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A Historical and Descriptive Account of Pacific Coast Anadromous Salmonid Rearing Facilities and a Summary of Their Releases by Region, 1960-76

Roy J. Wahle and Robert Z. Smith

September 1979

U.S. DEPARTMENT OF COMMERCE
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U.S. DEPARTMENT OF COMMERCE
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ROY J. WAHLE and ROBERT Z. SMITH[1]

ABSTRACT

A brief history of the artificial culture of salmonid fishes in North America is presented. The report contains a Pacific coast section followed by sections for each of six major regions on the coast: Alaska, British Columbia, Washington coastal and Puget Sound, Columbia Basin, Oregon coastal, and California. The Columbia Basin is further divided into three subregions. The Pacific coast section provides information on current production of anadromous salmon (*Oncorhynchus* spp.) and trout (*Salmo* spp.). Each regional or subregional section contains a short history and background, a map with current rearing facilities located, a general hatchery information table, and migrant release tables summarized by species. In the final portion of the report, changes in numbers of facilities, species reared, rearing techniques, and size at time of release are discussed.

INTRODUCTION

When the report on the "Releases of Anadromous Salmon and Trout from Pacific Coast Rearing Facilities, 1960 to 1973" by Roy J. Wahle, William D. Parente, Paula J. Jurich, and Robert R. Vreeland (1975) was published, it had three main objectives: 1) to provide past and present trends in artificial production of Pacific coast anadromous fish, 2) to supply base information needed for analysis of production practices, and 3) to bring together in a single source, detailed release information from all anadromous fish rearing facilities in Alaska, British Columbia, Washington, Idaho, Oregon, and California. In fulfilling these objectives, it was necessary for Wahle et al. (1975) to be very detailed. We have prepared this summary report to provide the reader with a more readily usable, quick reference to anadromous fish production on the Pacific coast, Alaska to California, from 1960 to 1976.

In addition to a section on interpretation and organization, this report includes a general history section covering artificial salmonid propagation in North America. The history is followed by a coast-wide summary and sections for Alaska, British Columbia, Washington coastal and Puget Sound, Columbia Basin, Oregon coastal, and California. The last portion of this report deals with hatchery production trends. These include changes in numbers of hatcheries, species reared, rearing techniques, and the size of fish at time of release.

The two appendix tables have been provided to allow maximum use of the informational tables in each regional section. Appendix Table 1 has an alphabetized list of Pacific coast rearing facilities along with the region for each. This table can be used as an index for locating individual facilities in the report. Appendix Table 2 contains information on all State, Federal, or Provincial agencies rearing anadromous fish on the Pacific coast. It includes addresses, phone numbers, and people to contact with each of these agencies.

The Columbia Basin, containing portions of Washington, Idaho, and Oregon, has been handled separately because of: 1) the large geographical area drained by a common river system; 2) the constant interaction of diverse resource agencies and interested user groups; 3) the need for evaluation of production and habitat improvement measures within the Basin; and 4) the contribution and value of Columbia Basin anadromous salmonids to Pacific coast fisheries.

Each regional section includes a short history and background, a map with the facilities located, a general hatchery information table, and a release summary table. The general information table lists the approximate location, species reared, operating and funding agencies, year of construction, and the operational status in 1976 for the facilities in each region.

Unless otherwise cited, all historical information on early hatcheries has been based on Cobb (1931). One area of possible confusion to the reader concerns the use of agencies "names." During the years fish have been artificially propagated in the United States, many of the agencies concerned have undergone name changes. In this report, we have attempted to use agency names as taken from the literature rather than the names that may be in current use.

INTERPRETATION AND ORGANIZATION

Six species of salmon (*Oncorhynchus* spp.) and two of anadromous trout (*Salmo* spp.) are included in this report. Because of their current economic and recreational importance, the primary species considered are chinook, *O. tshawytcha*, and coho, *O. kisutch*, salmon,

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and steelhead trout, *S. gairdneri.* The other species: chum, *O. keta,* pink, *O. gorbusha,* sockeye, *O. nerka,* and cherry, *O. masu,* salmon, and sea-run cutthroat trout, *S. clarki,* are presently reared on a limited basis and are included only if they were raised in the region being considered.

We have further divided chinook salmon into three races (spring, summer, and fall) and steelhead trout into two races (summer and winter). These designations are commonly used by all fisheries agencies rearing anadromous salmonids and are based for the most part on the season during which the adult fish return to freshwater. Rearing periods differ among the races of chinook salmon.

Releases of fish included in Wahle et al. (1975) were divided into two categories: migrants and submigrants. This was done to separate production releases from those necessitated by reducing numbers of fish to achieve "optimum" pond capacity levels. The definitions used were based on the best available knowledge of the ideal size at release for obtaining the greatest immediate seaward migration, but were not used as hard and fast rules. Exceptions were made in special cases if it was felt that a group of fish belonged in a different category than indicated by the definition.

The migrant and submigrant classifications used in this report should not be confused with the terms "fry," "fingerling," and "yearling" that we have included in the various history sections. "Fry" normally refers to fish released without any rearing, as soon as the yolk sac has been absorbed. "Fingerlings" can refer to any number of different sizes depending on the author and the species. Often "fry" and "fingerlings" refer to fish we would call submigrants. "Yearlings" in the historical literature normally refers to fish reared for a year in the hatchery before release. Depending on species, we might call these fish migrants.

As reported by Wahle et al. (1975), our definitions of migrants for each species are:

Spring and summer chinook salmon—those released after 12 mo of rearing or larger than 30/lb (15.1 g/fish).
Fall chinook salmon—those released after 90 days of rearing or larger than 300/lb (1.5 g/fish).
Coho salmon—those released after 12 mo of rearing or larger than 30/lb (15.1 g/fish).
Pink and chum salmon—those released after any period of feeding at the rearing facility.
Steelhead and sea-run cutthroat trout—those released after 12 mo of rearing or larger than 10/lb (45.4 g/fish).

Migrant criteria for sockeye and cherry salmon were not presented in Wahle et al. (1975). For those species, we have relied on the hatcheries or agencies involved to indicate whether each release was migrant in nature.

We define submigrants as those releases that do not meet migrant specifications. In the case of pink and chum salmon, submigrants would be any unfed fry released.

Data for this report was obtained from Wahle et al. (1975) and the appropriate State, Federal, and Canadian fishery management agencies.

HISTORY

Artificial propagation of salmonids began in North America in the mid-1800's. Theodatus Garlick of Cleveland, Ohio, in conjunction with H. A. Ackley, Successfully artificially bred brook trout, *Salvelinus fontinalis* (Milner 1874). The first hatchery in North America was established by Seth Green at Mumford, N.Y., in 1864, and the first anadromous fish hatchery was built in New Castle, Canada, in 1866 for the purpose of taking Atlantic salmon, *Salmo salar,* eggs (Atkins 1874).

In the late 19th and early 20th centuries, efforts were made by Federal and various State commissions to introduce Pacific coast salmon into eastern waters. In 1872, Livingston Stone was sent to California by the U.S. Commission of Fish and Fisheries to obtain salmon eggs for shipment to the east coast. He established the first Pacific fish cultural station in 1872 on the McCloud River, named after the then Commissioner of Fisheries, Spencer F. Baird. While the main purpose of this station was the shipment of eggs east, the Commission made a cooperative agreement with the State of California in which the State furnished part of the operating expense money in return for the station's releasing native fingerlings into the McCloud River. Eggs taken for shipment were kept in baskets at the hatchery until the eyes of the embryo were visible. They were then packed in moss, crated, and taken by stagecoach to Red Bluff, Calif. From there, they traveled by train to San Francisco and then on to the east coast. To assure the survival of the eggs, it was necessary to continually dampen the moss in which they were packed. In the first year of operation, 50,000 eggs were taken, but 20,000 were lost due to difficulties experienced in keeping the eggs cool prior to shipment. The remaining 30,000 eggs were shipped east and from these 7,000 fry were planted in Pennsylvania's Susquehanna River (Stone 1874).

Before the attempts to transplant Pacific salmon to the eastern United States were discontinued, Pacific coast salmon had been planted in a large number of major streams on the Atlantic coast, in the Mississippi drainage, and in the Great Lakes. Some of these transplants were moderately successful. From approximately 10,000 chinook salmon fingerlings planted in Lake Quinsigamond, Mass., 600 fish weighing between 0.68 and 2.27 kg were caught. Early plants of pink salmon in selected New England streams also met with some success. A female pink salmon weighing approximately 1.9 kg was taken in the Penobscot River. Most of these transplants resulted in failures as the selected waters were either too warm or too turbid for salmon to survive. The few runs that did become established either had so few returnees that they were not self sustaining or fishermen caught all the fish (Cobb 1931).

These early efforts at transplanting fish created a large demand for eggs. This demand resulted in construction

of hatcheries in all the Pacific Coast States. After a short time, the taking of eggs for transportation became secondary to augmenting runs in Pacific coast streams by rearing and releasing the fish (Stone 1874). From these beginnings emerged the Pacific coast salmon rearing industry.

PACIFIC COAST

With today's increasing use of the fishery resource and the continuing degradation of the environment necessary for proper spawning and freshwater rearing of anadromous salmonids, it has become necessary to augment natural production if we are to maintain viable sport and commercial fisheries. From 1960 through 1976 a total of 189 facilities, including 120 hatcheries and 69 rearing ponds and net pens, have made production releases for at least 1 yr. During this period, 3.44 billion migrant salmon and steelhead trout weighing over 105 million lb (47.6 million kg) have been released (Tables 1, 2). Annual migrant production of all species increased from 152 million fish weighing 1.7 million lb (0.77 million kg) at release in 1960 to 294 million fish weighing 11.1 million lb (5.03 million kg) in 1976.

Alaska

Most early Alaska hatcheries were located in the

Table 1.—Migrant releases of chinook and coho salmon and steelhead trout—Pacific coast[1] (in thousands).

Release year	Fall chinook		Spring chinook		Summer chinook		Coho		Winter steelhead		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	117,680.3	556.6	7,636.3	228.8	0.0	0.0	14,490.7	444.3	2,593.5	315.2	233.0	31.0
1961	103,220.8	672.7	5,315.2	197.9	0.0	0.0	26,148.8	864.6	2,522.8	314.6	674.5	97.3
1962	86,121.5	544.5	5,690.7	244.8	0.0	0.0	27,333.4	995.8	3,509.1	390.5	723.8	73.4
1963	99,806.7	658.9	9,421.1	370.1	0.0	0.0	30,987.2	1,123.5	2,922.8	332.9	1,336.4	146.8
1964	106,684.2	752.1	13,963.7	499.8	0.0	0.0	30,275.5	1,309.0	4,221.9	556.6	1,784.5	221.0
1965	95,918.6	740.6	7,302.7	303.7	0.0	0.0	34,746.8	1,516.8	4,216.2	536.5	1,660.4	185.2
1966	95,712.4	891.7	11,645.7	477.1	0.0	0.0	40,422.2	1,931.2	6,166.6	829.1	1,770.2	223.3
1967	96,386.1	885.8	14,063.7	644.6	0.0	0.0	40,276.6	2,059.9	5,784.1	774.2	3,316.5	401.2
1968	112,534.2	1,174.8	13,877.8	863.3	2,138.3	13.6	38,371.4	2,119.1	6,077.0	828.6	4,860.0	580.0
1969	124,125.1	1,266.4	10,392.1	804.6	2,121.3	20.2	47,988.0	2,814.4	6,380.0	886.1	4,814.1	593.9
1970	137,757.4	1,603.8	16,879.7	1,478.1	4,228.2	35.4	48,209.4	2,751.3	7,101.9	1,047.7	6,795.4	1,041.3
1971	168,388.9	1,706.2	14,726.1	1,151.0	2,184.5	37.0	51,182.3	3,039.6	8,733.5	1,090.6	8,143.4	1,091.5
1972	166,678.2	2,019.1	16,546.0	1,401.3	2,604.9	42.6	58,858.9	3,772.7	9,247.3	1,263.9	6,399.9	998.7
1973	162,515.8	2,266.4	17,604.5	1,761.6	2,312.6	34.3	53,400.0	3,178.5	8,680.1	1,243.3	8,111.9	972.5
1974	149,968.2	2,504.4	16,506.1	1,353.1	1,202.8	43.0	56,580.9	3,453.1	8,060.6	1,088.7	10,048.1	1,285.3
1975	157,707.6	2,554.7	21,389.5	1,848.6	120.8	3.1	60,936.3	3,854.5	7,376.7	1,067.2	7,126.3	1,068.1
1976	163,110.3	2,775.9	22,462.0	1,974.0	880.5	42.7	62,928.3	3,710.3	8,895.7	1,360.6	7,043.2	1,035.2
Total	2,144,316.3	23,574.6	225,422.9	15,602.4	17,793.9	271.9	723,136.7	38,938.6	102,489.8	13,926.3	74,841.6	10,045.7

[1]Data derived from Wahle et al. (1975) prior to 1974 and from appropriate State, Federal, and Provincial records thereafter.
[2]1 lb = 0.454 kg.

Table 2.—Migrant releases of chum, pink, sockeye, and cherry salmon and sea-run cutthroat trout—Pacific coast[1] (in thousands).

Release year	Chum		Pink		Sockeye		Cherry		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	5,031.6	8.8	555.5	2.5	3,177.0	69.2	0.0	0.0	155.4	42.8
1961	4,774.1	13.0	0.0	0.0	2,788.0	72.5	0.0	0.0	189.4	52.6
1962	1,859.3	4.6	145.7	0.5	2,224.0	43.8	0.0	0.0	292.0	77.6
1963	5,454.4	9.3	0.0	0.0	3,125.4	67.8	0.0	0.0	139.8	48.0
1964	3,358.5	6.9	525.3	0.9	3,364.0	58.8	0.0	0.0	258.7	64.3
1965	3,116.7	5.8	0.0	0.0	3,301.0	73.6	0.0	0.0	231.9	52.4
1966	1,785.4	6.0	421.0	1.3	73.0	1.6	0.0	0.0	395.9	95.3
1967	1,827.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	554.2	128.7
1968	1,264.3	3.7	602.8	1.4	0.0	0.0	0.0	0.0	561.6	121.3
1969	2,448.0	5.8	0.0	0.0	23.4	0.7	0.0	0.0	531.9	126.3
1970	1,563.0	4.4	774.9	2.4	0.0	0.0	0.0	0.0	639.5	139.8
1971	3,839.6	9.0	0.0	0.0	0.0	0.0	0.0	0.0	815.6	169.1
1972	5,624.2	17.2	1,957.9	5.1	2.5	(3)	0.0	0.0	491.8	122.0
1973	6,565.5	20.5	0.0	0.0	0.0	0.0	26.1	3.2	585.9	151.8
1974	10,012.1	34.1	1,211.9	3.5	0.0	0.0	44.4	4.3	462.3	112.4
1975	29,637.5	88.2	0.0	0.0	0.0	0.0	1.0	0.1	471.8	118.2
1976	23,779.9	86.6	4,850.4	8.7	16.2	0.6	0.5	0.1	496.9	132.5
Total	111,941.1	330.3	11,045.4	26.3	18,094.5	388.6	72.0	7.7	7,274.6	1,755.1

[1]Data derived from Wahle et al. (1975) prior to 1974 and from appropriate State, Federal, and Provincial records thereafter.
[2]1 lb = 0.454 kg.
[3]Less than 100 lb.

southeastern part of the State. They were funded by fish canneries and reared primarily sockeye salmon. The first hatchery in the State was a co-op built in 1891 by several canneries in Karluk, Kodiak Island. This was not an auspicious beginning for salmon culture in Alaska as the hatchery stopped production after only 1 yr because of violent disagreements among the canneries' personnel over fishing rights in the area.

By the early 1900's private hatcheries were in operation on Kodiak, Kuiu, Baranof, Etolin, Revillagigedo, Chichagof, and Prince of Wales Islands, as well as on the mainland. These facilities operated for varying periods of time through 1936. The world's largest and most costly facility to that time, the Fortmann Hatchery, was constructed in 1901 by the Alaska Packer's Association at Loring, Revillagigedo Island. It had a capacity of hatching 110 million eggs.

From 1893, when records were first kept, to 1912, releases of fry increased from 600,000 to a maximum of 156 million, and then declined to 32.5 million in 1936 when the last facility closed. During the peak years, from 1905 to 1912, the private hatchery annual releases averaged over 106 million fish. Although most of the fish were sockeye, a few pink salmon were released from several of the facilities.

Until 1900, the operation of private hatcheries was voluntary. Thereafter, a Congressional Act required salmon canning companies in Alaska to operate hatcheries and, each year, release four sockeye salmon fry for each adult salmon of any species taken during the previous year. In addition, the companies were required to keep records of the numbers of fish spawned, eggs taken, percentage hatched, fry planted, and release locations. In 1902, the release ratio was increased to 10 fry for each salmon taken. Most companies either ignored the requirement or found it impossible to follow. Because of this, the regulation was modified in 1906 to reduce license fees and taxes for complying companies.

In 1905, the U.S. Bureau of Fisheries erected Alaska's first Federal hatchery on Yes Bay near Ketchikan. This station, along with another Bureau hatchery on Afognak Bay, Afognak Island, hatched and released primarily sockeye salmon along with a few pinks, coho, and steelhead trout fry. Numbers of fish released ranged from 6 million in 1906 to 142 million in 1910 and then declined to 22 million in 1928. In addition, these two hatcheries shipped at least 150 million eyed eggs to Oregon, Washington, and the New England States including Maine, as well as the Province of British Columbia. The two hatcheries operated until 1933 when, because of the Depression, funding at Federal hatcheries was cut by 40%. All over the country, rearing programs were cut back and nine hatcheries, including the two in Alaska, were shut down (Leach and James 1934).

Little effort other than some experiments with planting eyed eggs was expended on anadromous salmonid production between 1936 and 1955. In 1955, the Deer Mountain Hatchery at Ketchikan hatched and reared coho and sockeye salmon. Some of the eggs for these plants, as well as those for some chinook salmon plants in 1965-66, came from the Green River in Washington. A hatchery near Fairbanks and the Deer Mountain Hatchery, as well as one operated on the Karluk River by a sports group, released fall chinook salmon and steelhead trout during the late 1950's. Fire Lake Hatchery, near Anchorage, opened in 1956. While this facility mainly reared trout for planting into lakes for resident fisheries, steelhead trout were also included in its program. Besides releasing a small number of steelhead trout fry, the hatchery also supplied eggs to the Fairbanks facility. All these hatcheries except Fire Lake have ceased anadromous rearing operations. Since 1960, one additional hatchery, Crystal Lake, and four experimental rearing facilities (one rearing pond and three saltwater net pens) have become operational (Table 3). Of the six, five are operated by the Alaska Department of Fish and Game (ADFG) and one by the National Marine Fisheries Service (NMFS). Four are located in southeastern Alaska and two are near Anchorage (Fig. 1).

In addition to these rearing stations, ADFG also operates several chum and pink salmon incubation facilities which release unfed fry. One, Kitoi Bay Hatchery on Afognak Island, has been in operation since 1953 and has also released large numbers of sockeye salmon fry. Others have been constructed in the past 3 yr by ADFG Fisheries Rehabilitation Enhancement and Development (FRED) Division using special monies appropriated by the State legislature. These incubation stations are being built to offset dramatic drops in Alaska's fish stocks (Alaska Department of Fish and Game 1976).

Table 3.—Anadromous fish rearing facilities—Alaska, 1960-76.

Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Hatcheries						
Crystal Lake	Petersburg	ADFG	sc, co, sh	Yes	1972	ADFG, Anadromous Fish Act
Fire Lake	Anchorage	ADFG	sc, co	Yes	1956	ADFG
Ponds and net pens						
Halibut Cove Lagoon net pen	Homer	ADFG	sc, co	Yes	1972	ADFG
Little Port Walter net pen	S.E. Baranof Island	NMFS	sc, co, sk	Yes	1967	NMFS
Mendenhall Pond	Juneau	ADFG	sc, co	Yes	1972	ADFG
Starrigavan net pens	Sitka	ADFG	sc, co	Yes	1971	ADFG

[1]ADFG = Alaska Department of Fish and Game, NMFS = National Marine Fisheries Service.
[2]sc = spring chinook salmon, co = coho salmon, sh = steelhead trout, sk = sockeye salmon.
[3]U.S. Fish and Wildlife Service monies.

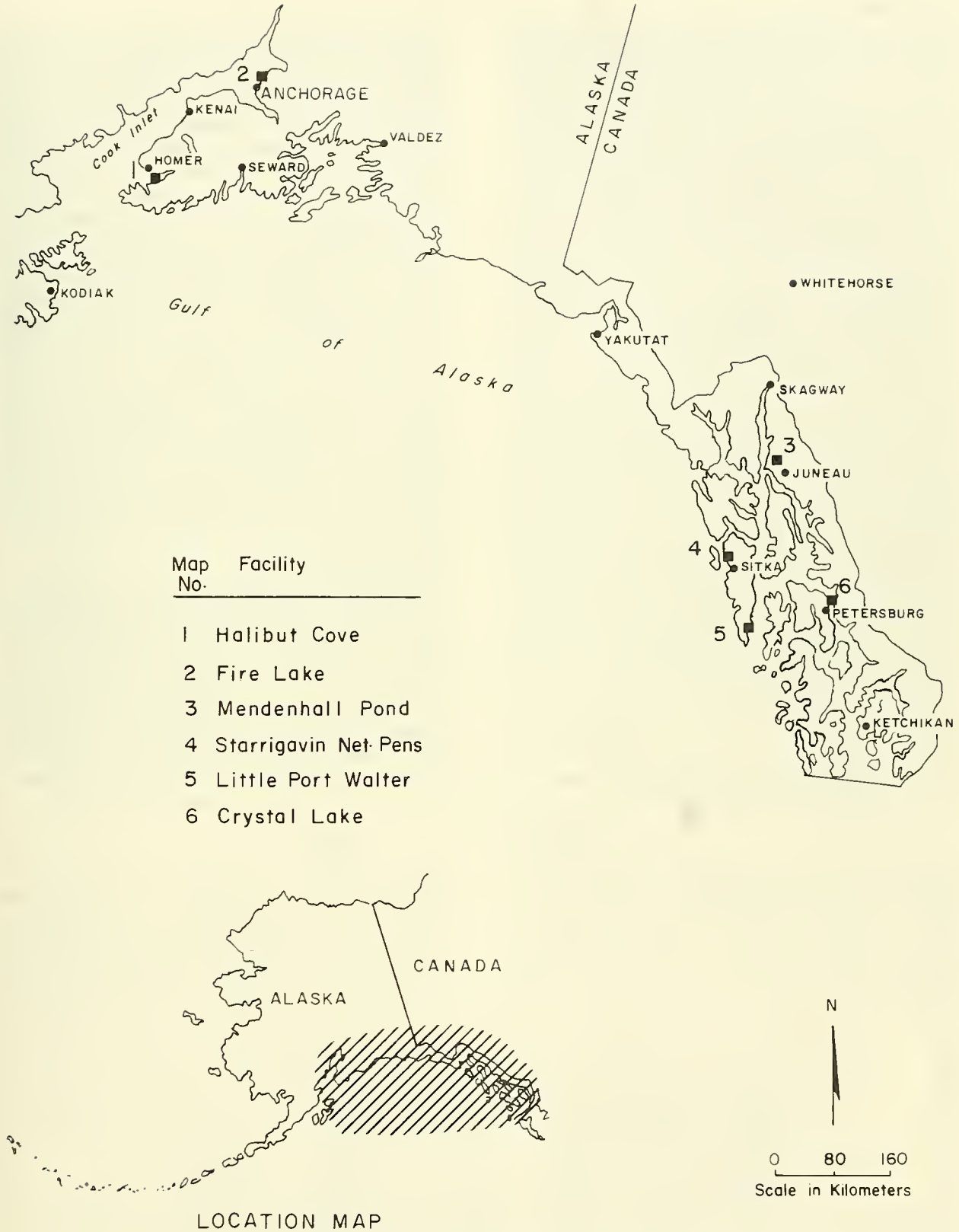


Figure 1.—Map of locations of Alaskan salmonid rearing facilities, 1960-76.

The State legislature also appropriated monies to be used to finance nonprofit, low-interest, State-secured loans for fish culture. The initial facilities built with these funds are still in the developmental stage. Releases made from both these private facilities and the FRED Division incubation stations are not included in this report because they normally consist of unfed fry.

Presently, the two agencies rearing fish in Alaska are concentrating on chinook and coho salmon (Table 4). Since a large majority of the chinook salmon plants have resulted from eggs taken from native stocks which closely approximate the spring race as we have defined it, we have called all of the chinook salmon plants spring chinook.

In 10 yr, releases of migrant chinook salmon went from a meager 400 fish weighing 4 lb (1.8 kg) to almost 600,000 fish weighing 33,000 lb (15,000 kg) in 1974. Coho salmon have also increased, from 171,000 migrants weighing 9,000 lb (4,000 kg) released in 1968 to approximately 1 million migrants weighing 50,000 lb (27,700 kg) in 1974.

Five of the Alaskan rearing facilities presently operating are noteworthy. The first of these, Fire Lake Hatchery, is actually a complex made up of a main hatchery and satellite ponds located at nearby Ft. Richardson and Elmendorf Air Force Base. These ponds are unique as they are the only ones currently using condenser cooling water heated as a byproduct during the thermal generation of electricity. This free supply of warm water allows fish to easily reach migrant size in an area were extreme weather conditions and cold-water temperatures would normally necessitate the use of expensive heating equipment to achieve similar growth.

Little Port Walter is a NMFS Research Station which was established in the late 1930's. It was expanded to include saltwater net pen rearing of coho salmon in the mid-1960's. The net pens are suspended from a floating platform anchored near the shore of a small saltwater bay. The salinities of the net pens are controlled using freshwater piped from nearby Sashin Creek. To obtain the initial supply of coho salmon for rearing, fingerlings were seined from the bay and placed in the pens. After migrating to the ocean, the adult fish return to the area of the net pens where they are trapped and spawned.

Table 4.—Migrant releases of chinook, coho, and sockeye salmon and steelhead trout—Alaska[1] (in thousands).

Release year	Spring chinook		Coho		Sockeye		Winter steelhead	
	No.	Lb.[2]	No.	Lb.	No.	Lb.	No.	Lb.
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.4	(3)	0.0	0.0	0.0	0.0	0.0	0.0
1965	8.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1966	166.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0
1967	538.3	11.6	0.0	0.0	0.0	0.0	0.0	0.0
1968	82.4	2.8	171.7	8.9	0.0	0.0	0.0	0.0
1969	95.9	5.7	187.4	13.8	0.0	0.0	0.0	0.0
1970	45.7	1.6	227.0	21.5	0.0	0.0	0.0	0.0
1971	217.4	11.6	92.7	6.5	0.0	0.0	0.0	0.0
1972	71.8	3.8	309.7	20.1	0.0	0.0	0.0	0.0
1973	177.3	11.0	143.3	15.9	0.0	0.0	0.0	0.0
1974	598.8	33.3	969.0	50.1	0.0	0.0	0.0	0.0
1975	154.8	6.9	1,032.1	72.1	0.0	0.0	17.5	0.6
1976	225.7	9.7	930.6	48.1	16.2	0.6	16.5	1.4
Total	2,384.2	100.0	4,063.5	257.0	16.2	0.6	34.0	2.0

[1]Derived from Wahle et al. (1975) prior to 1974 and from Alaska Department of Fish and Game and National Marine Fisheries Service release reocrds thereafter.
[2]1 lb = 0.454 kg.
[3]<100 lb.

Mendenhall Rearing Pond is located just off the Mendenhall River near Juneau. It is supplied with water from the melting Mendenhall Glacier. This pond is covered by ice each year from October to May so fish can be fed only during the warmer months. During the winter, water under the ice must be aerated with an electric pump. Coho salmon eggs are obtained from returns to the rearing pond. Because of the cold water, eggs taken from Mendenhall Pond are transferred to Crystal Lake Hatchery near Petersburg for hatching. The fry are then brought back to the pond for rearing and release.

The Starrigavan net pens are patterned after the Little Port Walter facility. They are anchored in the bay near Sitka. Like its prototype, the facility pipes water from a nearby creek to control salinity. Local and Crystal Lake Hatchery coho salmon fry were initially reared. As they become more available, endemic stocks are replacing those from Crystal Lake.

Halibut Cove is the saltwater net pen facility southwest of Anchorage. It is also an offshoot of the Little Port Walter and Starrigavan facilities. Rearing salmon in this near Arctic environment is challenging because the lagoon freezes in the winter and the water temperature drops to −2°C (18°F). Freshwater from a nearby lake is available only during the warmer months. There are no local salmon stocks available and no hatching facilities on the site, so Fire Lake chinook and coho salmon fry are brought in for rearing.

British Columbia

The program of anadromous fish propagation in British Columbia began in 1884 with the establishment of a hatchery on the Fraser River near the town of New Westminster. From 1901 through the mid-1930's additional facilities were constructed and operated by the Provincial government and private fisheries organizations on the Finger and Skeena Rivers, at Rivers Inlet, and on Vancouver Island. As in Alaska, all of these hatcheries concentrated on sockeye salmon production, but also intermittently hatched a few chum, coho, chinook, and pink salmon. All fish were released as fry. From 1885 to 1927 more than 2 billion sockeye salmon fry were released.

The operation of hatcheries decreased and then finally stopped completely in the late 1930's due to the Depression and the outbreak of World War II. Nothing was done on a production basis again until 1967 when a pilot project began at the newly constructed Big Qualicum Hatchery on Vancouver Island. At present, Canadian Fisheries and Marine Services (CFMS) operates six fa-

cilities in British Columbia (Table 5). Five of these are on Vancouver Island and the sixth, Capilano, is on the mainland just north of the city of Vancouver (Fig. 2).

Hatchery emphasis has been placed on fall chinook and coho salmon (Table 6) rather than sockeye salmon as was the case in the early years. In 9 yr (1968-76) fall chinook salmon migrant releases have increased twenty-fold (from 147,000 to 30 million fish). Coho salmon releases also increased, from almost 70,000 migrants in 1970 to over 2.3 million in 1976. In addition, the CFMS has begun a steelhead trout rearing program with the first migrant fish released in 1973 and has been experimenting with summer chinook salmon.

While numbers and pounds released by British Columbia hatcheries each year have been small when compared with the production of the large Columbia River complexes, results have been encouraging. To date, the most dramatic success has been the survival of the 1971-brood coho salmon released from Capilano hatchery. Of 284,000 fish released, there was a return of 2,700 jacks (fish returning as 2-yr olds) in 1973 and 37,000 adults in 1974. This is a hatchery return of almost 14%. In addition, these fish contributed heavily in the fishery, exhibiting a 1:1 catch to escapement ratio. The total survival for this brood of fish was almost 28%.[2]

It is interesting to note that of the six CFMS facilities, three began as spawning channels. All three of these have either been modified to include rearing facilities or have been converted to hatcheries. Big Qualicum Hatchery originally had two spawning channels; one is still being used for that purpose for chum salmon and the other has been converted to a rearing channel. Puntledge and Robertson Creek were unsuccessful as spawning channels primarily due to unsuitable water supplied during egg incubation. After several years of operation with poor results, the two facilities were converted to hatcheries.

Washington Coastal and Puget Sound

The Baker Lake Hatchery built in 1896 by the State of Washington on a tributary of the Skagit River, was the State's first facility located outside the Columbia River system. At this hatchery sockeye salmon were spawned, the eggs hatched, and the fry released back into the Skagit River. After several years, the hatchery was sold to the U.S. Fish Commission and was operated as part of the Federal hatchery system.

Between 1899 and 1925 more than 50 different salmon facilities were constructed and operated in this region by State and Federal agencies. Most were eventually failures due in part to lack of suitable water supplies, an insufficient supply of eggs, lack of funds, or, in many cases, lack of knowledge. A few, such as the Quilcene National Fish Hatchery (1911) operated by the U.S. Fish and Wildlife Service (USFWS) and the Dungeness (1902), Green River (1901), Nooksack (1899), Puyallup Salmon (1917), Samish (1899), Skykomish (1905), and Willapa (1899) hatcheries operated by Washington Department of Fisheries (WDF), are still in operation today.

All species of salmon were reared at these early facilities with coho and fall chinook salmon being predominant at the State hatcheries and fall chinook, coho, and sockeye salmon at the Federal hatcheries. In addition, both State and Federal hatcheries raised steelhead trout. In 1932, responsibility for steelhead and other anadromous trout was transferred to the newly formed Washington Department of Game (WDG) (Berg 1968). The majority of fish from the early State hatcheries were released as unfed fry while the Federal hatcheries reared a considerable number to larger sizes before release.

Due to the serious decline of the fishery resource, WDF, WDG, and USFWS have constructed new facilities to improve the runs of salmon and steelhead trout (Chaney and Perry 1976). Since 1960, these three agencies have operated or supervised a total of 26 hatcheries and 32 rearing ponds or net pens (Table 7). Of these, all of the hatcheries and 19 of the rearing ponds and net pens released anadromous fish in 1976. The rearing facilities in this region are located in two areas: Puget Sound (Fig. 3) and Pacific coast (Fig. 4).

This region has produced a large percentage of the total anadromous salmonids raised on the Pacific coast. The 921 million migrant fish that have been released over the 17 yr since 1960, constitute 27% of the total coastal releases by number (Tables 8, 9). By weight, the 23.4 million lb (10.6 million kg) of migrants are 22% of the coastal total. Migrant releases in 1976 totaled 89.4 mil-

[2]K. Sandercock, Department of Environment, Fisheries and Marine Service, Vancouver 1, B.C., Canada U6E 2P1, pers. commun. November 1976.

Table 5.—Anadromous fish rearing facilities—British Columbia, 1960-76.

Hatcheries	General location	Operation agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operations began
Big Qualicum	Qualicum Beach	CFMS	fc, co, sh	Yes	1967
Capilano River	North Vancouver	CFMS	fc, co, sh	Yes	1971
Puntledge	Courtenay	CFMS	fc	Yes	1971
Quinsam	Campbell River	CFMS	fc, co, sh	Yes	1975
Robertson Creek	Port Alberni	CFMS	fc, co, sh	Yes	1972
Rosewall[3]	Fanny Bay	CFMS	co	Yes	1972

[1]CFMS = Canadian Fisheries and Marine Service.
[2]fc = fall chinook salmon, co = coho salmon, sh = steelhead trout, sc = spring chinook salmon.
[3]Operated as research facility.

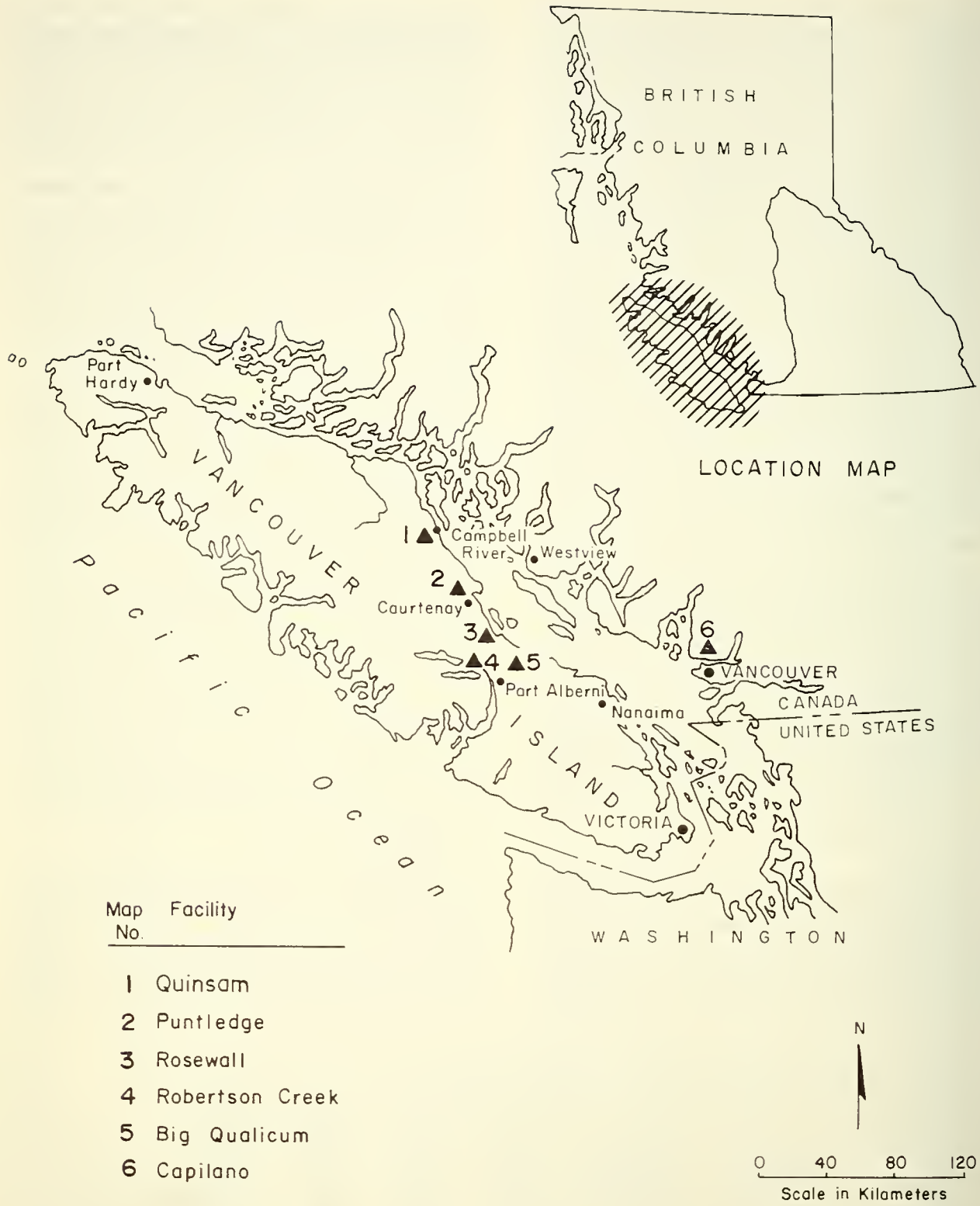


Figure 2.—Map of locations of British Columbian salmonid rearing facilities, 1960-76.

Table 6.—Migrant releases of chinook and coho salmon and steelhead trout—British Columbia[1] (in thousands).

Release year	Fall chinook		Coho		Winter steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds
1960	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0
1965	0.0	0.0	0.0	0.0	0.0	0.0
1966	0.0	0.0	0.0	0.0	0.0	0.0
1967	0.0	0.0	0.0	0.0	0.0	0.0
1968	147.0	1.3	0.0	0.0	0.0	0.0
1969	460.0	4.7	0.0	0.0	0.0	0.0
1970	67.5	0.7	69.0	2.5	0.0	0.0
1971	299.0	3.0	88.0	2.7	0.0	0.0
1972	822.7	9.0	210.0	7.5	0.0	0.0
1973	2,038.3	23.4	507.6	19.6	41.7	2.0
1974	2,361.1	31.7	517.7	20.7	23.0	3.1
1975	2,220.1	36.3	998.4	43.8	25.8	2.8
1976	3,005.5	36.8	2,385.7	143.8	80.5	6.3
Total	11,421.2	146.9	4,776.4	240.6	171.0	14.2

[1]Derived from Wahle et al. (1975) prior to 1974 and from Canadian Fisheries and Marine Service records thereafter.
[2]1 lb = 0.454 kg.

lion fish and 2.7 million lb (1.2 million kg). In 1976, fall chinook salmon were the most numerous with 35 million released, followed by coho salmon, steelhead trout, and chum salmon. By weight, coho salmon were dominant with 1.3 million lb (0.59 million kg) stocked, followed in order by fall chinook salmon, steelhead trout, and spring chinook salmon. No summer chinook salmon are reared in this region.

As noted in Table 7, the two State fisheries agencies use Dingell-Johnson Act and Anadromous Fish Act monies to partially fund some of their hatchery programs. Dingell-Johnson monies come from a Federal tax on recreational fishing gear and are divided among the States based on the number of fishing licenses sold. It is administered by the U.S. Fish and Wildlife Service (USFWS).

The Anadromous Fish Act (Public Law 89-304) is administered jointly by the USFWS and the National Marine Fisheries Service. Under this Act, cooperative agreements with States are made and other non-Federal interests for the conservation, development, and enhancement of, among others, the anadromous fishery resources of the Nation. Federal matching funds of up to 50% may be used to finance project costs if one state is

Table 7.— Anadromous fish rearing facilities—Washington coastal and Puget Sound, 1960-76.

Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Hatcheries						
Aberdeen	Aberdeen	WDG	sh, src	Yes	1936	WDG
Arlington	Oso	WDG	sh (src)	Yes	1956	WDG
Bellingham	Bellingham	WDG	sh (src)	Yes	1935	WDG
Chambers Creek	Tacoma	WDG	sh	Yes	1973	WDG, Anadromous Fish Act[3]
Dungeness	Sequim	WDF	fc, sc, co (ch, pi)	Yes	1902	WDF
George Adams	Shelton	WDF	fc, sc, co, ch (pi)	Yes	1960	WDF, Tacoma PUD
Green River	Auburn	WDF	fc, co (sc, ch)	Yes	1901	WDF
Hood Canal	Hoodsport	WDF	fc, sc, co, ch, pi	Yes	1953	WDF
Issaquah	Issaquah	WDF	fc, co (sk)	Yes	1937	WDF
Minter Creek	Purdy	WDF	fc, co, ch (sc, pi, ce)	Yes	1937	WDF
Nemah	Nemah	WDF	fc, co, ch	Yes	1953	WDF
Nooksack	Kendall	WDF	fc, co	Yes	1899	WDF
Puyallup salmon	Orting	WDF	fc, co (sc, pi)	Yes	1917	WDF
Puyallup trout	Puyallup	WDG	sh	Yes	1947	WDG
Quilcene	Quilcene	USFWS	fc, co, ch (sh)	Yes	1911	USFWS
Quinault	Neilton	USFWS	fc, co, ch, sh	Yes	1968	USFWS
Samish	Burlington	WDF	fc, co (ch)	Yes	1899	WDF
Seward Park	Seattle	WDG	sh	Yes	1935	WDG
Shelton	Shelton	WDG	sh, src	Yes	1947	WDG, Anadromous Fish Act[3]
Simpson	Matlock	WDF	fc, co (ch)	Yes	1949	WDF, PP&L
Skagit	Marblemount	WDF	fc, sc, co, ch (pi, sh)	Yes	1947	WDF
Skykomish	Startup	WDF	fc, sc, co (ch, pi)	Yes	1905	WDF
Soleduck	Sappho	WDF	fc, sc, co	Yes	1970	WDF
South Tacoma	Lakewood	WDG	sh	Yes	1933	WDG
Tokul Creek	Fall City	WDG	sh	Yes	1933	WDG
Willapa	Lebam	WDF	fc, co (ch, sk)	Yes	1899	WDF
Rearing ponds and net pens						
Barnaby Pond	Rockport	WDG	sh	Yes	1961	WDG, Dingell-Johnson[3]
Blue Slough Pond	Darrington	WDG	sh	No	1961	WDG
Bogachiel Pond	Forks	WDG	sh	Yes	1968	WDG, Anadromous Fish Act[3]
Garrison Creek (Western State)	Steilacoom	WDF	fc, co, pi (sc, ch)	Yes	1973	WDF, Sports Club
Green River pond	Palmer	WDG	sh	Yes	1968	WDG, Anadromous Fish Act[3]

Table 7.—Continued.

Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Harrison	Rockport	WDG	sh	No	1970	WDF, Dingell-Johnson[3]
Mayr Bros. pond	Aberdeen	WDG, Private	sh	Yes	1974	WDG, Private
Olympic rearing channel	Port Angeles	WDF	fc, co	Yes	1975	WDF
Percival-Deschutes Complex (including Capital Lake)	Olympia	WDF	fc, sc, co	Yes	1949	WDF, Olympic Salmon Club
Salt Creek pond	Joyce	WDG	sh	No	1964	WDG, Sportsmen's Group
Skykomish ponds	Gold Bar	WDG	sh	Yes	1974	WDG
South Sound net pens	Tacoma	WDF	fc, co, ch	Yes	1972	WDF
Squaxin	Squaxin Island	WDF, Squaxin Tribe	fc, sc, co	Yes	1971	WDF, Squaxin Tribe
Tualip	Marysville	WDF, Tualip Tribe	fc, co	Yes	1973	WDF, Tualip Tribe
Whitehorse	Darrington	WDG	sh (src)	Yes	1962	WDG, Dingell-Johnson[3]
WDF minor facilities and coops						
Bay Center	Bay Center	Bay Center Mariculture	fc, ch, pi	No	1972	Private
Bowmans Bay	Anacortes	WDF	fc, sc, co, ch	No	1947	WDF
Domsea Farms	Manchester	Domsea Farms Mariculture	co	No	1969	Domsea Farms Mariculture
Elliot Pond	Seattle	WDF, NW Steelheaders	fc, co	No	1974	WDF, NW Steelheaders
Gig Harbor net pens	Gig Harbor	WDF, Puget Sound Herring Sales, Peninsula High Key Club	fc, ch	Yes	1975	WDF, Puget Sound herring sales
Gorst Creek	Bremerton	WDF, Sports Club	fc	No	1962	WDF
Little Clam Bay	Port Orchard	WDF	co	No	1962	WDF
Lummi	Bellingham	Lummi Tribe	co	Yes	1972	Lummi Tribe
Manchester	Port Orchard	WDF	fc, co	No	1973	WDF
NW Steelheaders	Palmer, Renton	WDF, NW Steelheaders	sc, co	No	1971	WDF, NW Steelheaders
Ocean Shores pond	Ocean Shores	Sports Group	co	Yes	1974	Sports Group
Peninsula	Port Angeles	Peninsula Jr. College	co	Yes	1975	Peninsula Jr. College
Sultan Pond	Sultan	WDF, Sultan Sportsmen's Club	co	Yes	1973	Sultan Sportsmen's Club
Tacoma net pens (including Totem Marina)	Tacoma	WDF, City of Tacoma	fc, co	Yes	1973	WDF, City of Tacoma
Westport boat basin	Westport	WDF, Ocosta School	co	Yes	1972	WDF
Whidby Island	Oak Harbor	WDF, Sports Club	fc, sc, co	No	1972	WDF, Sports Club
Wynoochee Pond	Montesano	WDF, NW Steelheaders	fc, co	No	1974	WDF, NW Steelheaders

[1]WDG = Washington Department of Game, WDF = Washington Department of Fisheries, Tacoma PUD = Tacoma Public Utility District, USFWS = U.S. Fish and Wildlife Service, PP&L = Pacific Power and Light.

[2]fc = fall chinook salmon, sc = spring chinook salmon, co = coho salmon, sh = steelhead trout, ch = chum salmon, pi = pink salmon, ce = cherry salmon, src = sea-run cutthroat trout, sk = sockeye salmon (minor species in parentheses).

[3]Dingell-Johnson Act monies administered by U.S. Fish and Wildlife Service, Anadromous Fish Act monies administered by National Marine Fisheries Service and U.S. Fish and Wildlife Service.

involved. If two states cooperate on a project, the matching funds can total 66 2/3%.[3]

State and Federal anadromous salmonid rearing programs in this region are augmented by: 1) State and private cooperative efforts, 2) commercial enterprises, 3) regulated Indian tribe rearing programs, and 4) unregulated Indian tribe rearing programs.

The WDF cooperates with sport and school groups in salmon rearing programs. The agency supplies surplus fry for rearing in saltwater net pens or ponds. The cooperating groups supply equipment, fish food, and labor needed to rear the fish to migrant size. Releases are made directly from the pens or ponds. Facilities operated in this manner include Northwest Steelheader (various Puget Sound areas), Gorst Creek, Percival, Salt Creek, Whidby Island, and Westport boat basin.

Two commercial fish rearing companies, Domsea Farms and Bay Center Mariculture, have released salmon in this region. Normally these companies buy surplus eggs from State hatcheries, rear the fish to smolt size in freshwater, and then transfer the fish to saltwater net pens for final rearing to market size. Although emphasis is placed on commercial production, cooperative experimental releases have been made. Under Washington law,

[3]E. Wold, Director, Columbia River Fisheries Development Program, National Marine Fisheries Service, NOAA, Portland, OR 97208, pers. commun. June 1979.

the companies have no special harvest rights to fish returning to the release site.[4]

While the private companies are prohibited by State law from engaging in "ocean ranching," (see Oregon Coastal section), the treaty Indian tribes are not. Many tribal councils have become active in this form of aquaculture. The operations take place either on streams completely within reservation boundaries or on streams where the tribe has been granted exempt status through treaty. In one example of this type of operation, the Quinault Indians, as a tribal enterprise, hatch and rear salmon and release them into the Quinault River system. After maturing in the ocean, adult fish return to the Quinault River where many are caught in the exclusively Indian river net fishery.[5]

The fish released by these Indian operated facilities do contribute to ocean sports and commercial catches before they return to the rivers where only tribal members may fish for them. Because of difficulties in obtaining accurate release information from some of the operations, we have included in this report only the releases from facilities that provide information to WDF.

Columbia Basin

The Columbia Basin, as referred to in this report, contains the portions of Washington, Idaho, and Oregon drained by the Columbia River (Fig. 5). The five State and Federal fish management agencies in this region account for 54% (by number) and 55% (by weight) of the total Pacific coast anadromous releases made in 1976 (Tables 10, 11). Migrant releases for the 17-yr period starting in 1960 amount to over 2 billion fish and 61 million lb (27.7 million kg), raised at a total of 81 facilities—63 hatcheries and 18 rearing ponds. During the 17-yr, all species of fish included in this report, except pink salmon, were released into streams of the basin. During 1976, anadromous migrants were released from 53 hatcheries and 14 rearing ponds.

The Columbia Basin is unique in the number of hatcheries constructed and operated as compensation for habitat destroyed by water use projects on the Columbia River and its tributaries. Compensation was initiated on the Columbia River by the Mitchell Act passed by Congress in 1938. The Act provided for a cooperative fisheries management program involving the Federal Government and the States of Oregon and Washington. Initially a small amount of money was appropriated for the implementation of the Act under the Department of Commerce. Little was accomplished until 1946 when the Act was amended to create the Lower Columbia River Development Program (subsequently referred to as the Program) at the time under the Department of Interior. Initial funding came from the U.S. Army Corps of Engineers and the Program was administered by the USFWS. The funds were used for stream clearance and construction and modernization of hatcheries.

In 1956, the Program was expanded to include the upper Columbia and Snake River drainages extending into Idaho. The word "Lower" was subsequently dropped from the Program name. The funding is now administered by the National Marine Fisheries Service, Department of Commerce, Portland, Oreg.

Since 1960, releases from Program hatcheries have accounted for 74% of the Columbia Basin migrant release by number and 57% by weight (Tables 12, 13).

In recent years, an additional source of funds for construction and operation of hatcheries in the basin has been the power producing agencies and companies. The U.S. Army Corps of Engineers has funded the construction or modernization of nine hatcheries as mitigation and compensation for their hydroelectric projects and is presently providing operational monies for these facilities. Also in the basin, 17 facilities were constructed by public utility districts or private power companies in connection with the effects of their water related projects.

Columbia Basin-Washington.—The State Fish Commissioner, James Crawford (1890), stated in his first report to the Governor of Washington concerning artificial propagation: "To foster and replenish the streams of our state with salmon and trout, the establishment of a hatchery is a positive necessity. While though much could be done by the passage and enforcement of a stringent law protecting our fish during the spawning season, still, as has been demonstrated in the older states without the aid of artificial propagation, the stock of wild fish will eventually be exhausted." This statement was based on declining populations of fish in Washington's rivers, especially the Columbia, even at that early date. Diversions and obstructions were blocking access to historically important spawning and rearing areas. Also, operators of gill nets, fish wheels, and traps, along with the Indians and their dip nets, were taking excessive numbers of fish. It was estimated that each fish wheel took more than 100 tons of fish per year (Crawford 1890). The pack of salmon by Washington canneries had increased from 4,000 cases in 1866 to a high of 629,000 cases in 1883 (Crawford 1892) and then declined to 321,000 cases in 1889 (Cobb 1931).

In light of this dwindling resource, the 1891 legislature appropriated $15,000 for securing a site and erecting a hatchery. The commission first selected a location in Okanogan County, but was unable to build there because of title and land survey problems (Crawford 1892).

In 1894, Commissioner Crawford investigated the possibility of enhancing upper Columbia stocks of salmon by taking and eyeing eggs artificially in the lower reaches of the Columbia River and transporting them to suitable hatching sites up the river. Working with fishermen using pound net traps in Baker's Bay, near the mouth of the Columbia River, he secured 150 chinook salmon which he held for spawning. He obtained only 6,000 eggs before the holding area was washed out. No

[4]H. Senn, Chief of Artificial Production, Washington Department of Fisheries, Olympia, WA 98504, pers. commun. November 1977.

[5]C. Mahnken, Manchester Field Station, National Marine Fisheries Service, NOAA, Manchester, WA 98353, pers. commun. August 1976.

Figure 3.—Map of locations of Washington-Puget Sound salmonid rearing facilities, 1960-76.

further efforts to take eggs were made that year, but the idea was proven feasible as the eggs survived the transfer (Crawford 1896).

A law passed in 1893 provided for licensing of all Washington commercial fishermen. The fishermen supported the measure. The monies were to be placed in the Fish Commission fund to be used for fishery projects. In 1895, $20,000 was appropriated from this fund and the first hatchery in Washington was built on the Kalama River, 4 mi above its junction with the Columbia River. The land was donated by the citizens of Cowlitz County. Its initial capacity, 4 million eggs, was increased to 6 million in 1896. An auxiliary station was built on the Chinook River near the mouth of the Columbia River for collecting eggs as well as for hatching additional fish (Crawford 1896).

Map No	Facility
1	Nooksack
2	Lummi Ponds and Net Pens
3	Bellingham
4	Samish
5	Skagit
6	Harrison Pond
	Barnaby Pond
7	Bowmans Bay
8	Whidbey Island Rearing Pond
9	Arlington
10	Blue Slough
11	Whitehorse
12	Olympic Rearing Channel
13	Peninsula College
14	Tulalip
15	Dungeness
16	Sultan Pond
17	Skykomish Hatchery
18	Skykomish Rearing Ponds
19	Quilcene
20	Elliot Bay Net Pens
21	Takul Creek Hatchery and Pond
22	Garst Creek Pond
23A	Domsea Farms-Freshwater
23B	Domsea Farms-Saltwater
24	Seward Park
25	Little Clam Bay
	Manchester
26	Issoquah
27	Hood Canal
28	Minter Creek
29	Green River Hatchery
30	Green River Pond
31	Gig Harbor
32	Shelton
33	George Adams
34	Totem Marine (Tacoma Net Pens)
35	South Tacoma
	Garrison Creek
	Chambers Creek
36	South Sound Net Pens
37	Puyallup Trout
38	Squaxin Island Net Pens
39	Puyallup Salmon
40	Percival-Deschutes Complex
	(including Capital Lake)

Not Shown - Misc Northwest Steelheaders Net Pens

By 1900, State hatcheries were being constructed on the Wenatchee, Wind, Little Spokane, Methow, and Klickitat Rivers (Berg 1968). In addition, the U.S. Fish Commission constructed a station on the Little White Salmon River in 1897, supplemented by an auxiliary station on the Big White Salmon River. All these early hatcheries concentrated their efforts on chinook salmon fry plants. Coho salmon fry and chinook salmon fingerling releases became more prevalent after 1900, especially at the Federal facilities. In addition, some steelhead trout and chum salmon fry were also produced. In 1932, the Washington State legislature divided the anadromous fish programs between two newly created agencies. The Washington Department of Fisheries (WDF) assumed responsibility for salmon and the Washington Department of Game (WDG) became responsible for trout (steelhead and sea-run cutthroat).

The program of artificial propagation in Washington continued at about the same level until the early 1940's when the Columbia River Development Program (see Columbia Basin section) became active in this area. Under the Program, fish ladders were built over impassible barriers and log jams were removed from such Columbia River tributaries as Abernathy Creek and the Kalama, Cowlitz, Wind, and Klickitat Rivers to open up new spawning areas that were previously blocked to migrating fish. New hatcheries including Willard National Fish Hatchery (NFH), Klickitat, and Skamania were constructed, and Spring Creek NFH, Little White NFH, and Carson NFH remodeled.

From 1960 to 1976, 30 hatcheries and 12 rearing ponds raised anadromous salmonids in this region (Table 14). In 1976, the USFWS operated 3 hatcheries and 2 hatchery complexes, WDF operated 10 hatcheries and 5 ponds, and WDG operated 11 hatcheries and 4 ponds. The two USFWS hatchery complexes, Little White Salmon NFH and Leavenworth NFH, were formed in 1976 by placing one and two formerly independent stations (Willard, and Winthrop and Entiat, respectively) under the managers of these two complexes. Although the facilities in this region are scattered throughout the Columbia River drainage, there is a large concentration in the lower river and its tributaries within 75 mi of Portland, Oreg. (Fig. 6).

This region, with 1.2 billion migrant releases between 1960 and 1976, is the largest producer of salmon and steelhead trout on the coast. In 1976 releases numbered 92.6 million smolts, 31% of the coastal total, weighing 3.4 million lb (1.5 million kg), 31% of the total (Tables 15, 16).

Columbia Basin-Idaho.—Artificial production of salmon and steelhead in Idaho began around the turn of the century. A substation of Clackamas Hatchery, operated in Oregon by the U.S. Commission of Fish and Fisheries, was constructed on the Salmon River to take salmon and steelhead eggs. Additionally, eggs were shipped into the State from Clackamas Hatchery and another of its substations, Little White Salmon Hatchery, located in Washington. Fry hatched were released to the Pahsimeroi and Lemhi Rivers as well as the Salmon River (Leach 1932, 1933). This substation was phased out during the mid-1930's when the Federal hatchery system underwent a drastic budget reduction.

In addition to the Federal hatchery, the State of Idaho included a few salmon and steelhead with trout programs of their early hatcheries. In one example, the State took eggs from brood steelhead trout trapped in the Lewiston Dam fish ladder, eyed them in a spring at Hatwai Creek, and reared them at Grangeville Hatchery.[6]

All of the early hatchery efforts were minor in scope. The State relied instead on wild stocks of fish to perpetuate the anadromous fish runs. In 1956, because of the decline in the stocks, the Columbia River Development Program extended to the upper Columbia and Snake Rivers. (See the Columbia Basin section.) Under the Program, natural spawning and rearing areas were increased in Idaho through, among others, the construction of fishways over Sellway Falls and the now removed Lewiston Dam in the Clearwater River drainage and Dagger Falls on the Middle Fork Salmon River. Approximately 220 screens were built on irrigation diversions to prevent the loss of fish onto irrigated fields. Obstructions and debris were also removed from tributaries of the Clearwater River.

It had become obvious by 1960 that the increase in the number of dams in the Columbia and Snake Rivers had caused upstream passage problems for adult fish and downstream mortality for juvenile fish. About this time, Idaho Power Company was required to construct fish rearing facilities below Oxbow Dam on the Snake River, and more attention was focused on rearing anadromous fish in Idaho's hatcheries (Chaney and Perry 1976).

[6]D. Ortmann, Idaho Department of Fish and Game, Boise, ID 83707, pers. commun. September 1976.

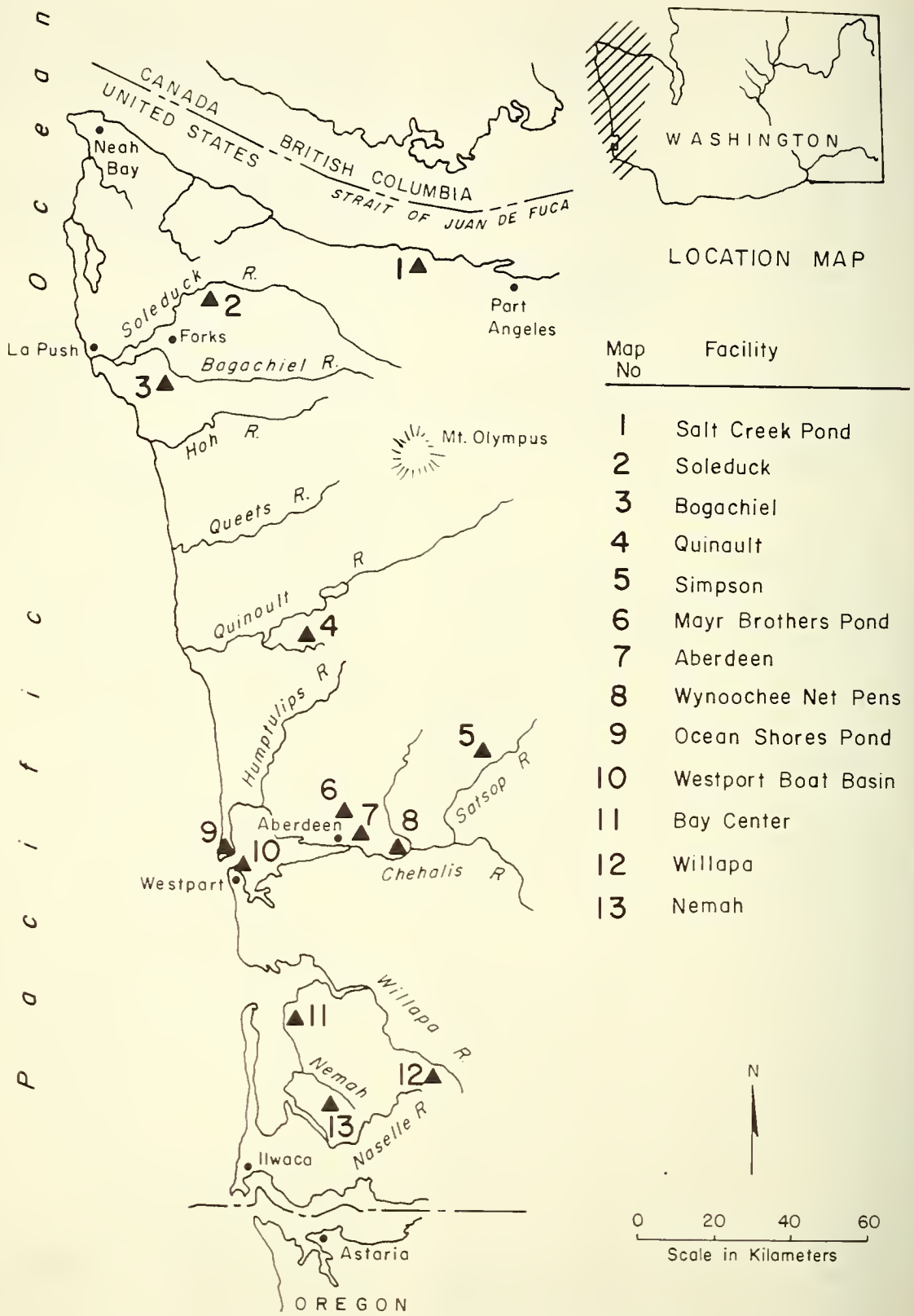


Figure 4.—Map of locations of Washington coastal salmonid rearing facilities, 1960-76.

Table 8.—Migrant releases of chinook and coho salmon and steelhead trout—Washington coastal and Puget Sound[1] (in thousands).

Release year	Fall chinook		Spring chinook		Coho		Winter steelhead		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	20,065.3	89.0	302.4	7.5	6,094.2	126.5	1,128.2	156.3	0.0	0.0
1961	19,508.0	123.9	694.7	10.6	9,612.6	243.5	847.0	135.6	20.4	1.7
1962	20,914.1	112.0	584.6	12.6	9,541.6	185.1	1,215.3	168.9	0.0	0.0
1963	19,224.1	114.1	466.3	7.1	5,297.8	96.7	1,236.0	165.4	206.6	21.4
1964	29,380.5	185.9	294.8	16.9	9,687.2	305.1	1,205.2	175.9	121.6	13.0
1965	30,955.2	196.5	491.8	15.5	10,763.3	358.1	1,204.5	177.5	132.2	13.8
1966	27,566.0	212.8	62.8	4.6	12,907.0	500.5	1,380.2	205.1	97.0	12.6
1967	29,938.7	238.3	378.5	32.7	12,787.3	634.0	1,152.9	179.0	77.3	9.2
1968	30,163.1	290.7	558.9	45.3	13,855.3	721.5	1,305.2	186.6	193.0	22.7
1969	36,030.0	320.0	256.8	21.4	14,901.0	779.8	1,960.0	278.0	124.9	17.7
1970	31,745.1	290.1	309.4	17.7	18,297.2	940.8	1,606.6	256.8	325.4	37.0
1971	47,330.8	434.2	190.1	24.0	16,497.0	928.8	1,581.0	227.4	364.7	62.9
1972	36,221.1	418.8	708.2	48.5	18,969.7	1,083.2	1,454.7	257.0	392.6	63.5
1973	43,007.7	635.2	1,267.0	170.4	18,425.3	1,049.7	1,796.1	321.2	421.7	62.4
1974	31,004.3	688.0	829.5	96.0	21,270.0	1,313.7	1,533.1	283.2	528.4	67.9
1975	33,342.7	702.1	1,030.3	164.4	22,858.7	1,263.6	1,582.4	288.7	564.4	75.3
1976	34,902.5	759.0	693.6	118.5	23,539.4	1,255.4	2,296.5	389.9	399.9	58.8
Total	521,299.2	5,810.6	9,119.7	813.7	245,304.6	11,786.0	24,484.9	3,852.5	3,970.1	539.9

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (Foster, R., R. Kolb, and V. Fletcher. 1975. 1974 hatchery statistical report of production and plantings. Wash. Dep. Fish., Olympia, 156 p.) for WDF 1974, Fletcher et al. (Fletcher, V., B. Kiser, B. Rogers, and B. Foster. 1976. 1975 hatchery statistical report of production and planting. Wash. Dep. Fish., Olympia, 154 p.) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual reports.

[2]1 lb = 0.454 kg.

Table 9.—Migrant releases of chum, pink, sockeye, and cherry salmon and sea-run cutthroat trout—Washington coastal and Puget Sound[1] (in thousands).

Release year	Chum		Pink		Sockeye		Cherry		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	5,031.6	8.8	555.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0
1961	4,710.5	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	1,141.8	2.8	145.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0
1963	3,683.6	6.8	0.0	0.0	4.4	[3]	0.0	0.0	0.0	0.0
1964	3,207.7	6.7	525.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0
1965	2,911.4	5.5	0.0	0.0	0.0	0.0	0.0	0.0	24.0	1.5
1966	1,047.3	3.6	421.0	1.3	0.0	0.0	0.0	0.0	134.7	24.1
1967	1,302.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	156.6	20.3
1968	1,090.7	3.1	602.8	1.4	0.0	0.0	0.0	0.0	155.4	22.3
1969	2,318.1	5.5	0.0	0.0	0.0	0.0	0.0	0.0	136.3	29.2
1970	1,500.5	4.3	774.9	2.4	0.0	0.0	0.0	0.0	85.2	16.1
1971	3,839.6	9.0	0.0	0.0	0.0	0.0	0.0	0.0	251.5	48.3
1972	4,985.7	16.0	1,957.9	5.1	2.5	[3]	0.0	0.0	111.8	26.3
1973	6,001.9	19.1	0.0	0.0	0.0	0.0	24.3	3.1	130.0	31.7
1974	9,384.8	30.7	1,211.9	3.5	0.0	0.0	44.4	4.3	107.7	19.3
1975	29,637.5	88.2	0.0	0.0	0.0	0.0	1.0	0.1	96.0	22.0
1976	22,653.1	81.9	4,850.4	8.7	0.0	0.0	0.5	0.1	79.8	21.2
Total	104,448.7	308.0	11,045.4	26.3	6.9	[3]	70.2	7.6	1,469.0	282.3

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (see footnote 1, Table 8) for WDF 1974, Fletcher et al. (see footnote 1, Table 8) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual reports.

[2]1 lb = 0.454 kg.

[3]<100 lb.

By 1976, releases had been made from two USFWS hatcheries and 11 hatcheries and 1 rearing pond operated by the Idaho Department of Fish and Game (IDFG) (Table 17). Of these, two are especially notable. Dworshak NFH was constructed at a cost of over $16 million by the U.S. Army Corps of Engineers. It was built as compensation for the loss of a large run of steelhead trout cut off by the construction of Dworshak Dam. It is one of the largest and most modern of the Pacific coast facilities. The State's Rapid River Hatchery (funded by Idaho Power Company) has been very successful as a spring chinook salmon station. From initial return of 1,039 immature male fish (jacks) in 1968, the run has grown until in 1973 the total number of returning fish reached a high in excess of 17,000.

Of the 14 facilities, only the 6 on the Clearwater and Salmon River drainages are directly accessible to returning fish (Fig. 7). The remainder are above the limits for

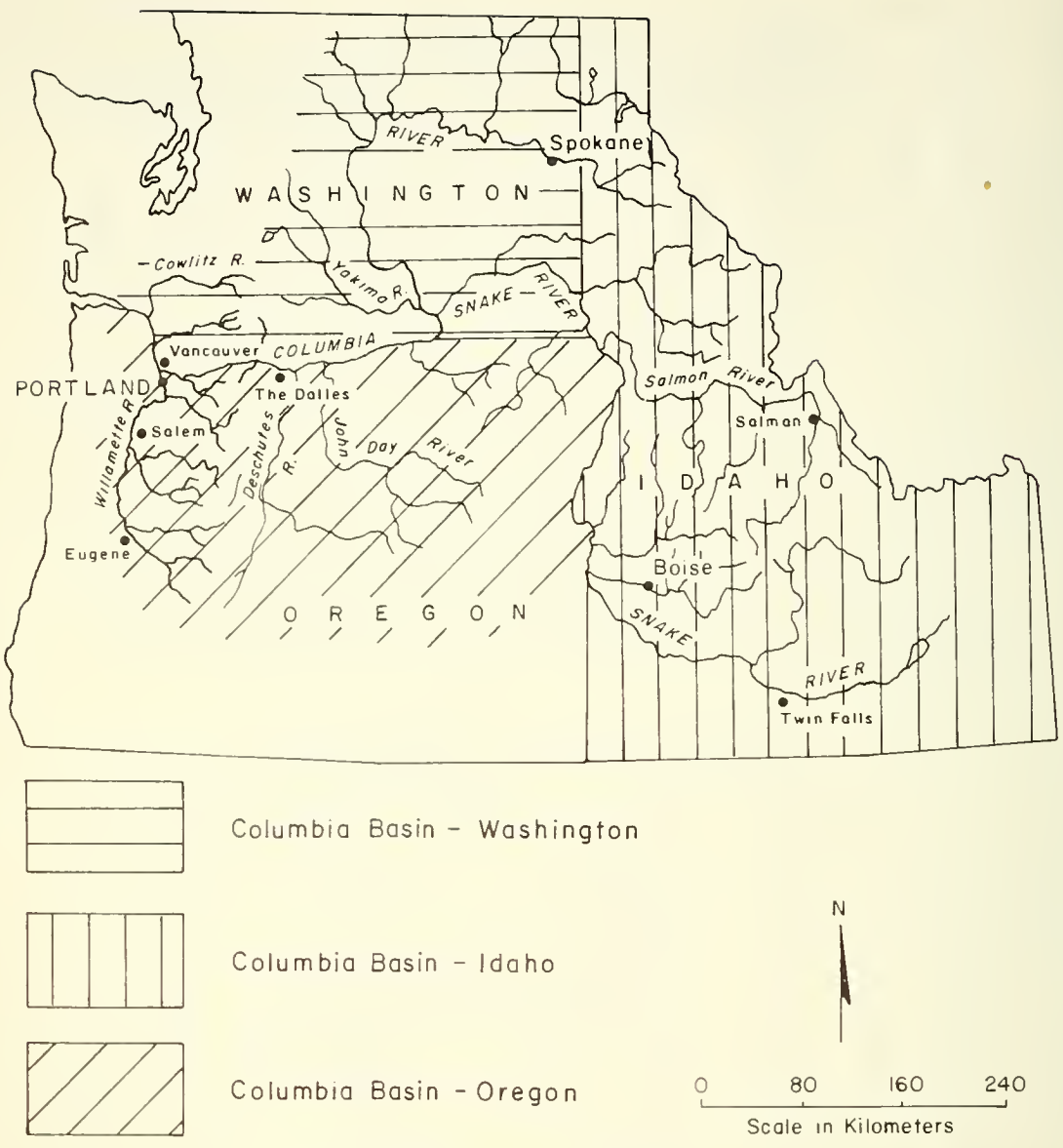


Figure 5.—Columbia Basin regions.

salmon and steelhead trout migration. In these cases, the State has been very successful with the program of transferring fish reared to suitable release sites, and trapping and returning brood stock, spawning them, and transporting the eggs back to the hatchery. In this way, IDFG has been able to make good use of off-site hatcheries on good water sources.

Summer steelhead trout and spring chinook salmon are the two species reared in the greatest numbers in Idaho. Although the facilities in the State have released only 6% of the Pacific coast migrant totals by weight since 1960, they have accounted for 42% of the summer steelhead trout and 11% of the spring chinook salmon by weight during that period (Table 18). Summer steelhead trout production has increased from an initial release in 1965 of 24,000 migrant fish weighing 2,600 lb (1,200 kg) to a high of 6.3 million fish weighing 750,000 lb (340,200 kg) in 1974. This is largely due to the opening of Dworshak NFH in 1969.

Columbia Basin-Oregon.—The first hatchery in Oregon was constructed by a private corporation, the Oregon and Washington Fish Propagating Company. Its hatchery, the first in the Columbia Basin, was built in 1876 on the Clackamas River near its confluence with the Willamette River. The company operated the hatchery from 1876 to 1880 when lack of funds forced a closure. In 1887, the Oregon Fish and Game Commission rented and renovated the facility, but was able to operate it for only 1 yr because of funding problems. In 1889, the operation of the hatchery was transferred to the U.S. Commission of Fish and Fisheries. One condition of this transfer was

Table 10.—Migrant releases of chinook and coho salmon and steelhead trout—Columbia Basin[1] (in thousands).

Release year	Fall chinook		Spring chinook		Summer chinook		Coho		Winter steelhead		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	91,923.9	341.1	7,235.5	207.4	0.0	0.0	7,394.8	249.8	933.9	125.8	153.8	22.5
1961	49,269.2	319.6	4,483.3	171.7	0.0	0.0	15,088.2	526.0	894.2	100.5	480.7	64.1
1962	57,573.4	290.7	4 854.4	190.0	0.0	0.0	14,617.1	610.9	1,812.4	169.8	355.5	41.1
1963	60,043.0	331.8	8,742.4	327.3	0.0	0.0	22,416.9	811.2	1,314.9	120.3	837.6	101.6
1964	66,782.5	415.6	13,037.7	432.9	0.0	0.0	18,128.4	838.8	1,342.6	173.6	1,328.0	180.0
1965	58,355.8	381.4	6,387.2	251.3	0.0	0.0	20,713.8	947.9	1,701.9	227.0	1,259.8	144.4
1966	56,324.2	498.1	11,277.4	455.9	0.0	0.0	24,663.0	1,205.8	1,733.1	206.5	1,467.3	188.1
1967	57,808.3	512.9	12,881.6	560.4	0.0	0.0	23,791.9	1,181.2	1,997.7	234.7	2,940.0	348.1
1968	65,360.3	677.2	12,448.2	734.0	2,138.3	13.6	19,294.4	1,064.8	1,773.1	200.5	4,329.4	503.8
1969	68,593.1	686.3	9,190.4	692.7	2,121.3	20.2	28,043.6	1,661.9	1,665.6	197.0	4,212.0	502.9
1970	86,255.7	902.6	15,986.0	1,387.9	4,228.2	35.4	25,160.8	1,474.3	2,112.4	299.0	5,921.8	911.5
1971	84,414.2	697.3	13,336.2	991.1	2,184.5	37.0	29,424.2	1,728.2	2,241.1	257.6	7,187.5	935.6
1972	90,689.5	993.4	15,140.3	1,267.0	2,604.9	42.6	34,176.7	2,264.5	2,073.5	267.6	5,334.5	836.6
1973	93,619.3	1,122.7	15,243.9	1,450.8	2,312.6	34.3	29,235.5	1,747.8	2,640.3	392.2	7,207.3	824.7
1974	91,303.9	1,203.9	14,060.4	1,093.3	1,202.8	43.0	28,733.7	1,740.7	2,236.0	294.7	8,956.5	1,117.2
1975	92,382.6	1,239.6	19,243.5	1,538.1	120.8	3.1	30,079.6	2,016.2	1,949.4	279.8	6,177.2	915.5
1976	98,855.7	1,342.5	20,236.9	1,672.5	880.5	42.7	29,808.3	1,823.4	2,274.4	340.0	6,247.6	910.5
Total	1,269,554.6	11,956.7	203,785.3	13,424.3	17,793.9	271.9	400,770.9	21,893.4	30,696.5	3,886.6	64,396.5	8,548.2

[1]Derived from Wahle et al. (1975) prior to 1974 and from appropriate State and Federal agencies thereafter.
[2]1 lb = 0.454 kg.

Table 11.—Migrant releases of chum, sockeye, and cherry salmon and sea-run cutthroat trout—Columbia Basin[1] (in thousands).

Release year	Chum		Sockeye		Cherry		Sea-run cutthroat	
	No.	Lb.[2]	No.	Lb.	No.	Lb.	No.	Lb.
1960	0.0	0.0	3,177.0	69.2	0.0	0.0	1.2	1.3
1961	63.6	0.4	2,788.0	72.5	0.0	0.0	15.9	2.6
1962	717.5	1.8	2,224.0	43.8	0.0	0.0	9.7	3.1
1963	1,770.8	2.5	3,121.0	67.8	0.0	0.0	12.9	2.7
1964	150.8	0.2	3,364.0	58.8	0.0	0.0	82.5	10.0
1965	205.3	0.3	3,301.0	73.6	0.0	0.0	86.9	13.9
1966	738.1	2.4	73.0	1.6	0.0	0.0	87.0	17.5
1967	524.1	3.0	0.0	0.0	0.0	0.0	190.0	40.9
1968	173.6	0.6	0.0	0.0	0.0	0.0	248.2	52.5
1969	129.9	0.3	23.4	0.7	0.0	0.0	261.3	50.3
1970	62.5	0.1	0.0	0.0	0.0	0.0	303.5	59.1
1971	0.0	0.0	0.0	0.0	0.0	0.0	371.3	66.9
1972	638.5	1.2	0.0	0.0	0.0	0.0	172.9	40.6
1973	563.6	1.4	0.0	0.0	1.8	0.1	210.9	48.7
1974	627.3	3.4	0.0	0.0	0.0	0.0	150.3	31.9
1975	0.0	0.0	0.0	0.0	0.0	0.0	173.7	43.9
1976	1,126.8	4.7	0.0	0.0	0.0	0.0	192.7	45.9
Total	7,492.4	22.3	18,071.4	388.0	1.8	0.1	2,570.9	531.8

[1]Derived from Wahle et al. (1975) prior to 1974 and from appropriate State and Federal agencies thereafter.
[2]1 lb = 0.454 kg.

that no eggs or fry obtained were to be taken out of Oregon.

Around the turn of the century, several other hatcheries and egg taking stations were built on the Clackamas River by government and private organizations. Due to financial difficulties, ownership of these often changed hands, and most were operated by the Federal Government for at least part of their existence. One, built by the Columbia River Packer's Propagating Company on the upper Clackamas River, was operated privately in 1895-96, Federally in 1897-98, and finally by the State in 1899.

Propagation of steelhead trout in the State began in 1897. The U.S. Commission of Fish and Fisheries had fair success with a temporary egg taking station for steelhead trout on the Salmon River, a tributary of the Sandy River. The following year, eggs were taken at Willamette Falls and again at the Sandy River station. The State also did some experimental steelhead trout research work on the upper Columbia River and its tributaries.

In 1909, the State constructed Bonneville Hatchery on Tanner Creek near the present site of Bonneville Dam. It was designed as a central hatching station, receiving all of its eggs from other facilities on the river. With a capacity of approximately 60 million eggs, it was one of the largest on the coast. Prior to Bonneville's construction there were no significant runs of salmon into Tanner Creek. After a number of years of rearing the transferred eggs and releasing fry into Tanner Creek, adult fish began to return to Bonneville at maturity. These developed stocks of fish became the hatchery's main egg source and the transfer programs were scaled down. In the past several years Bonneville has been able to rely on its egg source and actually supply surplus for other stations.

In 1920, the Legislature split the Oregon Fish and Game Commission's responsibility for anadromous fish between two new agencies: the Fish Commission of Oregon (FCO) took over salmon production and the Oregon Game Commission (OGC) concentrated on steelhead and sea-run cutthroat trout. The existing hatcheries were realigned under these two agencies, those raising primarily steelhead trout were placed under the OGC and those raising primarily salmon under the FCO.

In 1976, there were 15 hatcheries and 4 ponds operated in this region by the USFWS and Oregon Department of Fish and Wildlife (ODFW) (Table 19). As noted in the tables, the FCO and OGC were recombined into the ODFW in 1975. Most of the current facilities are concentrated near the mouth of the Columbia River, on the Willamette and Deschutes River systems, or near Bonneville Dam (Fig. 8). Wallowa Hatchery, located in ex-

Table 12.—Migrant releases of chinook and coho salmon and steelhead trout—Pacific coast by Columbia River Development Program hatcheries[1] (in thousands).

Release year	Fall chinook		Spring chinook		Summer chinook		Coho		Winter steelhead		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	89,105.2	329.7	1,836.1	60.2	0.0	0.0	6,359.8	217.6	916.9	124.7	67.5	11.3
1961	46,640.1	305.5	827.3	30.0	0.0	0.0	14,182.8	507.4	605.1	65.2	303.1	43.2
1962	55,783.6	283.3	1,666.8	57.7	0.0	0.0	12,863.8	571.4	1,408.9	110.4	227.2	28.6
1963	58,845.0	325.8	2,391.4	85.0	0.0	0.0	19,589.1	756.8	1,027.7	83.9	366.7	53.6
1964	65,501.5	407.5	7,643.3	220.8	0.0	0.0	16,529.8	775.3	1,106.7	145.6	562.3	87.1
1965	56,191.0	370.5	3,042.4	102.0	0.0	0.0	17,919.4	853.9	1,352.9	174.8	595.3	73.5
1966	54,944.7	488.9	3,812.4	111.5	0.0	0.0	21,170.4	1,074.7	1,733.1	206.5	745.7	101.8
1967	55,118.5	497.8	5,484.8	177.5	0.0	0.0	20,208.9	1,000.3	1,411.1	161.4	855.7	126.3
1968	55,514.9	595.5	3,788.8	166.8	0.0	0.0	15,715.2	866.9	1,425.9	149.3	1,527.7	175.7
1969	57,927.3	574.1	3,496.8	164.4	0.0	0.0	18,620.3	1,103.7	1,494.9	171.6	822.7	96.6
1970	62,175.2	689.6	2,578.7	148.3	393.8	9.8	17,450.8	1,002.7	1,363.6	196.9	1,525.6	258.1
1971	63,277.3	483.3	3,784.3	238.9	400.3	13.9	21,281.2	1,207.2	1,287.4	151.7	1,130.3	156.1
1972	67,053.7	721.8	3,619.8	253.1	231.7	13.3	23,887.6	1,520.5	1,315.3	172.8	1,233.0	198.7
1973	70,384.2	831.4	4,822.9	401.3	217.1	4.3	20,879.2	1,196.4	1,385.9	223.5	1,151.4	189.4
1974	65,476.3	887.5	4,423.5	269.2	330.0	8.1	20,163.6	1,177.4	1,137.9	162.7	1,168.5	176.7
1975	70,455.2	918.9	5,229.8	326.7	114.6	2.9	21,104.2	1,382.9	937.3	144.7	1,025.3	153.9
1976	80,866.8	1,108.1	5,933.6	479.8	406.6	15.8	22,217.8	1,325.9	1,216.7	184.9	950.4	150.5
Total	1,075,260.5	9,819.2	64,382.7	3,293.2	2,094.1	68.1	310,143.9	16,541.0	21,127.3	2,630.6	14,258.4	2,081.1

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (see footnote 1, Table 8) for WDF 1974, Fletcher et al. (see footnote 1, Table 8) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual reports.
[2]1 lb = 0.454 kg.

Table 13.—Migrant releases of chum and cherry salmon and sea-run cutthroat trout—Pacific coast-Columbia River Development Program hatcheries[1] (in thousands).

Release year	Chum		Cherry		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Number	Pounds
1960	0.0	0.0	0.0	0.0	0.0	0.0
1961	63.6	0.4	0.0	0.0	6.9	0.8
1962	717.5	1.8	0.0	0.0	0.0	0.0
1963	1,770.8	2.5	0.0	0.0	6.4	0.8
1964	150.8	0.2	0.0	0.0	82.5	10.0
1965	205.3	0.3	0.0	0.0	85.9	13.6
1966	738.1	2.4	0.0	0.0	41.5	6.7
1967	524.1	3.0	0.0	0.0	119.4	23.9
1968	173.6	0.6	0.0	0.0	121.2	25.8
1969	129.9	0.3	0.0	0.0	35.3	7.5
1970	62.5	0.1	0.0	0.0	50.0	10.6
1971	0.0	0.0	0.0	0.0	40.1	8.0
1972	638.5	1.2	0.0	0.0	22.8	5.7
1973	563.6	1.4	1.8	0.1	27.0	9.0
1974	627.3	3.4	0.0	0.0	4.3	1.1
1975	0.0	0.0	0.0	0.0	0.0	0.0
1976	1,126.8	4.7	0.0	0.0	0.0	0.0
Total	7,492.4	22.3	1.8	0.1	643.3	123.5

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (see footnote 1, Table 8) for WDF 1974, Fletcher et al. (see footnote 1, Table 8) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual reports.
[2]1 lb = 0.454 kg.

treme eastern Oregon near Enterprise, is the only exception.

Migrant releases from Oregon Columbia Basin hatcheries represent 20% (698 million migrants) of the 1960-76 Pacific coast total by number and 19% [20.3 million pounds (9.2 million kg)], by weight (Tables 20, 21). Fall chinook salmon, with 44 million migrants released, was the main species by number reared in 1976 followed by coho salmon, spring chinook salmon, and steelhead trout. The same year, the largest release by weight was of coho salmon, 600,000 lb (272,200 kg) followed by fall chinook salmon, spring chinook salmon, and steelhead trout.

The Columbia River Development Program ("Program") had an important impact on anadromous fish in Oregon's portion of the Columbia Basin. Funds were provided for stream clearance and improvement as well as for fishway and hatchery construction or reconstruction. Fishways were built on the Clatskanie River, Eagle Creek, and Scappoose Creek, among others, and the existing fishway at Willamette Falls was rebuilt. On streams such as the Calpooia and Clatskanie Rivers as well as Big, Tide, Goble, Eagle, Deep, Clear, Abernathy, and Delph Creeks, where needed, accumulated debris, log jams, and splash dams were removed. The State fisheries agencies screened problem irrigation diversion ditches and canals to prevent loss of trout and salmon fingerlings. Sandy, Cascade, Eagle Creek, and Gnat Creek hatcheries were constructed under the Program. Bonneville, Oxbow, Klaskanine, and Big Creek hatcheries were either renovated or completely reconstructed.

One of the major accomplishments of the Program in Oregon was the development or improvement of runs of several salmonid species in the area above Willamette Falls. A three-part project, the initial phase was a cooperative study of passage problems over Willamette Falls. Monies were then provided to stock the upper Willamette River and its tributaries as well as for stream clearance and improvement. In the final phase, the Program provided the major portion of funding the $4.1 million fishway. As a result of these efforts, runs of fall chinook salmon and summer steelhead trout have been developed and spring chinook and coho salmon have increased.

Oregon Coastal

The first anadromous fish facility on the Oregon coast

Table 14.—Anadromous fish rearing facilities—Columbia basin-Washington, 1960-76.

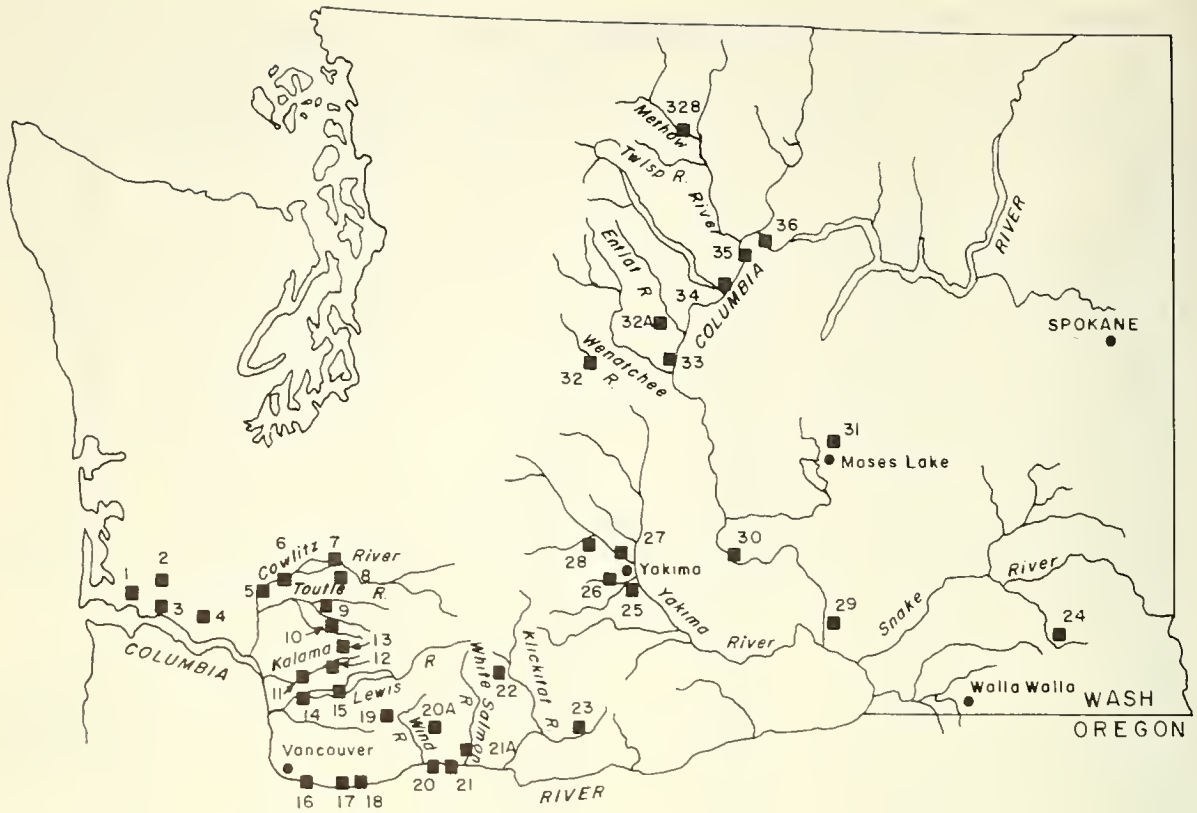
Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Hatcheries						
Abernathy	Longview	USFWS	fc (sc, co, sh)	Yes	1959	USFWS, NMFS
Beaver Creek	Cathlamet	WDG	sh, src	Yes	1958	NMFS
Carson	Carson	USFWS	sc (fc, co, sh)	Yes	1937	USFWS, NMFS
Chelan PUD	Chelan	WDG	sh	Yes	1964	Chelan PUD
Columbia Basin	Moses Lake	WDG	sh	Yes	1961	Chelan PUD
Cowlitz Salmon	Salkum	WDF	fc, sc, co	Yes	1967	Tacoma P&L
Cowlitz Trout	Ethel	WDG	sh, src	Yes	1967	Tacoma P&L
Elokomin	Cathlamet	WDF	fc, co (ch)	Yes	1954	NMFS
Goldendale	Goldendale	WDG	sh	No	1943	WDG
Grays River	Grays River	WDF	fc, co, ch	Yes	1961	NMFS
Kalama Falls	Kalama	WDF	fc, sc, co	Yes	1959	NMFS
Klickitat	Glenwood	WDF	fc, sc, co	Yes	1950	NMFS
Leavenworth complex	Leavenworth	USFWS	sc, co, sk (fc)	Yes	1938	USFWS
Entiat	Entiat	USFWS	smc (sc, co)	Yes	1942	USFWS
Winthrop	Winthrop	USFWS	sms (fc, sc, co, sh)	Yes	1967	USFWS
Lewis River	Woodland	WDF	co (fc, sc)	Yes	1909	WSF, Pacific P&L
Little White Salmon complex	Cook	USFWS	fc, sc, co (ch)	Yes	1898	USFWS, NMFS
Willard	Cook	USFWS	co (sc)	Yes	1951	NMFS, USFWS
Lower Kalama	Kalama	WDF	fc, co	Yes	1895	WDF
Mossyrock	Mossyrock	WDG	sh, src	Yes	1972	Tacoma P&L
Naches	Yakima	WDG	sh	Yes	1933	WDG
Skamania	Washougal	WDG	sh (fc)	Yes	1956	NMFS, WDG
Speelyai	Yale	WDF	sc, co (fc)	Yes	1958	Pacific P&L
Spring Creek	Underwood	USFWS	fc (co)	Yes	1901	USFWS, NMFS, Corps
Big White Salmon pond	Underwood	USFWS	fc, co	Yes	1901	USFWS, NMFS, Corps
Toutle	Toutle	WDF	fc, sc, co	Yes	1952	NMFS
Tucannon	Pomeroy	WDG	sh	Yes	1971	WDG
Vancouver	Vancouver	WDG	sh, src	Yes	1936	WDG
Washougal	Washougal	WDF	fc, co (ce)	Yes	1958	NMFS
Wells Trout	Azwell	WDG	sh	Yes	1968	Douglas Co. PUD
Yakima	Yakima	WDG	sh	Yes	1937	WDG
Rearing Ponds						
Alder Creek	Toutle	WDG	sh	Yes	1973	NMFS, WDG
Gobar	Toutle	WDG	sh	Yes	1975	NMFS, WDG
Nelson Bridge	Yakima	WDG	sh	No	1964	WDG
Nile Springs	Yakima	WDF, Sportsmen Group	sc	Yes	1976	Sportsmens Group
Priest Rapids	Priest Rapids Dam	WDF	fc	Yes	1972	Grant PUD
Ringold Salmon	Ringold	WDF	fc, sc, co	Yes	1962	NMFS
Ringold Trout	Ringold	WDG	sh	Yes	1962	NMFS
Rocky Reach	Wenatchee	WDF	fc, co	Yes	1970	Chelan PUD
Swofford Island	Mossyrock	WDG	sh	Yes	1968	WDG
Washburn Island	Brewster	WDG	sh	No	1966	Douglas PUD
Wells Salmon	Azwell	WDF	fc, sc, smc, co	Yes	1968	Douglas PUD

[1]USFWS = U.S. Fish and Wildlife Service, NMFS = National Marine Fisheries Service, WDG = Washington Department of Game, WDF = Washington Department of Fisheries, Chelan PUD = Chelan County Public Utility Division, Tacoma P & L = Tacoma Power and Light, Pacific P&L = Pacific Power and Light, Corps = U.S. Army Corps of Engineers, Douglas PUD = Douglas County Public Utility Division, Grant PUD = Grant County Public Utility Division.

[2]fc = fall chinook salmon, sc = spring chinook salmon, smc = summer chinook salmon, co = coho salmon, sh = steelhead trout, ch = chum salmon, src = sea-run cutthroat trout, sk = sockeye salmon, ce = cherry salmon.

was a private hatchery constructed by R. D. Hume. The hatchery was completed in 1877 on a site near Ellensburg on the lower Rogue River. Hume, a local salmon packer, operated the hatchery without assistance for 11 yr. In 1889, the Oregon Legislature supported his efforts with monies appropriated for enlargement as well as for operation and maintenance of the hatchery. Hume continued to operate the facility until his death in 1908 at which time it was turned over to the State. He built another hatchery in 1897 on the Rogue River at the mouth of Oak Creek. The U.S. Fish Commission, as agreed prior to construction, assumed responsibility for operating this hatchery after its completion.

Hume was an early developer of hatchery techniques. He is credited with the concept of adult holding ponds. The adult chinook salmon needed for the hatchery egg supply were trapped in tidewater on their way to the upper Rogue River. At trapping, these fish had not yet reached sexual maturity. Hume constructed a large, concrete-lined, covered holding pond to retain the fish until spawning time. Most present day hatcheries are built with a similar type adult holding facility.



Map No.	Facility
1	Grays River
2	Elokomin
3	Beaver Creek
4	Abernathy
5	Cowlitz Trout
6	Cowlitz Salmon
7	Mossyrock
8	Swofford Pond
9	Toutle
10	Alder Creek Pond
11	Lower Kalama
12	Kalama Falls
13	Gobar Pond
14	Lewis River
15	Speelyai
16	Vancouver
17	Skamania
18	Washougal
19	Carson
20	Little White Salmon
	20A Willard
21	Spring Creek
	21A Big White Salmon Pond
22	Klickitat
23	Goldendale
24	Tucannon
25	Nile Springs
26	Yakima
27	Nelson Bridge Pond
28	Naches
29	Ringold Trout
	Ringold Salmon
30	Priest Rapids
31	Columbia Basin
32	Leavenworth
	32A Entiat
	32B Winthrop
33	Rocky Reach
34	Chelan PUD
35	Wells Trout Hatchery
	Wells Salmon Pond
36	Washburn Island

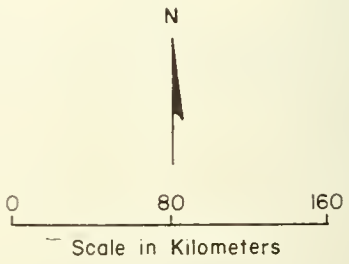


Figure 6.—Map of locations of Columbia Basin-Washington salmonid rearing facilities, 1960-76.

Table 15.—Migrant releases of chinook and coho salmon and steelhead trout—Columbia Basin-Washington[1] (in thousands).

Release year	Fall chinook		Spring chinook		Summer chinook		Coho		Winter steelhead		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	57,338.0	242.0	1,218.1	39.1	0.0	0.0	3,849.0	93.2	545.1	64.8	136.4	20.9
1961	33,531.9	241.5	667.7	27.1	0.0	0.0	9,161.6	259.3	586.5	73.1	417.6	57.2
1962	42,537.5	233.2	1,822.5	61.2	0.0	0.0	6,802.2	197.0	715.5	97.0	355.5	41.1
1963	42,646.2	238.7	1,680.9	55.3	0.0	0.0	15,096.9	428.9	568.7	74.4	767.2	95.0
1964	40,611.0	240.8	3,607.1	120.3	0.0	0.0	9,833.6	401.5	647.6	111.3	1,192.0	166.8
1965	37,073.6	234.4	2,072.4	77.7	0.0	0.0	13,950.5	557.5	943.7	151.8	1,176.7	135.4
1966	38,121.2	322.5	2,425.4	67.1	0.0	0.0	17,932.4	811.1	879.1	117.1	1,175.5	150.0
1967	34,969.8	313.1	3,269.7	122.0	0.0	0.0	15,092.7	709.6	992.8	138.1	1,460.3	214.0
1968	42,448.4	405.5	2,399.9	121.0	2,138.3	13.6	12,256.9	653.3	792.2	114.4	1,904.9	237.2
1969	45,846.5	459.1	3,876.2	317.4	2,121.3	20.2	20,808.5	1,181.1	782.6	110.0	1,948.9	257.8
1970	52,857.2	541.4	5,633.1	527.5	3,834.4	25.6	18,441.7	1,054.7	1,399.9	209.7	2,292.3	355.9
1971	50,830.3	421.3	6,706.0	530.3	1,784.2	23.1	23,336.8	1,330.6	1,493.0	184.6	1,813.8	236.5
1972	58,504.5	651.5	7,063.5	712.8	2,373.2	29.3	22,445.3	1,450.0	1,185.7	154.2	1,990.4	298.9
1973	61,036.0	751.1	5,899.1	635.5	2,095.5	30.0	21,317.9	1,266.1	1,815.9	269.0	1,578.6	249.4
1974	57,986.7	844.0	6,826.0	584.4	872.8	34.9	20,616.4	1,257.8	1,187.2	157.0	1,618.0	231.9
1975	60,938.2	867.0	7,863.2	729.7	0.0	0.0	21,785.9	1,440.6	1,099.5	153.9	1,789.0	259.3
1976	58,174.1	816.8	9,431.8	877.9	294.0	18.2	20,573.6	1,223.8	1,325.3	212.9	1,461.4	231.9
Total	815,451.1	7,823.9	72,462.6	5,606.3	15,513.7	194.9	273,301.9	14,316.1	16,960.3	2,393.3	23,078.5	3,239.2

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (see footnote 1, Table 8) for WDF 1974, Fletcher et al. (see footnote 1, Table 8) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual.
[2]1 lb = 0.454 kg.

Table 16.—Migrant releases of chum, sockeye, and cherry salmon and sea-run cutthroat trout—Columbia Basin-Washington[1] (in thousands).

Release year	Chum		Sockeye		Cherry		Sea-run cutthroat	
	No.	Lb.[2]	No.	Lb.	No.	Lb.	No.	Lb.
1960	0.0	0.0	3,177.0	69.2	0.0	0.0	0.0	0.0
1961	50.8	0.3	2,788.0	72.5	0.0	0.0	6.9	0.8
1962	402.9	1.2	2,224.0	43.8	0.0	0.0	0.0	0.0
1963	1,489.9	2.1	3,121.0	67.8	0.0	0.0	6.4	0.8
1964	150.8	0.2	3,364.0	58.8	0.0	0.0	82.5	10.0
1965	205.3	0.3	3,301.0	73.6	0.0	0.0	85.9	13.6
1966	422.7	0.4	73.0	1.6	0.0	0.0	87.0	17.5
1967	152.1	0.2	0.0	0.0	0.0	0.0	182.5	38.5
1968	38.6	0.1	0.0	0.0	0.0	0.0	248.2	52.5
1969	47.3	0.1	23.4	0.7	0.0	0.0	261.3	50.3
1970	62.5	0.1	0.0	0.0	0.0	0.0	302.3	55.2
1971	0.0	0.0	0.0	0.0	0.0	0.0	364.3	65.1
1972	638.5	1.2	0.0	0.0	0.0	0.0	159.2	37.2
1973	563.6	1.4	0.0	0.0	1.8	0.1	202.4	46.3
1974	627.3	3.4	0.0	0.0	0.0	0.0	150.3	31.9
1975	0.0	0.0	0.0	0.0	0.0	0.0	139.6	32.8
1976	1,126.8	4.7	0.0	0.0	0.0	0.0	151.8	34.6
Total	5,979.1	15.7	18,071.4	388.0	1.8	0.1	2,430.6	487.1

[1]Derived from Wahle et al. (1975) prior to 1974, Foster et al. (see footnote 1, Table 8) for WDF 1974, Fletcher et al. (see footnote 1, Table 8) for WDF 1975, Foster et al. (1977) for WDF 1976, and from WDG release records and USFWS hatchery annual reports.
[2]1 lb = 0.454 kg.

Hume was also one of the first to raise anadromous fish to larger than fry size on a production basis. Prior to his work, and in many cases afterwards, fish were released just after absorption of the yolk sac. A few fish were raised to fingerling and yearling size as a curiosity. While raising fish to larger sizes was not physically difficult, increased cost and need for larger facilities prevented the general adoption of the rearing procedure. Hume, among others, correctly predicted higher survival of larger fish with little increased costs of rearing. Presently, all anadromous facilities, with the exception of several chum and pink salmon hatcheries, rear their production fish for at least 30 days.

In the 1890's and early 1900's, there were hatcheries or egg taking stations built on most of Oregon's coastal streams. In 1902 alone, hatcheries were built on the Coquille, Siuslaw, Alsea, Yaquina, and Tillamook Rivers. One of these, built by the State on the Siuslaw River and then turned over to the U.S. Fish Commission, is interesting because of the reason for its failure. Adult fish were unable to reach the hatchery because fishermen working downstream blocked fish passage with nets stretched completely across the river. This is an extreme example of the intensive coast-wide pressure placed on the resource.

In 1920, the responsibility for rearing anadromous salmonids was split between the newly formed FCO and the OGC. By 1929, there were 10 State hatcheries and 1 Federal hatchery in operation. The total accumulated production through 1929 was almost 650 million fish with most coming from State facilities. Emphasis was placed on fall chinook and coho salmon which accounted for 56% and 31% of these releases, respectively.

There are presently 12 hatcheries in operation on the major coastal tributaries (Figs. 9, 10). Up until 1975 when the two State fisheries agencies were recombined to form the Oregon Department of Fish and Wildlife, five of these were operated by FCO and another five by OGC (Table 22). Nine of the 10 State hatcheries were built to enhance existing or depleted runs. The tenth, Cole Rivers Hatchery, is similar to many of the Columbia Basin facilities in that it was built on the Rogue River to compensate for the loss of spawning grounds and resultant fish from Lost Creek Dam.

In 1976, species reared in the greatest numbers at Oregon coastal hatcheries were coho salmon, fall chinook

Table 17.—Anadromous fish rearing facilities—Columbia Basin-Idaho, 1960-76.

Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Hatcheries						
Dworshak	Orofino	USFWS	sh	Yes	1969	USFWS, Corps
Eagle	Boise	IDFG	smc	Yes	1976	IDFG
Hagerman	Hagerman	IDFG	smc, sh (sc)	Yes	1969	IDFG
Hayden Creek	Salmon	IDFG	sc, sh	Yes	1973	NMFS, IDFG, USFWS
Kooskia	Kooskia	USFWS	sc	Yes	1966	USFWS
MacKay	MacKay	IDFG	smc	Yes	1976	NMFS
McCall	McCall	IDFG	smc	Yes	1976	IDFG, PNRC
Mullen	Mullen	IDFG	sc	Yes	1976	IDFG
Niagara Springs	Buhl	IDFG	sh	Yes	1966	Idaho Power Co.
Oxbow	Oxbow Dam	IDFG	fc	No	1964	Idaho Power Co.
Pahsimeroi	Challis	IDFG	smc, sh	Yes	1970	IDFG, NMFS
Rapid River	Riggins	IDFG	sc	Yes	1964	Idaho Power Co.
Sandpoint	Sandpoint	IDFG	sc	Yes	1972	IDFG, NMFS
Ponds						
Decker Flats	Stanley	IDFG	sc	No	1968	USFWS, NMFS, IDFG

[1]USFWS = U.S. Fish and Wildlife Service, Corps = U.S. Army Corps of Engineers, IDFG = Idaho Department of Fish and Game, NMFS = National Marine Fisheries Service, PNRC = Pacific Northwest Regional Commission.

[2]fc = fall chinook salmon, sc = spring chinook salmon, smc = summer chinook salmon, sh = steelhead trout (minor species in parentheses).

salmon, and winter steelhead trout, respectively. Summer steelhead trout and spring chinook salmon also accounted for a substantial number of releases. The first three represented 52%, 19%, and 13% of the migrant numbers released (Table 23).

There are also two private fish cultural operations active on the coast. They are a part of a new concept in commercial rearing of salmon by private companies termed "ocean ranching." Ocean ranching consists of raising fish to migrant size, releasing them into the ocean, and recovering returning adults. In Oregon, these returnees can then be sold commercially, hopefully at a profit, by the company. The enterprises are licensed by ODFW and must receive their initial egg supply from hatchery excesses at the State hatcheries. After their returns reach a sufficient number, the private hatcheries will be able to secure their own eggs without having to depend on the State. The primary species to be raised at these private facilities will be chinook, coho, and chum salmon.

California

Anadromous salmonid production on the Pacific coast began in California in 1872 with the activities of Livingston Stone. The Federally operated fish hatchery he built on the McCloud River was first used solely as a collection site for eggs to be shipped to the east coast. After several years, the U.S. Bureau of Fisheries cooperated with the State in egg shipments and fry releases in local streams to augment natural spawning. The first State operated salmon hatchery was authorized and constructed in 1885 on Hat Creek, a tributary of the Pit River. The local source of chinook salmon eggs proved inadequate so operations were transferred in 1888 to the newly constructed Mt. Shasta Hatchery on a site near Sisson in Siskiyou County. This station is still in full-scale operation producing rainbow trout, making it the oldest functional hatchery on the west coast (Leitritz 1970).

Up to the 1920's, many State and Federal hatcheries were built in northern California on the Klamath and Sacramento Rivers and their tributaries. There were also hatcheries on coastal tributaries such as the Eel, Russian, and Mad Rivers. A hatchery operated by the county of Santa Cruz at Brookdale was the most southerly location of early fish cultural operations.

Plants from these early hatcheries were made throughout the Sacramento and Klamath River drainages and most northern coastal streams. Some releases were made as far south as the Ventura River, south of Santa Barbara. While the majority of these fish were fall chinook salmon, the State hatcheries also liberated a few coho salmon fry. In 1902, the State hatcheries began a substantial steelhead trout program. As fish propagation was a cooperative effort between the Federal and State governments, the Federal hatcheries supplied a large portion of the eggs that State hatcheries reared for release. In 1914, the Federal installations began to artificially feed the small fall chinook salmon and release them as fingerlings or yearlings rather than planting them as unfed fry. This followed the example set by R. D. Hume in Oregon.

In 1976, 1 Federal, 10 State, and 2 private hatcheries and ponds were operated in California (Table 24). Of the 13, 6 are on tributaries of the Sacramento River (Fig. 11). Fall chinook salmon, coho salmon, and winter steelhead trout are the three primary species reared in California, but the hatcheries are also undertaking spring chinook salmon and summer steelhead trout programs (Table 25).

As shown in the "Funding Agency" column of Table 22, over one-half of the hatcheries and ponds are either partially or wholly supported by organizations other than the California Department of Fish and Game. While

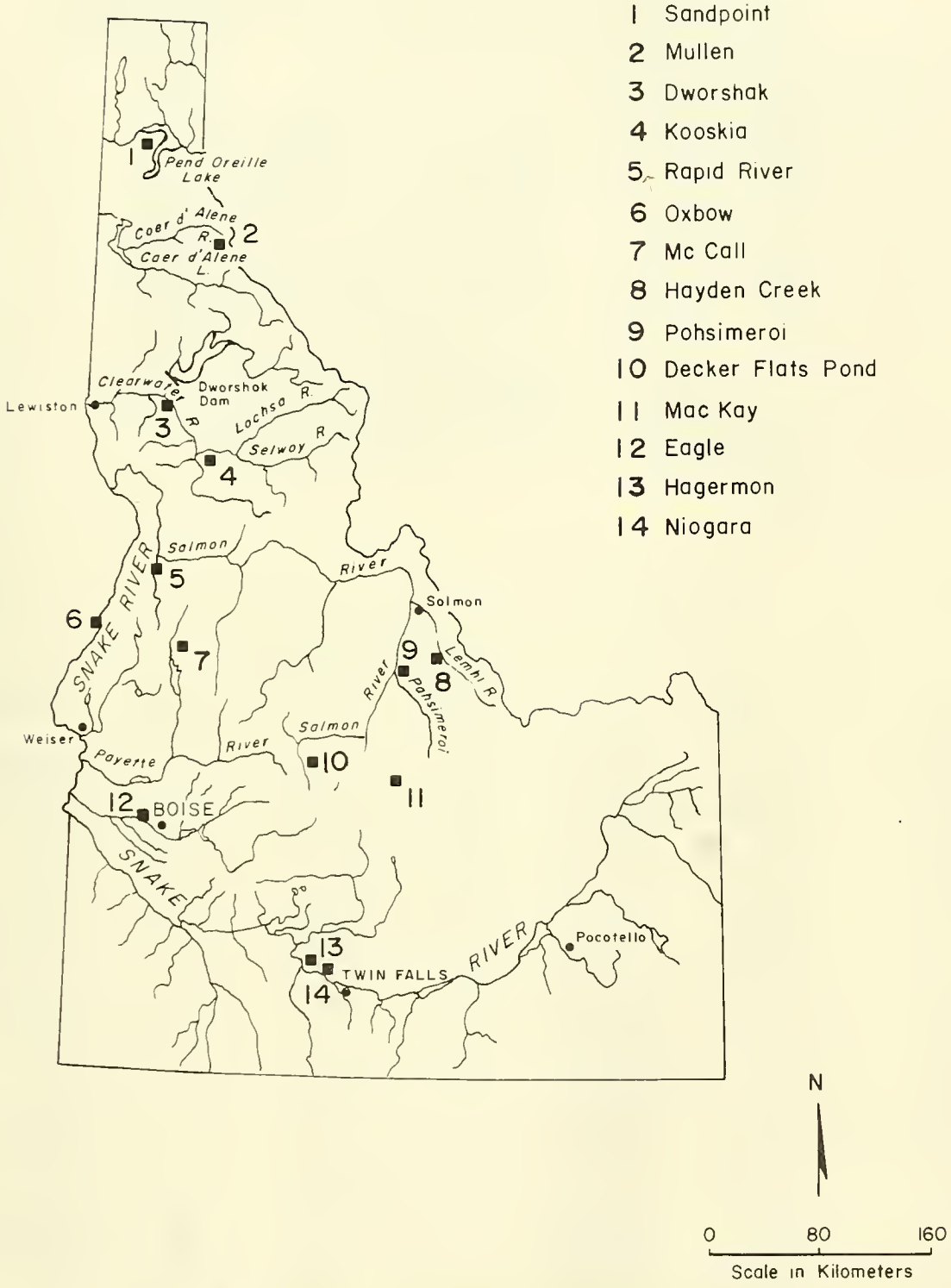


Figure 7.—Map of locations of Columbia Basin-Idaho salmonid rearing facilities, 1960-76.

Table 18.—Migrant releases of chinook salmon and steelhead trout—Columbia Basin-Idaho[1] (in thousands).

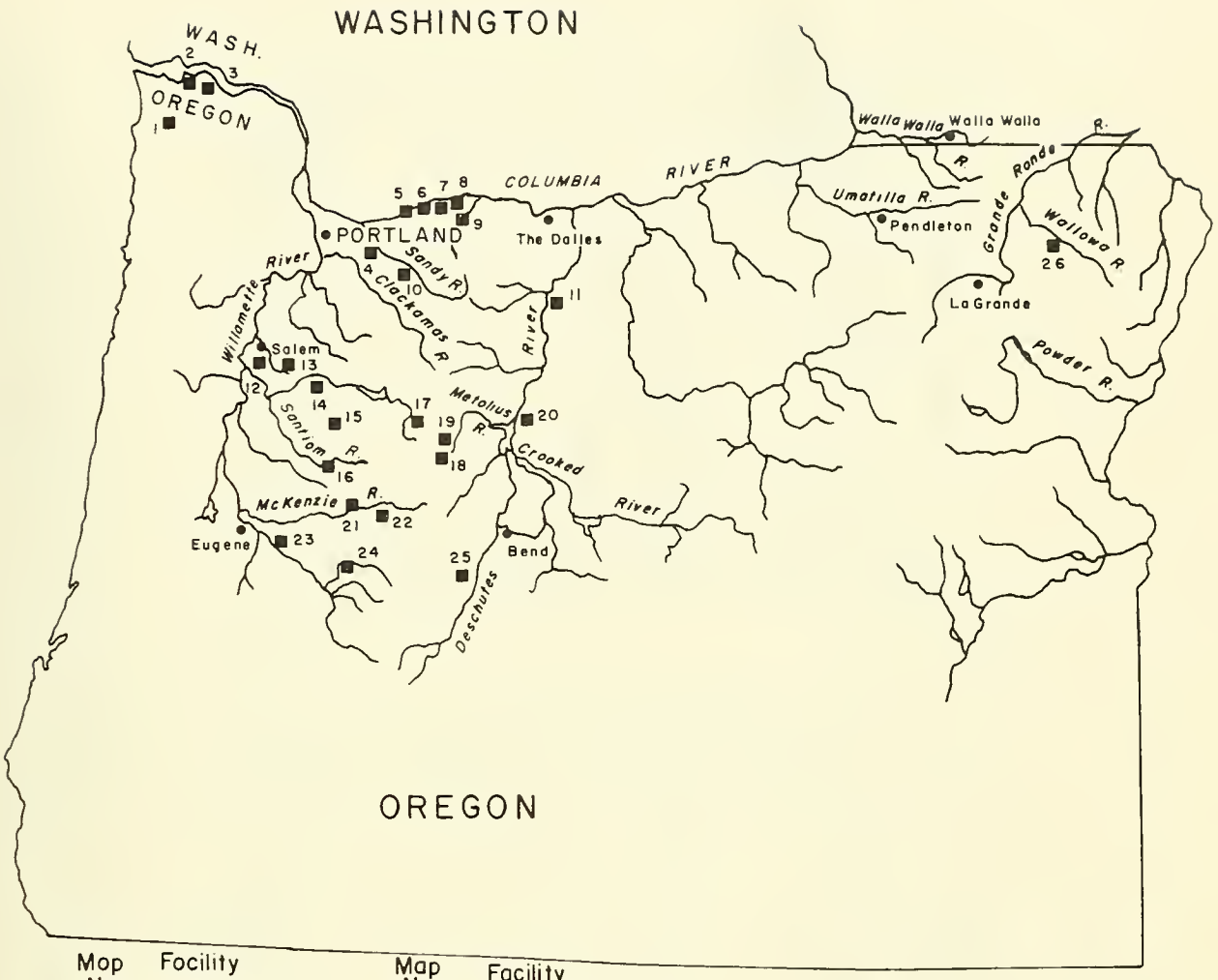
Release year	Fall chinook		Spring chinook		Summer chinook		Summer steelhead	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds
1960	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	1,282.3	5.7	0.0	0.0	0.0	0.0	24.1	2.6
1966	214.7	1.3	580.0	25.7	0.0	0.0	138.8	15.5
1967	1,473.5	5.9	449.3	19.4	0.0	0.0	1,364.8	121.9
1968	202.3	1.1	1,471.5	58.5	0.0	0.0	2,034.2	228.1
1969	255.5	1.9	1,057.6	40.9	0.0	0.0	1,732.5	185.3
1970	497.3	2.3	3,377.0	177.2	393.8	9.8	3,173.3	491.7
1971	0.0	0.0	3,489.3	172.5	400.3	13.9	4,932.0	634.8
1972	0.0	0.0	3,954.6	198.2	231.7	13.3	2,585.1	411.2
1973	0.0	0.0	3,830.5	206.3	217.1	4.3	4,619.6	400.0
1974	0.0	0.0	3,511.8	187.9	330.0	8.1	6,340.0	752.6
1975	0.0	0.0	5,134.1	309.9	114.6	2.9	3,511.6	520.4
1976	0.0	0.0	5,994.6	354.8	523.7	22.3	3,774.4	487.4
Total	3,925.6	18.2	32,850.3	1,751.3	2,211.2	74.6	34,230.4	4,251.5

[1]Derived from Wahle et al. (1975) prior to 1974, Idaho Department of Fish and Game release records, and U.S. Fish and Wildlife Service hatchery annual reports.
[2]1 lb = 0.454 kg.

Table 19.—Anadromous fish rearing facilities—Columbia Basin-Oregon, 1960-76.

Facility	General location	Operating agency[1,3]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding Agency[3]
Hatcheries						
Big Creek	Knappa	ODFW (FCO)	fc, co, sh (ch)	Yes	1938	NMFS, Oregon
Bonneville	Bonneville	ODFW (FCO)	fc, co (sh)	Yes	1909	NMFS, Oregon, Corps
Cascade	Cascade Locks	ODFW (FCO)	fc, co (sc, ch)	Yes	1958	NMFS
Eagle Creek	Estacada	USFWS	sc, co, sh (fc)	Yes	1957	NMFS
Fall River	LaPine	ODFW (OGC)	sc	No	1929	Oregon
Gnat Creek	Westport	ODFW (OGC)	sh (fc, sc, ch)	Yes	1960	NMFS
Hood River	Dee	ODFW (OGC)	co, sh	No	1958	Oregon
Klaskanine	Astoria	ODFW (FCO)	fc, co, sh	Yes	1911	NMFS, Oregon
Leaburg	Leaburg	ODFW (OGC)	sc (co, sh)	Yes	1954	Corps
Marion Forks	Idanha	ODFW (FCO)	sc, sh	Yes	1950	Corps, Oregon
McKenzie	Leaburg	ODFW (FCO)	sc (co)	Yes	1930	Corps, Oregon
Metolius	Camp Sherman	ODFW (FCO)	sc, sh	No	1947	Oregon
Oakridge (Willamette)	Oakridge	ODFW (FCO)	sc (co)	Yes	1911	Oregon, Corps
Oak Springs	Maupin	ODFW (OGC)	sh (sc)	Yes	1920	Oregon
Oxbow	Cascade Locks	ODFW (FCO)	fc, sc (co)	Yes	1938	NMFS, Oregon
Roaring River	Scio	ODFW (OGC)	sh	Yes	1925	Oregon
Round Butte	Madras	ODFW (OGC)	sc, smc, sh	Yes	1972	PGE
Sandy	Sandy	ODFW (FCO)	fc, co (sc, sh)	Yes	1950	NMFS
South Santiam	Foster	ODFW (FCO)	sc, sh (fc)	Yes	1923	Corps, Oregon
Wallowa	Enterprise	ODFW (OGC)	sh	No	1924	Oregon
Wizard Falls	Camp Sherman	ODFW (OGC)	sc, sh	No	1949	Oregon
Ponds						
Aumsville	Aumsville	ODFW (FCO)	fc	Yes	1970	Oregon, NMFS
Dexter	Dexter	ODFW (FCO)	sc	Yes	1955	Corps, Oregon
Salem	Salem	ODFW (FCO)	fc	No	1968	Oregon, NMFS
Stayton	Stayton	ODFW (FCO)	fc	Yes	1969	Oregon, NMFS
Wahkenn	Bonneville	ODFW (FCO)	fc, co	Yes	1961	NMFS

[1]Present agency with premerger agency in parentheses.
[2]fc = fall chinook salmon, sc = spring chinook salmon, co = coho salmon, sh = steelhead trout, ch = chum salmon (minor species in parentheses).
[3]ODFW = Oregon Department of Fish and Wildlife, OGC = Oregon Game Commission, FCO = Fish Commission of Oregon, NMFS =National Marine Fisheries Service, USFWS = U.S. Fish and Wildlife Service, Corps = U.S. Army Corps of Engineers, Oregon = State of Oregon General Funds, PGE = Portland General Electric.



Mop No.	Focility	Map No.	Facility
1	Klaskanine	14	Stayton Pond
2	Big Creek	15	Rooring River
3	Gnat Creek	16	S. Santiom
4	Sondy	17	Marion Forks
5	Wakeeno Pond	18	Metolius
6	Bonneville	19	Wizard Falls
7	Coscode	20	Round Butte
8	OxBow	21	McKenzie
9	Hood River	22	Leoburg
10	Eogle Creek	23	Dexter Pond
11	Oak Springs	24	Oakridge
12	Salem Pond	25	Fall River
13	Aumsville Pond	26	Wallowa

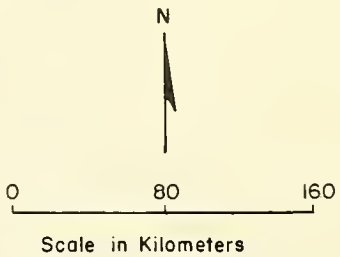


Figure 8.—Map of locations of Columbia Basin-Oregon salmonid rearing facilities, 1960-76.

Table 20.—Migrant releases of chinook and coho salmon—Columbia Basin-Oregon[1] (in thousands).

Release year	Fall chinook		Spring chinook		Summer chinook		Coho	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds
1960	34,585.9	99.1	6,017.4	168.3	0.0	0.0	3,545.8	156.6
1961	15,737.3	78.1	3,815.6	144.6	0.0	0.0	5,926.6	266.7
1962	15,035.9	57.5	3,031.9	128.8	0.0	0.0	7,814.9	413.9
1963	17,396.8	93.1	7,061.5	272.0	0.0	0.0	7,320.0	382.3
1964	26,171.5	174.8	9,430.6	312.6	0.0	0.0	8,294.8	437.3
1965	19,999.9	141.3	4,314.8	173.6	0.0	0.0	6,763.3	390.4
1966	17,988.3	174.3	8,272.0	363.1	0.0	0.0	6,730.6	394.7
1967	21,365.0	193.9	9,162.6	419.0	0.0	0.0	8,699.2	471.6
1968	22,709.6	270.6	8,576.8	554.5	0.0	0.0	7,037.5	411.5
1969	22,491.1	225.3	4,256.6	334.4	0.0	0.0	7,235.1	480.8
1970	32,901.2	358.9	6,975.9	683.2	0.0	0.0	6,719.1	419.6
1971	33,583.9	276.0	3,140.9	288.3	0.0	0.0	6,087.4	397.6
1972	32,185.0	341.9	4,122.2	356.0	0.0	0.0	11,731.4	814.5
1973	32,583.3	371.6	5,514.3	609.0	0.0	0.0	7,917.6	481.7
1974	33,317.2	359.9	3,722.6	321.0	0.0	0.0	8,117.3	482.9
1975	31,444.4	372.6	6,246.2	498.5	6.2	0.2	8,293.7	575.6
1976	40,681.6	525.7	4,810.5	439.8	62.8	2.2	9,234.7	599.6
Total	450,177.9	4,114.6	98,472.4	6,066.7	69.0	2.4	127,469.0	7,577.3

[1]Derived from Wahle et al. (1975) prior to 1974, Oregon Department of Fish and Wildlife release records, and U.S. Fish and Wildlife Service hatchery annual reports.
[2]1 lb = 0.454 kg.

Table 21.—Migrant releases of chum salmon and sea-run cutthroat trout—Columbia Basin-Oregon[1] (in thousands).

Release year	Chum		Winter steelhead		Summer steelhead		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds
1960	0.0	0.0	388.8	61.0	17.4	1.6	1.2	1.3
1961	12.8	0.1	307.7	27.4	63.1	6.9	9.0	1.8
1962	314.6	0.6	1,096.9	72.8	0.0	0.0	9.7	3.1
1963	280.9	0.4	746.2	45.9	70.4	6.6	6.5	1.9
1964	0.0	0.0	695.0	62.3	136.0	13.2	0.0	0.0
1965	0.0	0.0	758.2	75.2	59.0	6.4	1.0	0.3
1966	315.4	2.0	854.0	89.4	153.0	22.6	0.0	0.0
1967	372.0	2.8	1,004.9	96.6	114.9	12.2	7.5	2.4
1968	135.0	0.5	980.9	86.1	390.3	38.5	0.0	0.0
1969	82.6	0.2	883.0	87.0	530.6	59.8	0.0	0.0
1970	0.0	0.0	712.5	89.3	456.2	63.9	1.2	3.9
1971	0.0	0.0	748.1	73.0	441.7	64.3	7.0	1.8
1972	0.0	0.0	887.8	113.4	759.0	126.5	13.7	3.4
1973	0.0	0.0	824.4	123.2	1,009.1	175.3	8.5	2.4
1974	0.0	0.0	1,048.8	137.7	998.5	132.7	0.0	0.0
1975	0.0	0.0	849.9	125.9	876.6	135.8	34.1	11.1
1976	0.0	0.0	949.1	127.1	1,011.8	191.2	40.9	11.3
Total	1,513.3	6.6	13,736.2	1,493.3	7,087.6	1,057.5	140.3	44.7

[1]Derived from Wahle et al. (1975) prior to 1974, Oregon Department of Fish and Wildlife release records, and U.S. Fish and Wildlife Service hatchery annual reports.
[2]1 lb = 0.454 kg.

some of these are voluntarily funded by county governments or private industry, most were constructed and are supported as compensation for loss of fish spawning areas due to construction of dams and other water related projects. Coleman NFH, operated by the USFWS, was built in 1942 in conjunction with Shasta Dam and the Central Valley Project which blocked salmonid access to a large area of the Sacramento River drainage. The Trinity River and Nimbus hatcheries were both built by the Bureau of Reclamation to compensate for construction of the Trinity Dam and the Folsom and Nimbus Dams, respectively. Additionally, Iron Gate and Mokelumne are funded by power companies and the Feather River Hatchery is supported by the California Department of Water Resources.

HATCHERY TRENDS

Hatchery Numbers

Since the first Pacific coast hatchery was built in 1872, rearing of salmon and steelhead trout has become a big business, both in efforts and dollars expended and benefits derived. In the late 1800's and early 1900's, many

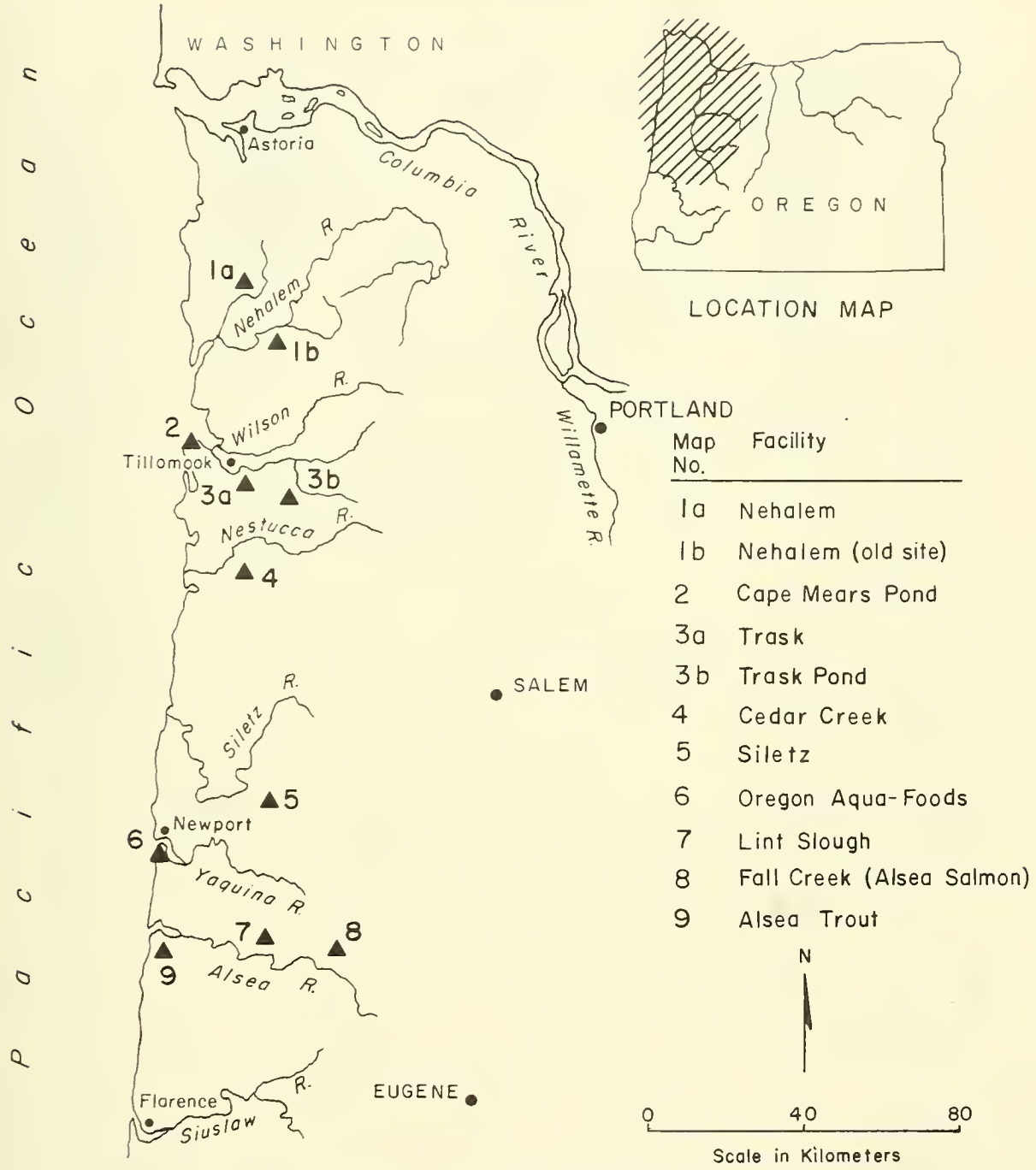
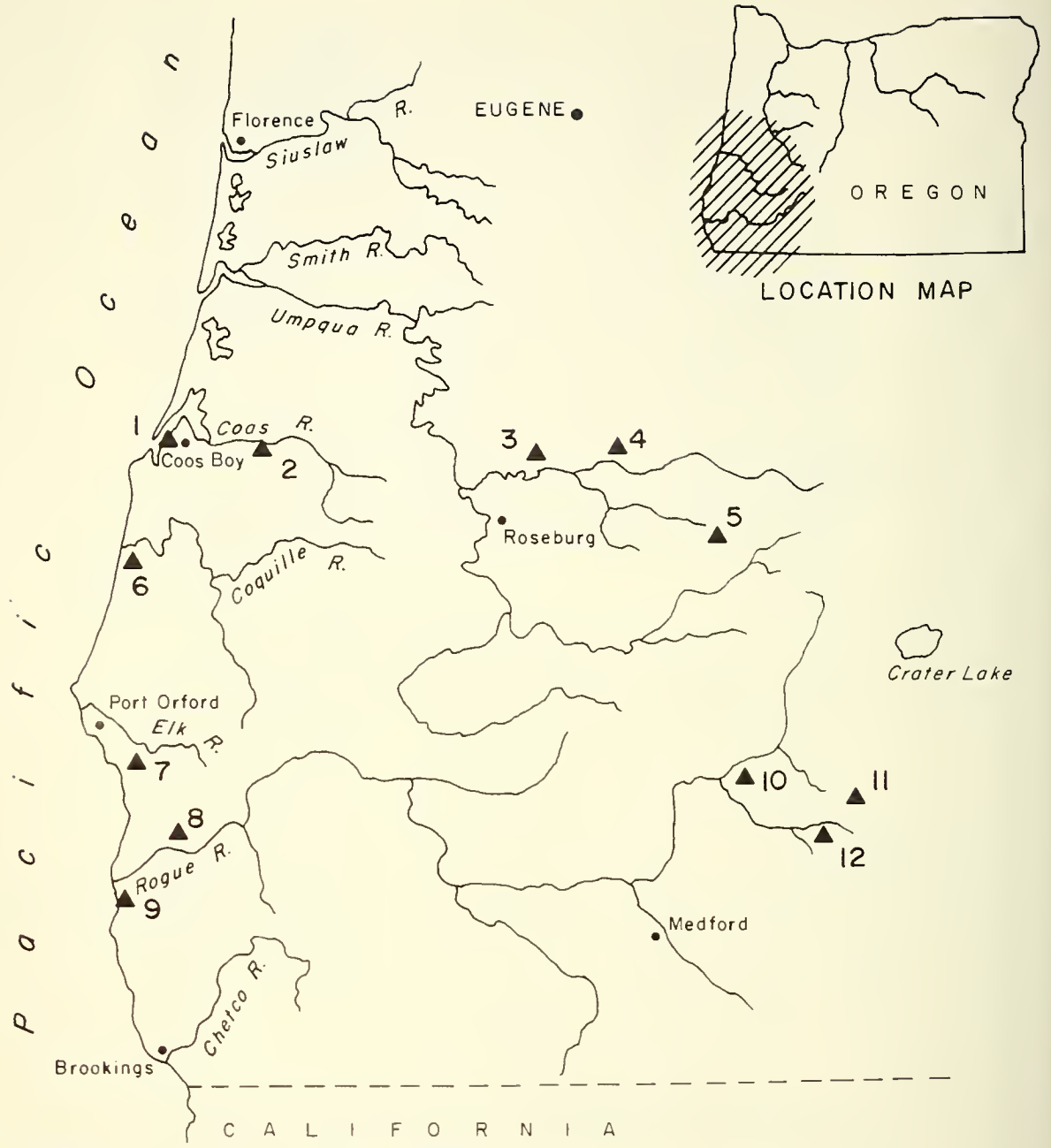


Figure 9.—Map of locations of northern Oregon coastal salmonid rearing facilities, 1960-76.

State, Federal, and local government agencies and private enterprises rushed to build hatcheries. Though many of these early efforts ended in failure for various reasons, there were 72 hatcheries and rearing ponds on the coast in 1929. The total releases from all early hatcheries through 1928 were in excess of 12 billion fry and 1 billion fingerlings and yearlings (Cobb 1931).

Between 1929 and the early 1940's, there was a decline in the number of active hatcheries due in part to the Depression and World War II. All but 3 of the 18 U.S. Bureau of Fisheries (now U.S. Fish and Wildlife Service) hatcheries were closed, replaced, or turned over for State operation. The Alaskan, Canadian, and California facilities in production in 1929 were also closed, or in a few cases, converted to trout culture. Only the State hatcheries of Washington and Oregon did not decline significantly in number. Many of those built in these two States prior to 1929 are currently in production. Additionally, new facilities built in the Washington coastal region in the 1930's are still in operation today.



Map No.	Facility	Map No.	Facility
1	Anadromous Inc.	7	Elk River
2	S. Coos	8	Libby Pond
3	Whistlers' Bend Pond	9	Indian Creek Pond
4	Rock Creek	10	Cole Rivers
5	Bandon	11	Medco Pond
6	Hemlock Meadows	12	Butte Falls

N

0 40 80

Scale in Kilometers

Figure 10.—Map of locations of southern Oregon coastal salmonid rearing facilities, 1960-76.

Table 22.—Anadromous fish rearing facilities—Oregon coastal, 1960-76.

Facility	General location	Operating agency[1,3]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[3]
Hatcheries						
Alsea	Philomath	ODFW (OGC)	sh, src (fc, co)	Yes	1937	Oregon
Anadromous Inc.	Coos Bay	Private	co	Yes	1975	Private
Bandon	Bandon	ODFW (OGC)	sh, src (fc, co)	Yes	1924	Oregon
Butte Falls	Butte Falls	ODFW (OGC)	sc, sh	No	1916	Oregon
Cedar Creek	Heho	ODFW (OGC)	fc, sc, sh, src (co)	Yes	1935	Oregon
Cole Rivers	McLeod	ODFW (OGC)	sc, sh	Yes	1972	Corps
Elk River	Port Orford	ODFW (FCO)	fc (co, sh)	Yes	1969	Oregon, Fed
Fall Creek	Alsea	ODFW (FCO)	fc, co (sc)	Yes	1952	Oregon
Nehalem	Nehalem	ODFW (FCO)	fc, co, sh (sc, ch)	Yes	[4]1968	Oregon
Oregon Aqua Foods	Newport	Private	fc, sc, co	Yes	1972	Private
Rock Creek	Idleyld Park	ODFW (OGC)	sc, co, sh (fc)	Yes	1922	Oregon
Siletz River	Nashville	ODFW (FCO)	co (fc, sc)	Yes	1937	Oregon
South Coos	Coos Bay	ODFW (FCO)	co	No	1900	Oregon
Trask River	Tillamook	ODFW (FCO)	fc, sc, co (ch)	Yes	1914	Oregon
Rearing ponds						
Cape Mears	Tillamook	ODFW (OGC)	fc	No	1967	Oregon
Hemlock Meadows	Rosehurg	ODFW (OGC)	sh	No	1964	Oregon
Indian Creek	Shady Cove	ODFW (OGC)	co	No	1969	Oregon
Lihhy	Gold Beach	ODFW (OGC)	fc	No	1965	Oregon
Lint Slough	Waldport	ODFW (OGC)	fc, co	No	1963	Oregon
Medco	Prospect	ODFW (OGC)	sh	No	1962	Oregon
Whistlers Bend	Roseburg	ODFW (OGC)	fc	No	1967	Oregon

[1]Current agency with premerger agency in parentheses.

[2]fc = fall chinook salmon, sc = spring chinook salmon, co = coho salmon, sh = steelhead trout, src = sea-run cutthroat trout, ch = chum salmon.

[3]ODFW = Oregon Department of Fish and Wildlife, FCO = Fish Commission of Oregon, OGC = Oregon Game Commission, Oregon = State of Oregon General Fund, Corps = U.S. Army Corps of Engineers, Fed = Federal Fund 89-304.

[4]Hatchery moved to this location in 1968. It was constructed on the original site in 1918.

Table 23.—Migrant releases of chinook and coho salmon and steelhead and sea-run cutthroat trout—Oregon coastal[1] (in thousands).

Release year	Fall chinook		Spring chinook		Coho		Winter steelhead		Summer steelhead		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Numher	Pounds	Number	Pounds	Number	Pounds	Numher	Pounds
1960	304.5	1.0	98.4	13.9	1,001.7	68.0	216.3	16.7	79.2	8.5	154.2	41.5
1961	358.1	2.6	137.2	15.6	1,390.0	89.2	263.5	28.8	173.4	31.5	173.5	50.0
1962	340.7	1.1	251.7	42.2	2,810.7	167.8	294.1	33.2	368.3	32.3	280.4	74.1
1963	677.2	7.5	212.4	35.7	2,773.6	171.7	299.6	36.8	292.2	23.8	126.9	45.3
1964	359.5	1.9	330.8	39.6	1,960.6	121.2	511.0	60.8	334.9	28.0	173.5	53.4
1965	77.8	0.9	190.4	23.8	2,172.3	129.0	573.1	57.4	268.4	27.0	114.2	35.9
1966	806.5	9.2	138.6	14.9	2,105.0	138.7	617.1	90.4	205.9	22.6	163.5	51.1
1967	890.7	10.7	265.3	39.9	2,432.8	156.8	606.5	79.2	299.2	43.9	200.0	65.5
1968	2,706.7	42.6	259.7	39.9	3,229.0	193.8	869.0	127.2	337.6	53.5	152.7	45.2
1969	1,599.1	61.7	175.6	27.4	3,407.9	235.8	935.6	136.3	477.2	73.3	131.2	45.5
1970	2,880.5	107.5	417.8	56.1	3,303.3	219.2	1,213.1	173.4	529.5	90.6	195.8	60.8
1971	2,138.8	96.4	412.5	57.8	3,834.9	261.3	1,292.5	206.3	457.6	74.5	192.8	53.9
1972	1,669.2	103.6	378.4	57.2	3,528.3	244.1	1,378.5	211.4	460.6	71.7	206.3	55.0
1973	2,143.4	97.5	408.7	64.9	3,926.6	266.2	1,285.3	183.5	445.8	81.6	244.0	70.8
1974	2,631.9	162.4	534.5	83.3	4,287.7	273.5	1,187.4	159.0	421.6	73.0	204.3	61.2
1975	1,924.6	120.1	657.7	106.3	4,196.4	307.8	1,277.3	196.5	384.7	77.3	106.0	51.5
1976	1,902.2	166.4	417.3	57.5	5,217.7	349.2	1,279.3	206.8	317.9	53.3	220.1	64.2
Total	23,411.4	993.1	5,287.0	776.0	51,578.5	3,393.3	14,099.2	2,003.7	5,854.0	866.4	3,129.4	924.9

[1]Derived from Wahle et al. (1975) prior to 1974 and Oregon Department of Fish and Wildlife hatchery release reports.

[2]1 lb = 0.454 kg.

In the late 1940's salmon and steelhead trout populations along the Pacific coast began to decline because of increased fishing pressure, loss of habitat, and fish passage problems at newly constructed hydroelectric projects. This decline stimulated increased hatchery production efforts. The Lower Columbia River Development Program, of the then Bureau of Commercial Fisheries, funded the construction of a number of hatcheries, including Willard, Kalama Falls, Abernathy, and Klickitat, and the renovation of other facilities already in operation. Several new hatcheries were built in California including the Coleman NFH constructed by the U.S. Bureau of Reclamation for the USFWS to replace two facilities inundated by the filling of Shasta Lake.

Table 24.—Anadromous fish rearing facilities—California, 1960-76.

Facility	General location	Operating agency[1]	Species reared during year span[2]	Anadromous releases in 1976	Year anadromous operation began	Funding agency[1]
Hatcheries						
Coleman	Anderson	USFWS	fc, sh (co)	Yes	1942	USFWS
Crystal Lake	Burney	CDFG	sh (co)	Yes	1948	CDFG
Darrah Springs	Paynes Creek	CDFG	co (fc)	Yes	1954	CDFG
Feather River	Oroville	CDFG	fc, sc, sh	Yes	1967	CDWR
Iron Gate	Hornbrook	CDFG	fc, sc, co, sh	Yes	1966	CDFG, PP&L
Mad River	Blue Lake	CDFG	fc, co, sh	Yes	1971	CDFG, NMFS
Merced rearing facility	Snelling	CDFG	fc, co	Yes	1973	CDFG
Mokelumne	Clements	CDFG	fc, sh	Yes	1964	EBMUD
Nimbus	Rancho Cordova	CDFG	fc, sh	Yes	1955	BR
Prairie Creek	Orick	Humbolt County	fc, co, sh, src	Yes	1928	Humbolt County
Trinity	Lewiston	CDFG	fc, sc, co, sh	Yes	1963	BR
Ponds						
Cochran Creek	Eureka	Fish Action Council Humbolt County	fc, co	Yes	1968	CDFG
Pacific Lumber Co.	Scotia	Pacific Lumber Co., CDFG	sh	No	1972	Pacific Lumber Co.
Talmadge	Talmadge	Sports Club, CDFG	sh	Yes	1972	Mendocino County

[1]USFWS = U.S. Fish and Wildlife Service, CDFG = California Department of Fish and Game, CDWR = California Department of Water Resources, PP&L = Pacific Power and Light, NMFS = National Marine Fisheries Service (Anadromous Fish Act), EBMUD = East Bay Municipal Utility District, BR = Bureau of Reclamation.

[2]fc = fall chinook salmon, sc = spring chinook salmon, co = coho salmon, sh = steelhead trout, src = sea-run cutthroat trout.

As water-use projects continued to block access to anadromous salmonid spawning and rearing areas, it was necessary to build hatcheries to compensate for the resulting loss of fish. Some of these hatcheries include Trinity River and Iron Gate in California, Chelan PUD and the two Cowlitz hatcheries in Washington, and Round Butte in Oregon.

The 1960's saw the re-entry of Alaska and British Columbia into the salmonid propagation field. Again, this was necessitated by decline in fish stocks and the decreases in catches in those two areas. Idaho was also forced into the hatchery salmon and steelhead trout program because of the adverse effects of dams on the Columbia and Snake Rivers.

In 1960 there were 72 hatcheries, pens, and saltwater net pens producing salmon and steelhead trout on the coast (Fig. 12). This was approximately the same number as in 1929. The number increased to a maximum of 154 in 1976, over a twofold gain. In all, 192 facilities reared anadromous fish for at least 1 yr on the Pacific coast during the 17-yr span ending in 1976.

Species Reared

One of the major trends in hatchery production of salmonids has been the shift in emphasis placed on rearing different species of salmon and anadromous trout. Prior to 1929, of the over 12 billion fry and 1 billion fingerlings and yearlings released, almost half were sockeye salmon. In 1910 alone there were almost 400 million sockeye salmon fry released (Cobb 1931).

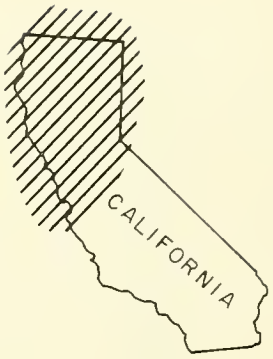
With the closing of large Alaska and British Columbia sockeye salmon stations in the 1920's and 1930's species emphasis changed. For the 17 yr since 1960, the major species reared have been chinook salmon, coho salmon, and steelhead trout (Fig. 13). The sockeye salmon releases had declined to only 3 million in 1960 with most of these coming from Leavenworth NFH on the upper Columbia River in Washington. Since 1967, when Leavenworth terminated its sockeye salmon program, only two releases of this species have been made totaling 27,000 fish.

Rearing Trends

One of the major changes in hatchery operations has been the switch from releasing unfed fry to releasing salmon and steelhead trout after a period of rearing. In the late 1800's and early 1900's, the standard hatchery practice was to release fish soon after the eggs hatched, when the yolk sac had been absorbed. The small number that were retained and fed were kept as curiosities. Although no difficulty was experienced raising these fish, the added expense of fish food as well as the inadequate rearing space at the hatcheries precluded general adoption of rearing programs.

As previously stated, a few fish culturists, including R. D. Hume from Oregon, disagreed with the practice of releasing unfed fry. It was their belief that unfed fry were ill equipped to survive competition with wild fish and predators and the increased survival and contribution obtained from releasing larger fish would outweigh the additional expense of rearing. Over the years this has proven to be true and today almost all anadromous fish are fed for a period of time before they are released.

The early efforts of rearing fish depended on diet based on ground meat and fish products. Liver, spleen, and salmon carcasses were common ingredients, supplemented with various grains and meals. These diets were not very efficient and were messy and time consuming to



LOCATION MAP

Map No.	Facility	Map No.	Facility
1	Iron Gate	8	Darrah Springs
2	Prairie Creek	9	Crystal Lake
3	Mad River	10	Feather River
4	Cochran Creek	11	Talmadge Pond
5	Pacific Lumber Co. Pond	12	Nimbus
6	Trinity River	13	Mokelumne Facility
7	Coleman	14	Merced River

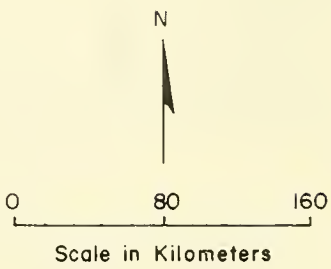


Figure 11.—Map of locations of northern California salmonid rearing facilities, 1960-76.

Table 25.—Migrant releases of chinook and coho salmon and steelhead and sea-run cutthroat trout—California[1] (in thousands).

Release year	Fall chinook		Spring chinook		Coho		Winter steelhead		Summer steelhead		Sea-run cutthroat	
	Number	Pounds[2]	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
1960	5,386.6	125.5	0.0	0.0	0.0	0.0	315.1	16.4	0.0	0.0	0.0	0.0
1961	34,085.5	226.6	0.0	0.0	58.0	5.9	518.1	49.7	0.0	0.0	0.0	0.0
1962	7,293.3	140.7	0.0	0.0	364.0	32.0	187.3	18.6	0.0	0.0	1.9	0.4
1963	19,862.4	205.5	0.0	0.0	498.9	43.9	72.3	10.4	0.0	0.0	0.0	0.0
1964	10,161.7	148.7	300.0	10.4	499.3	43.9	1,163.1	146.3	0.0	0.0	2.7	0.9
1965	6,529.8	161.8	224.5	12.8	1,097.4	81.8	736.7	74.6	0.0	0.0	6.8	1.1
1966	11,015.7	171.6	0.0	0.0	747.2	86.2	2,436.2	327.1	0.0	0.0	10.7	2.6
1967	7,748.4	123.9	0.0	0.0	1,264.6	87.9	2,027.0	281.3	0.0	0.0	7.6	2.0
1968	14,157.1	163.0	528.6	41.3	1,821.0	130.1	2,129.7	314.3	0.0	0.0	5.3	1.3
1969	17,442.9	193.7	673.4	57.4	1,448.1	123.1	1,818.8	274.8	0.0	0.0	3.1	1.3
1970	16,808.6	302.9	120.8	14.8	1,152.1	93.0	2,169.8	318.5	18.7	2.2	55.0	3.8
1971	34,206.1	475.3	569.9	66.5	1,245.5	112.1	3,618.9	399.3	133.6	18.5	0.0	0.0
1972	37,275.7	494.3	247.3	24.8	1,664.5	153.3	4,340.6	527.9	212.2	26.9	0.8	0.1
1973	21,707.1	387.6	507.6	64.5	1,161.7	79.3	2,916.7	344.4	37.1	3.8	1.0	0.6
1974	22,667.0	418.4	482.9	47.2	802.8	54.4	3,081.1	348.7	141.6	27.2	0.0	0.0
1975	27,837.6	456.6	303.2	32.9	1,771.1	151.0	2,524.3	298.8	0.0	0.0	6.1	0.8
1976	24,444.4	471.2	888.5	115.8	1,046.6	90.4	2,948.5	416.2	77.8	12.6	4.3	1.2
Total	318,629.9	4,667.3	4,846.7	488.4	16,642.8	1,368.3	33,004.2	4,167.3	621.0	91.2	105.3	16.1

[1]Derived from Wahel et al. (1975) prior to 1974, U.S. Fish and Wildlife Service hatchery annual reports, and California hatchery records.

[2]1 lb = 0.454 kg.

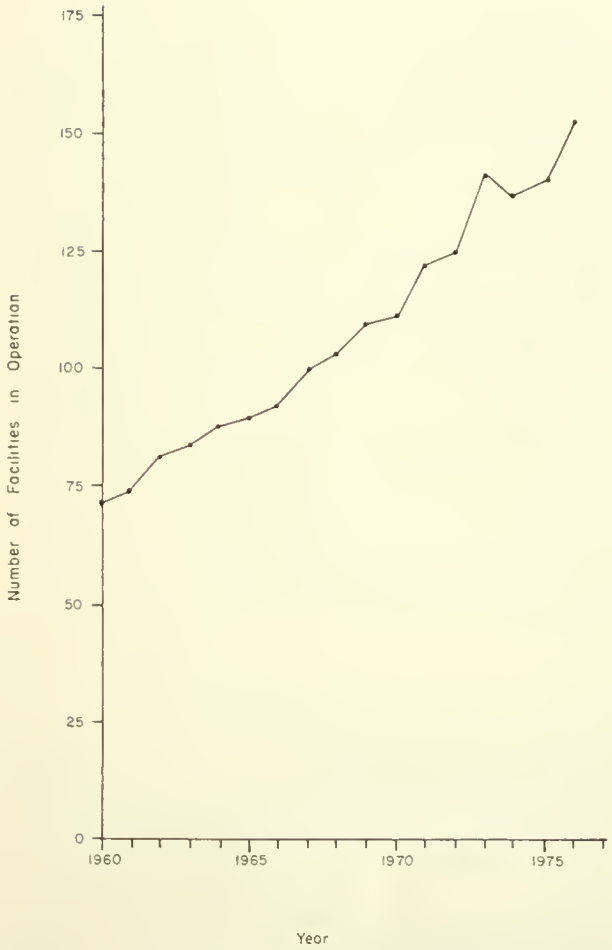


Figure 12.—Number of Pacific coast salmonid rearing facilities releasing anadromous salmonids by year, 1960-76.

Figure 13.—Numbers of Pacific coast releases of chinook and coho salmon and steelhead trout (in millions).

prepare. In the 1950's, conversion ratios as low as 5.6 lb (25 kg) of food fed per pound (0.45 kg) of weight gained were reported from the ground-meat base diets used at several FCO hatcheries. At most hatcheries today, less than 2 lb (0.91 kg) of food are required for a 1 lb (0.45 kg) gain in weight. Another disadvantage of the meat diets was the spread of bacteria and viral diseases, to young fish from diets that included salmon carcasses. Although the diets did have disadvantages, they still allowed larger fish to be reared.

Several developments in the late 1950's had important effects on rearing practices. Improved pasteurization methods were developed to treat salmon viscera, an important component of many meat based diets. This process was used to kill disease-causing organisms that would otherwise have affected the young fish. Commercial, dry, pelletized trout diets received much attention experimentally as a salmon diet. Few of the standard trout feeds showed promise and all required meat diets to be used while the fish started feeding.

In 1959, after many years of experimentation, the FCO began feeding Oregon moist pellets (OMP) to fish at 16 of their salmon hatcheries. The OMP diet, developed jointly by the FCO and Oregon State University scientists with funds supplied by the U.S. Bureau of Commercial Fisheries (now National Marine Fisheries Service), was a breakthrough in the area of hatchery nutrition. This easily fed diet does not require any preparation at the hatchery and is readily accepted by the fish. It consists of a combination of cereals, fish meals, fish oils, dried skim milk, and vitamin supplements. Fish fed this diet have shown, in almost all cases, better survival and contribution to the fishery than fish fed old ground meat type diets (Hublou et al. 1959, Hublou 1963). Development of the OMP has opened the way for other types of diets including the Abernathy dry pellet developed at Abernathy Salmon Cultural Development Center. These new diets have made hatcheries biologically and economically feasible ventures.

Size at Time of Release

One of the most interesting trends of hatchery production over the last 17 yr has been the change in release size of migrant coho, spring chinook, and fall chinook salmon. Until the early 1960's hatcheries emphasized numbers of fish liberated. It was common for a hatchery to take more eggs than could be reared to migrant size. As fish grew and crowding occurred, fish in excess of hatchery capacities were released. Out of an egg-take of over 13 million fall chinook salmon eggs in 1959, Spring Creek NFH produced only 7.8 million migrants in May of 1960. The other 5.8 million were thinned out 3 mo earlier (Wahle et al. 1975). The average size for all species of migrant salmon released from Pacific coast rearing facilities in 1960 was 88 fish/lb (5.2 g/fish) (Fig. 14a). Fall chinook salmon, reared for 5 or 6 mo, averaged 211 fish/lb (2.29 g/fish) (Fig. 14b). Spring chinook and coho salmon, reared for an average of 20 mo, both averaged 33 fish/lb (13.8 g/fish) (Fig. 14c,d).

Figure 14.—Average size of various species of Pacific coast anadromous salmonid releases (all species combined), 1960-76. (1 lb equals 0.454 kg.)

In the early 1960's, a trend developed away from maximizing numbers at hatcheries. Instead, the philosophy of raising less fish to a larger size began to gain acceptance among the fish rearing agencies. Marking experiments showed that these larger fish had better survival and contribution to the fisheries (Senn and Noble 1968; Johnson 1970; Wallis[7]; Senn et al.[8]; Washington Department of Fisheries[9]). Numbers of migrant fish released actually declined slightly from 1960 to 1962 (Fig. 15) even though the number of facilities increased (Fig. 12). While migrant numbers held fairly constant from 1960 to 1976, the number of migrant pounds increased almost six times (Fig. 15). In 1976, fall chinook salmon smolts averaged 59 fish/lb (7.7 g/fish) (Fig. 14b). Spring chinook and coho salmon showed similar size change, going from approximately 32 fish/lb (4.2 g/fish) to 11 fish/lb (41.2 g/fish) and from 33 fish/lb (13.6) to 17 fish/lb (26.7 g/fish), respectively (Fig. 14c,d). During this time, the average size for all species combined went from 88 fish/lb (5.2 g/fish) to 26 fish/lb (17.5 g/fish) (Fig. 14a).

[7]Wallis, J. 1968. Recommended time, size and age for release of hatchery-reared salmon and steelhead trout. Fish. Comm. Oreg., Clackamas, Proc. Rep., 61 p.

[8]Senn, H. G., R. C. Hager, and C. W. Hopley, Jr. 1975. The effects of experimentally varying the size and time of release of hatchery-reared coho salmon. Unpubl. manuscr., 14 p. Washington Department of Fisheries, Olympia, Wash.

[9]Washington Department of Fisheries. 1977. 1972-brood Toutle River coho time/size at release study. Unpubl. manuscr., 16 p. Washington Department of Fisheries, Olympia, Wash.

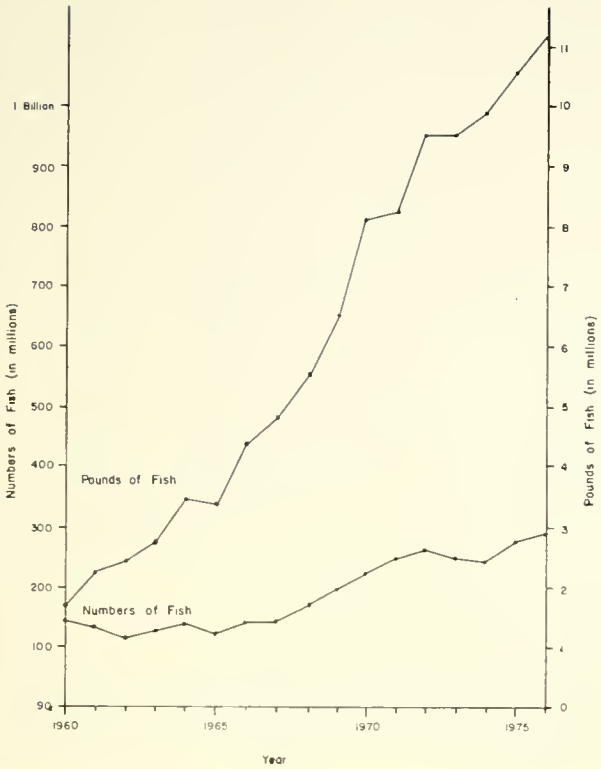


Figure 15.—Total Pacific coast migrant anadromous salmonid releases (all species combined), 1960-76. (1 lb equals 0.454 kg.)

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Appendix Table 1.—Pacific coast anadromous fish rearing facilities.

Facility name	Region
Aberdeen State Fish Hatchery 4203 Central Park Drive Aberdeen, WA 98520	Washington coastal and Puget Sound
Abernathy Salmon Cultural Development Center 1440 Abernathy Road Longview, WA 98632	Columbia Basin-Washington
Alder Creek Rearing Pond c/o Beaver Creek State Fish Hatchery Route 1, Box 274A Cathlamet, WA 98612	Columbia Basin-Washington
Alsea Fish Hatchery Star Route 2, Box 52 Philomath, OR 97370	Oregon coastal
Anadromous Inc. Route 2, Box 2012 Deer Island, OR 97054	Oregon coastal
Arlington Trout Hatchery Route 3, Box 107 Arlington, WA 98223	Washington coastal and Puget Sound
Aumsville Pond 8743 Bisbop Rd S.E. Aumsville, OR 97325	Columbia Basin-Oregon
Bandon Fish Hatchery Route 1, Box 195 Bandon, OR 97411	Oregon coastal
Barnaby Rearing Pond P.O. Box 102 Rockport, WA 98283	Washington coastal and Puget Sound
Bay Center Mariculture Box 303 Bay Center, WA 98527	Washington coastal and Puget Sound
Beaver Creek Trout Hatchery Route 1, Box 274A Cathlamet, WA 98612	Columbia Basin-Washington
Bellingbam Fish Hatchery Whatcom Falls Park Bellingham, WA 98225	Washington coastal and Puget Sound
Big Creek Fish Hatchery Route 4, Box 594 Astoria, OR 97103	Columbia Basin-Oregon
Big Qualicum Hatchery RR = 3 Qualicum Beach, British Columbia	British Columbia
Big White Salmon Rearing Pond c/o Spring Creek National Fish Hatchery Underwood, WA 98651	Columbia Basin-Washington
Blue Slough Rearing Pond (Closed) c/o Washington Dept. of Game 600 N. Capitol Way Olympia, WA 98504	Washington coastal and Puget Sound
Bonneville Fish Hatchery P.O. Box 262 Bonneville, OR 97008	Columbia Basin-Oregon
Bowman's Bay Rearing Ponds (Closed) c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Butte Falls Fish Hatchery 580 Fish Lake Road Butte Falls, OR 97522	Oregon coastal
Cape Mears (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Capilano Hatchery 4500 Capilano Park Road North Vancouver, British Columbia	British Columbia
Carson National Fish Hatchery Carson, WA 98610	Columbia Basin-Washington
Cascade Fish Hatchery Star Route, Box 526 Bonneville, OR 97008	Columbia Basin-Oregon
Cedar Creek Fish Hatchery Route 1, Box 9 Hebo, OR 97122	Oregon coastal
Chambers Creek Trout Hatchery c/o South Tacoma Hatchery 7723 Phillips County Road, S.W. Tacoma, WA 98498	Washington coastal and Puget Sound
Chelan PUD Trout Fish Hatchery Star Route Chelan, WA 98816	Columbia Basin-Washington
Cochran Creek Rearing Pond c/o Humbolt Fish Action Council P.O. Box 154 Eureka, CA 95501	California

Coleman National Fish Hatchery Route 1, Box 2105 Anderson, CA 96007	California
Cole Rivers Fish Hatchery Laurelhurst Road Trail, OR 97541	Oregon coastal
Columbia Basin State Fish Hatchery Route 2, Box 333C Moses Lake, WA 98837	Columbia Basin-Washington
Coos River State Hatchery (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Cowlitz Salmon Hatchery 2284 Spencer Road Salkum, WA 98582	Columbia Basin-Washington
Cowlitz Trout Hatchery Salkum, WA 98582	Columbia Basin-Washington
Crystal Lake Hatchery P.O. Box 1088 Petersburg, AK 99833	Alaska
Crystal Lake Hatchery Route 2, Box 1113 Burney, CA 96013	California
Darrah Springs Hatchery P.O. Box 8 Paynes Creek, CA 96075	California
Decker Flats Rearing Pond P.O. Box 1196 Salmon, ID 83467	Columbia Basin-Idaho
Deschutes Rearing Pond c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Dexter Rearing Pond General Delivery Lowell, OR 97456	Columbia Basin-Oregon
Domsea Farms Aquaculture Salt water-P.O. Box 372 Manchester, WA 98353 Fresh water-510 Washington Bremerton, WA 98310	Washington coastal and Puget Sound
Dungeness Salmon Hatchery Route 6, Box 983 Sequim, WA 98383	Washington coastal and Puget Sound
Dworshak National Fish Hatchery P.O. Box 251 Ahsahka, ID 83520	Columbia Basin-Idaho
Eagle Hatchery Eagle, ID 83616	Columbia Basin-Idaho
Eagle Creek National Fish Hatchery Route 1, Box 610 Estacada, OR 97023	Columbia Basin-Oregon
Elk River Fish Hatchery Star Route, Box 150 Port Orford, OR 97465	Oregon coastal
Elokomin Salmon Hatchery Route 1, Box 300 Cathlamet, WA 98612	Columbia Basin-Washington
Entiat National Fish Hatchery Star Route, Box 410 Entiat, WA 98822	Columbia Basin-Washington
Fall Creek Hatchery (Alsea Salmon) Route 2, Box 47 Alsea, OR 97324	Oregon coastal
Falls River Fish Hatchery 15055 S. Century Drive Bend, OR 97701	Columbia Basin-Oregon
Feather River Hatchery 5 Table Mt. Blvd. Oroville, CA 95965	California
Fire Lake Hatchery P.O. Box 488 Eagle River, AK 99577	Alaska
Garrison Spring Salmon Hatchery P.O. Box 94141 Fort Steilacoom, WA 98494	Washington coastal and Puget Sound
George Adams Hatchery Rt. 5, Box 125 Shelton, WA 98584	Washington coastal and Puget Sound
Gnat Creek Fish Hatchery Star Route 2 Clatskanie, OR 97016	Columbia Basin-Oregon
Goldendale Trout Hatchery Route 2, Box 111 Goldendale, WA 98620	Columbia Basin-Washington
Gorst Creek Pond c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Grays River Salmon Hatchery P.O. Box 768 Grays River, WA 98621	Columbia Basin-Washington
Green River Salmon Hatchery Route 1, Box 740 Auburn, WA 98002	Washington coastal and Puget Sound
Green River Rearing Pond P.O. Box 96 Palmer, WA 98048	Washington coastal and Puget Sound
Hagerman State Fish Hatchery Hagerman, ID 83332	Columbia Basin-Idaho
Halibut Cove Lagoon c/o F.R.E.D. Division P.O. Box 234 Homer, AK 99603	Alaska
Harrison Rearing Pond c/o Barnaby Rearing Pond P.O. Box 102 Rockport, WA 98283	Washington coastal and Puget Sound
Hayden Creek Hatchery P.O. Box 25 Lemhi, ID 83465	Columbia Basin-Idaho

Hemlock Meadows Rearing Pond (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Hood Canal Salmon Hatchery P.O. Box 6 Hoodsport, WA 98548	Washington coastal and Puget Sound
Hood River State Trout Hatchery (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Columbia Basin-Oregon
Indian Creek Rearing Pond (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Iron Gate Hatchery Copco Star Route Hornbrook, CA 96044	California
Issaquah Salmon Hatchery P.O. Box 465 Issaquah, WA 98027	Washington coastal and Puget Sound
Kalama Falls Salmon Hatchery 3900 Kalama River Road Kalama, WA 98625	Columbia Basin-Washington
Klaskanine Fish Hatchery Route 1, Box 764 Astoria, OR 97103	Columbia Basin-Oregon
Klickitat Salmon Hatchery Route 2, Box 90 Glenwood, WA 98619	Columbia Basin-Washington
Kooskia National Fish Hatchery Route 1, Box 98-A Kooskia, ID 83539	Columbia Basin-Idaho
Leaburg Fish Hatchery 90701 Fish Hatchery Road Leaburg, OR 97401	Columbia Basin-Oregon
Leavenworth National Fish Hatchery Route 1, Box 123-A Leavenworth, WA 98826	Columbia Basin-Washington
Lewis River Salmon Hatchery 4404 Lewis River Road Woodland, WA 98674	Columbia Basin- Washington
Libby Rearing Pond (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Lint Slough Rearing Pond c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Little Clam Bay Rearing Pond c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Little Port Walter Research Station c/o Auke Bay NMFS Fisheries Laboratory P.O. Box 155 Auke Bay, AK 99821	Alaska
Little White Salmon National Fish Hatchery P.O. Box 17 Cook, WA 98605	Columbia Basin-Washington
Lower Kalama Salmon Hatchery 1404 Kalama River Road Kalama, WA 98625	Columbia Basin-Washington
Lummi Indian Net Pens c/o Lummi Indian Tribal Enterprises Mr. Jim Ellis P.O. Box 309 Marietta, WA 98268	Washington coastal and Puget Sound
MacKay Hatchery MacKay, ID 83251	Columbia Basin-Idaho
Mad River Hatchery Route 1, Box 184 Arcata, CA 95521	California
Marion Forks Fish Hatchery Star Route, Box 71 Idanha, OR 97350	Columbia Basin-Oregon
McCall Hatchery P.O. Box 1021 McCall, ID 83638	Columbia Basin-Idaho
McKenzie Fish Hatchery 43863 Greer Drive Leaburg, OR 97401	Columbia Basin-Oregon
Medco Rearing Pond (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Oregon coastal
Mendenhall Rearing Pond c/o Alaska Dept. of Fish and Game 210 Ferry Way Juneau, AK 99801 ATTN: Mr. Bethers	Alaska
Merced River Rearing Facility P.O. Box 94 Snelling, CA 95369	California
Metolius Hatchery (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Columbia Basin-Oregon
Minter Creek Salmon Hatchery Route 4, Box 4595 Gig Harbor, WA 98335	Washington coastal and Puget Sound
Mokelumne Rearing Facility P.O. Box 158 Clements, CA 95227	California

Mossyrock Trout Hatchery P.O. Box 108 Mossyrock, WA 98564	Columbia Basin-Washington
Mullen Hatchery P.O. Box 448 Mullen, ID 83846	Columbia Basin-Idaho
Naches Trout Hatchery Rural Route 1 Naches, WA 98937	Columbia Basin-Washington
Nehalem Fish Hatchery Route 1, Box 292 Nehalem, OR 97131	Oregon coastal
Nelson Bridge Rearing Pond c/o Naches State Fish Hatchery Rural Route 1 Naches, WA 98937	Columbia Basin-Washington
Nemah Salmon Hatchery Star Route South Bend, WA 98586	Washington coastal and Puget Sound
Niagara Springs Hatchery P.O. Box 128 Wendell, ID 83355	Columbia Basin-Idaho
Nile Springs c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Columbia Basin-Washington
Nimbus Hatchery 2001 Nimbus Road Rancho Cordova, CA 95670	California
Nooksack Salmon Hatchery Glacier Star Route Deming, WA 98244	Washington coastal and Puget Sound
Northwest Steelheaders' Rearing Ponds c/o N.W. Steelheaders Council 3634 Walker Road Tacoma, WA 98443	Washington coastal and Puget Sound
Oakridge Fish Hatchery 76389 Fish Hatchery Pt. Oakridge, OR 97463	Columbia Basin-Oregon
Oak Springs Fish Hatchery Route 1, Box 134 Maupin, OR 97037	Columbia Basin-Oregon
Olympic Rearing Channel 420 Laird Port Angeles, WA 98362	Washington coastal and Puget Sound
Oregon Aqua Foods 88700 Marcola Road Springfield, OR 97477	Oregon coastal
Oxbow Hatchery P.O. Box 85 Oxbow, OR 97840	Columbia Basin-Idabo
OxBow Fish Hatchery Star Route, Box 750 Cascade Locks, OR 97014	Columbia Basin-Oregon
Pacific Lumber Co. Rearing Ponds c/o Pacific Lumber Council Scotia, CA 95565	California
Pahsimeroi Hatchery P.O. Box 84 Ellis, ID 83235	Columbia Basin-Idaho
Percival Cove Rearing Pond c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Prairie Creek Hatchery Orick, CA 95555	California
Priest Rapids Salmon Rearing Facility P.O. Box 937 Mattawa, WA 99344	Columbia Basin-Washington
Puntledge Rearing Facility c/o Big Qualicum Hatchery RR # 3 Qualicum Beach, British Columbia	British Columbia
Puyallup Salmon Hatchery Route 1, Box 97 Orting, WA 98360	Washington coastal and Puget Sound
Puyallup Trout Hatchery 1416 14th Street Puyallup, WA 98371	Washington coastal and Puget Sound
Quilcene National Fish Hatchery Quilcene, WA 98376	Washington coastal and Puget Sound
Quinault National Fish Hatchery P.O. Box 80 Neilton, WA 98556	Washington coastal and Puget Sound
Rapid River Hatchery (Circle "C" Hatchery) Riggins, ID 83549	Columbia Basin-Washington
Ringold Salmon Rearing Pond Star Route Mesa, WA 99343	Columbia Basin-Washington
Ringold Trout Rearing Pond Star Route Mesa, WA 99343	Columbia Basin-Washington
Roaring River Fish Hatchery 42255 Fish Hatchery Drive Scio, OR 97374	Columbia Basin-Oregon
Robertson Creek Rearing Facility c/o Environment Canada Fisheries and Marine Service 1090 Pender St. Vancouver, British Columbia V6E 2P1	British Columbia
Rock Creek Fisb Hatchery Toketee Route, Box 12 Idleyld Park, OR 97447	Oregon coastal
Rock Reach Salmon Rearing Facility 601 N. Jenifer Lane E. Wenatchee, WA 98801	Columbia Basin-Washington
Rosewall Rearing Facility c/o Pacific Biological Station P.O. Box 100 Nanaimo, British Columbia	British Columbia

Round Butte Fish Hatchery P.O. Box 513 Madras, OR 97741	Columbia Basin-Oregon
Salem Rearing Pond c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTN: Mr. Jefferies	Columbia Basin-Oregon
Salt Creek Rearing Pond (Closed) c/o Washington Dept. of Game 600 N. Capitol Way Olympia, WA 98504	Washington coastal and Puget Sound
Samish Salmon Hatchery P.O. Box 555 Old Highway 99 Burlington, WA 98233	Washington coastal and Puget Sound
Sandpoint Hatchery Route 1 Sagle, ID 83860	Columbia Basin-Washington
Sandy River Fish Hatchery 39800 S.E. Fish Hatchery Road Sandy, OR 97055	Columbia Basin-Oregon
Seward Park Hatchery Seward Park Seattle, WA 98118	Washington coastal and Puget Sound
Shelton Trout Hatchery Route 5, Box 251 Shelton, WA 98584	Washington coastal and Puget Sound
Siletz Fish Hatchery Nashville Route, Box 125 Blodgett, OR 97326	Oregon coastal
Simpson Salmon Hatchery Route 1, Box 140 Elma, WA 93541	Washington coastal and Puget Sound
Skagit Salmon Hatchery Cascade Route Marblemount, WA 98267	Washington coastal and Puget Sound
Skamania Trout Hatchery Route 2, Box 464 Washougal, WA 98611	Columbia Basin-Washington
Skykomish Rearing Ponds Route 2, Box 395½ Sultan, WA 98294	Washington coastal and Puget Sound
Skykomish Salmon Hatchery Route 2, Box 423 Sultan, WA 98294	Washington coastal and Puget Sound
Soleduck Salmon Hatchery P.O. Box 8 Beaver, WA 98305	Washington coastal and Puget Sound
South Santiam Fish Hatchery 43182 N. River Road Sweet Home, OR 97386	Columbia Basin-Oregon
South Sound Net Pens c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
South Tacoma Trout Hatchery 7723 Phillips County Road, S.W. Tacoma, WA 98498	Washington coastal and Puget Sound
Speelyai Salmon Hatchery 11001 Lewis River Road Ariel, WA 98603	Columbia Basin—Washington
Spring Creek National Fish Hatchery Underwood, WA 98651	Columbia Basin— Washington
Squaxin Island Mariculture 33324 Pacific Highway Auburn, WA 98002	Washington coastal and Puget Sound
Starrigavan Net Pens P.O. Box 499 Sitka, AK 99835	Alaska
Stayton Rearing Pond c/o Aumsville Rearing Pond 8743 Bishop Road S.E. Aumsville, OR 97325	Columbia Basin-Oregon
Steilacoom Net Pens (Closed) c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Swofford Rearing Pond 1182 Spencer Road Winlock, WA 98596	Columbia Basin-Washington
Talmadge Rearing Pond c/o Mendocino County Offices Ukiah, CA 95482	California
Tokul Creek Trout Hatchery Route 1 Fall City, WA 98024	Washington coastal and Puget Sound
Toutle River Salmon Hatchery 1500 Cook Road Toutle, WA 98649	Columbia Basin-Washington
Trask River Fish Hatchery 15020 Chance Road Tillamook, OR 97141	Oregon coastal
Trinity River Hatchery P.O. Box 162 Lewiston, CA 96052	California
Tucannon Trout Hatchery Route 1, Box 32 Pomeroy, WA 99347	Columbia Basin-Washington
Tulalip Rearing Facility c/o Mr. Wayne Williams 3901 Totem Beach Road Marysville, WA 98270	Washington coastal and Puget Sound
Vancouver Trout Hatchery 12208 Evergreen Highway S.E. Vancouver, WA 98660	Columbia Basin-Washington
Wahkeena Rearing Pond c/o OxBow State Salmon Hatchery Star Route, Box 750 Cascade Locks, OR 97014	Columbia Basin-Oregon

Wallowa Fish Hatchery Route 1, Box 278 Enterprise, OR 97828	Columbia Basin-Oregon
Washburn Island Rearing Facility (Closed) c/o Washington Dept. of Game 600 N. Capitol Way Olympia, WA 98504	Columbia Basin-Washington
Washougal Salmon Hatchery Route 2, Box 443 Washougal, WA 98671	Columbia Basin-Washington
Wells Salmon Rearing Facility Box 3, Azwell Route Pateros, WA 98846	Columbia Basin-Washington
Wells Trout Hatchery Box 2, Azwell Route Pateros, WA 98846	Columbia Basin—Washington
Westport Boat Basin Rearing Facility c/o Washington Dept. of Fisheries Rm 115, Gen. Admin. Bldg. Olympia, WA 98504	Washington coastal and Puget Sound
Whidby Island Rearing Facility c/o Whidby Salmon Association P.O. Box 175 Clinton, WA 98236	Washington coastal and Puget Sound
Whistler's Bend Rearing Pond (Closed) c/o Oregon Dept. of Fish and Wildlife P.O. Box 3503 Portland, OR 97208 ATTEN: Mr. Jefferies	Oregon coastal
Whitehorse Rearing Pond Route 3, Box 229 Arlington, WA 98223	Washington coastal and Puget Sound
Willapa Salmon Hatchery Route 1, Box 192 Raymond, WA 98577	Washington coastal and Puget Sound
Willard National Fish Hatchery Star Route Cook, WA 98605	Columbia Basin-Washington
Winthrop National Fish Hatchery P.O. Box 218 Winthrop, WA 98862	Columbia Basin-Washington
Wizard Falls Fish Hatchery Camp Sherman, OR 97730	Columbia Basin-Oregon
Yakima Trout Hatchery 2306 S. 16th Avenue Yakima, WA 98902	Columbia Basin-Washington

Appendix Table 2.—Agencies operating fish rearing facilities on the Pacific coast.

Agency	Address	Contact	Phone
Alaska Department of Fish and Game	F.R.E.D. 333 Raspberry Road Anchorage, AK 99502	Nikki Newcome	907-344-0541
California Department of Fish and Game	1001 Jedsmith Drive Sacramento, CA 95819	Patrick O'Brien	916-445-0111
Environment Canada-Fisheries and Marine Service	1090 West Pender St. Vancouver 1, B.C. V6E 2P1	Ted Perry	604-666-6966
Humboldt County, California	C/o Prairie Creek Hatchery Orick, CA 95555	Steven Sanders	707-488-2253
Idaho Department of Fish and Game	600 South Walnut P.O. Box 25 Boise, ID 83707	Walt Bethke	208-964-3791
National Marine Fisheries Service (Alaska)	Auke Bay Research Station Box 155 Auke Bay, AK 99821	William Heard	907-789-7231
Oregon Department of Fish and Wildlife	P.O. Box 3503 Portland, OR 97208	Ernie Jefferies	503-229-5675
U.S. Fish and Wildlife Service	Suite 1692 Lloyd 500 Building 500 N.E. Multnomah St. Portland, OR 97232	Paul Handy	503-231-6216
Washington Department of Fisheries	Room 115, General Admin. Bldg. Olympia, WA 98501	Harry Senn	206-753-1872
Washington Department of Game	600 N. Capitol Way Olympia, WA 98504	James Gearhart	206-753-5713

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Personal communications. Cite name in text and footnote. Cite in footnote: John J. Jones, Fishery Biologist, Scripps Institution of Oceanography, La Jolla, CA 92037, pers. commun., 21 May 1977.

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