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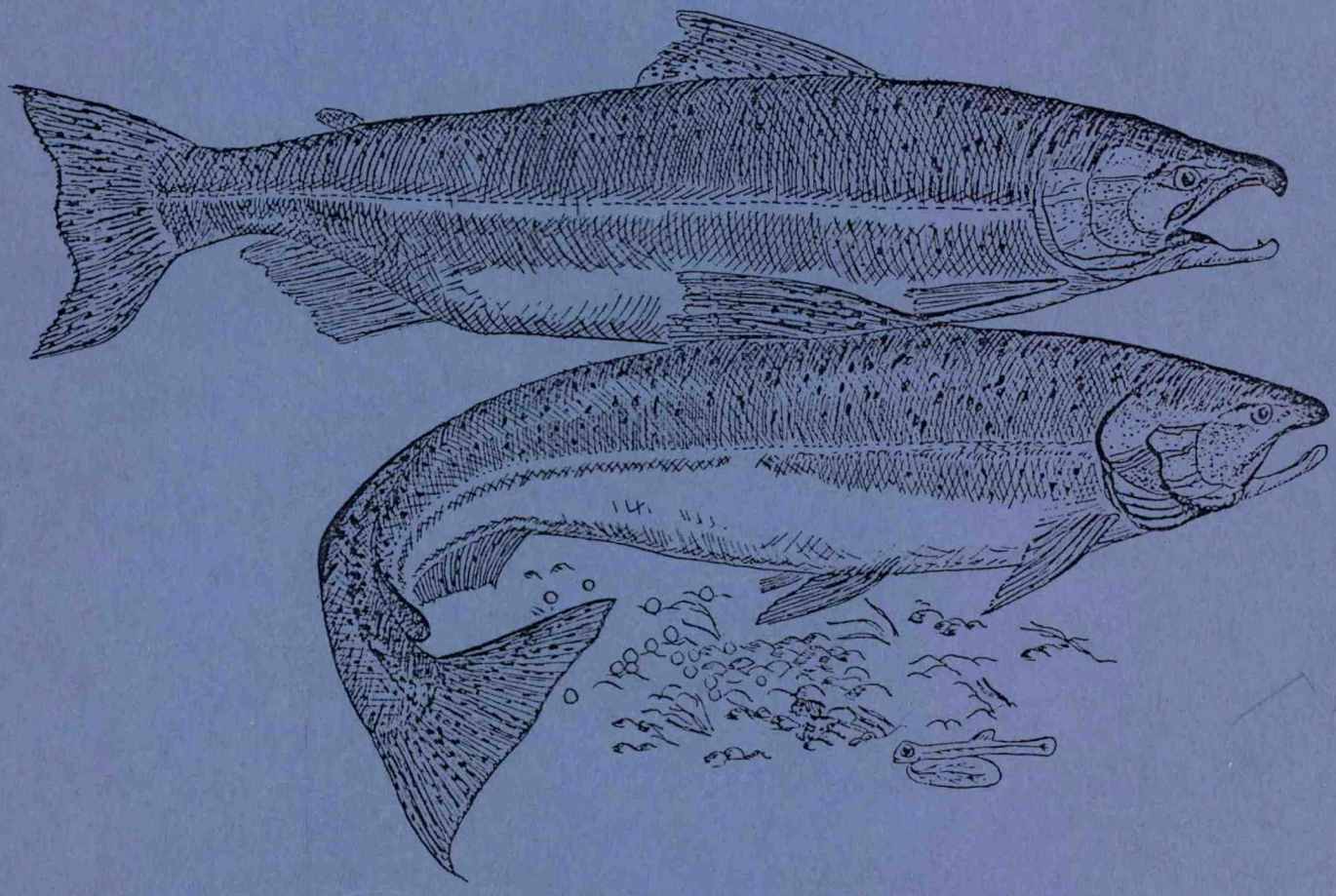

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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U.S. DEPARTMENT OF COMMERCE
Malcolm Baldridge, Secretary
National Oceanic and Atmospheric Administration
James P. Walsh, Acting Administrator
National Marine Fisheries Service
Terry L. Leitzell, Assistant Administrator for Fisheries

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM

ANNUAL REPORT FY 1980

Introduction

In 1938 the Congress, recognizing the need for firm and positive action to halt the pronounced downward trend in populations of Pacific salmon and steelhead trout having their origins in the Columbia River Basin, passed the Mitchell Act (P.L. 75-502). This act authorized the appropriation of $500,000 to be used to reverse the trend. The initial funds were used to develop a program of surveying the tributary streams in the Basin. By the time the surveys were completed in 1942, considerable data were accumulated regarding the various populations of salmon and steelhead. Unscreened diversions, impassible waterfalls, log and debris jams, splash dams, and sources of pollution throughout the Basin were catalogued.

In 1946, the Mitchell Act was amended (P.L. 79-676) allowing the appropriation of additional funds and the use of the facilities and services of Idaho, Washington, and Oregon, in developing the salmon and steelhead trout resources. This amendment allowed for closer cooperation between the Federal Government and the states and permitted the transfer of monies for specific work.

The Lower Columbia River Fishery Development Program ("Program") under the Department of the Interior was formed in 1949 as a direct result of the Mitchell Act. The Program brought into being a concerted plan for the development of salmon and steelhead in the Basin watershed.

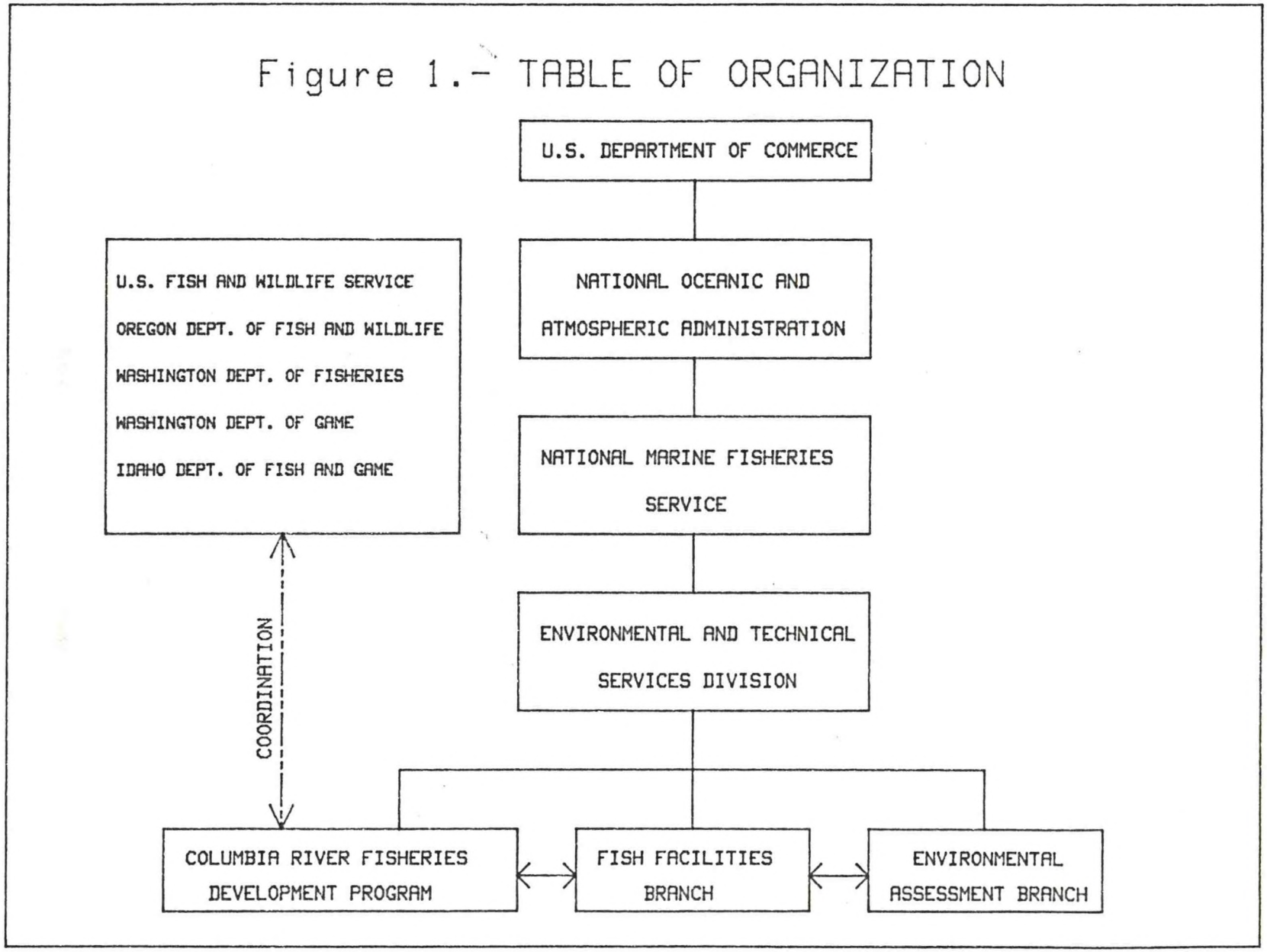
Until 1956, only the states of Oregon and Washington were actively engaged in the Program. The area included was that portion of the Columbia River and its tributaries below McNary Dam. In 1956, Congress

instructed that the Program be activated above McNary Dam and Idaho became a participant in 1957. At this time the word "Lower" was dropped from the Program name. Under the Program, emphasis has been placed on the following: expansion of artificial propagation; improvement of existing salmon rearing and spawning habitat in the tributary streams by removal of log jams, splash dams, and natural rock obstructions; construction and operation of permanent fishways either to facilitate passage at partial barriers or provide access to areas not previously available to any anadromous fish; construction and operation of screens to protect downstream migrants from irrigation diversions; and an accelerated program of developing new and improved hatchery techniques.

In 1970, with a reorganization of Federal fisheries responsibilities, the oversight of the Program was transferred from the Department of the Interior to the Department of Commerce. It is currently administered as a part of the Environmental and Technical Services Division (ETSD) of the National Marine Fisheries Service (NMFS) in Portland, Oregon, (Figure 1) in cooperation with the USFWS, Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fisheries (WDF), Washington Department of Game (WDG), and Idaho Department of Fish and Game (IDFG).

The Columbia River Fisheries Development Program has included four major functions in resource development: 1) the protection and improvement of stream environment which has included improvement of natural habitat, such as clearing obstructions from nearly 2,000 miles of tributary streams, building 87 fish ladders past natural barriers, and installation of 720 screens in irrigation diversion canals, 2) the production of fish in hatcheries which has been accomplished by the construction or modernization of 22 hatcheries and 7 rearing ponds located primarily on the lower Columbia River, 3) the conduct of evaluation and contribution studies related to Program activities, especially in the area of hatchery operations, and 4) the provision of design, operation, and maintenance criteria for fish passage and protective facilities that are required at water use projects to reduce losses of adult and juvenile salmonids.

Figure 1.- TABLE OF ORGANIZATION



HIGHLIGHTS

1980 proved to be a successful year at most Program hatcheries. Expenditures of almost $4.9 million on hatchery O & M resulted in the release of an estimated 114.6 million Pacific salmon and steelhead trout smolts weighing almost 3 million pounds. In most cases, returning adult fish supplied enough eggs to meet current production goals. Where shortages did occur, sufficient supplies of eggs were available at other Program hatcheries to fill production requirements.

Two significant natural events occurred in 1980 that adversely affected operations at two Program hatcheries. In January a severe ice and snow storm killed 1.9 million coho salmon at Cascade hatchery and hampered operations of other hatcheries in the Columbia Gorge region. In May, mud flows resulting from the eruption of Mt. St. Helens destroyed the Toutle Hatchery. Losses included 165 thousand coho smolts, 4.5 million coho fry, and 5.7 million fall chinook smolts.

Botulism has become a problem at several Program hatcheries. In FY 1979, an outbreak of botulism at Elokomin hatchery killed almost 800,000 coho. In FY 1980, the problem reoccurred but with less severity. Sanitation problems in the rearing pond have led to these disease outbreaks.

On a positive note, releases were made from the new Clackamas Hatchery in Oregon. This hatchery has been under construction for several years and is funded by the Oregon Department of Fish and Wildlife, Portland General Electric Company, and NMFS.

FY 80 was the second year of the Bonneville Power Administration (BPA) funded "Fall Chinook Hatchery Evaluation Study." A total of 2.8 million fall chinook migrants at 19 Columbia River facilities were marked with an adipose-Coded Wire Tag (ad-CWT) mark and released.

Connected with the BPA funded study, a mobile fish marking unit was completed and used to augment marking equipment possessed by the agencies involved in the study.

Studies on steelhead and searun cutthroat trout in the Kalama River being carried on by WDG have continued. Observations showed that parr steelhead outmigrating from the study area on Gobar Creek exceeded smolt outmigrants 5 to 1. Most of the spawning steelhead in Gobar Creek were hatchery summer steelhead. Winter run adult fish which were re-spawners were significant in number during FY 1980.

The first phase of a three phase study to improve hatchery data collection was completed. In this phase, a format for data collection was developed (Appendix I). Subsequent phases will test and improve the format and then begin the actual data collection. The study is being contracted to an economic consultants' group.

A cooperative coho time of release study conducted at two ODFW and two WDF Program hatcheries was begun in FY 1978. In FY 1978 and 1979, groups of marked coho salmon smolts, all of similar size, were released at one month intervals from May through July to determine the effect of release time on survival. The study is now in the data collection and analysis phase.

The hatchery pollution abatement program is rapidly coming to a conclusion of the construction phase. Facilities have been constructed at all Program hatcheries except for Carson NFH.

FY 1980 Budget

The majority of the almost $7 million (Table 1) available for expenditure under the Program was dispersed directly to the State and Federal fisheries agencies involved in the Program (Figure 2). Of the total 8.4% was allocated for administration of the Program, salaries and benefits for Program personnel, and activities funded directly out of the Program Office.

Table 1.-- FUNDS EXPENDED BY THE COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM 1949-1980

FICSAL 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	6,435,100	500,000	6,944,200
TOTALS	$30,346,264	$77,276,491	$5,696,600	$113,319,355

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

Figure 2.- DIVISION OF FY1980 COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FUNDS

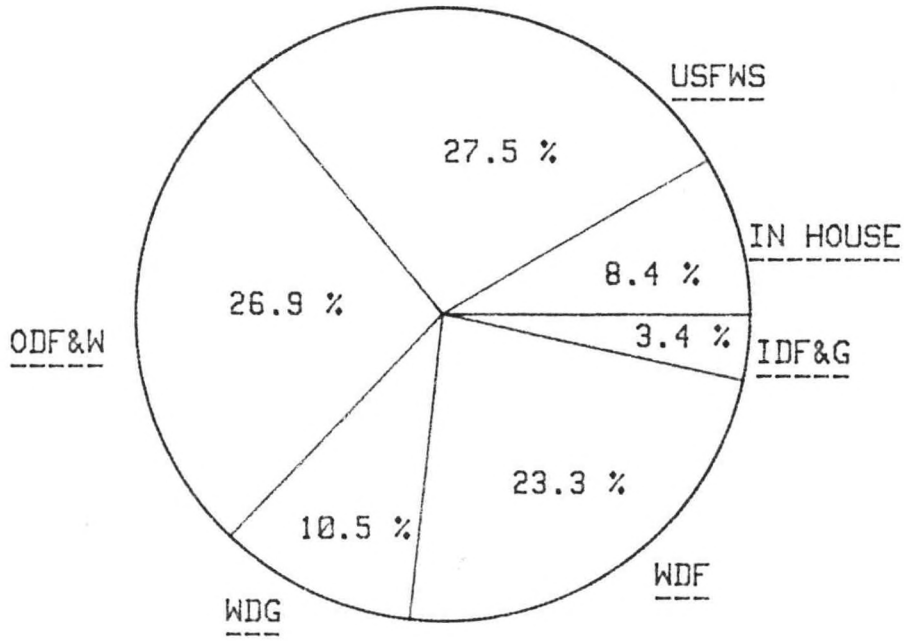
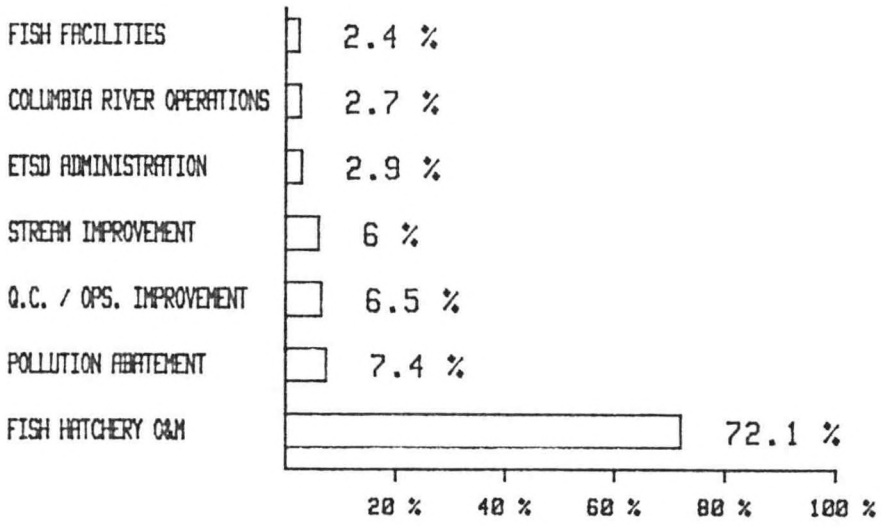


Figure 3.-- DIVISION OF FY 1980 COLUMBIA RIVER DEVELOPMENT PROGRAM FUNDS BY TASK



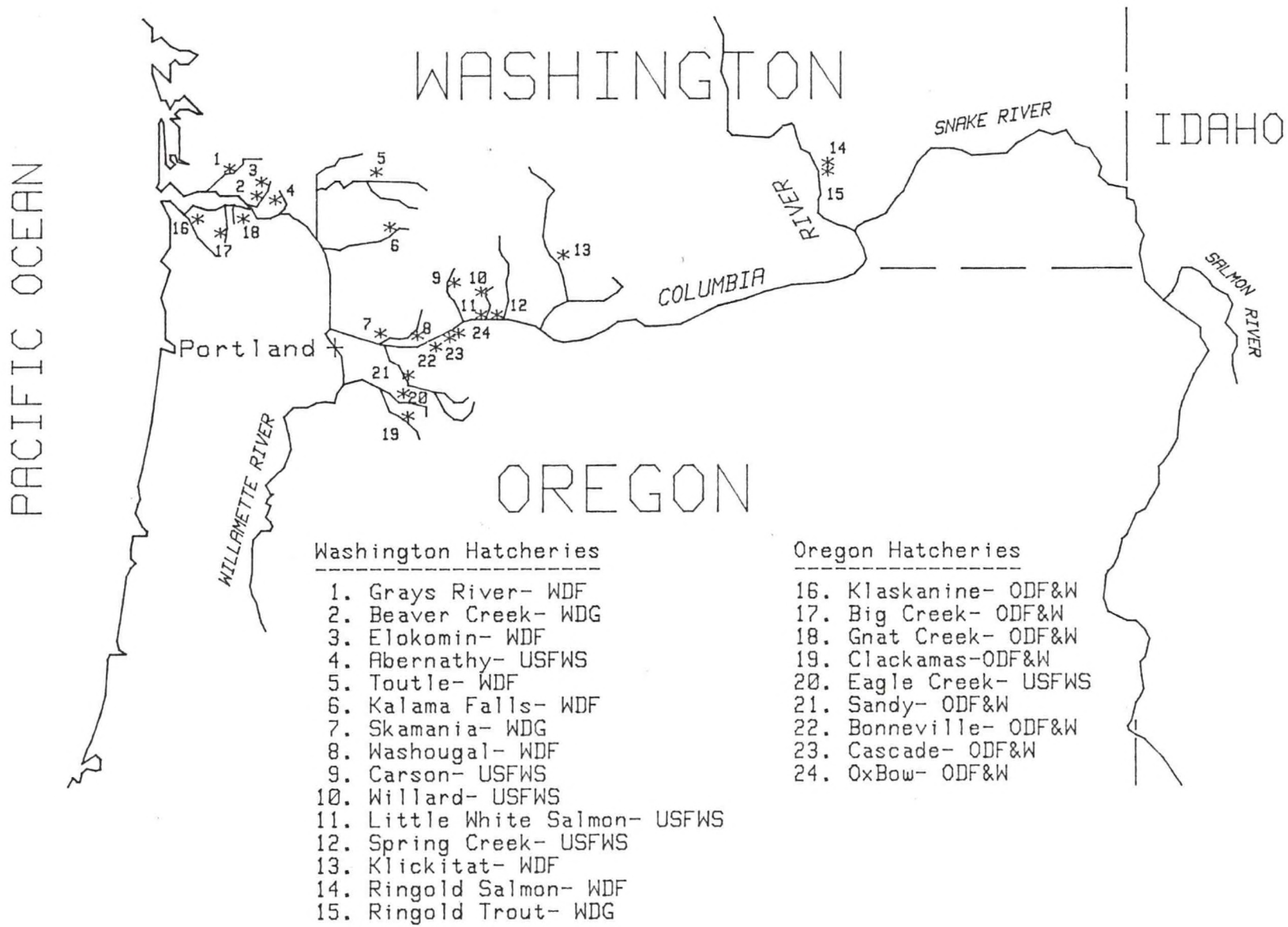


Figure 4.- COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FUNDED HATCHERIES

The remaining 91.6% was divided as shown in Figure 2 among the USFWS, WDF, WDG, ODFW, and IDFG. Figure 3 shows the distribution of funds by task. Hatchery O& M accounted for over 72% of the total. It made up the largest portion of the expenditures of all the agencies except for IDFG which has only limited hatchery production using Program funds. Construction during the fiscal year was minimal (Table 1) and the pollution abatement activities accounted for $500,000.

Implementation of P.L. 95-224 (Federal Grant and Cooperative Agreement Act of 1977) has made our annual contractual relationships with the operating agencies subject to OMB A102 application procedures. Therefore, starting in FY 1980 Cooperative Agreements will be signed with all State agencies for their participation in the Program activities.

Hatcheries

As previously mentioned, the majority of Program funds are spent on hatchery O & M. In FY 1980 the Program funded, either totally or in conjunction with other state, federal, and commercial organizations, 22 hatcheries and 2 major rearing ponds. (Figure 4). Additionally, a number of satellite rearing ponds were in operation. The differentiation between a major rearing pond and a satellite rearing pond is based on how they are staffed. The major rearing ponds are isolated and have a full time staff on-site while the satellite ponds are located near Program hatcheries and are staffed on an as needed basis by hatchery personnel.

All but the two Ringold rearing ponds are located in the lower portion of the Columbia River Basin (Figure 4). Six hatcheries and 1 major rearing pond are operated by WDF, 2 hatcheries and 1 major rearing pond by WDG, 6 hatcheries by USFWS, and 8 hatcheries by ODFW (Tables 2 and 3).

Planned production at Program facilities for the fiscal year was down from the high years of 1977 and 1978 (Table 4). This reflects a trend

TABLE 2 - COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FACILITIES - COLUMBIA BASIN -- WASHINGTON

Facility	General Location	Congressional District	Operating Agency 1/	Species Reared 1960-80	Anadromous Releases 1980	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	Yes	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 1960-80 2/	Anadromous Releases 1980	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, ch-chum salmon, sh-steelhead trout

Table 4. -- Releases of Salmonids in Numbers and Pounds from Columbia River Development Program Funded Rearing Facilities, 1960-80

Year	Fall Chinook 1/ Numbers (millions)	Fall Chinook 1/ Pounds (10,000's)	Spring Chinook Numbers (millions)	Spring Chinook Pounds (10,000's)	Coho Numbers (millions)	Coho Pounds (10,000's)	Steelhead Numbers (millions)	Steelhead Pounds (10,000's)	Totals Numbers (millions)	Totals Pounds (10,000's)
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	157.4
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 2/	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	87.2	109.6	5.9 2/	46.7	20.6	116.2	2.5	40.3	116.2	312.8
1980 3/	(80.1)	(93.6)	(6.2) 2/	(29.6)	(26.0)	(127.6)	(2.3)	(38.1)	(114.6)	(288.9)

1/ From 1972 on, part of the funds to operate the fall chinook programs was supplied by 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.

towards reducing densities in hatchery ponds and the effects of inflation on hatchery costs. Production by agency is shown in Table 5.

Two significant natural events occurred in 1980 that adversely affected operation at two of the Program hatcheries. Between January 7 and 11, a severe ice and snow storm hit the region with especially heavy impact on the Columbia Gorge area. Record snow fall amounts ranging from five to six feet fell on Bonneville, Cascade, and OxBow Hatcheries starting on the evening of January 7 (Figure 5). All three hatcheries were isolated from outside contact for several days. The only fish loss occurred at Cascade Hatchery where despite round-the-clock efforts by the hatchery staff, 1.9 million coho salmon weighing more than 60 thousand pounds were lost. Here, the snow fell so quickly that it turned the water in the creek supplying the hatchery and in the hatchery itself to slush, suffocating fish in the ponds. The losses amount to approximately 24% of the planned Columbia River coho releases from ODFW hatcheries funded by the Program.

When Mt. St. Helens violently erupted on May 18, much of the Pacific Northwest was adversely impacted. Clouds of ash coming from the mountain blanketed large areas extending to Montana and beyond. The shock wave from the initial blast levelled the thick forests to the north and west of the mountain. The heat that accompanied the eruptions melted the snow and ice resulting in floods of mud, ash, and debris that rushed down the Toutle and Green Rivers, into the Cowlitz River, and then on out into the Columbia. Besides destroying roads, bridges, homes and equipment, the floods and mud flows inundated Toutle Hatchery. The hatchery, funded by the Program, is located on the Green River just upstream of its confluence with the Toutle River. The hatchery suffered extensive damage to the physical plant and all fish on station were lost. These losses totalled 165 thousand coho smolts, 4.5 million coho fry, and 5.7 million fall chinook smolts. All hatchery personnel were evacuated prior to any danger.

Currently mud and ash still cover the hatchery ponds (Figure 6) and conditions in the Green and upper Toutle Rivers are still too hostile for

Figure 5 - The snow is still piled up around the Cascade Hatchery. It is part of almost six feet of snow that fell there in early January, 1980. The hatchery crew members are (left to right) Virgil Edwards, Randy Winters, Alan Meyer, and Manager Gene Middaugh.

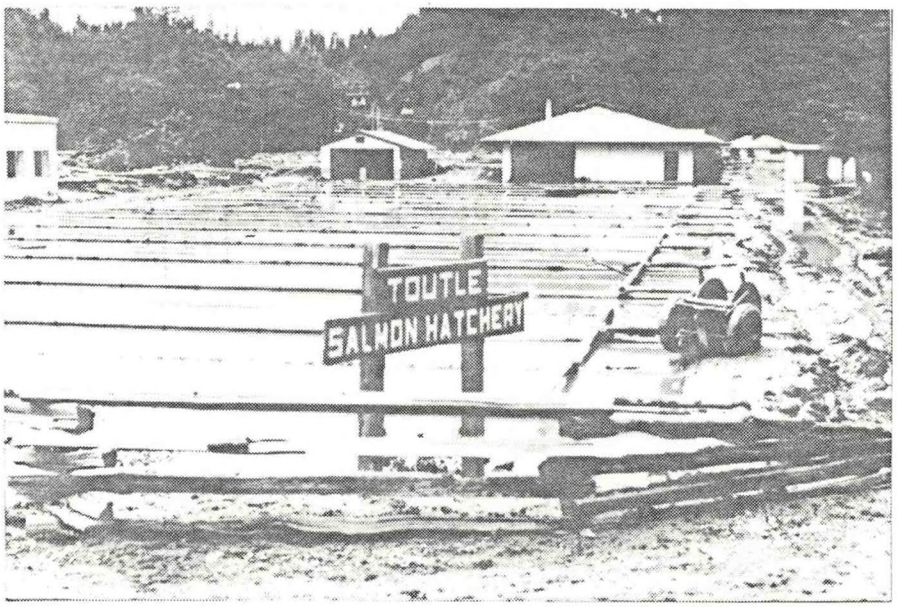


Figure 6 - The Toutle Salmon Hatchery as it looked several days after the eruption of Mt. St. Helens. Mud and ash carried by flood waters covered the hatchery filling the hatchery raceways and made stream conditions inhospitable for fish.

fish to survive. Silt and ash suspended in the water continues to adversely affect fish by abrading gill tissue and causing hemorrhaging. Spawning and rearing areas are still covered by the mud and the silt. The hatchery had all movable fixtures removed and a dyke was built around it in anticipation of winter and spring floods directly resulting from damage to the water shed. Plans for reconstruction or renovation are being held in abeyance until conditions improve or a decision is made to move operations elsewhere.

The Clackamas Hatchery made its first releases. This hatchery, located in the Clackamas River in the Willamette River drainage, is operated by the ODFW. Funding is provided by the ODFW, NMFS, and Portland General Electric Company. The hatchery will concentrate on spring chinook salmon production.

Botulism has become a problem at several Program hatcheries. In FY 1979, an outbreak of botulism at Elokomin hatchery killed almost 800,000 coho. In FY 1980, the problem reoccurred with less severity. Sanitation problems in the rearing pond have led to these disease outbreaks. The pond bottom will be paved with asphalt in FY 1981 to allow for improved pond cleaning. This should reduce accumulations of fecal material and unused food and thereby reduce the chances of botulism developing. Research needs to be conducted to identify means to prevent losses at other hatcheries in the future.

Fish Screens

A major activity supported by the Program is the construction and maintenance of fish screens on irrigation diversions in the Columbia River Basin. These diversions annually remove large volumes of water from the Columbia River and its tributaries to provide irrigation for the vital Northwest agricultural operations. While the irrigation produces benefits through increased agricultural production, it can have disastrous results on populations of fish, especially on migrating juvenile anadromous salmonids.

Irrigation diversions typically consist of an intake structure with a shut off capability and a ditch leading to the fields. The problem to migrating fish develops when the fish follow the current into the diversion ditch instead of continuing on downstream. When in the ditch, the fish become disoriented and usually cannot get back to the river. They then die, often after swimming with the current out into fields.

The purpose of fish screens is to prevent the entrapment of fish and to route them back to the river below the diversion entrance. Figure 7 shows a side view schematic of a typical fish screen installation and Figure 8 shows it from overhead. Although fish screens vary in design, they are commonly located on a diversion ditch downstream from its entrance. The screen itself serves as a block to movement of fish and forces them to enter the bypass pipe shown in the figures. Passing through this pipe, they are returned to the river.

Since the flow of water into the diversion carries debris as well as fish, it is necessary that a fish screening installation have some form of cleaning system included, preferably an automatic one to prevent constant maintenance. Without cleaning, the screen itself would quickly become plugged and stop passing water. The example shown in the figures is a typical drum-type screen which uses water power to operate the cleaning mechanism. The flow of water through the diversion rotates the paddle wheel which is geared back to the screen drum. Debris which collects on the upstream side of the drum is washed away by the current when the drum rotates. This cleaning cycle is constant with debris being carried on down the ditch.

As previously mentioned, screens differ radically in design but all designs serve the same purpose. Screens can be drum shaped or flat, may be mechanically or manually cleaned, and, if they have any moving parts, may be electric or hydraulically operated (Figure 9).

The construction of fish screens is required by statute by Oregon, Washington, and Idaho, on all diversions where anadromous fish are present.

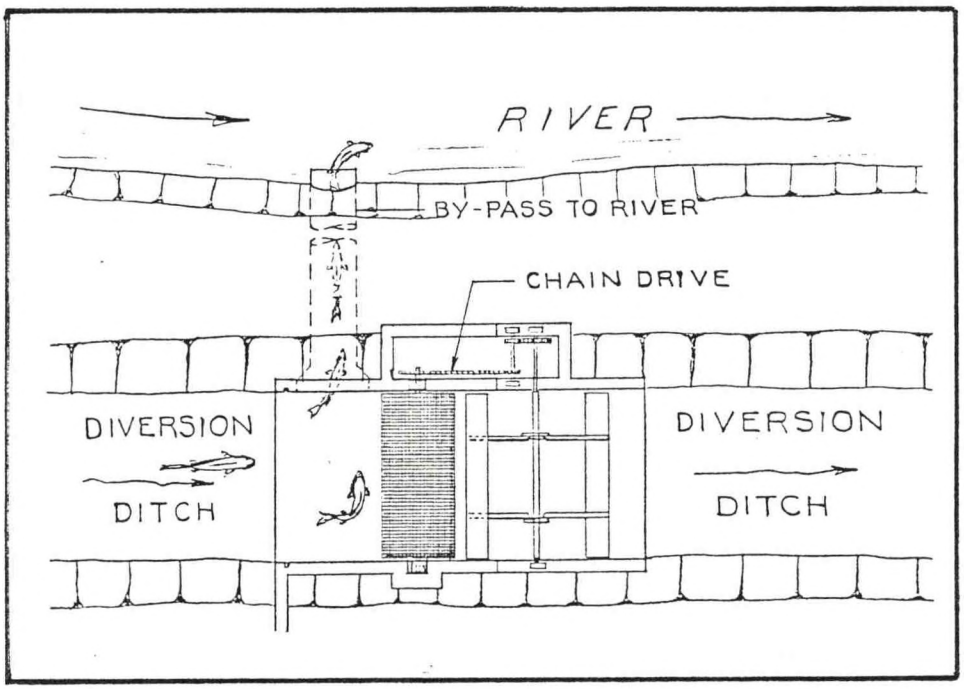


Figure 7 - Overhead line drawing of a typical fish screen set up. Fish coming down the diversion ditch are routed back to the river through a diversion pipe.

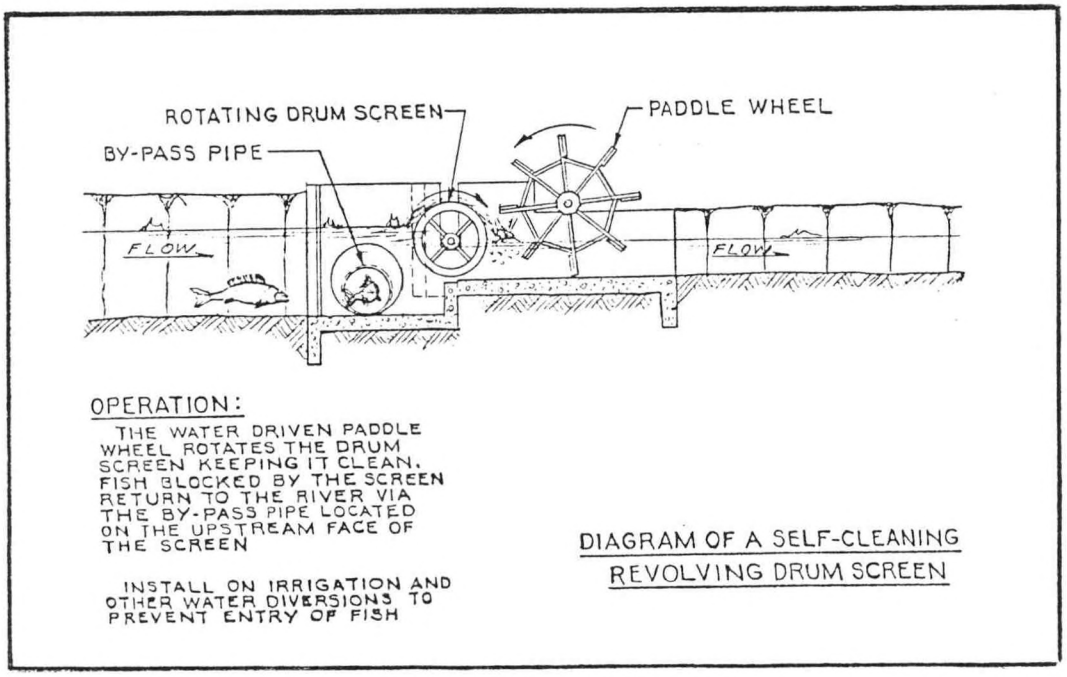


Figure 8 - Side view of a typical fish screen. This one uses water power to drive the paddle wheel which in turn rotates the screen to provide for automatic cleaning of debris.

Figure 9 - A paddle wheel operated drum fish screen in operation on a tributary of the Salmon River in Idaho. Water flow is from right to left.

Table 6.--Columbia River Fisheries Development Program Funded Fish Screens in Operation in FY 1980.

Agency	Number of Screens
Idaho Department of Fish and Game	340
Oregon Department of Fish and Wildlife	297
Washington Department of Fisheries	16
Total	653

In accordance with Section 2 of the Mitchell Act which authorizes the protection of migrating fish from irrigation projects, the Program has worked with the fisheries organizations of the three states to assure that all diversions are screened. Except for some work being done in Idaho, construction of screens funded by the Program was completed by the early 1960's.

Under the Program a total of 720 screens have been constructed, the majority of which are in Oregon and Idaho. Washington only has a few screens that were Program-funded as most of the diversions in the state were screened prior to the Program's initiation. Of the 720 screens, approximately 650 are still operated. The others were either found to save very few fish or the use of the ditch was stopped. Table 6 shows the number of screens funded by the Program which are currently being operated by Basin fisheries agencies.

The effectiveness of fish screens is difficult to evaluate. Spot checks done in 1969 on 49 screens in the John Day River drainage showed that more than 63,000 were routed back to the river through the bypass pipes. The value of these fish was not determined.

Since construction is for the most part completed, Program funds expended in FY 1980 were mainly used by the operating agencies for routine maintenance and repairs. However, especially in Idaho, some of the screens are of inefficient antiquated design or have deteriorated to the point where they are not longer effective. In these cases, the agencies have developed and are implementing replacement schedules to correct deficiencies.

Program personnel made annual inspection tours in the three states to examine screen sites as required by the contracts with the operating agencies. Problems noted as well as plans for maintenance in FY 1981 were discussed. In general, the screens are serviceable and in good operating order though many are getting old.

The one area that construction has continued into FY 1980 is the Sawtooth National Recreational Area in Idaho. The Cooperative Agreement signed in 1978 between National Marine Fisheries Service and the U. S. Forest Service established a program of screening irrigation diversions within the recreational area. Monies for design and construction were transferred to the Program and in turn were provided to the IDFG to conduct the actual work. In FY 1980 two screens were completed.

Stream Maintenance

Section 2 of the Mitchell Act, in addition to authorizing the construction of fish screens, directs construction and installation of devices in the Columbia River Basin for the improvement of feeding and spawning conditions for fish and for facilitating free migration of fish over obstacles and obstructions.

Program activities in the area of stream maintenance can be divided into two categories--construction of fish ladders or modifying barriers to migration, and improvement of spawning and rearing habitat. Program funds have been used to construct and operate 85 fish ladders or fishways in Oregon, Washington, and Idaho. These vary in size from ladders over minor falls (Figure 10) to the massive, four-entranced ladder over Willamette Falls (Figure 11), in Oregon. While the ladders vary in design as well as size, they all make it possible for fish to pass areas in streams and rivers which either have physical barriers that block migration or water velocity barriers.

No construction was done in FY 1980 under the Program. Funds provided to the fisheries agencies were used for routine maintenance and inspections. Each ladder was examined prior to the arrival of fish to insure that proper passage conditions existed. Program personnel periodically participated in these inspections, providing biological as well as engineering expertise as required.

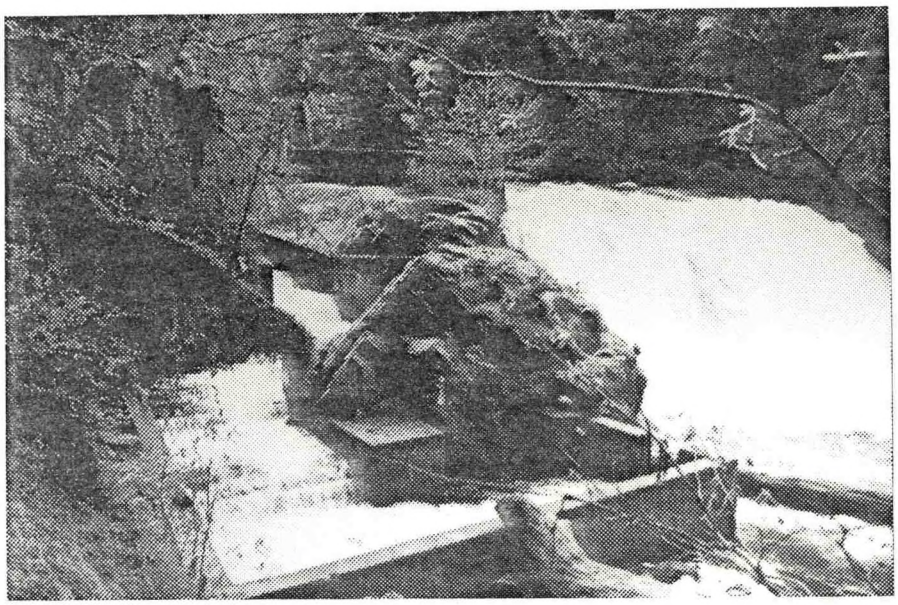


Figure 10 - The Middle Falls on Eagle Creek, a tributary of the Clackamas River in Oregon. This ladder makes it possible for fish to pass the 20 foot falls and reach the Eagle Creek Hatchery.

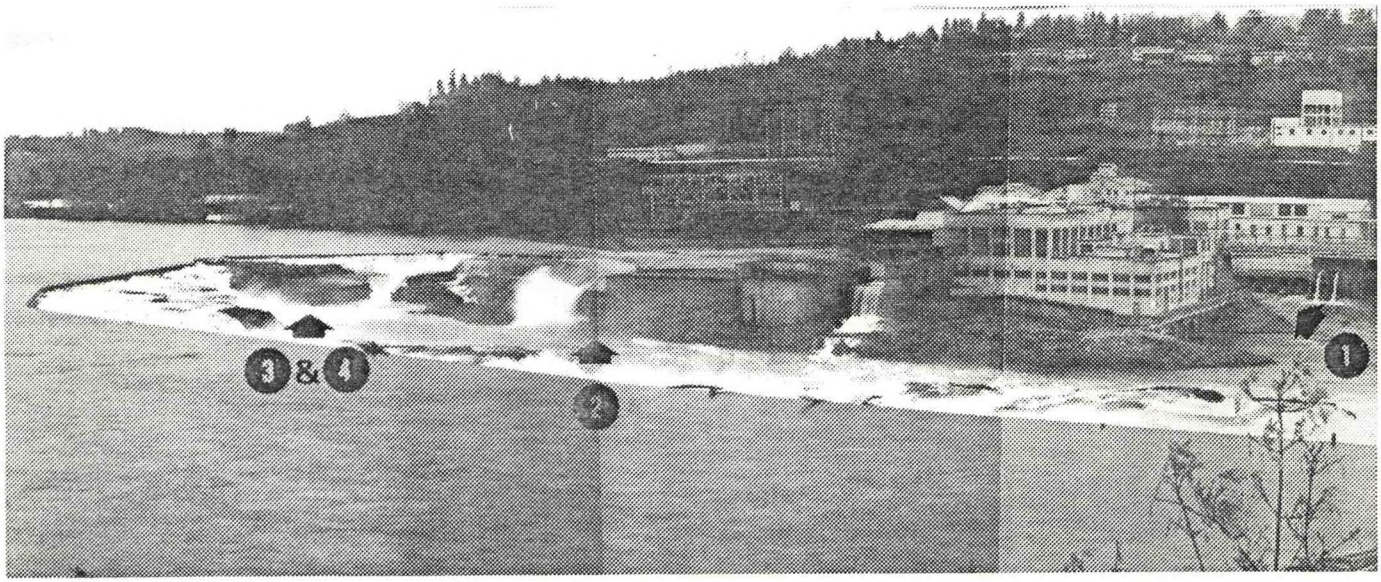


Figure 11 - Willamette Falls in Oregon City, Oregon. The ladder over this falls has four separate entrances which join to the right of entrance #2. Adult salmon pass a viewing station in the ladder and pass out the exit to continue their spawning migration.

Figure 12 - Poor logging practices in the past resulted in massive log jams which blocked access to spawning adult salmon. Regulations have since been enacted to prevent these types of blockages from occurring now.

The major portion of the second category of stream maintenance activities was completed prior to 1960. Over 2,000 miles of stream were made available by a combination of stream clearance work and the fish laddering program. This was accomplished mainly by removal of debris, log jams (Figure 12), splash dams, and other obstructions.

With improved logging practices, stream clearance has been reduced to an inspection and maintenance operation. FY 1980 expenditures were minor, concentrating on assuring that streams already cleared were kept open.

Pollution Abatement

With the increasing awareness of the impacts of environmental degredation and the desirability of restoring and maintaining the chemical, physical, and biological integrity of the nation's water, the 92nd Congress of the United States passed the "Amendment to the Federal Water Pollution Control Act" (P.L. 92500) in 1972. Under the amendment, fish hatchery wastes are regarded as industrial wastes and are subject to the requirements of Section 402. The requirements of the Act and Executive Order 11507 required that all hatcheries have pollution abatement facilities installed which are designed to eliminate the discharge of pollutants in hatchery effluent. Initially, 1977 was the planned completion date for having these facilities in operation.

In FY 1974, the Program retained a private engineering firm to evaluate hatchery evaluations and waste water treatment needs at all Program hatcheries. The objectives for these evaluations were to:

1. Prepare preliminary designs for facilities for appropriate levels of pollution abatement, including plan layouts and sizes of various features.

2. Prepare cost and energy use estimates for the various pollution abatement levels.

3. Make recommendations for land acquisition, if necessary for facilities.

4. Make recommendations for changes in hatchery operations which would minimize pollution, for conditions both before and after installation of pollution abatement facilities.

To attain these objectives, four basic study areas were covered in their reports:

1. A survey of existing plant facilities, operating procedures, and fish production and feeding schedules.

2. A definition of the flood plain expected to be inundated in 50-year frequency.

3. Calculation of discharge pollution loads.

4. Sanitary engineering evaluation of abatement facilities.

The reports detailed hatchery operations and recommended steps to be taken to meet the preliminary Environmental Protection Agency (EPA) guidelines. Implementation of the recommendations was divided into two phases for each hatchery. First, the required pollution abatement facilities were designed. Once designs were completed, construction contracts were let. Design work began with Eagle Creek National Fish Hatchery in FY 1974 and construction there began in FY 1975 (Figure 13a). As monies became available, design and construction were begun at other Program hatcheries (Figure 13b). Expenditures to date total almost $5.7 million (Table 1). Since these monies were not made available when the Program began, the 1977 deadline was not met. Extensions were granted by the EPA to postpone this deadline.

Throughout the study, design, construction, and operation of pollution abatement facilities at Program hatcheries, personnel from the Fish Facilities

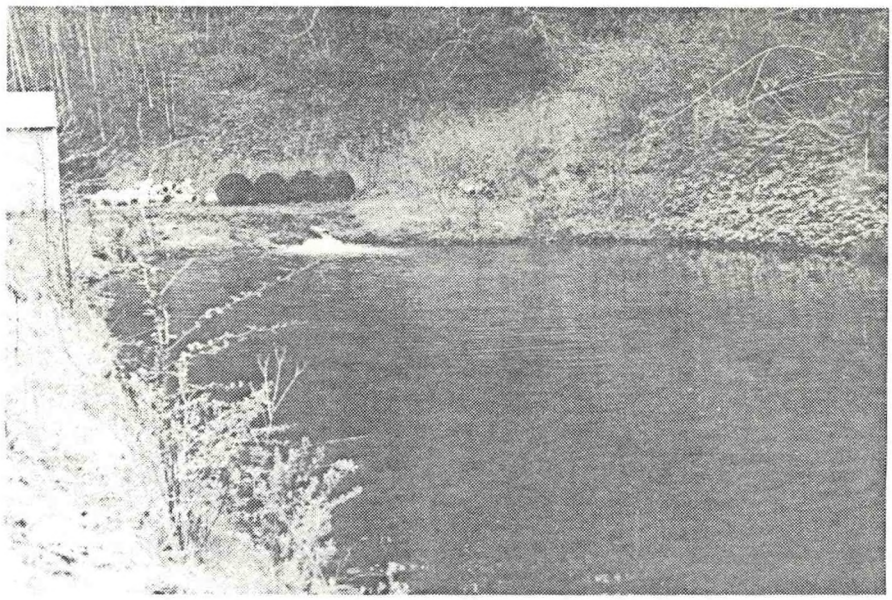


Figure 13a - The pollution abatement pond at Eagle Creek Hatchery. Hatchery effluent is pumped into the pond as shown. After wastes settle out, the clean water is discharged back into Eagle Creek.

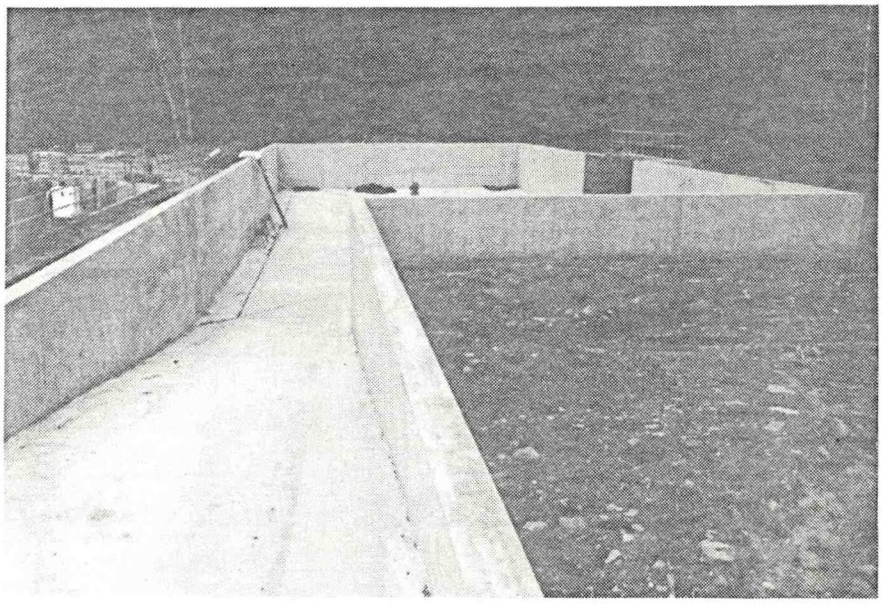
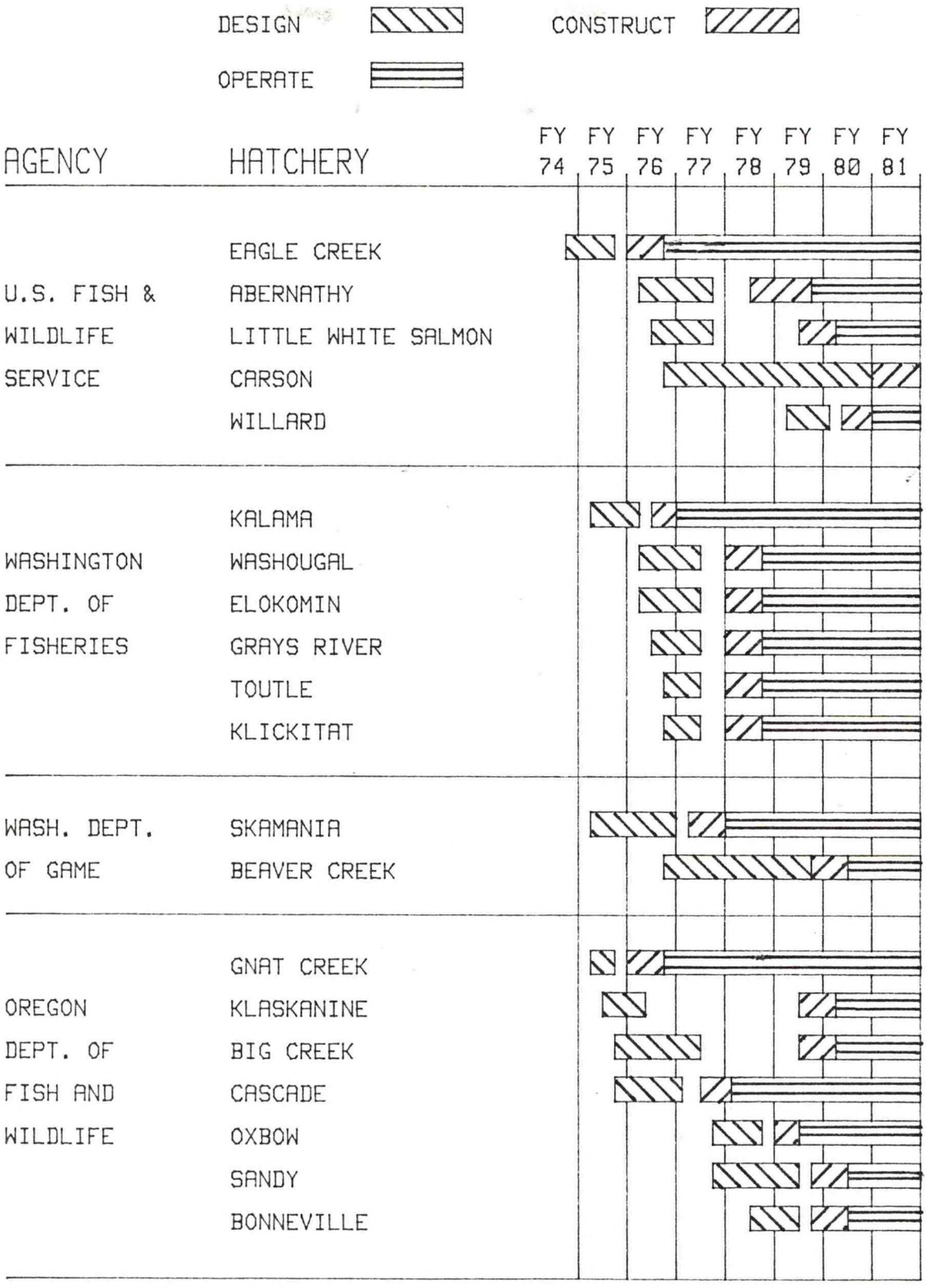


Figure 13b - A concrete pollution abatement pond at Big Creek Hatchery shown during construction. Wastes settle out in the pond prior to the discharge of water into Big Creek.

Figure 14.- HATCHERY POLLUTION ABATEMENT SCHEDULE



Branch provided expertise and advice to both Program personnel and to the fisheries agencies.

FY 1980 saw the completion and operation of pollution abatement facilities at all Program hatcheries except for Carson National Fish Hatchery. Figure 14 shows the facilities that were completed and put into operation during this fiscal year. Facilities at Carson National Fish Hatchery are scheduled to be completed in FY 1981, bringing to a close the construction portion of the project. This has been an expensive but environmentally responsible task undertaken by the Program.

FISH FACILITIES BRANCH

The Fish Facilities Branch (FFB) 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 FFB 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 Branch are Federal agencies, such as the Corps of Engineers, Water and Power Resources Services, and Federal Energy Regulatory Commission; private and public power companies; and various State fishery agencies. Activities of the FFB fall into the following six categories:

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

2. Review and establishment of functional fish facility design for Federal, Federally funded, Federal Energy Regulatory Commission and Nuclear Regulatory Commission licensed, and Public Law 89-304 projects.

3. Review of fish facility construction and operation at Columbia River projects.

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

5. Development of methods for fisheries agencies' participation in regional hydropower system operation to obtain river flows for anadromous fish.

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

The FFB is funded under the Columbia River Fisheries Development Program (CRFDP). The present staff consists of three engineers, one biologist, and one secretary.

During FY 1980, the FFB was involved in planning of numerous fish passage and protective facilities in the Columbia River Basin. Included in these were the upstream and downstream migrant passage facilities for the new second powerhouse currently under construction at Bonneville Dam. These facilities, estimated to cost in excess of $50 million will begin operating in March 1981. Other selected projects included adult fish collection facilities for the powerhouse currently under construction at Pelton Reregulating Dam and juvenile protection facilities for the proposed rehabilitation of Dryden Dam powerhouse on the Wenatchee River.

The Branch participated with the Corps of Engineers, Bonneville Power Administration, and Water and Power Resources Service in carrying out flow simulation studies to determine the potential for providing river flows required for anadromous fish migrations on the Columbia and Snake Rivers.

Branch personnel assisted the staff of the Environmental Assessment Branch in the planning and review of studies concerning fish passage in the mid-Columbia River reach. These studies, required under a Federal Energy Regulatory Commission settlement, include development of methods and facilities to protect downstream migrating juvenile salmon as they pass five mainstem Columbia hydropower projects.

STUDIES

Section 2 of the Mitchell Act also authorizes and directs the conduct of investigation necessary to direct and facilitate conservation of the fisheries resources of the Columbia River and its tributaries. Since the beginning of the Columbia River Fisheries Development Program, these studies have accounted for a significant portion of the expenditures. In FY 1980 Quality Control and Operational Improvement Activities made up 6.5% of the Program budget.

Many accomplishments in salmon culture have resulted from research done under the guidance of Program personnel. Two methods of marking juvenile fish developed with support of the Program are in world-wide use. One method allows fish to be marked internally through the feeding of tetracycline supplemented food. The tetracycline is taken up into the bones of growing fish. This can be detected with accuracy in returning adult fish by microscopically examining the fish's vertebra for a visible yellow ring using a specific wave length fluorescent light source. The second method involves injecting a coded piece of stainless steel wire into the snouts of young fish prior to the release from hatcheries or in the wild. Removal of an external fin in conjunction with this coded tag facilitates recovery of marked fish. Upon recovery of marked fish the tags are removed from the snout of the fish and decoded to identify hatchery source or specific research study.

Other advancements made through the Program are directly related to hatchery evaluation studies. Evaluations of Columbia River fall chinook and coho hatcheries have yielded information that is in constant use by fisheries agencies and regulatory bodies on the Pacific Coast

Diets developed with Program support have increased the quality of hatchery fish while reducing the cost of rearing these fish relative to the old types of feed.

Studies funded by the Program are of two types, those conducted or coordinated directly by Program personnel and those conducted by the fisheries

agencies using NMFS funds. In the former type, Program personnel are directly responsible for writing proposals, conducting or coordinating the research, and preparing reports. In the latter, State and Federal fisheries agencies submit proposals for review and possible funding. Based on a review process and examination of the Program's goals, a number of these studies are funded each year. Results and assessment of progress are supplied in the form of periodic reports with closing reports submitted at the completion of each study.

An example of the study conducted by Program personnel is the extensive new fall chinook salmon hatchery evaluation currently underway. This study is being funded by the Bonneville Power Administration. The study will update the previous 1961-64 brood fall chinook evaluation study and to determine the current distribution, contribution, and value of fall chinook released from artificial rearing facilities in the Columbia River Basin. In cooperation with State Fisheries agencies in Washington and Oregon, and the U. S. Fish and Wildlife Service, a portion of the 1978-81 brood fall chinook production at Columbia River rearing facilities will be tagged in 1979-82.

In FY 1979, 3.9 million 1978-brood fall chinook were tagged at 18 facilities in the Columbia River Basin. A mobile fish tagging trailer shell and tagging equipment were purchased and an inclined plane fish sampler (Figure 15) was built. The sampler was used to obtain fish for tagging at Spring Creek, Bonneville, Big Creek and Klaskanine hatcheries.

In FY 1980, 2.6 million 1979 brood fall chinook were tagged at 18 facilities on the Columbia River. A second inclined plane table sampler was constructed and the tagging trailer was completed (Figure 16). The trailer was used for the fish tagging operation at Spring Creek, Little White Salmon, Bonneville, and OxBow Hatcheries. The two samplers were used to obtain fish for tagging and for prerelease sampling at Spring Creek, Abernathy, Little White, Bonneville, OxBow, Big Creek, and Klaskanine Hatcheries. An open house was conducted near the BPA office in Portland on January 22 and 23, 1980, to display the tagging trailer. Over 600 people visited the facility during the two days (Figure 17).

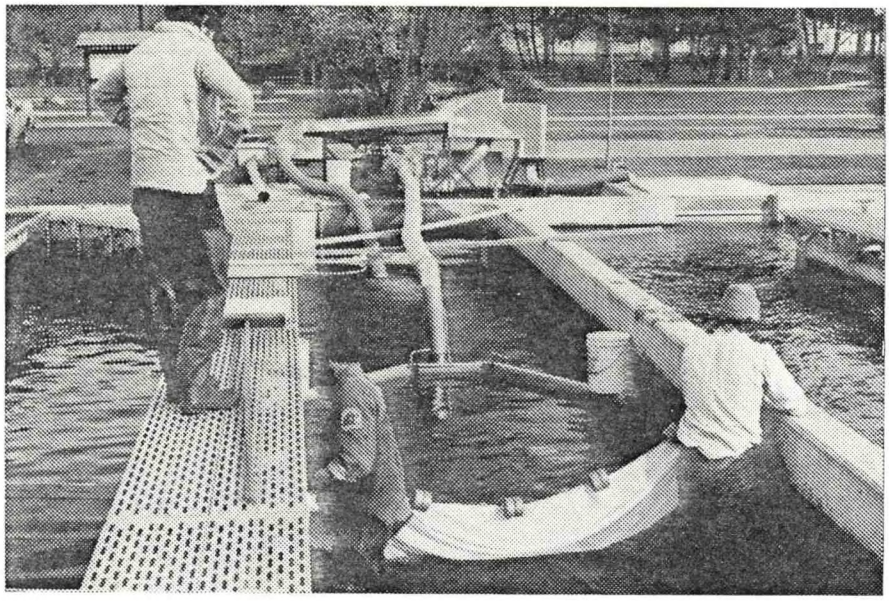


Figure 15 - The fish sampler built as part of the Fall Chinook Hatchery Evaluation Study in use to secure a random sample of fish from the population in a pond at Bonneville Hatchery for marking.

Figure 16 - The mobile fish marking unit built to mark fall chinook as part of the hatchery evaluation study currently in progress.

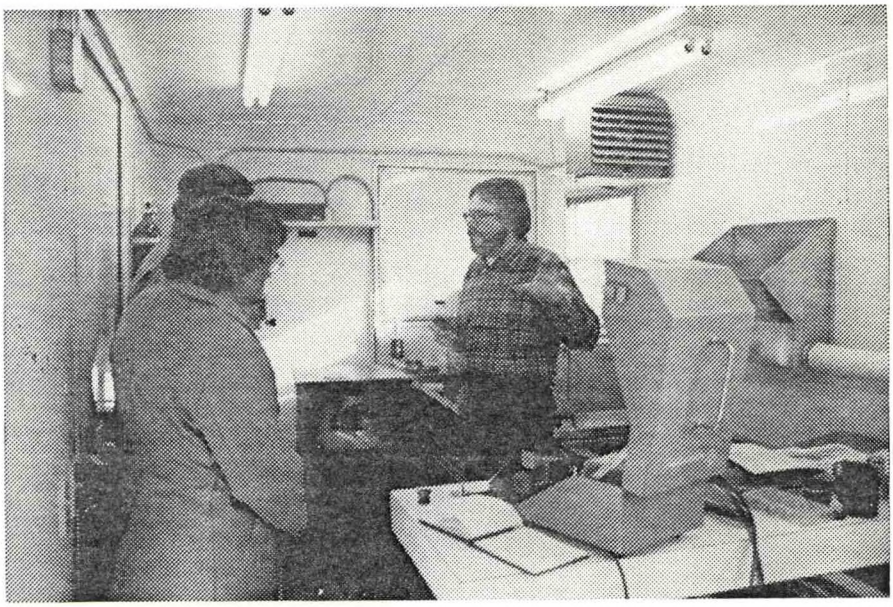


Figure 17 - NMFS employee explaining operation of the mobile fish marking unit to employees of the Bonneville Power Administration during an open house staged during 1980.

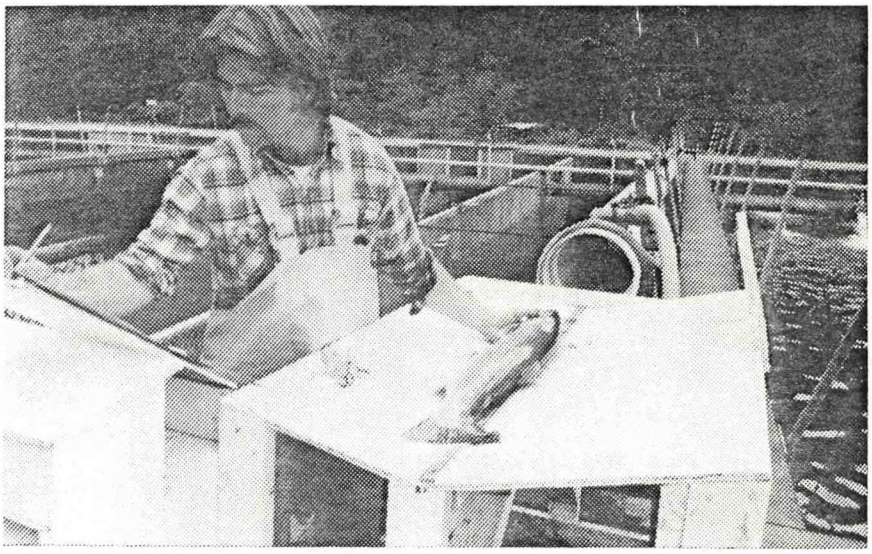


Figure 18 - An employee of Washington Department of Game taking biological samples from a steelhead trapped at Kalama Falls Hatchery as part of the Kalama River Study. The fish will be allowed to proceed on up river to spawn naturally.

The first fishery and hatchery recoveries of 1978-brood fall chinook occurred in FY 1980. The gathering of information on catches and the decoding of recovered tags began late in the fiscal year and is not yet completed. More extensive data collection will begin in FY 1981.

FY 1980 saw the beginning of a three-phase study to improve the collection of hatchery-related data. In Phase 1, Program personnel contracted with an economic consultants' group to develop a data collection format.

This format will allow the uniform collection of necessary hatchery data, fiscal as well as physical, from all Program hatcheries while causing the least amount of work for hatchery and agency personnel. It is vital that this information be collected to provide accurate and timely input for studies as well as to assure the Program hatcheries are operated in an economical and responsible manner.

Phase 2 will be completed in FY 1981, also under contract with an outside consultant, and will consist of collecting data from five sample hatcheries using the format. After the data collection, the effectiveness and completeness of the format will be evaluated and the format will be modified as necessary. The last portion of Phase 2 involves the setting up of the Program's computer data base management system to handle the data and produce required reports.

Phase 3 will be a continuing activity beginning in FY 1982 and will involve the actual data collection and processing from all Program hatcheries by Program personnel.

Two other studies that were underway in FY 1980 were a Spring Creek hatchery evaluation and a homing study using coho salmon. Both studies are at the end of the data collection phase and will be completed in FY 1981.

An example of a study being conducted for the Program by one of the participating fisheries agencies is the "Kalama River Study" being done by WDG (Figure 18). This study was initiated in 1974 to determine the general life history and biology of steelhead and cutthroat trout in the Kalama

River and to determine the relative contributions and competition between hatchery and wild steelhead. To achieve these goals, all hatchery steelhead going into the Kalama are genetically marked.

Using data collected in FY 1980 it was determined that steelhead parr migrating out of Gobar Creek in the spring outnumbered steelhead smolts 5 to 1. Nearly equal numbers of steelhead parr and smolts were estimated to have outmigrated from the Kalama River.

Life histories of searun cutthroat and steelhead trout appear to differ in at least three ways: cutthroat smolt outmigrations tend to be later in the spring; 2. about 10% of the steelhead smolts are one year old, no cutthroat smolts have been found in this category; and 3. unlike steelhead, large numbers of cutthroat parr migrants have not been observed.

Most of the spawners in Gobar Creek in 1979 were hatchery summer steelhead (95%). Peak spawning was in February. The highest number of redds ever reported for Gobar Creek were observed (60.9/km). The 1978-79 adult winter steelhead run was very small, with wild fish outnumbering hatchery fish 3 to 1. The proportion of steelhead re-spawners (fish that have spawned at least once before) in the 1978-79 winter run was more significant than in past years. This observation demonstrates the importance of respawners to natural reproduction in the years when dominant year class survival is low.

In FY 1980 the Program continued to provide funds to the Oregon Department of Fish and Wildlife to conduct three major activities in the Willamette River system. These were to evaluate and enhance salmon runs in the Willamette River, develop summer steelhead runs in the Willamette River, and to conduct fish counts on the ladder over Willamette Falls.

Work on the evaluation and enhancement of salmon runs was composed of two parts: 1. the evaluation and development of the natural potential of fall chinook and coho in the Willamette, and 2. evaluation of the effect of Willamette Falls on spring chinook with emphasis on increasing survival.

The development of the Part 1 portion of this project is a continuation of work in progress for several years with most of the emphasis being shifted to evaluation beginning in 1978. The second portion of the project was initiated in July of 1976. The same personnel work on both portions of this project and, in addition to Program funds, significant amounts of the financial support comes from State and other funds.

The development of summer and winter steelhead in the Willamette River is a continuing project which has placed the greatest emphasis on the development of summer steelhead populations in the area above Willamette Falls.

The last major activity, the Willamette Falls fish count, is an important component of efforts to evaluate the results of developmental projects for salmon and steelhead in the Willamette Basin. Table 7 shows the counts through the end of 1980.

In FY 1978 a cooperative study was initiated by the Oregon Department of Fish and Wildlife and the Washington Department of Fisheries to determine the ocean distribution and relative survival of coho salmon released in May, June, and July, from representative Columbia River hatcheries. This study, funded under the Program, evolved out of the results of recent time-and-size hatchery release studies which strongly suggested that the progressively later hatchery releases of yearly coho during March through July yield increasingly higher survival rates.

To test this hypothesis, the two agencies selected two of their hatcheries each and began a feeding regime for 1977-brood coho that resulted in three groups of fish reaching the size of 18 fish/lb at one month intervals starting in May of 1979. Each group of fish received a distinctive adipose coded wire tag mark prior to release to enable the monitoring of ocean and river catches as well as hatchery returns. The process was repeated in FY 1979 with 1978 brood fish.

During FY 1980, the second group of marked fish was released and the agencies began to monitor hatchery returns of two-year-old fish as well as sampling fishery recoveries. The data collection will be completed in FY 1981 and the study results will be assessed.

TABLE 7.--ADULT SALMONIDS COUNTED OVER WILLAMETTE FALLS

Year	Fall Chinook	Spring Chinook	Coho	Sockeye	Winter Steelhead	Summer Steelhead
1968	4,040	29,070	7,080	-0-	6,400	-0-
1969	6,820	31,110	12,400	-0-	8,400	-0-
1970	7,460	33,410	3,260	-0-	4,700	150
1971	4,800	42,900	17,410	-0-	26,300	2,310
1972	11,614	25,300	9,983	-0-	23,200	690
1973	21,861	40,500	5,174	26	17,800	1,790
1974	33,924	44,100	1,501	21	14,800	4,900
1975	32,877	17,800	5,922	1	6,100	2,900
1976	29,269	21,000	2,333	575	9,400	3,900
1977	25,742	38,500	1,007	151	13,600	9,200
1978	17,437	45,700	1,711	16	16,800	15,200
1979	9,905	25,500	1,787	16	8,700	7,600
1980	7,760	26,364	1,275	3,046	22,400	11,222