

HABITAT IMPROVEMENT PROJECT

Fishery Division



OREGON STATE GAME COMMISSION
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John Day River
Number 12

COLUMBIA FISHERY DEVELOPMENT PROGRAM

Closing Report

AGENCY: Oregon State Game Commission

PROJECT TITLE: Reduction of salmonid predators by chemical treatment

PROJECT NO: 912.4-05-3.1

CONTRACT NO: 14-17-0001-1016

PERIOD COVERED: December 1960 through June 30, 1965

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ABSTRACT

The upper drainage of the John Day River system produces summer steelhead and spring chinook salmon. The fish are generally confined to the main stem and its tributaries above Prairie City. The spawning and rearing areas are comparatively free of undesirable fish species, but salmonid smolts migrating downstream must travel through populations of large predatory squawfish.

The purpose of the study was to determine if salmonid smolt survival could be increased through removal of the large squawfish by treatment with rotenone. A 40-mile section of the John Day River between Dayville and John Day was selected for study. A pretreatment fish population inventory was conducted to determine the species and numbers of fish present within the test area. Significantly large populations of undesirable fish and correspondingly low numbers of salmonids were observed in the test area.

In late August 1962 the 40-mile study area was treated with liquid rotenone. Observations indicated the kill of all fish species was greater than 99 percent in the river and irrigation ditches. None of the tributary streams were treated. It was necessary to use a detoxifying agent to prevent kill of fish populations downstream from the study area. Liquid potassium permanganate was successfully used for this purpose.

Posttreatment inventory of fish populations within the study area has shown that average size and number of squawfish was effectively reduced and that salmonid

numbers can be increased by temporary control of rough fish populations. There was a significant increase of resident rainbow trout within the study area. Steelhead fingerling and fry reared in the treated area. Most of the salmonid populations resulted from natural recruitment from upstream areas.

REPORT OF OPERATIONS

After site selection the study consisted of a two-year pretreatment phase, chemical treatment, and a two-year posttreatment evaluation.

Pretreatment

Sampling of fish populations in the study area was initiated in 1961 and continued until chemical treatment was completed in late August 1962. Sampling of steelhead and spring chinook smolts was attempted from mid-April through mid-June of each year. During the summer low flow period an intensive fish sampling program was conducted in the study area.

In the spring of 1961 smolt sampling was accomplished by using rotary screen bypass traps located at six irrigation diversions in the study area. The location of these diversions is shown in Appendix I. Most of the fish collected were marked by excising a small portion of the lower caudal and left pectoral fins. The fish were then released for subsequent downstream observation. The 1961 smolt collection at these installations included 3,589 steelhead and 46 chinook. From the 3,004 steelhead and 25 chinook marked, 14 steelhead and one chinook were recovered at downstream trapping locations. Fork length measurement showed that 72 percent of the salmonids were over 6 inches in length, 22 percent were between 4 and 6 inches long and 6 percent were 2 to 4 inches long.

In the spring of 1962 three metal louver traps were installed in the John Day River. The louvers were of a portable design and did not prove efficient under the conditions which prevailed in the river. High water velocities caused problems in handling and holding the installation in position. A head of water tended to build up at the lower end of the louver train, causing wash out underneath

the structure. Because of these difficulties no smolts were captured. Figure 2 shows a louver installation.

Low flow sampling of fish populations in the study area was accomplished by AC electric shocker. The gill nets and seines proved ineffective and the use of this equipment was abandoned after the first year. Electric shocker sampling proved to be effective and this method was employed exclusively for the remainder of the study. A total of 23 electrofishing stations was established but only 19 remained usable throughout the study because of riverbed changes. These sample areas include 1,340 linear yards of stream. Table 1 gives electrofishing data for both the pretreatment and posttreatment periods. Appendix I gives sample area locations.

Table 1

John Day River Electrofishing Data

Year	Rainbow Trout		Whitefish	Chiselmouth	Squawfish	Coarsescale Sucker	Bridgelip Sucker
	Native	Marked					
1961	56	0	48	0	313	865	246
1962	25	0	29	0	153	1,101	143
1963 ^{1/}	457	42	15	4	58	153	536
1964	179	2	79	0	137	798	2,117

^{1/} After chemical treatment and restocking.

The following species of fish were encountered in the study: spring chinook, Oncorhynchus tshawytscha; cutthroat trout, Salmo clarki; rainbow trout, Salmo gairdneri; Dolly Varden trout, Salvelinus malma; mountain whitefish, Prosopium williamsoni; bridgelip sucker, Catostomus columbianus; coarsescale sucker, Catostomus macrocheilus; carp, Cyprinus carpio; chiselmouth, Acrocheilus alutaceus; speckled dace, Rhinichthys osculus; squawfish, Ptychocheilus oregonensis; redbreast shiner, Richardsonius balteatus; brown bullhead, Ictalurus nebulosus; cottid, Cottidae; and Pacific lamprey, Lampetra tridentata.

Eighty-five percent of the squawfish taken in 1962 were adult fish 10 to 14 inches long. Most fish other than squawfish were in the 4- to 6-inch size range.

It was estimated that salmonids made up less than three percent of the total fish population in the study area prior to treatment.

Chemical Treatment

The 40 miles of river between John Day and Dayville were treated with liquid rotenone in late August 1962. The rotenone was introduced into the river at 24 locations, each one downriver from a gravel irrigation diversion dam (see Figure 3). The water volume in the river at the time of treatment fluctuated from a low of 1 cfs below the diversion dams to a high of 15 cfs. Undiluted rotenone was introduced at a rate of 40 to 44 cubic centimeters per minute. Most stations were in operation for a 24-hour period (see Figures 3 and 4).

Live-boxes containing adult fish were used to test the effectiveness of the rotenone. At the end of 24 hours all test fish were dead. In most instances the fish had succumbed at the end of 12 hours. None of the tributary streams were treated even though they contained coarse fish.

Because of the necessity of protecting fish populations below the test area, detoxification of the river was commenced one-half mile below Dayville. Liquid potassium permanganate was dripped into the river at the rate of 60 to 77 cubic centimeters per minute.

Total cost of treatment was estimated at \$4,150.00.

During treatment three test areas were used to gather population numbers and species composition data. Each area was isolated from the rest of the river by placing seines across the river at the upper and lower ends of the section. After fish in the sample area were killed by rotenone, as many as time would permit were collected, separated by species and counted.

After the initial collection of fish a visual estimate was made of the number of each species remaining in the section. A total of 316 yards of river was sampled in like manner. Table 2 summarizes the fish population by species in the 316 yards of river.

Table 2

Fish Population Composition of a 316-yard Sample of John Day River

<u>Fish Species</u> ^{1/}	<u>No. in Sample</u>	<u>Total in Sample Area</u>	<u>Percent of Total Population</u>
Coarsescale sucker	572	759	13
Bridgelip sucker	77	169	3
Squawfish	505	1,110	19
Chiselmouth	620	1,525	26
Whitefish	25	45	
Rainbow trout	38	42	
Carp	7	12	0.2
Cottid	3	6	0.1
Redside shiner	981	1,810	30
Dace	123	213	4
Brown bullhead	47	67	1

^{1/} Also known to occupy the waters in the study sections are Dolly Varden trout and cutthroat trout.

To obtain a total fish population for the treated section of the river the number of fish in the 316-yard sample was multiplied by 223--the number of 316-yard sections in 40 miles. Table 3 presents the estimated population by species and size range. The estimated population of cottids and dace is probably low due to the difficulty of collecting these fish.

Table 3

Estimated Fish Population by Species in the 40-mile Section of the John Day River

<u>Fish Species</u>	<u>Estimated Population</u> ^{1/}	<u>Size Range in Inches</u>
Coarsescale sucker	169,000	3 to 22
Bridgelip sucker	38,000	3 to 14
Squawfish	248,000	3 to 18
Chiselmouth	340,000	4 to 11
Whitefish	10,000	4 to 15
Rainbow trout	9,000	3 to 14
Carp	3,000	4 to 20
Cottid	1,000	
Redside shiner	404,000	
Dace	58,000	
Brown bullhead	15,000	3 to 6

^{1/} To the nearest 1,000.

Posttreatment

In the spring of 1963 a combination of rotary screen bypass traps and two Sacramento fyke nets was used to collect migrating salmonid smolts. The rotary screen bypass traps proved ineffective because the migration of wild salmonids

occurred before the irrigation season began. In the absence of suitable numbers of wild smolts, 10,700 steelhead fingerlings were stocked from Eagle Creek National Fish Hatchery. These fish averaged 4.5 inches in length and were marked with a lower caudal fin clip. The fish were stocked upriver from John Day and the fyke nets were used to trap them as they passed downstream. One net was located 13 miles and the other 14.5 miles below John Day. Fish taken in the first trap were marked with a temporary right pectoral fin clip so that they could be identified at the second trap. Results of the 1963 smolt trapping are given in Table 4.

Table 4

Fyke Net Catch Record, John Day River, 1963

Net Number	Days Fished	Smolts		Smolts Recovered		Other Species ^{1/}
		Steelhead	Chinook	Steelhead	Chinook	
1	43	339	57	19 ^{2/}	0	81
2	41	1,545	90	39 ^{2/}	0	165
Totals	84	1,884	147	58		246

^{1/} Includes suckers, redbreast shiners, chiselmouth, squawfish, carp, brown bullhead, lamprey (adults and juveniles) and dace. The majority of these fish were less than six inches.

^{2/} Lower caudal-marked hatchery fish.

The hatchery steelhead did not appear to be in a smolting condition and many of them did not migrate.

During the spring of 1964 six Sacramento fyke nets were used to provide information on the total numbers of migrating salmonids, recruitment to the main stem from tributaries, and mortality of young fish through the test area. Trapping efforts were complicated by high water and debris on the traps. It was necessary to employ hatchery-reared steelhead and 10,200 were stocked above the town of John Day. The majority of these fish did not migrate out of the area before trapping was terminated; thus, the 1964 study of fish migration did not provide sufficient data to use the program designed by Oregon State University. Results of the 1964 spring migration study are presented in Table 5.

Table 5

Fyke Net Catch Record, John Day River, May 15 to June 6, 1964

Net Number	Smolts		Marked Fish		Marked Fish Recovered		Other ^{1/} Species
	Steelhead	Chinook	Steelhead	Chinook	Steelhead	Chinook	
1	372	35	356	30	9	0	71
2	776	68	698	48	23	3	69
3	1,361	106	1,089	98	57	11	238
4	1,171	24	657	19	58	0	79
5	7	1	0	0	0	0	10
6	41	1	0	0	0	0	126
Total	3,728	235	2,800	195	152	14	593

^{1/} Includes suckers, reddsides, shiners, chiselmouth, squawfish, carp, brown bullhead, lamprey (adults and juveniles) and cottids.

All rough fish numbers were reduced with the exception of the bridgelip sucker which is the most numerous coarse species found in the small tributaries of the John Day River. Most of the coarse fish other than the squawfish were in the 4- to 6-inch length range. The reduction in numbers of coarse fish is not impressive; however, there was a great size differential in species of fish collected each year. Eighty-five percent of the squawfish taken in the pretreatment phase were adults 10 to 14 inches long; whereas in 1963 following treatment, the majority of the squawfish were immature and under six inches in length.

Although the purpose of treatment was to enhance anadromous fish production, valuable benefits for resident rainbow trout were realized within the treated river section. In 1962 the estimated rainbow trout population of the study area was 1,312 fish. The year following treatment the rainbow trout population was estimated at 26,197 trout. The increase was mostly the result of natural recruitment, although 7,500 hatchery fish were stocked. In 1964 the resident trout population was estimated to be 16,695 fish. A valuable trout fishery has developed within the area where almost no fishery existed prior to treatment.

Resident trout exhibited an excellent growth rate in the test section following chemical treatment. Some of the marked 5-inch trout stocked attained a length of 17 inches after two years residence in the stream (see Figure 6).

Discussion

The study showed that by removing both competition and predation, habitat resulted in which salmonids could obtain a good food supply in larger waters conducive to fish rearing. The main objectives of the program were to reduce the number of large squawfish with liquid rotenone and to evaluate the effect on the spring outmigration of steelhead smolts. The average size and number of squawfish were reduced by the treatment, but it appears that chemical control would be necessary at least every four years. A sampling method was developed to obtain total numbers of outmigrants, but equipment limitations and river fluctuations prevented significant results.

Chemical treatment could be a feasible tool for the manipulation of fish species in the John Day or similar rivers. Salmonid numbers and growth can be increased by temporary control of rough fish populations.

The control program was of definite benefit to the resident trout fishery. The removal of rough fish from the river created a new void in which trout could survive. They increased in numbers, and growth rate was exceptional. The major part of the posttreatment trout population resulted from natural recruitment from tributary streams. Steelhead fry and fingerling from tributaries appeared to survive in the new environment. Bridgelip suckers also benefited from the reduced competition.



Figure 1. Small suckers, dace, shiners and chiselmouth collected from part of one sample area.

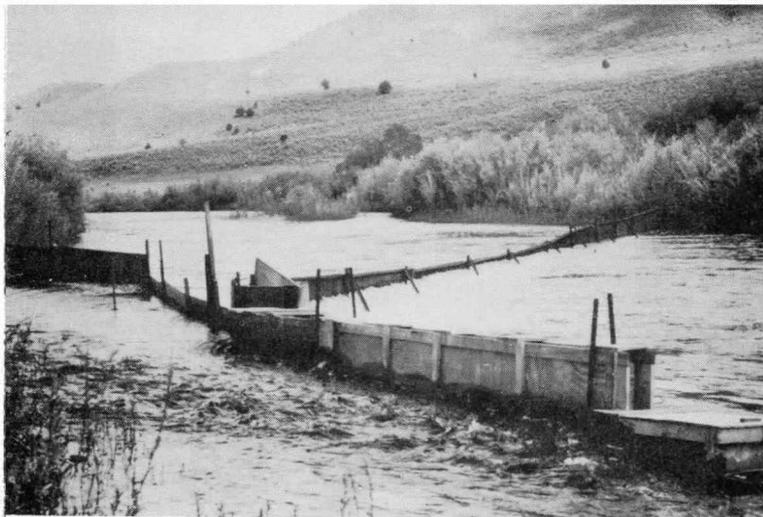


Figure 2. Portable metal louver trap, John Day River. Note trap box on lower end of louver train.



Figure 3. One of 24 dripper stations used in treating the John Day River. Gravel irrigation dam in background.



Figure 4. Five adult squawfish in foreground taken in a sample area.

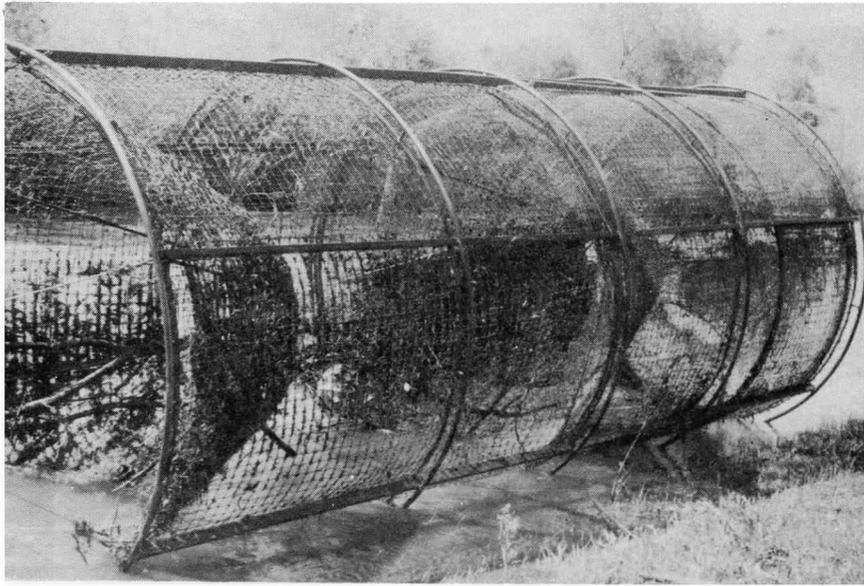


Figure 5. One of the Sacramento fyke nets employed in the study. Note debris.

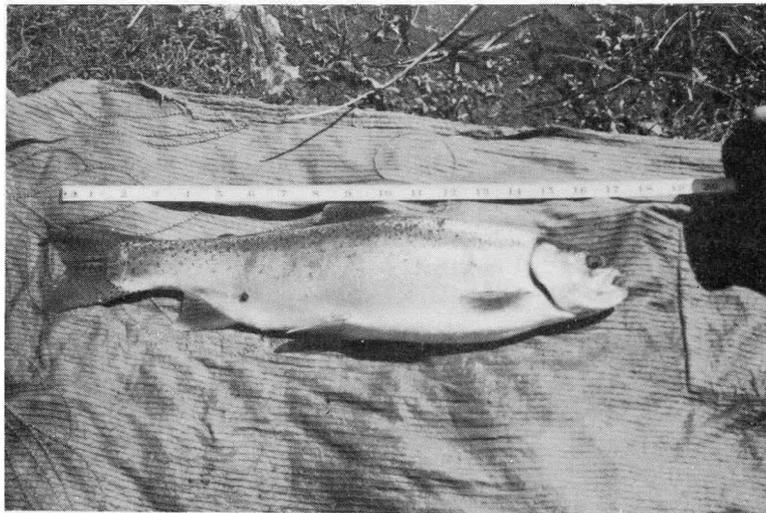


Figure 6. Resident rainbow trout taken in John Day River sampling program.

