 155). Only wild trout are included in the tables, which explains the differing numbers of trout in these and the preceding tables (annual reports of 1947, 1948 and 1949).

Methods of revision of scale readings

Since the report on scales from cutthroats of the 1948-49 run was written, it has been concluded that some tidewater annuli and some injury checks occurring soon after the trout has entered the ocean cannot be clearly enough distinguished in all cases so that it may be said definitely that they are in one or the other category. In some cases, such checks may even mark a revisit of the trout in tidewater after part of the ocean growth has been completed. Some supposed tidal growth may be rapid stream growth, which takes place when a fish becomes large enough to start feeding on small fish. In the following revision of previous work, which involved a re-examination of all scale samples, scales have not usually been discarded because of uncertainty as to whether a check indicated one aspect of growth or another. In doubtful cases, classification has been based on examples offered by marked trout of known age. Only three specimens have been excluded from the revised 1946-47 run data, three added to the 1947-48 data, and two hatchery trout excluded from the 1948-49 data.

Table 150

Cutthroat trout age-length relationship
Sand Creek weir--upstream trap, 1946-47

Length inches	Number of annuli									Total	Percentage of total
	2	3	4	5	6	7	8	9	10		
11-11.9		1	7	3	1					12	9.6
12-12.9			16	16	3					35	28.0
13-13.9			14	16						30	24.0
14-14.9			4	13	4					21	16.8
15-15.9	1		3	4	7					15	12.0
16-16.9				1	5	1	1		1	9	7.2
17-17.9					1	1				2	1.6
18-18.9					1					1	0.8
Total	1	1	44	53	22	2	1	0	1	125	
Percentage of total	0.8	0.8	35.2	42.4	17.6	1.6	0.8		0.8		
Average fork length inches	15.9	11.9	13.0	13.4	15.2	16.6	16.1		16.9		

Table 151

Cutthroat trout age and previous spawning
Sand Creek weir--upstream trap, 1946-47

In year	Annuli stream	Annuli sea	Number previously spawned			Total number	Percentage of total number
			1	2	3		
2	1	1				1	0.8
3	2	1				1	0.8
4	2	2	5			5	4.0
	3	1				39	31.2
5	2	3		1		1	0.8
	3	2	12			12	9.6
	3	2				1	0.8
	4	1				39	31.2
6	3	3		8		8	6.4
	4	2	8			8	6.4
	5	1				6	4.8
7	4	3		2		2	1.6
8	5	3		1		1	0.8
9						0	
10	6	4			1	1	0.8
Total number			25	12	1	125	
Percentage of total			20.0	9.6	0.8		

Table 152

Cutthroat trout age-length relationship
Sand Creek weir--upstream trap, 1947-48

Length inches	Number of annuli							Total	Percentage of total
	3	4	5	6	7	8	9		
10-10.9		3		1				4	4.2
11-11.9		2	2					4	4.2
12-12.9		8	7	7				22	23.2
13-13.9	3	3	4	3	1			14	14.8
14-14.9		5	19	10	1			35	36.9
15-15.9	1	1	6	2	2			12	12.6
16-16.9			1				1	2	2.1
17-17.9				1				1	1.0
18-18.9		1						1	1.0
Total	4	23	39	24	4	0	1	95	
Percentage of total	4.2	24.2	41.1	26.3	4.2		1.0		
Average fork length inches	13.8	13.1	14.0	13.7	14.5		16.6		

Table 153

Cutthroat trout age and previous spawning
Sand Creek weir--upstream trap, 1947-48

In year	Annuli stream	Annuli sea	Number previously spawned 1	2	3	Total number	Percentage of total number
3	2	1				4	4.22
4	2	2	4			4	4.22
	3	1				19	20.00
5	3	2	23			23	24.25
	4	1				16	16.85
6	3	3		1		1	1.05
	4	2	15			15	15.80
	5	1				8	8.42
7	4	3		1		1	1.05
	5	2	2			2	2.10
	6	1				1	1.05
8						0	
9	5	4			1	1	1.05
Total number			44	2	1	95	
Percentage of total			46.40	2.11	1.05	49.56	

Table 154

Cutthroat trout age-length relationship
Sand Creek weir--upstream trap, 1948-49

Length inches	Number of annuli 3	4	5	6	7	Total	Percentage of total
10-10.9	1					1	1.2
11-11.9	1	2	4			7	8.7
12-12.9	1	14	4			19	23.8
13-13.9		9	10	3		22	27.5
14-14.9	1	7	8	2	1	19	23.8
15-15.9		1	5	4		10	12.5
16-16.9				1	1	2	2.5
Total	4	33	31	10	2	80	
Percentage of total	5.0	41.3	38.7	12.5	2.5		
Average fork length inches	11.8	12.8	13.3	14.1	15.3		

Table 155

Cutthroat trout age and previous spawning
Sand Creek weir--upstream trap, 1948-49

In year	Annuli stream	Annuli sea	Number previously spawned 1	2	3	Total number	Percentage of total number
3	2	1				4	5.00
4	2	2	1			1	1.25
	3	1				32	40.00
5	3	2				1	1.25
	3	2	9			9	11.25
	4	1				22	27.50
6	3	3		2		2	2.50
	4	2	3			3	3.75
	4	2				1	1.25
	5	1				3	3.75
7	4	3		1		1	1.25
	5	2	1			1	1.25
Total number			15	3	0	80	
Percentage of total			18.75	3.75		22.50	

Table 156

Cutthroat trout age-length relationship
Sand Creek weir--upstream trap, 1949

Length inches	Number of annuli 3	4	5	6	Total	Percentage of total
10-10.9		1			1	1.3
11-11.9	1	1	3		5	6.6
12-12.9	1	13	12	2	28	36.8
13-13.9		3	14	5	22	29.0
14-14.9		4	2	7	13	17.1
15-15.9		1	4	2	7	9.2
Total	2	23	35	16	76	
Percentage of total	2.6	30.3	46.1	21.0		
Average fork length inches	11.9	12.9	13.3	14.1		

Table 157

Cutthroat trout age-length relationship
Sand Creek weir--upstream trap, 1949

In year	Annuli stream	Annuli sea	Number previously spawned 1	2	3	Total number	Percentage of total number
3	2	1				2	2.6
4	2	2	2			2	2.6
	3	1				21	27.6
5	3	2	6			6	7.9
	4	1				29	38.2
6	4	2	9			9	11.9
	5	1				7	9.2
Total number			17	0	0	76	
Percentage of total			22.4				

Trends in Sand Creek cutthroat runs

In the course of the weir experiment, the number of age groups of upstream sea-run cutthroat trout has tended downward, as have also maximum lengths and number of previous spawnings. In respective runs from that of 1946-47 to that of 1949, the maximum numbers of annuli have been 10, 9, 7, and 6 (Table 158), and the maximum lengths (in inch groups) 18, 18, 16, and 15 (Table 159). But only 0.8 per cent of all 376 fish treated were in the 8-10 annulus groups and only 1.3 per cent in the 17- and 18-inch groups. In the first two runs were fish which had spawned three times previously, in the third were fish that had spawned twice before, while in the last run only fish with one prior spawning were represented.

The cause of the aforementioned reduction in numbers of size and age groups could lie in more than one direction. It may be that increased angling pressure, especially at the Sand Lake Island County Park, had begun to crop down the old age classes. Increased predation in the sea is another possibility.

In Tables 158 and 159 are analyzed the age and length distribution of Sand Creek upstream sea-run cutthroat trout by season of migration, in terms of percentage of total numbers. It is believed that the 1946-47 run was the most normal, while that of 1947-48 was the most abnormal because of large relative numbers of repeats from the previous upstream migration, reflected in the proportions of the run in the 6- and 7-annulus, and the 14-inch, groups.

Calculation of growth

In previous work on trout growth as calculated from scale measurement, allowance has often been made for average length of fish when scales first appear, usually at a body length of 1 to 2 inches. The method used for the calculation of average length at each annulus in Table 161 is based on direct proportion between body length and scale radius with no correction for

Table 158

Sea-run cutthroat trout, upstream runs, Sand Creek weir
Percentage age distribution by season of migration

Number of annuli	1946-47	1947-48	1948-49	1949
2	0.8	0	0	0
3	0.8	4.0	5.0	2.6
4	35.2	24.0	41.3	30.3
5	42.4	41.0	38.7	46.1
6	17.6	26.0	12.5	21.0
7	1.6	4.0	2.5	0
8	0.8	0	0	0
9	0	1.0	0	0
10	0.8	0	0	0
	100.0	100.0	100.0	100.0
Number of cases	125	95	80	76

Table 159

Sea-run cutthroat trout, upstream runs, Sand Creek weir
Percentage length distribution by season of migration

Fork length inches	1946-47	1947-48	1948-49	1949
10-10.9	0	4.2	1.2	1.3
11-11.9	9.6	4.2	8.7	6.6
12-12.9	28.0	23.2	23.8	36.8
13-13.9	24.0	14.8	27.5	29.0
14-14.9	16.8	36.9	23.8	17.1
15-15.9	12.0	12.6	12.5	9.2
16-16.9	7.2	2.1	2.5	0
17-17.9	1.6	1.0	0	0
18-18.9	0.8	1.0	0	0
	100.0	100.0	100.0	100.0
Number of cases	125	95	80	76

body length at scale formation. Though it is probable that scales are not formed until an average length of about 1.5 inches is reached (based on sketchy microscopic examination of skin from the posterior lateral-line area), the method used accords well with empirical data from periodic seinings in small Sand Creek tributaries, streams in which no fish larger than 5 to 6 inch cutthroats were found.

Table 160

Time-length distribution of cutthroat fingerlings seined from small Sand Creek tributaries, by per cent of total number each month 1947-1948

Length-group inches	January	February	March	April	May	June	July	August	September	October	November	December
0.5-0.9				1.3								
1.0-1.4		17.3	42.1	48.1	4.2	8.0	4.0					
1.5-1.9				11.7	50.0	22.7	18.9	3.6				
2.0-2.4	16.7	10.3	15.8	1.3	4.2	45.3	36.5	28.6	43.3	10.5	16.7	27.0
2.5-2.9	30.9	24.2	18.4	10.4		9.3	24.3	51.8	40.0	57.9	16.7	29.8
3.0-3.4	30.9	31.0	21.0	11.7	8.3		4.0	10.7	16.7	5.3	33.4	21.6
3.5-3.9	7.1	6.9		7.8	16.7	9.3	8.1	3.6		21.0	16.7	2.7
4.0-4.4	4.8	3.4		2.6	8.3	1.3	2.7			5.3		2.7
4.5-4.9	9.5	3.4	2.6	5.2	4.2	4.0	1.3					10.8
5.0-5.4		3.4			4.2			1.8			16.7	5.4
Total number of fish	42	29	38	77	24	75	74	56	30	19	6	37

Table 161

Sand Creek weir, upstream trap
Average fork length in inches at all annuli
Sea-run cutthroat trout

Season of migration	Number of annuli									
	Stream						Sea			
	1	2	3	4	5	6	1	2	3	4
1946-47										
Number of fish	125	124	117	58	8	1	125	39	13	2
Average length	2.6	4.5	6.5	8.0	8.4	(7.4)	12.6	14.6	16.4	17.2
1947-48										
Number of fish	95	95	87	44	12	1	95	47	3	1
Average length	2.8	4.8	6.7	8.0	9.5	(11.4)	12.6	15.0	15.6	(16.6)
1948-49										
Number of fish	80	80	75	31	5	-	80	19	3	-
Average length	2.6	4.5	6.4	7.5	10.0	-	12.9	14.7	15.7	-
1949										
Number of fish	76	76	72	45	7	-	76	17	-	-
Average length	2.6	4.8	6.6	8.1	9.7	-	12.9	14.6	-	-
All										
Number of fish	376	375	351	178	32	2	376	122	19	3
Average length	2.6	4.6	6.5	7.9	9.3	9.4	12.7	14.8	16.2	17.0

( ) Single specimens

In Table 160, which presents length-frequency distributions by month of cutthroat fingerlings, it will be noted that 56.8 per cent of the fish at the end of the year are in the 2-inch group. Thus, the average calculated length at the first annulus accords well with actual measurements of fish. There is also indication (though scanty) in Table 160 that the 2-annulus fish are in the 4.5-4.9 inch group, which is also in accordance with calculated length data. In the 1947 Annual Report, Table 18 is an age-length distribution of 253 downstream cutthroats whose scales were read. The largest 3-annulus group shown in the table is that whose length was 6.0-6.9 inches, further corroboration for the present calculations of length. Correspondence is also found between lengths of trout in the 4- and 5-annulus groups, though for the 5-annulus group, the case is weak.

PACIFIC CITY OFFSHORE SALMON TAGGING STUDY

A unique offshore salmon fishery exists in the vicinity of Pacific City. The boats are launched through the surf in a sheltered cove behind Cape Kiwanda near Haystack Rock. Launching and landing are accomplished by the use of oars; outboard motors are used for trolling at sea. The fishing consists of both commercial and sport fishermen using double-end dories 20 to 25 feet long. The fishing area extends from Cascade Head on the south to Cape Lookout on the north and extends to sea for approximately 10 to 12 miles. An estimated forty boats fish this area during the peak of the season. The fishing season extends from July through the first part of October. Through the early part of the fishery, chinooks make up most of the catch, while silvers are more abundant through the later part; August being the peak month. At times when salmon fishing is poor, many boats fish for ling cod, sea bass, snapper, and other fish in the areas of rocky reefs.

During the summer of 1951, the area within 3 miles of the mouth of the Nestucca River in the ocean was fished with commercial gear by Game Commission employees in an endeavor to tag enough salmon to make a determination concerning the ultimate destination of fish which spent at least part of their summer near the mouth of the river.

Peterson disc tags were used and placed at the base of the anterior edge of the dorsal fin. Most of the fish were caught on wobblers using deep gear although plugs and feather jigs were also used. During the early part of the study, a 16 foot semi-double end Rogue River boat was used. Fishing time was thus limited since it was necessary to return to the beach whenever the winds increased to around 20 miles per hour and the ocean became rough. A larger double-end dory was not available until around the first of September. Had the larger boat been used throughout the study, more fish would have been tagged. Many times when fish were striking, it was necessary to return to the beach in the small boat because of the increasing wind and wave action.

A total of fifty-five salmon was tagged; five were chinook, and the remaining fifty were silvers. The five chinooks were tagged during July, forty-four silvers were tagged in August, and six in September. The tagging operations extended from July 17 through September. Weather conditions controlled much of the tagging activity. Fishing was possible on twenty-nine days. During the remaining forty-four days fog, rough seas, and surf prevented the launching of the boat. The best fishing conditions existed when the winds were from the north or northwest at 5 to 15 miles per hour. Southwest winds made tagging operations hazardous as they increased the height of the surf at the beach to the extent that launching and landing were dangerous. When fishing

was not possible, the Nestucca watershed was surveyed for log jams and other barriers. Spawning bed counts for spring chinook were also made.

Tag recovery

Twenty-one and eight-tenths per cent of the tagged salmon were recovered up to January 7, 1952. The tags were reported from as far south as the Sacramento River (two fish) and as far north as Vancouver Island (one fish). Table 162 depicts the returned tag number, date, place of capture, and species.

Table 162

Recoveries, Pacific City offshore salmon tagging study, 1951

Returned tag number	Date of tagging	Place of capture	Species
302	8/3	Columbia River	Silver
303	8/4	Newport - offshore (Ore.)	Silver
310	8/3	Tillamook Bay (Ore.)	Silver
325	8/8	Columbia River	Silver
326	8/9	Willapa Harbor (Wash.)	Silver
333	7/18	Sacramento River	Chinook
336	7/18	Sacramento River	Chinook
339	8/12	Tillamook Bay - offshore	Silver
352	9/14	Seaside - offshore (Ore.)	Silver
357	7/28	Astoria - offshore	Chinook
?	10/25	Necanicum River (Ore.)	Silver
?	9/22	Victoria (B.C.)	Silver

Oddly enough, only five chinook were tagged and those wholly in the month of July. Table 163, Pacific City salmon tagging record, 1951, depicts the tagging operation.

It has been said that the commercial fishery existing off the mouth of the river might be taking Nestucca River fish and as a result might be a factor in decimating the Nestucca River salmon runs. None of the 21.8 per cent return was recovered in the Nestucca.

Obviously, in the light of tag returns, the fishery which takes place during July, August and September around the immediate mouth of the river is not taking Nestucca River fish to any amount, and a 3-mile closure to protect the fish would thus seem to be not necessary. There is a time when fish destined for the Nestucca River must approach the area near the mouth and it possibly occurs in October. The commercial fishery adjacent to the mouth is largely absent during that month as a result of adverse weather conditions which generally prevent the launching of boats through the surf. The troll silver commercial landings at Newport are largely confined to the months of July, August and September, thus generally precluding any great loss of strictly Nestucca River fish which might result from a concentration of commercial vessels at the mouth of the river.

It has been said that the salmon runs of the Nestucca should be on the increase as a result of the cessation of commercial fishing in

April, 1927, the removal of the spring salmon racks, and the stoppage of the accompanying deleterious taking and transplantation of eggs to other rivers. Unfortunately, the closure of the river, which was designed to rehabilitate the runs, did not protect the fish to the degree desired. Bootleg salmon fishing continued in spite of every effort aimed at its removal, and the offshore troll fishery continued to take its toll.

Table 163

Pacific City salmon tagging record, 1951

Date	Tag No.	Species	Color*	Date	Tag No.	Species	Color*
7/17	363	Chinook	R-R	8/7	322	Silver	R-G
7/18	333	Chinook	R-R	8/7	323	Silver	R-G
7/18	336	Chinook	R-R	8/8	324	Silver	R-G
7/25	341	Chinook	R-R	8/8	325	Silver	R-G
7/28	357	Chinook	R-R	8/9	326	Silver	R-G
8/3	373	Silver	R-G	8/9	327	Silver	R-G
8/3	310	Silver	R-G	8/9	328	Silver	R-G
8/3	301	Silver	R-G	8/9	329	Silver	R-G
8/3	300	Silver	R-G	8/9	330	Silver	R-G
8/3	302	Silver	R-G	8/9	331	Silver	R-G
8/4	303	Silver	R-G	8/9	332	Silver	R-G
8/4	304	Silver	R-G	8/9	334	Silver	R-G
8/4	305	Silver	R-G	8/12	335	Silver	R-G
8/5	306	Silver	R-G	8/12	337	Silver	R-G
8/5	307	Silver	R-G	8/12	338	Silver	R-G
8/5	308	Silver	R-G	8/12	339	Silver	R-G
8/5	309	Silver	R-G	8/12	340	Silver	R-G
8/5	311	Silver	R-G	8/12	342	Silver	R-G
8/5	312	Silver	R-G	8/12	343	Silver	R-G
8/5	313	Silver	R-G	8/14	344	Silver	R-G
8/5	314	Silver	R-G	8/15	345	Silver	R-G
8/5	315	Silver	R-G	9/4	346	Silver	R-R
8/6	316	Silver	R-G	9/14	347	Silver	R-R
8/6	317	Silver	R-G	9/14	348	Silver	R-R
8/6	318	Silver	R-G	9/14	352	Silver	R-R
8/6	319	Silver	R-G	9/14	353	Silver	R-R
8/7	320	Silver	R-G	9/27	349	Silver	R-R
8/7	321	Silver	R-G				

*R - Red
G - Green

Preliminary regulations which have little or no effect on the total landings of troll-caught fall salmon are now generally in operation on the Pacific Coast, but except for occasional size limits, the troll fishery for salmon has been practically unregulated since its inception.

The recovery of the Nestucca River salmon fishery, insofar as fall chinooks and silvers are concerned, must in part depend upon a curtailment of the offshore troll salmon fishery which could take as much as one-half of the fish of a given river.

ALSEA RIVER STUDY

The following report sets forth the information obtained from checking anglers' creels on the Alsea River during the 1951 trout season. The Alsea River Study was carried on mainly from the confluence of the North and South Forks of the Alsea to the head of tidewater. Some data were collected on the tributaries of the river.

The objective of the study was to determine the comparative return to the creel of yearling cutthroat and yearling rainbow stocked in equal numbers on identical dates in identical locations on the main Alsea River between the confluence of the North and South Forks and Five Rivers, a point approximately 10 miles above the head of tidewater.

Secondary objectives of the study were as follows:

1. Determine the number and the species of fish of sublegal length taken and returned to the water and, if possible, the mortality that occurred.

2. Tabulate the number of marked yearling silvers that entered the catch.

3. Determine the approximate total catch by species.

4. Measure angler success by species in relation to the time interval elapsing after the fish were planted.

5. Attempt to determine which of the two species (rainbow or cutthroat) tended to move more rapidly from the planting area.

6. Note the comparative conditions of the two species in relation to the time intervals subsequent to planting, and the greater susceptibility of one or the other to parasites or disease.

As many anglers as possible were interviewed on the stream and their catch recorded. The river was checked four days per week until late in August when fishing pressure had so relaxed that it did not seem practical to check on weekdays. Few anglers were checked on the tributaries during the first part of the season because of the heavy fishing pressure on the main river. When the fishing pressure decreased on the main river, some tributaries were checked but few fishermen used them.

The aid of boat moorages and lodges was solicited during the first part of the season in order to check anglers who patronized such establishments. Excellent cooperation was received from some of the places, but others failed to be of assistance. When people did not cooperate or hesitated to check anglers, the issue was not carried any further.

Five thousand yearling rainbow with the adipose and right ventral fins removed and 5,000 cutthroat with both ventral fins removed were planted in the Alsea River on April 9 and 10. The rainbows averaged 2.5 fish per

Table 164

Alsea catch record

	April 14-27	April 28 - May 11	May 12-26	May 27 - June 8	June 9-22	June 23 - July 6	July 7-20	July 21 - Aug. 3	Aug. 4-18	Aug. 19 - Sept. 1	Sept. 2-15	Sept. 15 - Oct. 1	Totals
No. of parties	233	118	82	114	98	103	51	55	28	16	32	31	961
No. in party	496	248	159	262	200	197	98	97	54	32	56	56	1,955
Total hours fished	2,025.5	738.5	487	582	467.5	462	310	198	123	46	133	122.5	5,695
Rainbow, marked 1951 A-RV	258	115	64	79	77	96	70	29	16	1	4	6	815
Rainbow, unmarked	26	7	8	10	5	4	2	0	0	0	2	1	65
Cutthroat, marked 1951 BV	172	45	31	25	106	40	36	15	10	0	3	19	502
Cutthroat, unmarked-immature	458	102	92	160	107	25	20	11	3	3	53	39	1,073
Cutthroat, unmarked-mature	99	35	12	9	4	0	0	3	2	0	3	1	168
Steelhead, immature	23	4	1	0	0	0	0	0	0	0	0	0	28
Steelhead, mature	2	0	0	0	0	0	0	0	0	0	0	0	2
Silvers, marked, BV	1	1	0	0	0	0	0	0	0	0	0	0	2
Silvers, immature	1	0	0	0	0	0	0	0	0	0	0	0	1
Fish totals	1,040	309	208	283	299	165	128	58	31	4	65	66	2,656

pound and the cutthroats averaged 4.5 fish per pound.

The second planting took place on June 11, 12, and 13. Again 5,000 rainbow and 5,000 cutthroat were released. The fish were marked the same as the first group but were larger. The rainbows averaged 1.2 fish per pound and the cutthroats 3.2 per pound.

At both stockings, equal numbers of rainbow and cutthroat were released in identical places and on the same day.

Table 164 gives the results of the creel check in biweekly periods.

Creel census data

Table 165 gives totals and percentages for the complete trout fishing season.

Table 165

Number of parties checked	961
Total number of anglers	1,955
Number of hours fished	5,695
Total fish caught	2,656
Fish per hour	0.46
Hour per fish	2.14
Fish per angler	1.35
Percentage of total catch, marked rainbow	30.6 %
Percentage of total catch, marked cutthroat	18.9 %
Total marked fish	1,317
Percentage marked rainbow	61.8 %
Percentage marked cutthroat	38.2 %
Rainbow:	
Adipose and right ventral fins	815
Both ventrals	0
Unmarked	65
Cutthroat:	
Both ventral fins	502
Immature, unmarked	1,073
Mature, unmarked	168
Steelhead:	
Mature	2
Immature	28
Silver salmon:	
Immature, unmarked	1
Marked, both ventrals	2
Chinook salmon:	
Immature	0
Mature	2*

*Not included in any totals.

The marked rainbow gave a greater return to the anglers' creel than did the marked cutthroat. Marked rainbow exceeded the catch of marked cutthroat in ten of the twelve biweekly periods. Marked cutthroats outranked rainbow from June 9 to June 22 and from September 15 to October 1. A larger number of marked fish were taken at the beginning of the season. As the season progressed, the return of marked fish became less.

Marked rainbow and cutthroat contributed nearly 50 per cent of the total number of fish taken by anglers from the study area.

Anglers' reports to regional office

Table 166 contains information volunteered by anglers who were not checked on the river. Many anglers did not include all of the desired information in their reports. The table was completed by comparing the desired information with the partial information.

Table 166

Number of parties	64
Total number of anglers	106
Number of hours fished	523
Total fish caught	605
Fish per hour	1.15
Hour per fish	0.86
Fish per angler	5.7
Percentage of total catch, marked rainbow	51.5 %
Percentage of total catch, marked cutthroat	32.5 %
Total marked fish	510
Percentage marked rainbow	61.2 %
Percentage marked cutthroat	38.8 %
Rainbow:	
Adipose and right ventral fins	312
Unmarked	21
Cutthroat:	
Both ventral fins	197
Immature, unmarked	70
Mature, unmarked	4
Silver salmon:	
Marked, both ventrals	1

Seven of the marked cutthroats were reported to have been taken at Taylors Landing which is approximately 13 miles below the lowest planting site.

Boat moorage and lodge reports

Boat moorages and lodges were given tally sheets and asked to check anglers. Table 167 depicts data obtained.

Table 167

Number of parties	67
Total number of anglers	166
Number of hours fished	597
Total fish caught	366
Fish per hour	0.61
Hour per fish	1.6
Fish per angler	2.20
Percentage of total catch, marked rainbow	20.8 %
Percentage of total catch, marked cutthroat	11.7 %
Total marked fish	119
Percentage marked rainbow	63.8 %
Percentage marked cutthroat	36.2 %
Rainbow:	
Adipose and right ventral fins	76
Unmarked	28
Cutthroat:	
Both ventral fins	43
Immature, unmarked	110
Mature, unmarked	109

A total of nine marked fish was checked by moorages in tidewater. Five of them were marked cutthroat and four were marked yearling rainbow (A-RV). The Curtis Boat Moorage, which is approximately 8 miles below the head of tidewater, checked two marked cutthroats and one marked rainbow. Three marked cutthroats and three marked rainbow were checked at Kozy Kove which is about one and one-half miles below head of tidewater. One marked cutthroat checked at the Curtis Boat Moorage was taken about one mile up Drift Creek.

During the latter part of July, verbal reports were received stating that cutthroat with both ventrals removed were being taken in tidewater at Kozy Kove. It was not until the latter part of August that one of them was seen. The fish was a 15-inch marked (both ventral fins) cutthroat in excellent condition. It is believed that the fish, released probably in April, had gone to tidewater soon after being stocked.

Fish of sublegal length taken and returned to the stream

Anglers interviewed estimated that they caught and returned to the stream, approximately 3,950 fish of sublegal length during the entire season. The anglers reported taking approximately 1.5 sublegal fish to every legal fish. The estimate is believed to be reasonably accurate.

During the entire season, forty-six dead sublegals were counted by the agent working on the river.

It was not possible to determine the species of the sublegals taken and returned to the stream. It was noted that a great majority of anglers could not tell whether the small fish they caught were salmon or trout.

Marked silvers checked

During the month of March, 1951, 17,500 marked (B.V.) silver salmon were stocked in the North Fork of the Alsea River. Two of them were checked as taken by anglers. The first one was caught April 25 at the Curtis Boat Moorage approximately 8 miles below the head of tidewater. The second was checked on April 29 in the North Fork of the Alsea River.

On May 16, a marked silver was reported from tidewater and on May 18, two more were reported. There is some doubt as to the accuracy of the reports since it is possible that the three fish were yearling cutthroat, as they were similarly marked.

Unmarked rainbow

Only sixty-five unmarked rainbow were checked during the season. The fish were parasitized by the salmon poisoning fluke (Troglatrema salmincola) and some were in very poor condition by the end of the season. In February, 1,600 unmarked rainbow were stocked in Five Rivers, and in August, 281 unmarked rainbow were stocked in the study area.

Immature unmarked cutthroat

This group of fish made up a larger percentage of the catch than did any other to the extent of 1,073 individuals checked. A large number of them appeared to be hatchery fish. Several groups of unmarked cutthroat were stocked during the season above and in the study area.

Mature unmarked cutthroat

Only 168 mature cutthroats were found in the anglers' catches. It is believed that most of them were brood fish that were stocked from the Alsea Hatchery early in the year. The majority of them were taken during the early part of the season in the upper reaches of the river. These fish were dark in color and thin.

Counts and estimates

During the entire season, 1,311 anglers' cars were counted. It was noted at the end of the season that each car carried an average of 2.04 fishermen. One hundred eight of the cars carried boats. It is believed that approximately 200 boats were used above tidewater during the season.

During the study period it was estimated that 4,284 anglers fished in the Alsea River, including the North and South Forks. The estimate does not include anglers fishing below the head of tidewater. It is estimated that the anglers took 5,780 fish of legal length of which 1,915 were rainbows, 3,175 were cutthroats, and 690 immature steelhead and salmon. The estimated percentage of anglers checked was 45.8 per cent.

Percentage marked fish return

At only two periods did the take of cutthroat exceed that of the rainbows. Table 168 gives the percentage of marked rainbow and marked cutthroat in biweekly periods.

Table 168

Period	Total marked rainbow	Total marked cutthroat	Percentage of marked fish rainbow	Percentage of marked fish cutthroat
April 14 - April 27	258	172	60.0	40.0
April 28 - May 11	115	45	71.9	28.1
May 12 - May 26	64	31	67.4	32.6
May 27 - June 8	79	25	76.0	24.0
June 9 - June 22	77	106	42.1	57.9
June 23 - July 6	96	40	70.6	29.4
July 7 - July 20	70	36	66.0	34.0
July 21 - Aug. 3	29	15	65.9	34.1
Aug. 4 - Aug. 18	16	10	61.5	38.5
Aug. 19 - Sept. 1	1	0	100.0	0
Sept. 2 - Sept. 15	4	3	57.1	42.9
Sept. 16 - Oct. 1	6	19	24.0	76.0
Season totals	815	502	61.8	38.2

As the season progressed, the number of marked fish taken decreased. The percentages remained fairly constant except for the two periods when the cutthroat went ahead of the rainbow. The percentage for the period August 19 to September 1 is, of course, a skewed figure.

Migration of marked fish

A downstream movement occurred soon after the fish were released. On April 14, four days following liberation, one marked cutthroat was checked 2 miles below the lowest stocking point. Five days following stocking, one rainbow was checked in the same area. A total of seven marked cutthroat was checked, within eleven days following release, at the same point. By May 20, four marked rainbow and two marked cutthroat had been checked approximately 16 miles below the lowest stocking point.

On July 19, one marked cutthroat was checked from Drift Creek, the only instance of upstream migration. The fish had moved downstream and then up the tributary. Both species moved downstream at about the same time and reached tidewater at approximately the same date.

Condition of rainbows and cutthroats as season progressed

The marked fish were in excellent condition when liberated. Soon after planting the relative plumpness of the rainbow started to decrease whereas that of the cutthroat did not become thinner until late in August. Possibly, the decrease in condition factor of the rainbow was partially caused by the onset of parasitism by the salmon poisoning fluke.* The first indication of the parasite was noticed on May 30 when a rainbow was checked with the outer edges of the caudal fin and the leading edges of the pectoral fin slightly eroded. Later, many rainbow with eroded fins were checked. The fin erosion increased as the season progressed. By the end of the season, nearly one-third of the leading edge of the pectoral fins was eroded away on some rainbow. The parasite was evident in and around eye structures in the rainbow. No rainbows

*Identified by Dr. Ivan Pratt, Dept. of Zoology, Oregon State College, Corvallis, Or.

Table 169

Stream	Legal	Sublegal
Mill Creek		
Fishing effort - 8 hours		
Fish taken:		
Cutthroat	1	16
Rainbow	0	13
Steelhead	0	19
Silver salmon	0	10
Chinook salmon	0	10
Honeygrove Creek		
Fishing effort - 3½ hours		
Fish taken:		
Cutthroat	0	7
Rainbow	0	0
Steelhead	0	0
Silver salmon	0	5
Chinook salmon	0	0
Salmonberry Creek		
Fishing effort - 4½ hours		
Fish taken:		
Cutthroat	0	9
Rainbow	0	0
Steelhead	0	0
Silver salmon	0	0
Chinook salmon	0	0
Yew Creek		
Fishing effort - 12½ hours		
Fish taken:		
Cutthroat	1	54
Rainbow	0	0
Steelhead	0	8
Silver salmon	0	28
Chinook salmon	0	5
Scott Creek		
Fishing effort - 8 hours		
Fish taken:		
Cutthroat	2	18
Rainbow	0	0
Steelhead	0	21
Silver salmon	0	2
Chinook salmon	0	0

were found to have died as a result of parasitism.

No cutthroats were found with eroded fins although they are not immune to parasitism by the fluke.

Several rainbow stomachs were opened during the early part of the season and were found to have contained mostly small rocks, freshwater snails, and an occasional stonefly larva. Cutthroat stomachs contained mostly stonefly larva, caddis fly larva, May fly larva, crayfish and small fish.

Water conditions

The river became quite low as the season progressed. On June 1, a maximum water temperature of 56° F. was recorded. On June 30, the temperature was 72° F., the highest water temperature recorded during the entire season. The water varied from 65° F. to 72° F. from June 15 to August 27. From August 27 to October 1, the temperature gradually decreased to the low 60's.

Tributary test fishing

A Game Commission agent spent some time test fishing tributaries that were newly opened in 1951. No anglers were found on the streams. Table 169 shows the catch taken from each stream fished.

SUMMARY

Creel census checks indicated that rainbow provided better returns to the angler through the first summer than cutthroats when released in equal numbers in identical places on the Alsea Study Area. A percentage of the total catch of 30.6 was composed of marked rainbow, and 18.9 per cent of the total catch was of marked cutthroat. Approximately 50 per cent of the total catch from the Alsea Study Area was composed of marked cutthroat and rainbow.

Marked rainbow and marked cutthroat moved downstream soon after stocking. The two species reached tidewater at approximately the same date.

The degree of plumpness began to decrease in the rainbow soon after their liberation, whereas the cutthroat retained their condition until late in August.

FISH STOCKING

A record volume of fish was released into fishing waters of the State during 1951 to approximate amount of 500,000 pounds of trout and salmon. Although the increase in weight over that stocked in 1950 was almost 50,000 pounds, a considerable reduction in numbers of fish stocked occurred. The decrease of almost ten million trout is attributed to a program of planned production which is explained in the paper, "A Stocking and Fish Hatchery Policy," contained elsewhere in this report. The program eliminates from production those classes of fish which have given little or no return at considerable expense.

Yearling fish, as in 1950, made up the bulk of the total output to the extent of 2,091,589 fish weighing 422,237 pounds. The increase of almost 100,000 pounds in this age group is attributable in some part to the increased production of salmon. Unexpected trout growth occurred in some hatcheries and added much weight to the fish.

Figure 19 is a representation of the size increase of fish stocked over a period of six years. Over six million fry and fingerlings are included in the average for 1951. Yearling fish for 1951 averaged more than 8 inches in length. The increase in total weight of fish stocked has been quite constant as depicted in Figure 20. The climb begun in 1942 was cut short by restrictions during the war years. The drop in 1949 resulted from a shortage of fish food in the fall of 1948. It became apparent that the available supply would not be sufficient to maintain the large number of yearlings to be retained in ponds until the 1949 stocking season. Consequently, the fish in excess of those for which feed was available were released in 1948, increasing the poundage much more than had been planned.

Almost all classes of fish were planted on schedule. Some lag occurred in June and July but no serious difficulties were encountered. Low water conditions in the coastal area and high summer air and water temperatures caused some difficulty in July and August. Distribution was difficult on the shorter coastal streams because of the low water levels and some reallocation was necessary. Some fish losses were caused by the high air and water temperatures in the Southeast Region. They are discussed more fully in a subsequent section.

The bulk of the year's stocking was completed by the end of August as planned, with April, May, June, and July as the peak months as shown in Figure 21.

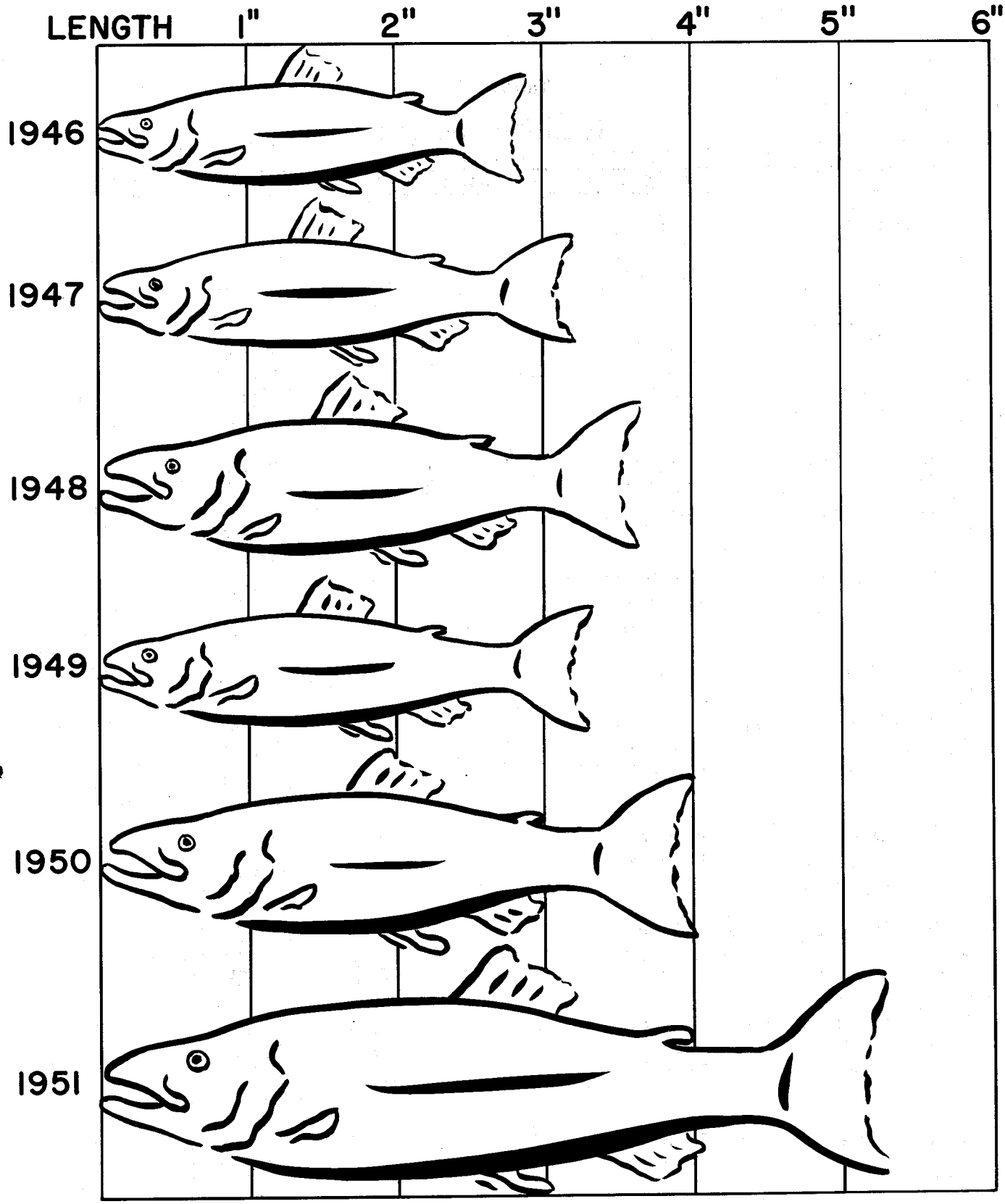
Six large tank trucks and portable units at five hatcheries were in use during the peak of stocking. Much effort was expended by all field men in obtaining proper distribution of all sizes of fish. It is believed that the stocking program in general was well-planned and executed.

The use of the airplane in the isolated lake stocking program has completely eliminated pack string operation. A total of 335 lakes was stocked by the method. Table 171 delineates activity by hatchery.

Table 170

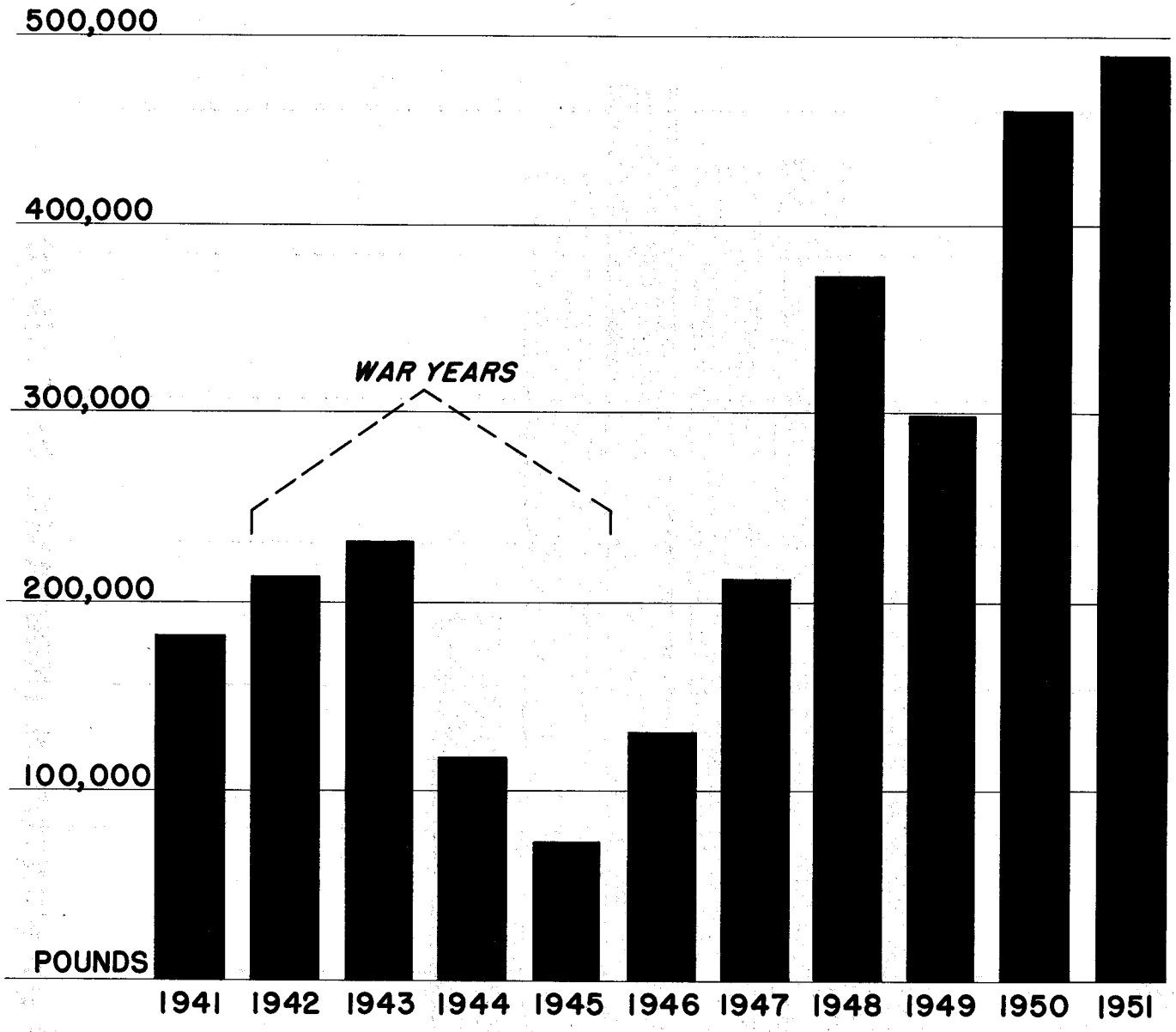
Yearling plants, 1951

Hatchery	Species	Lot number	Number	Pounds
Alsea	Cutthroat	3	47,127	10,930
	Silvers	8	45,726	2,754
	Rainbow	9	56,981	29,958
			149,834	43,642
Bandon	Cutthroat	2	62,688	16,291
	Silvers	5	23,389	5,159
	Rainbow	6	60,949	28,461
			147,026	49,911
Butte Falls	Silver	1	49,446	2,747
	Rainbow	3	113,701	14,299
	Chinook	6	39,718	1,489
			202,865	18,535
Cedar Creek	Cutthroat	1	51,265	10,870
	Rainbow	3	48,762	13,555
	Rainbow	9	7,701	1,572
Hood River	Rainbow	3	104,399	10,661
Klamath	Lake trout	8	76,907	8,415
	Rainbow	9	125,456	14,304
	Eastern brook	10	111,725	20,586
			314,088	43,305
McKenzie	Rainbow	1	89,978	15,611
	Rainbow	4	57,216	9,545
			147,194	25,156
Oak Springs	Rainbow	2	152,577	68,866
	Rainbow	8	55,224	7,077
			207,801	75,943
Roaring River	Rainbow	2	156,279	28,256
	Browns	9	21,389	1,341
	Rainbow	11	58,652	8,542
			236,320	38,139
Rock Creek	Chinook	3	5,205	962
	Chinook	4	13,997	1,851
	Chinook	6	35,671	5,437
	Rainbow	7	153,763	38,671
			208,636	46,921
Wallowa	Rainbow	6	120,741	14,944
Wizard Falls	Rainbow	2	72,180	16,217
	Rainbow	3	72,777	12,865
			144,957	29,082
GRAND TOTAL			2,091,589	422,237



INCREASE IN AVERAGE SIZE OF GAME FISH STOCKED 1946-1951

Fig. 19



Pounds of Game Fish Stocked 1941–1951

Fig. 20

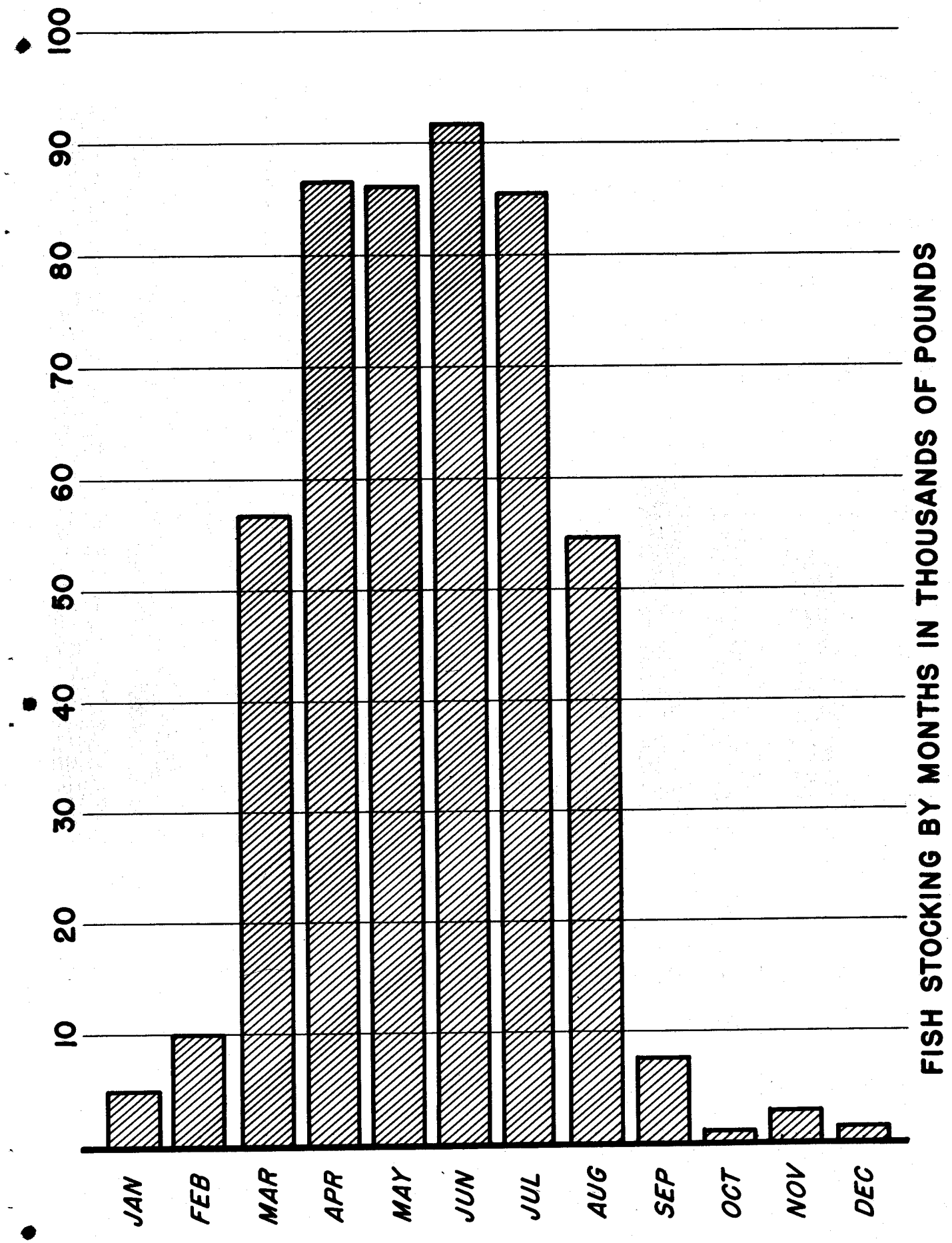

FISH STOCKING BY MONTHS IN THOUSANDS OF POUNDS
100
90
80
70
60
50
40
30
20
10
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Fig. 21

Table 171

Hatchery	No. of lakes stocked	No. of fish	Pounds of fish
Klamath	56	285,751	880.3
Fall River	243	1,174,997	1,275.5
Hood River	33	112,625	505.0
Wallowa	3	25,200	84.0
Total	335	1,598,573	2,744.8

Stocking of fingerling trout by airplane commenced on July 12, 1951, and ended on August 15, 1951. A total of 16 days was required to complete the schedule.

In 1951, a considerable increase in the number of isolated lakes stocked occurred. A decrease in the numbers and pounds of fish stocked resulted from low egg-takes. Fish could have been made available but at prohibitive costs. Table 172 compares results of the 1951 season with those of the three previous years.

The airplane tank used was designed for larger loads than carried in 1951. The high costs per pound and per lake are, therefore, a result of decreased volume. If fish had been available, the costs would have been much less.

The cost per lake of $12.65 would be much lower if savings in overhead are considered. Five days of operation were cut off by the improved tank setup. The elimination of the loading of fish at Sisters, Oregon, where trout had to be delivered from Wizard Falls and held in irrigation water, was worth the additional expense in flying the fish from the Fall River station.

A faster plane used in 1951 resulted in a shorter carrying time for the fish in the tanks. The improvement cannot be measured in cost.

Some losses were experienced, most of them occurring in flights from Hood River. It is possible that the rapid climb from low altitudes to 7,500 feet was the cause.

Tests designed to determine safe capacities for the tanks were conducted at Fall River. The results were adapted with success to operations at Fall River and Klamath, but as mentioned, losses did occur at Hood River.

The program is to be continued in 1952. Changes in the airplane tanks are to be made to the effect that a controlled air inlet is to be installed and an observation window is to be placed in a wall of the tank. An inside thermometer is to be installed in the tank.

More experiments are to be conducted in order to determine maximum capacities for different sizes of fish and various temperatures of water.

A summarization of all plantings of trout and salmon by watershed is given in Table 173. In addition, the distribution units handled a considerable amount of fish which were transferred for one purpose or

Table 172

A comparison of results and costs of air-stocking for a four-year period in lakes of the Cascade Range

	1948	1949	1950	1951
Number of lakes planted	35	92	290	332
Total number of fish	237,726	878,341	4,100,193	1,573,373
Total poundage	656.75	1,548.6	4,585.3	2,660.8
Total costs (includes planting-time reconnaissance and ferrying)	$ 817.80	$ 1,562.00	$ 3,088.40	$ 4,280.00
Total cost of actual planting flights	$ 539.60	$ 1,070.00	$ 2,840.00	$ 4,200.00
Average cost per lake	$ 15.42	$ 10.63	$ 10.14	$ 12.65
Average cost per pound	$ 0.82	$ 0.69	$ 0.62	$ 1.57
Average planting costs with pack animals	$ 0.95 per pound	$ 1.03 per pound	$ 1.03 per pound *	$ 1.03 per pound*

*1949 figure used since no other was available.

1951 Fish Stocking*

Watershed	Rainbow	Cutthroat	Steelhead	Silver salmon	Eastern brook	Kokanee	Brown	Lake trout	Spring chinook	Total
1....	72,438	98,338	15,486	141,837	-	-	-	-	-	328,099
	15,718	8,389	11	2,835						26,953
2....	1,333,597	25,892	-	-	335,924	-	-	-	-	1,695,413
	67,546	3,858			1,904					73,308
3....	112,360	2,508	-	-	82,997	-	-	-	-	197,865
	21,636	330			399					22,365
4....	80,363	-	-	-	28,750	-	-	-	-	109,113
	8,998				120					9,118
5....	1,202,867	-	1,071	-	895,864	434,041	102,889	76,907	-	2,713,639
	103,949		5		16,066	92	1,531	8,415		130,058
6....	74,543	-	-	-	39,886	-	-	-	-	114,429
	8,598				137					8,735
7....	28,077	-	-	-	27,450	-	-	-	-	55,527
	6,238				95					6,333
8....	80,570	-	-	-	20,100	-	-	-	-	100,670
	9,439				67					9,506
9....	140,071	-	-	-	-	-	-	-	-	140,071
	4,417									4,417
10....	434,275	-	-	-	-	-	-	-	-	434,275
	2,422									2,422
11....	8,203	-	-	-	-	-	-	-	-	8,203
	1,109									1,109
12....	19,114	-	-	-	4,988	-	-	-	-	24,102
	3,465				1,000					4,465
13....	50,060	-	-	-	5,693	-	-	-	-	55,753
	2,822				1,230					4,052
14....	399,520	-	-	-	335,302	-	-	-	-	734,822
	5,754				3,990					9,744
15....	438,491	-	-	55,455	25,200	-	-	-	39,718	558,864
	27,654			3,870	90				1,489	33,103
16....	245,786	9,272	-	23,932	17,360	-	-	-	471,233	767,583
	49,526	2,410		1,283	62				8,644	61,925
17....	25,088	464,440	-	19,673	-	-	-	-	-	509,201
	11,503	14,113		4,359						29,975
18....	76,138	99,961	42,914	36,799	-	-	-	-	-	255,812
	32,356	15,493	1,844	1,979						51,672
Totals	4,821,561	700,411	59,471	277,696	1,819,514	434,041	102,889	76,907	510,951	8,803,441
	383,150	44,593	1,860	14,326	25,160	92	1,531	8,415	10,133	489,260

*To December 15, 1951. Note: Upper figures signify numbers of fish and lower figures signify pounds of fish.

another but not actually stocked by these units. Several loads of sturgeon were hauled from Bonneville Dam to the upper Willamette area but are not included in Table 174.

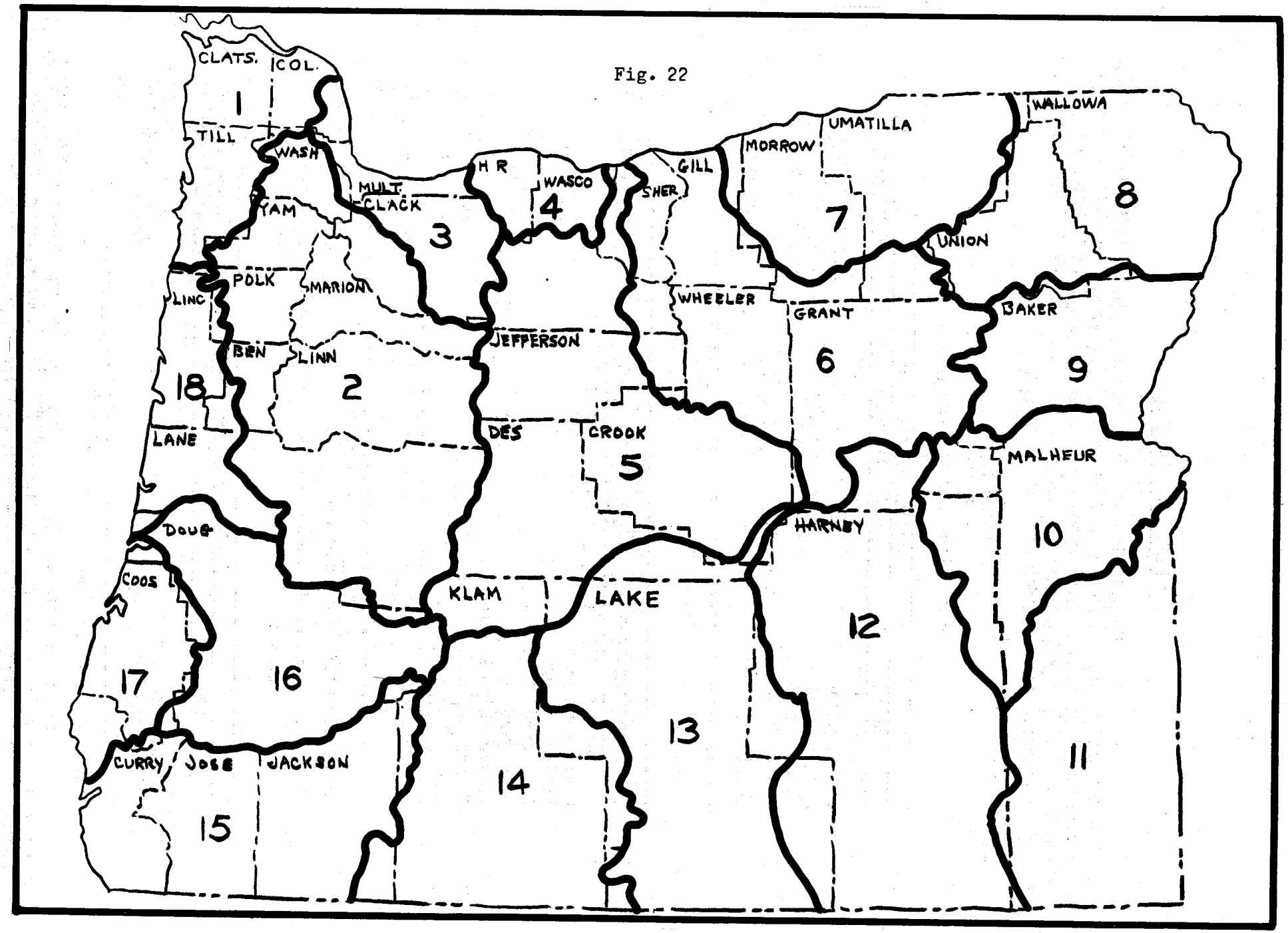
The revised stream and lake coding system which was completed in June, 1951, has been in use since that time and provided the department with much-needed stocking information. In addition to its value in recording stocking activities, the system has provided us with a catalogued list of all streams and lakes in the State. Regional offices have received copies and plans are being made to supply copies to each field biologist.

Table 174

Transfer of fish, 1951

	Numbers	Pounds	Mileage
Hatchery transfers	168,952	1,517	1,609
Airplane transfers	244,171	1,010	1,319
Other transfers	20,316	103	396
Total	433,439	2,630	3,324

Fig. 22


CLATS.
COL.
1
TILL
WASH
MULT.
CLACK
3
H R
WASCO
4
SHER
GILL
MORROW
UMATILLA
WALLOWA
7
8
YAM
UNION
POLK
MARION
LINC
WHEELER
GRANT
BAKER
6
9
BEN
LINN
JEFFERSON
18
2
LANE
DES
CROOK
5
MALHEUR
DOUG
HARNEY
10
COOS
KLAM
LAKE
12
17
16
13
11
CURRY
JOSE
JACKSON
14
15

FISH PROPAGATION

A total of 8,803,441 fish was produced in Oregon trout hatcheries in 1951 and their total weight at release was 489,260 pounds. The total fish food consumed during the period December 1, 1950 to and including November, 1951 was 2,604,735 pounds including that fed to 35,391 brood fish. Table 175 depicts egg production in hatcheries and from wild fish.

Table 175

Brood stock and egg production

Brood stock held		
Species	Number	Eggs produced
Fall rainbow	12,084	4,687,120
Spring rainbow	10,161	1,530,560
Cutthroat	13,146	1,321,640
Total	35,391	7,539,320

Eggs taken from wild fish	
Species	Eggs produced
Eastern brook	2,255,428
Spring rainbow	2,862,513
Lake trout	90,000
Steelhead	99,152
Spring chinook salmon	208,373
Silver salmon	314,375
Sockeye salmon	147,531
Total	5,977,372
Grand total all eggs produced	13,516,692

Eggs purchased	
Species	Number
Eastern brook	2,000,000
Spring rainbow	2,000,000

Silver salmon eggs are taken at Butte Falls and Cedar Creek. The green fish are allowed to pass the traps and to go on up the rivers to spawn naturally. Eggs are taken only from fish that are ready to spawn when they

reach the traps. Such eggs are hatched to supply fish for the rearing of yearlings at Alsea, Bandon, and Butte Falls.

Spring chinook eggs are taken in the Umpqua River and in Big Butte Creek near McLeod.

Fall chinook eggs were furnished again in 1951 by the U. S. Fish and Wildlife Service for the Rock Creek Hatchery where they will be reared for release as yearlings. The exchange of fall rainbow eggs for chinook eggs and for intermountain cutthroat eggs is again being consummated.

In 1951, 147,531 sockeye eggs were taken in Odell Creek near Davis Lake. The fry hatched from these eggs as well as from 300,000 obtained from the State of Montana will be released in Odell Lake.

Lake trout were netted and spawned again in 1951. The egg-taking started October 20 and ended October 23. There were 90,000 green eggs secured from twenty-two females. The green eggs were taken to Willamette Hatchery for eying. The eyed eggs will be sent to Klamath and Wallowa for hatching. At Klamath, they will be reared to the yearling stage in covered ponds.

Excellent results were obtained at Big Butte Creek near McLeod where a special underground water supply was brought into a retaining pool in order to prevent adult spring chinook salmon from jumping and injuring themselves. Eighty-eight thousand five hundred green spring chinook salmon eggs were taken at Big Butte. The eggs were eyed at the Butte Falls Hatchery and 50,000 will be reared to the yearling stage.

A STOCKING AND FISH HATCHERY POLICY

A review of the results of research on the survival of the planting of small (fingerlings) trout discloses that maximum average survivals of such plantings seldom exceed 3 per cent and more often than not, are far below that figure where the small fish are placed in streams. Considerably higher returns are obtained from lakes and especially so from small lakes where a single species is present, but in the face of roach, Dolly Varden trout, and whitefish, it is not to be expected that fry plantings will meet with such success in lakes.

Our returns from the planting of fish of legal length are of much greater magnitude to the extent that as many as 80 per cent of planted fish are caught in lakes while in streams the return varies from 20 to 30 per cent.

In view of the small returns from stream-planted fry or fingerlings, we should not be stocking such fish in running water. Of course, we will need considerable numbers of young fish for stocking in lakes and a planting chart is contained in Table 176 Table 177 outlines similar information by hatchery.

Small fish which are graded out in the fall should be allotted to lake planting. Large fish, if they are anadromous, will be placed in coastal streams if they are graded out in the fall. We shall endeavor to aim at not having overly-large non-anadromous fish. Table 178 contains the numbers of yearling fish to be produced during the 1951-52 season.

Trout holding schedules by hatchery are shown in Tables 179 through 182. Factors which have an effect upon the holding of large numbers of fry and fingerlings are concerned with food, labor, cost, and space in the hatcheries. The meat products so vital to the rearing of trout must be available when the fish are young. There is only so much of such meat products available and we are scraping the bottom of the barrel because of the present national emergency. We are experiencing labor difficulties and the cessation of the planting of fry will aid tremendously since the young fish need much attention. Considerable saving in money would result from a diminishing of fry and fingerling yearlings, possibly to the extent of $150,000 per year.

During that critical period in the spring of the year when the fry are ready for ponding and when the yearling fish are not yet out of the hatchery, the need for space is critical. In order to avoid such a problem, it would be necessary to expend monies far in excess of the resulting benefits.

As the hatcheryman cannot hold yearling trout until they can most advantageously be planted, then an economic waste results from the placing of the fish in the streams prematurely.

The hatchery building program insofar as pond space is concerned has resulted in general in an added capacity for the rearing of yearlings. We have been able to place our fish in ponds under conditions which are not crowded with the resultant lessening of disease problems and a very large increase in growth. While we cannot say that the total numbers of fish raised have been increased, we can proudly state that our yearling fish are in better condition.

We could take millions of eggs and publish an astronomical figure of fish released but that would merely be making the books look good with no thought for the results attained.

All hatchery superintendents are aware that the practice of planting unnecessarily large trout is not proper fish culture. At at least one of our stations, the rainbows which result from fall eggs can grow out of proportion to the ability of the liberation department to keep up with the weight increase.

Where changes have already been made, they reduced the excessive size of the yearling end-product by grading in the fall and by introducing eggs which hatch later and produce a smaller fish for planting. All hatcheries will grade fish for the production of an ideal size. In our coastal stations where cutthroat trout are reared, a grading will get rid of the small fish in order that we may raise a cutthroat for spring planting whose size exceeds the 8-inch coastal limit. Silver salmon will be graded in the fall and the large fish will be removed and planted. If it is necessary to grade rainbow trout at a hatchery in order that the final product does not exceed 10 to 11 inches in length, then that will be done.

At Wizard Falls, several rearing experiments are in progress in an endeavor to arrive at the best method of producing a fish of the proper size for stocking. It is anticipated that we shall have a certain cushion in order that grading may be carried on without falling below our yearling fish production scheduled figures. That cushion shall vary between 5 and 10 per cent or it may be even lower. We shall no longer have overruns of fish.

Table 176 shows the estimated number of fry needed for stocking lakes and reservoirs. More specifically, such fish will be placed in mountain lakes, recently reclaimed lakes and reservoirs, and other bodies of water where fry planting has proved to be or might prove to be beneficial. No fry plantings will be made in streams except on an experimental basis.

The rainbow fry will be obtained from spring spawning stock so that they will be the proper age for distribution in the summer months. Brook fry will, of course, have to be fed and at some stations will have reached the fingerling size at release time in the summer. Coastal cutthroat fry will be released as advanced fry in some of the coastal lakes, and the intermountain cutthroat fry will be released in lakes in northeast Oregon.

Table 177 outlines the trout fry needs by hatchery. The hatchery closest to the body of water to be planted was selected in all cases. It is quite likely that adjustments will be necessary in order to avoid an overcrowded situation such as might occur at the Fall River station where planting needs combined with accessibility call for the production of 7,100,000 fry. The Willamette and Klamath stations could be utilized to take some of the burden. The fact remains though that the fish should be at Fall River for the most economical distribution.

Tables 179 through 182 outline the rearing and release schedule for fall rainbow, spring rainbow, eastern brook, and cutthroat including fry, fingerlings and yearling fish.

In regard to fall rainbow, only a sufficient number of eggs will be taken to provide yearlings a 10 per cent grading buffer of fingerlings in the fall; and no fall rainbow fry will be released. The graded rainbow fingerlings

will be placed in lakes. Yearling figures used are based on the intended numbers to be held over the winter of 1951-52.

The earliest fall rainbow eggs will be placed at stations where the rate of growth is comparatively slow and progressively later eggs will be placed at stations where the rate of growth is more rapid. The hatcheries in Table 179 are listed in the order in which they would receive eggs.

The rearing and release schedules would be planned so that the maximum release size would not be in excess of five per pound at all stations other than those in the coastal watersheds where a size maximum of three per pound would be allowed. The range for the coastal stations would be three to five per pound and for the other stations five to ten per pound.

The spring rainbow schedule calls mainly for the release of fry with 405,000 yearlings to be held over the coming winter at Oak Springs, Wizard Falls, McKenzie and Willamette hatcheries. The same procedure would be followed as with the fall rainbow regarding a grading release of fingerlings in the fall and the maximum size of five per pound.

Eastern brook would be held for yearling release only at the Klamath station. The remainder of the eastern brook would be released as fry or fingerlings from Fall River, Klamath, Hood River, and Enterprise. Releases of all eastern brook should take place during the months of June and July if possible. The eastern brook holding schedule does not consider the accessibility factor too strongly because of the difficulty in rearing eastern brook at some stations which otherwise might be more suitably located from an accessibility standpoint. The number to be reared at Fall River may be too great for the capacity there in which event Klamath would have to absorb the surplus.

The cutthroat schedule calls for the release of over 900,000 fry into coastal lakes. There is some doubt as to the wisdom of such stocking in view of the fact that most of the coastal lakes have mixed populations of trout and warm water game fish. Proper distribution and planting should aid in obtaining a greater survival than might otherwise be expected.

Yearlings would be held for release from the three coastal stations and as with the fall rainbow, eggs would be furnished to the hatcheries in the order of expected growth.

Fall rainbow yearlings will be available for release in coastal streams in the spring and early summer. They will make a faster growth than cutthroat which may not obtain the planting size of three to five per pound before May or possibly June. The cutthroat would be retained for the later plantings after they have obtained legal size. If at all possible, no cutthroat or rainbow will be planted in coastal waters before having obtained a size of eight inches.

DISTRIBUTION

With the exception of the 10 per cent for grading and release in the fall, most fish will be released from March to July. In general, it is unwise to commence planting prior to the first of March because of the disproportionately low return to the angler when and after the season opens. Disregarding the cost and capacity factors it is unwise to retain fish too late in the

summer because of low stream conditions and high temperatures.

This brings up the matter of how many distribution units should be available. We have had five tank trucks operating full time in 1951 and a sixth has been in operation throughout most of the season. In addition, the one-ton tanker has been used for releasing most of the fish from the Enterprise station, and a considerable percentage of the fish from the Hood River station. The early release of yearling fish from the McKenzie station was accomplished with one of the portable units. The other four portable units have been used from time to time at other stations. In spite of having twelve liberation units in operation full time or part time it was impossible to keep within the schedule outlined. A similar situation will arise in the months of May and June every year unless additional liberation equipment is added and additional personnel is utilized to accomplish the planting.

We could add two more large units to be used during the peak periods, but they should be of the dismountable type so that the trucks could be used for some other purpose the other ten months of the year.

This poses the problem of obtaining short-term employees for driving the liberation units. As pointed out previously, the main liberation season would extend over a period of five months. It is difficult to obtain and keep good men for seasonal work, and it would be much more difficult to obtain them for only two or three months' work. Unless additional employment can be obtained for three of the drivers now employed, they must be released, and it may be impossible to obtain their services again next year which will necessitate employing and "training" green men again.

The answer appears to lie in the need for using permanent employees as liberation truck drivers. This year considerable expense money was saved by employing men in areas where most of their driving has been done. This is a step toward locating drivers on a regional basis and the next logical step would be to employ them permanently, using them in other capacities at times when they were not planting fish. We may have men in our employ on a full-time basis now who could be worked into such a schedule.

ALLOCATIONS

In general, yearling fish are planted on a put-and-take basis with little expectation of carry-over into the succeeding year except in lakes where the return to the creel the succeeding year is ordinarily comparatively small. With that in mind it is unnecessary or illogical to allocate fish to streams on the basis of their "carrying capacity" and it is difficult indeed to determine how many yearling fish should be planted in a stream using the physical and biological aspects of the stream as an index. Certain obvious factors can be considered and for the purposes of allocating fish in an equitable manner, should be sufficient.

Aside from the question of suitable trout habitat, the two factors given the most weight in determining the number of fish to be allocated to a particular stream from the available supply are its size and the angling pressure on it. Angling pressure is measured generally by accessibility. Other considerations of perhaps somewhat less importance include velocity, fluctuating volumes and high summer temperatures. Streams not accessible by road are, of course, not stocked with yearling fish but generally those are the streams that

are less heavily fished. That stocking has a definite influence on the distribution of the anglers is evidenced by the number of calls received at the Portland office asking where fish have been planted. A wide distribution of yearling fish in accessible waters obtains a wider distribution of anglers than would be had if the fish were concentrated in comparatively few streams and lakes.

Table 176

Trout fry releases by watershed

Watershed	Spring Rainbow	Eastern Brook	Cutthroat	
1	-	-	50,000 (C.C.)	
2	100,000 (W.F.)[1] 300,000 (M.R.)[2] 2,000,000 (F.R.)[3]	1,100,000(F.R.)[4]	-	1. Clear Lk. 4. 500,000 for Waldo 2. Dorena Res. 3. 500,000 for Waldo
3	-	125,000(H.R.)[1]	-	1. Airplane planting on Mt. Hood Forest
4	-	50,000(H.R.)[1]	-	1. Airplane planting on Mt. Hood Forest
5	500,000 (W.F.)[1] 140,000 (O.S.)[2] 2,000,000 (F.R.)[3]	2,000,000(F.R.)[4]	-	1. Ochoco & Suttle 2. Olallie Area 3. 25% for airplane; 75% to truck lakes
6	-	35,000(Ent.)[1]	-	1. Lakes in John Day country
7	-	-	-	
8	-	25,000(Ent.)	30,000 (Ent.)	
9	300,000 (Ent.)[1]	-	-	1. Unity Reservoir
10	300,000 (Ent.)[1]	-	-	1. Malheur & Beulah Reservoirs
11	-	-	-	
12	40,000 (W.F.)[1]	-	-	1. Delintment
13	100,000 (K.L.)[1]	-	-	1. To be used in conjunction with reservoir development.
14	820,000 (K.L.)[1]	425,000 (KL)[2]	-	1. 500,000 to Klamath Lk. 200,000 to Indian Res 2. 200,000 for Fourmile Lk. 100,000 to Lake of the Woods 20,000 to airplane
15	10,000 (KL)[1]	70,000 (KL)[2]	-	1. For airplane planting 2. For airplane planting
16	70,000 (KL)[1]	15,000 (KL)[2]	-	1. For airplane planting 2. For airplane planting
17	-	-	400,000(Bandon)[1]	1. Lakes in Coos to Curry Counties
18	-	-	300,000(Alsea)[1]	1. Mercer & Woahink or treated lakes
TOTALS	6,680,000	3,795,000	780,000	

Table 177

Trout fry releases by hatchery

Hatchery	Spring rainbow	Eastern brook	Cutthroat	Totals
Alsea	-	-	300,000	300,000
Bandon	-	-	400,000	400,000
Butte Falls	-	-	-	-
Cedar Creek	-	-	50,000	50,000
Diamond Lake	-	-	-	-
Fall River	4,000,000	3,100,000	-	7,100,000
Hood River	-	175,000	-	175,000
Klamath	1,000,000	510,000	-	1,510,000
McKenzie	300,000	-	-	300,000
Oak Springs	140,000	-	-	140,000
Roaring River	-	-	-	-
Rock Creek	-	-	-	-
Wallowa	600,000	60,000	30,000	690,000
Willamette	-	-	-	-
Wizard Falls	640,000	-	-	640,000
Totals	6,680,000	3,845,000	780,000	11,305,000

Table 178

Yearling fish production
1951 - 1952

Hatchery	Cutthroat	Fall Rainbow	Spring Rainbow	Summer Steelhead	Winter Steelhead	Silver Salmon	Fall Chinook	Spring Chinook	Eastern Brook	Brown Trout	Lake Trout	Atlantic Salmon	Total
Alsea	50,000	50,000	-	-	15,000	35,000	-	-	-	-	-	-	150,000
Bandon	65,000	60,000	-	-	-	25,000	-	-	-	-	-	-	150,000
Butte Falls	-	115,000	-	-	-	50,000	-	18,000	-	-	-	-	183,000
Cedar Creek	50,000	50,000	-	-	25,000	25,000	-	-	-	-	-	-	150,000
Hood River	-	100,000	-	-	-	-	-	-	-	-	-	-	100,000
Klamath	-	125,000	-	-	-	-	-	15,000	75,000	-	45,000	4,500	264,500
McKenzie	-	80,000	80,000	-	-	-	-	-	-	-	-	-	160,000
Oak Springs	-	150,000	100,000	-	-	-	-	-	-	-	-	-	250,000
Roaring River	-	175,000	-	-	-	-	-	-	-	-	-	-	175,000
Rock Creek	-	75,000	75,000	-	-	25,000	20,000	30,000	-	-	-	-	225,000
Wallowa	-	125,000	-	-	-	-	-	-	-	-	-	-	125,000
Willamette	-	-	100,000	-	-	-	-	-	-	-	-	-	100,000
Wizard Falls	-	-	125,000	40,000	-	-	-	-	-	500	-	3,000	168,500
TOTAL	165,000	1,105,000	480,000	40,000	40,000	160,000	20,000	63,000	75,000	500	45,000	7,500	2,201,000

Table 179

Fall rainbow schedule

Hatchery *	No. of Eggs	Month	No. of Fingerlings	Fingerling Release	Yearlings	Planting Size Range	Months of Planting
Klamath	165,000		137,500	12,500	125,000	5-10 per lb.	April - July
Enterprise	165,000		137,500	12,500	125,000	5-10 per lb.	April - June
Hood River	132,000		110,000	10,000	100,000	5-10 per lb.	April - July
Willamette *	-		-	-	-	-	-
Butte Falls	151,800		126,500	11,500	115,000	5-10 per lb.	April - June
Roaring River	231,000		192,500	17,500	175,000	5-10 per lb.	March - July
Rock Creek	99,000		82,500	7,500	75,000	5-10 per lb.	March - June
McKenzie	105,600		88,000	8,000	80,000	5-10 per lb.	April - July
Oak Springs	198,000		165,000	15,000	150,000	5-10 per lb.	March - July
Cedar Creek	66,000		55,000	5,000	50,000	3- 5 per lb.	March - May
Alsea	66,000		55,000	5,000	50,000	3- 5 per lb.	March - May
Bandon	79,200		66,000	6,000	60,000	3- 5 per lb.	March - May

Fall Grading

* Will have Fall Rainbow yearlings in subsequent years.

Table 180

Spring rainbow schedule

Hatchery	No. of Eggs	Month	No. of Fry	Fry Released	Yearlings	Planting Size Range	Months of Planting
Oak Springs	300,000		250,000	140,000	100,000	5-10 per lb.	May - July
Wizard Falls	927,000		772,500	640,000	125,000	5-10 per lb.	April- July
Fall River	4,800,000		4,000,000	4,000,000	-	-	-
Klamath	1,200,000		1,000,000	1,000,000	-	-	-
McKenzie	465,600		388,000	300,000	80,000	5-10 per lb.	-
Enterprise	720,000		600,000	600,000	-	-	-
Willamette	120,000		-	-	100,000	5-10 per lb.	April- June

Table 181

Eastern brook schedule

Hatchery	No. of Eggs	Month	No. of Fry	Fry Released		Yearlings	Planting Size Range	Months of Planting
Fall River	3,565,000		3,100,000	3,100,000		-	-	June - July
Klamath	681,375		592,500	510,000		75,000	5-10 per lb.	June - July
Hood River	183,750		175,000	175,000		-	-	July
Enterprise	69,000		60,000	60,000		-	-	July

Table 182

Cutthroat schedule

Hatchery	No. of Eggs	Month	No. of Fry	Fry Released		Yearlings	Planting Size Range	Months of Planting
Cedar Creek	131,250		105,000	50,000	Grading	50,000	3-5 per lb.	June - July
Alsea	444,750		355,000	300,000	Grading	50,000	3-5 per lb.	June - July
Bandon	589,375		471,500	400,000		65,000	3-5 per lb.	May - June
Enterprise	35,000		30,000	30,000		-	-	-

FACTORS INVOLVED IN THE DISTRIBUTION OF YEARLING TROUT

Complaints have been expressed by individuals and groups regarding the heavy angling pressure centered upon points of release of large fish in streams during the open season.

The situation is a result of changed stocking policies and the characteristics of certain streams or stream sections.

In recent years, the necessity of stocking trout of legal length in greater numbers has increased. We have knowledge that such trout in most instances are available to the angler for a period of not more than six weeks. Hence, in streams that require heavy stocking, releases are made throughout the season. Repeated grading in hatcheries makes it possible to release fish progressively as they reach legal length.

The within-season releases pose a problem of distribution. If the fish are released in one or two locations, they fall easy prey to a few anglers, especially those using bait. Even when placed in rapid stretches, the fish tend to congregate in the first available pool. The rate of dispersal has been demonstrated by our workers to be slow. Workers in Colorado found that of an entire season's stocking of rainbow in a stream, over 90 per cent were caught within one mile of the stocking point. The test was conducted on a stream similar in size to many of our Willamette Valley trout waters. In larger rivers, the dispersal would probably be greater. All available data for rainbow trout show the migration to be greatest in a downstream direction.

It is difficult to reach many parts of some streams. Roads do not always follow the stream courses, steep canyons and areas of dense brush often prevent access to a stream, and the distribution may thus be limited.

In many cases, accessible stocking points are on private land or bordering such areas. The liberators have instructions to skip such locations if it is known that the general public does not have access. Tests with marked rainbow trout have demonstrated a 20 to 30 per cent migration into adjacent closed areas even when stocked as far as one-third of a mile away.

Many suggestions have been put forth in an effort to obtain an improved distribution of yearling trout in streams. Listed below are some of the recommendations:

1. Have the liberator spend more time in actual distribution.

2. Close certain areas of streams and stock all fish in those areas.

3. Close portions of a stream for a short time after stocking.

4. Use more man power.

5. Use special techniques and methods in distribution to obtain better spread.

6. Make more and smaller releases in order to avoid concentrations.

7. Make releases at night..

8. Increase the amount of stocking equipment.

A discussion of each suggestion follows:

1. It is conceivable that the truck drivers could spend more time putting out the fish than at the present. This applies in those areas where numerous sites are available. A problem arises, however, in the additional cost in wages. All drivers in the 1951 season worked many days and hours beyond their normal work week.

2. Closing portions of streams as stocking sites for yearling fish has been tried experimentally without success. A closure which is too large will allow too few fish to migrate to open water. Many small closures would pose difficult enforcement problems.

3. Post-stocking closures would probably result in an added burden of enforcement problems. The number of releases made in some streams are so many that utter confusion would result. Tests in Colorado showed a greater catch ratio for a one-week period following a six-week closure than in areas with shorter closures or no closures. The attendant publicity necessary to close these areas increases the fishing pressure greatly.

4. The use of more man power is often suggested. There are many sources of help from other organizations but disadvantages occur with each. Sportsmen, youth groups, personnel of the cooperating agencies, and employees of other departments of the Game Commission have all been used in some capacity in the work in the past.

   The situation regarding the aid of sportsmen is delicate. The practice of having local sportsmen assist in distributing fish has been in vogue for many years. As originally conceived, it was a good plan and provided labor to carry fish to the stream, and guide service on little known roads. In addition, there is some value in affording the local anglers the opportunity to see the trout which are produced by use of license funds. An undesirable outgrowth of the method has crept into the picture in recent years. It is the action of the unscrupulous

local angler who continues to become appointed to the "Fish Committee" of his club with an eye to having good fishing for himself and friends throughout the season. Some of these gentlemen have gone so far as to ask the driver to make releases in obviously private areas. This type of person is responsible for a large part of the "follow-up" angling at points of trout releases.

The effective assistance supplied by field personnel throughout the state in making releases has partially controlled the problem. In reviewing 650 releases made early in 1951, it was noted that representatives of sportsmen's groups were in attendance at 42 per cent of the stockings and Game Commission personnel, other than drivers, assisted in 38 per cent of the releases. The continued increase in assistance by field personnel, made possible by the regional organization, will control the off-color sportsman to some degree. Much valuable assistance can be obtained from local clubs under trained supervision. Such assistance could be utilized in distributing trout in order to avoid concentrations.

The employment of additional men to ride with the drivers during stocking season has lately been under consideration. Only two or three men would be needed since many hauls are made into areas where regular field men could handle the assignments. Perhaps the stationing of a man at each of several hatcheries, where more than one truck is normally located, would be advisable. This man could then participate in releases in territories where Game Commission personnel would not be available.

The assistance of game officers of the Oregon State Police has often been sought in distributing fish. These men have helped in spreading the loads and with the knowledge of places of release have been able to check for possible violations. In addition, we have been informing the Salem office of stocking schedules in advance. A plan is being formulated whereby our regional offices will immediately inform the State Police of releases in areas which should be patrolled.

The United States Forest Service has always been cooperative in helping with the distribution of fish. Their efforts, of course, are confined to the lakes and streams in national forests. At several meetings between Game Commission representatives and Forest Service officers held earlier

this year, agreements were reached encompassing further assistance from the Forest Service in such matters. Their help is valuable but there are times during fire season when Forest Service man power is not available.

Youth groups such as the Boy Scouts of America have been of assistance, although they have been rarely used. They could become a valuable man power pool. Much value lies in the educational aspect of training youngsters in the stocking phase of fishery management.

Field personnel of all five regions have been active in fish stockings. With an average of over twelve releases being made daily during a seven months' period, it is obvious that if all releases were attended by regional field men, no other work would be accomplished. In some areas, such as at East Lake and in the Deschutes Study Area, almost every release is handled by the biological staff. It is doubtful that this assistance can be increased without endangering other worthwhile work.

In addition to stocking accomplished by crews in hatcheries where portable tankers are used, hatcherymen have been used for general distribution work. Fish production is at its peak during the season of stocking work, and all hatchery employees are normally busy with their routine duties. Thus, very little additional help can be expected.

5. The use of improved techniques and equipment in distribution has increased in the past two years. Planting boats were developed for more efficient stream and lake stocking. On the McKenzie, the "trout trolley" has been designed for more effective distribution of yearling trout and has proven suitable for delivering fish to the streamside in areas where accessibility would otherwise be denied. It is planned to use the technique on other streams.

   An innovation developed for use in releasing fish from high bridges is a trip bucket operated with two ropes. The simple contrivance, although limited in application, will be used on all trucks, enlarging the scope of distribution on streams having many high bridges.

6. A suggestion to make smaller releases with more trips has some merit. The idea has been put into practice in areas where it is applicable. Along

the coast, in the Willamette Valley, and in lakes and streams near hatcheries, the system has worked well. The contents of a single truck load are planted in several streams. Such plantings are then repeated at intervals until the full allocation for each body of water is reached. Heavy concentrations have been avoided in most instances by the practice. It is not an economical procedure where long hauls are necessary. East of the Cascades, the streams to be stocked are often too far apart for efficient use of the method.

7. The making of releases of fish at night has been tried with some success in limited situations. Some night work has been a necessity because of a need for running two shifts during the peak of activity. Lakes can be stocked quite easily at night, but streams present a problem because of limited access. Only those streams which are heavily fished and which run close to highways should and could be stocked at night but here we are often limited to only a few points of access.

8. An increase in equipment used is related closely to man power. If additional trucks are used, drivers must be employed and trained and it is difficult to find competent drivers for temporary work. Either individual truck equipment should be enlarged or some plan put in operation whereby regular employees are used as drivers. Equipment such as planting boats, trout trolleys, and holding pens could be increased without creating a need of additional employees.

   For reasons of economy, the trend is toward the use of larger tank trucks in order to reduce the number of long hauls. By reducing total travel time, more effort can be directed toward better distribution within a stream or lake.

   Figures taken from the financial statement of the Oregon State Game Commission show a decline in stocking costs per pound of fish. In comparison to a five-year average of 11.27 cents per pound from 1945 to 1949, the 1950 cost was 07.76 cents per pound. Costs for the first six months of 1951 were 06.53 cents per pound, pointing to an even greater increase in efficiency of operation.

The policy of the Game Commission in regard to fish stockings is as follows:

"Release of salmonoid fish shall be made only in waters available to the public. The most efficient and successful techniques of fish stocking shall be employed in the release of hatchery-reared fish and constant effort shall be directed at

improving such methods to the end that maximum efficiency shall prevail in the stocking program."

In order to further implement the policy, the Fishery Division plans to take the following action for the ensuing year:

Equipment

One new tank of 500-gallon capacity will be constructed, designed along similar lines to that of the California type of fish-planting unit.

Two additional 150-gallon portable tanks will be constructed for use at hatcheries utilizing the same principles of water circulation and aeration as in the 500-gallon unit above.

It is also planned to convert at least one of our present units of medium size in such a manner that it can be used experimentally in testing the efficiency of different types of circulation and aeration.

Four more planting boats of self-bailing design will be constructed for use on both lakes and streams. The four boats now in use have been effective in obtaining improved distribution. Streams such as the Clackamas, Wilson, Nestucca, and lower Deschutes could be stocked effectively by boat.

"Trout trolleys" will be used on the trucks to obtain distribution to stream sections difficult of access by other means.

Collapsible live-boxes constructed recently will be used in certain areas to hold large loads for redistribution by regional personnel. If funds are available, at least two permanent concrete live-pens will be installed in eastern Oregon for a similar purpose.

A constant search is being made for ways to improve our present stocking equipment. Improvements designed to increase truck capacity, which in turn would improve carrying conditions for the fish, are under consideration. Experiments will be conducted in cooperation with the Fishery Research Unit in an effort to reduce post-stocking mortalities.

Techniques

Night planting will be carried on where it is deemed necessary and desirable. The "split load" procedure will be used in heavily fished areas where such is economically feasible. The greatest distribution possible will be obtained on heavily-fished streams through the use of planting boats and other devices mentioned in the preceding section.

Week-end releases during the open season will be made only in areas where rapid distribution and dispersal can be obtained, or in closed areas in certain lakes.

Man power

All available permanent man power will be used, limited only by budgeted time. If double shifting on stocking units is necessary, regional

employees should be used as far as possible.

The aid of other agencies will be saught where necessary.

The assistance of sportsmen will be obtained for distribution of fish in certain areas, and when possible such will be done under the supervision of regional personnel.

WARM-WATER GAME FISH

The exotic warm-water game fishes, obtained from eastern United States, were first introduced into Oregon late in the nineteenth century. The fish found conditions favorable for growth and reproduction in the lowland waters of the Willamette and Columbia Rivers. Further development of the warm-water fishery at that time was limited primarily to production stocking in additional areas. Salvage operations on Sauvie Island served for many years as a means for extending the range of the several species throughout Oregon.

A stimulated interest in game fish other than trout and salmon occurred following recent increased industrial and agricultural development. Recruitment of workers from eastern and southern United States who prefer their native species to trout and salmon has intensified the demand for warm-water game fish. Along with industrial and agricultural development has come the inevitable decline in the amount of trout water. This has thrown an additional stress on fish adapted to higher water temperatures.

At the onset of an intensified program in February, 1950, it was assumed that an improvement in the warm-water game fishery would best be obtained through the application of current biological precepts. A phenomenal discovery by early research workers that many lakes having warm-water game fish were overpopulated and that annual plants of hatchery fish were deleterious to existing populations, has been of considerable value in developing a modern program.

Inasmuch as warm-water game fish are now present in most suitable waters, recent development has been concerned with improving existing populations, or developing waters through chemical treatment and rehabilitation.

Areas investigated

Investigations were conducted on numerous streams, lakes, sloughs, borrow pits, reservoirs, and farm ponds. One typical Willamette Valley lake was established as a test area and received detailed studies. It is hoped that information on management obtained through the study of this lake will be applicable to other bodies of water having similar physical properties. Population studies were conducted on six coastal lakes. Several lakes and reservoirs of eastern Oregon were also examined in order to determine methods best suited for the development of warm-water game fish.

Fish population studies

Equipment used in the collection of fish for population studies consisted of a New York type trap net, gill nets, a trammel net and seines. Rotenone proved an effective method in sampling for young-of-the-year fish in vegetated shoal areas and in determining total populations of lakes and ponds. In sampling fish populations, a New York trap net was used extensively. Data from trap net sets on ten lakes are presented in Table 183. Total population figures were obtained from forty-one net sets comprising over fourteen hundred hours of fishing time.

Table 183

Catch of New York trap net in population studies of
Oregon warm-water lakes

Lake	Net lifts	Total hours	Date (1951)		Crappie*	Bluegill	Bullhead**	Bass	Perch	Trout	Silver salmon	Warmouth bass	Carp	Squawfish	Sucker
Clear	5	120	6-25	6-29	73	4	1	-	-	3	-	-	46	5	75
Tenmile	1	24	8-9	8-10	-	-	87	-	8	-	-	-	-	-	-
Siltcoos	3	72	8-7	8-9	12	104	65	2	46	1	-	-	-	1	-
Tahkenitch	1	24	8-10	8-11	3	12	5	-	20	-	-	2	-	-	-
Goose	6	168	7-6	7-13	568	166	21	1	-	-	-	2	7	3	41
Hubbard	3	96	7-28	7-31	121	72	77	-	-	-	-	13	26	-	-
Mission	3	72	8-22	8-24	2,051	27	43	-	-	-	-	2	3	2	56
Devils	1	48	7-26	7-28	-	4	79	2	9	-	1	2	17	-	-
Willow	17	768	5-1	6-7	3,125	102	4	2	14	-	-	6	2	20	16
Blue	1	24	8-20	8-21	-	1	2	-	-	-	-	-	27	36	-
Total	41	1,416			5,953	492	384	7	97	4	1	27	128	67	188

* Represents both black and white crappie. The white crappie is more abundant and more widely distributed.

** The yellow and brown bullhead are included. Predominance varies with different lakes.

The crappie, although not present in all lakes sampled, formed the greatest number of game fish collected. An average of approximately twenty-eight crappie per hour was obtained from net sets in Mission Lake of Marion County. Mission Lake receives moderately heavy fishing pressure since it lies in the vicinity of Salem and is one of the few Willamette Valley lakes open to public fishing. Considering the fishing intensity and number of crappie present, it is obvious that overpopulations of crappie cannot be brought under control by angling. The white crappie predominates in the Willamette Valley lakes while the black is more common in the coastal region.

The bluegill was second in abundance and present in nine out of ten lakes. Several lakes apparently supported a small population, but in Siltcoos Lake, it was found to be more abundant than any other species.

The bullhead catfish were third in abundance and present in every lake. Adequate numbers were found in over half of the lakes sampled, with three coastal lakes, Siltcoos, Devils and Tenmile, having large populations.

Perch reached their peak of abundance in coastal lakes. From trap net returns in valley lakes, they would seldom, if ever, reach sufficient numbers to attract the angler.

The largemouth bass are difficult to capture in trap nets; hence, the small number of returns is not indicative of the true population. With the exception of Tenmile Lake, all areas are assumed to be supporting populations of largemouth.

Warmouth bass are found throughout the valley and in some coastal lakes. The species never becomes numerous when in competition with other fish and only occasionally is present in the angler's catch.

A small number of trout and salmon were taken along with warm-water species. They were never abundant and, with the exception of one rainbow in Siltcoos Lake, all were native cutthroat trout and silver salmon.

Rough fish such as carp, suckers and squawfish were present in many net lifts. Clear, Hubbard, Devils, and Blue Lakes were found to have a heavy concentration of carp. Blue Lake, in addition, supported a large population of squawfish.

Two years of netting in Mission Lake, which is directly connected with the Willamette River during winter months, indicates a change in the proportionate number of bluegill and crappie which may be the result of flooding. Fish populations in other Willamette Valley lakes appear to be undergoing gradual changes which cannot be attributed to introductions through flood stages of the Willamette River.

In most lakes supporting large quantities of rough fish, the production of warm-water game species appears to be below average. For instance, in a total of sixty-six fish collected in Blue Lake, only three were game species. The ratio of game and rough fish is even more pronounced in some lakes when total weights are compared, such as that found in Clear Lake and presented in Table 184.

Table 184

A comparison in the catch of rough and game fish in five New York trap net sets in Clear Lake - 1951

	Game fish	Rough fish
Total number	81	126
Percentage weight	4	96
Percentage number	40	60

Other lakes which are known to produce a high level of fishing, such as Tenmile, Siltcoos, and Tahkenitch, appear to be relatively free from rough fish. One hundred and ten hours of trap net fishing in them produced only one squawfish.

Average size of game species

Many fish obtained in population studies were measured in order to determine the average size for various species in different lakes. In addition, the data for a group of lakes were used to determine the average size for each species. A compilation of the measurements is presented in Table 185. All measurements were recorded in millimeters and converted to inches. Fork length measurements, i.e., tip of mouth to fork of tail, were used throughout.

The bullhead catfish, frequently found in the Willamette Valley and coastal lakes, had the largest average size of warm-water game fish taken in population studies. An average length of 10 inches was determined for this group which includes the brown and the yellow bullhead. Siltcoos Lake produced the largest bullheads of any lake examined. Twenty-five specimens had an average length of 12 inches. Tenmile Lake had the lowest average, 9.1 inches, further evidence that the present large population of bullhead catfish may be making poor growth. With the exception of Tenmile Lake, coastal waters produced larger bullheads than inland lakes.

An average length of 8.2 inches was calculated for perch collected in four coastal lakes. The collection from Tenmile Lake consisted of only eight specimens, none of which was under 9 inches in length. Although they exhibited an average length of 10.8 inches which was above that of perch from other lakes, the size of the sample was too small for the determination of a representative average size.

The crappie represented by the white and the black forms was third in size with an average length of 6.9 inches. Average lengths for five lakes varied from 5.4 inches to 8.1 inches.

An average length of 6 inches, the lowest of all game species, was calculated for the bluegill sunfish. In Siltcoos Lake, the bluegill averaged 7.3 inches, an excellent size considering that the species seldom exceeds 9 inches in length.

Growth studies

Age determinations were made on four game species collected in population studies of numerous valley and coastal lakes. Plastic scale

Table 185

Lengths of game fish determined from
samples collected by New York trap net and experimental gill net sets

Lake	Collecting gear	Crappie		Bluegill		Bullhead		Perch	
		Number of specimens	Average length (inches)	Number of specimens	Average length (inches)	Number of specimens	Average length (inches)	Number of specimens	Average length (inches)
Willow	New York trap	267	5.4	-	-	-	-	-	-
Mission	New York trap	370	6.4	9	5.8	28	9.4	-	-
Hubbard	New York trap	120	7.0	72	5.2	77	9.3	-	-
Siltcoos	New York trap	-	-	37	7.1	25	12.0	42	8.5
Tahkenitch	New York trap	-	-	12	5.3	5	11.8	20	7.0
Goose	New York trap	422	8.1	87	6.3	18	9.8	-	-
Devils	New York trap	-	-	4	7.5	79	11.3	-	-
Tenmile	New York trap	-	-	-	-	87	9.1	8	10.8
Clear	New York trap	66	6.4	4	6.6	-	-	-	-
Sunset	Exp. gill net	-	-	-	-	-	-	76	8.0
Average for all lakes			6.9		6.0		10.0		8.2

impressions and dry mounts were employed in calculating growth rates. Age groups of certain species were not of sufficient magnitude to complete growth curves which resulted in some divisions having minor discrepancies. The average age of fish at time of capture presented in Table 186 is a preliminary report which will be augmented through collections made in sampling additional bodies of water.

The white crappie appear to grow well for the first four years, after which they fall below the average reported in many other states. The species becomes available to the angler in its second or third summer.

Bluegill growth in Oregon is similar to that found in the northern tier of Midwest States since they reach creel size in their third of fourth summer.

The perch show an excellent growth, especially in some coastal lakes, in comparison to that found in other states. Some perch in their second summer become available to the angler.

Owing to the difficulty involved in trapping largemouth bass, few scale samples were collected for age determinations. In addition to net-caught fish, scales were also obtained from the anglers' catch and specimens from lakes in which populations were destroyed by chemical treatment. From the few samples available for reading, growth of the largemouth is comparable to average bass lakes in other states. The largemouth bass also appears to have better growth in its first few years of life.

The growth of warm-water game fish in Oregon is similar to that found in Michigan, Ohio and Wisconsin. Warm-water game fish show a much better growth in southern states, where a much longer growing season prevails.

Test lakes

An inventory of warm-water game fish in Oregon revealed that serious overpopulation and other complex conditions existed in many lakes which adversely affected the production of game fish. In certain areas conventional management procedures were impractical owing to periodic flooding of the Willamette River. Other bodies of water not subject to flooding could be improved in a routine manner.

Several Willamette Valley lakes known to be either overpopulated or to contain an abundance of rough fish were chosen as test lakes. Preliminary investigations in 1950 indicated that Willow Lake was supporting an unusually large number of predaceous fish. This overpopulation was characterized by an abundance of small white crappie.

In the spring of 1951, a trap net was employed in an attempt to reduce the number of crappie. In operating the net 768 hours, a total of 3,125 white crappie and 43 rough fish, weighing approximately 330 pounds, was removed from the lake. The average catch for the white crappie was 4.0 fish per hour. Although the lake has a minimum pool area of between twelve and fifteen acres, and appears to be ideal for trap net operation, the net was found to be impractical in reducing the crappie an appreciable amount. After the net had been fished 600 hours, the crappie were still caught at the rate of 3.1 fish per hour.

Table 186

Average length at time of capture of four warm-water game species by age groups

Age group	White crappie		Bluegill		Perch		Largemouth bass	
	Number	Length (inches)	Number	Length (inches)	Number	Length (inches)	Number	Length (inches)
I	27	5.4	4	3.2	2	4.9	3	5.9
II	58	6.6	13	4.7	18	7.0	13	8.5
III	25	8.0	27	5.8	32	6.8	8	9.0
IV	23	8.8	45	6.3	19	9.0	9	11.2
V	26	9.4	19	6.4	5	10.8	5	13.9
VI	8	10.1	5	6.5	4	10.6	4	13.4
VII	3	11.4	8	7.1	1	13.8	2	16.0
VIII	1	13.8	2	7.2	-	-	3	16.0
IX	1	14.4	-	-	-	-	3	18.3

After a portion of the lake had been cleaned of debris, a large small-mesh seine was utilized in a further attempt to reduce the population. The method was also found to be of little value because of the time consumed and the small area covered by each seine haul.

As the water level recedes in late summer, Willow Lake becomes separated by an exposed earth fill which divides the lake into a north and south half.

On September 17, forty pounds of rotenone was applied to the north half of Willow Lake. Subsequent checks indicated a complete kill consisting of many large carp and suckers in addition to a tremendous number of small crappie and bluegill. It was estimated that from four to five thousand pounds of fish were destroyed. Less than 2 per cent of the total number killed was classed as game fish of creel size. In view of the high percentage of rough fish found in the poisoned area, it was assumed that poisoning operations should be extended to a portion of the south half to assure an adequate reduction in the total population. Ten pounds of rotenone was then applied to one-half of the remaining lake. The kill in the south half consisted of a greater number of bass, crappie and bluegill in proportion to the rough fish destroyed. It was estimated that approximately 60 to 75 per cent of the fish present in Willow Lake were destroyed by rotenone in the two treatments.

It is not surprising that Willow Lake held little interest for anglers considering the small number of creel-size game fish it supposed prior to treatment. It is hoped that Willow Lake will respond in a manner similar to many lakes and reservoirs in which a rapid increase in bass follows a winter kill or extensive loss during drouth periods. The planting of bass is not anticipated but an effort will be made to hold rough fish under control.

Hubbard Lake was chosen as a second test area because of its large population of rough fish and a reported decline in the success of local anglers. One hundred pounds of rotenone was distributed over approximately twenty acres of Hubbard Lake on September 18, 1951. The kill was predominantly carp followed

by crappie, bluegill, squawfish, and bullheads. Thirty-six creel-size bass, or 1.8 per acre, were counted in the area treated. A very high percentage of other game species had not reached sufficient size to attract the angler. It was estimated that Hubbard Lake at the time of treatment had an area of forty to fifty surface acres. Owing to the dense beds of submerged vegetation and marginal plants, it was difficult to arrive at more than approximations of acreage and number of fish destroyed. Hubbard Lake has been in senescence but is experiencing a rejuvenation through the efforts of beaver in damming the outlet.

Other areas treated

Perkins Lake, a small five-acre body of water having a mixed population of warm-water game fish, was treated with an improved form of Fish-Tox. Satisfactory results were obtained through a surface application of the material in burlap bags at the rate of about one p.p.m. Toxic material of sufficient strength to destroy bullheads had diffused to a depth of 25 feet in four days. Perkins Lake will be used experimentally in developing a population of white catfish or a combination of warm-water game species best suited for stocking the coastal region.

Two highway borrow pits near Eugene having stunted populations of crappie, bluegill and bullhead catfish were treated with rotenone. They will be utilized as rearing ponds and fishing areas.

Observations of spawning habits

Observations have been made in order to determine the time at which spawning takes place for different species of warm-water game fish. Spawning data recorded in routine field duties are presented in Table 187.

Table 187

Observed spawning activities of warm-water game fish in Oregon

Species	Observations	Date	Place
Largemouth	First fry observed	6/23/50	Pudding River Slough
Largemouth	Adults on nests	6/26/50	Willamette Slough above Salem
Largemouth	Newly hatched fry	7/30/51	Lambert Slough
Bluegill	Nesting	6/12/51	Highway borrow pit, Eugene
Brown bullhead	Nesting	5/14/51	Highway borrow pit, Eugene
White crappie	Newly hatched fry	7/6/51	Goose Lake
Perch	Extruded egg ribbons	4/4/51	Tenmile Lake

Variations in water temperatures resulting from climatic changes are reflected in the spawning dates of certain warm-water species. In 1950, bass fry collections in Lambert Slough were begun on July 24. In 1951, bass schools had dispersed and individuals had attained lengths of from 1½ to 2 inches by July 18.

Farm ponds

Several cooperative farm ponds have been planted with different ratios

of yearling bass and bluegill in order to determine the number desirable for stocking small bodies of water in Oregon. Development of a correct stocking ratio has been handicapped by the few ponds available for experimental purposes and by an inadequate source of bass stock for planting.

Preliminary returns from two similar ponds indicate that even small variations in stocking ratios may have a decided influence in establishing a balance between the number of bass and bluegill. Bluegill were found to have successfully spawned in one pond which received an initial stock of 200 yearling bass and 600 yearling bluegill. In a similar pond having 200 yearling bass and 400 yearling bluegill, reproduction of bluegill was not apparent. Although some bass, collected as fry in 1950, had attained lengths of from 8 to 10 inches in June, none were found to have spawned in their second summer. It is conceivable that under ideal conditions, largemouth bass in Oregon could spawn in their second summer but such would be an exception rather than the rule.

Fry collections and planting record

As a result of an unusually early and apparently poor hatch of bass in Lambert Slough, the number of fry collected was considerably below that obtained in 1950. Yearling bass were distributed to a number of rearing ponds in the Willamette Valley and in eastern Oregon. It is expected that reproduction from these plantings will augment collections made from natural reproduction in lakes and sloughs in the spring of 1952.

Fry plantings made in 1950 were recovered at the rate of 11 to 20 per cent in the spring of 1951. In one cooperative farm pond, it is thought that an appreciable loss occurred during an unscheduled drawdown. In two other areas, mature volunteer cutthroat trout are believed to have made inroads on the initial plant. Cannibalism within the species is evident from the growth of some specimens and is believed to have been responsible for the reduction in the number of bass in certain ponds.

An examination of Waverly Lake, chemically treated in 1950 and planted with bass fry, revealed the presence of large numbers of volunteer bluegill in adult, intermediate, and fry classes. It was orginally planned to remove the surplus of bass from Waverly Lake for stocking other lakes, but such was not deemed advisable in view of the abundance of volunteer bluegill and the apparent loss of bass during unusually high water in the winter of 1950-51. That bass are doing well in Waverly Lake was manifest in the catch of juvenile anglers which contained specimens from 6 to 10 inches in length.

Approximately 300 immature white catfish, Ictalurus catus, were obtained from California in November, 1951. In view of the persistent toxic condition of Perkins Lake, the white catfish are being held temporarily at the Turner pond where, at times, bass fry and fingerlings have been held for temporary storage.

A record of warm-water game fish plants made in 1951 is presented in Table 188. The planting record includes the transfer of bass to and from the Turner holding pond.

Mixed populations of salmonoid and warm-water game fish

Populations of salmonoid and warm-water game fish are occasionally

Table 188

Planting record of warm-water game fish - 1951

Where obtained	Lake planted	Species	Number	Age	Size (inches)	Location of pond	Date (1951)	Intended use
Serres' Pond	Cottage Grove	LM Bass	956	Yrl.	3½	Cottage Grove	2/5	Angling
Serres' Pond	Cottage Grove	Bluegill	461	Ad.	3½-6½	Cottage Grove	2/5	Angling
Arboretum	Cottage Grove	LM Bass	1,150	Yrl.	3-9	Cottage Grove	3/2	Angling
Arboretum	Arboretum*	LM Bass	1,150	Yrl.	3-9	Corvallis	3/2	Stocking
Bartels'	Joe Serres'	LM Bass	198	Yrl.	2½-8½	Woodburn	5/7	Surplus for stocking
Bartels'	Bartels'*	LM Bass	200	Yrl.	2½-8½	Shaw	5/7	Surplus for stocking
Bartels'	Walton's	LM Bass	834	Yrl.	2½-8½	Turner	5/7	Stocking
Hy. Borrow Pit	Waverly Lake	Bluegill	6 pr.	Ad.	4-7	Albany	5/15	Angling
Salem Sloughs	Silverton Mill Pond	Bluegill	8 pr.	Ad.	4-7	Salem	5/21	Angling
Walton's	Bartels'	Bluegill	600	Yrl.	1-1½	Shaw	5/22	Surplus for stocking
Walton's	Serres'	Bluegill	400	Yrl.	1-1½	Woodburn	5/22	Surplus for stocking
Goose Lake	Hy.Borrow Pit No.1**	LM Bass	600	Fry	1-1½	Eugene	6/15	Angling, stocking
Clear Lake	Hy.Borrow Pit No.4**	LM Bass	1,700	Fry	1-1½	Eugene	7/8	Angling, stocking
Clear Lake	Hy.Borrow Pit No.5**	LM Bass	800	Fry	1-1½	Eugene	7/8	Angling, stocking
Mission Slough	Cottage Grove	Bluegill	49	Ad.	4-7	Cottage Grove	7/16	Angling
Walton's	Cottage Grove	LM Bass	318	Yrl.	4-5	Cottage Grove	7/16	Angling
Walton's	Dutchy Lake	LM Bass	200	Yrl.	4-6	Summer Lake	10/15	Angling, stocking

* Returned to pond after drawdown.
** Borrow pits are numbered consecutively from Junction City south.

found in inland and coastal lakes. In mixed populations neither salmon nor trout were ever found in abundance. It would appear that many lakes and ponds found at low elevations west of the Cascade Mountains may be suitable for either salmonoid or warm-water game fish. Excellent bass growth has been obtained in a pond which was formerly considered a good trout producing area. Rainbow trout, released as advanced fry, have been carried through two summers in shallow ponds near Salem. Similar adjacent ponds have successful bass and bluegill reproduction. The growth of chinook salmon, isolated in sloughs of the valley floor at the time of their downstream migration, is greater than that in a hatchery on their parent stream.

Parasites and diseases

Most species of warm-water game fish were examined for parasites in routine collections. No detailed studies were made to determine specific identifications or the extent of distribution.

Perhaps the most important fish parasite in warm-water game fish management is the heavy infestation of an encysted fluke found in the bullhead catfish. The parasite appears to be confined to the coast and has not been found in the Willamette Valley. The subcutaneous cysts are readily seen by the angler in dressing the fish. An abundance of small white cysts in the flesh of the bullhead catfish undoubtedly discourages the less hardy angler in accepting them as a food fish.

The largemouth bass in Devils Lake was found to contain cysts of a parasite resembling that of the bass tapeworm. One mature largemouth was found to be eggbound as a result of infestation by the parasite. The presence of bass tapeworm cysts in gonad tissue often prevents bass from spawning, but it is generally believed that an adequate number of bass are able to spawn even in heavily infested waters.

Mature and immature stages of parasites were found in other warm-water game species, but never in sufficient numbers to seriously affect growth or reproduction.

A mortality of bullhead catfish in Fern Ridge Reservoir was reported on May 22, 1951. It is believed that the loss was due to a condition associated with spawning.

Miscellaneous activities

Creel census was conducted on a few valley lakes when time permitted. Fishing intensity and the rate of catch were similar to that obtained in 1950.

Several pollution investigations were made following reports of fish losses. A release of ammonium from a cooling system at the Detroit Dam resulted in a loss of approximately 2,000 spring chinook salmon and considerable numbers of resident trout in the Santiam River.

Numerous individuals having farm ponds were helped. Assistance to private pond owners, as in the past, has been confined to information on proper construction and fishery management, with the exception of previously established cooperative projects.

STRIPED BASS INVESTIGATION

Introduction

This is the second report on the striped bass investigation of the Coos Bay area. It covers the period from November 18, 1950, to August 12, 1951, and includes a comparison of the data obtained in the same period for 1949-50.

Creel census

The creel census was made by personal interviews with anglers. No log books were left with moorage operators. During the majority of the season, there were no skiffs to rent in Isthmus Slough or on the bay, and most operators elected to make no rentals because it was felt that they could not make enough profit to warrant the expense. The data obtained in the census were composed of the number of persons per party, length of time spent in fishing and number of fish caught.

Angling for striped bass was done by boat or bank fishing. Of the total anglers checked, 64 per cent were bank fishermen. The low percentage of boat fishermen was caused by the scarcity of skiffs and the inaccessibility of the slough and river to private boat owners. Until the fishing effort moved to Coos River, there were only four skiffs and three inboards available for rental. The majority of the skiffs used were privately owned. Frozen pilchard shipped from California was the main type of bait used. When such was not available, frozen herring and sculpins were used. The principal artificial lures were plugs or yellow jigs which were trolled or cast from boats or the bank. When the fishing effort moved to Coos River, seventeen skiffs and three inboards became available for rental. In the month of July, this was increased to twenty-five skiffs and three inboards when a new moorage was opened in North Bend. All of the moorages were seasonal in operation.

From November 18, 1950, to August 12, 1951, 4,481 anglers fished 22,100 hours to catch 2,375 bass. The information was compiled in biweekly periods and is presented in Table 189 , along with similar data for the same period in 1949-50. The estimated poundage was 10,212 and the average sport-caught bass weighed 4.3 pounds.

There were three periods of good fishing. The first occurred in January and February on Isthmus Slough, the second was in April as the fishing moved to Coos River, and the third was in July as small fish made their appearance in Coos River. During May and June, fishing was poor since the bass were spawning and dredging operations conducted by Weyerhaeuser Timber Company caused considerable silting in the river. Angling was at its poorest in the first week of June but started to improve as the small fish that enter the nursery grounds during the summer began to make up a greater part of the catch. For numbers of fish, July and the first part of August were outstanding for the season, while for size of fish, the months of January and February were best. During the first two weeks of the census, most of the time was spent on the legislative report and no information was gathered, and for the two weeks beginning December 18, the survey biologist was on annual leave. There was little variation during the year except for May and June. The expected large numbers of 4th of July bass

Table 189

Total creel census in bi-weekly periods for the 1949-50 and 1950-51 striped bass sport fishery of Coos Bay, Oregon

	Number of anglers		Hours fished		Fish caught		Average fishing effort		Average catch per angler		Average time to catch one bass	
	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951	1950	1951
Nov. 18 - Dec. 2	*	213**	*	1,125	*	96	*	5.28	*	0.45	*	11.72
Dec. 3 - Dec. 17	*	113	*	560	*	35	*	4.96	*	0.31	*	16.00
Dec. 18 - Jan. 2	183	188	943	995	44	68	5.15	5.29	0.24	0.36	21.43	14.63
Jan. 3 - Jan. 17	8	304	24	1,569	0	74	2.88	5.16	0	0.24	0	21.00
Jan. 18 - Feb. 2	70	123	157	724	2	68	2.24	5.89	0.03	0.55	78.50	10.65
Feb. 3 - Feb. 17	68	454	298	2,729	36	229	4.39	6.01	0.52	0.50	8.28	12.13
Feb. 18 - Mar. 2	127	133	664	739	39	42	5.23	5.55	0.31	0.32	17.02	17.59
Mar. 3 - Mar. 17	312	129	1,815	701	45	40	5.82	5.43	0.14	0.31	42.20	17.53
Mar. 18 - Apr. 2	183	219	928	1,223	49	38	5.07	5.58	0.27	0.17	18.94	32.18
Apr. 2 - Apr. 17	223	249	1,361	1,335	37	65	6.10	5.36	0.17	0.26	36.78	20.54
Apr. 18 - May 2	153	98	810	550	62	44	5.29	5.61	0.41	0.45	13.06	12.50
May 3 - May 17	37	114	122	667	9	19	3.30	5.85	0.24	0.15	13.56	35.63
May 18 - June 2	169	140	804	700	20	15	4.72	5.00	0.12	0.11	40.20	46.67
June 3 - June 17	157	61	772	285	42	13	4.92	4.67	0.27	0.21	18.45	21.92
June 18 - July 2	656	198	3,125	948	119	89	4.76	4.78	0.18	0.45	26.26	10.66
July 3 - July 17	601	476	3,069	2,312	308	265	5.11	4.73	0.51	0.56	9.96	8.72
July 18 - Aug. 2	352	770	1,688	3,083	318	837	4.79	2.83	0.90	1.08	5.30	3.81
Aug. 2 - Aug. 12	409	499	1,783	1,855	377	338	4.36	3.72	0.92	0.67	4.73	5.48
Total	3,708	4,481	18,373	22,100	1,507	2,375	4.96	4.93	0.41	0.53	12.19	9.31

* No data available for 1949-50
** Data estimated.

anglers did not materialize since excellent sport salmon fishing offshore was a stronger lure to the angler.

Sport fishery by areas

During the fall and winter months, sport fishing is carried on in Isthmus Slough, while in the spring and summer fishing moves to Coos and Millicoma Rivers and the lower bay. A small summer fishery developed in Isthmus Slough in 1951, but was curtailed in the middle of July when construction on the highway paralleling the slough, made it difficult for anglers to reach the water.

Comparison of the 1949-50 and 1950-51 surveys

Summarized data for the two years shows that fishing was better during the 1950-51 season since 4,481 angler-days totaling 22,100 hours of effort resulted in a catch of 2,375 striped bass, compared with the 1949-50 season when 3,708 anglers fished 18,373 hours and took only 1,507 specimens. These data are depicted graphically in Figures 23 and 24 . There was no appreciable change in the average length of time spent on each angling trip, the 1950-51 angler-day being 4.93 hours as compared to 4.96 hours in 1949-50.

The average catch was 0.53 fish per angler for the 1950-51 season and 0.41 fish per angler in 1949-50. Figure 25 gives a graphic comparison of the average catch per angler in biweekly periods for the two years. Angling improved in the winter months of 1950-51 over the same interval in the previous year. The best period for angling in both years was during the summer months of June, July and August when there was a steady increase in the catch per unit of effort.

In 1949-50, an average of 12.19 hours was required to catch one striped bass while in 1950-51, only 9.31 hours were necessary. A comparison in biweekly periods of the time required to catch one bass is illustrated in Figure 26.

Length-frequencies

Lengths have been summarized into monthly periods and are presented in Figures 27, 28, and 29. A total of 1,601 bass was measured in 1950 and 1951. The size of the fish ranged from 6 to 50 inches. The October, November, and December length-frequencies were not included in the 1949-50 report. The length of fish in the winter and early spring sport catch ranged from 20 to 50 inches, and fish that made up the late spring and summer sport catch varied from 6 to 40 inches, with the majority of the fish falling between 8 and 15 inches. There was no appreciable difference in the two periods for the size ranges of fish, an indication that the population has not been overfished.

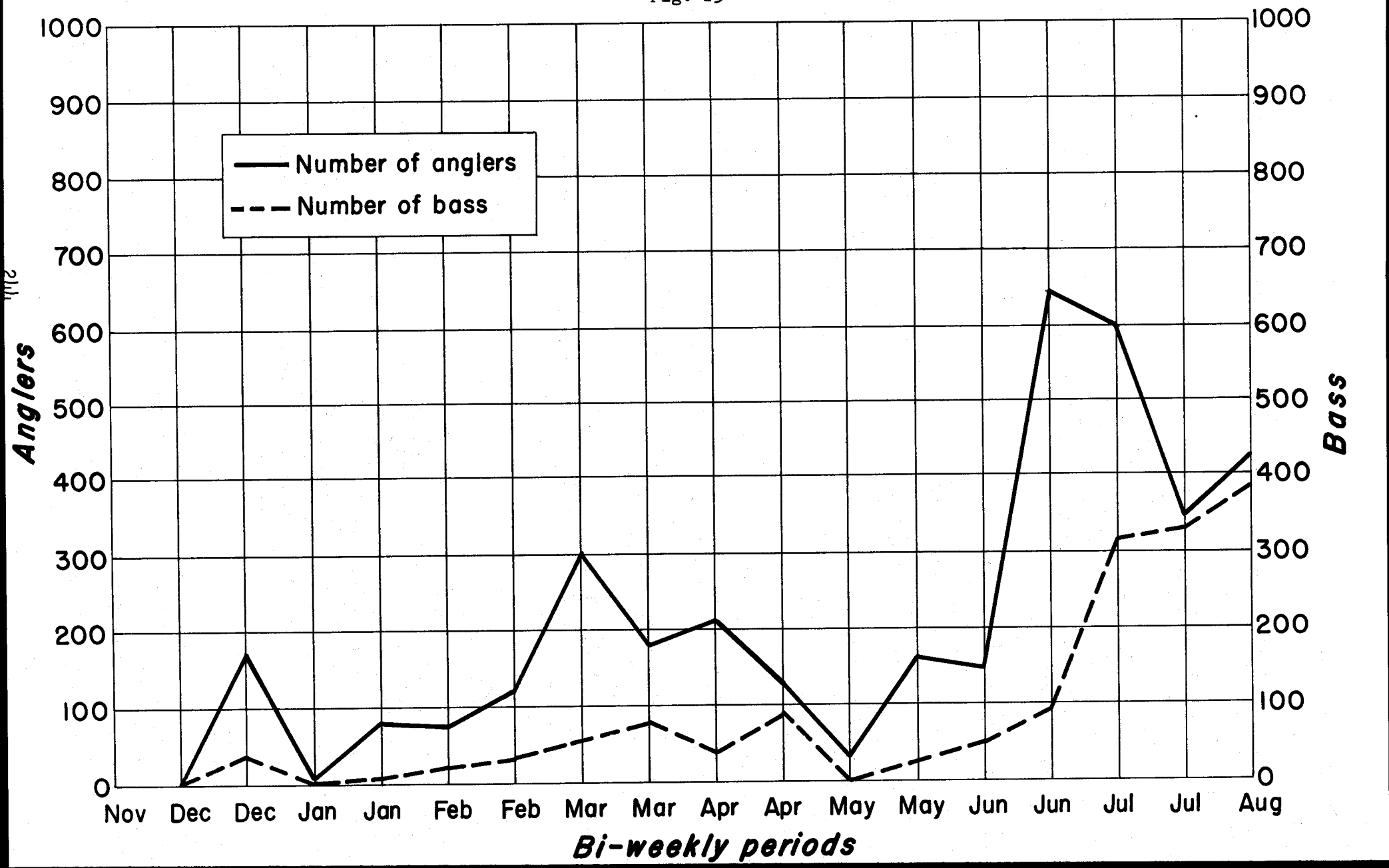
Life history

There was no major change in the habits of the striped bass. The only difference observed was that the bass spawned farther up Coos River, an anticipated occurrence as the bass have moved farther up Coos River each year when spawning.

No scale samples were read because it was felt that there was not

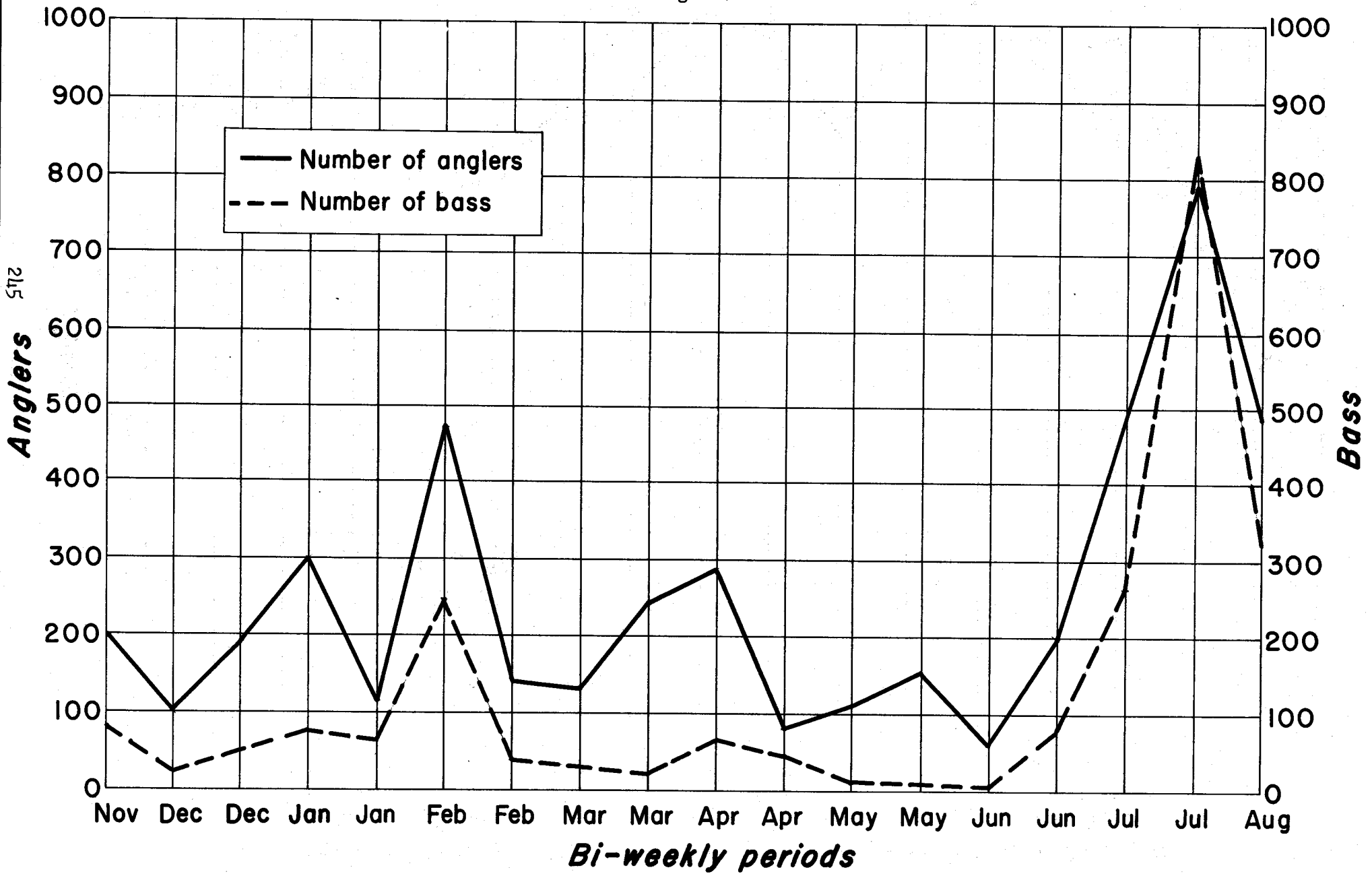
The number of anglers and the total striped bass catch for 1949-50 striped bass sport fishery, Coos Bay, Ore.

Fig. 23



The number of anglers and the total striped bass catch for 1950-51 striped bass sport fishery, Coos Bay, Ore.

Fig. 24



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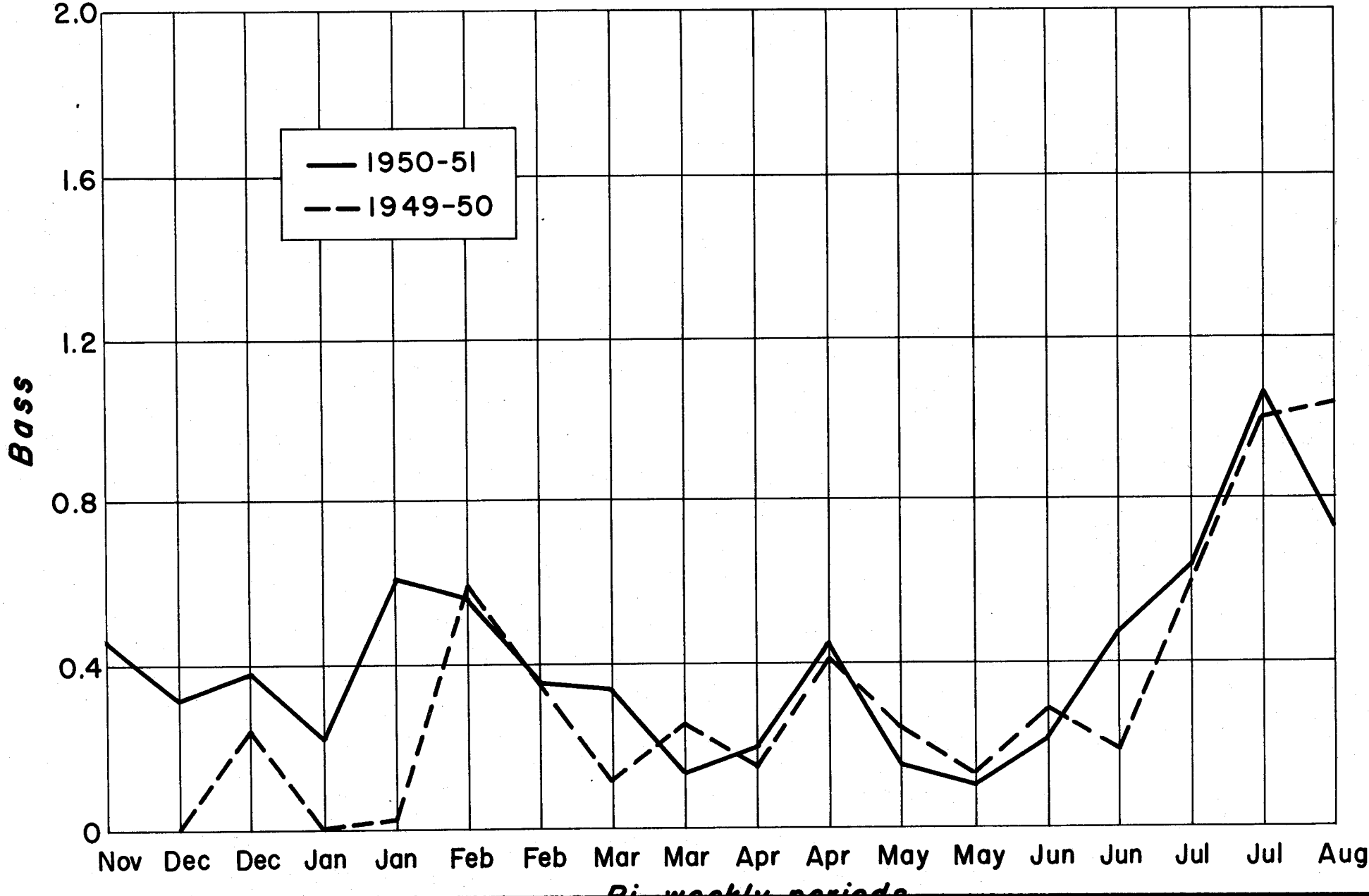
The average catch per angler for the 1949-50 and the 1950-51 striped bass sport fishery, Coos Bay, Ore.

Fig. 25



A comparison of the time required to catch one bass for the 1949-50 and the 1950-51 seasons, striped bass sport fishery, Coos Bay, Oregon

Fig. 26

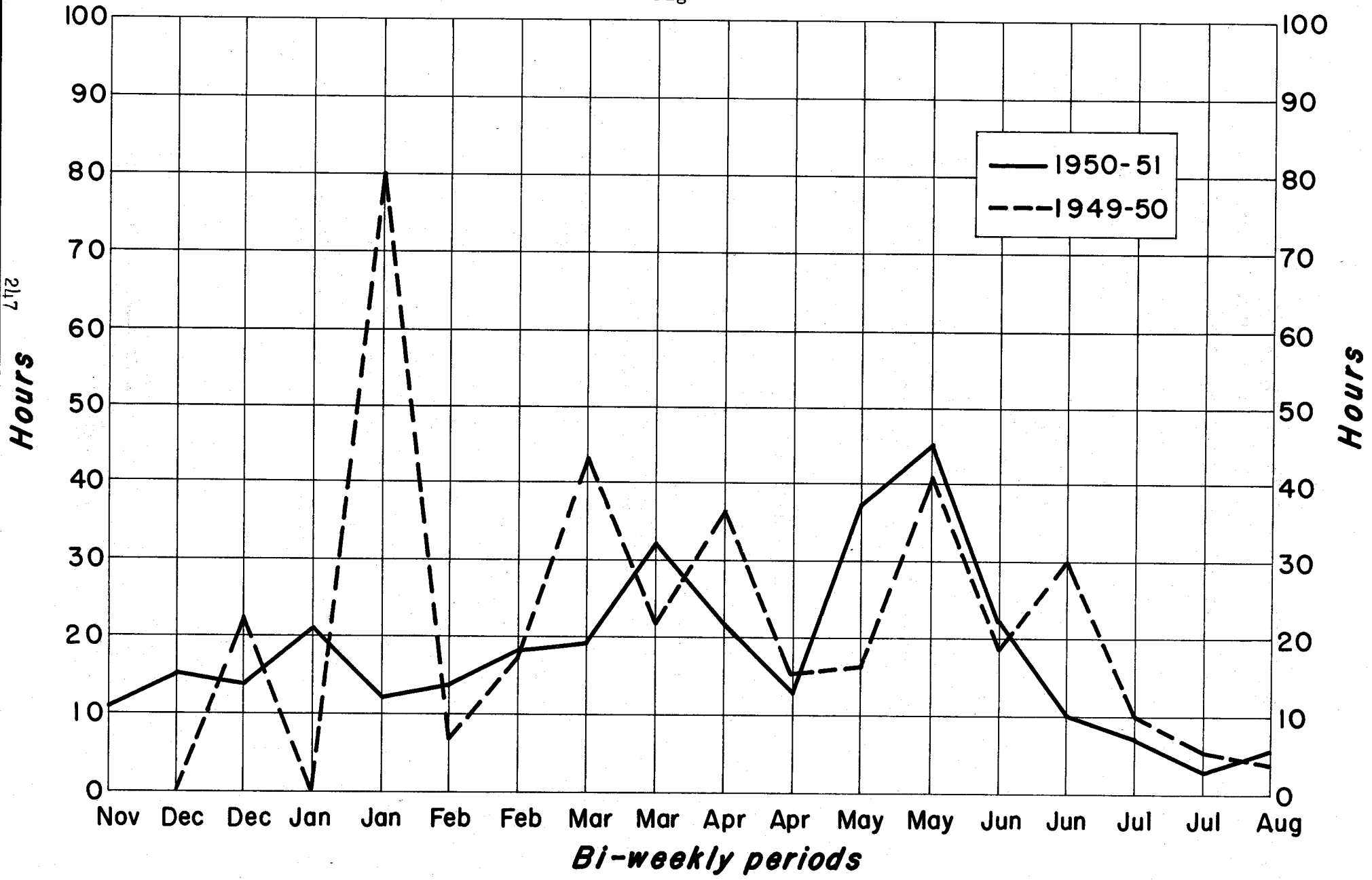


Fig. 27

Length-Frequencies for striped bass taken by sport gear on Coos Bay, Oregon, during the months of April through July 1950 and 1951

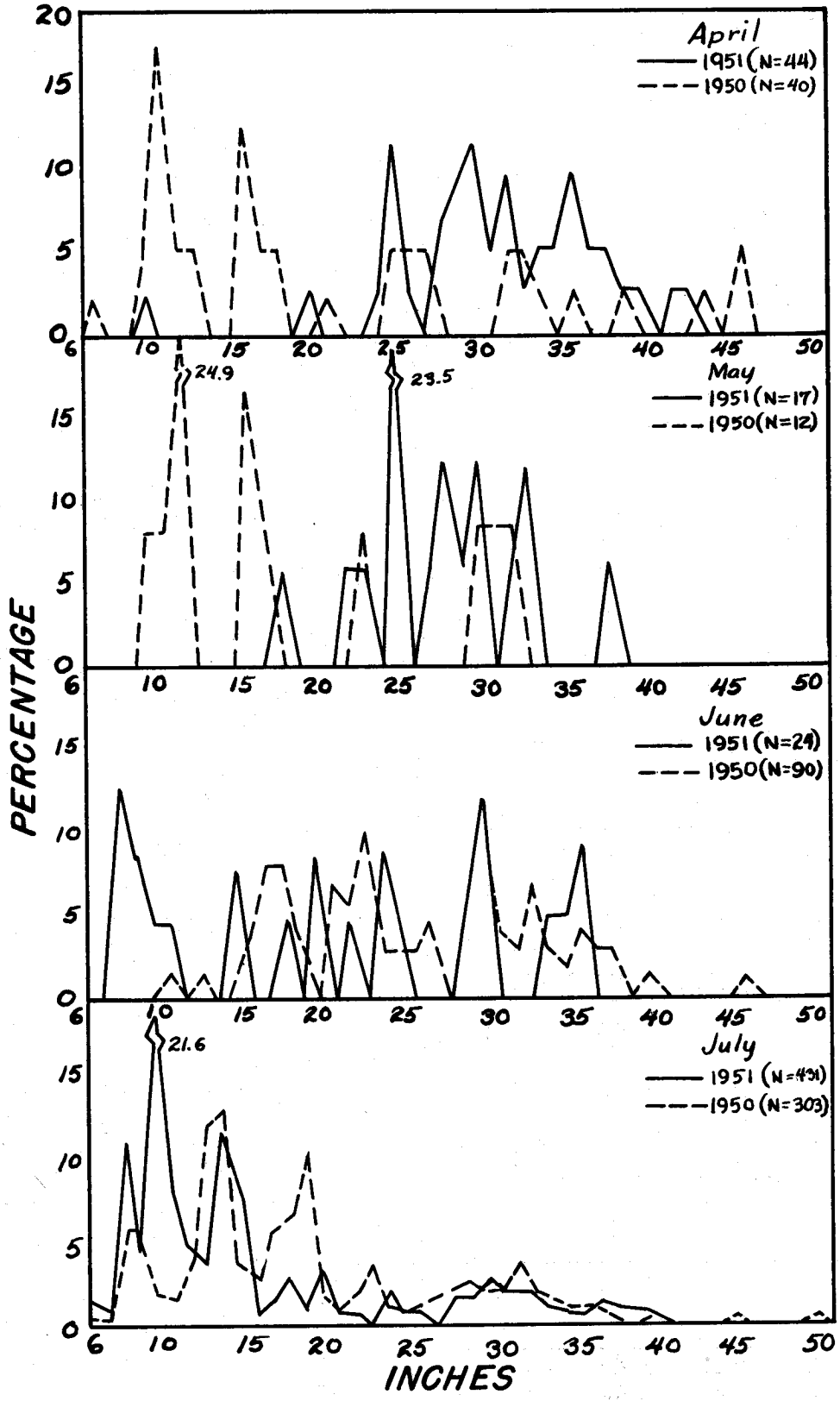


Fig. 28

Length-Frequencies for striped bass taken by sport gear on Coos Bay, Oregon, during August 1-12, 1950 and 1951 and for total sport catch for 1950 and 1950-51

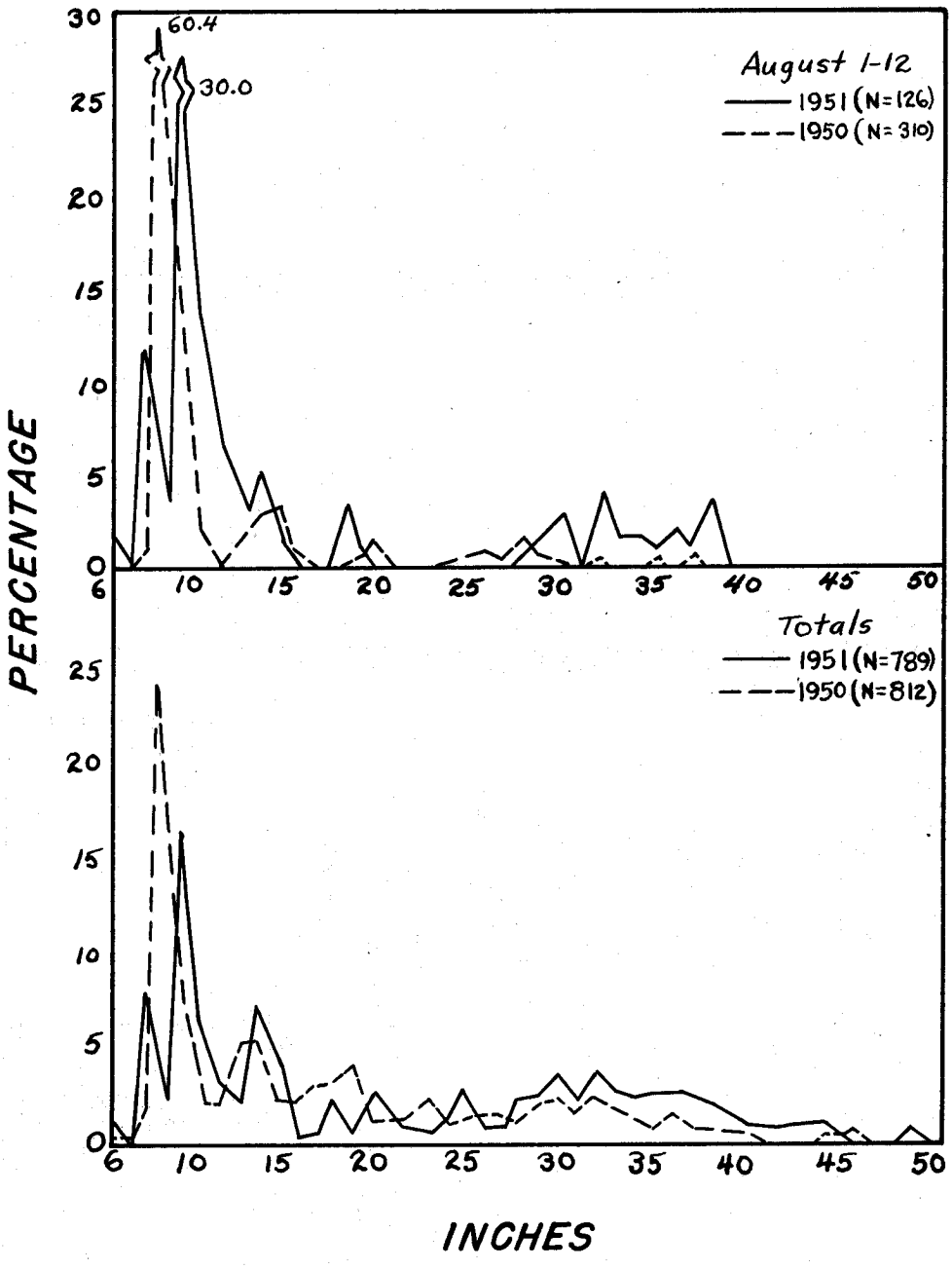
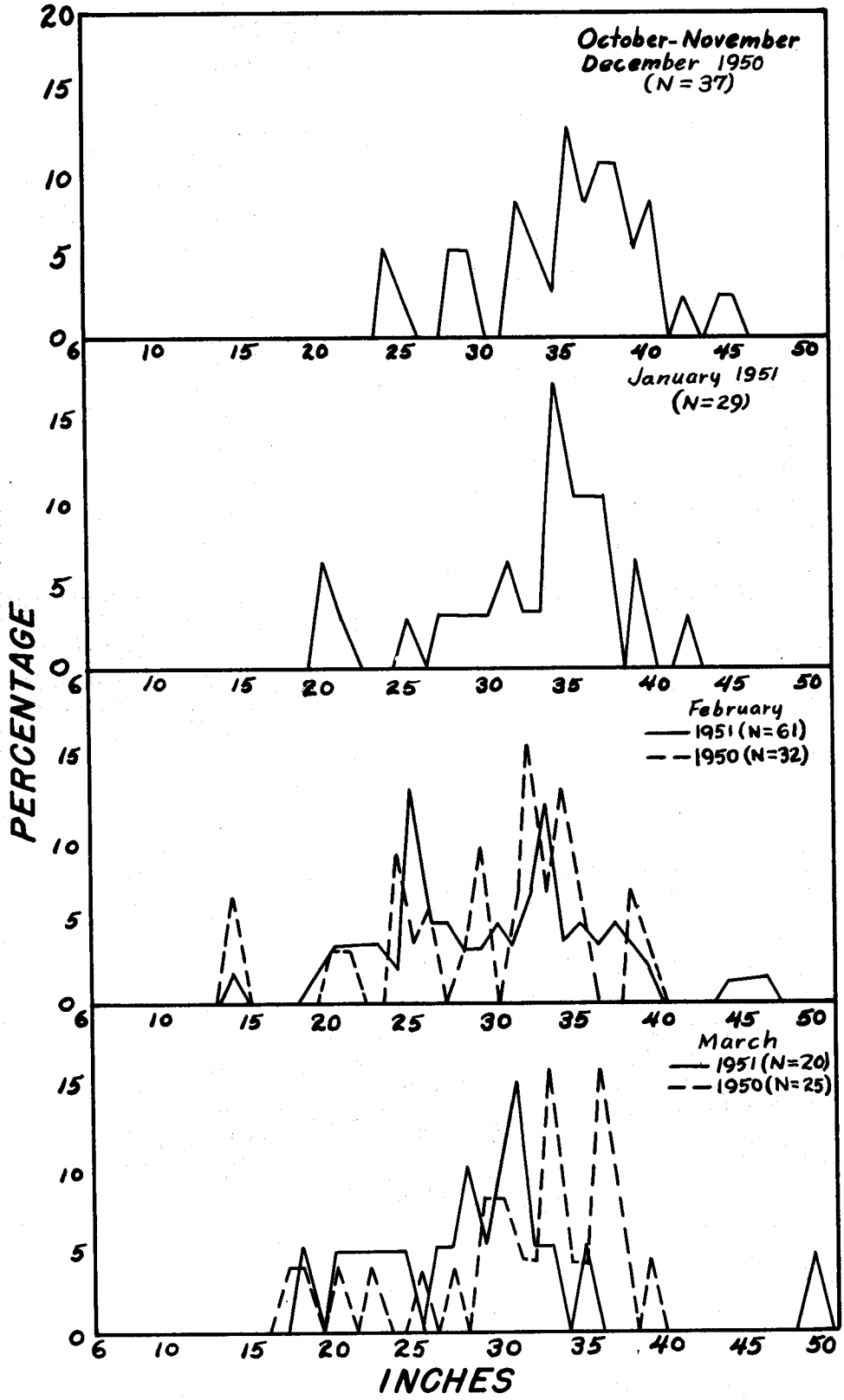


Fig. 29

Length-Frequencies for striped bass taken by sport gear on Coos Bay, Oregon, during the months of October through March 1950 and 1951



a sufficient change in the size groups to make this necessary.

The feeding habits of the bass did not change from those of 1949-50. They continued to take scrap fish and crustaceans of the bay. Two stomachs examined contained salmonoids. One of the bass was from the North Fork of Coos River and the other was from the Coquille River.

Migration studies were continued, as was tagging. The Peterson disc tag was used for the most part, but a few strap tags with braided nylon thread were also attached to the fish. No information was available concerning the number of fish tagged and the number of returns since such work was under the jurisdiction of the Oregon Fish Commission and had not yet been compiled for 1951.

Economic evaluation

The economic evaluation was carried on in the same manner as during the previous season. Two hundred fishermen were interviewed in order to learn what was spent on striped bass fishing in 1950-51. It was found that each angler made an average of 2.6 trips and caught an average of 1.4 bass per year. Boat and motor rentals were separated from bank fishing in order to make certain that only the boat anglers (34 per cent of all) figured in the total outlay. Out-of-town fishermen were separated from local fishermen in order to evaluate lodging costs. Only 20 per cent of the out-of-town anglers spent money on lodgings as compared to 50 per cent in 1949-50. All fishermen checked were asked to state their points of origin in order to determine mileage traveled to fish for bass. A total of 108,402 miles was logged as compared with 120,933 miles in 1949-50. Using $0.06 per mile as the unit cost, $6,504.12 were spent in travel concerned with striped bass fishing. Miscellaneous items such as torn clothing, toothbrushes and similar articles added $1,317.96, at an average cost of $0.84 per person per year.

The 1,569 anglers spent an average of $23.33 a year in the pursuit of striped bass in the Coos Bay area for a total of $36,702.29 in 1951. The cost per fish was estimated at $16.67, or $3.87 per pound. This amount was about half that spent by the angler in the 1949-50 period. Businessmen of the Coos Bay area were interviewed, and the general consensus was that the angler was not spending as much money as in 1949-50.

Table 190 presents cost per person and total cost for 1950-51 and compares them with the same expenditures of the previous year.

Commercial fishery

The commercial fish catch was considerably lower than in 1949-50. The approximate take was 24,400 pounds, or 10,600 pounds less than the previous year. The principal causes for the smaller catch were that the fish spawned above the commercial dead line and that dredging was in progress on the North Fork of Coos River during the spawning period when many of the fish are ordinarily caught.

Coquille River striped bass fishery

The sport fishery was so small that it was impossible to obtain a comprehensive picture. The commercial catch was limited and was estimated

at less than 500 pounds for the complete season.

Table 190

Expenditures of 1,569 anglers during 1950-51 and 1,214 anglers during 1949-50 striped bass sport fishery in the Coos Bay area

Item	Cost per person		Total cost	
	1950	1951	1950	1951
Tackle	$19.05	$11.98	$23,126.70	$18,896.62
Boat	9.42	2.84	11,439.28	4,453.56
Motor	11.23	0.91	13,677.88	1,425.78
Bait	5.89	1.49	7,158.43	2,347.81
Lodging	1.37	1.12	1,666.25	1,756.44
Travel	5.98	4.15	7,255.98	6,504.12
Miscellaneous	1.11	0.84	1,347.54	1,317.96
Total	$54.05	$23.33	$65,722.06	$36,702,29

RECOMMENDATIONS

After a period of 5 years has elapsed from the date of this study, another investigation should be made in order to evaluate the changes, if any, which may have occurred in the size and age composition of the striped bass stocks as well as to assess the angling intensity and its impact on the economy of the area.

There should be no change toward restrictive regulations since there has been no indication that the striped bass population is being depleted.

OREGON SALMON AND STEELHEAD SPORT FISHERY
March 1, 1950 - February 28, 1951

For the first time in the history of sport fishing in Oregon, a measure of the number of salmon caught has been obtained. Letters were sent to a random sample of 2,895 anglers out of a total of 141,600 who obtained salmon and steelhead tag cards. The 2,895 anglers can be classified under the following categories according to the information obtained from them:

I.	No information obtained.		461
	A. No response.	443	
	B. Did not specify number of fish caught	18	
II.	Anglers caught no fish		1,859
	A. Did not fish	809	
	B. Fished but did not catch.	1,050	
III.	Anglers caught at least one fish		575
	Total		2,895

Two methods of estimating the total number of fish caught were used.

1. Assuming that the 461 anglers, from whom no information was obtained, had the same chance of catching fish as those who supplied the information, the estimated total number of fish caught by the 141,600 anglers is 94,100. The true number probably lies somewhere between 83,100 and 105,100 with a confidence coefficient of 0.95.

2. Assuming that the 461 anglers, from whom no information was obtained, had not caught a single fish, the estimated total number of fish caught by the 141,600 anglers is 79,100. The true number probably lies somewhere between 69,800 and 88,500 with a confidence coefficient of 0.95.

Assumption No. 1 which postulates that the 461 anglers from whom no information was obtained had the same chance of catching fish as those who supplied the information, has been used by the Game Commission in determining the total take.

An 83 per cent return on questionnaire letters was realized.

Many items of interest came to light in connection with the analysis. One of the most striking was that most of the anglers caught nothing but the experts made catches with apparent ease to the effect that a lot of fish were taken by only a few anglers. Only 32 per cent of the anglers took fish. Approximately 34 per cent of the anglers who caught fish took steelhead to the number of 31,994. The remaining 66 per cent of the anglers who caught fish took 62,106 salmon.

We are indebted to Dr. Jerome C. R. Li of the Department of Mathematics of Oregon State College for an analysis of the data.

FISHERY RESEARCH

Since 1950, Game Commission fishery research projects have been the responsibility of the Oregon Cooperative Wildlife Research Unit which consists of personnel of the Game Commission, Oregon State College, and the U. S. Fish and Wildlife Service. The laboratory and research facilities of Oregon State College are used by the unit.

Projects transferred to the unit from the Game Commission are the McKenzie River, striped bass, and coast cutthroat investigations, which are discussed elsewhere in this report.

New projects are concerned with the age assessment of salmon populations, an establishment of the value of stream closures, a determination of the role of tributary streams as nursery areas, and an investigation of factors associated with fish stocking procedures. Only the salmon age assessment study has progressed to termination and final report.

Umpqua River spring chinook age assessment study

The scale study of Umpqua River spring chinook salmon was undertaken in order to ascertain the age composition of the fish. It was not intended to be a detailed life history study.

Scales from 191 Umpqua River spring chinook salmon obtained during the years 1946 through 1951 were available for study. Age determinations were made for all but twelve of the fish. It is believed that the fish obtained from the sport fishery constitute a representative sample of the age and sex composition of the Umpqua River spring chinook run. A larger sample, particularly for the years 1947 and 1950, would have been desirable.

Practically all of the scales examined showed a close-ringed nuclear area indicating about one year of growth in fresh water. The close spacing of circuli extended to the second annulus on a few scales suggesting that a small number of chinooks may spend a second year in fresh water. Generally, the fish's growth in the second year was greater than in subsequent years as indicated by a wide band of circuli in the second year. The growth in later years of a chinook's life is more pronounced as a weight increase rather than as an increase in length. Absorption to some degree was apparent in most of the scales examined.

The ages of 179 of the 191 specimens available have been established. By adding the total number of fish in each age group from 1946 through 1951, a summary of the age composition for the six years is possible. Twelve specimens (7 per cent) were in the six-year group, 107 specimens (60 per cent) were in the five-year group, 32 specimens (18 per cent) were in the four-year group, and 28 specimens (15 per cent) were in the three-year group. The percentage of specimens in each age group each year follows closely the trends of the total percentage given above. Exceptions are the years 1947 in which only a small number of individuals was involved and 1949 when only one 4-year-old (3.4 per cent) was obtained. Another way of stating this is that the age composition of spring chinooks was fairly constant for each of the six years under consideration. It is apparent that the predominant age at maturity is five years for fish of the race under discussion. Other workers tentatively determined that five-year fish were predominant among Umpqua River spring chinook salmon and it has been reported that the greatest number of spring chinooks matured in their fifth year in the Columbia River and its tributaries.

The sex of 158 fish was indicated on the scale collection envelopes. Of this number, 75 were females and 83 were males. Males were slightly in excess of females among the six-year fish but the sample was small and the fact is of questionable significance. Sixty-seven per cent of the fish of known sex were females among the five-year fish when the six seasons are considered collectively. The percentage varied in different years but among five-year fish, more than half were females in any one year. Male fish were predominant among the 4-year-olds. In any one year, at least 60 per cent of the four-year fish were males. All 3-year-olds were males.

The length and weight ranges of chinooks of different age groups overlap, but length and weight of the particular fish does give a basis for an intelligent guess of the age of the fish in question. Such a guess should be substantiated by scale analysis if an accurate age determination is desired.

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(Miss Hisa Yamada aided in the preparation of the index. Harold P. Smith developed the layout of the figures and prepared them in final form for the report.)

GAME COMMISSION HATCHERIES

Hatchery	Location	Superintendent
Alsea	Philomath	G. C. Webb
Bandon	Bandon	W. C. Baker
Butte Falls	Butte Falls	Everett Moore
Cedar Creek	Hebo	C. T. Roadarmel
Diamond Lake	Diamond Lake	Arne Shannon
Fall River	Bend	Lloyd Wilson
Hood River	Hood River	Archie McRae
Klamath	Klamath Agency	R. A. Evans
McKenzie	Leaburg	L. W. Webb
Oak Springs	Maupin	A. B. Smith
Roaring River	Scio	P. W. Southwick
Rock Creek	Idleyld Park	Henry Reed
Wallowa	Enterprise	Ralph Kay
Willamette	Oakridge	C. C. Green
Wizard Falls	Camp Sherman	K. E. Morton

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