NOAA Technical Memorandum NMFS F/NWR - 6

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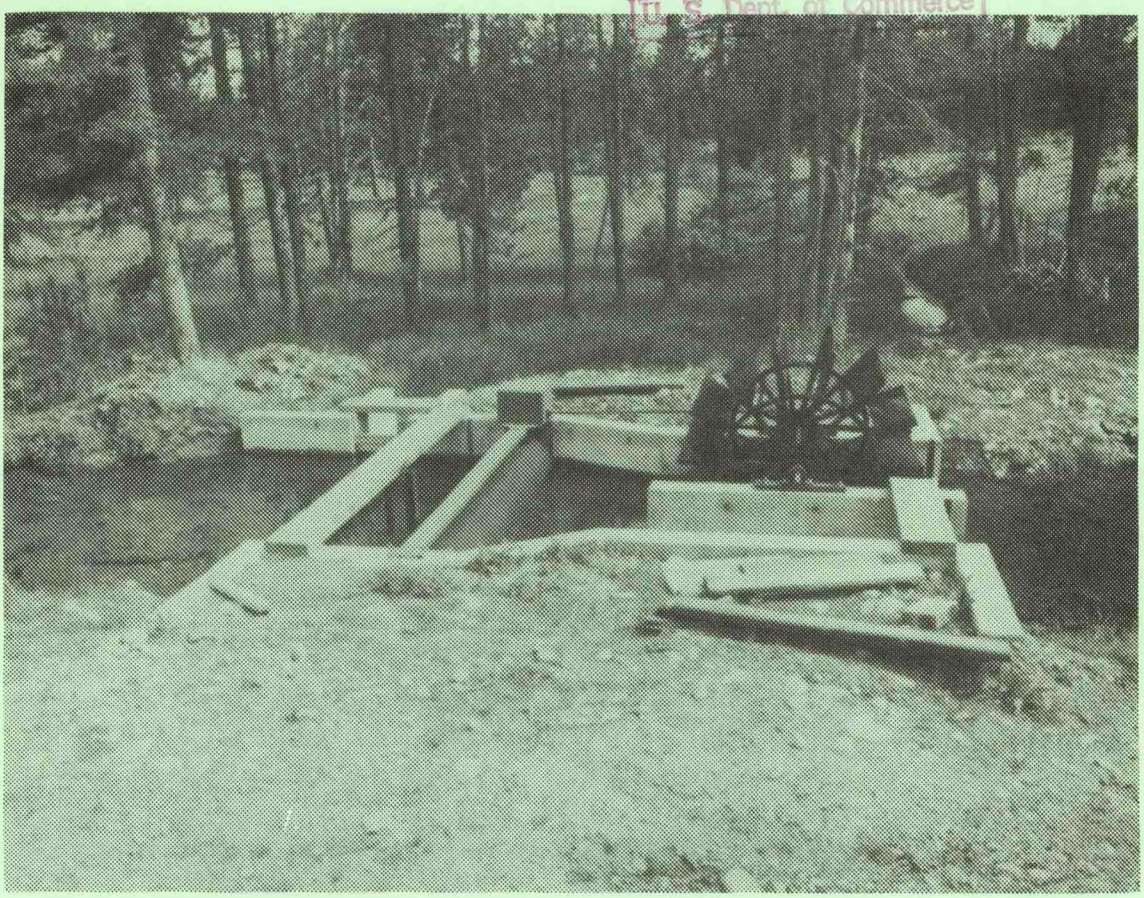
R.Z. Smith and E. Wold

October 1983



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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U.S. DEPARTMENT OF COMMERCE
Malcolm Baldridge, Secretary
National Oceanic and Atmospheric Administration
John Byrne, Administrator
National Marine Fisheries Service
William G. Gordon, Assistant Administrator for Fisheries

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National Marine Fisheries Service
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COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM

Annual Report - 1982

When Congress passed the Mitchell Act in 1938 and amended it in 1946, they set into motion the activities of the Columbia River Fisheries Development Program. Starting with an initial appropriation in 1949 of $1 million, the Program has concentrated on three main areas: 1) hatchery construction and operation; 2) stream improvement, and 3) studies to evaluate activities under the Program. Since its inception, the Program has operated in cooperation with State and other Federal fisheries agencies. Currently involved are the U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, and Idaho Department of Fish and Game. Under the Program, the majority of activities are conducted by the cooperating agencies using funds provided to them based on their budget requests and Program priorities.

For FY 1982 of the almost $7.9 million budget, by far the largest portion is distributed to the state fishery agencies and the U. S. Fish and Wildlife Service to be used to operate hatcheries and for stream improvement activities, etc. (Figure 1), with the majority of the expenditures (Figure 2) for hatchery O&M. Almost 4 out of every 5 dollars are spent in this category. As most of the stream improvement and irrigation diversion screening was completed in the early days of the Program, annual expenditures are now used to maintain and operate the structures. Through FY 1982 almost $130 million has been spent by the Program, again with the largest portion in the recent past being concentrated on hatchery O&M and studies (Table 1).

Fish Culture

The Columbia River Fisheries Development Program has used all practical means available to increase the abundance of salmonids in the Basin. The most important of these, both in effort and money spent, has been the artificial culture of fish in hatcheries. Starting with the initial $1.0 million in 1949, 22

Figure 1.-- DIVISION OF FY1982 COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FUNDS

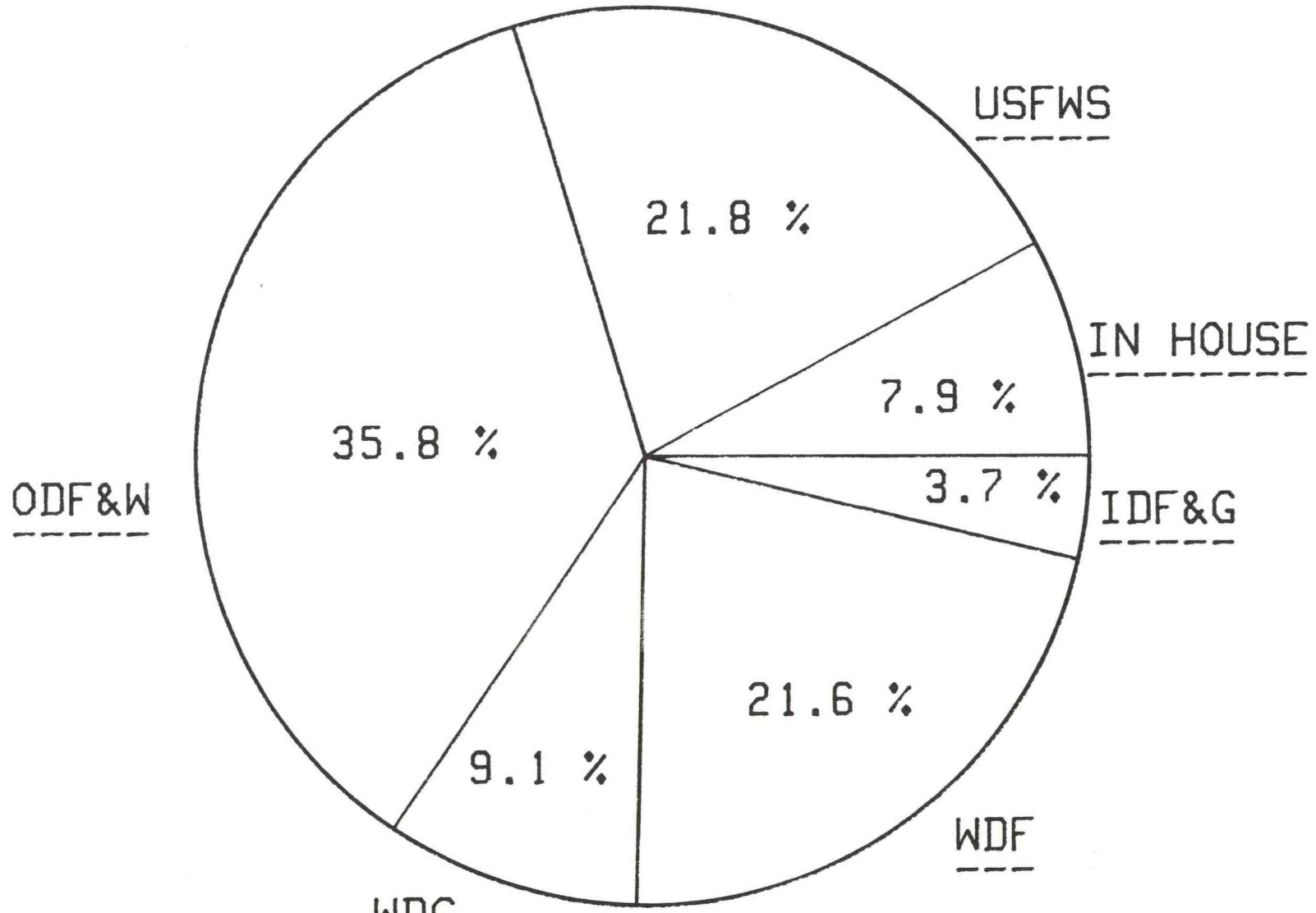


FIGURE 2.-- FY1982 C.R.F.D.P. APPROPRIATED FUNDS

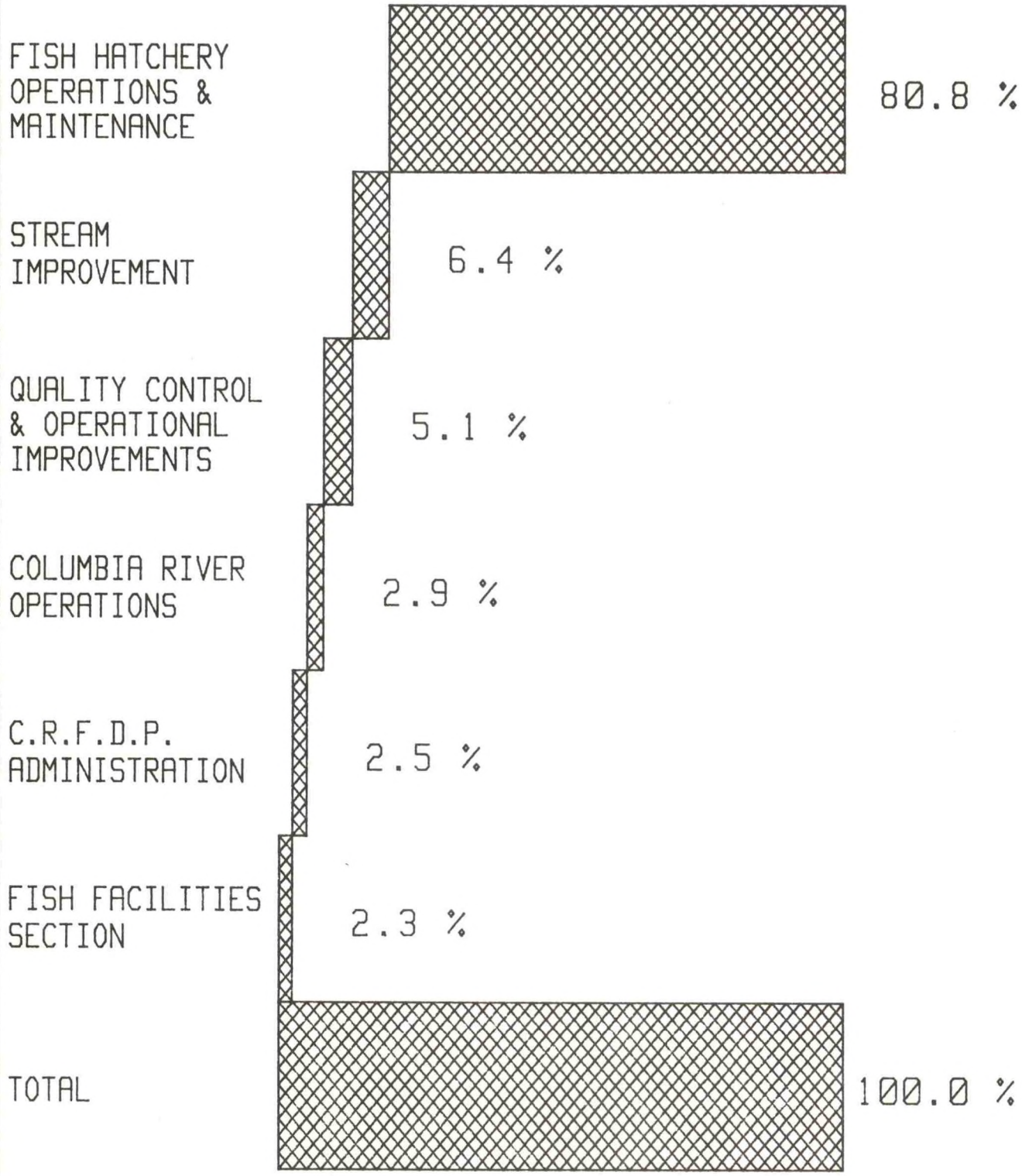


Table 1.-- FUNDS EXPENDED BY THE COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM 1949-1982

FISCAL YEAR	CONSTRUCTION	O&M AND STUDIES	POLLUTION ABATEMENT	TOTAL
1949	$1,000,000	0	0	$1,000,000
1950	1,192,500	7,500	0	1,200,000
1951	2,118,813	94,130	0	2,212,943
1952	1,525,451	149,983	0	1,675,434
1953	2,935,000	476,885	0	3,411,885
1954	1,750,000	634,814	0	2,384,814
1955	1,000,000	1,080,305	0	2,080,305
1956	900,000	972,527	0	1,872,527
1957	1,400,000	1,274,133	0	2,674,133
1958	1,600,000	1,215,091	0	2,815,091
1959	1,600,000	1,404,498	0	3,004,498
1960	1,200,000	1,625,157	0	2,825,157
1961	1,400,000	1,964,429	0	3,364,429
1962	1,431,000	1,934,060	0	3,365,060
1963	1,608,200	2,056,563	0	3,664,763
1964	965,700	2,049,416	0	3,015,116
1965	588,000	2,273,900	0	2,861,900
1966	968,700	2,382,800	0	3,351,500
1967	1,050,000	2,429,000	0	3,479,000
1968	0	2,599,200	0	2,599,200
1969	420,000	2,571,800	0	2,991,800
1970	1,048,000	2,886,000	0	3,934,000
1971	0	2,939,400	0	2,939,400
1972	0	3,020,400	0	3,020,400
1973	0	3,314,000	0	3,314,000
1974	63,400	3,301,300	394,500	3,759,200
1975	1,095,000	3,799,800	495,700	5,390,500
1976	781,800	4,439,100	500,000	5,720,900
T.Q. 1/	0	1,179,900	9,400	1,189,300
1977	445,100	5,007,300	500,000	5,952,400
1978	217,000	5,646,600	500,000	6,363,600
1979	33,500	6,111,400	2,797,000	8,941,900
1980	9,100	6,385,100	500,000	6,894,200
1981	0	6,821,300	386,800	7,208,100
1982	0	7,801,900	0	7,801,900
TOTALS	$30,346,264	$91,849,691	$6,083,400	$128,279,355

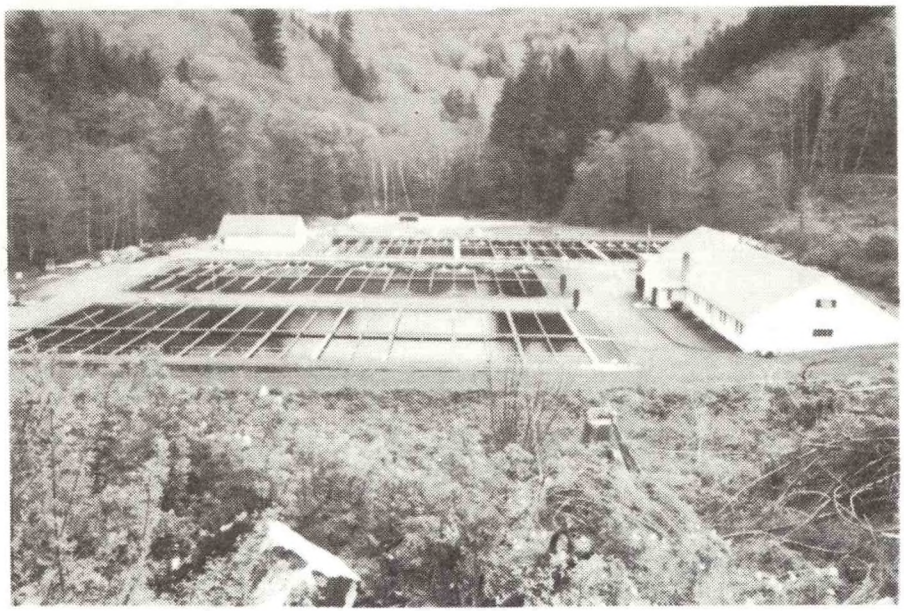
1/ T.Q. refers to the three month Transition Quarter from July to September necessitated by a change in Federal fiscal year reporting dates.

hatcheries and 2 major rearing ponds have been built in the Basin (Figure 3). They are concentrated in the lower Columbia within 100 miles of Portland (Figure 4 and Tables 2 and 3). The two exceptions are the Ringold rearing ponds located near the Columbia River above the confluence of the Snake River. All of these except for the Toutle Hatchery which was destroyed by the May 18, 1980 eruption of Mt. St. Helens operated during FY 1982.

In addition to the two major rearing ponds, a number of Program facilities have had satellite rearing ponds built to augment their production (Figure 3). These ponds, usually located near the hatchery, serve to expand the available rearing space for a portion of the year. In addition, since some of these ponds are located on different river systems than the hatcheries and are used as release sites, they serve to spread out the area utilized by salmonids.

The production from Program facilities in FY 1982 was similar to that in FY 1981 but down from the high point in FY 1977-79 (Table 4). The main reason for this decrease has been an effort to improve the quality of fish produced by reducing the rearing densities. A number of studies, especially some work done with coho salmon in British Columbia, have shown that reduction in rearing densities has resulted in large increases in catches and hatchery returns. As mentioned in the Studies section of this report, several studies are under way to further evaluate the density question.

In addition to the 21 active hatcheries shown in Figure 4, Program funds were used on a temporary basis to fund production at Lower Kalama Hatchery operated by Washington Department of Fisheries and Tucannon Hatchery operated by Washington Department of Game. A program for developing a brood stock of upriver fall chinook salmon lead to this funding decision. A portion of the normal production at Kalama Falls Hatchery was displaced by the rearing of upriver fall chinook, and since the rearing of those fish was funded by the U.S. Fish and Wildlife Service under the Lower Snake River Compensation Plan, monies are available to raise the displaced production at the Lower Kalama Hatchery. In the case of the Tucannon Hatchery, a reduction in State funds dictated the closure of the hatchery. Since, in addition to the normal steelhead trout program, the hatchery has been used as



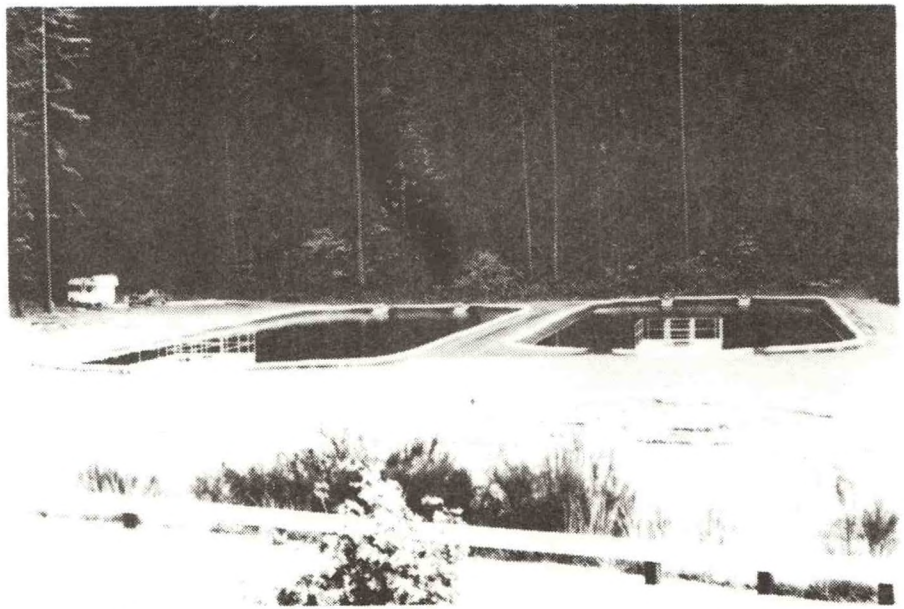


Figure 3.-- Three hatcheries and one satelite rearing facility participating in the Columbia River Fisheries Development Program. (Clockwise from upper left- Big Creek, Kalama Falls, and Klickitat Hatcheries and Herman Creek Rearing Ponds.

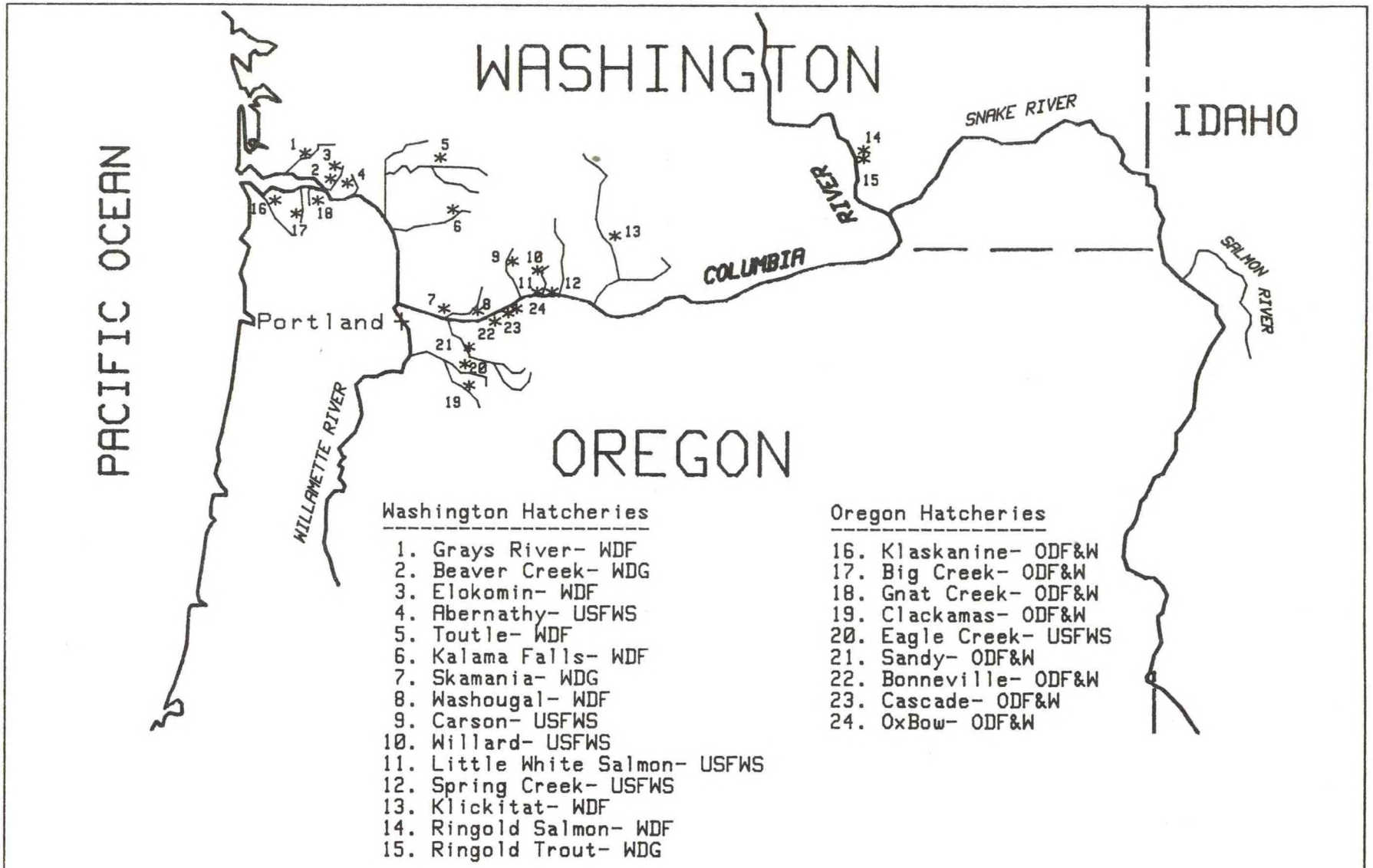


Figure 4.-- COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FUNDED HATCHERIES

Table 2.--Columbia River Fisheries Development Program Facilities - Columbia Basin --Washington

Facility	General Location	Congressional District	Operating Agency 1/	Species Reared 1960-81	Anadromous Releases 1981	Year Anadromous Operation Began	Funding Agency 1/
Hatcheries							
Abernathy	Longview	3rd	USFWS	fc(sc,co,sh)	Yes	1959	NMFS, USFWS
Beaver Creek	Cathlamet	3rd	WDG	sh, src	Yes	1958	NMFS
Carson	Carson	4th	USFWS	sc, co(fc,sh)	Yes	1932	NMFS, USFWS
Elokomin	Cathlamet	3rd	WDF	fc, co (ch)	Yes	1954	NMFS
Grays River	Grays River	3rd	WDF	fc, co, ch	Yes	1961	NMFS
Kalama Falls	Kalama	3rd	WDF	fc, sc, co	Yes	1959	NMFS
Klickitat	Glenwood	4th	WDF	fc, sc, co	Yes	1950	NMFS
Little White Salmon	Cook	4th	USFWS	fc, sc, co(ch)	Yes	1898	NMFS, USFWS
Willard	Cook	4th	USFWS	co (fc, sc)	Yes	1951	NMFS, USFWS
Skamania	Washougal	4th	WDG	sh (fc)	Yes	1956	NMFS
Spring Creek	Underwood	4th	USFWS	fc (co)	Yes	1901	NMFS, CE, USFWS
Toutle	Toutle	3rd	WDF	fc, sc, co	No	1952	NMFS
Washougal	Washougal	4th	WDF	fc, co (ce)	Yes	1958	NMFS
Rearing Ponds							
Ringold Salmon	Ringold	5th	WDF	fc, sc, co	Yes	1962	NMFS
Ringold Trout	Ringold	5th	WDG	sh	Yes	1962	NMFS

1/ USFWS-U.S. Fish and Wildlife Service, NMFS-National Marine Fisheries Service, WDF-Washington Department of Fisheries, WDG-Washington Department of Game, CE-U.S. Army Corps of Engineers

2/ fc-fall chinook salmon, sc-spring chinook salmon, co-coho salmon, ch-chum salmon, ce-cherry (masu) salmon, sh-steelhead trout, src-sea run cutthroat

Table 3.--Columbia River Fisheries Development Program - Columbia Basin -- Oregon

Facility	General Location	Congressional District	Operating Agency 1/	Species Reared 1960-81	Anadromous Releases 1981	Year Anadromous Operation Began	Funding Agency 1/
Hatcheries							
Big Creek	Knappa	1st	ODFW	fc, co, sh(ch)	Yes	1938	NMFS, ODFW
Bonneville	Bonneville	3rd	ODFW	fc, co (sh)	Yes	1909	NMFS, CE, ODFW
Cascade	Cascade Locks	3rd	ODFW	fc,co (sc,ch)	Yes	1958	NMFS
Clackamas	Estacada	2nd	ODFW	sc	Yes	1979	ODFW, NMFS, PGE
Eagle Creek	Estacada	2nd	USFWS	sc,co,sh(fc)	Yes	1957	NMFS
Gnat Creek	Westport	1st	ODFW	sh (fc,sc,sh)	Yes	1960	NMFS
Klaskanine	Astoria	1st	ODFW	fc, co, sh	Yes	1911	NMFS, ODFW
OxBow	Cascade Locks	2nd	ODFW	fc, sc (co)	Yes	1938	NMFS, ODFW
Sandy	Sandy	2nd	ODFW	fc,co (sc,sh)	Yes	1950	NMFS

1/ ODFW-Oregon Department of Fish and Wildlife, USFWS-U.S. Fish and Wildlife Service, CE-U.S. Army Corps of Engineers, PGE-Portland General Electric

2/ fc-fall chinook salmon, sc-spring chinook salmon, smc-summer chinook salmon, co-coho salmon, sh-steelhead trout

Table 4.--Releases of Salmonids in Numbers and Pounds from Columbia River Development Program Funded Rearing Facilities, 1960-84.

Year	Fall Chinook 1/ Numbers (millions)	Fall Chinook 1/ Pounds (10,000's)	Spring Chinook Numbers (millions)	Spring Chinook Pounds (10,000)	Coho Numbers (millions)	Coho Pounds (10,000)	Steelhead Numbers (millions)	Steelhead Pounds (10,000)	Totals Numbers (millions)	Totals Pounds (10,000)
1960	89.1	33.0	1.8	6.0	6.4	21.7	1.0	13.6	98.3	74.3
1961	46.6	30.6	0.8	3.0	14.2	50.7	0.9	10.8	62.5	95.1
1962	55.8	28.3	1.7	5.8	12.9	57.2	1.6	13.9	72.0	105.2
1963	58.8	32.6	2.4	8.5	19.6	75.7	1.4	13.8	82.2	130.6
1964	65.5	40.7	7.6	22.1	16.5	77.5	1.7	23.3	91.3	163.6
1965	56.2	37.0	3.0	10.2	17.9	85.4	1.9	24.8	79.0	175.4
1966	54.9	48.9	3.8	11.2	19.7	103.2	2.5	30.8	80.9	194.1
1967	55.1	49.8	5.5	17.8	20.2	100.0	2.3	28.8	83.1	196.4
1968	55.5	59.5	3.8	16.7	15.7	86.7	3.0	32.5	78.0	195.4
1969	57.9	57.4	3.5	16.5	18.6	110.4	2.3	26.9	82.3	211.2
1970	62.2	69.0	2.6	14.8	17.4	99.7	2.9	45.5	85.1	229.0
1971	63.3	48.3	3.8	23.9	21.3	120.7	2.4	30.8	90.8	223.7
1972	67.1	72.2	3.6	25.3	23.9	152.1	2.5	37.1	97.1	286.7
1973	70.4	83.2	4.8	40.1	20.9	119.7	2.5	41.3	98.6	284.3
1974	65.5	88.8	4.4	26.9	20.2	117.7	2.3	33.2	92.4	266.6
1975	67.3	87.8	5.2	32.7	21.1	138.3	1.9	29.4	95.5	288.2
1976	84.0	114.9	5.9	48.0	22.2	132.6	2.1	33.0	114.2	328.5
1977	95.0	103.4	5.1	37.2	26.3	155.6	2.2	35.4	128.6	331.6
1978	89.3	116.2	5.5 2/	40.9	26.3	165.8	2.4	39.9	123.5	362.8
1979	89.1	119.1	7.5 2/	60.6	21.1	113.3	2.4	38.6	120.1	331.6
1980	80.1	113.3	7.2 2/	51.2	20.8	124.0	2.2	33.0	110.3	321.5
1981	73.3	106.3	7.6	52.1	19.2	112.2	2.3	38.0	102.4	308.6
1982	78.6	110.7	7.3	62.4	17.4	97.8	2.1	35.2	105.4	306.1
1983 3/	(72.5)	(102.6)	(6.5)	(47.7)	(19.9)	(107.8)	(2.3)	(38.9)	(101.2)	(297.0)
1984 3/	(70.9)	(114.4)	(7.7)	(61.4)	(21.4)	(121.4)	(2.5)	(40.7)	(102.5)	(337.9)

1/ From 1972 on, part of the funds to operate the fall chinook program was supplied by outside outside sources such as the U.S. Army Corps of Engineers.

2/ Includes a small number of summer chinook reared at Program facilities.

3/ Estimated numbers.

a holding and spawning site for fall chinook trapped in the Snake River, the Program provided operating funds for 1 year until Lower Snake River Compensation funds were provided.

Studies

Studies form the second major area of activity under the Columbia River Fisheries Development Program. In addition to the Fall Chinook Hatchery Evaluation study discussed in detail in a separate section of this report, a number of studies were under way or in the process of being completed in FY1982. As with the operation of Program-funded hatcheries, most studies are conducted by the cooperating agencies.

Establishment of the time to release yearling coho salmon that results in maximum adult survival should be a concern of biologists and managers involved with hatchery procedures. Experimental releases of 1972-brood Toutle Hatchery coho by WDF (1977) demonstrated a large adult survival advantage from June and July releases of yearlings compared to those released in April and May. Consequently, a cooperative study between ODFW and WDF was initiated at selected Columbia River facilities to examine the effects of release time in the May-July period on adult coho production. Using 1977 and 1978-brood fish at Toutle and Washougal hatcheries in Washington, and 1977, 1978 and 1979-brood fish at Big Creek and Cascade hatcheries in Oregon, populations of equivalent sized yearling coho were serially released in May, June, and July of 1979, 1980, and 1981. These fish were given distinctive wire nose tag marks to aid in the evaluation. Currently, hatchery returns and catch data are being evaluated.

While final results are not yet available, several interesting occurrences have been noted at the Oregon facilities. Generally, fewer jacks (males returning at age 2 rather than the normal age 3) were produced from the later release times. The returns have been the highest from the releases made in June/July. The size of returning adults seems to be related to release times also. The largest average size of returnees has come from the earliest release and the average size has decreased with each later release. The total

biomass, however, tends to support the later releases as the larger numbers of fish compensate for the decreased size.

The WDF initiated two studies in FY 1982 supported by the Program. The first of these, a rearing density study, was initiated during FY 1982 using 1980-brood coho at Washougal and Grays River hatcheries. The two stated objectives of the study are to: 1) detail the effects that flow related loading has on ultimate performance of coho salmon from Columbia River hatcheries; and 2) determine the most advantageous loadings to be employed at Washougal and Grays River hatcheries. This study differs from other density studies, notably the density work done in Canada, in that loadings are being calculated on flow rather than pond volume because production at WDF facilities is limited by water volume rather than pond space.

The study plan involves 3 broods of coho at each station and will include the use of coded wire tags to identify experimental groups. This will allow for accurate monitoring of catches and returns. At Washougal, six identical rearing units were set up with six different rearing densities in November of 1981. The first brood of fish were released on May 31, 1982. At Grays River, because of the variation of release ponds, only one loading level was established in each of 3 rearing ponds. The fish were marked and put into the ponds in December 1981 and released on April 30, 1982.

The only results of the study to date relate to length-weight relationships between study groups just prior to release. There was no significant difference in any of the study groups at Washougal and difference in only one group at Grays River.

Final results for the first brood of the 3 brood year study will be available in March of 1984 with the study being completed in 1986.

The second study initiated by WDF during FY 1982 evaluates the control of coagulated yolk or white spot disease through the use of substrate in hatchery incubators. The study involved mixed stock fall chinook salmon at Grays River and Elokomin Hatcheries. Test lots of fish were hatched and

raised to ponding size in vertical tray incubators which had been modified prior to introduction of eggs by inserting bio-rings or Vexar sheeting. After ponding the mortalities were monitored and samples of the dead fish were examined for coagulated yolk. The fish were given distinct wire tags prior to release to allow the monitoring of ocean catch and hatchery returns. The fish were released from Grays River, 1982 and June 15, 1982.

Preliminary results show no size difference for mean egg size at either hatchery. At Grays River, mean fry size at ponding didn't vary between the control and substrate groups while at Elokomin the fish in control groups were larger and heavier. There were no significant size differences at release. At Elokomin, the over all mortalities were low with slightly higher losses in the substrate group. Examination of fish at time of ponding showed 24% of the substrate group and 17% of the control group had signs of coagulated yolk. Grays River mortalities were higher and the difference between the control group and the substrate group was highly significant, with the overall mortality rate of 11% for the controls and 10% for the substrate group. At ponding, 50% of the Grays River control fish showed signs of coagulated yolk compared to less than 10% for the substrate group.

Marine catch data and hatchery returns won't be available until 1983-84 at which time final analysis of the study will be completed and variations due to factors such as type of substrate will be analyzed. A summary of the preliminary conclusions shows:

1. The use of bio-rings at Grays River Hatchery was effective in reducing the mortality of chinook salmon caused by coagulated yolk disease.

2. The use of Vexar at Elokomin did not appear to reduce the mortality of chinook salmon due to coagulated yolk.

3. The overall mortality rate at Grays River was much higher than the mortality rate at Elokomin; thus it appears that the problem is not as severe at Elokomin.

4. The use of substrate did not confer a size advantage to the fry or increase the efficiency of yolk absorption.

5. The cause of coagulated yolk disease was not determined but appears to be related to the incubation phase of culture.

A study, scheduled for completion in FY 1985, is being conducted by the WDG on the Kalama River with steelhead trout. While there are many objectives of this study, a primary purpose is to determine the effect of an introduced hatchery stock of steelhead on a stream that already has a native wild population. It is commonly felt that the hatchery fish will displace the active fish but the preliminary data shows just the opposite. The wild stocks have been thriving and the hatchery fish have to struggle just to survive.

Another purpose of this study has been to evaluate the effectiveness of using a "genetic mark" to identify different groups of fish. This was accomplished by selectively breeding fish at Skamania Hatchery that had certain genotypes which do not occur or which occur in small numbers in the native fish in the Kalama system. By examining the genotypes of steelhead in the Kalama, it has been possible to distinguish hatchery reared steelhead from wild steelhead. This technique, involving electrophoresis has shown to be an effective identification tool and is in use in other areas with other studies.

Studies are underway at Eagle Creek NFH (coho salmon), Carson NFH (spring chinook salmon), and Willard NFH (coho salmon), all operated by the USFWS, to evaluate the effect of density on survival. Study designs include use of two variables, the number of fish per raceway, and the amount of water flow per raceway to density as a function of pounds of fish per gallon of water and pounds of fish per gallon of water per minute. The study at Eagle Creek has been conducted for several years, and results should be available soon. At the other two facilities, a shakedown year was run in which the study design was tested for any major flaws without marking the fish prior to release. Now that any problems have been identified and corrected, the study will proceed.

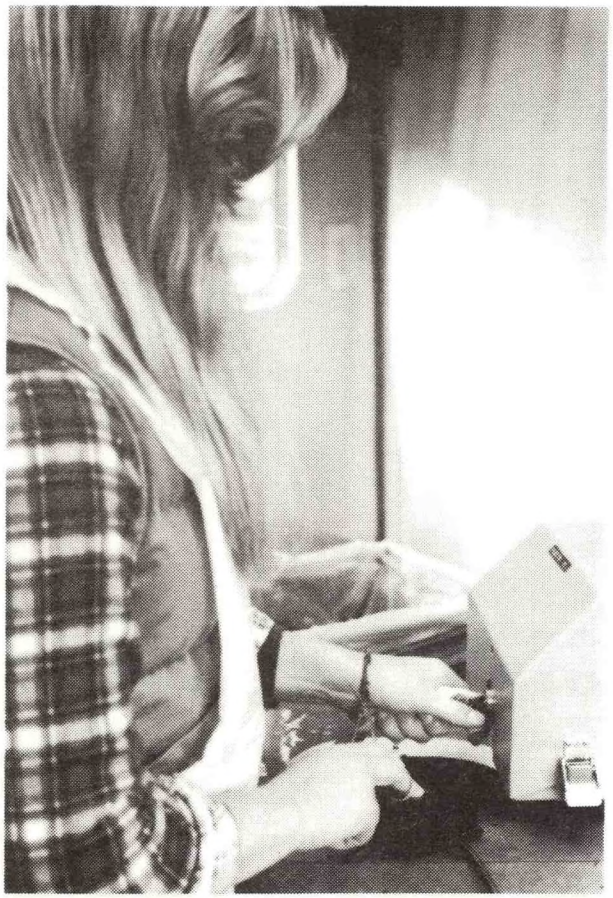


Figure 5a.-- Injecting a coded wire tag into the snout of a young salmonid.

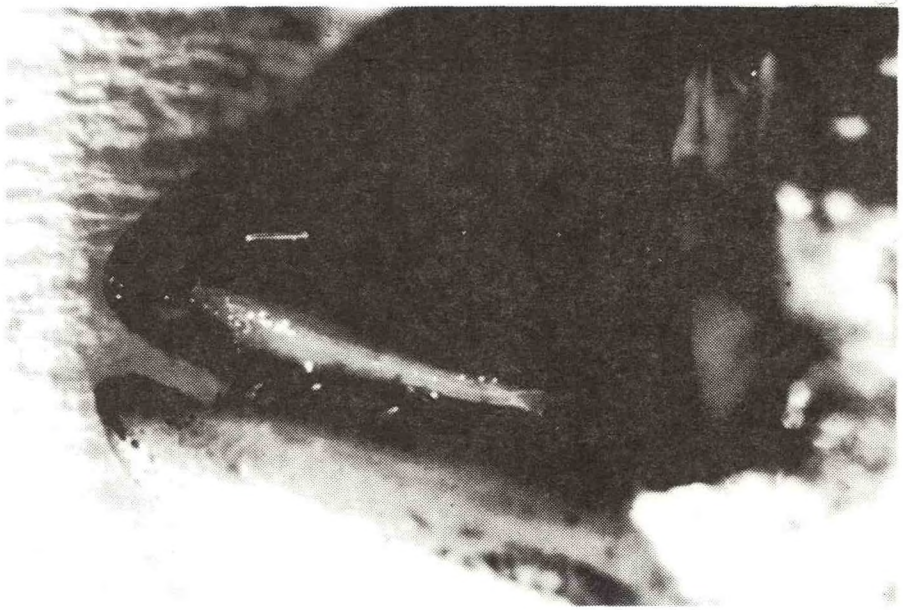


Figure 5b.-- Cross-section through the snout of a young salmonid showing a coded wire tag in place.

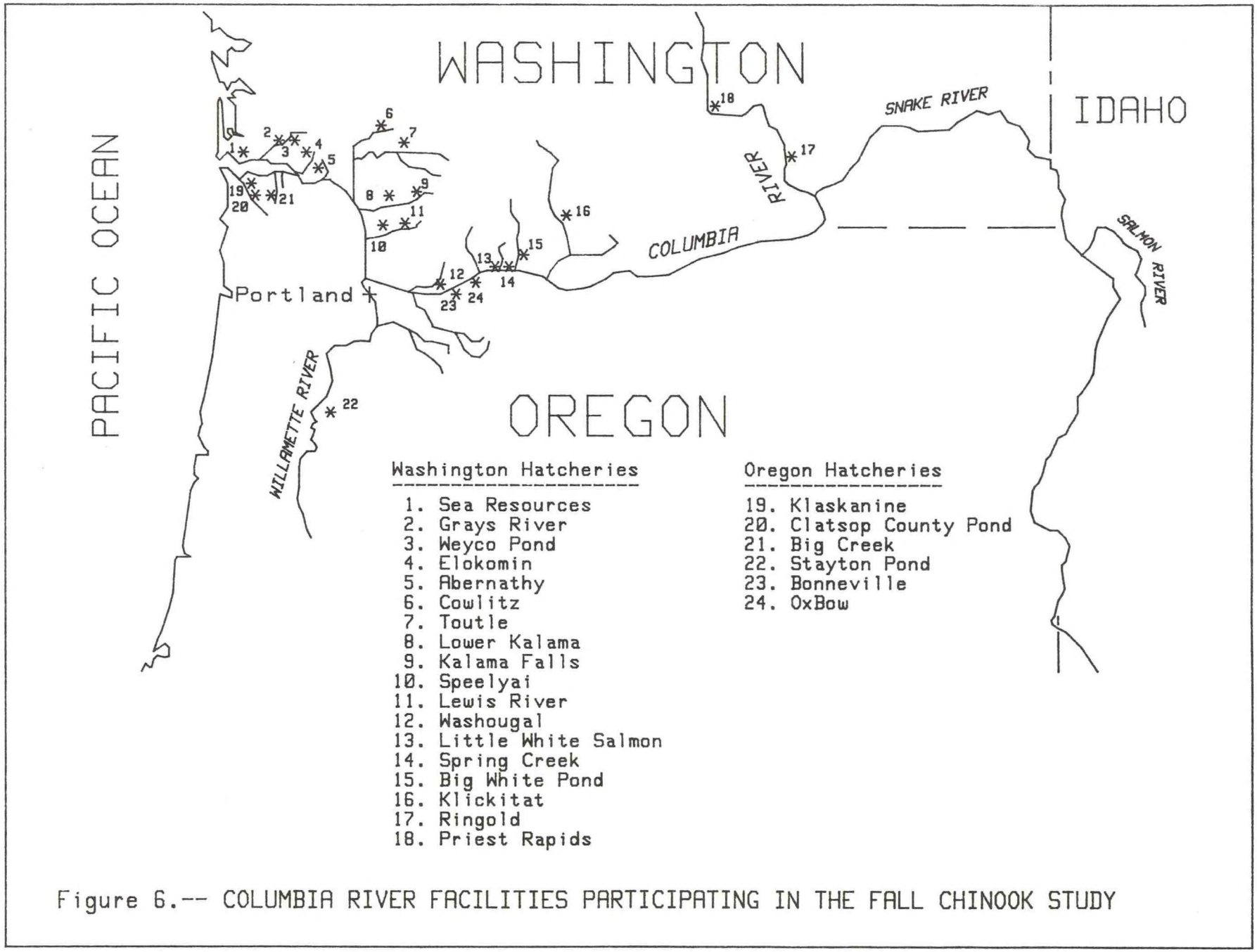


Figure 6.-- COLUMBIA RIVER FACILITIES PARTICIPATING IN THE FALL CHINOOK STUDY

Several lakes of the upper Salmon River basin in Idaho, including Alturas, Pettit, Redfish, and Stanley lakes, contained sockeye salmon in large abundance until the early 1900's. The runs were large enough to support some local commercial harvest and were attributed to populate the most important spawning grounds for this species in the Columbia Basin. The construction of Sunbeam Dam in 1913 on the Salmon River near Stanley, Idaho blocked these important spawning and rearing grounds. Even after the removal of Sunbeam Dam in 1934, effects of Snake and Columbia River hydroelectric projects have kept the numbers of sockeye returning to Idaho low.

In 1980, using study funds provided by the Program, the Idaho Department of Fish and Game began a program for reestablishing the sockeye runs in the upper Salmon River drainage. This is being done by augmenting the residual natural run with hatchery-reared fish. Since there were no populations of sockeye in the Columbia Basin with excess breeding potential, an egg source outside the Basin was sought. Through an agreement with the Government of Canada, arrangements were made to take eggs at the Babine Fence on the Fulton River in British Columbia. The eggs have hatched, and the fish reared at various hatcheries in Idaho and the resultant fry have been released into Stanley Lake. Releases totaled 174,000 in 1981 and 260,000 in 1982. This project will continue at least through FY 1984.

Fall Chinook Hatchery Evaluation Study

In 1979 the Bonneville Power Administration (BPA) began funding an 8-year study to determine the distribution, contribution, and value of fall chinook salmon raised at Columbia River rearing facilities. The last brood year of fall chinook was tagged in 1982 which completed four years of tagging. Information from this tagging study will provide data to determine the effectiveness of hatcheries constructed as mitigation for hydroelectric developments. In addition, this data will aid fishery agencies in planning further measures to protect, mitigate, and enhance salmon runs on the Columbia River. This information is important to regulating bodies, such as the Pacific Fishery Management Council, charged with negotiating, setting, and

adjusting fishing seasons, locations, and limits. Current regulations are based on data from a fin-marking study completed over ten years ago. Since completion of that study, new rearing facilities have been built, existing facilities renovated, sport and commercial fisheries are different, and hatchery practices have changed.

The National Marine Fishery Service (NMFS) is coordinating the study among three other fishery agencies. They include the U.S. Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), and Washington Department of Fisheries (WDF). Marking a portion of the fall chinook production occurred at all Columbia River chinook rearing facilities operated by the participating agencies (Figures 5a and 5b).

Monitoring of tagged fish begins as they migrate downstream through the Columbia River estuary. Monitoring is done by NMFS and provides an estimate of survival from time of release to entry into the ocean.

Monitoring of sport and commercial landings of fall chinook will occur along the entire Pacific coast. Fishery sampling agencies from Alaska to California will sample catches for marked fish. The Columbia River fisheries and adult returns to USFWS, ODFW, and WDF hatcheries will be monitored for marked fall chinook through 1986.

The objectives of the study are to: 1) determine the contribution of hatchery fall chinook from Columbia River hatcheries to individual Pacific salmon fisheries by age class of fish, and 2) determine the distribution, contribution, and value of each hatchery's production of fall chinook to Pacific coast salmon fisheries.

In FY82, fall chinook were released from 19 facilities on the Columbia River (Figure 6). Funds from BPA were used to tag fish at all 19 facilities.

Tagging began February 22, 1982 at the USFWS' Abernathy facility and continued through July 2, 1982 at the WDF's Cowlitz facility. Personnel from the three operating agencies tagged 3,651,297 fish at 19 facilities for the

project. Total marks by agency are: 762,597 at USFWS facilities, 967,500 at ODFW facilities, 1,758,300 at WDF facilities, 115,400 at Clatsop County Economic Development Commission (CEDC) ponds, and 47,500 at the Sea Resources facility. After tagging, all fish were returned to the populations of untagged fish from which they came. Prior to release, fish were sampled to estimate the tagged to untagged ratio and the percentage of tag loss.

The mobile tagging unit constructed by NMFS with BPA money was used by ODFW personnel to tag fish at Bonneville and Oxbow facilities. ODFW tagging equipment was used at Big Creek, CEDC, Klaskanine, and Stayton Pond. The USFWS used the mobile tagging unit (NMFS's) at Abernathy, Little White Salmon, and Spring Creek hatcheries. The WDF used their own tagging equipment at all their facilities and at the Sea Resources hatchery.

Releases by hatchery personnel at participating facilities totaled 82,138,272 untagged and 3,460,906 tagged fall chinook under this project in 1982 (Table 5). In most cases, fish were released at the rearing site. Exceptions included portions of the April releases at Spring Creek and Bonneville which were transported above John Day Dam for release. In addition ODFW personnel transported fall chinook from Stayton Pond to various release sites on the Willamette River system.

A late release at Spring Creek National Fish Hatchery was originally scheduled for August, 1982. A temporary power interruption and malfunctioning backup system cut off the water supply to the raceways, forcing an early release (July 30). Excessive mortality occurred to this group due to the malfunction. The failure in the backup system has since been corrected.

Releases of 1978 to 1981 brood fall chinook from participating facilities have been summarized in Table 5.

TABLE 5. -- Releases of 1978-81 brood fall chinook from Columbia River rearing facilities

Rearing Facility	Releases							
	1978 Brood		1979 Brood		1980 Brood		1981 Brood	
	Tagged	Total	Tagged	Total	Tagged	Total	Tagged	Total
ABERNATHY	112,300	1,610,200	147,700	1,977,600	82,600	1,201,200	120,400	1,456,300
BIG CREEK	224,900	5,247,300	143,400	6,433,500	147,300	5,594,500	131,200	4,536,300
BIG WHITE POND	141,400	3,028,700	0	2,199,100	0	0	0	0
BONNEVILLE	303,000	13,395,100	121,100	5,072,900	205,700	8,333,600	305,100	6,219,600
CLATSOP COUNTY PONDS	0	1,430,000	0	2,016,000	123,000	3,158,600	113,600	2,740,100
COWLITZ	147,200	4,636,000	335,500	8,130,300	274,500	6,178,800	296,300	7,940,400
ELOKOMIN	138,900	2,875,400	98,400	2,411,100	165,600	2,925,000	102,800	2,600,100
GRAYS RIVER	149,600	1,373,000	37,500	807,000	74,300	1,220,800	72,900	826,400
KALAMA FALLS	214,500	4,158,100	100,400	2,400,900	175,400	3,611,400	163,200	3,539,000
KLASKANINE	244,100	5,490,800	66,300	2,237,700	101,000	3,943,400	100,300	2,029,300
KLICKITAT	225,400	2,035,400	156,100	3,139,400	130,000	2,479,100	204,100	3,679,700
LEWIS RIVER	0	0	103,700	427,200	0	446,800	0	0
LITTLE WHITE SALMON	442,600	11,410,800	162,600	8,776,000	249,100	9,215,600	199,100	8,038,700
LOWER KALAMA	0	3,119,800	144,500	3,279,800	155,300	2,998,700	139,400	3,168,000
OXBOW	0	0	101,300	2,388,400	0	0	104,800	4,281,600
PRIEST RAPIDS	153,100	1,199,900	110,100	2,336,500	236,700	4,819,400	310,900	5,509,300
RINGOLD POND	0	0	37,100	668,800	0	0	0	0
SEA RESOURCES	24,200	982,000	20,300	766,100	44,000	901,400	45,000	858,500
SPEELYAI	156,200	238,600	0	0	0	0	0	0
SPRING CREEK	578,000	19,558,900	284,300	15,557,300	516,700	16,638,100	398,506	13,433,678
STAYTON POND	283,800	4,691,600	282,000	6,348,600	245,500	5,902,700	265,800	6,750,900
TOUTLE	144,100	2,769,600	0	0	0	0	0	0
WASHOUGAL	251,900	5,087,000	314,600	6,093,900	307,500	6,022,100	170,400	3,495,900
WEYCO POND	92,400	366,500	97,800	1,951,900	233,800	4,773,300	217,100	4,495,400
TOTAL	4,027,600	94,704,700	2,864,700	85,420,000	3,468,000	90,364,500	3,460,906	85,599,178

Personnel from NMFS sampled downstream migrants in the Columbia River estuary and marine waters near the mouth of the Columbia in 1982. Sampling began in mid March but the most intense sampling occurred from April through mid June. Up to 100 adipose marked fish per day per species were sacrificed and tag codes read.

Due to potential differences in catch vulnerability among releases from participating hatcheries and possible differences in sampling intensity and catch rates from year to year, it is not possible at this time to predict or compare survivals of hatchery releases from the magnitude of recoveries of smolts migrating downstream. When fishery catches and hatchery returns are complete and compared with recoveries of migrating smolts, we will be able to detect a pattern and develop survival prediction methods.

Sport and commercial recoveries of tagged fall chinook began occurring in marine waters in 1980. Limited recovery data is available for 1980 to 1982 catch years. The largest numbers of observed recoveries have come from Spring Creek, Abernathy, Bonneville, Big Creek, and Stayton Pond. To date, surprisingly few fall chinook tag recoveries have occurred from WDF facilities.

The majority of the tag recovery data available to date have been observed recoveries. Contribution estimates and comparisons of survival can only be made from estimated recoveries. Thus no conclusions should be formulated from the data presently available. Conclusions may possibly change when estimated recoveries become available and are analyzed.

Observed recoveries are not yet available for Alaska fisheries. All other Coastal fisheries have supplied some tag recovery data. The 1982 data is incomplete and/or preliminary.

Personnel from WDF, ODFW, and USFWS examined all fall chinook returning to hatcheries for the absence of fins. Samplers removed the snout of all fish with a missing adipose fin to recover nose tags. In addition they collected biological data from a predetermined random sample of untagged fish

at each facility. The biological data will be used to estimate age of untagged fish. The age structure for tagged and untagged fish will be compared to determine if tagging changes the age distribution of returning adults.

A total of 93,264 fall chinook returned to 13 participating facilities in 1981. This return total does not include 301 from Klickitat and 63 from Klaskanine hatcheries. At the above two facilities no scale sampling took place. An age-of-return ratio of 65 percent 3-year-olds, 30 percent 4-year-olds, and 5 percent 5-year-olds was assigned at Klickitat. ODFW assigned 60 age 3 and 3 age 2 to Klaskanine's returns. The return percentages for the 13 facilities combined were 17, 52, 28, and 3 for 2-, 3-, 4-, and 5-year-old fall chinook, respectively.

A total of 89,808 fall chinook returned to the participating facilities in 1982 (Appendix Table A). The age composition for these returns to the USFWS and the WDF facilities are shown in Appendix Table B. All returning fish were examined for marks. Appendix Table C shows the number of tags recovered by tag codes at the USFWS and the ODFW facilities. Examination of the origin of these fish shows that in some cases there was considerable straying.

Preliminary recoveries of the 1978-brood releases are presented in Appendix Table D. These numbers are for actual tags recovered and are not the estimated tag recoveries or the estimated hatchery contribution that will be calculated when the final evaluation report is prepared. All fisheries except Alaska are included. Although preliminary, indications are that Bonneville Hatchery and Stayton Pond in Oregon and Abernathy and Spring Creek Hatcheries and Big White Salmon Pond in Washington had good survivals.

Transportation Operations on the Snake and Columbia Rivers, 1982

Collection and mass transportation of juvenile anadromous salmonids occurred at Lower Granite (River Mile [RM] 107.5) and Little Goose (RM 70.3) dams located on the Snake River and at McNary Dam (RM 324.3) on the Columbia River. Collected smolts and fry were transported to a site below

Bonneville Dam (RM 146.1) via barge or truck and released. The goal of this transportation program is to reduce dam-related mortalities and the impedance of migration by passing 4 to 8 dams and 146 to 280 miles of impounded river (Figure 7).

Since 1981, the transportation program has operated with Walla Walla District, Corps of Engineers (NPW), providing funding, maintenance and manpower; fishery agencies and tribes providing biological oversight; and program oversight by the Fish Transportation Oversight Team (FTOT). Prior to the 1982 season, cooperative agreements were signed between NPW and the States of Idaho, Oregon, and Washington to place state fishery biologists/fish culturists at the projects for biological oversight during the juvenile fish emigration. Idaho's representatives were assigned to Lower Granite, Oregon's to Little Goose, and Washington's to McNary. Work loads at each project were shared by the NPW biologist and State biologist/fish culturist.

The FTOT, formed in late 1980 to provide coordination between NPW, fishery agencies, and tribes, continued to manage the program in 1982. The FTOT is composed of a NPW fishery biologist, Idaho Department of Fish and Game (IDFG) fishery biologist, and a NMFS fishery biologist. The NMFS representative, a member of the Columbia River Fisheries Development Program staff, is the FTOT chairman. The FTOT is responsible for transportation coordination and program oversight; developing an annual work plan, conducting on-site project inspections prior to, during, and after the season; and producing a published annual report summarizing transport activities.

Salmonids migrating downstream are intercepted and collected at the transport projects. As fish approach the turbine intakes, a percentage are guided by submersible traveling screens (STS) into gatewells (Figure 8). Fish exit from the gatewells through 8- or 12-inch orifices, and into the collection channel. Fish are either bypassed back into the river or collected for transportation by truck or barge (Figure 9a and 9b).

Collecting and transporting smolts reduced turbine-related mortalities, predation mortalities, and migrational delay. Research to identify areas of

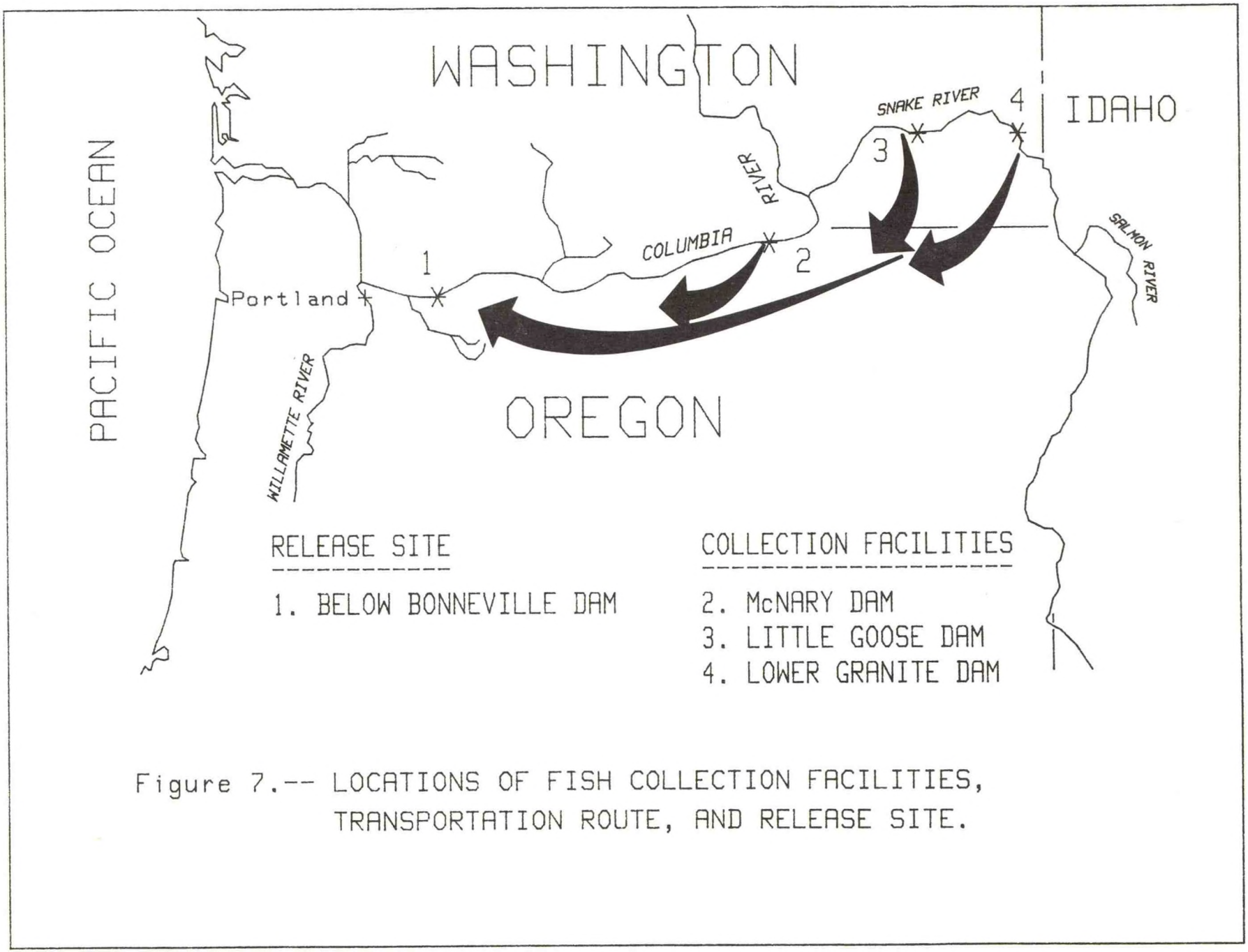
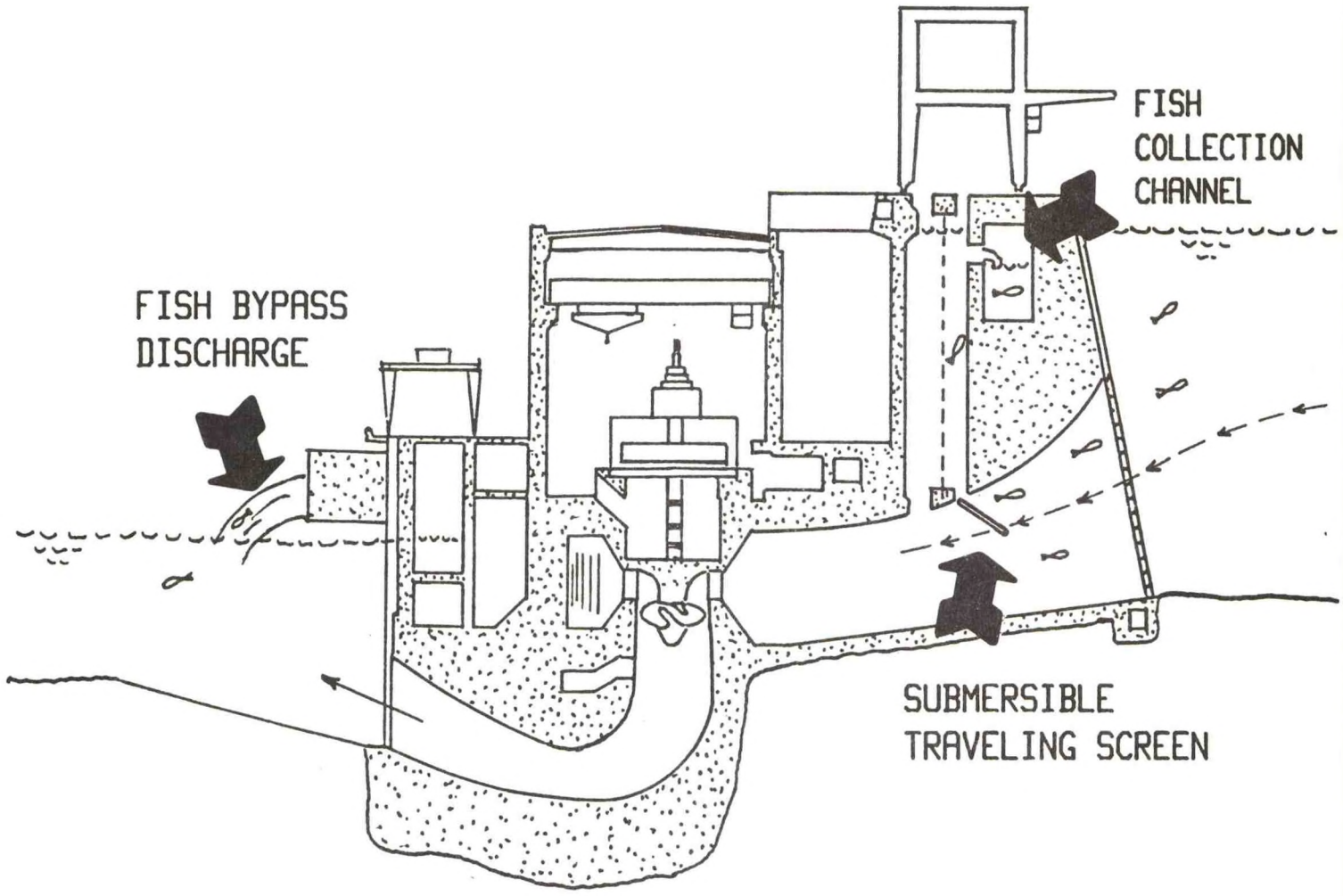


Figure 7.-- LOCATIONS OF FISH COLLECTION FACILITIES, TRANSPORTATION ROUTE, AND RELEASE SITE.



CROSS-SECTION THROUGH DAM

Figure 8.-- JUVENILE FISH PASSAGE SYSTEM

Figure 9a.-- Unloading a truck full of juvenile salmonids, trapped at collector dams on the Columbia and Lower Snake Rivers, at a site below Bonneville Dam.

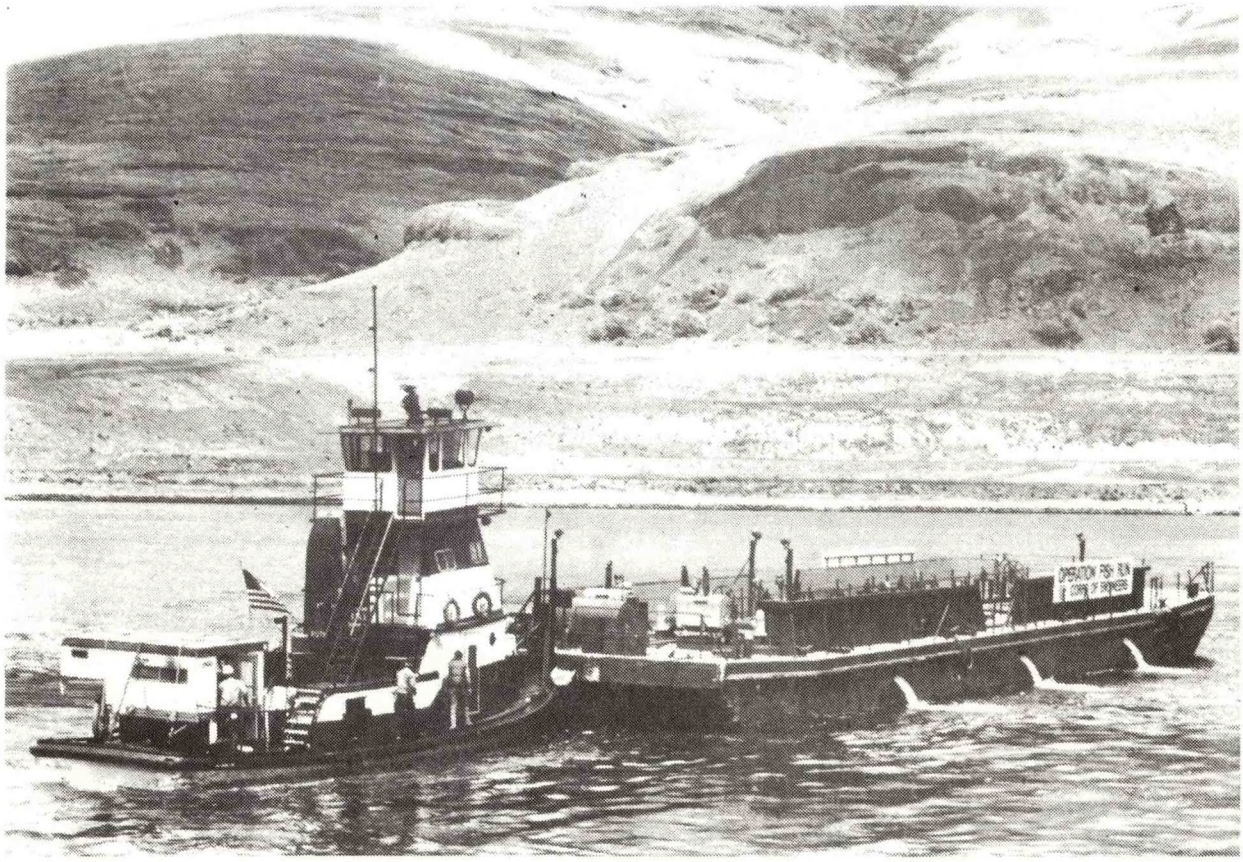


Figure 9b.-- A barge full of juvenile salmonids on its way to a release site below Bonneville Dam.

stress in the collection and transport process has been and should continue to be a high priority. Once points of stress are identified, corrective measures will be sought. Future modifications should decrease stress, increase smolt survival and result in greater numbers of adult returns.

The dates of operation were from March 30 to September 24. During this period Snake and Columbia River flows were near or above optimum levels as recommended by the Columbia River Fisheries Council (CRFC). During the juvenile spring outmigration, excellent migratory conditions existed. Transportation of spring migrants was not maximized at Snake River projects from April 17 through May 17 in order to spill a large percentage of juveniles down the river system rather than transport them. The CRFC believed that this mode of operation would be especially beneficial to spring chinook juveniles since they have not responded as well to transportation as have steelhead.

Numbers of juveniles collected at Lower Granite, Little Goose, and McNary dams were: 1,939,273, 1,265,503, and 3,152,440, respectively, for a total of 6,357,216. This total is 25 percent lower than in 1981, mainly due to the period of heavy spill which occurred throughout the juvenile emigration. Also, numbers of spring chinook salmon migrating from the Snake River were the lowest on record; 1.7 million were estimated to have arrived at Lower Granite Dam. In 1982, 95.8 percent of the fish collected were transported from the projects to below Bonneville Dam. Fish mortalities, fish used for research purposes, and fish bypassed to the river accounted for the remaining 4.2 percent.

Stream Improvements

The third major area of work under the Columbia River Fisheries Development Program since its inception has been stream improvements through stream clearance, laddering of obstructions, and screening irrigation diversions. In the early years of the Program many miles of otherwise accessible spawning and rearing habitat on the tributary rivers and streams in the Basin were blocked by logging debris, land slides, and flood damage.

Using Program funds, these obstructions were identified and removed. All identified obstructions have been removed and with today's improved logging practices the stream clearance work now consists mainly of yearly surveys by the state fish and wildlife agencies to detect and clear any new obstructions.

In addition to the removable obstructions, many Columbia River tributaries were blocked by impassable water falls. Under the Program, these water falls were cataloged and were either altered by blasting and excavation or bypassed by the construction of fish ladders. Current activity by Program-funded State fish and wildlife agencies consists of annual maintenance to assure that the fishways and ladders are operated properly.

The three State fish and wildlife agencies: Washington Department of Fisheries, Idaho Department of Fish and Game, and Oregon Department of Fish and Wildlife, currently operate 31 fish ladders or fish ladder complexes in the Basin, 14, 2, and 15, respectively (Table 6 and Figures 10a and 10b). In addition Oregon has all rock cut fish passes and Washington operates several informal ladders in the lower Columbia. Size and complexity of these fish ladders and fishways vary widely from simple blasted rock cut fish passes over minor falls several feet high, through large concrete fishways over major barriers such as Shippard falls on the Wind River in Washington, to the very large and complex, four-entranced Willamette Falls fish ladder which opened up the entire Willamette River above Oregon City to anadromous salmonids. Although a number of these fish passage facilities may need major overhauls or replacement in the future, no major problems exist at this time, and the Basin's salmon populations continue to have access to large areas of formerly inaccessible spawning and rearing habitat.

The third area of stream improvement work under the Program is the construction and maintenance of fish screens on irrigation diversions. In the past, these diversions have caused the loss of large numbers of juvenile salmonids during the downstream migration portion of their life cycle. The fish enter the irrigation canals and, rather than continuing on to the ocean, end up dying on the farmers fields. To prevent these losses, screens of various types have been built across these diversions with an escape route

Table 6.--Fish Ladders or Ladder Complexes Operated Under the Columbia River Fishery Development Program.

Agency	Ladder	Location
ODFW *	Barth Falls	NF Klaskanine River
	Bonnie Falls	NF Scappoose Creek
	City of Lostine Dam	Lostine River
	Clatskanie Falls	Clatskanie River
	Elkhorn Falls	Little North Santiam River
	Fifteenmile Creek Falls	Fifteenmile Creek
	Goble Creek Falls	Goble Creek
	Minam River Falls	Minam River
	Oregon Iron & Steel Dam	Tualatin River
	Pegleg Falls	Callawash River
	Punchbowl Falls	WF Hood River
	Sheepridge Dam	Lostine River
	Threemile Dam	Umatilla River
	Wiley Creek Falls	Santiam River
	Willamette Falls	Willamette River
WDF **	Cameron	Abernathy Creek
	Casteel	Klickitat River
	Cedar Creek	Lewis River
	Delimeter	Cowlitz River
	Johnson	Lewis River
	Kalama Falls	Kalama River
	Klickitat #2	Klickitat River
	Klickitat #5	Klickitat River
	Little Kalama	Kalama River
	Ostrander	Cowlitz
	Shippard Falls	Wind River
	Trout	Wind River
	Washougal	Washougal River
	Winkler	Washougal River
IDFG	Middle Fork	Middle Fork Salmon River
	Selway	Selway River

* Also operates "rock cut fish passes" on the Yamhill, Willamina, Molalla, Santiam, and Mohawk rivers.

** Also operates several informal ladders on lower Columbia River tributaries.

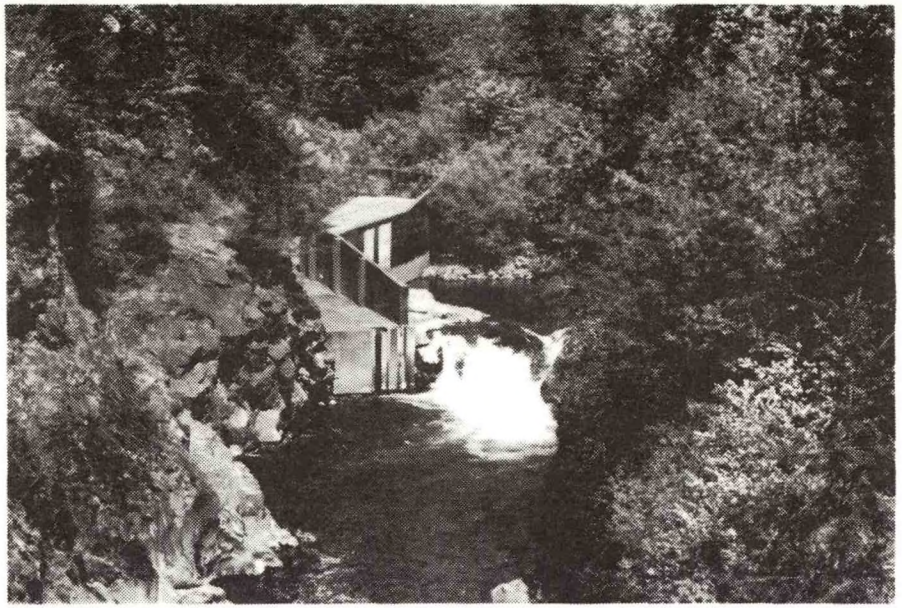


Figure 10a.-- A fish ladder over Salmon Falls on the Washougal River.

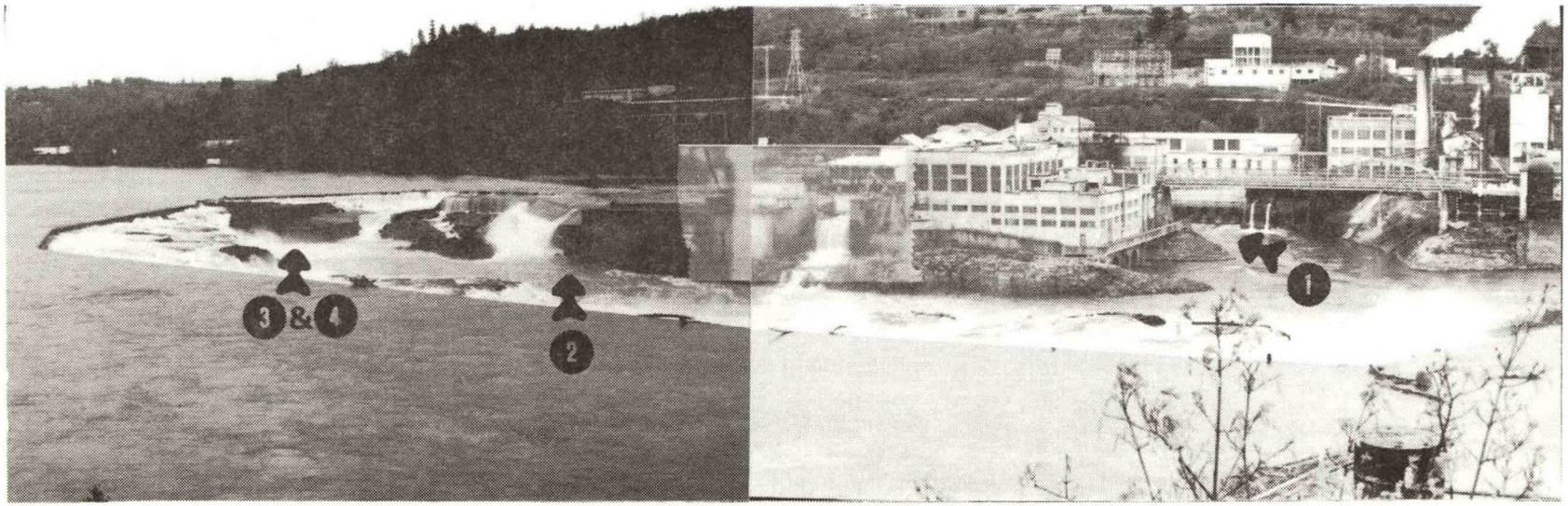


Figure 10b.-- Willamette Falls on the Willamette River near Oregon City. A large, 4 entrance fish ladder was constructed over this falls using funds provided to the State of Oregon by the Program.

which allows fish which have entered the diversion to return to the main stream (Figure 11a). Due to the varying sizes, orientations, and capacities of the diversions the screens can vary from simple fixed plated to large multi-drum screens (Figure 11b, 11c).

At the time the Program began the process of identify and screening diversions the work had already been completed for the most part in Washington. A a result, only 16 screen are operated in Washington by WDF with Program funds. They are on the Entiat, Methow, Twisp, Tonchet, Tucannon, and Rattlesnake Rivers. Idaho and Oregon, which had essentially no screens in operation prior to the Programs screening efforts, have constructed more that 600 screens, 400+ in Oregon and 239 in Idaho. Due to variations in the number of diversions used each year, Oregon and Idaho operated and maintained approximately 380 and 200 screens, respectively, during FY 1982. The Oregon screens are mainly on the John Day and Wallowa Rivers and the Idaho screens are in the Salmon River drainage.

There are only a few diversions that still need to be screened in the Basin, mostly in the Sawtooth National Recreation Area on the Upper Salmon River. They have been identified and will be screened in the future. (Figure 11d).

Fish Facilities Section

The Fish Facilities Section (FFS) functions in those areas where application of engineering capability and behavioral expertise is necessary to protect or develop the fisheries resource. The primary areas include 1) the development and implementation of instream flow requirements for fish in concert with streamflow regulation resulting from flood control, irrigation and hydro power system operation; 2) the design and operation of fish passage, protection, and production facilities; and 3) review of proposed activities in habitat areas which require Federal permit or license. Efforts are directed toward protecting and improving passage conditions along migration routes and toward minimizing adverse effects of water resource development on natural

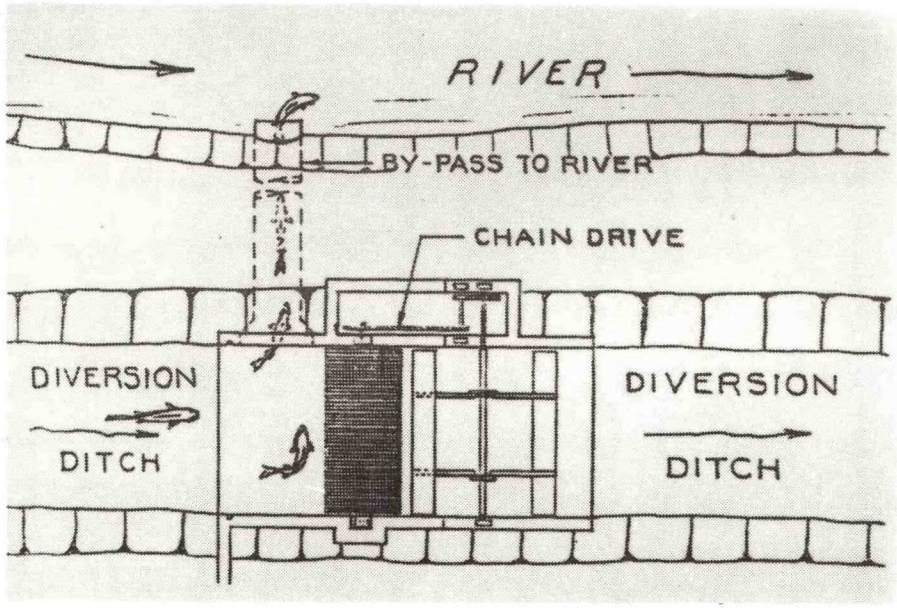


Figure 11a.-- Schematic of irrigation diversion screen. Fish passing down the ditch are stopped by the screen and then returned to the river through the by-pass pipe.

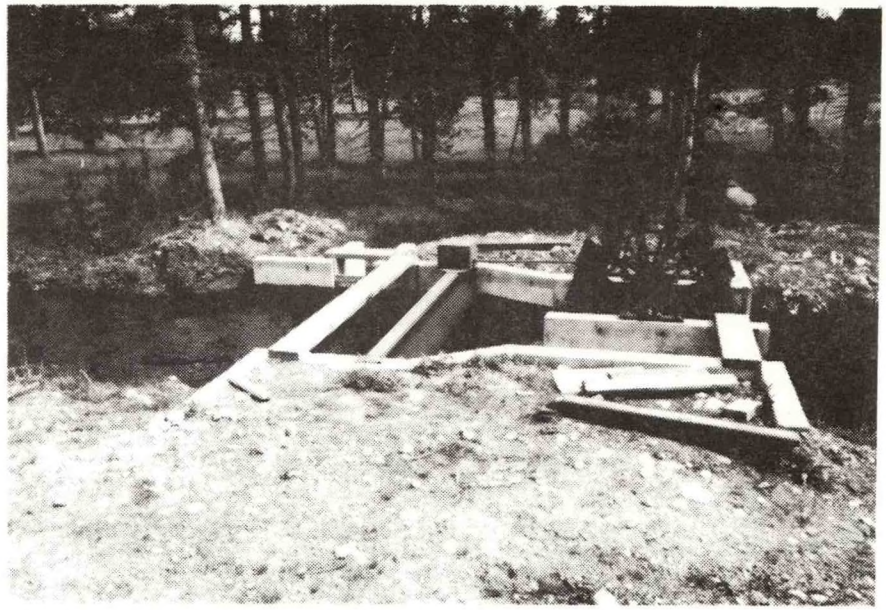


Figure 11b.-- Small, single drum, water powered screen in the upper Salmon River drainage near Stanley, Idaho.

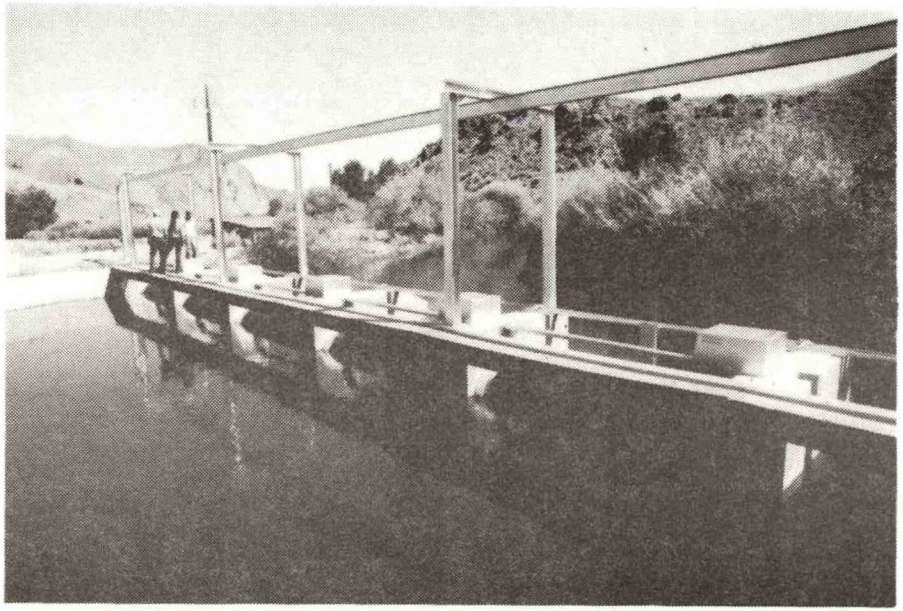


Figure 11c.-- Large, five drum, electric powered screen on a major diversion from the Salmon River near Challis, Idaho.

Figure 11d.-- Unscreened diversion near Stanley, Idaho. The screen has been designed and is ready for installation.

spawning and rearing areas. Effort is also directed toward providing effective hatchery facilities for salmon and steelhead production.

The Fish Facilities Section provides biological and engineering expertise for the design and operation of fish passage and fish protective facilities for adult and juvenile anadromous fish at dams and water diversion structures. Although the primary objective of the FFS is to develop methods of providing anadromous fish safe upstream and downstream passage at projects in the Northwest Region, it is also involved in fish protective activities throughout the country. Primary recipients of the services provided by the Section are Federal agencies, such as the Corps of Engineers, U. S. Bureau of Reclamation, and Federal Energy Regulatory Commission; private and public power companies; and various state fishery agencies. Activities of the FFS fall into the following six categories:

1. Review and establishment of functional fish facility design for Federal, Federally-funded, Federal Energy Regulatory Commission, and Nuclear Regulatory Commission licensed projects.

2. Review of fish facility project construction and operation.

3. Development of instream flow requirements and methods for fisheries agencies' participation in regional hydropower system operation to obtain river flows for anadromous fish.

4. Assistance in design review for Columbia River Fisheries Development Program activities.

5. Participation in interagency committees for design and review of fish protective facilities.

6. Responses to requests from other Regions or agencies for assistance in designing fish protective facilities.

Recent Activities:

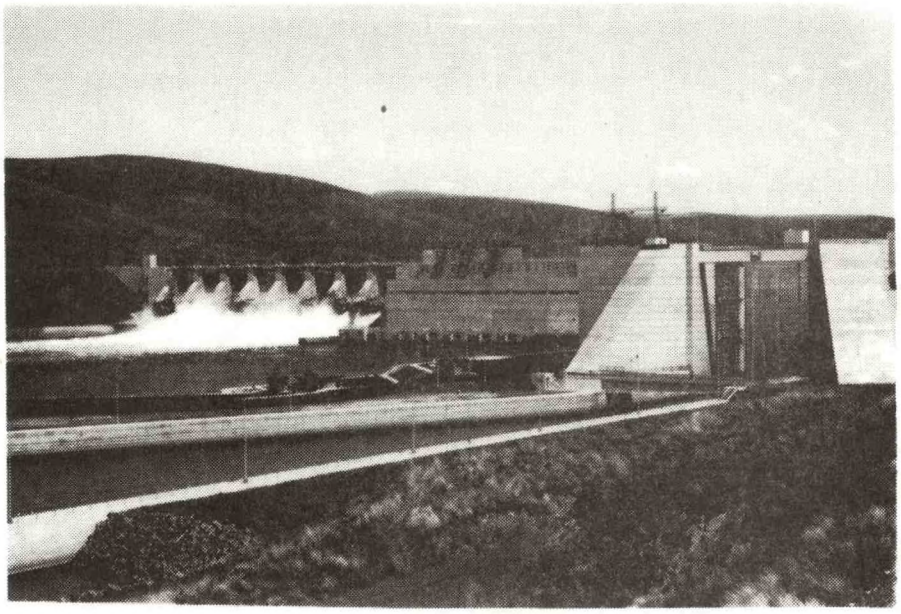
The types of projects FFS has been involved with have remained quite similar over many years. New hydro projects being developed in the Region continue to require the development of general and site specific fish passage criteria and the planning and design of the appropriate facilities to satisfy these criteria. Existing projects continue to require structural and operational improvements to existing facilities based on on-site experience and continuing fish passage research.

As an example of recent work, in 1982 FFS continued to participate in planning and design of fish passage facilities at all nine lower and mid-Columbia River dams, the four lower Snake River dams (Figure 12), and numerous smaller tributary dams in the Columbia Basin and other Northwest Region river basins.

Included are the design of juvenile passage facilities for Bonneville First Powerhouse and John Day Dam powerhouse. These facilities, structurally designed by the Corps, incorporate functional design criteria provided by fisheries agencies through a subcommittee on fish passage. FFS plays a prominent role on these types of committees.

FFS continues to work with other fisheries agencies in obtaining improvements in operation of adult fish passage facilities at the five Public Utility District (PUD) dams on the mid-Columbia. Review of past and current adult passage conditions at these PUD projects by FFS personnel has resulted in development, in conjunction with other fisheries agencies, of more stringent passage criteria which the agencies are now requesting be carried out by the PUD's.

Planning of McNary Dam second powerhouse is continuing by the Corps of Engineers. FFS is providing agency input to the design of the adult collection facility and the juvenile bypass and collection facility.



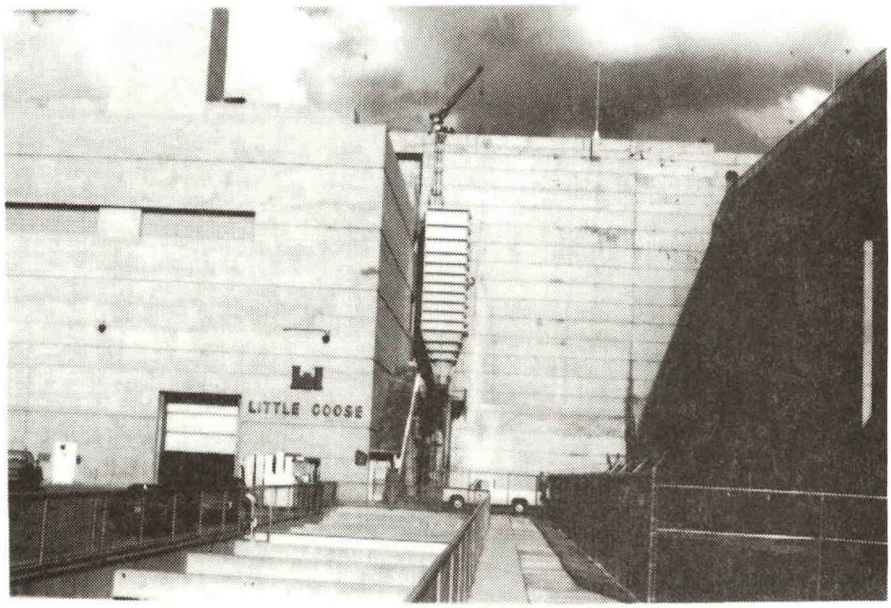


Figure 12.-- Fish handling facilities constructed as a part of Little Goose Dam on the Lower Snake River.

The numerous smaller hydro projects provide a large segment of FFS workload. As an example, during this year FFS engineers participated in the planning and design of fish passage and protective facilities for approximately 18 of these projects. While adult passage facilities are needed at many of these projects, frequently the most difficult problem is to work with the developer to provide a juvenile fish protection system which will be effective and reliable yet not unnecessarily expensive.

The Section provides engineering review of hatchery facilities to be constructed under the CRFDP. This requires working with hatchery operating agencies' designers. Recent projects include improvements to adult holding ponds at Bonneville Hatchery, and a proposed new water intake at Beaver Creek Hatchery.

FFS receives several requests each year for assistance from agencies outside of the Northwest Region. In 1982, significant amounts of time were spent on recommendations for fish protection at Potter Valley Dam and Contra Costa Power Plant in California, and at three dams in Michigan. FFS' assistance on all of these projects was requested by the U. S. Fish and Wildlife Service.

A more complete list of FY 1982 activities is included as Appendix E.

Research continues to be conducted at juvenile fish collector dams which is designed to measure areas of stress in the system and evaluate Submersible Traveling Screen efficiencies. Additional proposed facility modifications and changed already incorporated, such as reduced holding and transportation densities, should further improve the transportation process. When flows such as recommended by the 4(h) section of the Northwest Power Act are implemented, fish will be moved through the reservoirs with less delay than in the past. We believe fish survival should be improved as the bypass systems and stream flows are perfected.

APPENDIX A.--Returns of Fall Chinook to Columbia River Facilities Participating in the Chinook Hatchery Evaluation in 1982.

Facility		Females	Males	Jacks	Total
Abernathy		1,032	1,033	1,016	3,081
Little White Salmon		1,337	710	101	2,148
Spring Creek		17,210	9,498	739	27,447
Klaskanine		68	26	3	97
Big Creek		4,425	5,820	400	10,645
Bonneville		11,672	9,409	2,199	23,280
Grays River		284	391	26	701
Elokomin		889	1,170	3	2,062
Cowlitz		2,618	2,042	1,130	5,790
Lower Kalama	Production	242	518	60	820
	Upriver Brights	3	4	736	743
Kalama Falls	Production	357	456	79	892
	Upriver Brights	61	54	233	348
Washougal		1,271	1,294	243	2,808
Klickitat				23	337
Lewis River		127	61	178	366
Priest Rapids		1,132	1,481	5,119	7,732
Ringold				14	191
Sea Resources					320
				Total	89,808

APPENDIX B.--Age Composition of Fall Chinook Sampled From Returning Adults to USFWS and WDF Columbia River Facilities in 1982.

	Age									
	2		3		4		5		6	Total
	No.	%	No.	%	No.	%	No.	%	No.	No.
Spring Creek	17	1.1	1,060	71.1	413	27.7	2	0.1		1,492
Abernathy	343	30.8	616	55.4	151	13.6	2	0.2		1,112
Little White Salmon	39	5.9	445	67.4	167	25.3	9	1.4		660
Grays River	23	3.3	494	70.4	178	25.4	6	0.9		701
Elokomin	6	0.3	1,457	70.6	583	28.3	16	0.8		2,062
Cowlitz	1,023	17.7	1,178	20.3	3,160	54.6	427	7.4	2	5,790
Kalama 1A/	170	9.9	489	28.6	920	53.7	133	7.8		1,712
Kalama 1B/	290	26.6	696	63.8	66	6.0	39	3.6		1,091
Lewis River	147	40.1	84	22.9	112	30.5	24	6.5		367
Washougal	260	9.3	940	33.5	1,013	36.1	595	21.2		2,808
Priest Rapids	4,201	54.3	2,584	33.4	633	8.2	314	4.1		7,732
Totals	6,519	25.5	10,043	39.4	7,396	29.0	1,567	6.1	2	25,527

1/ Lower Kalama and Kalama Falls Hatcheries combined for production stock (1A) and upriver bright egg bank stock (1B).

APPENDIX C.--Number of tags recovered by code from tule fall chinook adults returning to U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife facilities in 1982.

Return Site	Tag Code	Number of Tags	Brood Year	Rearing Facility
Abernathy	05-04-50	7	1978	Abernathy
	05-04-51	10	1978	"
	05-06-44	12	1979	"
	05-06-46	42	1979	"
	05-07-44	14	1980	"
	05-07-45	33	1980	"
	07-18-44	1	1978	Big Creek
	07-21-60	6	1979	"
Little White Salmon	05-04-43	6	1978	Big White Pond
	05-04-48	1	1978	Little White Salmon
	05-04-49	5	1978	" " "
	05-06-39	1	1979	Spring Creek
	05-06-40	2	1979	" "
	05-06-43	1	1979	Little White Salmon
Spring Creek	05-04-33	37	1978	Spring Creek
	05-04-43	9	1978	Big White Pond
	05-04-44	78	1978	Spring Creek
	05-04-46	47	1978	" "
	05-06-39	109	1979	" "
	05-06-40	95	1979	" "
	05-06-41	77	1979	" "
	05-06-42	7	1979	" "
	05-06-46	2	1979	Abernathy
	05-07-40	1	1980	Spring Creek
	05-07-41	4	1980	" "
	05-07-52	1	1980	" "
	05-10-52	1	1981	" "
Big Creek	07-18-44	67	1978	Big Creek
	07-18-45	3	1978	Klaskanine
	07-21-59	1	1980	Clatsop County Ponds
	07-21-60	100	1979	Big Creek
	07-23-31	1	1980	" "
	07-23-33	4	1980	" "
	05-06-46	1	1979	Abernathy
	63-16-46	1	1978	Grays River
	63-19-39	3	1978	Weyco Pond
	63-20-05	1	1979	Elokomin
	63-20-43	3	1979	Grays River
	63-22-63	1	1980	" "

APPENDIX C Continued

Return Site	Tag Code	Number of Tags	Brood Year	Rearing Facility
Bonneville	07-18-41	1	1978	Stayton Pond
	07-18-42	91	1978	Bonneville
	07-21-56	13	1980	"
	07-21-57	17	1979	"
	07-21-60	1	1979	Big Creek
	07-21-62	1	1979	Oxbow
	07-21-63	4	1979	"
	07-23-29	6	1980	Bonneville
	05-04-33	5	1978	Spring Creek
	05-04-43	4	1978	Little White Salmon
	05-04-44	6	1978	Spring Creek
	05-04-46	2	1978	" "
	05-04-48	2	1978	Little White Salmon
	05-06-39	21	1979	Spring Creek
	05-06-40	9	1979	Spring Creek
	05-06-41	13	1979	" "
	05-06-46	1	1979	Abernathy Creek
	63-19-38	2	1978	Washougal
	63-21-53	1	1979	Washougal
	63-22-51	1	1980	Washougal
Cascade	07-18-42	4	1978	Bonneville
	07-18-43	1	1978	"
	07-21-63	1	1979	Oxbow
	05-04-46	1	1978	Spring Creek
	05-06-39	1	1979	" "
	05-06-40	1	1979	" "
	05-06-41	2	1979	" "
Klaskanine	07-18-45	3	1978	Klaskanine
Willamette River Spawning Surveys	07-18-41	8	1978	Stayton Pond
	07-20-55	4	1979	" "
Willamette Fall Trap	07-18-41	136	1978	Stayton Pond
	07-18-43	1	1978	Bonneville
	07-20-55	155	1979	Stayton Pond
	07-21-60	1	1979	Big Creek
	07-23-35	3	1980	Stayton Pond

APPENDIX D.-- OBSERVED RECOVERIES OF TAGGED 1978- BROOD FALL CHINOOK FROM COLUMBIA RIVER FACILITIES TO PACIFIC COAST FISHERIES BY CATCH YEAR.

HATCHERY	TAG CODE	CATCH YEAR	NUMBER OF RECOVERIES						
			MARINE					COLUMBIA RIVER	
			ALASKA	CANADA	WASHINGTON	OREGON	CALIFORNIA	GILLNET	INDIAN
BIG CREEK	07-18-44	1980	0	9	5	0	0	0	0
		1981	0	47	45	5	0	26	0
		TOTAL	0	56	50	5	0	26	0
BONNEVILLE	07-18-42	1980	0	8	12	0	0	0	0
		1981	0	50	77	13	0	13	2
		TOTAL	0	58	89	13	0	13	2
	07-18-43	1980	0	0	0	0	0	0	0
		1981	0	0	0	0	0	2	0
		TOTAL	0	0	0	0	0	2	0
KLASKANINE	07-18-45	1980	0	4	5	0	0	0	0
		1981	0	24	45	4	0	26	9
		TOTAL	0	28	50	4	0	26	9
STAYTON POND	07-18-41	1980	0	24	20	0	0	0	0
		1981	0	144	173	20	0	20	0
		TOTAL	0	168	193	20	0	20	0
SEA RESOURCES	63-19-18	1980	0	2	0	0	0	0	0
		1981	0	0	0	0	0	0	1
		TOTAL	0	2	0	0	0	0	1
ABERNATHY	05-04-50	1980	0	8	5	0	0	0	0
		1981	0	30	21	5	1	22	0
		1982	0	4	0	0	0	2	0
		TOTAL	0	42	26	5	1	24	0
	05-04-51	1980	0	6	3	0	0	3	0
		1981	0	10	20	4	0	14	0
		1982	0	1	1	1	0	3	0
		TOTAL	0	17	24	5	0	20	0
BIG WHITE POND	05-04-43	1980	0	4	5	0	0	0	0
		1981	0	15	29	4	0	0	8
		1982	0	3	4	0	0	4	4
		TOTAL	0	22	38	4	0	4	12

APPENDIX D. -- CONTINUED

HATCHERY	TAG CODE	CATCH YEAR	NUMBER OF RECOVERIES						
			MARINE					COLUMBIA RIVER	
			ALASKA	CANADA	WASHINGTON	OREGON	CALIFORNIA	GILLNET	INDIAN
LITTLE WHITE SALMON	05-04-48	1980	0	0	0	0	0	0	0
		1981	0	2	4	0	0	0	2
		1982	0	0	0	0	0	0	1
		TOTAL	0	2	4	0	0	0	3
	05-04-49	1980	0	1	0	0	0	0	0
		1981	0	0	4	2	0	0	0
		1982	0	3	0	0	0	0	3
		TOTAL	0	4	4	2	0	0	3
SPRING CREEK	05-04-33	1980	0	8	23	0	0	3	0
		1981	0	69	142	30	0	22	86
		1982	0	16	9	1	0	17	28
		TOTAL	0	93	174	31	0	42	114
	05-04-44	1980	0	25	40	0	0	3	0
		1981	0	105	241	33	0	30	150
		1982	0	22	17	2	0	26	32
		TOTAL	0	152	298	35	0	59	182
	05-04-45	1980	0	0	0	0	0	0	0
		1981	0	0	1	0	0	0	0
		TOTAL	0	0	1	0	0	0	0
	05-04-46	1980	0	9	13	0	0	2	0
		1981	0	66	133	18	0	14	65
		1982	0	13	6	1	0	17	20
		TOTAL	0	88	152	19	0	33	85
COWLITZ	63-19-42	1980	0	0	0	0	0	2	0
		1981	0	5	12	4	0	4	0
		TOTAL	0	5	12	4	0	6	0
	63-19-51	1980	0	0	0	0	0	0	0
		1981	0	1	7	1	0	0	0
		TOTAL	0	1	7	1	0	0	0
ELOKOMIN	63-18-56	1980	0	0	0	0	0	0	0
		1981	0	1	0	0	0	0	0
		TOTAL	0	1	0	0	0	0	0
	63-19-56	1980	0	1	0	0	0	2	0

APPENDIX D. -- CONTINUED

HATCHERY	TAG CODE	CATCH YEAR	NUMBER OF RECOVERIES						
			MARINE					COLUMBIA RIVER	
			ALASKA	CANADA	WASHINGTON	OREGON	CALIFORNIA	GILLNET	INDIAN
ELOKOMIN	63-19-56	1981	0	1	1	0	0	2	0
		TOTAL	0	2	1	0	0	4	0
GRAYS RIVER	63-16-46	1980	0	0	0	0	0	0	0
	63-18-33	1980	0	0	0	0	0	0	0
	63-19-37	1980	0	0	0	0	0	0	0
		1981	0	0	2	2	0	0	1
		TOTAL	0	0	2	2	0	0	1
KALAMA FALLS	63-19-57	1980	0	2	0	0	0	0	0
		1981	0	1	2	1	0	0	0
		TOTAL	0	3	2	1	0	0	0
KLICKITAT	63-19-49	1980	0	2	2	0	0	0	0
		1981	0	10	14	3	0	2	4
		TOTAL	0	12	16	3	0	2	4
PRIEST RAPIDS	63-18-21	1980	0	2	0	0	0	0	0
		1981	0	5	1	1	0	0	1
		TOTAL	0	7	1	1	0	0	1
	63-18-57	1980	0	0	0	0	0	0	0
		1981	0	1	0	0	0	0	0
		TOTAL	0	1	0	0	0	0	0
	63-19-58	1980	0	0	0	0	0	0	0
	63-20-17	1980	0	0	0	0	0	0	0
		1981	0	1	0	0	0	0	0
		TOTAL	0	1	0	0	0	0	0
SPEELYAI	63-19-20	1980	0	3	0	0	0	0	0
		1981	0	3	6	0	0	0	1
		TOTAL	0	6	6	0	0	0	1
	63-19-50	1980	0	1	0	0	0	0	0
		1981	0	8	7	3	0	2	0
		TOTAL	0	9	7	3	0	2	0
TOUTLE	63-18-54	1980	0	0	0	0	0	0	0

APPENDIX D.-- CONTINUED

HATCHERY	TAG CODE	CATCH YEAR	NUMBER OF RECOVERIES						
			MARINE					COLUMBIA RIVER	
			ALASKA	CANADA	WASHINGTON	OREGON	CALIFORNIA	GILLNET	INDIAN
TOUTLE	63-18-54	1981	0	1	1	0	0	0	0
		TOTAL	0	1	1	0	0	0	0
	63-19-41	1980	0	1	0	0	0	1	0
		1981	0	5	0	0	0	6	0
		TOTAL	0	6	0	0	0	7	0
WASHOUGAL	63-19-38	1980	0	0	0	0	0	2	0
		1981	0	7	5	2	0	2	0
		TOTAL	0	7	5	2	0	4	0
	63-19-46	1980	0	1	0	0	0	1	0
		1981	0	6	9	3	0	2	0
		TOTAL	0	7	9	3	0	3	0
WEYCO POND	63-19-39	1980	0	0	0	0	0	0	0
		1981	0	5	1	0	0	6	2
		TOTAL	0	5	1	0	0	6	2

Appendix E

FISH FACILITIES ACTIVITIES
PARTIAL LISTING OF PROJECTS DURING F.Y. 1982

I. Review and Establishment of Fish Facility Design -

1. Bonneville Dam - adult and juvenile fish passage facilities
2. The Dalles Dam - adult passage and counting facilities
3. John Day Dam - juvenile passage facilities
4. McNary Dam - adult and juvenile passage facilities
5. Little Goose Dam - juvenile passage facilities
6. Roza Diversion Hydro Project - adult and juvenile protection facilities
7. Pelton Re-regulation Dam - adult collection facilities
8. Three Mile Dam - adult and juvenile passage facilities
9. Condit Dam - adult and juvenile passage facilities
10. So. Fork Tolt Hydro Project - adult passage
11. Pistol River Hydro Project - adult and juvenile fish passage facilities
12. Winchester Dam - adult and juvenile fish passage facilities
13. Boyd Hydro Project - adult and juvenile passage facilities
14. Olney Falls Hydro Project - juvenile passage
15. Rock Island Dam - juvenile bypass
16. Rocky Reach Dam - juvenile bypass
17. Easton Dam Hydro Project - adult and juvenile passage
18. Marmot Dam - adult passage
19. Lower Snake River Compensation Plan - hatchery facilities
20. Lacomb Hydro Project - juvenile and adult passage
21. Gold Hill Hydro Project - juvenile and adult passage
22. Wells Dam - juvenile passage
23. Sullivan Plant - juvenile passage
24. Three Mile Dam - juvenile and adult passage
25. Hamma Hamma Hydro Project - adult passage

26. Little Goose Dam - juvenile bypass
27. White River (Washington) Hydro Project - juvenile and adult passage
28. South Fork Skokomish Hydro Project - juvenile and adult passage

II. Review of Fish Facility Construction and/or Operation

1. Bonneville Dam - adult and juvenile passage
2. Willamette Falls - adult passage
3. Priest Rapids Dam - adult passage
4. Wanapum Dam - adult passage
5. Rock Island Dam - adult passage
6. Rocky Reach Dam - adult passage
7. Wells Dam - adult passage

III. Assistance in Design Review

1. Eagle Creek Hatchery - reuse system
2. Beaver Creek Hatchery - water supply intake facility
3. Corps of Engineers Permits (numerous sites)
4. Skagit River Projects - flow regulation study
5. Yakima River Fish Screens and Ladder Rehabilitation

IV. Responses to Requests from Other Regions and Agencies

1. Olympic National Park - information on fish counting fences
2. U.S. Fish and Wildlife Service - review of 3 Michigan State fishway designs
3. Northeast Region, NMFS - shad passage at proposed James River dams
4. U.S. Fish and Wildlife Service - fish protection facilities at Potter Valley Dam and Contra Costa Power Plant