

HABITAT IMPROVEMENT PROJECT

Fishery Division



OREGON STATE GAME COMMISSION
1634 S. W. Alder Portland 5, Oregon

NUMBER 8
Miller Lake

STATE OF OREGON
OREGON STATE GAME COMMISSION
P. W. Schneider, Director

FEDERAL AID TO FISH RESTORATION
FINAL REPORT

State-wide Fishery Rehabilitation
Miller Lake and Tributaries Segment
F-20-D-11

By

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NUMBER 8
Miller Lake

State Oregon

Project No. F-20-D-11

Date DEC 1 1964

COMPLETION REPORT

State-wide Fishery Rehabilitation Miller Lake and Tributaries Segment

Period Covered: January 1, 1959 to March 1, 1964

ABSTRACT

Miller Lake was chemically treated with toxaphene on September 16, 1958 to destroy a population of parasitic lamprey (E. tridentatus) and Tui Chub (Siphateles bicolor). Toxaphene was applied at the rate of 0.04 ppm. No lamprey or fish have been collected in the lake since the chemical treatment. Work since 1959 has been in the form of testing the water for residual toxaphene and toxicity to trout. Materials and water were analyzed by Charlton Laboratories in Portland, Oregon by paper chromatography. The Agricultural Chemistry Department at Oregon State University conducted the majority of the analyses by gas chromatography. The detailed information on the chemical treatment was reported in a progress report February 13, 1959. Testing of Miller Lake will continue under Federal Aid Project No. F-20-D-20.

Lamprey-proof barrier

A lamprey-proof barrier was constructed at the falls on Miller Creek approximately one-half mile downstream from the U. S. Forest Service bridge below the lake. The barrier was designed by the engineering staff of the Game Commission and constructed by crews from the Central Point screen plant. The dam is 36 feet long with a 12-foot spillway. The structure is constructed of rock and mortar with a steel plate extending over the face of the dam to prevent lamprey from moving upstream. The height of the spillway from the streambed is approximately 44 inches.

The dam was constructed in August of 1959 and was still in good condition in 1964. It is possible that in 1965 some maintenance may be necessary to reinforce some of the mortar joints. Plate 1019 is a drawing of the structure.

Testing for Toxicity

The major activity other than the construction of the lamprey-proof barrier has been testing of the lake for toxicity to trout. The testing results will be presented by each year that the work was accomplished.

1958 - 1961 Tests for Toxicity

The first test of rainbow trout to toxaphene was made simultaneously with the introduction of lamprey into seven different concentrations of toxaphene. The experiment was conducted in the concrete fry tanks inside the Klamath Hatchery building. Water was static as it was necessary to maintain a control on the toxaphene in the water. Rainbow were placed in water 12 days after the toxaphene was introduced in the concentrations 0.5 to 0.04 ppm. All fish died within 24 hours. In toxaphene concentrations from 0.05 to 0.001 ppm the large trout, approximately 8 inches long, died the first day while the fish of approximately 4 inches lived for three days. At the end of the three days all trout placed into the toxic water were dead. The water temperature was 54°F. No additional tests were made with trout before Miller Lake was chemically treated in September, 1958.

The first testing of Miller Lake to determine the toxic level of the water was made in 1959. All trout died after 20 hours exposure. The result of the testing is shown in Table 1. The live-boxes used to hold trout in the lake in 1959 were constructed of metal rods and galvanized wire. It was first thought that there would be a toxic reaction from the galvanized wire used

in the live-box. A test using one of the boxes containing two rainbow trout was made at the Klamath Hatchery. The two trout remained alive in the box for a period of one month.

In 1960 live-boxes containing trout were placed into the lake in the same locations as in 1959. Two series of tests were conducted with the addition of one new site in the last test. One of the boxes containing trout was placed into the outlet, Miller Creek, to determine if the water leaving the lake was toxic. The results of the two tests are presented in Table 1.

Table 1: List of a Series of Live-box Tests Made to Test Toxicity of Miller Lake
From Introduction of Toxaphene in September, 1958 to August, 1961

Year	Test Number	Depth of live-box and time in hours to kill rainbow trout							/3 Outlet	/4 Stream 1	/5 Stream 2
		1 foot	5 feet	10 feet	30 feet	50 feet	100 feet				
1959	1			19	19	19	19				
	2			20	20	20	20				
1960	<u>1</u>			25	25	25	25				
	2		23			72	72	72			
1961	<u>2</u>	1	96(3 dead) 288(all dead)		96(3 dead) 288(all dead)		96				
		2	96(4 dead) 288(all dead)		96(4 dead) 288(all dead)		96		288	288	
		3						264			

- 1 All tests were conducted with live-boxes made of plastic screen and wood with exception of the stream tests.
- 2 A control live-box was placed in Evening Creek for the tests made in 1960 and 1961; six trout were used in each live-box.
- 3 The site of the outlet test area is just below the lake on Miller Creek.
- 4 The site of Stream 1 test area is approximately five miles upstream from Highway 97 on Miller Creek.
- 5 The site of Stream 2 test area is at the Miller Creek Bridge approximately 7 miles from Highway 97.

In August and November of 1960 Miller Lake water was analyzed at Charlton Laboratories in Portland. The tests demonstrated that the amounts of toxaphene in the water were great enough to kill trout. The results of the two tests are listed in Table 2.

Table 2: Results of Analyses of Miller Lake Water for Concentrations of Toxaphene

Year sample taken	Concentrations of toxaphene in ppm	
	Surface	50-100 feet
August, 1960 <u>/1</u>	0.009	0.009
November, 1960	0.014	0.008
July, 1961	Less than 0.001	Less than 0.001
August, 1961	Less than 0.001	Less than 0.001

/1 Both samples were combined in analyses.

July, 1961, before live-box tests were initiated, a sample of Miller Lake water was analyzed for toxaphene. The results indicated that the toxic level had decreased to a concentration that would no longer be lethal to fish as determined by a search of literature. To test the indicated safe concentrations, three live-boxes, constructed of plastic screen and wood were placed in different levels of the lake. Each live-box contained rainbow trout. After 96 hours exposure the fish in the deep area were all dead and those in the shallow area were dead or dying. After 288 hours, all fish were dead. A second test was made in August with the addition of a station on Miller Creek. The results were the same as the first test.

A third test was made with fish in a live-box at the outlet of the lake. At the end of 286 hours the fish were all dead. It is possible that the live-boxes in the third test were disturbed by visitors on the lake.

Trout in the control live-box in the tributary, Evening Creek, were never in distress through the entire experiment. The water temperature of Evening Creek was 44°F. Miller Creek water temperature was 46°F. on August 30, 1961.

In the fall of 1961, 4,030 rainbow fingerlings, averaging 4 inches in length, were released into Miller Lake. Control fish were placed in live-boxes at the sites of previous tests to determine if trout released free in the lake would die at the same time interval as those in live-boxes.

First observed mortalities occurred the second day of the experiment in a live-box in Miller Creek, at the outlet of the lake. Two additional fish were found dead in the live-box the next morning. In the evening of the same day, trout in distress were observed along the shallows in the vicinity of the forest camp on the south side of the lake. The morning of the fourth day, a storm made the lake too rough to check for dying fish around the shore line. Fish in the live-box in Miller Creek near the outlet were dead and fish were dying in both live-boxes placed in the lake. The evening of the fourth day of the experiment, the lake became calm and five dead trout were observed in the shallows on the west end near the major tributary, Evening Creek. By the afternoon on the fifth day, many trout were observed dead or dying in the shallow areas at the west end of the lake. The remainder of the lake was too rough to check.

The morning of the sixth day, the lake was calm and it was possible to check all the shallow areas. Dead rainbow trout were found in shoal areas of the lake and for 100 yards downstream in Miller Creek. One test fish out of six remained alive in each of live-boxes in the lake.

The test using liberated trout indicated that the mortality of fish in live-boxes was similar to free-swimming fish. The experiment also indicated that there was sufficient toxaphene or some material present in the water to cause complete loss of any trout stocked in the fall of 1961.

Water samples taken from Miller Lake in August 1961 were analyzed by the process of paper chromatography at Charlton Laboratories in Portland, Oregon. Toxaphene in concentrations of less than 0.001 ppm were found in the samples taken at 5 feet and 55 feet.

1962 - 1963 Tests for Toxicity

The 1962-63 sampling procedures were changed at Miller Lake. Plants, aquatic organisms, bottom matter, and fish were included in the elements in and around the lake that were analyzed for the presence of toxaphene. Analysis of the samples collected was made by the Agricultural Chemistry Department at Oregon State University as a result of a contract with the Oregon State Game Commission. The technique used to determine the toxaphene residue was gas chromatography.

Test fish were placed in Miller Lake to determine if the residues of toxaphene had declined to a safe level for trout. The longest period of trout survival to this time occurred in June, 1963, when fish lived for 17 days. Table 3 lists the results obtained from tests conducted in 1962 and 1963 and the amount of toxaphene present in the fish at the time of sacrifice or death.

Table 3: Results of Live-box Tests, Using Rainbow Trout - Miller Lake, 1962 - 1963

Date test started	Length of time to kill all test fish		Toxaphene residue in test trout in ppm.
	Days	Hours	
July 7, 1962	7	168	15.5
October 26, 1962	5 ^{/1}	120 ^{/1}	5.1
May 31, 1963	17	408	10.33
July 23, 1963	10	240	12.1

/1 Fish were sacrificed for analysis

To obtain a more accurate knowledge of the residue build-up in the trout, the second series of test fish was sacrificed at two-day intervals for a period of ten days. Fish that had been in the lake for two days contained 3.05 ppm of toxaphene. An increase of chemical was found after each sampling period. The final test fish died at the end of ten days, and the concentration of toxaphene had reached a peak of 12.1 ppm. No explanation can be given for the short period of survival of the fish in this test.

Live-boxes containing test fish were placed at three different stations on Miller Creek in 1962 and 1963. The location of the test sites were:

- (1) Three miles upstream from Highway 97
- (2) Miller Creek Bridge, six miles upstream from Highway 97
- (3) Forest Service road crossing, 100 yards below Miller Lake.

The 1962 test indicated that test fish near the lake died first and at approximately the same rate as those in the lake. Fish at the two lower sites lived longer with an elapsed time of 21 days before all fish were dead. In the 1963 test, the lower live-box was destroyed before the

completion of the experiment. Of the original six trout placed in the live-box at Station 2 at the Miller Creek Bridge on May 31, 1963, one was still alive on July 3, thirty-three days later. The fish was sacrificed to determine the amount of toxaphene present in body tissues. The length of time required to kill all of the trout in the live-boxes and the concentration of toxaphene found in the trout are listed in Tables 4, 5 and 6.

Table 4: Results of Live-box Tests, Using Rainbow Trout at Station 1, Miller Creek, 1962 - 1963.

Date test started	Number of days to kill all test fish	Toxaphene residue in ppm
July 5, 1962	21	16.9
October 26, 1962	$\frac{1}{5}$	3.8
May 31, 1963	$\frac{2}{17}$	7.58

1 Fish sacrificed for analysis

2 Live-box damaged, but three dead trout remained of the original six fish.

Table 5: Results of Live-box Tests, Using Rainbow Trout at Station 2, Miller Creek, 1962 - 1963

Date test started	Number of days to kill all test fish	Toxaphene residue in ppm
July 5, 1962	21	6.89
October 26, 1962	$\frac{1}{5}$	3.00
May 31, 1963	$\frac{2}{33}$	13.00

1 Fish sacrificed for analysis

2 One fish still alive and sacrificed for analysis

Table 6: Results of Live-box Tests, Using Rainbow Trout at Station 3, Miller Creek, 1962- 1963

Date test started	Number of days to kill all test fish	Toxaphene Residue in ppm
July 5, 1962	5	11.2
October 26, 1962	5 ^{/1}	4.5
May 31, 1963	17	10.6

/1 Fish sacrificed for analysis

Plants were taken from the shore line and submerged areas in Miller Lake and analyzed for content of toxaphene. Table 7 lists the amount of toxaphene found in both plants and roots for the shore and submerged vegetation. In comparing the amount of residue present in the shore and submerged plants, it was found that the quantity of toxaphene had gradually diminished in the plant portion of Eleocharis sp. and Polygonum sp. but had increased in the underground root system of Polygonum sp. In the two years that analyses have been made of Isoetaceae sp. (quillwort) there has been a gradual build-up of toxaphene residue from the start of the summer to the fall months. The algae, Nostoc sp., was analyzed in 1963 and did not vary much in the quantity of toxaphene residue present in the two samples.

Table 7: Results of Analysis for Toxaphene in Vegetation, Miller Lake
1962 - 1963

	Date Obtained and Toxaphene Residue in ppm				
	6/20/62	8/28/62	11/1/62	6/17/63	9/13/63
<u>Shore Plants</u>					
<u>Juncus sp.</u>	12.8 /1	0.57	1.6	-	-
Roots of <u>Juncus sp.</u>		0.63	1.7	-	-
<u>Eleocharis sp.</u>	15.5 /1	4.10	0.73	0.20	0.03
Roots of <u>Eleocharis sp.</u>	-	7.81	11.30	4.05	0.39
<u>Submerged Plants</u>					
<u>Isoetaceae sp.</u>	-	0.86	9.00	1.23	6.24
<u>Polygonum sp.</u>	-	2.49	5.40	3.63	2.93
Roots of <u>Polygonum sp.</u>	-	1.44	3.10	3.68	5.22
<u>Algae</u>				(7/3/63)	
<u>Nostoc sp.</u>				4.47	4.68

/1 Roots and plants combined

Insect production is still limited at Miller Lake and the only specie available in sufficient numbers for an adequate sample was the dragonfly (Odonata sp.). Mayflies were observed in large numbers but a sample large enough to analyze could not be collected. No midges (Chironomus sp.) have been found in the bottom samples since the chemical treatment in 1958. Leeches (Hirudinae sp.) have returned in large numbers. Table 8 presents data on toxaphene residues in insects, leeches and frogs.

Table 8: Results of Analysis for Toxaphene in Organisms, Miller Lake
1962 - 1963

Species	Date Obtained and Toxaphene Residue in ppm		
	Nov. 1 1962	June 17, 1963	Sept. 13, 1963
<u>Odonata sp.</u>	0.69	0.18	0.42
<u>Hirudinae sp.</u>	-	3.18	8.23
<u>Rana sp.</u>	3.55	4.00	3.24
<u>Bufo sp.</u>	Less than	0.4	0.51

Future Testing

The plan is to continue with detailed tests to determine the build-up of toxaphene residues in fish, aquatic organisms, vegetation and other materials. New tests for toxicity using live fish will be conducted. Another experimental stocking of trout will be made in the lake.

Restocking

Final restocking of the lake will not be attempted until tests prove the lake is not toxic to fish.

Miscellaneous

The segment is closed, but the Miller Lake work will continue under Project F-20-D-20.

Financial Statement

Project approval	\$ 10,523.00
Actual expenditures	10,190.00

Approved by:

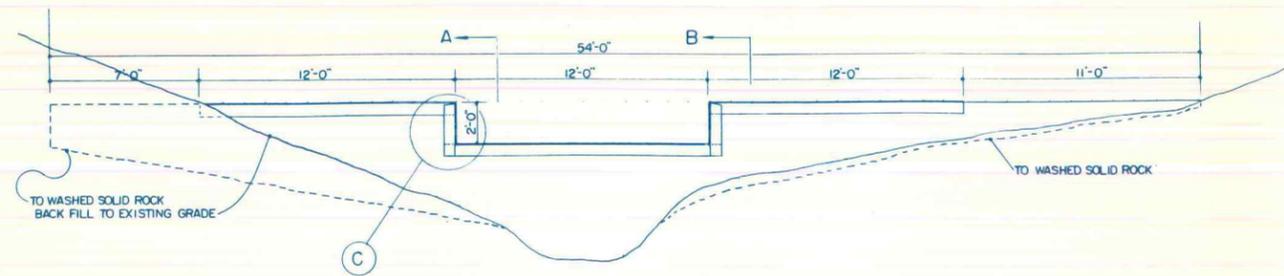
Submitted by:

James W. Goin, Jr.
Federal Aid Funds Coordinator

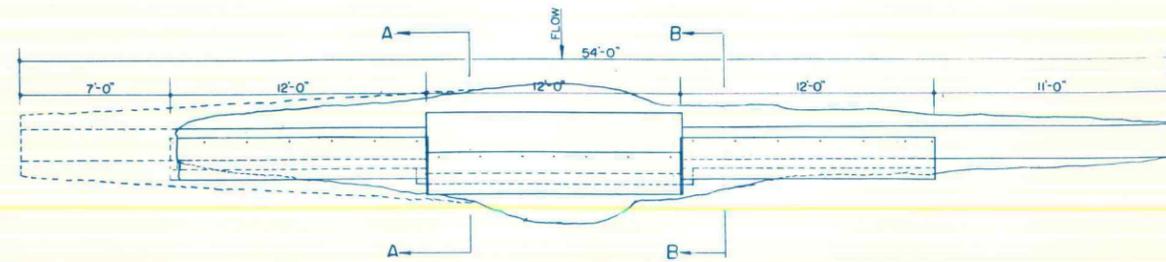
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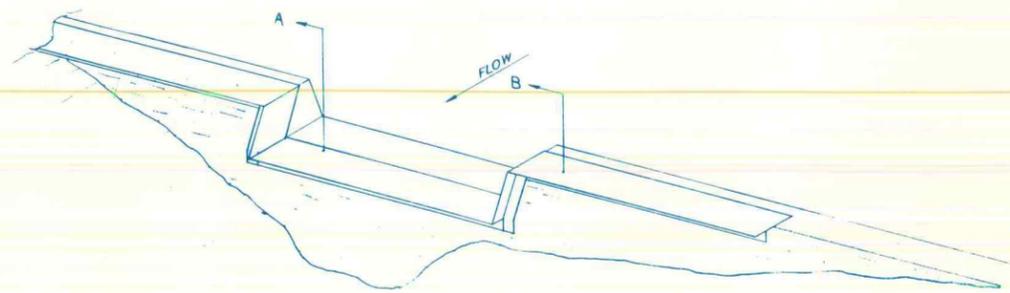
Róbert L. Borovieka
Coordinating Biologist



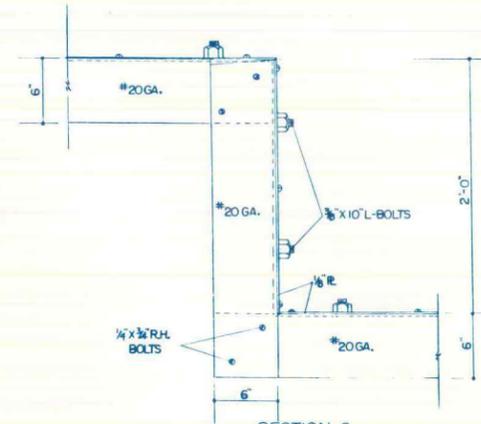
DOWNSTREAM FACE OF DAM
SCALE 1/4" = 1'-0"



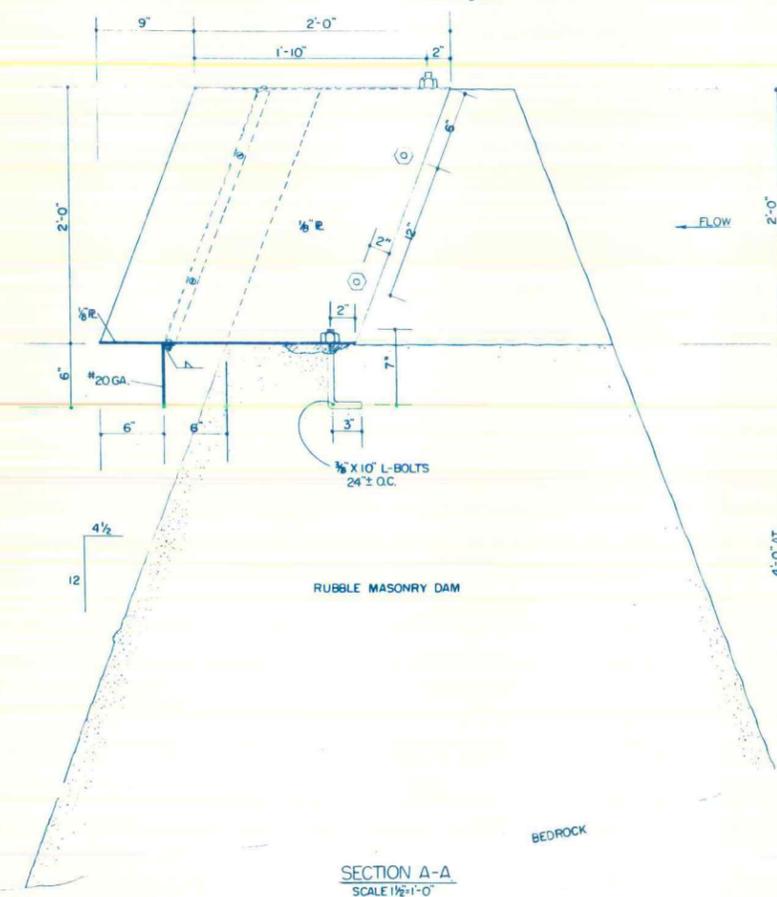
PLAN
SCALE 1/4" = 1'-0"



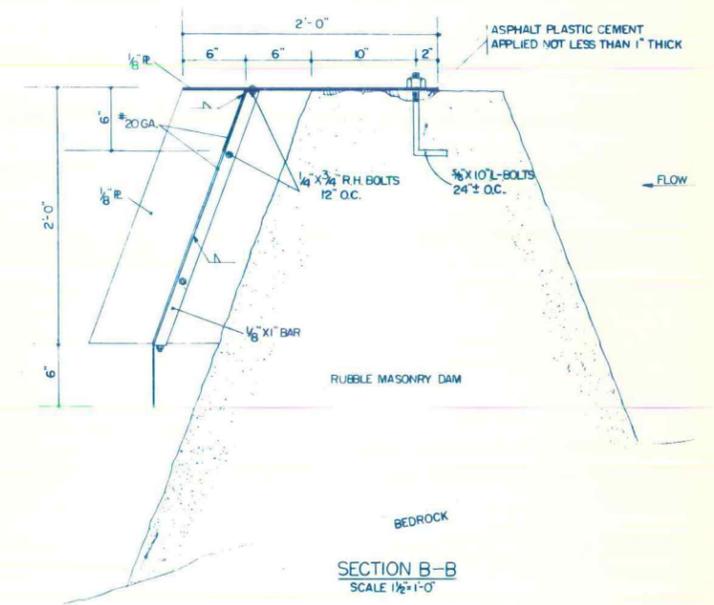
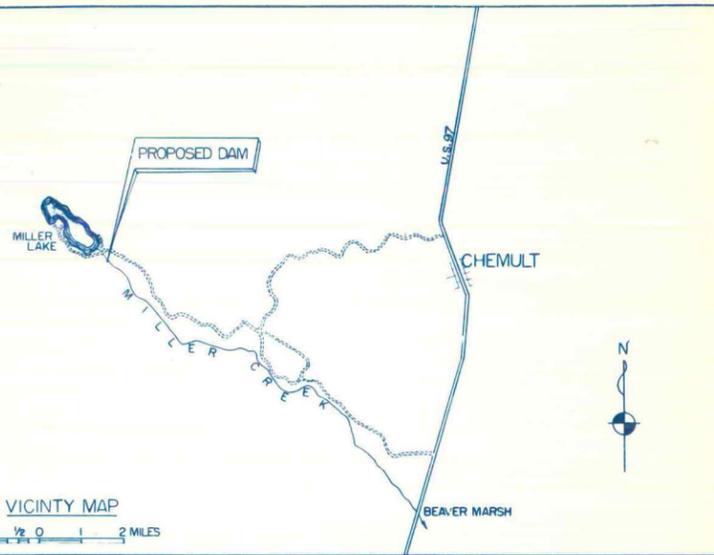
PROJECTION VIEW



SECTION C
SCALE 1/2" = 1'-0"



SECTION A-A
SCALE 1/2" = 1'-0"



SECTION B-B
SCALE 1/2" = 1'-0"

NOTES:
WASH BEDROCK BY PUMP.
TO BE CONSTRUCTED OF FIELDSTONE
EMPLOYING GROUT.
APPROX. 19 CU.YD. STONE REQUIRED.
50 SACKS CEMENT REQUIRED.
6 CU.YD. SAND REQUIRED.

MILLER LAKE PROPOSED LAMPREY CONTROL DAM		PLATE 1 OF
SCALE AS SHOWN	DRAWN 11-13-58 BY KS.	PLATES
ENGINEER		1019
CHECKED BY ASST. DIRECTOR		
APPROVED BY DIRECTOR		

Oregon State Game Commission - Portland, Oregon