

SH
11
.A2
N66
no.13
c.2

NOAA Technical Memorandum NMFS F/NWR-13

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM
ANNUAL REPORT FOR F.Y. 1984

MICHAEL R. DELARM AND EINAR WOLD

SEPTEMBER 1985



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

SH
11
.A2
NG6
no. 13
c. 2



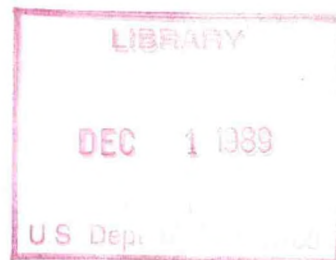
NOAA Technical Memorandum NMFS F/NMR-13

This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information; and have not received complete formal review, editorial control, or detailed editing.

COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM ANNUAL REPORT FOR F.Y. 1984

MICHAEL R. DELARM AND EINAR WOLD

SEPTEMBER 1985



COVER PHOTO: THE U.S. FISH AND WILDLIFE SERVICE SPRING
CREEK HATCHERY. THE FACILITY IS LOCATED
APPROXIMATELY 30 MILES UPSTREAM FROM
BONNEVILLE DAM ON THE COLUMBIA RIVER.

U.S. DEPARTMENT OF COMMERCE
MALCOLM BALDRIGE
National Oceanic and Atmospheric Administration
ANTHONY J. CALIO
National Marine Fisheries Service
WILLIAM G. GORDON

TABLE OF CONTENTS

	PAGE
INTRODUCTION.	1
FISH CULTURE.	9
STUDIES	20
Washington Department of Fisheries	21
Washington Department of Game.	22
Idaho Department of Fish and Game.	22
Oregon Department of Fish and Wildlife	23
U.S. Fish and Wildlife Service	23
STREAM IMPROVEMENTS	26
IRRIGATION SCREENS.	26
OPERATIONS BRANCH	30
Fall Chinook Hatchery Evaluation	30
Transport Operations on the Snake and Columbia Rivers.	31
Bioengineering Group	38
LITERATURE CITED.	42
APPENDIX 1 - Mitchell Act	A1
APPENDIX 2 - List of Selected Publications by the Environmental and Technical Services Division Staff.	A2
APPENDIX 3 - A Brief Description and History of Oregon Department of Fish and Wildlife Rearing Facilities.	A5
APPENDIX 4 - A Brief Description and History of Washington Department of Game Rearing Facilities	A14
APPENDIX 5 - A Brief Description and History of Washington Department of Fisheries Rearing Facilities.	A17
APPENDIX 6 - A Brief Description and History of U.S. Fish and Wildlife Service Rearing Facilities	A23
APPENDIX TABLE 7 - Number and Pounds of Juvenile Salmonids Released By the U.S. Fish and Wildlife Service	A29
APPENDIX TABLE 8 - Number and Pounds of Juvenile Salmonids Released By the Oregon Department of Fish and Wildlife	A31
APPENDIX TABLE 9 - Number and Pounds of Juvenile Salmonids Released By	

TABLE OF CONTENTS

	PAGE
the Washington Department of Game	A34
APPENDIX TABLE 10 - Number and Pounds of Juvenile Salmonids Released By the Washington Department of Game	A36
APPENDIX TABLE 11 - Adult and Jack Salmonids Returning to U.S. Fish and Wildlife Service Hatcheries	A38
APPENDIX TABLE 12 - Adult and Jack Salmonids Returning to Oregon Department of Fish and Wildlife Hatcheries.	A39
APPENDIX TABLE 13 - Adult and Jack Salmonids Returning to Washington Department of Fisheries Hatcheries.	A40
APPENDIX TABLE 14 - Adult and Jack Salmonids Returning to Washington Department of Game Hatcheries	A41
APPENDIX TABLE 15 - Release, Catch, and Return Statistics for 1978 - Brood Fall Chinook by Facility and Tag Code	A42
APPENDIX TABLE 16 - Release, Catch, and Return Statistics for 1979 - Brood Fall Chinook by Facility and Tag Code	A44
APPENDIX 17 - Partial Listing of Bioengineering Activities During FY 1984	A45

INTRODUCTION

Congress passed the Mitchell Act in 1938 authorizing the appropriation of \$500,000 for surveys and improvements in the Columbia River watershed for the benefit and conservation of salmon (Oncorhynchus sp.) and steelhead (Salmo gairdnerii). The Act recognized that the salmonid resource was in serious and progressive decline due to destruction of favorable environmental conditions by hydroelectric projects, deforestation, pollution, and water diversions. The purpose of the initial appropriation was to reinvest funds the Government had received from fishermen for leases of seining grounds on the Federally owned Sand Island and Peacock Spit in the mouth of the Columbia River.

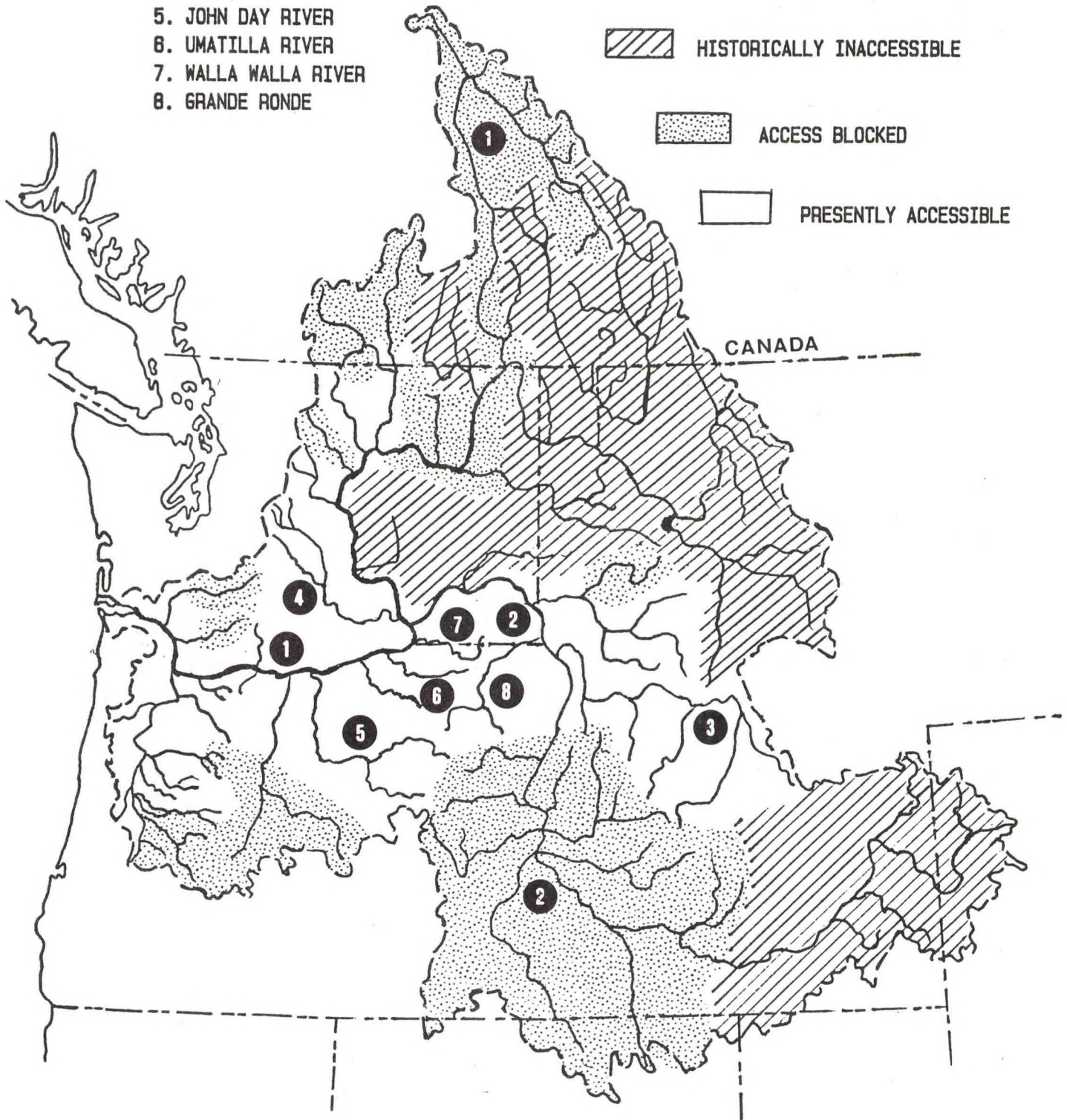
Stream census and surveys were initiated and by 1942 most tributary streams in the Columbia Basin had been surveyed. Data on various populations of salmon and steelhead were accumulated and information regarding unscreened irrigation diversions, impassable waterfalls, log and debris jams, splash dams, and sources of pollution were cataloged for future use. These surveys indicated a detrimental degradation of the original pristine habitat had occurred. Hydroelectric projects had reduced the area available to anadromous fish (Figure 1). Mining and lumber operations and unscreened irrigation diversions were adversely affecting salmon and steelhead in the remaining habitat.

The Mitchell Act was amended in 1946 (Appendix 1) which removed the limitations on subsequent appropriations from Congress for development of anadromous fish in the Columbia Basin. The Act authorized the utilization of facilities and services from the State conservation agencies of Idaho, Washington, and Oregon in developing the salmonid resources of the region. The Act also permitted closer cooperation between Federal and State governments and for the first time allowed transfer of monies to the States for specific work.

In 1947, State and Federal agencies recommended the formation of the Lower Columbia River Fisheries Development Program (CRFDP) as a way of maintaining salmon and steelhead resources in the Columbia Basin. This recommendation was endorsed by the Federal River Basin Inter-Agency Committee, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation. The resultant CRFDP was administered

FIGURE 1. - THE HISTORICAL AND PRESENT AREA AVAILABLE TO ANADROMOUS FISH IN THE COLUMBIA RIVER

1. COLUMBIA RIVER
2. SNAKE RIVER
3. SALMON RIVER
4. YAKIMA RIVER
5. JOHN DAY RIVER
6. UMATILLA RIVER
7. WALLA WALLA RIVER
8. GRANDE RONDE



under the U.S. Department of the Interior. The U.S. Corps of Engineers submitted, and Congress approved for FY 1949, an initial appropriation of \$1 million to be utilized by the CRFDP.

Prior to 1956, the CRFDP involved only the States of Oregon and Washington and included that part of the Columbia Basin located below McNary Dam. In 1956, Congress instructed the CRFDP to develop the fishery resources above McNary Dam, and Idaho became a participant in 1957. At this time the word "Lower" was dropped from the CRFDP name.

Since its creation, the CRFDP's goal has been to develop maximum salmon and steelhead runs into the Columbia Basin and increase adult contribution to the various fisheries and escapement. To work towards that goal, the CRFDP has concentrated on three areas; hatchery construction and operation, stream improvement and screening irrigation diversions, and quality improvement studies.

In 1970, with the reorganization of Federal fisheries responsibilities, the CRFDP was transferred from the Department of the Interior to the Department of Commerce. It is currently administered as part of the Environmental and Technical Services Division (ETSD) of the National Marine Fisheries Service (NMFS) in Portland, Oregon in cooperation with the U.S. Fish and Wildlife Service (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) (Figures 2 and 3).

In FY 1984 approximately \$ 9,583,600 was appropriated, the majority of which went to the USFWS and State agencies (Figure 4) with approximately 6.9 percent of funds used in-house. The majority of expenditures (83.0 percent) was used for hatchery operation and maintenance (Figure 5). Through FY 1984 approximately \$147,446,555 million has been provided by the CRFDP for production and enhancement of salmonids (Table 1).

Information concerning CRFDP and other ETSD activities are published periodically under the NOAA Technical Memorandum NMFS F/NWR series and other

Figure 2 -- Organizational Chart Showing the Location of the Columbia River Fisheries Development Program in the Federal Government.

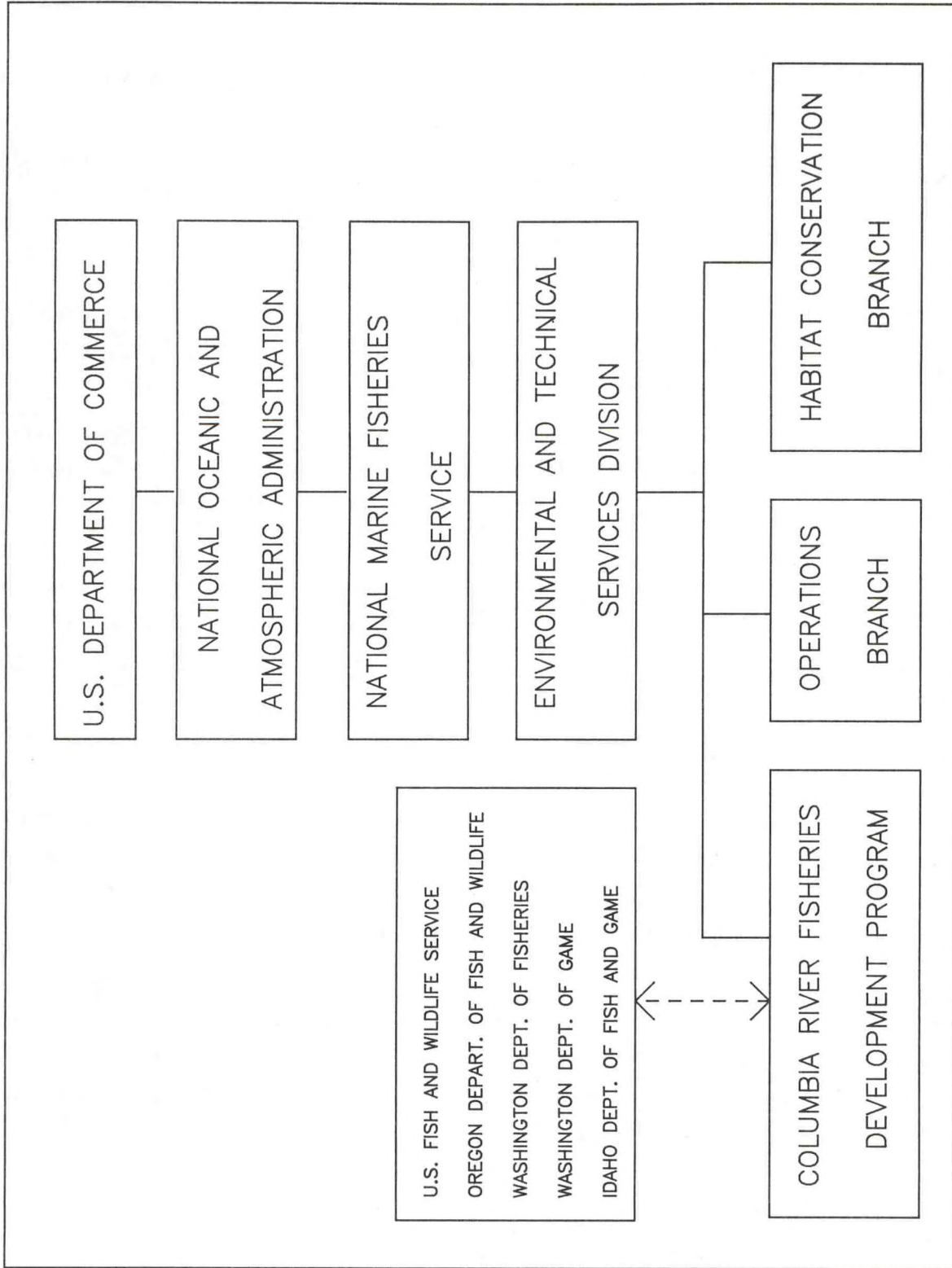


Figure 3 -- Table of Organization for the Environmental and Technical Services Division.

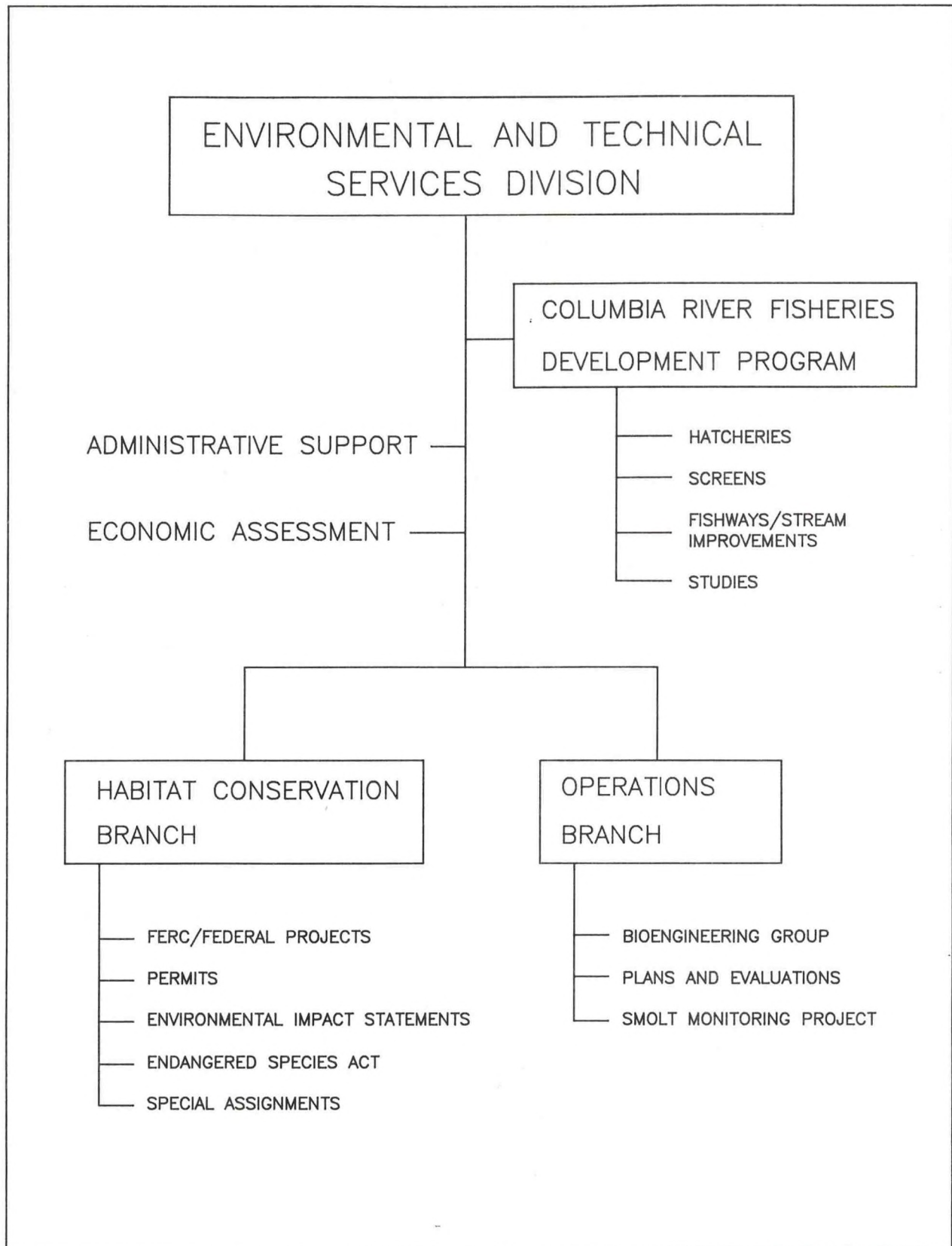


Figure 4.--- DIVISION OF FY1984 COLUMBIA RIVER
FISHERIES DEVELOPMENT PROGRAM FUNDS

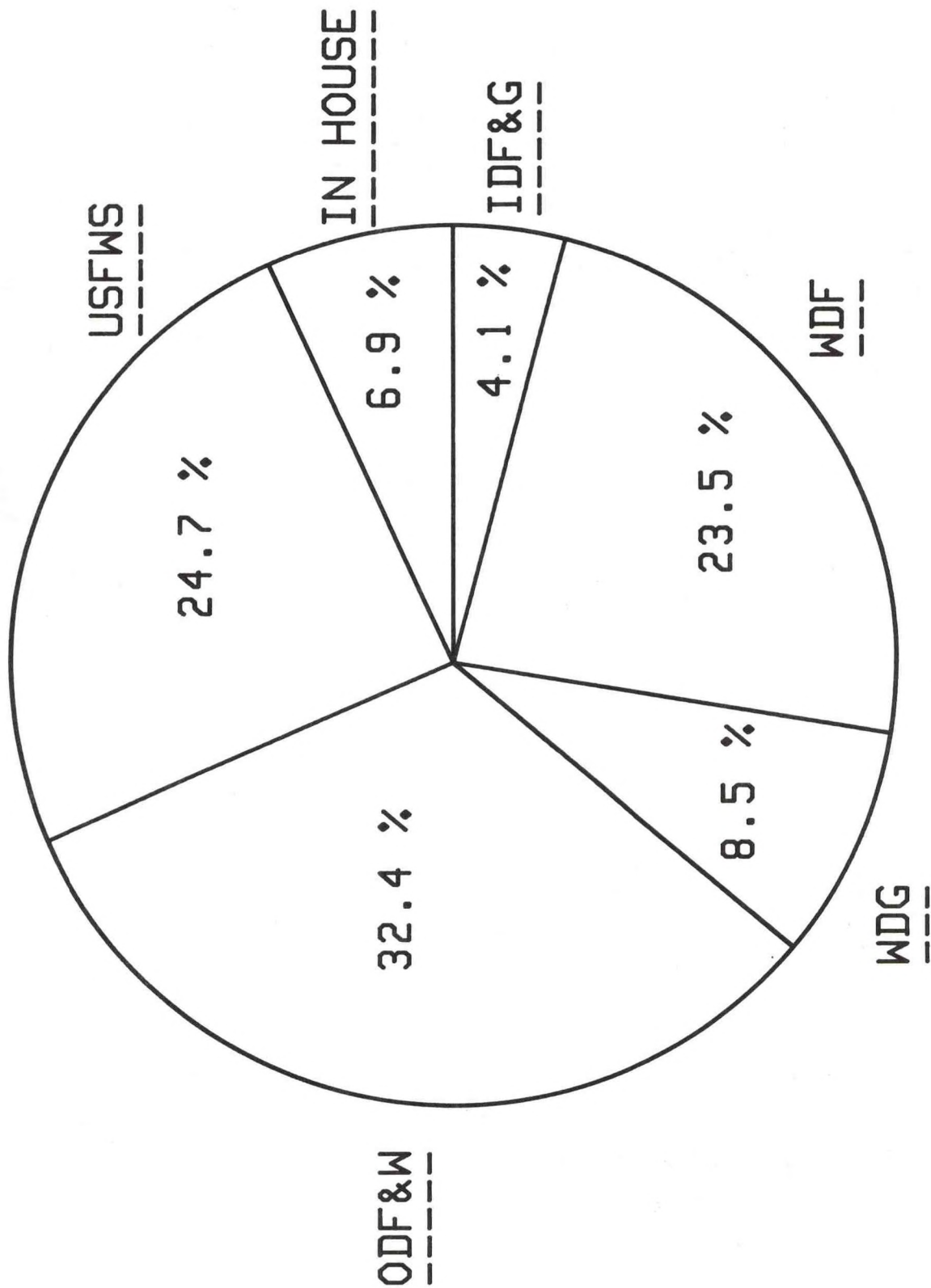


FIGURE 5. FY 1984 C.R.F.D.P. APPROPRIATED FUNDS.

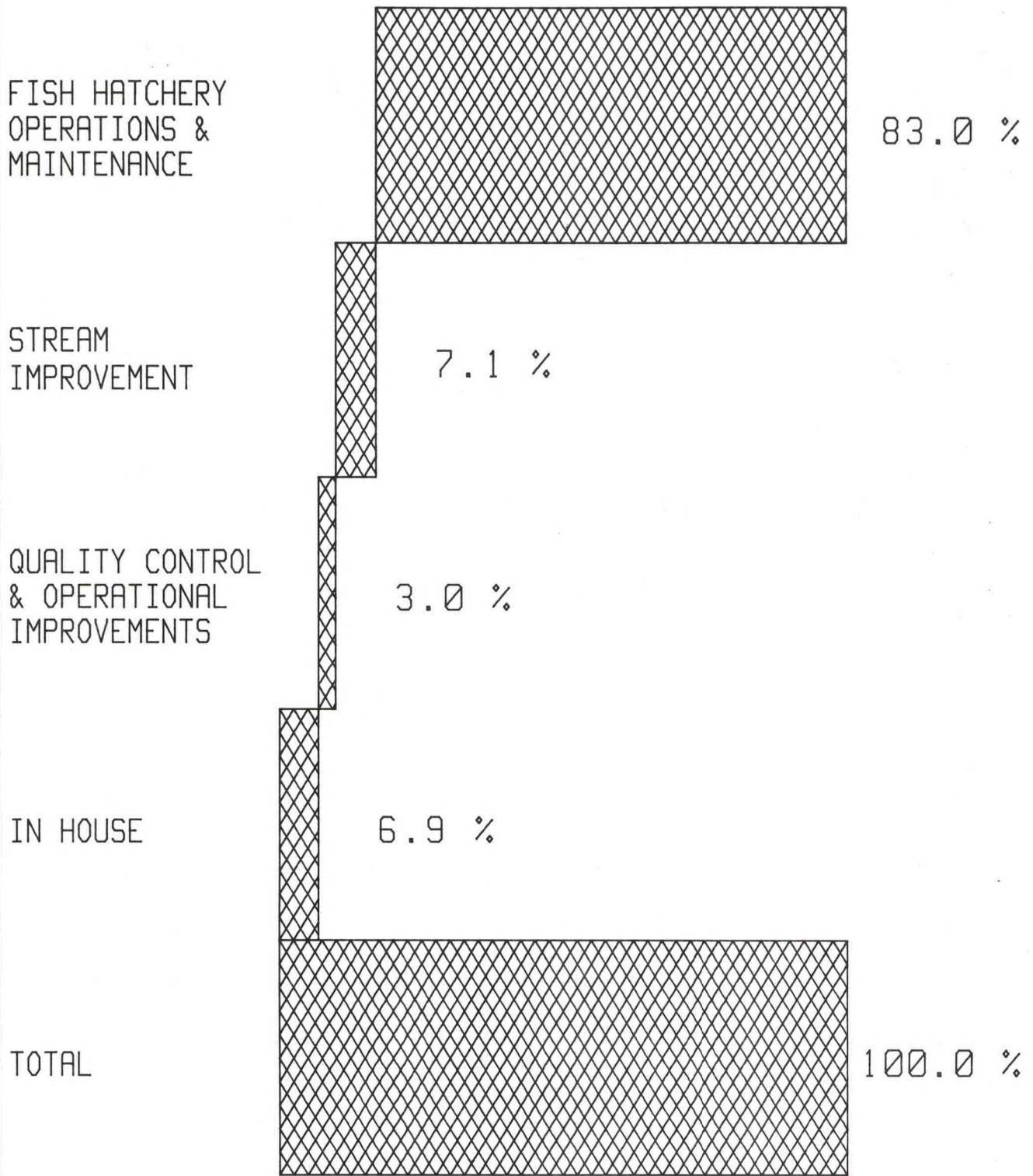


Table 1.-- FUNDS EXPENDED BY THE COLUMBIA RIVER
FISHERIES DEVELOPMENT PROGRAM 1949-1984

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
1983	0	9,583,600	0	9,583,600
1984	190,434	9,393,166	0	9,583,600
TOTALS	\$30,536,698	\$110,826,757	\$6,083,400	\$147,446,555

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

publications. The series is subjected to peer review and editing and may be cited as a publication. Copies of the reports may be ordered from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. A list of NOAA publications completed by this office is presented in Appendix 2.

FISH CULTURE

The original plan for artificial propagation under the CRFDP envisioned construction, enlargement or renovation of 31 hatcheries over a ten-year period. In 1949, part of the initial \$1 million was used to initiate construction of Klickitat and expand Spring Creek National Fish Hatchery. Clackamas (not one of the original 31) was the last hatchery constructed and was jointly funded by Portland General Electric Company and the CRFDP in 1979. Due to changes in the initial plan, a total of 22 hatcheries and 3 major rearing ponds have been constructed (Figure 6, Appendix 3, 4, 5, 6). All except for the Toutle Hatchery continue to produce salmon, steelhead trout, or sea-run cutthroat. Toutle hatchery was destroyed during the May 18, 1980 eruption of Mt. St. Helens.

The CRFDP rearing facilities are concentrated in the lower Columbia Basin below The Dalles Dam with only the two Ringold facilities located above that point (Tables 2 and 3). In addition to the main rearing facilities many hatcheries operate satellite rearing ponds (Table 4). These satellite facilities serve to extend production through outplants to surrounding areas.

Since 1949, the CRFDP has utilized the majority of funds on fish culture, including construction, operation, and maintenance of hatcheries. In FY 1984 83.0 percent of appropriated funds were provided for hatchery operations (Figure 5). Stream improvement (7.1 percent), quality improvement studies (3.0 percent), and various in-house functions (6.9 percent) account for the remaining appropriated funds.

Production from CRFDP facilities totaled approximately 107 million fish during the year (Table 5, Appendix Tables 7, 8, 9, 10). Species such as spring chinook salmon, coho salmon, steelhead trout, and sea-run cutthroat are usually

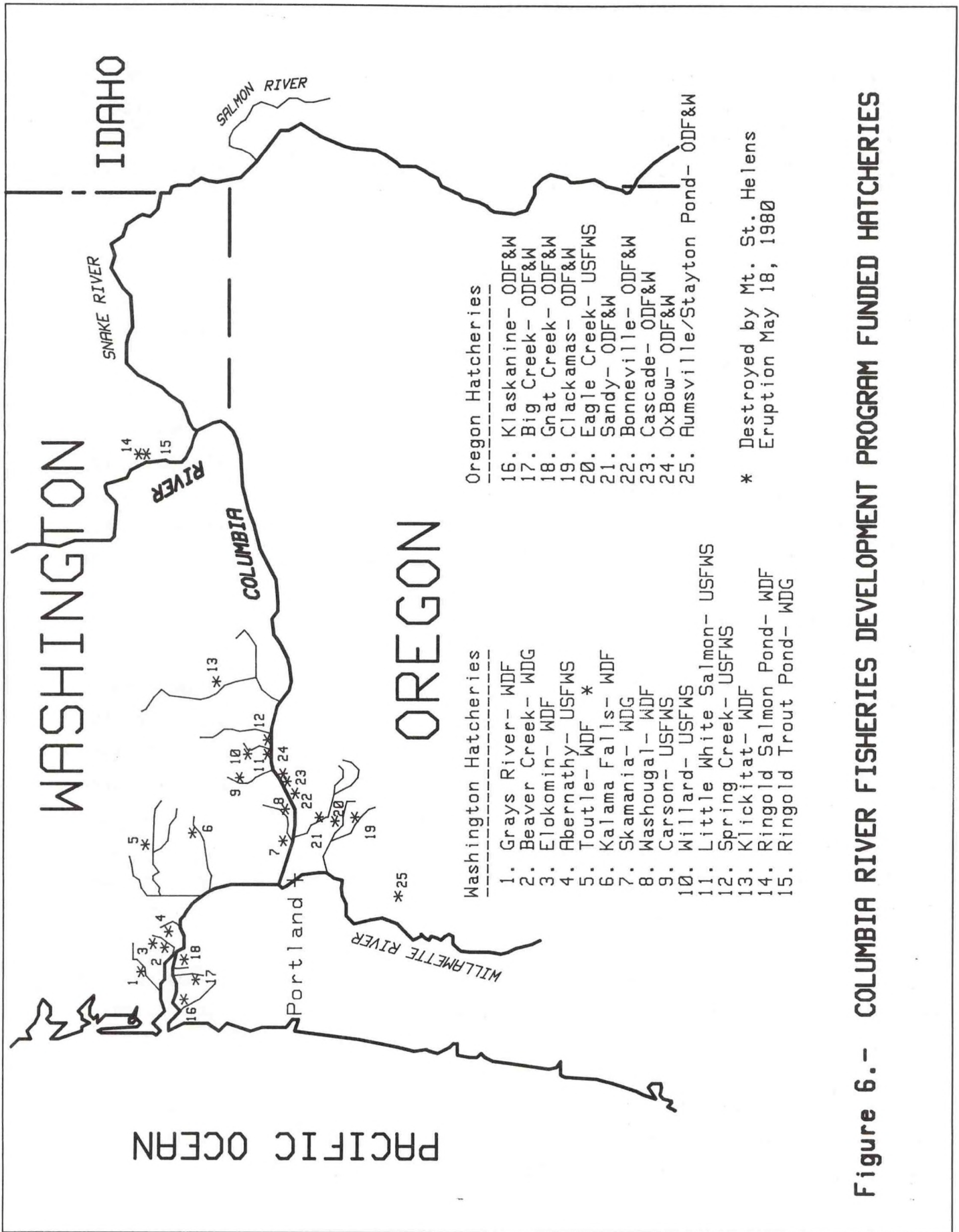


Figure 6.- COLUMBIA RIVER FISHERIES DEVELOPMENT PROGRAM FUNDED HATCHERIES

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

Facility	General Location	Congressional District	Operating Agency	Species Reared 1/ 1960-81	Anadromous Releases 1981	Year 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	Species Reared 1960-81	Anadromous Releases 1981	Year Anadromous Operation Began	Funding Agency
Hatcheries							
Big Creek	Knappa	1st	ODFW	fc, co, sh(ch)	Yes	1938	NMFS
Bonneville	Bonneville	3rd	ODFW	fc, co (sh)	Yes	1909	NMFS, CE
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
OxBow	Cascade Locks	2nd	ODFW	fc, sc (co)	Yes	1938	NMFS
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. -- Satellite Rearing and Acclimation Facilities Operated by Each Agency

Agency	Hatchery	Satellite
USFWS	Spring Creek	Big White Salmon Pond
ODFW	Gnat Creek	Trojan Ponds
	Oxbow	Wahkeena Pond Herman Creek Ponds
WDG	Skamania	Vancouver Pond Gobar Pond
	Beaver Creek	Alder Creek Pond Coweeman River Net Pen Toutle River Trap Coal Creek Cooperative
WDF	Kalama Falls	Lower Kalama Hatchery Gobar Pond
	Grays River	Weyco Pond

Table 5. -- Releases of Salmonids in Numbers and Pounds from Columbia River Development Program Funded Rearing Facilities, 1960-84.

Year	Fall Chinook ^{1/}		Spring Chinook		Coho		Steelhead		Totals	
	Numbers (millions)	Pounds (10,000s)	Numbers (millions)	Pounds (10,000s)	Numbers (millions)	Pounds (10,000s)	Numbers (millions)	Pounds (10,000s)	Numbers (millions)	Pounds (10,000s)
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 ^{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	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	74.5	116.9	6.9	46.6	21.7	107.5	2.1	33.1	105.2	304.1
1984	72.4	112.8	8.7	62.3	22.3	128.3	3.3	41.4	106.7	344.8

^{1/} From 1972 on, part of the funds to operate the fall chinook program 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.

reared more than one year and are released the second spring after hatching. Fall chinook and chum salmon are usually released the first spring after they are hatched.

Adult and jack returns to CRFDP facilities totaled 133,371 fish (Table 6, Appendix Tables 11, 12, 13, 14). Spring chinook, fall chinook, coho, steelhead, and sea-run cutthroat recoveries were 7,808, 36,699, 77,843, 9,711, and 1,218, respectively. In cases where surplus adults are recovered, they may be sold and the proceeds credited to the CRFDP. Biological sampling for various bacterial and viral diseases commonly occurs during spawning operations (Figures 7 and 8). Program-funded facilities also attract increased numbers of the public during spawning season. Tours from nearby schools provide opportunities to educate youngsters on the value of this natural resource (Figure 9).

Table 6. Adult and Jack Returns to Columbia River Fisheries Development Program Funded Hatcheries in 1984.

	Fall Chinook	Spring Chinook	Coho	Chum	Steelhead	Cutthroat	Total
ODFW	15,658	2,521	43,075	92	695	199	62,240
WDF	9,983	1,525	25,300				36,808
WDG					7,585	1,019	8,604
USFWS	11,058	3,762	9,468		1,431		25,719
TOTAL	36,699	7,808	77,843	92	9,711	1,218	133,371

The WDG's Beaver Creek Hatchery had its water intake on the Elokommin River extensively modified in 1984 (Figure 10). Prior to the modification, salmon smolts released from WDF's Elokommin Hatchery which is located above Beaver Creek were pumped into the lower hatcheries' rearing ponds. The new intake effectively screens inriver fish and has alleviated the problem. It also has reduced the amount of trash pumped from the river into the hatchery.

The adult holding and spawning facility at WDF's Washougal Hatchery underwent extensive modification and reconstruction. The new facility eases spawning and allows individual salmon species to be held separately (Figure 11).



Figure 7. -- Spawning (upper photo) and obtaining scale samples (lower photo) from adult fall chinook

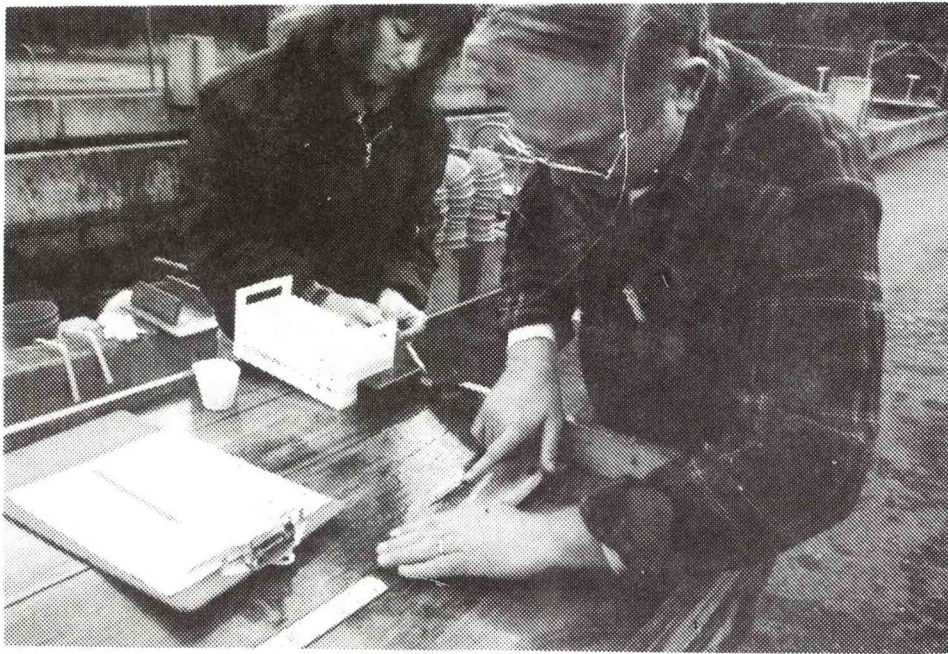


Figure 8. -- Biological sampling for various bacterial and viral diseases of searun cutthroat trout during spawning operations.

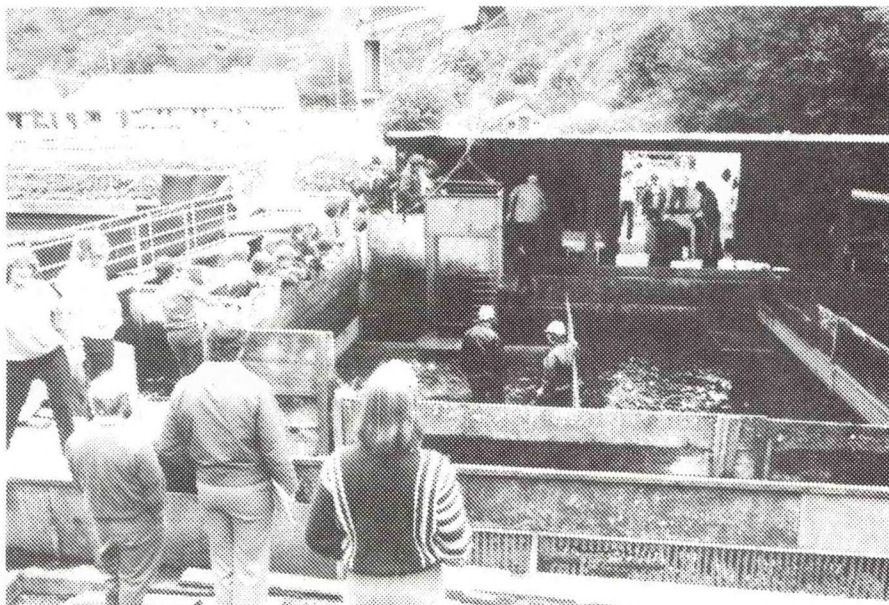


Figure 9. -- Tour from nearby school observing spawning and operations at Big Creek Hatchery.

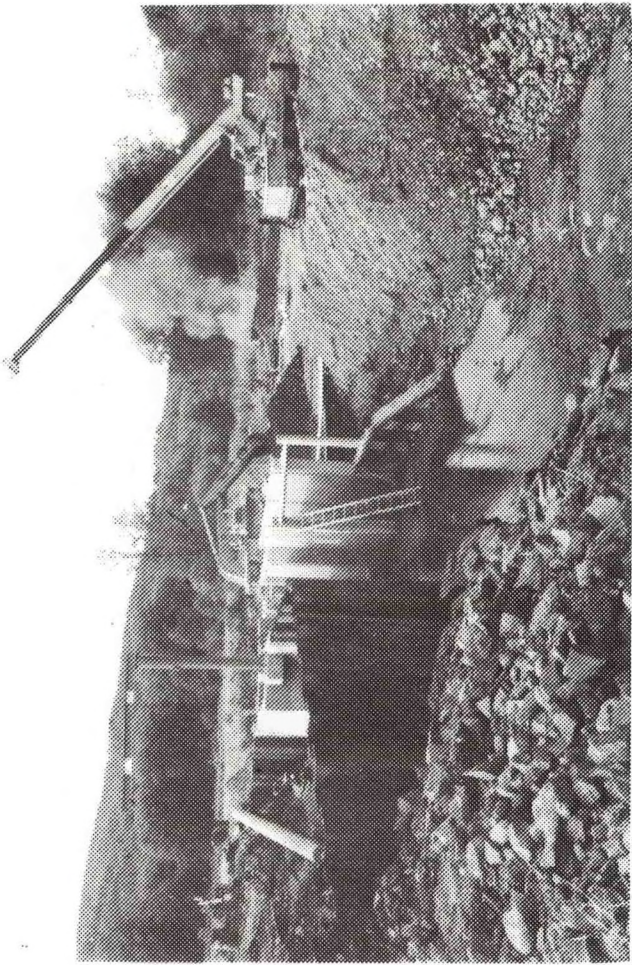
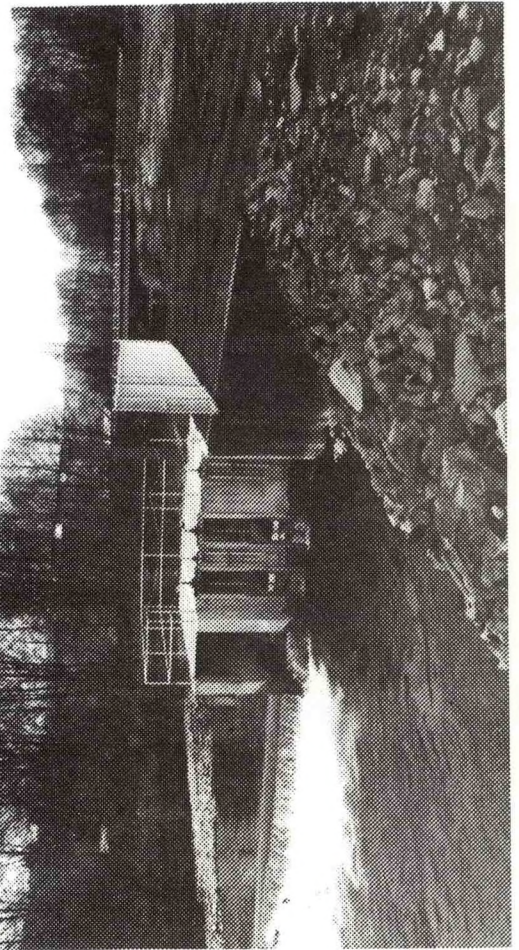
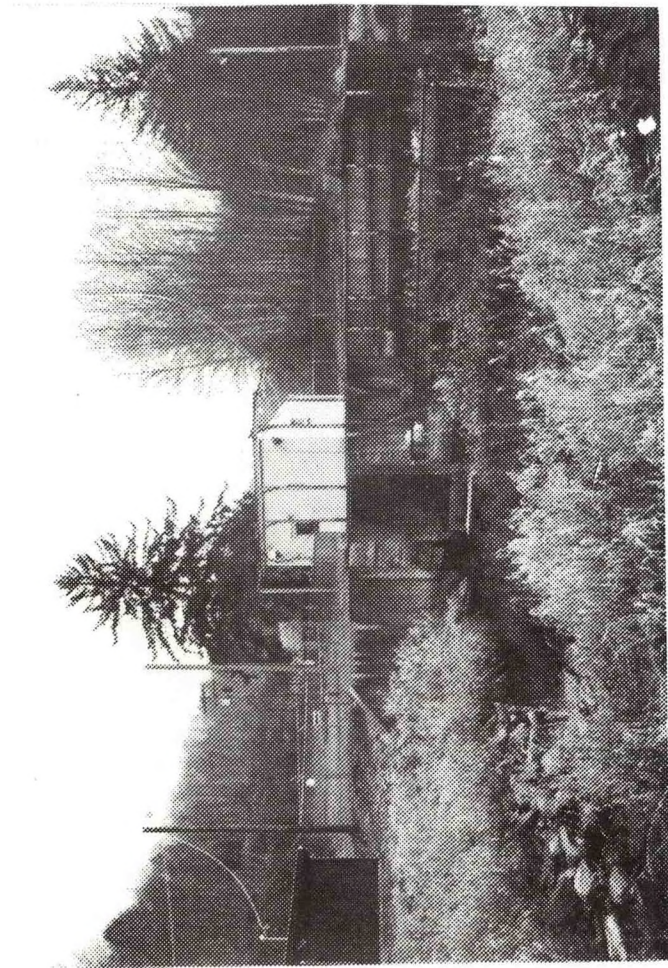


Figure 10. -- Beaver Creek Hatchery's original Elokomin River intake structure (upper left); construction of new intake (upper right), and completed construction (lower left) which occurred in FY 1984.

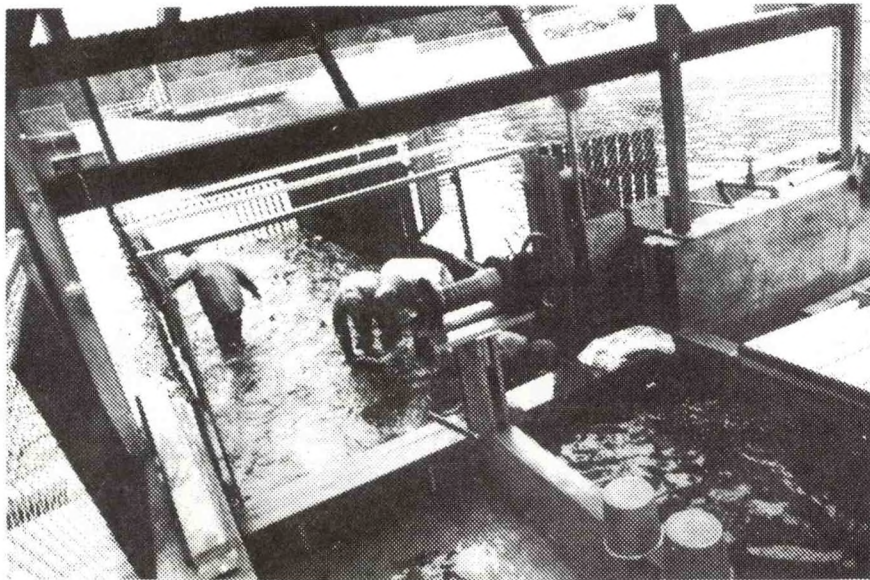
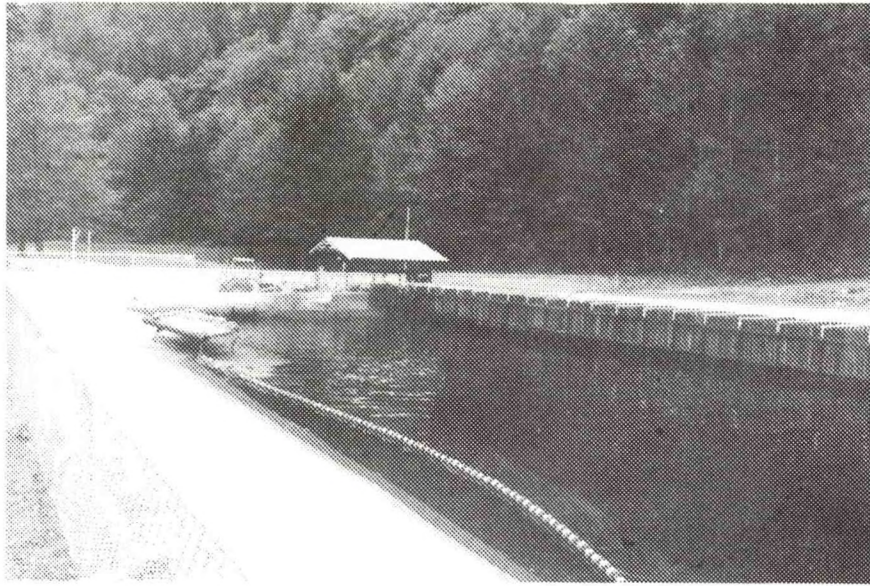


Figure 11. -- New holding pond and spawning facility constructed at Washougal Hatchery during FY 1984.

Funds were provided to initiate major rehabilitation at WDF's Klickitat Hatchery late in the fiscal year. Many of the existing raceways at this hatchery are crumbling beyond repair. Also, the freezer building ceiling has collapsed and is being held in place with a temporary plywood support. New raceways and a freezer building are to be constructed during the summer and fall of 1985.

STUDIES

Since its creation, the CRFDP has assumed a lead role in protecting the anadromous resource and enhancing fish culture. CRFDP studies have resulted in major advancements in fish culture. Oregon moist pellets (OMP) and Abernathy dry diets were developed with CRFDP funding and support. Both diets are currently in wide use and represented a tremendous improvement over prior diets. A second major development included two methods of mass marking juvenile fish. The first, a terramycin mark, is deposited on fishes bones when fed food coated with this drug. The drug is detectable as a fluorescent yellow ring when bones are viewed in a special wave length fluorescent light under a microscope. This method is limited in its use to studies that are based on returns to hatcheries. The second method included the development of a prototype of the coded-wire tag (CWT). This research served as a foundation for the development of the tags which are currently in use world-wide. The tag itself is only 0.042 inch long and contains information on its surface in the form of binary notches.

Studies funded by the CRFDP have typically encompassed a wide spectrum of activities. These have included broad hatchery evaluations using fin-marks and CWT's, evaluations of time/size at release, assessments of performance for various stocks of fish, and development of new techniques for use in salmonid culture.

Several studies were supported by the CRFDP this year, the majority of which are conducted by the cooperating agencies. The objective of these studies is to improve the quality of juvenile fish and improve adult contribution to the various fisheries.

Washington Department of Fisheries (WDF)

The WDF continued three studies this year; one is to determine the effects of six loading densities of coho salmon on survival and contribution to the fisheries. The stated objectives of the study are to (1) detail the effects that flow-related loading has on ultimate performance of coho salmon and (2) determine the most advantageous loadings to be utilized at Washougal and Grays River hatcheries. This study differs from other density studies in that loadings are being calculated on inflow rather than pond volume because production at WDF facilities is limited by water quantity rather than pond space. Preliminary information should become available in FY 1986.

The second study involved investigating methods of reducing the incidence of coagulated yolk disease in chinook salmon at Grays River and Elokomina hatcheries. Coagulated yolk or white spot disease has historically been the source of high mortalities in both alevin and fry at several Columbia River hatcheries. Work conducted since 1979 indicates that fish incubated in artificial substrate show improved survival. The FY 1984 study investigated water quality parameters and adult spawning time at Grays River Hatchery. Results indicated water quality at the hatcheries and adult spawning time were unrelated to mortality.

The third investigation incorporated a time of release study for fall chinook at Washougal hatchery. This was the second of four years fall chinook are to be marked to determine if fall releases will increase survival without suffering unacceptable losses while rearing through the summer. Historical survival rates at Washougal hatchery have averaged 0.7 percent for fall chinook released in May at 90-100 per pound. However, one group released in November 1974 at 8 fish per pound survived at 4.88 percent. The WDF is testing the fall time of release strategy by releasing approximately 100,000 coded-wire tagged fish in June, September, October, and November. Preliminary information should become available in FY 1988.

Washington Department of Game (WDG)

The WDG continued their steelhead study on the Kalama River. This will be the last year of field activities for the study. A final report will be due at the end of FY 1985 which will summarize all data collected. A successful method has been developed under this investigation which utilizes 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 native fish in the Kalama River system. By examining genotypes of wild steelhead in the Kalama River, 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.

Idaho Department of Fish and Game (IDFG)

Idaho conducted two ongoing studies this year. The first is titled Clearwater River Development of Spring Chinook and Steelhead Stocks. The objective is to restore the Clearwater drainage chinook and steelhead runs to self-sustaining and fishable populations. This program has been in existence since 1961. The old Washington Water Power Dam located near Lewiston, Idaho was a primary factor in the depressed runs and in 1972 this dam was removed. Adult fish are collected, eggs taken, and eyed eggs and smolts planted in hatching channels or rearing ponds in the Selway and South Fork Clearwater rivers.

The second investigation involves attempting to bolster the remnant population of sockeye salmon returning to several lakes in the upper Salmon River drainage with stocks obtained from Fulton River, British Columbia. Historically, Idaho's Salmon River drainage had large runs of sockeye. The Payette River system alone had a run in excess of 100,000 fish and Redfish Lake was named for its sockeye runs. Sunbeam Dam on the Salmon River and Black Canyon Dam on the Payette River blocked these runs during the early 1900's. Sunbeam Dam was later removed but was in place long enough to reduce the sockeye runs to a few pair since that time. Beginning in 1980, sockeye eggs have been obtained from the Government of Canada, transported to Idaho for rearing, and

released. A total of 147,000 and 63,000 fingerlings were released this year into Stanley and Alturas lakes, respectively.

Oregon Department of Fish and Wildlife (ODFW)

The ODFW has experimented with different diets in recent years. This season, Sandy Hatchery and Wahkeena Pond coho salmon were fed a closed formula dry diet. Preliminary results indicated problems with getting the fish to accept the diet. ODFW also conducted unannounced quality control inspections of the feed manufacturing plant. Ingredients were sampled, formulations checked, conditions examined, and samples taken to ensure feed quality is maintained.

The ODFW is continuing work on a final report of the Columbia River coho salmon time of release experiment. In that study, yearling coho salmon were released in early May, June, and July of 1979, 1980, and 1981. Preliminary results have been reported (Westgate 1979, 1980, 1981, 1982, 1983). Those results indicated a substantial increase in adult coho salmon survival occurred when yearlings were released in June and July as compared to May each year the study was conducted.

Work progressed on the implementation of juvenile salmonid population rearing levels at hatcheries. The goal is to formulate rearing programs specific to the species and rearing conditions found at each hatchery. Water flow, temperature, and fish size are major factors that limit allowable loads of rearing ponds. During FY 1984, daily water temperatures from all Columbia river hatcheries for recent years was compiled and computerized. These data will be integrated with measurements of available water flows and fish growth regimes to establish maximum population levels at various life stages. On that basis, an evaluation for juvenile coho salmon at Cascade Hatchery resulted in pond loadings that would be considerably below those that have recently been reared.

U.S. Fish and Wildlife Service (USFWS)

The USFWS continued studies to evaluate the effect of density on fish

survival at Carson NFH (spring chinook) and Willard NFH (coho salmon). Two broods of coded-wire-tagged coho (1981 and 1982) have been released in 1983 and 1984. The first brood of marked spring chinook was released in 1984 and three more years of marking are planned. The study design includes use of two variables, the number of fish per raceway, and the amount of water flow per raceway. Juvenile spring chinook at Carson NFH had significantly higher mortalities due to bacterial kidney disease in raceways with the lowest water inflows. Tag recoveries for spring chinook will not be available until 1986 or 1987.

In 1984, 1,050 coded-wire-tagged 3-year-old 1981-brood coho from density and loading studies at Willard NFH returned from the sea and were recovered at the Little White Salmon NFH rack. A summary of the returns by pond loading treatment is shown in Table 7. Preliminary analyses of this data indicate that rate of water flow into raceways had no effect on return of adults to the hatchery. This may be a reflection of the cold year-around water temperatures at Willard NFH and a resulting low metabolic rate in fish reared in all pond loading treatments. There were differences, however, among the density treatments (number of fish reared per raceway). A significant inverse relationship was found between increased rearing density and the rate (percent) of adult return. However, expanded total fish contributions were significantly higher from raceways in which fish were reared at the highest densities. In comparing the highest with the lowest density treatments, rate of return decreased by 25 percent but total adult contribution increased by 221 percent.

Blood chemistry was also monitored for the density study. The USFWS, Oregon Cooperative Fishery Research Unit, Oregon State University, did the measurements. Such factors as fish size, plasma hormone profiles, corticosteroid dynamics, immunological competence, histology, and water quality parameters were investigated. For coho, the results have shown that raceway density and/or water inflow rate can affect the physiological status of the fish, and seawater adaptability may also be affected.

Table 7. -- Hatchery Returns of Three-Year-Old Coho Salmon From Raceway
Density and Loading Studies at Willard NFH a/

Water Inflow	Number of Fish per Raceway			Overall Mean <u>h/</u>
	25,000	50,000	75,000	
<u>200 gpm</u>				
Percent Return	0.286	0.284	0.242	0.271
No. Contributed <u>b/</u>	133	272	334	246
<u>400 gpm</u>				
Percent Return	0.262	0.256	0.189	0.236
No. Contributed	122	239	266	209
<u>600 gpm</u>				
Percent Return	0.341	0.236	0.227	0.268
No. Contributed	158	223	317	233
<u>Overall Mean</u>				
Percent Return	0.296 <u>c/</u>	0.259 <u>cd/</u>	0.219 <u>d/</u>	
No. Contributed	138 <u>e/</u>	245 <u>f/</u>	306 <u>g/</u>	

a/ Each cell value represents the mean of paired ponds.

b/ Estimated contribution = (no. tagged fish returned from each treatment/no. of tagged fish released in each treatment) (total no. of fish released in each treatment).

cd/ Column means for percent return with different superscripts are significantly different.

efg/ Column means for contribution are significantly different.

h/ Row means for percent return and contribution are not significantly different.

STREAM IMPROVEMENTS

A major emphasis in the early years of the program to increase the abundance of salmonids was the construction of fishways and the removal or modification of both natural and man-made barriers affecting fish migration. These activities were authorized and directed by Section 2 of the amended Mitchell Act. To date, approximately two thousand miles of prime rearing and spawning habitat formerly inaccessible to returning adult fish have been opened up. Current stream clearance work consists primarily of yearly surveys by state fish and wildlife departments. These surveys detect and allow removal of obstructions before they cause major fish passage problems. In addition, fish ladders are maintained to assure proper operation.

The three state agencies, ODFW, WDF, and IDFG, currently operate 31 fish ladders or fish ladder complexes in the basin. The ODFW, WDF, and IDFG operate 15, 14, and 2 ladders, respectively (Table 8). In addition Oregon has rock cut fish passes that require no formal operation but only periodic inspection. The WDF also operates several informal ladders in the lower Columbia River tributaries. The size and complexity of fishways and ladders vary from simple rock cut passes a few feet in height to the large and complex Willamette Falls fish ladder which opened up the entire Willamette River above Oregon City to anadromous salmonids.

IRRIGATION SCREENS

The CRFDP involvement in screening irrigation diversions began in the early to mid-1950's. The initial task in developing a screen program was to identify and describe the need for one. To define the problem, the CRFDP initiated watershed surveys of the mid-Columbia and Snake rivers and their tributaries in the 1950's. The resulting sub-basin reports located and enumerated most unscreened irrigation diversions in the target watersheds. The reports described serious problems needing corrective action. Construction began in the mid-1950's and has continued to some extent into the 1980's.

Table 8. -Fish Ladders or Ladder Complexes Operated Under the Columbia River Fishery Development Program.

<u>Agency</u>	<u>Ladder</u>	<u>Location</u>
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.

Since the CRFDP began, over 600 screens have been constructed in Oregon, Idaho, and Washington. Oregon and Idaho have constructed 400+ and 236 screens respectively. Due to variations in the number of diversions used each year, Oregon and Idaho operate approximately 380 and 200 screens, respectively. Washington currently operates 16 screens with program funding.

Due to varying ditch sizes, orientations, and capacities, the screens can vary from simple fixed plate to multi-drum screens (Figures 12 and 13). Oregon and Washington operate primarily drum screens. Idaho originally installed perforated plate wiper blade screens but are in the process of converting to drum screens. They have the manpower to convert 4-5 screens to drums per year.

A typical irrigation diversion consists of a temporary rock-log wing dam extending upstream and across the river, although permanent concrete structures requiring adult fish passage facilities are also used. The angle at which the diversion leaves the river can vary from a few degrees to 90 degrees. The diverted water in many cases passes through a headgate structure used to regulate flow. The water and fish move down the canal, through a trash rack and water passes through the screen; the fish are deflected by the screen into a bypass pipe which transports them back to the river downstream of the wing dam. Diversion flows range in size from less than one cubic feet per second (cfs) to well over 100 cfs. In general, Oregon has much smaller diversions than Idaho or Washington. In some cases, diversions totally dewater a stream, causing migration problems to both juvenile and adult migrants. Without adequate screening and bypass facilities, juvenile fish would end up in ranchers' fields or be left stranded in the irrigation canal at the end of the season.

Over 600 diversions in the basin have been screened with CRFDP funds. There remain significant numbers of ditches unscreened in certain watersheds. The Walla Walla River in Oregon may have over 30 unscreened diversions. The Imnaha, Wallowa, Grande Ronde, and Umatilla rivers, all in Oregon, have unscreened ditches. Recognizing a potential problem, the CRFDP is sponsoring an ODFW study to identify all irrigation screen problems and requirements for correction in northeastern Oregon in 1985. There also remain several unscreened diversions in the Sawtooth National Recreation Area on the upper Salmon River in

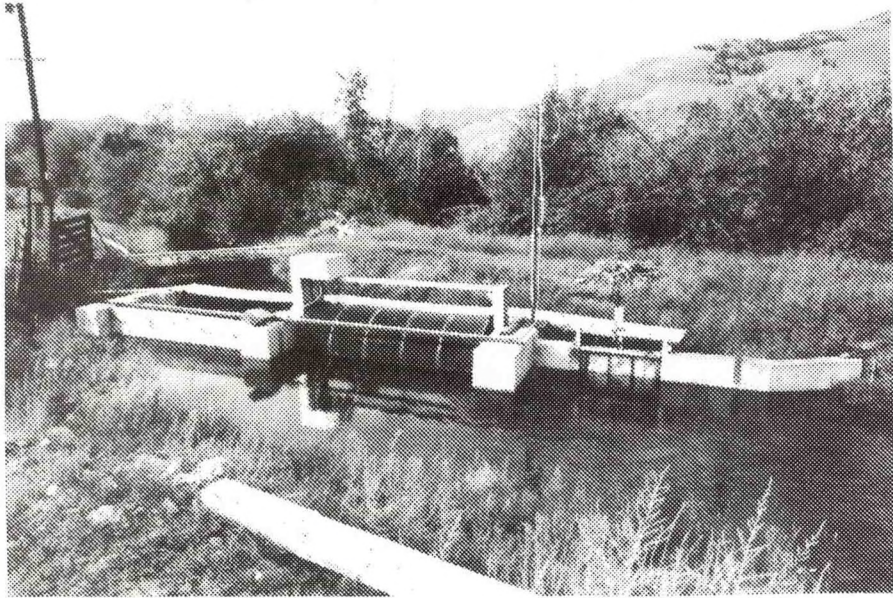


Figure 12. -- Typical electrically powered drum screen found in Idaho.

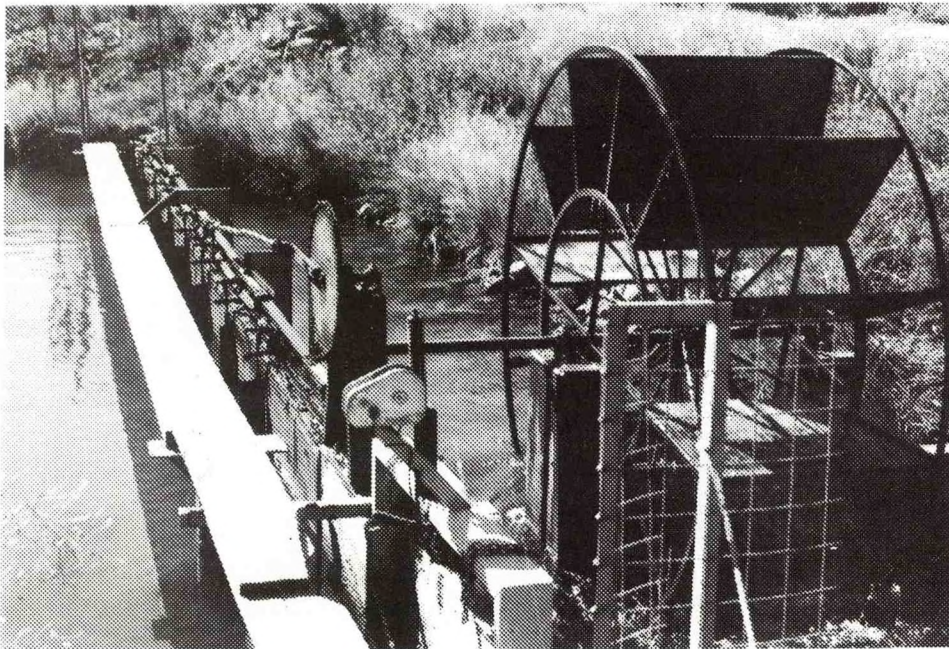


Figure 13. -- Typical paddle wheel-driven fixed-plate wiper blade screen found in Idaho.

Idaho. The Idaho diversions have been identified and will be screened in the future. To obtain additional information concerning the screen program, refer to Delarm et al. (1985).

OPERATIONS BRANCH

Early in 1984 the ETSD was reorganized (Figure 3). Prior to that time the ETSD was divided into three branches; the CRFDP, the Fish Facilities Branch (engineering), and the Environmental Assessment Branch. The ETSD was reorganized into two branches - Operations and Habitat Conservation. The CRFDP continues to be managed by the ETSD.

Fall Chinook Hatchery Evaluation

The Bonneville Power Administration (BPA) began funding an 8-year study in 1979 to determine distribution, contribution, and value of fall chinook salmon reared at Columbia River hatcheries. FY 1984 was the sixth year of the study. Information from this tagging study will provide data to determine the effectiveness of hatcheries constructed as mitigation for hydroelectric developments. In addition, these 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, alterations in sport and commercial fisheries have occurred, and hatchery practices have changed.

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.

The desired goal to achieve objective 1 was to tag a constant percentage of fish at each rearing facility. A goal of tagging at least 150,000 fish at each facility was set to achieve objective 2. Attempts were made to meet both goals at each hatchery. This required additional tag codes at some hatcheries because the number of fish tagged for the constant percentage was insufficient to meet the 150,000 goal.

Nearly 14 million tagged fall chinook were released from the participating facilities during the four brood years. Releases were 4,035,100, 2,864,700, 3,466,400, and 3,475,500 for the 1978-through-1981 brood years, respectively. The percentage of the releases tagged each year was 4.4, 3.5, 3.9, and 4.1 for the four broods, respectively. Total yearly releases ranged from 81 million to 92 million from the participating facilities.

Sport and commercial fisheries from Alaska through California are being sampled for wire-tagged salmonids (Figure 14). Recoveries of the 1978 brood began in 1980. Fishery recoveries of the 1981 brood will not be complete until 1986.

Final estimated catch data are not yet available for any complete brood of fall chinook marked for this study. Values are available through 1982 for British Columbia, Washington, Oregon, and Columbia River fisheries. Fall chinook from Columbia River hatcheries are predominantly recovered in these fisheries. Appendix Tables 15 and 16 show tagged releases and tag recovery statistics for the 1978 and 1979 broods. For more indepth information, see Vreeland (1985).

Transport Operations on the Snake and Columbia Rivers - 1984

The Fish Transportation Oversight Team (FTOT) continued to manage the transport program and provided coordination between Walla Walla District, Corps of Engineers (NPW), fishery agencies, and tribes. The FTOT is composed of biologists from the National Marine Fisheries Service (NMFS), Idaho Department of Fish and Game (IDFG), Columbia River Inter-Tribal Fish Commission (CRITFC),

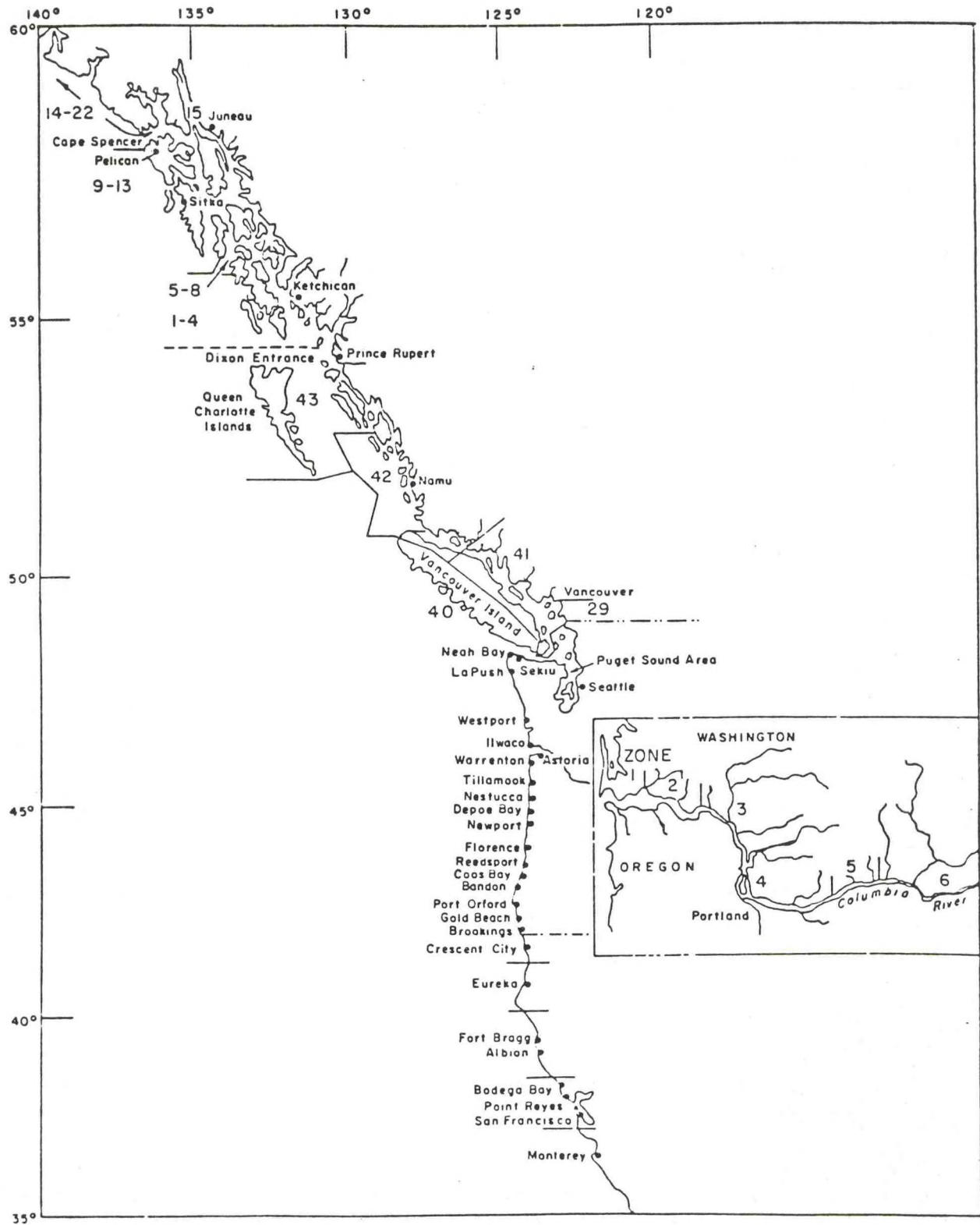


Figure 14. Ports and zones sampled for tagged fall chinook of Columbia River origin.

and NPW. The IDFG member was chairman for the team. Line of authority and responsibilities for transporting salmonids is given in Figure 15.

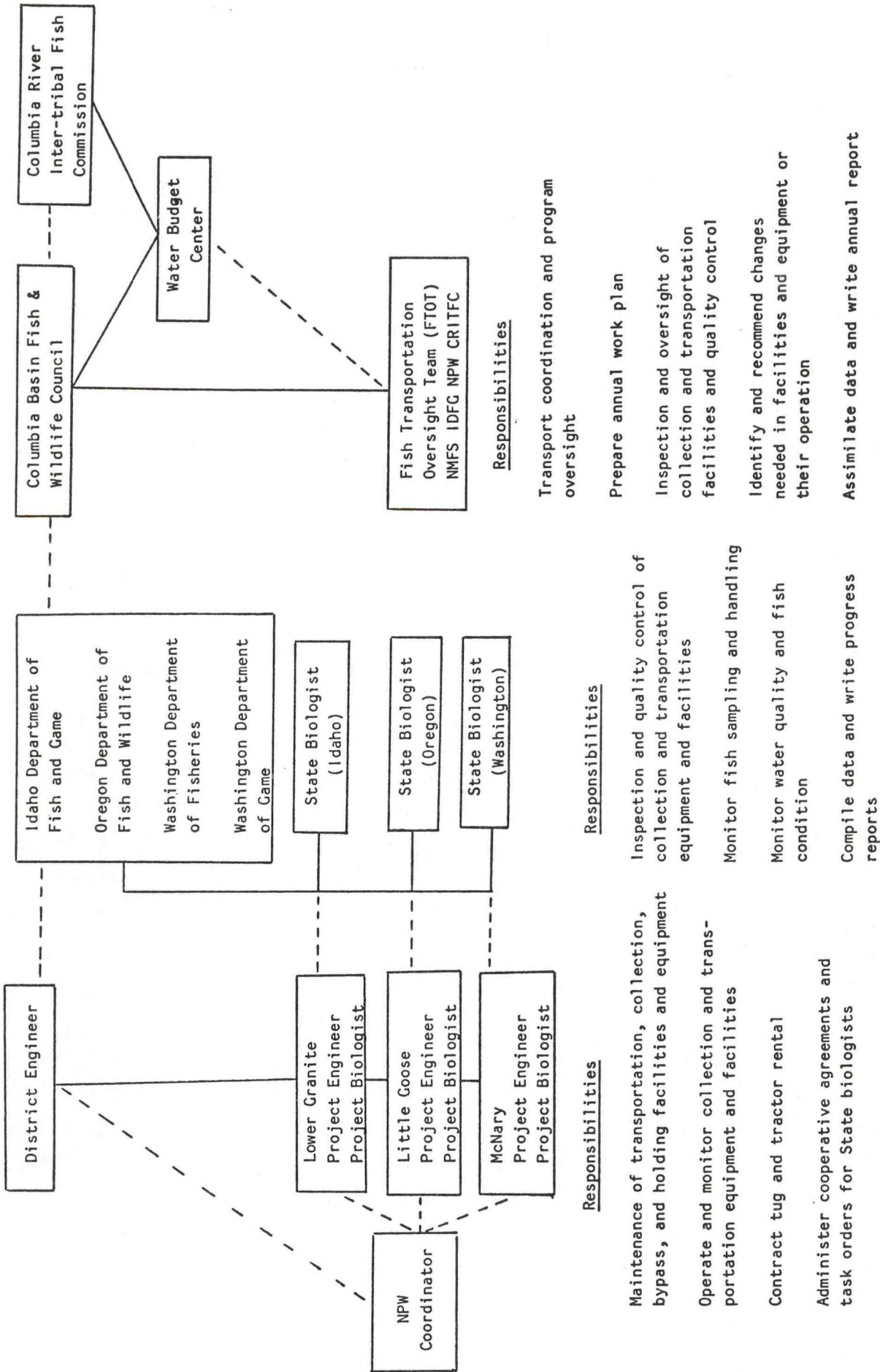
The FTOT's goal is to maximize survival of Snake and Columbia River salmonids by improving collection, transport, and bypass conditions for juvenile migrants. Responsibilities include providing coordination; biological and program oversight, developing an annual work plan; conducting on-site inspections of collection and transport facilities prior to, during, and after the season; and producing an annual report summarizing transport activities. A meeting is hosted by FTOT each summer for program participants and other interested individuals to discuss current season's operation and recommend program and facility modifications for the following year.

Additional biological oversight is provided by cooperative agreements between NPW and the States of Idaho, Oregon, and Washington. Under these cooperative agreements NPW funds State fishery biologists at each transport project. Idaho's representatives were assigned to Lower Granite, Oregon's to Little Goose, and Washington's to McNary. Work loads were shared by NPW's project biologists and State biologists.

Juvenile salmonids were collected and transported from the Snake River at Lower Granite (River Mile (RM) 107.5) and Little Goose (RM 70.3) dams, and from the Columbia River at McNary Dam (RM 292). The Snake River, a major tributary of the Columbia River, joins at RM 324.3. Collected smolts were transported below Bonneville Dam (RM 146.1) via truck or barge and released into the river. Transported smolts bypass 4 to 8 dams and 145 to 280 miles of impounded river (Figure 16).

The 1984 transport season commenced April 1 and ended on September 28. A total of 11,033,317 smolts were collected including 2,052,119 at Lower Granite, 2,737,422 at Little Goose, and 6,243,776 at McNary. Total collection included 1,504,941 and 445,922 smolts bypassed at McNary and Little Goose, respectively. Bypass operations began the first day of operation and ended on May 2 and May 29 at Little Goose and McNary, respectively.

Figure 15. Line of authority and responsibilities for trapping and transportation of juvenile salmon and steelhead trout from collection points at Lower Granite, Little Goose, and McNary Lock and Dam projects to release sites below Bonneville Lock and Dam. Dotted line denotes line of communication and solid line is supervision.



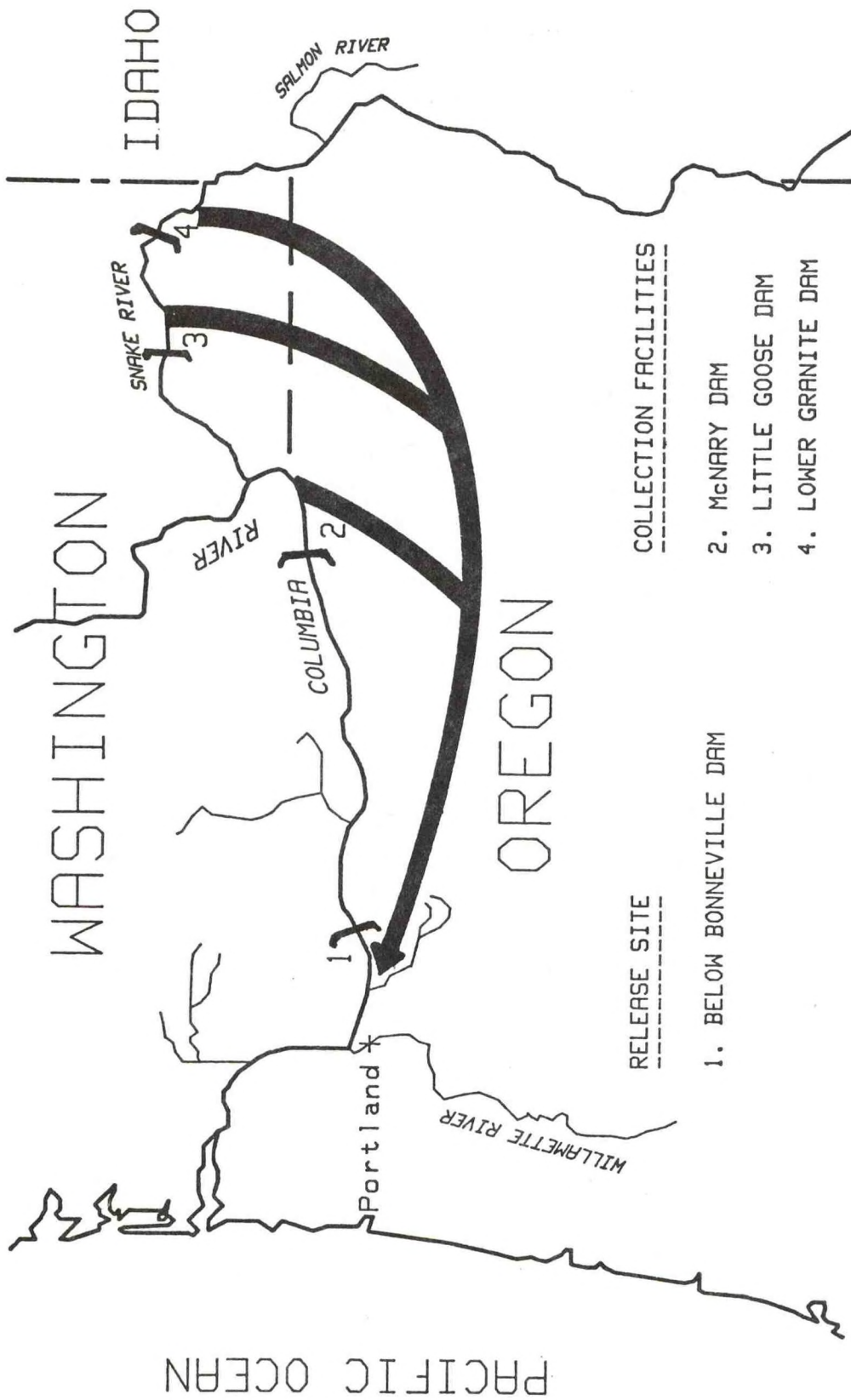


Figure 16 --- LOCATIONS OF FISH COLLECTION FACILITIES, TRANSPORTATION ROUTE, AND RELEASE SITE.

Table 9. -- 1984 Juvenile Fish Transport Summary and Dates of Operation.

	Trucked	Barged	Total
<u>Lower Granite</u>			
April 1-July 26			
Yearling chinook	97,807	726,657	824,464
Subyearling chinook	37,823	59,102	96,925
Steelhead	39,157	1,074,518	1,113,675
Sockeye	2,713	7,987	10,700
Coho	<u>43</u>	<u>213</u>	<u>256</u>
TOTAL	177,543	1,868,477	2,046,020
<u>Little Goose</u>			
April 5-July 28			
Yearling chinook	104,730	383,769	488,499
Subyearling chinook	73,446	84,150	157,596
Steelhead	55,506	1,562,043	1,617,549
Sockeye	2,133	8,530	10,663
Coho	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL	235,815	2,038,492	2,274,307
<u>McNary</u>			
April 16-September 28			
Yearling chinook	28,599	263,973	292,572
Subyearling chinook	552,163	3,357,820	3,909,983
Steelhead	30,194	336,453	366,647
Sockeye	4,243	95,085	99,328
Coho	1,469	38,633	40,102
TOTAL	<u>616,668</u>	<u>4,091,964</u>	<u>4,708,632</u>
Grand Total	1,030,026	7,998,933	9,028,959

Table 10. -- Summary by dam of all juvenile fish transported from 1978 through 1984.

	<u>Lower Granite</u>	<u>Little Goose</u>	<u>McNary</u>	<u>Total</u>
1978	1,980,600	996,285	82,211	3,059,906
1979	2,367,446	1,453,615	1,247,120	5,068,181
1980	3,830,747	2,282,987	1,740,545	7,854,279
1981	2,730,866	1,464,991	4,112,993	8,308,850
1982	1,851,616	1,234,110	3,003,853	6,089,579
1983	2,368,049	868,937	4,326,013	7,562,999
1984	2,046,020	2,274,307	4,708,632	9,028,959

Table 11. -- Transport summary of total juvenile fish trucked or barged from Lower Granite, Little Goose, and McNary Dams from 1978 through 1984.

	<u>Trucked</u>	<u>Barged</u>	<u>Total</u>
1978	1,580,724	1,478,372	3,059,096
1979	2,031,212	3,036,969	5,068,181
1980	3,019,232	4,835,047	7,854,279
1981	3,145,980	5,162,860	8,308,850
1982	2,152,901	3,936,678	6,089,579
1983	2,780,487	4,782,512	7,562,999
1984	1,030,026	7,998,933	9,028,959

A total of 9,028,959 juvenile salmonids were transported to below Bonneville, with Lower Granite accounting for 2,0456,020, Little Goose 2,274,307, and McNary 4,708,632 (Table 9). Barge transport accounted for 7,998,933 and trucking for 1,030,026. Tables 10 and 11 compare number of fish transported for the years 1979 through 1984. For an indepth description of the 1984 transport operations, see Koski et al. (1985).

Bioengineering Group

The Bioengineering Group of the Operations Branch 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 spawning and rearing areas. Effort is also directed toward providing effective hatchery facilities for salmon and steelhead production.

The Bioengineering Group 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 Bioengineering Group 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, U.S. Fish and Wildlife Service, and Federal Energy Regulatory Commission; private and public power companies; and various state fishery agencies. Activities of the Bioengineering Group 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 the Bioengineering Group has been involved with have remained quite similar over many years. New hydroelectric 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 1984, the Bioengineering Group continued to participate in planning, design and operation of fish passage facilities at all nine lower and mid-Columbia River dams, the four lower Snake River dams, and numerous smaller tributary dams in the Columbia Basin and other Northwest Region river basins.

The design of juvenile passage facilities for Little Goose Dam powerhouse and John Day Dam powerhouse continued in 1984. These facilities, structurally designed by the Corps, incorporate functional design criteria provided by fisheries agencies through a subcommittee on fish passage. The Bioengineering Group plays a prominent role on these types of committees.

The Bioengineering Group 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 Bioengineering 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. The Bioengineering Group is providing agency input to the design of the adult collection facility and the juvenile bypass and collection facility.

The numerous smaller hydroelectric projects provide a large segment of the Bioengineering Group's workload. The engineers participated in the planning and design of fish passage and protective facilities for 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 Group provides engineering review of hatchery facilities to be constructed under the CRFDP. This requires working with hatchery operating agencies' designers.

The Group receives several requests each year for assistance from agencies outside of the Northwest Region. In 1984, significant amounts of time were spent on review of fish passage plans at several dams in Michigan and Indiana. The Bioengineering Group's assistance on all of these projects was requested by

the U. S. Fish and Wildlife Service. A more complete list of FY 1984 activities is included as Appendix 17.

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 being developed and changes already incorporated, such as reduced holding and transportation densities, should further improve the transportation process. When flows such as recommended by Section 4(h) of the Northwest Power Act are implemented, fish will be moved through the reservoirs with less delay than in the past. Fish survival will be improved as the bypass systems and stream flows are perfected.

LITERATURE CITED

- Delarm, Michael R. and Einar Wold, June 1985. Columbia River Fisheries Development Program, Screening of Irrigation Diversions. NOAA Technical Memorandum NMFS F/NWR-12.
- Koski, Charles H., Stephen W. Pettit, James B. Athearn, and Alex L. Heindl. February 1985. Fish Transportation Oversight Team Annual Report - FY 1984. Transport Operations on the Snake and Columbia Rivers. NOAA Technical Memorandum NMFS F/NWR-11. 78 p.
- Vreeland, Robert R. February 1985. Evaluation of the Contribution of Chinook Salmon Reared at Columbia River Hatcheries to the Pacific Salmon Fisheries, Annual Report FY 1984. To the Bonneville Power Administration. Contract No. DE-AI79-84BP39638.
- Westgate, J.W., A.R. Hemmingsen, and J.F. Conrad. 1979. Hatchery Biology - Columbia River Fishery Development Program. Federal Aid Progress Report. Oregon Department of Fish and Wildlife, Fish Division. 18 p.
- Westgate, J.W., A.R. Hemmingsen, and J.F. Conrad. 1980. Hatchery Biology - Columbia River Fishery Development Program. Federal Aid Progress Report. Oregon Department of Fish and Wildlife, Fish Division. 32 p.
- Westgate, J.W., A.R. Hemmingsen, and J.F. Conrad. 1981. Hatchery Biology - Columbia River Fishery Development Program. Federal Aid Progress Report. Oregon Department of Fish and Wildlife, Fish Division. 43 p.
- Westgate, J.W., A.R. Hemmingsen, and R.A. Holt. 1982. Hatchery Biology - Columbia River Fishery Development Program. Federal Aid Progress Report. Oregon Department of Fish and Wildlife, Fish Division. 29 p.
- Westgate, J.W., A.R. Hemmingsen, and R.A. Holt. 1983. Hatchery Biology - Columbia River Fishery Development Program. Federal Aid Progress Report. Oregon Department of Fish and Wildlife, Fish Division. 33 p.

Mitchell Act

To provide for the conservation of the fishery resources of the Columbia River, establishment, operation, and maintenance of one or more stations in Oregon, Washington, and Idaho, and for the conduct of necessary investigations, surveys, stream improvements, and stocking operations for these purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is authorized and directed to establish one or more salmon-cultural stations in the Columbia River Basin in each of the States of Oregon, Washington, and Idaho. Any sums appropriated for the purpose of establishment such stations may be expended, and such stations shall be established, operated, and maintained, in accordance with the provisions of the Act entitled "An Act to provide for a five-year construction and maintenance program for the United States Bureau of Fisheries", approved May 21, 1930, insofar as the provisions of such Act are not inconsistent with the provisions of this Act.

Sec. 2. The Secretary of the Interior is further authorized and directed (1) to conduct such investigations, and such engineering and biological surveys and experiments, as may be necessary to direct and facilitate conservation of the fishery resources of the Columbia River and its tributaries; (2) to construct and install devices in the Columbia River Basin for the improvement of feeding and spawning conditions for fish, for the protection of migratory fish from irrigation projects, and for facilitating free migration of fish over obstructions; and (3) to perform all other activities necessary for the conservation of fish in the Columbia River Basin in accordance with law.

Sec. 3. In carrying out the authorizations and duties imposed by section 2 of this Act, the Secretary of the Interior is authorized to utilize the facilities and services of the agencies of the States of Oregon, Washington, and Idaho responsible for the conservation of the fish and wildlife resources in such States, under the terms of agreements entered into between the United States and these States, without regard to the provisions of section 3709 of the Revised Statutes, and funds appropriated to carry out the purposes of this Act may be expended for the construction of facilities on and the improvement of lands not owned or controlled by the United States: Provided, That the appropriate agency of the State wherein such construction or improvement is to be carried on first shall have obtained without cost to the United States the necessary title to, interest therein, right-of-way over, or licenses covering the use of such lands.

Approved May 11, 1938, amended August 8, 1946
(52 Stat. 345) (60 Stat. 932)

Appendix 2. -- List of Selected Publications by the Environmental and
Technical Services Division Staff

TITLE

YEAR

A Hist. & Desc. Acct. of Pac. Coast Anad. Salmon. Rearing/Releases 1960-76
1979

A Production Economic Analysis of the Little White Salmon and Willard NFH
1976

Adult Coho Salmon Recoveries and Their Na⁺ -K⁺ ATPase Activity at Release
1982

Areal Distrib. of Marked Col. R. Sp. Chinook Recovered in Fish. & at Parent Hat.
1981

Bioeconomic Contrib. of Col. R. Hatchery Coho, 1965/1966 Broods
1973

Bioeconomic Contrib. of Col. R. Hatchery F. Chinook, 1961-1964 Broods
1977

Columbia River Fisheries Development Annual Report-F.Y. 1981
1982

Columbia River Fisheries Development Program
1981

Columbia River Fisheries Development Program Annual Report-F.Y. 1980
1981

Columbia River Fisheries Development Program Annual Report-F.Y. 1982
1983

Columbia River Fisheries Development Program Annual Report-F.Y. 1983
1984

Columbia River Fishery Program Circular 192
1964

Contribution of Columbia River Hatcheries to Harvest of Fall Chinook Salmon
1969

Contribution of Columbia River Hatcheries to Harvest of 1962 Brood F. Chinook
1970

Contribution of Columbia River Hatcheries to Harvest of 1963 Brood F. Chinook
1970

Contribution of Columbia River Hatcheries to Harvest of 1964 Brood F. Chinook
1972

TITLE

YEAR

Contribution of 1960-63 Brood Hatchery-Reared Sockeye to Col. R. Comm. Fishery
1978

Effect of Finclipping on Survival of Sockeye Salmon
1969

Effects of Ocean Fishing on 1961-Brood F. Chin. Salmon
1969

Establishment of Nonindigenous Runs of Sp. Chinook in Wind R. Drainage 1955-63
1981

Estimated Net Econ. Benefits to Visitors of Selected Col. R. Fish Hatcheries
1978

FTOT Annual Report-FY 1981 Transport Operations on the Snake and Columbia R.
1982

FTOT Annual Report-FY 1982 Transport Operations on the Snake and Columbia Rivers
1983

FTOT Annual Report-FY 1983 Transport Operations on the Snake and Columbia Rivers
1984

Homing and Fisheries Contrib. of Marked Coho at 2 Columbia River Locations
1983

Homing Behavior & Contrib. to Col. R. Fish. of Marked Coho Released at 2 Loc.
1975

Impact of Artif. Prop. of Salmon on the Pac. Coast U.S. & Canada 1872-1979
1979

Improved Econ. Eval. of Comm. & Sport-Caught Salmon & Steelhead of the Col. R.
1976

Making Economic Information More Useful for Salmon & Steelhead Prod. Decisions
1984

Net Economic Values for Salmon & Steelhead from the Columbia River System
1982

Partial Net Economic Values for Salmon & Steelhead for the Col. River System
1975

Proceedings of The Thirty-Third Northwest Fish Culture Workshop
1982

TITLE

YEAR

Progress Report - Spring Chinook Salmon Transplantation Study 1955-61
1963

Recent Advances in Artif. Cult. of Salmon and Steelhead Trout of the Col. R.
1969

Releases of Anad. Salmon & Trout from U.S. & Can. Pac. Coast Rear. Fac. 1960-76
1981

Releases of Anadromous Salmon and Trout from Pac. Coast Rearing Fac. 1960-1973
1975

Subject & Author Index-Proceedings of the NW Fish Culture Conferences/Workshops
1982

Appendix 3 -- A brief description and history of Oregon Department of Fish and Wildlife Salmonid Rearing Facilities Funded by the Columbia River Fisheries Development Program.

Big Creek Hatchery

Route 4, Box 594

Astoria, Oregon 97103

Dave Rieben, Manager - Telephone (503) 458-6512

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	49,335	740,000
Fall Chinook	71,250	5,800,000
Steelhead	15,000	90,000
Sea Run Cutthroat	3,335	10,000

History

Big Creek Hatchery is located near Knappa, Oregon, approximately 20 miles upstream from Astoria.

Big Creek Hatchery is one of the four Oregon hatcheries that were remodeled and enlarged under the Columbia River Fishery Development Program. The refurbishing took place in 1957 at a cost of \$437,000.

The hatchery was remodeled to rear fall chinook and coho salmon. NMFS pays the main operation and maintenance costs. However, the Bureau of Reclamation contributes approximately \$20,600 each year for coho production in addition to the above.

Bonneville Hatchery

P.O. Box 262

Bonneville, Oregon 97008

Trent Stickle, Manager - Telephone (503) 374-8393

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	133,335	1,000,000
Fall Chinook	87,500	7,000,000

History

Bonneville Hatchery is located downstream from Bonneville Dam.

The hatchery was remodeled and enlarged in 1957 at a cost of \$413,000. Prior to the enlargement, the hatchery was operated solely by the State of Oregon. In 1974 the station was once more enlarged by the Corps of Engineers to mitigate fish losses occasioned by construction of John Day Dam.

Total facilities now include 8 residences and 58 rearing ponds. Under present arrangements, the Corps finances 45 percent of the operations costs and the NMFS funds the remaining 55 percent.

The hatchery receives its rearing water from three sources: Tanner Creek, Mitchell Creek, and a series of wells that were drilled by the Corps of Engineers. The station presently rears coho and up-river bright and "tule" fall chinook salmon.

Cascade Hatchery

Star Route, Box 526
Bonneville, Oregon 97008

Wayne Stedronsky, Manager - Telephone (503) 374-8381

Expected Releases in 1985

<u>Species</u>	<u>Pounds</u>	<u>Numbers</u>
Coho	94,444	1,700,000

History

Cascade Salmon Hatchery is located on the Oregon shore approximately 1 mile upstream from Bonneville Dam.

The hatchery was constructed by the Federal Government in 1959 with funds provided by the Columbia River Fishery Development Program at a cost of \$683,000. The hatchery was constructed on U.S. Forest Service land under a Forest Service use permit.

The station has a gravity flow water supply from Eagle Creek.

The station was originally built with two residences and in 1963 a third one was added at a cost of \$30,000. Cascade Hatchery rears principally coho in 30 ponds and a 16' x 80' raceway.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Oregon Department of Fish and Wildlife.

Clackamas Hatchery
24500 S. Entrance Road
Estacada, Oregon 97023

Dick Harrison, Manager - Telephone (503) 630-7210

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Spring Chinook	37,500	300,000

History

Clackamas Hatchery was constructed in 1976 and is located near Estacada, Oregon. It is presently funded by three organizations. The Portland General Electric Company provides 25 percent of O&M funding for the production of 25,000 pounds of spring chinook for partial mitigation for its projects on the Clackamas River. The Oregon Department of Fish and Wildlife and NMFS share in the remainder of the funding obligations.

Gnat Creek Hatchery

Route 2, Box 2198

Clatskanie, Oregon 97016

R. L. Warren, Manager - Telephone (503) 455-2234

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Steelhead	107,500	645,000

History

Gnat Creek Hatchery is located near the town of Westport, Oregon, approximately 22 miles upstream from Astoria.

The station was constructed in 1960 under the Columbia River Fishery Development Program at a cost of \$566,000. It was constructed to rear steelhead trout, but since the merging of Oregon Fish and Game Commissions, some salmon have been included in its program.

The hatchery has four residences and fifteen large rearing ponds, 16' x 100'.

The station has two water sources, Gnat Creek and an artesian well.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Oregon Department of Fish and Wildlife.

The Trojan ponds are operated as a satellite installation to Gnat Creek Hatchery and are used primarily as acclimation ponds.

Klaskanine Hatchery

Route 2, Box 764

Astoria, Oregon 97103

Quentin Smith, Manager - Telephone (503) 325-3653

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	82,350	1,400,000
Fall Chinook	50,000	4,000,000
Steelhead	10,800	65,000

History

Klaskanine Hatchery is located about 8 miles southeast of Astoria.

The hatchery was enlarged in 1959 under the Columbia River Fishery Development Program at a cost of \$511,000. The original hatchery was operated by the Oregon Fish Commission.

The outside rearing facilities consist of sixteen 20' x 80' raceways, five concrete series raceways, and a 1½-acre rearing pond. The hatchery was originally constructed to rear steelhead and coho salmon but in recent years fall chinook have been added to the program. Very few fall chinook are able to return to the hatchery as at the time of entrance into the Klaskanine River, the water is too low for easy migration upstream.

The water supply for the hatchery comes from 3 intakes located on the North Fork of the Klaskanine and the Little North North Fork.

There are currently five residences at the hatchery.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Oregon Department of Fish and Wildlife.

Oxbow Hatchery

Star Route, Box 750
Cascade Locks, Oregon 97014
John Isley
Manager - Telephone 374-8540

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	130,770	1,700,000

History

Oxbow Hatchery is located 1 mile east of Cascade Locks.

The hatchery was remodeled with Columbia River Fishery Development Program funds in 1952 at a cost of \$310,000. It is relatively a small station with four residences and twelve ponds operating in tandem, utilizing a spring water supply. The spring water runs approximately 45° and the station is used to start fish for both Bonneville and Cascade whose water temperatures sometimes are lower.

In 1977, two large rearing ponds were constructed under the Columbia River Fishery Development Program utilizing Herman Creek water at a cost of \$300,000.

Wahkeena Pond is located on the Columbia River, twenty miles east of Portland near Multnomah Falls. It was constructed in 1963 under the Columbia River Fishery Development Program at a cost of \$51,000. The pond is presently being operated as a satellite facility to Oxbow Hatchery.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Oregon Department of Fish and Wildlife.

Sandy Hatchery

39800 S.E. Fish Hatchery Road
Sandy, Oregon 97055

Dick Whitlatch, Manager - Telephone (503) 668-4222

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Reared Annually</u>
Coho	55,555	1,000,000

History

The Sandy River Hatchery is located approximately two miles northeast of the town of Sandy on Cedar Creek, a tributary to the Sandy River.

The station was constructed in 1959 under the Columbia River Fishery Development Program at a cost of \$333,000. It has twenty circulating ponds and four residences. The upstairs of the hatchery building has been converted into a laboratory and the Oregon Department of Fish and Wildlife utilize this space as a nutrition research station.

The water supply for the station comes from Cedar Creek and its quantity in the summer at times is critical. Sandy Hatchery is primarily a coho station. However, it has intermittently reared some fall chinook.

The O&M is funded totally by NMFS under a Cooperative Agreement with Oregon Department of Fish and Wildlife.

Appendix 3 (continued)

Aumsville/Stayton Pond
43182 North River Drive
Sweethome, Oregon 97386

Gene Middaugh, Manager - Telephone (503) 367-3437

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Reared Annually</u>
Fall chinook	87,500	7,000,000

History

The Aumsville Pond was developed to provide a rearing facility for the Willamette River fall chinook program.

The O&M is funded totally by NMFS under a Cooperative Agreement with Oregon Department of Fish and Wildlife.

Appendix 4 -- A brief description of Washington Department of Game
Salmonid Rearing Facilities funded by the Columbia River Fisheries
Development Program.

Beaver Creek Hatchery

28 Beaver Creek Road
Cathlamet, Washington 98612

Stanley Woody, Manager - Telephone 206-795-3620

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Steelhead	80,000	457,000
Cutthroat	9,000	33,000

History

Beaver Creek Hatchery is located on the Elokomina River approximately 2 miles from its confluence with the Columbia River at Cathlamet, Washington. It is primarily a winter steelhead and searun cutthroat rearing station constructed in 1958 by the Columbia River Fishery Development Program at a cost of \$663,000.

The hatchery is composed of 10-4' x 30' raceways, 20-80' x 10' raceways, 2 100' x 12' raceways, and rearing pond. The hatchery receives its water from three sources, the Elokomina River, Beaver Creek, and it also utilizes well water for incubation of eggs within the hatchery building.

There are four residences at the hatchery.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Game.

Ringold Springs Rearing Pond

Star Route, Box 188
Meda, Washington 99343

Bruce Walters, Manager - Telephone 509-269-4327

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Steelhead	25,000	146,000

History

The Ringold Springs Rearing Pond is located on the Columbia River 20 miles upstream from Pasco, Washington. It was constructed as experimental facilities in 1963 under the Columbia River Fishery Development Program at a cost of \$80,000.

The facility (5-acre pond) is operated by the Washington Department of Game. There is one residence at the facility.

The pond receives water from springs that emerge from the adjacent hillside. These springs are irrigation return water that appeared following the creation of Banks Lake irrigation system.

The Ringold Springs water is not suitable for the incubation of eggs. Water temperatures are around 50 degrees the year around but even when water is chilled there is a low survival rate. The reasons for the high mortalities are attributed to phosphate introduced by fertilizers.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Game.

Skamania Hatchery

MPO 39L

Washougal, Washington 98671

Vince Janson, Manager - Telephone 206-837-3131

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Steelhead	98,000	588,000

History

The Skamania Hatchery is located on the North Fork of the Washougal River, approximately 12 miles northeast of the town of Washougal, Washington. The station rears spring summer and winter-run steelhead and was constructed in 1957 by the Columbia River Fishery Development Program at a cost of \$458,000.

The station has 32 80' x 10' raceways and 10 4' x 30' raceways. The main water supply for the station is from the North Fork of the Washougal River. The five residences receive their domestic water from a well. Because of the cold water temperatures in the winter, eggs are usually transferred from the station after stripping in January and February to the Vancouver Hatchery. The fry are returned to the station when the water is warming in June and the fish are reared to smolt size for release. There are five residences at the facility.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Game.

Appendix 5 -- A brief description and history of Washington Department of Fisheries salmonid rearing facilities funded by the Columbia River Fisheries Development Program

Elokomin Hatchery

1318 State Highway 407
Cathlamet, Washington 98612

Roy Pigott, Manager - Telephone 206-795-3608

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	106,000	1,700,000
Fall Chinook	32,000	2,500,000

History

Elokomin Hatchery is located approximately 6 miles northeast of Cathlamet, Washington, on the Elokomin River. The station was constructed in 1954 under the Columbia River Fishery Development Program at a cost of \$566,000.

In 1958 the first dirt pond was constructed at a cost of \$10,000 and in 1976 the second horseshoe-shaped dirt pond was placed in operation at a cost of \$160,000.

The hatchery has four residences with a domestic water supply from a well. The hatchery receives its water from three separate sources: Elokomin River, Clear Creek, and an un-named intermittent spring.

The hatchery has 20 concrete raceways, 20' x 80', and two large dirt rearing ponds. The station rears principally coho and fall chinook.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Grays River Hatchery

P.O. Box 768

Grays River, Washington 98621

Don Rapelje, Manager - Telephone 206-465-2446

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Fall Chinook	17,500	1,750,000
Coho	20,000	400,000

History

Grays River Hatchery is located approximately three miles northeast of the town of Grays River on the West Fork of the Grays River, about 20 miles upstream from the mouth of the Columbia River. This station was the last formal hatchery constructed under the Columbia River Fishery Development Program and was completed in 1961 at a cost of \$666,000.

It has three residences, ten formal concrete rearing ponds, 20' x 78' and one large earth rearing pond, 60' x 200'. The two adult holding ponds, 40' x 60', are also used for rearing.

The hatchery receives the majority of its water from the West Fork of the Grays River. However, some hatchery water is obtained from infiltration pump systems located on the hatchery grounds.

Weyco Pond is a 5-acre pond constructed by the Weyerhaeuser Lumber Company and is operated as a satellite rearing facility to the Grays River Hatchery. It is located on the upper watershed of Grays River. Columbia River Fishery Development Program funds are used to help pay for food.

The principal species reared in this pond has been fall chinook, as water flows and temperatures preclude the rearing of yearling coho. Washington Department of Fisheries Enhancement Program includes an additional water supply for this pond.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Kalama Falls Hatchery
Box 3900, Kalama River Road
Kalama, Washington 98625

Bob Ready, Manager - Telephone 206-673-4825

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	71,250	1,425,000
Spring Chinook	50,000	500,000
Fall Chinook	75,000	7,500,000

History

Kalama Falls Hatchery is approximately ten miles upstream from the mouth of the Kalama River. The station was constructed in 1959 at a cost of \$928,000.

The station has five residences, twelve concrete ponds, 20' x 77', and six dual-purpose adult juvenile ponds, 40' x 50'.

The station rears spring chinook, fall chinook, and coho salmon.

The station's water supply is totally by pump from the Kalama River. Standby generation is provided in case of a power failure.

Lower Kalama Hatchery is presently operated as a satellite to Kalama Falls Hatchery.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Klickitat Hatchery

Route 2, Box 90

Glenwood, Washington 98619-9607

Doug Loucks, Manager - Telephone 509-364-3310

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	87,500	1,400,000
Spring Chinook	112,500	900,000
Fall Chinook	40,000	4,000,000

History

Klickitat Hatchery is located approximately 35 miles upstream from the mouth of the Klickitat River, east of the town of Glenwood, Washington. The station was the first hatchery constructed under the Columbia River Fishery Development Program at a cost of \$650,000.

The hatchery consists of five residences, thirty 20' x 80' concrete ponds, two earthen ponds, and two lined ponds.

The Klickitat station rears fall and spring chinook and coho salmon. Some difficulty has been experienced in obtaining enough adult fish to supply the hatchery with an adequate number of eggs to fulfill rearing schedules. A major falls was laddered under the Columbia River Fishery Development Program to provide access to the hatchery. Native runs of fish in the Klickitat consisted of spring chinook and steelhead as other species were blocked by the falls. The hatchery is one of the most remote stations in the Columbia system.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Washougal Hatchery

Route 2, Box 443

Washougal, Washington 98671

Richard Johnson, Manager - Telephone 509-837-3311

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Fall Chinook	60,000	6,000,000
Coho	200,000	4,000,000

History

Washougal Hatchery is located 14 miles northeast of Washougal, Washington. The station was constructed in 1958 with funds provided by the Columbia River Fishery Development Program at a cost of \$1,025,000.

The station has four residences, 24 concrete ponds of various sizes, two dirt ponds, and one large rearing lagoon. The hatchery receives its rearing water from four separate sources: Bob's Creek, Boyles Creek, C Creek, and the Washougal River. The station uses a unique pumping system to take water from the river. It employs the Bob's Creek water with approximately 100 feet of head to drive turbine pumps with intakes in the river.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Ringold Springs Rearing Pond

HC-01, Box 189

Meda, Washington 99343

Frank Anderson, Manager - Telephone 509-269-4448

<u>Species</u>	<u>Pounds Released Annually</u>	<u>Numbers Released Annually</u>
Spring Chinook	125,000	1,000,000

History

The Ringold Springs Rearing Pond is located on the Columbia River 20 miles upstream from Pasco, Washington. It was constructed as experimental facilities in 1963 under the Columbia River Fishery Development Program at a cost of \$80,000.

The facility (a 9-acre pond and 14 rearing ponds) is operated by the Washington Department of Fisheries.

The pond receives water from springs that emerge from the adjacent hillside. These springs are irrigation return water that appeared following the creation of Banks Lake irrigation system.

The Ringold Springs water is not suitable for the incubation of eggs. Water temperatures are around 50 degrees the year round but even when water is chilled there is a low survival rate. The reasons for the high mortalities are attributed to phosphate introduced by fertilizers.

The O&M is funded totally by NMFS under a Cooperative Agreement with the Washington Department of Fisheries.

Appendix 6 -- A brief description and history of U.S. Fish and Wildlife Service salmonid rearing facilities funded by the Columbia River Fisheries Development Program.

Abernathy Hatchery

Abernathy Salmon Cultural Techniques Center
1440 Abernathy Road
Longview, Washington 98632

Dave Leith, Director - Telephone (206) 425-6072

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Fall Chinook	42,000	1,500,000

History

Abernathy Hatchery is located 14 miles downriver from Longview and is approximately five miles from the confluence of Abernathy Creek and the Columbia River. It was constructed in 1960 at a cost of \$389,000. All construction was funded by NMFS. NMFS funds only about 40 percent of the operational costs, FWS 60 percent.

The Abernathy Hatchery is principally a research and development center for hatchery practices, including nutritional studies. Only about half of the station is dedicated to standard fish production. Most of the research and development has been confined to fall chinook although some coho investigations have been undertaken.

The station consists of three residences and 12 rearing ponds, 6 of which utilize reuse water systems. The 6 ponds not on the reuse system utilize Abernathy Creek water. The reuse system is operated utilizing well water.

The Abernathy research lab contains numerous rearing tanks which also utilize well water. The hatchery employs a unique electric weir to guide the adult fish to the spawning pond.

The Fish and Wildlife Service and NMFS share in the funding of studies and fish production.

Carson Hatchery

Carson, Washington 98610

Don Zirjacks, Manager - Telephone (509) 427-5905

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Spring Chinook	133,500	2,670,000

History

Carson Hatchery is located about 13 miles northwest of Carson, Washington, on the Wind River. It was remodeled and changed from trout to a salmon hatchery in 1956 at a cost of \$477,000. NMFS funded the remodeling.

The station consists of 46 8' x 80' concrete raceways and two large dirt rearing ponds. These dirt ponds were added in 1977 with funds provided by NMFS.

The water supply for the hatchery is principally the Tye Springs which has a constant temperature of about 46 degrees. River water is mixed with Tye Springs water to obtain higher temperatures during the summer period. This warmer water is used effectively to ripen adult spring chinook which are spawned usually in late August.

The funds for operating Carson are supplied by NMFS, with cyclic maintenance funds provided by the Fish and Wildlife Service.

Eagle Creek Hatchery
Route 1, Box 610
Estacada, Oregon 97023

Jamieson E. Holway, Manager - Telephone (503) 630-6270

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Spring Chinook	35,000	400,000
Coho	72,000	1,000,000
Steelhead	15,500	100,000

History

Eagle Creek Hatchery is located approximately 7 miles from Estacada, Oregon on Eagle Creek which is a tributary to the Clackamas River. The station was constructed under the Columbia River Fishery Development Program in 1956 at a cost of \$474,000. In 1963, 36 additional ponds were added with CRFDP funds.

The station has three duplex residences, housing six families. The station rears spring chinook, coho and steelhead.

The station's water supply comes from Eagle Creek and is inadequate to run all of the ponds during the low flow period in the summer and early fall. Both banks of raceways are located in tandem and reuse the water three times.

The funds for operating Eagle Creek Hatchery are supplied by NMFS, with cyclic maintenance funds provided by the Fish and Wildlife Service.

Little White Salmon Hatchery (Willard National Fish Hatchery)

P.O. Box 17

Cook, Washington 98605

Jack E. Bodle, Manager - Telephone (509) 538-2755

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Fall Chinook	176,000	8,700,000
Spring Chinook	35,000	1,200,000

History

Little White Salmon Hatchery is located at the mouth of the Little White Salmon River approximately 20 miles upstream from Bonneville Dam. This station is one of the oldest hatcheries on the river, and has been remodeled several times. The latest rehabilitation occurred in 1958 under the Columbia River Fishery Development Program at a cost of \$612,000.

In addition to being one of the oldest hatcheries on the river, it is also one of the largest. The hatchery is composed of a series of 49 rearing ponds. These ponds vary in size and shape depending on the topography of the land.

The station receives its primary water from the Little White Salmon River and Bailey Springs. The station also utilizes water from a series of intermittent springs during the winter rearing period when Little White Salmon River water is quite cold.

There are four residences at the Little White Salmon Station.

The funds for operating Little White Salmon Hatchery are supplied by NMFS, with cyclic maintenance funds provided by the Fish and Wildlife Service.

Willard National Fish Hatchery
Star Route
Cook, Washington 98605

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Coho	166,000	2,500,000

History

The Willard National Fish Hatchery is located on the Little White Salmon River at Willard, Washington. Willard is supervised by the management of Little White Salmon Hatchery. It is a coho rearing station constructed in 1954 with funds from the Columbia River Fishery Development Program at a cost of \$640,000.

The station was originally constructed to rear both fall chinook and coho; however, cold water temperatures prohibit effective rearing of zero-year migrant fall chinook.

The station receives its main rearing water from the Little White Salmon River and a groundwater well. Willard takes no eggs as a natural barrier blocks all fish downstream from the station. Returning adults are collected at Little White Salmon Hatchery and the eggs are taken to Willard for incubation and rearing.

The station has 50 8' x 80' raceways and 12 residences.

The funds for operating Willard Hatchery are supplied by NMFS, with cyclic maintenance funds provided by the Fish and Wildlife Service.

Spring Creek Hatchery

Underwood, Washington 98651

Ed LaMotte, Manager - Telephone (509) 493-1730

<u>Species</u>	<u>Pounds Reared Annually</u>	<u>Numbers Released Annually</u>
Fall Chinook	162,000	15,000,000

History

Spring Creek Hatchery is located approximately 30 miles above Bonneville Dam at Underwood, Washington. The original station was one of the older hatcheries on the river. However, it was remodeled in 1955 by the Columbia River Fishery Development Program at a cost of \$492,000. It was nearly completely razed and remodeled again by the Corps of Engineers in 1970 at a cost of approximately \$8,000,000.

The station features a 90 percent reuse system with 44 circulating rectangular Abernathy ponds with rock and oyster shell filters as an integral part of the reuse facilities. The water source is a series of springs that emerge from the base of the cliff adjacent to the hatchery.

Two satellite ponds on the Big White Salmon River are operated by the Spring Creek staff.

Funding is approximately 50 percent NMFS and 50 percent Corps of Engineers. The Corps funding is for the mitigation of losses occurred at John Day Dam. This station is probably the most successful fall chinook station on the Columbia River.

Appendix Table 7. -- Numbers and Pounds of Juvenile Salmonids Released from Columbia River Fisheries Development Program Funded Hatcheries Operated by the U.S. Fish and Wildlife Service

Facility	Year	Fall Chinook		Sp. Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Abernathy	1980	2,156,095	30,192											2,156,095	30,192
	1981	1,201,432	33,623											1,201,432	33,623
	1982	1,456,407	28,380											1,456,407	28,380
	1983	1,557,504	48,735											1,557,504	48,735
	1984	2,247,786	45,231											2,247,786	45,231
5 Year Average	1,723,845													1,723,845	37,232
Carson	1980			3,261,200	123,165			777,300	38,961					4,038,500	162,126
	1981			2,880,912	130,748			405,736	20,086					3,286,648	150,834
	1982			2,677,640	143,365									2,677,640	143,365
	1983			3,992,280	93,986									3,992,280	93,986
	1984			3,418,635	188,103									3,418,635	188,103
5 Year Average			3,246,133	135,873			236,607	11,809					3,482,740	147,682	
Eagle Creek	1980			574,257	28,890			1,699,472	110,019	388,895	14,549			2,662,624	153,458
	1981			1,292,922	69,254			941,011	68,619	310,248	20,884			2,544,181	158,757
	1982			589,624	47,854			932,686	59,228	247,796	14,391			1,770,106	121,473
	1983			786,233	72,723			573,512	45,736	113,328	16,927			1,473,073	135,306
	1984			454,570	55,768			156,951	10,121	418,426	12,784			1,029,947	78,673
5 Year Average			739,521	54,898			860,726	58,745	295,739	15,907			1,895,986	129,550	
Little White Salmon/Willard Complex	1980	9,772,895	91,871	510,802	23,778			3,413,577	171,601					13,697,274	287,250
	1981	10,436,242	107,073	745,680	39,735			2,790,185	145,680					13,972,107	292,488
	1982	8,091,829	86,922	794,203	35,183			2,519,871	115,318					11,405,903	237,423
	1983	9,500,331	105,078	3,698,578	59,225			3,423,094	171,790					16,822,003	336,093
	1984	7,778,794	95,749	787,215	28,211			2,566,594	157,655					11,132,603	281,615
5 Year Average	9,116,018	97,339	1,347,296	37,226			2,942,664	152,409					13,405,978	286,974	

Appendix Table 7. -- (continued)

Facility	Year	Fall Chinook		Sp Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Spring Creek	1980	18,017,998	266,733											18,017,998	266,733
	1981	16,688,525	229,144											16,688,525	229,144
	1982	10,739,060	113,372											10,739,060	113,372
	1983	23,611,036	264,234											23,611,036	264,234
	1984	16,594,816	212,784											16,594,816	212,784
5 Year Average		17,130,487	217,253											17,130,487	217,253

Appendix Table 8. -- Numbers and Pounds of Juvenile Salmonids Released from Columbia River Fisheries Development Program Funded Hatcheries Operated by the Oregon Department of Fish and Wildlife from 1980 - 1984.

Facility	Year	Fall Chinook		Sp. Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Aumsville- Stayton Pond	1980	6,346,989	72,990											6,346,989	72,990
	1981	5,908,700	79,210											5,908,700	79,210
	1982	6,731,246	76,866											6,731,246	76,866
	1983	6,912,114	87,581											6,912,114	87,581
	1984	5,170,802	89,456											5,170,802	89,456
5 Year Average	6,213,970	81,221												6,213,970	81,221
Big Creek	1980	6,433,919	86,698					730,345	39,166	190,121	10,149	1,324	78	7,355,709	136,091
	1981	6,147,934	83,883	44,464	123	601,103	30,556	83,716	13,668	5,302	482			6,882,519	128,712
	1982	6,175,275	82,337	33,836	26	841,500	47,801	256,603	10,848	4,401	677			7,311,615	141,689
	1983	5,889,942	91,865	80,979	118	1,054,857	51,567	109,558	11,045	5,626	893			7,140,962	155,488
	1984	6,088,937	84,823	69,365	194	788,767	63,947	62,288	11,086	5,724	1,967			7,015,081	162,017
5 Year Average	6,147,201	85,922	45,729	92	803,314	46,607	140,457	11,359	4,475	819			7,141,177	144,799	
Bonneville	1980	13,520,367	281,188					3,470,997	124,651					16,991,364	405,839
	1981	11,418,405	210,475			2,635,987	178,277							14,054,392	388,752
	1982	12,555,513	193,714			3,719,904	140,496							16,275,417	334,210
	1983	9,292,351	173,391			1,802,207	118,794							11,094,558	292,185
	1984	12,887,142	287,271			461,521	38,843							13,348,663	326,114
5 Year Average	11,934,756	229,208			2,418,123	120,212							14,352,879	349,420	
Cascade	1980	551,033	16,524			516,307	22,014							1,067,340	38,538
	1981					2,983,497	28,143							2,983,497	28,143
	1982					215,999	12,204							215,999	12,204
	1983					4,278,253	60,882			57,570	8,582			4,335,823	69,464
	1984					1,578,506	122,048							1,578,506	122,048
5 Year Average	110,207	3,251			1,914,512	49,058			11,514	1,716			2,036,233	54,025	

Appendix Table 8. (continued)

Facility	Year	Fall Chinook		Sp. Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Clackamas	1980			1,054,859	127,818									1,054,859	127,818
	1981			998,780	103,496									998,780	103,496
	1982			1,123,411	167,183									1,123,411	167,183
	1983			992,408	189,982									992,408	189,982
	1984			921,743	125,785									921,743	125,785
5 Year Average			1,018,240	142,853										1,018,240	142,853
Gnat Creek	1980									609,508	89,820			609,508	89,820
	1981									581,617	95,810			581,617	95,810
	1982									434,722	81,663			434,722	81,663
	1983							790,775	673	650,465	86,725			1,441,240	87,398
	1984									632,971	102,649			632,971	102,649
5 Year Average					158,155	135			581,857	91,333			740,012	91,468	
Klaskanine	1980	3,554,908	44,999			755,210	1,478	1,410,045	82,459	50,894	8,928			5,771,057	137,864
	1981	3,943,444	45,854					1,475,277	85,792	57,695	9,779			5,476,416	141,425
	1982	3,307,775	38,915					2,104,932	82,735	38,863	6,587			5,451,570	128,237
	1983	3,511,519	48,103					1,814,124	87,617	69,828	13,175			5,395,471	148,895
	1984	4,077,845	50,257					1,264,234	131,691	72,681	14,251			5,414,760	196,199
5 Year Average	3,679,098	45,626					1,613,722	94,059	57,992	10,544			5,501,854	150,524	
Oxbow/Wahkeena	1980	2,110,325	20,923	414,488	49,822									2,524,813	70,745
	1981	3,321,769	30,925					3,263,588	45,839					6,585,357	76,764
	1982	344,759	46,780	460,741	49,015									805,500	95,795
	1983	1,799,192	17,403					499,511	418					2,298,703	17,821
	1984	150,960	1,020					5,529,586	234,819					5,680,546	235,839
5 Year Average	1,545,401	23,410	175,045	19,767			1,858,537	56,216					3,578,983	99,393	

Appendix Table 8. (continued)

Facility	Year	Fall Chinook		Sp. Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Sandy	1980													1,188,865	66,061
	1981													3,383,670	64,872
	1982													1,026,848	56,102
	1983													2,760,129	65,094
	1984													1,053,067	61,185
	5 Year Average													1,882,516	62,663

Appendix Table 9. -- Numbers and Pounds of Juvenile Salmonids Released from Columbia River Fisheries Development Program Funded Hatcheries Operated by the Washington Department of Fisheries from 1980 - 1984.

Facility	Year	Fall Chinook		Sp Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Grays River	1980	1,351,890	13,040					2,650,280	63,777					4,002,170	76,817
	1981	1,220,759	14,296					3,026,035	59,231					4,246,794	73,527
	1982	826,350	9,495					505,998	34,871					1,332,348	44,366
	1983	1,503,900	15,476					621,600	20,246					2,125,500	35,722
	1984	1,621,300	19,744					405,600	22,533					2,026,900	42,277
5 Year Average		1,304,840	14,410					1,441,902	40,132					2,746,742	54,542
Elokomin	1980	2,411,131	29,628					4,414,192	187,357					6,825,323	216,985
	1981	2,925,006	28,722					3,911,613	146,030					6,836,619	174,752
	1982	2,600,154	32,501					2,864,256	138,175					5,464,410	170,676
	1983	2,558,000	29,926					2,976,500	145,395					5,534,500	172,321
	1984	2,769,000	30,767					3,038,800	148,262					5,807,800	179,029
5 Year Average		2,652,658	29,709					3,441,072	153,044					6,093,730	182,753
Kalama Falls	1980	5,017,399	49,583	413,406	31,151			2,567,148	18,583					7,997,953	99,317
	1981	4,069,097	78,440	1,099,800	33,974			425,800	20,007					5,594,697	132,421
	1982	4,811,888	83,779	160,000	16,000			1,349,814	17,895					6,321,702	117,674
	1983	2,272,800	97,890	228,000	16,286			2,062,800	34,778					4,563,600	148,954
	1984	3,844,700	77,537	325,900	32,590			662,000	43,262					4,832,600	153,389
5 Year Average		4,003,177	77,446	445,421	26,000			1,413,512	26,905					5,862,110	130,351
Washougal	1980	6,122,198	61,368					3,346,701	134,416					9,468,899	195,784
	1981	6,467,138	90,909					6,622,907	184,814					13,090,045	275,723
	1982	6,787,115	48,610					3,303,820	155,875					10,090,935	204,485
	1983	6,715,300	71,711					4,053,803	172,079					10,769,103	243,790
	1984	5,846,662	78,528					3,400,200	178,255					9,246,862	256,783
5 Year Average		6,387,683	70,225					4,145,486	165,088					10,583,169	235,313

Appendix Table 9. (continued)

Facility	Year	Fall Chinook		Sp Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Klickitat	1980	3,139,434	36,935	2,067,592	63,766	1,431,093	85,473	1,333,976	63,887	1,431,093	85,473	6,638,119	186,174		
	1981	2,479,132	31,784	1,950,702	85,212	1,333,976	63,887	1,653,687	105,837	1,333,976	63,887	5,763,810	180,883		
	1982	3,679,620	44,333	1,759,802	78,665	1,653,687	105,837	1,456,910	97,051	1,653,687	105,837	7,093,109	228,835		
	1983	4,864,600	54,658	1,354,800	117,900	1,456,910	97,051	1,339,300	70,489	1,456,910	97,051	7,676,310	269,609		
	1984	1,195,800	16,843	1,846,500	57,061	1,339,300	70,489	1,442,993	84,547	1,339,300	70,489	4,381,600	144,393		
	5 Year Average	3,071,717	36,911	1,795,880	80,521	1,442,993	84,547			1,442,993	84,547	6,310,590	201,979		
Ringold	1980	943,800	35,100	350,000	50,000							1,293,800	85,100		
Salmon	1981			750,000	75,000							750,000	75,000		
	1982	788,000	105,067	900,000	36,000							1,688,000	141,067		
	1983														
	1984	2,100,000	38,200	950,000	135,700							3,050,000	173,900		
	4 Year Average	957,950	44,592	737,500	74,175							1,695,450	118,767		

Appendix Table 10. -- Numbers and Pounds of Juvenile Salmonids Released from Columbia River Fisheries Development Program Funded Hatcheries Operated by the Washington Department of Game from 1980 - 1984.

Facility	Year	Fall Chinook		Sp Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Beaver Creek	1980									990,512	96,922	96,708	8,720	1,087,220	105,642
	1981									709,741	107,290	66,050	14,840	775,791	122,130
	1982									751,801	108,902	60,160	13,700	811,961	122,602
	1983									532,876	83,670	78,765	7,835	611,641	91,505
	1984									700,164	100,375	43,210	12,300	743,374	112,675
5 Year Average										737,019	99,432	68,979	11,479	805,998	110,911
Skamania	1980									1,078,534	104,550			1,078,534	104,550
	1981									742,765	119,860			742,765	119,860
	1982									560,616	70,880			560,616	70,880
	1983									737,687	71,370	10,860	30	748,547	71,400
	1984									943,044	90,099	22,903	6,882	965,947	96,981
5 Year Average										812,529	91,352	6,753	1,382	819,282	92,734
Ringold	1980									187,000	26,666			187,000	26,666
	1981									194,759	26,384			194,759	26,384
	1982									189,000	28,636			189,000	28,636
	1983									146,000	22,813			146,000	22,813
	1984									201,008	29,560			201,008	29,560
5 Year Average										183,553	26,812			183,553	26,812
Alder Creek Pond	1980									83,124	11,545			83,124	11,545
	1981														
	1982									76,650	15,930			79,650	15,930
	1983														
	1984														
2 Year Average										81,387	13,738			81,387	13,738

Appendix Table 10. (continued)

Facility	Year	Fall Chinook		Sp Chinook		Chum		Coho		Steelhead		Cutthroat		Total	
		No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds	No.	Pounds
Vancouver Pond 1980	1981														
	1982									54,170	9,970			54,170	9,970
	1983									81,761	16,451			81,761	16,451
	1984									124,428	24,265			124,428	24,265
	3 Year Average									86,786	16,895			86,786	16,895
Gobar Pond	1980														
	1981														
	1982									129,534	22,725			129,534	22,725
	1983									138,654	28,540			138,654	28,540
	1984									120,240	23,676			120,240	23,676
3 Year Average									129,476	24,980			129,476	24,980	
Tucannon	1980														
	1981														
	1982									682,360	13,918			682,360	13,918
	1983														
	1984														
Average									682,360	13,918			682,360	13,918	
Cowesman South Toutle	1980														
	1981														
	1982														
	1983														
	1984									32,900	4,872			32,900	4,872
Average									32,900	4,872			32,900	4,872	

Appendix Table 11. -- Adult and Jack Salmonids Returning to Columbia River Fisheries Development Program Funded Hatcheries Operated by the U.S. Fish and Wildlife Service in 1984

URB	Fall Chinook							Total
	Tules	Sp Chinook	Coho	Steelhead	Cutthroat	Chum		
Abernathy	742							742
Carson		2,153						2,153
Eagle Creek		1,032	2,405	1,431				4,868
Little White Salmon/ Willard Complex	809	577	7,063					8,449
Spring Creek	9,507							9,507
TOTAL	11,058	3,762	9,468	1,431				25,719

Appendix Table 12. -- Adult and Jack Salmonids Returning to Columbia River Fisheries Development Program Funded Hatcheries Operated by the Oregon Department of Fish and Wildlife in 1984

	<u>Fall Chinook</u>							Total
	URB	Tules	Sp Chinook	Coho	Steelhead	Cutthroat	Chum	
Big Creek		6,593		6,123	695	199	42	13,652
Bonneville	3,253	5,478		14,751				23,482
Cascade		297		628				925
Clackamas			2,521					2,521
Klaskanine		37		9,004			50	9,091
Sandy				12,569				12,569
TOTAL	3,253	12,405	2,521	43,075	695	199	92	62,240

Note: Aumsville/Stayton Pond, Gnat Creek, and Oxbow do not have any adult collection

Appendix Table 13. -- Adult and Jack Salmonids Returning to Columbia River Fisheries Development Program Funded Hatcheries Operated by the Washington Department of Fisheries in 1984

	<u>Fall Chinook</u>							Total
	URB	Tules	Sp Chinook	Coho	Steelhead	Cutthroat	Chum	
Elokomin		1,714		4,328				6,042
Grays River		237		2,773				3,010
Lower Kalama	1	1,378		555				1,934
Kalama Falls	484	3,907	807	2,342				7,540
Washougal		2,116		15,262				17,378
Klickitat		146	718	40				904
TOTAL	485	9,498	1,525	25,300				36,808

Appendix Table 14. -- Adult and Jack Salmonids Returning to Columbia River Fisheries Development Program Funded Hatcheries Operated by the Washington Department of Game in 1984

	<u>Fall Chinook</u>			<u>Steelhead</u>			Total	
	URB	Tule	Sp Chinook	Coho	Winter	Summer		Chum
Beaver Creek					2,043		1,019	3,062
Skamania					1,016	3,576		4,592
Ringold						950		950
TOTAL					3,059	4,526	1,019	8,604

Appendix Table 15. -- Release, catch and return statistics for 1978-brood fall chinook by facility and tag code.

Rearing Facility	Tag Code	Number Released	Catch	Return	Catch/ 1,000 Releases	Percent Survival
Big Creek	7-18-44	224,900	576	190	2.6	.3
Bonneville	7-18-42	287,900	822	297	2.9	.4
	7-18-43	15,100	0	4	0	.0
Klaskanine	7-18-45	244,100	287	14	1.2	.1
Stayton Pond	7-18-41	283,800	1,793	250	6.3	.7
Sea Resources	63-19-18	24,200	24	0	1.0	.1
Abernathy	5-4-50	63,400	280	52	4.4	.5
	5-4-51	48,900	180	42	3.7	.5
Big White Pond	5-4-43	141,400	270	56	1.9	.2
Little White Salmon	5-4-48	177,800	30	10	.2	.0
	5-4-49	264,800	36	10	.1	.0
Spring Creek	5-4-33	140,900	1,412	243	10.0	1.2
	5-4-44	135,500	2,170	363	16.0	1.9
	5-4-45	55,600	2	1	.0	.0
	5-4-46	246,000	1,157	191	4.7	.5
Cowlitz	63-19-42	143,600	222	96	1.6	.2
	63-19-51	11,100	65	24	5.9	.8
Elokomin	63-18-56	21,100	3	2	.1	.0
	63-19-56	117,800	9	0	.9	.0
Grays River	63-16-46	73,900	25	10	.3	.0
	63-18-33	7,600	4	2	.5	.1
	63-19-37	68,100	27	8	.4	.1
Kalama Falls	63-19-57	214,500	71	35	.3	.0
Klickitat	63-19-49	225,400	240	0	1.1	.1
Priest Rapids	63-18-21	48,100	83	49	1.7	.3
	63-18-57	17,500	8	2	.5	.1
	63-19-58	5,300	2	1	.4	.1
	63-20-17	82,200	23	15	.3	.0

Appendix Table 15. (Continued)

Rearing facility	Tag Code	Number Released	Catch	Return	Catch/ 1,000 Releases	Percent Survival
Speelyai	63-19-20	51,700	110	17	2.1	.2
	63-19-50	104,500	149	30	1.4	.2
Toutle	63-18-54	12,000	8	3	.7	.1
	63-19-41	132,100	108	38	.8	.1
Washougal	63-19-38	97,400	80	23	.8	.1
	63-19-46	154,500	124	40	.8	.1
Weyco Pond	63-19-39	92,400	61	9	.7	.1
TOTAL		4,035,100	10,491	2,127	2.6	.3

Appendix Table 16. -- Release, catch and return statistics for 1979-brood fall chinook by facility and tag code.

Rearing Facility	Tag Code	Number Released	Catch	Return	Catch/ 1,000 Releases
Big Creek	7-21-60	143,400	1,060	261	7.4
Bonneville	7-21-57	121,100	111	31	.9
Klaskanine	7-21-61	66,300	79	2	1.2
OxBow	7-21-62	49,400	37	8	.7
	7-21-63	51,900	85	14	1.6
Stayton Pond	7-20-55	282,000	1,746	187	6.2
Sea Resources	63-20-61	18,400	2	21	.1
Abernathy	5-6-44	35,200	164	32	4.7
	6-6-46	112,500	368	114	3.3
Little White Salmon	5-6-43	162,600	47	2	.3
Spring Creek	5-6-39	125,500	1,236	196	9.8
	5-6-40	75,200	1,182	180	15.7
	5-6-41	60,500	1,141	135	18.9
	5-6-42	23,100	64	15	2.8
Cowlitz	63-21-37	20,700	88	62	4.3
	63-21-54	244,300	113	60	.5
63-21-59	63-21-59	70,500	44	19	.6
Elokomin	63-20-5	98,400	35	10	.8
Grays River	63-20-43	37,500	31	10	.8
Kalama Falls	63-21-5	100,400	83	76	.8
Klickitat	63-19-47	156,100	176	10	1.1
Lewis River	63-21-60	103,700	135	34	1.3
Lower Kalama	63-20-6	144,500	91	38	.6
Priest Rapids	63-19-48	147,200	115	145	.8
Washougal	63-21-53	314,600	359	246	1.1
Weyco Pond	H1-2-3	97,800	54	29	.6
TOTAL		2,864,700	8,665	1,937	3.0

Appendix 17

BIOENGINEERING ACTIVITIES PARTIAL LISTING OF PROJECTS DURING F.Y. 1984

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. Winchester hydro project - adult and juvenile protection facilities
7. Yakima River Passage Projects - fish screens and ladders
8. Three Mile Dam - adult and juvenile passage facilities
9. Stayton Ditch Hydro Project - adult and juvenile passage
10. Tumwater and Dryden dams - adult passage
11. Crabtree Creek proposed hydro project - adult and juvenile fish passage facilities
12. Zillah proposed hydro project - adult and juvenile fish passage facilities
13. Boyd proposed hydro project - adult and juvenile passage facilities
14. Olney Falls proposed hydro project - juvenile passage
15. Rock Island Dam - juvenile bypass
16. Rocky Reach Dam - juvenile bypass
17. Horn Rapids Dam - adult and juvenile passage
18. Marmot Dam - adult and juvenile passage
19. Lower Snake River Compensation Plan - hatchery facilities
20. Leaburg hydro project - juvenile and adult passage
21. Sullivan Plant - juvenile passage
22. Priest Rapids Dam - juvenile passage studies
23. Wanapum Dam - juvenile passage studies
24. White River (Washington) Hydro Project - juvenile and adult passage

II. Review of Fish Facility Construction and/or Operation

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

III. Assistance in Design Review

1. Corps of Engineers Permits (numerous sites)
2. Beaver Creek Hatchery Water Intake Modification

IV. Responses to Requests from Other Regions and Agencies

1. U.S. Fish and Wildlife Service - review of Michigan State fishway designs
2. U.S. Fish and Wildlife Service - review of passage problems at Red Bluff Dam and Tehama-Colusa Canal, California
3. NMFS Southwest Region - fish protection for Tulare Lake dewatering project and adult passage facilities at Cape Horn Dam