

# ESTABLISHMENT OF NONINDIGENOUS RUNS OF SPRING CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA*, IN THE WIND RIVER DRAINAGE OF THE COLUMBIA RIVER, 1955-63

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## ABSTRACT

In 1955, cooperating agencies of the Columbia River Fishery Development Program embarked upon a 9-year program to introduce nonindigenous spring chinook salmon, *Oncorhynchus tshawytscha*, into Wind River, a tributary of the Columbia River. The program consisted of: 1) construction of a fishway at an impassable falls on the lower Wind River, 2) transplantation of nonindigenous adult spring chinook salmon from the Columbia River to Carson National Fish Hatchery on the upper Wind River, and 3) rearing and release of juvenile spring chinook salmon into the Wind River. As a result of these activities, approximately 66,000 adult spring chinook salmon returned to Carson hatchery during 1959-79. Additional nonindigenous adult fish annually utilized natural spawning habitat of the Wind River drainage. Hatchery and naturally produced spring chinook salmon from the Wind River contributed to marine and freshwater commercial and sports fisheries. Through 1979, about 46.5 million spring chinook salmon eggs and 3.5 million juveniles were transplanted from Carson hatchery to other areas of the Pacific Northwest.

The Columbia River Basin produces the world's largest runs of chinook salmon, *Oncorhynchus tshawytscha*, and steelhead, *Salmo gairdneri*; major runs of coho salmon, *O. kisutch*; and lesser runs of sockeye salmon, *O. nerka*, and chum salmon, *O. keta*. Since the 1938 completion of Bonneville Dam on the main-stem Columbia River at river mile 146.1 from the Pacific Ocean, the Columbia River Basin has been divided into upper and lower river fishery management units encompassing areas above and below Bonneville Dam, respectively. Chinook salmon produced in the upper river area, particularly the spring and summer runs,<sup>3</sup> provided the bulk of freshwater commercial catches which annually averaged approximately 29 million lb from 1866 to 1940, and peaked at more than 40 million lb/yr during 10 yr of that period (Beiningen<sup>4</sup>).

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<sup>3</sup>Distinct runs of adult chinook salmon enter the Columbia River from February through October of each year. Those entering the river in late February through May are classed as spring chinook salmon. Spring chinook salmon destined for upriver spawning areas generally enter the Columbia in late March through May with peak passage at Bonneville Dam in late April or early May. Chinook salmon entering the Columbia from late May through July are classed as summer chinook salmon and are all destined for spawning areas above Bonneville Dam (Chaney and Perry see footnote 5).

<sup>4</sup>Beiningen, K. T. 1976. Investigative reports of Columbia

By the beginning of the 1940's, land and water developments in the upper Columbia Basin had eliminated or degraded major anadromous salmonid spawning and rearing areas. The resulting reduced production in combination with overfishing had a significant diminishing effect on salmon and steelhead runs originating in the upper basin (Chaney and Perry<sup>5</sup>).

In 1949 the U.S. Congress appropriated initial funds for a cooperative state-federal fishery development effort which soon came to be known as the Columbia River Fishery Development Program (CRFDP). This program is now administered by the Northwest Region Environmental and Technical Services Division, National Marine Fisheries Service, NOAA, Portland, Oreg. Operations are largely conducted via contract with the U.S. Fish and Wildlife Service and fishery management agencies of Oregon, Washington, and Idaho. The program has two primary components: protection and improvement of stream environments for anadromous salmonids, and hatchery production of salmon and steelhead to partially offset the loss of production from natural spawning and rearing areas.<sup>6</sup>

River fisheries project, Section E-Fish Runs. Prepared for Pacific Northwest Regional Commission, Vancouver, Wash., 65 p.

<sup>5</sup>Chaney, E., and L. E. Perry. 1976. Columbia Basin salmon and steelhead analysis. Prepared for Pacific Northwest Regional Commission, Vancouver, Wash., 74 p.

<sup>6</sup>Program activities to date include clearing of obstructions

In 1955, CRFDP cooperating agencies initiated a 9-yr program to introduce spring chinook salmon into Wind River, which enters the Columbia River at river mile 155 in southwestern Washington (Figure 1). Historically, chinook salmon were blocked from all but a few miles of the lower Wind River by an impassable series of falls located 3.7 mi upstream from its confluence with the Columbia River. The upper Wind River drainage was believed to contain substantial spring chinook salmon spawning and rearing habitat and to have the potential for supporting a productive spring chinook salmon hatchery program. Approximately 35,000 spring chinook salmon eggs from Camas Creek, Idaho, were transferred to Carson National

Fish Hatchery on upper Wind River in 1945. About 20,500 resulting fingerlings were marked and released into the Wind River in October 1946. In 1949, 21 adult spring chinook salmon were observed below Shipperd Falls. Four carcasses bearing the 1946 mark were subsequently recovered (Zimmer et al. 1963).

This report is a summary of the 1955-63 Wind River spring chinook salmon introduction program and results through 1979.

### MAJOR ELEMENTS OF THE PROGRAM

The Wind River spring chinook salmon introduction program had three discrete, interrelated elements: 1) construction of a fishway at Shipperd Falls, 2) trapping nonindigenous adult spring chinook salmon from a heterogenous population passing Bonneville Dam on the main-stem Columbia River and transporting them to hatchery facilities on the upper Wind River, and 3) holding of transported adults to maturity, spawning the adults, and rearing the resulting progeny to migrant size for release into Wind River.

from about 2,000 mi of streams, construction of 87 fishways at natural barriers, installation of 570 screens at diversion ditches and canals, and construction or modernization of 22 salmon and steelhead hatcheries and 7 rearing ponds which annually produced an average of 98 million salmon (2.6 million lb) and 2.3 million steelhead (350,000 lb) during 1971-76. Wahle and Vreeland (1978) list numerous operational improvement studies also funded to complement artificial production throughout the basin.

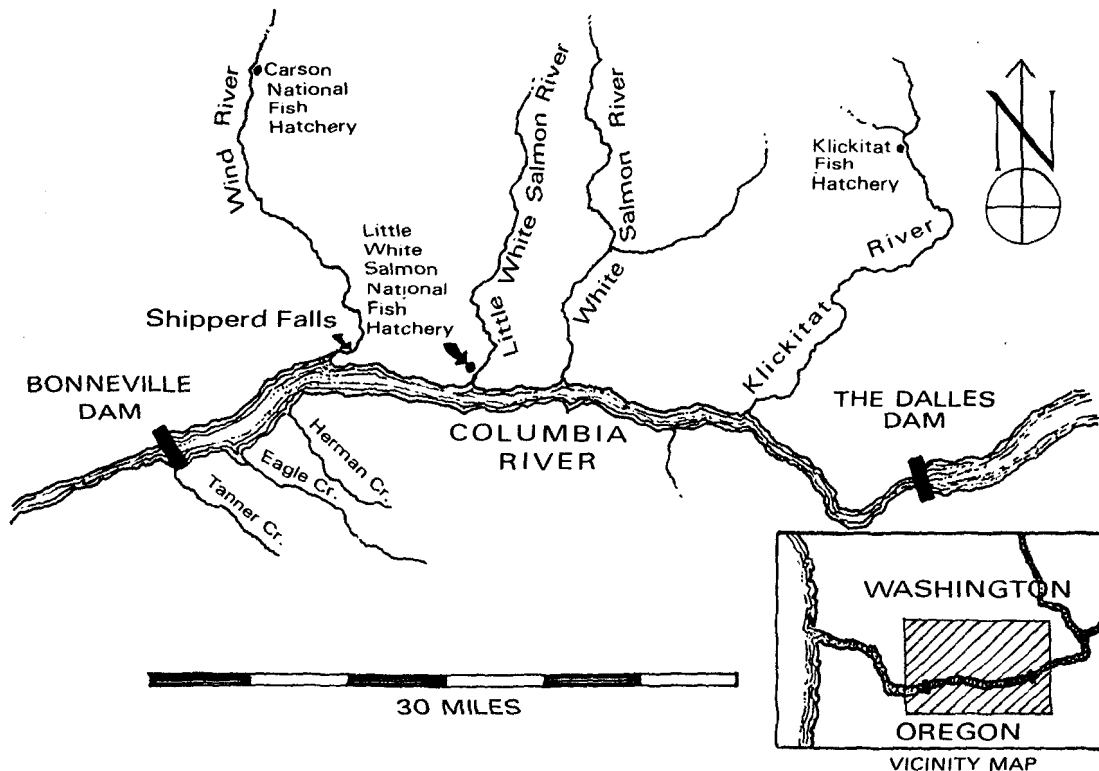


FIGURE 1.—Wind River and vicinity.

### Shipperd Falls Fishway

Shipperd Falls is a series of falls ranging from 3 to 15 ft high with a collective total vertical drop of 44.8 ft. The falls are located 3.7 mi upstream from the Wind River's confluence with the Columbia River. Small numbers of steelhead reportedly were able to negotiate the falls during periods of high river flow during spring runoff (Bryant 1949). However, the falls apparently presented an impassable barrier to chinook salmon at all flows. No spring chinook salmon spawning habitat exists in the Wind River drainage below Shipperd Falls.

Construction of a fishway began in 1953 and was completed in 1956. A barrier dam was constructed across the stream to increase the height of the lowermost vertical drop of the falls to block upstream migrants and lead them to the fishway entrance. The fishway is of single slot vertical baffle design, commonly employed where integral pool regulation is not possible. Forty-five 9-ft long, 6-ft wide pools were constructed on a 1:9 slope providing 1-ft vertical rise from pool to pool. Total length of the fishway including entrance and exit facilities is about 454 ft with a vertical rise from downstream entrance to upstream exit of 44.8 ft. When complete the fishway provided fish passage at all stream flows (Figures 2, 3).

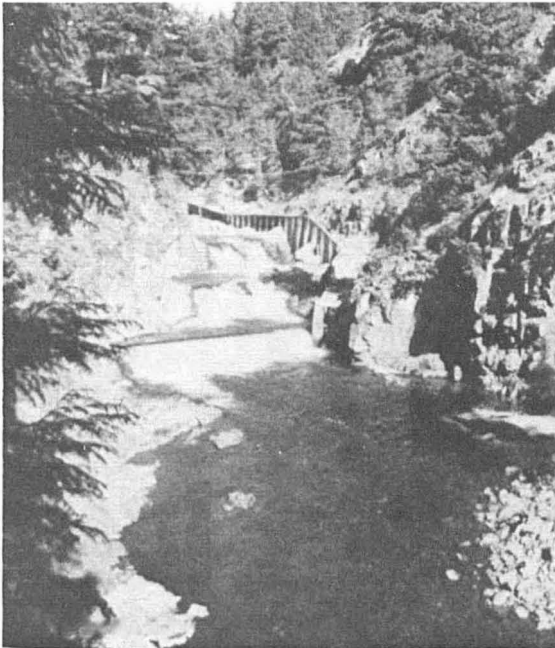


FIGURE 2.—Shipperd Falls and fishway.

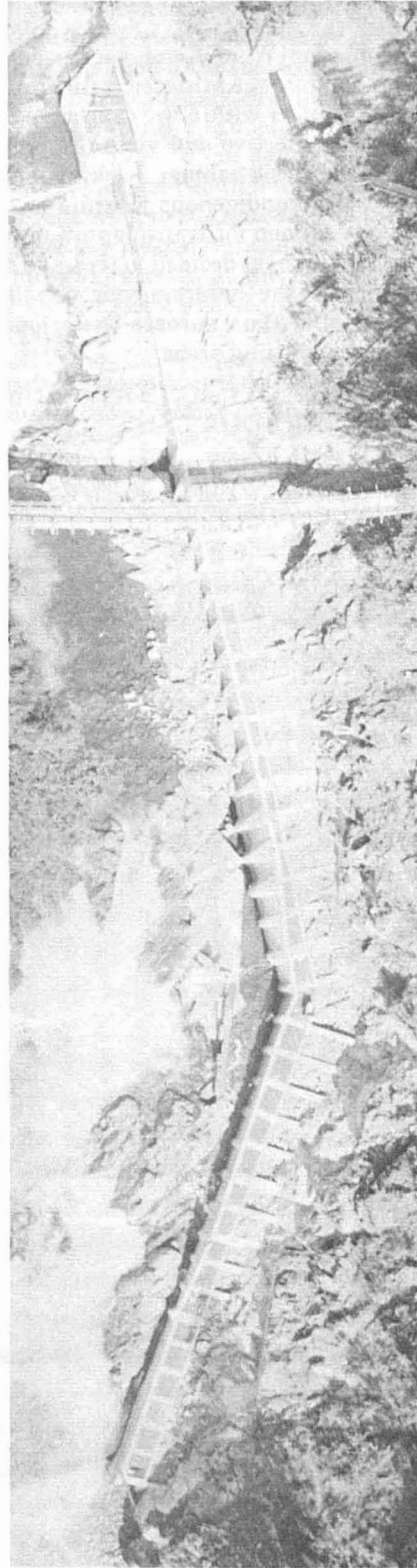


FIGURE 3.—Shipperd Falls and fishway.

## Adult Trapping and Hauling

At the time the Wind River spring chinook salmon introduction was initiated, artificial propagation of all salmon within the Columbia Basin was generally ineffective and virtually nonexistent for spring chinook salmon. Lacking a convenient source of nonindigenous juvenile or adult spring chinook salmon for transplantation to the Wind River, researchers decided to trap adults for brood stock from the heterogeneous population passing Bonneville Dam enroute to various up-river tributary spawning areas.

A specially designed trap similar to that described by Gunsolus and Eicher<sup>7</sup> was installed at

<sup>7</sup>Gunsolus, R. T., and G. J. Eicher. 1962. Evaluation of fish passage facilities at the Pelton Project on the Deschutes River in Oregon. Oregon Department of Fish and Wildlife Research and Management Laboratory, 17330 SE Evelyn St., Clackamas, OR 97015, 133 p.

the fishway on the north side of Bonneville Dam. The trap basically consisted of a hopper which was lowered into the fishway to intercept and collect upstream migrants. Once several adult spring chinook salmon had entered the hopper, it was raised from the fishway, positioned over and emptied into a 1,000-gal capacity tank truck previously filled with water from the fishway (Figure 4). This process was repeated until each truck held approximately 20 adult fish. During the loading operation, water in the truck tank was continually being drawn from the fishway, circulated through the tanks, and released to the forebay of the dam. Water in the tank was mechanically aerated during the approximately 1 h transportation time to Carson Hatchery. At the hatchery, the tank trucks were emptied into adult holding ponds. The fish were retained in water throughout the trapping and hauling operation.

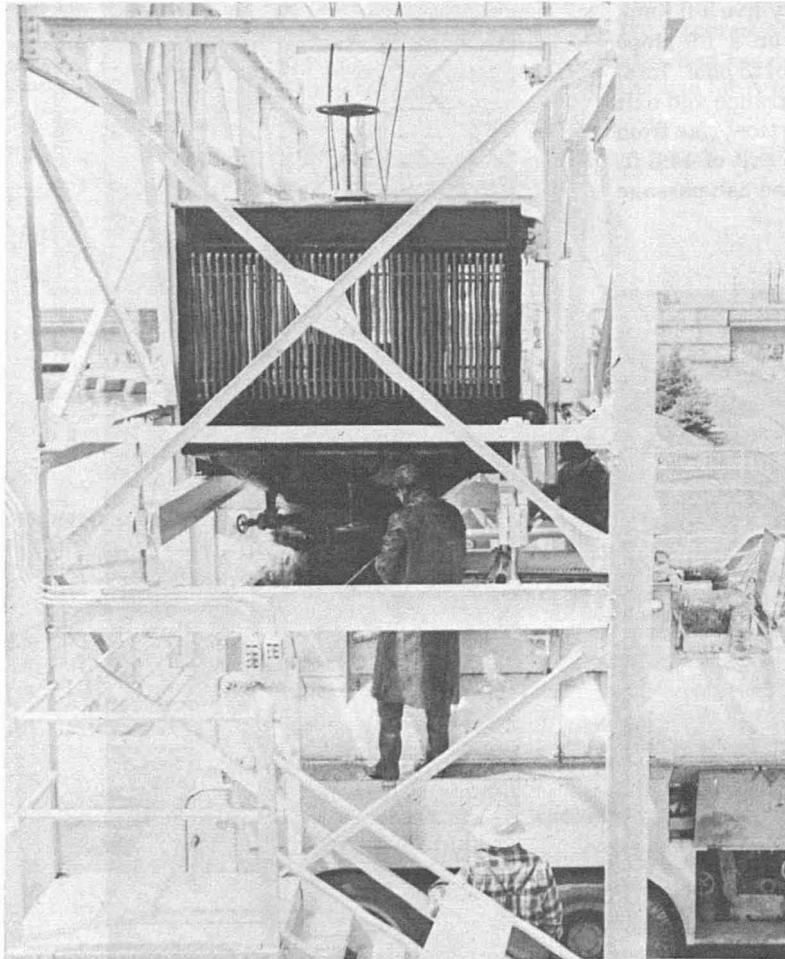


FIGURE 4.—Transfer of adult spring chinook from hopper of fishway to tank truck for transport to Carson Hatchery.

Zimmer et al. (1963) reported on adult mortalities resulting from trapping and hauling operations.

During 1955-63 a total of 4,239 adult spring chinook salmon were trapped at Bonneville Dam and hauled to Carson Hatchery. Table 1 displays trapping and related details for each year of that period.

### Hatchery Operations

The adult spring chinook salmon trapped at Bonneville Dam in the spring of each year during 1955-63 were held in adult holding ponds at Carson Hatchery (Figure 5) until sexually mature and ready for spawning in late August and early September. Eggs taken were fertilized and incubated and the resulting juveniles reared for about 13 mo in hatchery raceways. Zimmer et al. (1963)

provided details on hatchery facilities, water supply, fish cultural operations, disease, and diets.

During the 1955-63 transplantation program, about 8.5 million eggs were taken from adult female spring chinook salmon trapped at Bonneville Dam. In 1960-63, an additional 5.3 million eggs were taken from adult female spring chinook salmon returning to the hatchery as the result of releases of the progeny of the transplanted fish. Total juvenile releases at the hatchery from the 1955-63 brood years was about 10.6 million yearlings (Table 2).

### EVALUATION OF THE RESULTS OF THE PROGRAM

Adult fish counts at Shipperd Falls fishway, returns to Carson National Fish Hatchery and

TABLE 1.—Adult spring chinook salmon trapped at Bonneville Dam and transferred to Carson National Fish Hatchery, 1955-63.

Year	Bonneville Dam spring chinook salmon count <sup>1</sup>	Period of trapping	No. days of trapping	Total trapping-period count <sup>2</sup>	Fish transferred to hatchery			Percent of trapping-period count
					Male <sup>1</sup>	Female	Total	
1955	171,596	19-22, 25, 27 April	6	28,007	161	356	517	1.85
1956	63,449	4-8 May	5	7,595	228	270	498	6.55
1957	136,440	22-26 April	5	8,111	192	234	426	5.25
1958	75,206	1-3, 5, 6 May	5	4,870	164	360	524	10.76
1959	61,133	27 April-1, 4, 11-15 May	11	10,740	94	90	184	1.71
1960	69,597	26 April-1 May	6	7,334	237	290	527	7.19
1961	98,695	17-22 April	6	1,993	252	293	545	27.30
1962	91,116	23-27 April, 3, 4, 7 May	8	13,067	212	267	479	3.67
1963	75,471	22-27 April	6	4,388	—	—	513	11.69

<sup>1</sup>Includes jacks.

<sup>2</sup>Washington shore fishway only.



FIGURE 5.—Carson National Fish Hatchery.

TABLE 2.—Wind River Transplantation Program, 1955-79.

Year	Number adults hauled	Shipperd Falls adult count	Carson Hatchery returns <sup>1</sup>	Number fingerlings released at hatchery	Brood year
1955	517	—	—	—	—
1956	498	—	—	—	—
1957	426	—	—	967,000	1955
1958	524	—	—	623,000	1956
1959	184	—	107	733,000	1957
1960	527	854	552	1,016,000	1958
1961	545	1,032	609	261,000	1959
1962	479	2,515	1,718	2,479,000	1960
1963	513	1,255	825	1,265,000	1961
1964	—	5,429	2,517	3,037,000	1962
1964	—	—	—	39,000	<sup>3</sup> 1963
1965	—	2,284	1,474	<sup>4</sup> 1,154,000	1963
1966	—	4,174	3,666	1,909,000	1964
1967	—	—	2,749	2,412,000	1965
1968	—	—	<sup>5</sup> 663	1,613,000	1966
1969	—	—	1,609	1,535,000	1967
1970	—	—	3,120	757,000	1968
1971	—	—	4,250	1,178,000	1969
1972	—	—	6,641	1,409,000	1970
1973	—	—	2,189	1,541,000	1971
1974	—	—	1,563	2,001,000	1972
1975	—	—	4,905	2,000,000	1973
1975	—	—	—	197,000	<sup>3</sup> 1974
1976	—	—	5,496	2,291,000	1974
1976	—	—	—	253,000	<sup>3</sup> 1975
1977	—	—	2,975	2,813,000	1975
1978	—	—	2,976	2,836,000	1976
1979	—	—	2,541	1,792,000	1977

<sup>1</sup>After a sufficient number of adults had entered hatchery holding ponds, entrance to the hatchery was frequently blocked, forcing returning adults to spawn in Wind River and tributaries.

<sup>2</sup>First year released juveniles included progeny of nontransplanted adults.

<sup>3</sup>Time of release study.

<sup>4</sup>Included last juveniles from transplanted fish.

<sup>5</sup>Last year of possible returns resulting from first generation progeny of transplanted fish.

resulting juvenile releases, and Wind River spawning ground surveys provided the primary means of evaluating results of the Wind River spring chinook salmon introduction program. Secondary indicators were the amount of contribution to catches and a surplus of eggs and juveniles available from Carson hatchery for transplantation to other areas of the Northwest.

### Shipperd Falls Counts

Counting of adult upstream migrant salmonids began at Shipperd Falls fishway in 1954 and terminated in 1966. Fish ascending the fishway were trapped in a confined area of the upstream exit facility, raised near the water surface by an electrically operated false floor, identified, and counted. An adjustable headgate was then opened, allowing the fish to exit from the fishway and continue upstream.

Frequency of counting varied with the number and rate of migration of spring chinook salmon through the fishway. Counting was intermittent during 1954-58, not conducted in 1959, and conducted throughout the time of spring chinook salmon migration in 1960-66. Spring chinook

salmon counts ranged from 1 fish in 1957 to 5,429 fish in 1964 (Table 2).

### Hatchery Returns-Juvenile Releases

Spring chinook salmon from any given brood year returned to Carson Hatchery as 3-yr-old precocious males (jacks) and 4-, 5-, and 6-yr-old adults. Table 3 contains age composition of spring chinook salmon from the 1963-73 broods that returned to the hatchery.

The first spring chinook salmon resulting from the transplantation program returned to Carson Hatchery in 1959: 99 jacks, 6 adult males, and 2 adult females. The first significant return, 522 spring chinook salmon in 1960, consisted of 331 adult females, 170 adult males, and 51 jacks.

Transplantation of brood stock from Bonneville Dam to Carson Hatchery terminated with the completion of 1963 trapping and hauling operations. Thereafter, hatchery brood stock consisted exclusively of adult fish returning as the result of juvenile releases at the hatchery.

From 1964 through 1979, about 49,000 spring chinook salmon returned to Carson Hatchery adult holding ponds. The annual average return during that period was about 3,100 spring chinook salmon. The peak return of 6,641 occurred in 1972 (Table 2).

Table 2 displays the number of juvenile spring chinook salmon released into the Wind River at Carson Hatchery 1956-79. Releases during 1956-61 (brood years 1954-59) were exclusively progeny of fish trapped at Bonneville Dam; 1962-65 releases (brood years 1960-63) were from a composite of adults transported and those returning to the hatchery from earlier juvenile releases. The approximately 26.6 million juveniles released 1966-79 (brood years 1964-77) were all progeny of adult spring chinook salmon returning to the hatchery.

TABLE 3.—Age composition of 1967-73 broods of spring chinook salmon returning to Carson National Fish Hatchery.

Brood year	3	4	5	6	Total
1967	0	2,580	2,470	0	5,050
1968	952	4,124	1,066	261	6,403
1969	50	1,022	261	0	1,333
1970	101	905	264	24	1,294
1971	384	4,630	5,025	0	10,039
1972	10	161	46	5	222
1973	288	2,907	2,360	12	5,567
Total	1,785	16,329	11,492	302	29,908
% of total	6	55	38	1	100

## Spawning Ground Surveys

Achieving the production potential of natural habitat in upper Wind River and its tributaries was the companion goal to developing a self-sustaining spring chinook salmon hatchery program at Carson Hatchery. Annual spawning ground surveys for spring chinook salmon in the Wind River and selected tributaries began in 1959. Surveys were conducted in late August and early September; Table 4 contains data on the 1959-79 surveys. The largest number of spring chinook salmon observed during that period was 1,476 fish in 1962; the largest number of redds counted in the same period was 527 in 1964. Figure 6 illustrates the general distribution of spring chinook spawners in Wind River and tributaries based upon composite data from several years' surveys.

TABLE 4.—Spawning ground surveys of Wind River spring chinook salmon, 1959-79.

Year	Above hatchery		Below hatchery		Totals	
	Fish	Redds	Fish	Redds	Fish	Redds
1959	—	—	24	—	24	—
1960	34	107	6	9	40	116
1961	23	62	8	12	31	74
1962	35	155	1,441	—	1,476	155
1963	—	—	—	—	—	—
1964	579	422	107	105	686	527
1965	—	—	—	—	—	—
1966	111	63	121	48	232	111
1967	—	—	—	—	—	—
1968	—	—	—	—	—	—
1969	—	—	—	—	—	—
1970	59	138	72	73	131	211
1971	839	308	391	52	1,230	360
1972	372	112	189	51	561	163
1973	79	56	17	8	96	64
1974	37	30	7	2	44	32
1975	25	16	12	9	37	25
1976	23	13	37	12	60	25
1977	26	29	16	9	42	38
1978	40	25	41	22	81	47
1979	—	—	—	—	—	—

## Catch Contribution

In 1959 the first adult spring chinook salmon adults resulting from progeny of the transplantation program returned to Wind River. Small numbers of spring chinook salmon were reported caught by steelhead fishermen in 1959-61. In 1962 a spring chinook salmon sport fishery developed in the Columbia River at the mouth of the Wind River. Based upon Washington Department of Fisheries salmon creel census data submitted voluntarily by fishermen, catches during 1964 and

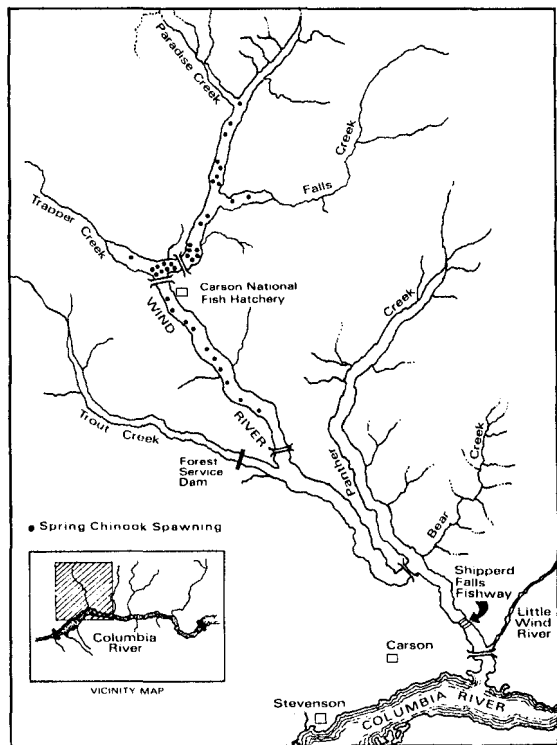


FIGURE 6.—Generalized distribution of naturally spawning chinook in the Wind River drainage. Stream widths exaggerated.

1965 were estimated at 592 fish and 363 fish, respectively (Nye and Ward 1968).

In 1966 an intensive creel census specially designed for small geographic areas<sup>8</sup> provided data to estimate the catch of Wind River spring chinook salmon at the confluence of the Wind and Columbia Rivers. Major features of the census program included: creel census of boat and shore fishermen twice daily 29 March-1 June, and hourly census of boat and shore fishermen for 6 weekend days and 10 weekdays, including number and species of fish caught and total hours fished. Total estimated catch for the period 29 March-1 June was 1,144 fish (Table 5). Based upon far less precise, voluntarily submitted creel census data, February-June 1964-75 Wind River spring chinook salmon sport catches ranged from 34 fish (1968) to 2,454 fish (1975) with an estimated catch of 362 spring chinook salmon in 1966 (Nye and Ward 1968; Nye et al. 1975, 1976).

<sup>8</sup> Donald D. Worlund, Northwest and Alaska Fisheries Center Fisheries Data and Management Systems, National Marine Fisheries Service, NOAA, 2725 Montlake Boulevard East, Seattle, WA 98112.

TABLE 5.—Estimates of sport catch of spring chinook salmon at the confluence of the Wind and Columbia Rivers, 29 March-1 June 1966.

Period ending	Boat	Shore	Total	Period ending	Boat	Shore	Total
17 April	69	10	79	15 May	40	28	68
24 April	269	61	330	22 May	35	7	42
1 May	271	63	334	29 May	2	1	3
8 May	239	49	288	Totals	925	219	1,144

TABLE 6.—Recovery data for marked spring chinook salmon of the 1971 brood from Carson National Fish Hatchery, 1973-76.

Area	Fishery	1973	1974	1975	1976	Total recoveries
Alaska	Troll	—	1	3	0	4
British Columbia	Troll	—	3	0	0	3
Washington:						
Cape Flattery	Troll	0	8	0	0	8
Quillayute		0	49	0	0	49
Split Rock		0	2	0	0	2
Grays Harbor		0	31	0	0	31
Columbia R.		0	17	0	10	27
Sekiu	Ocean sport	0	0	0	0	0
Neah Bay		0	9	0	0	9
LaPush		0	0	0	0	0
Westport		0	31	0	6	37
Ilwaco		12	25	0	0	37
Oregon:						
Astoria	Troll	0	2	4	0	6
Newport		0	3	0	0	3
Coos Bay		0	26	8	0	34
Bandon		0	0	1	0	1
Warrenton	Ocean sport	0	0	23	0	23
California:						
Crescent City	Troll	0	0	14	0	14
Eureka		0	15	9	0	24
	Sport	0	0	0	0	0
Columbia R.:						
Below Bonneville	Gill net	0	8	8	3	19
Above Bonneville		0	0	0	0	0
Below Bonneville	Sport	0	0	0	0	0
Above Bonneville <sup>1</sup>		—	—	—	—	—
Totals		12	230	70	19	331

<sup>1</sup>Not sampled.

In late March and early April 1972, 142,000 dorsal-right ventral marked 1970 brood Wind River spring chinook salmon juveniles were released at Carson Hatchery. From November 1971 to March 1972, 161,000 1970 brood juveniles bearing the same mark were released at two other hatcheries on nearby Klickitat and Little White Salmon Rivers. These releases were part of a Columbia River Fishery Development Program funded marking and mark sampling program involving all spring chinook salmon rearing facilities in the Columbia River Basin. During 1972 and 1973, marks were sampled only at Washington, Oregon, and California ports. Beginning in 1974, the sampling program covered all significant

Pacific coast marine and Columbia River recreational and commercial chinook salmon ports of landing from Pelican, Alaska, to Monterey, Calif. Sampling a total of 140 Wind-Klickitat-Little White Salmon-River marks, recoveries included Alaska 4, British Columbia 6, Washington 27, and California 5. Seventy-two marks were recovered in the main-stem Columbia River sport fishery and 26 in the main-stem Columbia River gill net commercial fishery.

In late March and early April 1973, about 142,000 1971 brood spring chinook salmon juveniles (average length 5½ in) bearing a distinctive adipose-right ventral mark were released from Carson Hatchery into Wind River. Table 6 contains 1973-76 mark recoveries in marine and Columbia River fisheries.

### Wind River Spring Chinook Salmon Transfers

As a result of the Wind River spring chinook salmon introduction program, Carson National Fish Hatchery has become an important source of spring chinook salmon for transplantation to diverse areas within and outside the Columbia River Basin. About 46.5 million eggs and 3.5 million juveniles from adult returns to the hatchery were transferred to other areas during 1960-79 (Table 7).

These transfers contributed to the establishment of several spring chinook salmon runs, including hatchery runs to Leavenworth National Fish Hatchery on Washington's Icicle River, a tributary of the Wenatchee River, and to the Little White Salmon National Fish Hatchery on Washington's Little White Salmon River; naturally spawning runs were created in Fall Creek, tributary to Oregon's Willamette River, and in the Selway River, tributary to the Clearwater River in Idaho.

### SUMMARY

In 1955, a 9-yr program was initiated to introduce nonindigenous spring chinook salmon into Wind River, a southwestern Washington tributary of the Columbia River. A fishway was constructed to provide chinook salmon passage over a heretofore impassable falls located at Wind River mile 3.7. During 1955-63, 4,239 adult spring chinook salmon were trapped from the heterogeneous population passing over Bonneville Dam



TABLE 7.—Spring chinook salmon, eggs, and juveniles by brood year transported from Carson National Fish Hatchery, 1960-79.

Year	Transferred to	Number		Brood year
		Eggs	Juveniles	
1960	Klickitat Hatchery, Wash. (W.D.F.) <sup>1</sup>	35,000	—	1960
1961	Klickitat Hatchery	100,000	—	1961
1961	Warm Springs Creek, Oreg. (Warm Springs Indian Tribe)	—	75,313	1960
1961	Clearwater River, Idaho (I.F.&G.)	705,711	—	1961
1962	Klickitat Hatchery	899,339	—	1962
1962	Clearwater River	959,200	—	1962
1963	Clearwater River	1,000,000	—	1963
1964	Clearwater River	1,000,000	—	1964
1964	Klickitat Hatchery	121,500	—	1964
1965	Willard N.F.H. <sup>2</sup> Wash. (U.S.F.&W.)	19,341	—	1965
1965	Clearwater River	634,942	—	1965
1966	Nat'l. Marine Fisheries Service, Seattle, Wash.	—	10,000 (50-70/lb)	1966
1966	Clearwater River	—	1,018,200 (50-70/lb)	1966
1967	Clearwater River	—	1,016,300 (50-70/lb)	1967
1968	Clearwater River	—	951,970 (50-70/lb)	1968
1968	Weyerhaeuser Corp., Oreg.	—	10,880 (125/lb)	1966
1968	Little White Salmon N.F.H., Wash. (U.S.F.&W.)	101,000	—	1968
1969	Kooskia N.F.H., Idaho (U.S.F.&W.)	255,300	—	1969
1969	Clearwater River	990,117	—	1969
1969	Warm Springs Creek	300,017	—	1969
1970	Little White Salmon N.F.H.	1,123,190	—	1970
1970	Leavenworth N.F.H., Wash. (U.S.F.&W.)	307,810	—	1970
1970	Willamette River, Oreg. (F.C.O.)	2,999,130	—	1970
1970	Willamette River	—	359,280 (462/lb)	1970
1971	Kooskia N.F.H.	1,532,020	—	1971
1971	Leavenworth N.F.H.	600,000	—	1971
1971	Southeast Alaska (A.F.&G.)	500,000	—	1971
1971	Clearwater River	2,423,080	—	1971
1972	Southeast Alaska	1,510,000	—	1972
1972	Leavenworth N.F.H.	600,860	—	1972
1972	Klickitat Hatchery	5,495,160	—	1972
1972	Willamette River	1,730,760	—	1972
1972	Little White Salmon N.F.H.	1,070,610	—	1972
1972	Kooskia N.F.H.	801,890	—	1972
1973	Little White Salmon N.F.H.	846,640	—	1973
1973	Eagle Creek N.F.H., Oreg. (U.S.F.&W.)	354,000	—	1973
1973	Leavenworth N.F.H.	747,000	—	1973
1974	Abernathy N.F.H., Oreg. (U.S.F.&W.)	113,000	—	1974
1974	Little White Salmon N.F.H.	300,000	—	1974
1975	Entiat N.F.H., Wash. (U.S.F.&W.)	1,000,000	—	1975
1975	Leavenworth N.F.H.	1,056,000	—	1975
1975	Leavenworth N.F.H.	1,243,000	—	1975
1975	Kooskia N.F.H.	300,000	—	1975
1975	Klickitat Hatchery	449,000	—	1975
1976	Kooskia N.F.H.	1,000,000	—	1976
1976	Entiat N.F.H.	721,000	—	1976
1976	Leavenworth N.F.H.	2,443,000	—	1976
1976	Winthrop N.F.H., Wash. (U.S.F.&W.)	473,000	—	1976
1976	Marion Forks Hatchery, Oreg. (F.C.O.)	744,000	—	1976
1977	Leavenworth N.F.H.	721,000	—	1977
1977	Leavenworth N.F.H.	1,171,000	—	1977
1978	Leavenworth N.F.H.	2,043,000	—	1978
1978	Leavenworth N.F.H.	250,000	—	1978
1979	Leavenworth N.F.H.	2,238,000	—	1979
1979	Leavenworth N.F.H.	315,000	—	1979
1979	Kooskia N.F.H.	200,000	—	1979
Totals		46,543,617	3,441,943	

<sup>1</sup>Abbreviations: (W.D.F.) Washington Department of Fisheries, (I.F.&G.) Idaho Fish and Game Department, (U.S.F.&W.) U.S. Fish and Wildlife Service, (F.C.O.) Fish Commission of Oregon.

<sup>2</sup>N.F.H. - National Fish Hatchery.

at Columbia River mile 146.1 and transferred to Carson National Fish Hatchery on the upper Wind River. About 10.6 million yearling progeny of these fish were released into Wind River.

From 1959 to 1979, about 66,000 adult spring chinook salmon returned to Carson Hatchery. During that period about 37 million yearling progeny of the 1955-77 broods were released into

Wind River. Surveys of natural spawning grounds during 1959-78 recorded a peak number of 1,476 spring chinook salmon in 1962 and 527 redds in 1964. A spring chinook salmon sport fishery developed within the Wind River drainage and at its confluence with the Columbia River at the mouth of the Wind. Marking and mark sampling programs indicated Wind River spring chinook

salmon contributed to marine commercial and recreational fisheries from Alaska to California, and to main-stem Columbia River fisheries. During 1960-79, about 46.5 million eggs and 3.5 million juveniles from spring chinook salmon introduced to Wind River were transplanted to other Pacific Northwest locations.

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