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Development of a Stock Assessment and Research Plan for Mid- Columbia Summer Chinook Salmon

Technical
Report
03-03

Danielle F. Evenson
André J. Talbot
May 2003



Columbia River Inter-Tribal Fish Commission
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Abstract

Available data pertinent to mid-Columbia summer chinook were collected, summarized, and analyzed to identify information gaps necessary to develop a comprehensive stock assessment and to propose areas for further research that will help evaluate current escapement goals and guide future management plans. Data were gathered on life cycle patterns, stock history, harvest estimates, abundance estimates, redd counts, carcass recoveries, age composition of returning adults, coded wire tags, escapement, juvenile outmigrants, artificial production, and management practices. It was found that the existing direct data are too limited to adequately assess abundance and productivity of summer chinook and determine escapement goals. Data were particularly lacking for refining estimates of adult escapement, juvenile productivity, and evaluating of the contribution of artificially propagated fish to spawning and productivity in the wild; further research is recommended in these areas.

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Introduction

Populations of summer chinook (*Oncorhynchus tshawytscha*) destined for the mid-Columbia River have declined dramatically from historical levels (Nehlsen *et al.* 1991, WDF *et al.* 1993). Once termed “June Hogs” for their hefty size, summer chinook were previously the most robust and heavily fished of the Columbia River chinook stocks (Thompson 1951, Chapman 1986). Causes of the declines are attributed to overfishing in the lower Columbia and loss of habitat primarily from hydropower and storage dams (Mullan 1987, Chapman *et al.* 1994).

Historically, mid-Columbia summer (ocean-type) chinook salmon have been important to the culture of Indian tribes in the Columbia River basin for subsistence, spiritual, and socioeconomic reasons. This stock has a far-north ocean migration pattern and is harvested in ocean fisheries in southeast Alaska, northern British Columbia, and off the west coast of Vancouver Island. However, there is a negligible level of in-river harvest. The Pacific Salmon Commission (PSC) considers mid-Columbia summer chinook an exploitation rate indicator stock for harvest evaluation, and poor stock performance can constrain ocean and terminal fisheries.

Assembly of available baseline data will be essential for analysis of stock productivity and abundance, evaluation of escapement goals, and the development of management plans. The purpose of this report is to compile essential data pertinent to mid-Columbia summer chinook salmon, including historical abundance estimates, synopsis of the artificial production program, redd counts, carcass surveys, coded-wire tag information, and run size estimates, and to identify further work that is needed to establish a long-term stock assessment and research program.

The Stock of Concern

Background

The mid-Columbia region is defined as the section of the mainstem Columbia River and its tributaries above the confluence with the Snake River (rm 324) and continuing upstream to the Chief Joseph Dam (rm 545) in the context of hydroelectric operations. This reach of the Columbia River forms the boundary between two distinct ecosystems: the Columbia Plateau to the east and the North Cascades Mountains to the west. Five major tributaries drain the eastern slope of the Cascade Mountains; from south to north these include the Yakima,

Wenatchee, Entiat, Methow, and Okanogan rivers. No major tributaries drain into the mid-Columbia River (MCR) from the east.

The present day summer-run chinook population is a remnant of a much larger population that existed prior to the construction and operation of hydroelectric dams on the Columbia River and its tributaries (Figure 1). Historically, this run was composed of early run stream-type fish destined for Snake River tributaries and late run ocean-type fish destined for the lower tributaries and mainstem of the mid-Columbia and Snake Rivers. Grand Coulee Dam was constructed without fish passage facilities, and henceforth represents the upstream limit of the range of chinook salmon in the mainstem Columbia River.

Currently, the range of mid-Columbia River summer chinook includes the Wenatchee, Entiat, Chelan, Methow, and Okanogan rivers, as well as the Similkameen River (the major tributary to the Okanogan River). Few summer chinook have been observed in the Entiat River between 1976 and 1992 (SASSI 1992), although numbers have increased in the past decade. Summer chinook have not been observed in the Yakima River since 1970 (YFP 1992); this may be due to poor habitat quality for salmonids in the lower Yakima River, and that the Yakima River is predominantly Upriver Bright fall chinook habitat, as it empties into the Columbia River at Hanford Reach, the most productive fall chinook spawning grounds in the Columbia River Basin.

Current and historical programs include: counts of summer chinook at four mainstem mid-Columbia River hydroelectric facilities; Priest Rapids, Rock Island, Rocky Reach and Wells dams; counts at Tumwater dam on the Wenatchee, a tributary to the mid-Columbia; redd surveys and carcass counts in tributary spawning streams; a coded wire tag (CWT) program; and juvenile indices at the Rock Island facility.

Life history

Adult migration timing. Summer chinook are distinguished from fall chinook by run timing, and location and timing of spawning. Dates for classifying fish as summer chinook at each dam are based on analysis of historical run timing curves and travel times of marked fish. However, annual variations in run timing can result in the misclassification of fish between run types. Dates for classifying fish as summer chinook at various dams are given in Table 1. Daily counts are available.

Spawning. Upriver Bright fall chinook generally spawn in the Yakima and the mainstem Columbia rivers, while summer chinook spawn higher in the tributaries and occupy a broader geographic range that includes the Wenatchee, Chelan, Entiat, Methow, Okanogan, and Similkameen rivers. Summer chinook

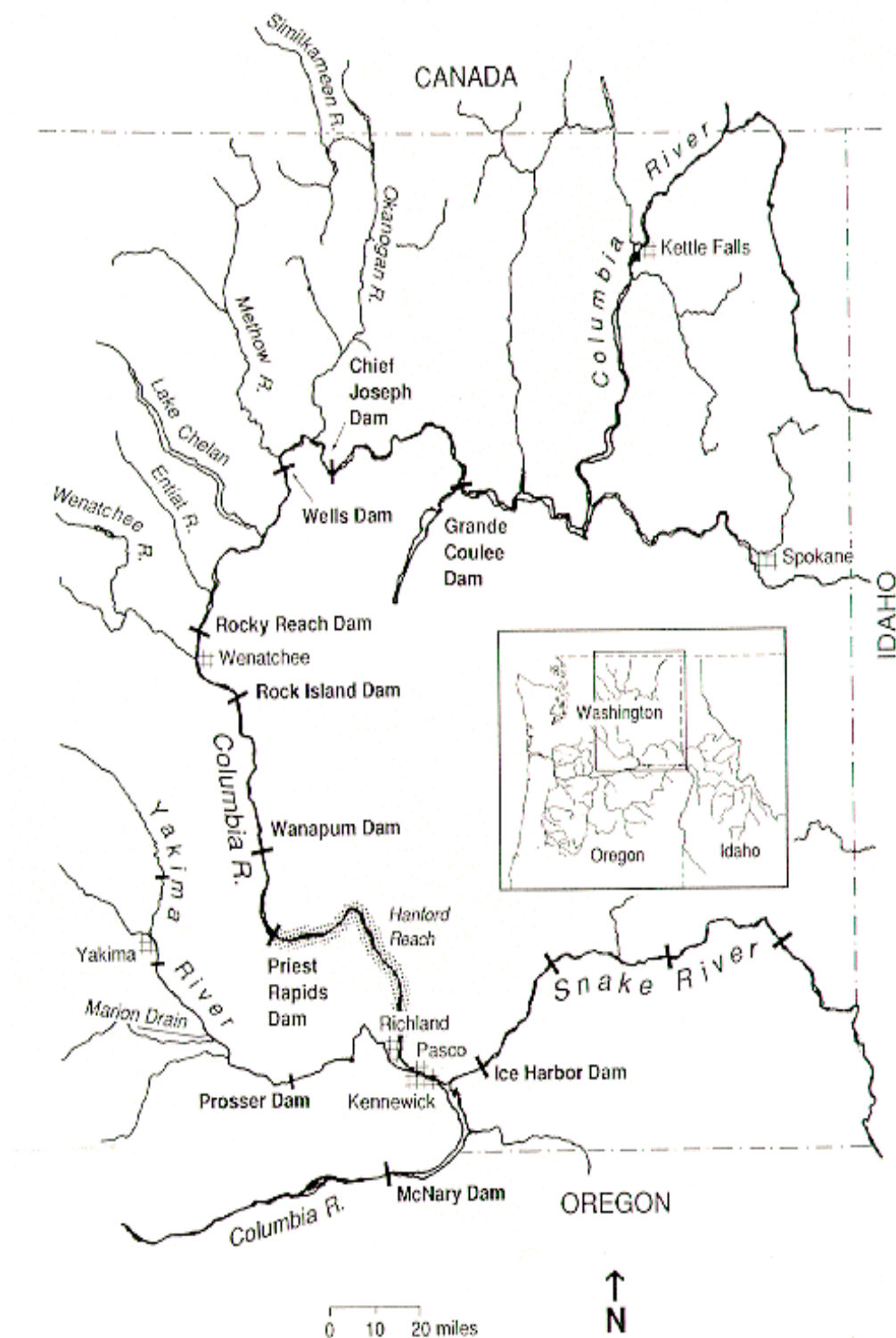


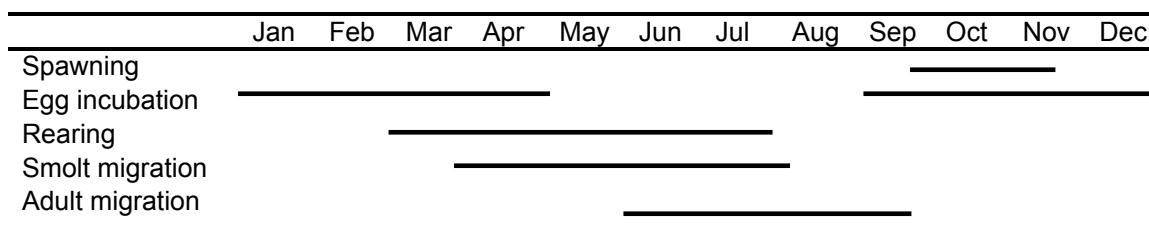
Figure 1. Map of the mid-Columbia River basin with hydro-electric facilities from Waknitz et al. (1995).

Table 1. Dates for classifying summer chinook at five Columbia River dams.

Dam	Dates of summer chinook passage
Bonneville	1 June – 31 July
Priest Rapids	14 June – 13 August
Rock Island	18 June – 17 August
Rocky Reach	20 June – 19 August
Wells	22 June – 21 August

characteristically spawn between late-September and mid-November (Figure 2), while Upriver Bright fall chinook typically spawn between mid-October and early December. In the 38-mile long Methow spawning reach and the 54-mile Wenatchee reach, spawning begins upstream in late September and ends in the lower part of the reach in early November (Hillman and Ross 1992, Chapman et al. 1994, Waknitz et al. 1995). Spawning in the Okanogan River occurs from late September through early November, with a peak in mid-October (Murdoch and Miller 2002). In the Entiat River, spawning begins upstream in late September, peaks in mid October, and ends in the lower river in early November (Peven 1992). Age at spawning is primarily 4 and 5 years old, but can range from 2 to 6 years (Waknitz et al. 1995).

Juvenile characteristics. Fry emergence, from limited information, appears to occur primarily in April and May. Fry move downstream away from redd locations a few days to weeks after emergence. Subyearling fry from upstream habitats begin moving downstream up to 2 to 3 weeks later than the downstream emerging fry. For Wenatchee and Methow river summer chinook, fry enter the mainstem Columbia River between 1 to 4 months after emergence (Myers et al. 1998).

**Figure 2.** Periodicity of ocean-type summer-run chinook salmon life history in the mid-Columbia River basin, adapted from Squire et al. (2001).

Mid-Columbia River summer chinook are distinguished from spring-run chinook not only by run timing, but by rearing strategy. MCR summer chinook are classified as “ocean type” salmon, because they generally migrate as sub-yearlings spending their first winter in the ocean, whereas spring chinook are considered to be “stream type” salmon because they migrate as yearlings spending their first winter in the freshwater. Most MCR subyearlings pass downstream of McNary Dam from mid-July through mid-September prior to the lowest flow conditions that typically occur in the fall. Although most migrate to the sea as subyearlings, some summer chinook exhibit a slower rearing migration, remain in freshwater as late as the following spring, and migrate as yearlings (J. Sneva, WDFW, Olympia, WA, pers. comm. 2002)

Estuary rearing. Subyearling chinook may take up residence in the Columbia River estuary for a few days up to several months prior to entering the ocean (Healey 1991). Subyearling chinook have been recorded in the estuary in all months, with some staying over winter. (Rich 1920 as cited by Waknitz et al. 1995).

Ocean rearing. MCR summer chinook rear primarily in coastal waters (Waknitz et al. 1995). Data from coded wire tag recoveries suggest a distribution ranging from the Gulf of Alaska to northern California, but typically spanning from off the coast of southeast Alaska to Coos Bay, Oregon.

Life history summary. The life history of mid-Columbia River summer chinook involves an egg incubation phase of approximately 6 months (Figure 2), a freshwater rearing/mainstem migration phase of 1 to 4 months with some overwintering in freshwater, an estuary residence phase that may last 1 to 2 months, an ocean rearing phase of 2.75 to 3.75 years, a mainstem migration phase of 1 month, adult holding of 1 to 3 months, and up to 1 month spawning/redd guarding period. Adults with this life history would be 4 or 5 years old at spawning.

Historical Status

Monitoring programs that help reveal the historical status of the stock include: commercial catch and harvest records and counts of adult summer chinook at four mainstem mid-Columbia River hydroelectric facilities; Priest Rapids, Rock Island, Rocky Reach and Wells dams. Years of available data, monitoring dates, counting hours, and monitoring method are given for each dam in Table 2.

Historical abundance (up to 1939)

Available historical data suggest that summer-run chinook salmon were the most prolific upstream run in the Columbia River Basin (Thompson 1951). Prior to 1933, the only data available on chinook salmon abundance were from catch and commercial usage records (Table 3). Based on harvest catch figures and probable exploitation rates, Chapman (1986) estimated a mean annual catch of 1.7×10^6 summer and late spring chinook salmon from 1881-1885. Beiningen (1976) indicated a mean of catch of 2.1×10^6 chinook salmon for the same time period, with a peak harvest of 2.3×10^6 fish recorded in 1883. Based on these peak catch figures, the Northwest Power Planning Council (NWPPC 1986) estimated a summer run size of 2.7×10^6 to 4.6×10^6 fish depending on assumptions of catch efficiency. This range encompasses the estimate of approximately 3.4×10^6 chinook made by Pacific Fishery Management Council (1979) based on habitat availability prior to water developments. Estimates of peak harvests and run sizes are summarized in Table 4.

Although the mean annual chinook catch remained relatively constant from 1880 to 1920, the proportion of the catch sustained by summer-run chinook declined (NWPPC 1986). As summer stocks dwindled in the early 1900's, fishing efforts previously concentrated in June and July shifted to August (Beiningen 1976). These once robust summer runs nearly disappeared completely by 1919. Thompson (1951) cited heavy overfishing as causation for this decline. Irrigation, dam construction, water diversion, logging, mining, livestock grazing, and other water uses have severely reduced quantity and quality of salmonid habitat, and thereby contributed to the reduction in salmon runs (Fulton 1968).

Following the construction of Rock Island Dam (rm 454), the first Columbia River hydroelectric project in 1933 (Figure 1), run specific counts of returning adults and jacks were recorded annually. Total counts of summer chinook at Rock Island Dam from 1933-1938 ranged from 5,133 (1937) to 17,803 (1938) fish (Appendix A-1).

Table 2. Summary of dam count indices for summer chinook at four mainstem Columbia River dams.

Dam	Years	Monitoring dates	Monitoring hours	
			Direct	Video
Priest Rapids	1998-2000	4/15 –11/15	24	
	1996-1997	4/15 –11/15	16	
	1995	4/15 –11/15	16	
	1994	4/16 –11/15	20	
	1992-1993	4/16 –11/15	24	
	1989-1991	4/16 –11/15	16	
	1988	4/16 –11/15	8-16	
Rock Island	1996-2000	4/15 –11/15		24
	1995	4/15 –11/01		24
	1993-1994	4/15 –11/15		24
	1992	5/01 –11/15		24
Rocky Reach	1996-2000	04/15-11/15		24
	1993-1995	04/15-11/15	16	
Wells	2000	05/01-11/15		24
	1999	05/15-11/15		24
	1998	04/15-11/15		24
	1996-1997	05/01-11/15	16	8
	1995	05/01-10/31	16	8
	1992-1994	05/01-11/15	16	8
	1991	05/01-11/15	16	
	1990	05/01-11/07	16	
	1988-1989	05/01-10/31	16	
	1987	05/01-11/13	16	
	1986	05/01-11/14	16	
	1985	05/01-11/22	16	
	1984	05/01-11/25	16	
	1983	05/01-11/30	16	
	1980-1982	05/01-11/22	16	
	1979	05/01-11/16	16	
	1978	05/01-10/31	16	
	1977	05/01-11/15	16	

Table 3. Commercial landings of Columbia River Basin chinook salmon given in pounds and numbers of fish (1866-1938). Data are adapted from Beiningen (1976).

Year	Pounds *1000	No. of fish *1000	Year	Pounds *1000	No. of fish *1000
1866	272	15	1906	29970	1616
1867	1224	66	1907	24250	1307
1868	1904	102	1908	14743	1064
1869	6800	367	1909	17119	923
1870	10200	550	1910	25326	1365
1871	13600	733	1911	36602	1973
1872	17000	916	1912	21388	1153
1873	17000	916	1913	19384	1045
1874	23800	1283	1914	25409	1370
1875	25500	1375	1915	32127	1732
1876	30600	1650	1916	31093	1725
1877	25840	1393	1917	29522	1591
1878	31280	1686	1918	29249	1577
1879	32640	1760	1919	30325	1635
1880	36040	1943	1920	31094	1676
1881	37400	2016	1921	21552	1162
1882	36808	1984	1922	17915	966
1883	42799	2307	1923	21578	1163
1884	42160	2273	1924	22365	1206
1885	37658	2030	1925	26660	1437
1886	30498	1644	1926	21241	1145
1887	24208	1305	1927	24011	1294
1888	25328	1365	1928	18140	978
1889	18135	978	1929	18151	978
1890	22821	1230	1930	20070	1082
1891	24065	1297	1931	21378	1152
1892	23410	1262	1932	16001	863
1893	19637	1059	1933	19528	1053
1894	23875	1287	1934	18788	1013
1895	30253	1631	1935	15206	920
1896	25224	1360	1936	15960	860
1897	29867	1610	1937	18654	1006
1898	23180	1250	1938	12418	669
1899	18771	1012			
1900	19245	1037			
1901					
1902	23034	1242			
1903	27917	1505			
1904	31783	1713			
1905	33029	1781			

Table 4. A comparison of peak estimates of historical Columbia River chinook salmon harvests and run sizes.

Time period	No. of fish *10 ⁶	Method	Author
Harvests			
1800's	1.5	Mean annual harvest.	Mullan (1987)
1883	2.3	Harvest records	Beiningen (1976)
1881-1885	1.7 ^{1*}	Mean value from harvest records and probable exploitation rates	Chapman (1986)
1889-1893	1.2	Mean value from harvest records	Beiningen (1976)
1889-1893	0.9	Mean value from harvest records	Smith (1894)
Run Sizes			
Peak years	2.7-4.6 ²	Assumed summer catch = 2.3×10^6 divided by 85%, 67%, and 50% catch efficiency	NWPPC (1986)
Pre-development	3.4	Habitat availability	PFMC 1979

¹ Includes spring and summer chinook only.

² Includes summer chinook only.

Grand Coulee Fish-Maintenance Project (1939-1943)

In 1939, the completion of the Grand Coulee Dam (RM 596) without fish passage facilities eliminated 1,140 lineal miles of spawning and rearing habitat (Fish and Hanavan 1948). The United States Fish and Wildlife Service (USFWS) initiated the Grand Coulee Fish-Maintenance Project (GCFMP) to mitigate effects on anadromous fish stocks and the estimated \$250,000 annual loss to commercial and sports fisheries. The intent of the project was to compress the existing salmon run by more than 40%. This program also included a provision for irrigation diversion screening in mid-Columbia River tributaries.

The project entailed annual transplanting of all salmon and steelhead runs into the major tributaries located downstream of Grand Coulee Dam and upstream of Rock Island Dam for five years (the duration of one salmonid life cycle). Except for the Entiat River (Brennan 1938), selected transplanting sites were already supporting small runs. All of these relocation sites were believed capable of supporting additional runs; the sites historically contained robust runs that were depleted locally by competing water uses and overfishing.

Beginning in May 1939, chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), and steelhead trout (*O. mykiss*) stocks of mixed origins were trapped in the fishways at Rock Island Dam and transferred to holding facilities for both natural and artificial propagation. Summer-run chinook and fall-run steelhead were released into enclosed reaches of the mainstem Wenatchee River and tributaries to the Entiat River to spawn naturally (Tables 5 and 6). Stocks were also relocated to Leavenworth Hatchery on Icicle Creek, a tributary to the Wenatchee River, for artificial propagation; the intent was to supply eyed eggs for hatching and rearing on the Entiat, Methow and Okanogan Rivers. Table 7 summarizes hatchery production and distribution for summer chinook salmon (1940-1947).

The success of the Leavenworth Hatchery led to the construction of two additional USFWS artificial propagation facilities, the Entiat Substation on the Entiat River and the Winthrop Substation on the Methow River (Table 8). Originally under the GCFMP, Leavenworth and Entiat hatcheries reared summer chinook; currently they rear spring chinook. A third substation was planned for the Okanogan River, but was never constructed due to site suitability limitations. The Okanogan River was also the only tributary that did not receive implants of spawning adults or hatchery juveniles (Fish and Hanavan 1948). Four Washington Department of Fish and Wildlife (WDFW) hatcheries were constructed on the mainstem mid-Columbia: Priest Rapids, Turtle Rock, Eastbank and Wells hatcheries. Acclimation ponds were constructed on the Wenatchee, Methow and Similkameen rivers (Figure 3)(Waknitz et al. 1995).

Table 5. Mid-Columbia River summer-run chinook salmon transplanted into the Wenatchee River for natural propagation (1939-1943) under the GCFMP. Data are adapted from Fish and Hanavan (1948).

Year	Number released	Fish recovered	
		Spawned	Unspawned
1939	3498	869	83
1940	752	157	93
1941	446	56	60
1942	3050	302	39
1943	386	NA	NA

Table 6. Mid-Columbia River summer-run chinook salmon transplanted into the Entiat River for natural propagation (1939-1940) under the GCFMP. Data are adapted from Fish and Hanavan (1948).

Year	Number released	Fish recovered	
		Spawned	Unspawned
1939	2913	406	42
1940	102	59	12

Table 7. Hatchery production and distribution records for Columbia River summer chinook salmon (1940-1947). Data are adapted from Fish and Hanavan (1948).

Brood Year	No. Adult Fish Received	No. Fish Artificially Spawned	No. Eggs Collected	No. Feeding Fingerlings Produced	No. Fingerlings Released	Location of Fingerling Releases
1940	4299	1062	3979700	2682192	583900 512557 522556	Entiat River Icicle Creek Methow River
1941	788	36	111900	98754	85489	Entiat River
1942	2387	184	560168	382705	55940 117600 77196	Entiat River Icicle Creek Methow River
1943	1478	79	204508	138470	31250 85347	Entiat River Icicle Creek
1944	32	11	50075	46593	43464	Entiat River
1945	551	145	266662	238185	206446	Entiat River
1946	1207	552	1146804	973028	73633 206812 371828	Icicle Creek Methow River Entiat River
1947	408	206	608791	576254	94671	Leavenworth

Table 8. Rearing facilities for mid-Columbia River summer chinook and upriver bright fall chinook operated by the U.S. Fish and Wildlife Service (USFWS) and Washington Department of Fisheries Wildlife (WDFW). Modified from Chapman et al. (1994), reported by Waknitz et al. (1995).

Facility	Agency	Years	River
Leavenworth NFH	USFWS	1941-1967	Wenatchee
Entiat NFH	USFWS	1941-1976	Entiat
Winthrop NFH	USFWS	1942-1983	Methow
Priest Rapids Hatchery	WDFW	1963-present	mid-Columbia
Turtle Rock Hatchery	WDFW	1974-present	mid-Columbia
Wells Hatchery	WDFW	1967-present	mid-Columbia
Eastbank Hatchery	WDFW	1990-present	mid-Columbia
Dryden Acclimation Pond	WDFW	1990-present	Wenatchee
Similkameen Acclimation Pond	WDFW	1990-present	Similkameen
Carlton Acclimation Pond	WDFW	1990-present	Methow

Mid-Columbia Fish Hatcheries



Figure 3. Map of artificial propagation facilities of the mid-Columbia River basin from www.ICBEMP.gov

Status of summer chinook from the inception of the GCFMP in 1941 to the completion of the last hydroelectric facility in 1972

In 1942, runs over Rock Island Dam contained the first returning progeny of relocated stock, and by 1943, transplanted stock dominated the runs (Fish and Havanan 1948). In 1944, Rock Island fishways were reopened to permit the free passage of fish and transplanting ceased. At this point, all runs were essentially composed of progeny of relocated stocks aside from age-6 adult returns that would have eluded GCFMP transplanting (Fish 1944). Presently, summer-run chinook spawning in the Wenatchee, Entiat, Chelan, Methow, Okanogan, Similkameen, and mainstem Columbia rivers are predominantly descendants of the mixed origin chinook stocks trapped at Rock Island Dam from 1939-1943.

Data available from Data Access Real Time (DART) for combined summer and fall-run chinook passage recorded at Rock Island Dam between 1933 and 1940 indicates approximately 1,000 to 15,000 adults and jacks. Between 1933 and 1972, summer chinook passage hit a peak of 29,900 fish in 1957 (Appendix A-1). Between the 1957 peak and 1969, total counts fluctuated between 12,900 and 28,800 summer chinook salmon. Since that time counts have fluctuated between 9,100 (1983) and 20,100 (1999) summer chinook. The median value for the 69-year record is 13,600 summer chinook.

Summer chinook adult and jack counts were also recorded at Priest Rapids Dam beginning in 1960, at Rocky Reach Dam beginning in 1962, and at Wells Dam starting in 1967 (Appendix A-1, Figure 4). These data show trends similar to the data from Rock Island Dam with peak fish counts occurring in 1966. The decline in the number of fish from 1967 to 1969 counted at the four dams may be due to the completion of Wells Dam in 1967 that inundated the channel and drowned mainstem spawning habitat. Since 1967, Wells Dam has marked the farthest upstream hydroelectric project on the mainstem Columbia River with fish passage facilities. Stocks destined for the Methow and Okanogan river basins must pass through this project.

The Wells Fish Hatchery was also completed in 1967. Broodstock for the Wells Hatchery/Spawning Channel Facility originated from fish trapped at Wells Dam and from volunteers entering the spawning channel (Howell et al. 1985). From 1968 to 1971, 10.1 million fry, 1.1 million fingerlings, and 359,000 yearlings were released from this facility (Appendix B-1).

Broodstock for the Rocky Reach and Winthrop facilities also originated from fish trapped at Wells Dam and voluntary migrants into the Wells spawning channel. Fish produced in these facilities were released into the Methow and Okanogan subbasins. Broodstock for the Entiat Hatchery came from the Methow River (1945), Entiat River (1946-1964), and from Wells Dam, and were released into the Entiat River (Chapman et al. 1994). Between 1941 and 1964, the Entiat facility released over 5.5 million subyearling and over 2.4 million yearling ocean-

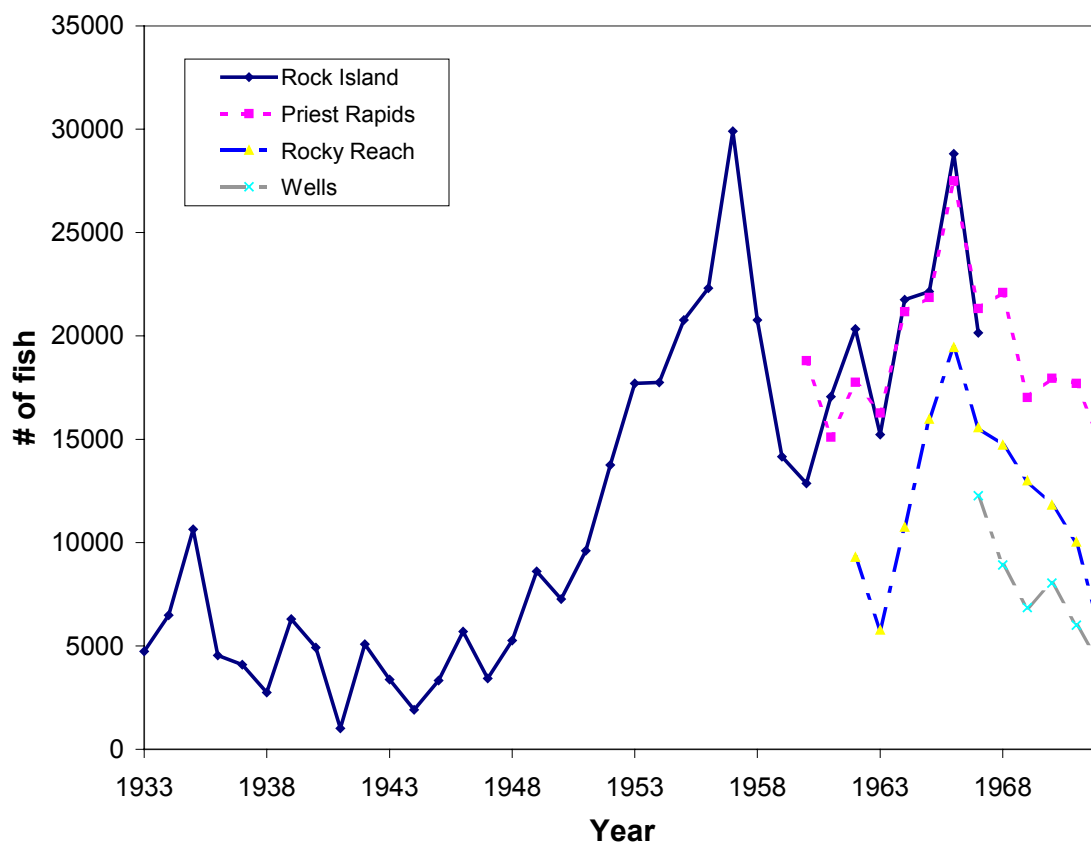


Figure 4. Trends in numbers of adult summer-run chinook counted at four dams on the mid Columbia River (1933-1972).

type chinook salmon into the Entiat River (Appendix B-1). The hatchery stopped producing summer chinook in 1964, and subsequently, the Entiat River run declined, though adult returns have increased in the last ten years.

The Wenatchee subbasin runs were augmented by Leavenworth Hatchery output until 1967 when the facility ceased its propagation of summer chinook. During this time period, over 600,000 subyearling and 73,000 yearling ocean-type chinook salmon were released into Icicle Creek (tributary to the Wenatchee River), 85,000 subyearlings into the Entiat River and 180,000 subyearlings into the Methow River. Broodstock for this hatchery was supplied from fish trapped at Dryden and Tumwater Dams on the Wenatchee River.

Current Status

The National Marine Fisheries Service (NMFS) evaluated MCR summer chinook population for potential listing under the Endangered Species Act (ESA) in 1995. Using their species definition approach, a population must be determined to be an evolutionarily significant unit (ESU) to receive protection under the ESA. To receive this determination, a population must be both reproductively isolated from other conspecific populations and represent a significant evolutionary component to the legacy of the species (Waples 1991). The NMFS concluded that all Columbia upriver ocean-type chinook salmon are part of the same ESU, because of inadequate reproductive isolation. When combined under one ESU, the population of Columbia upriver ocean-type chinook is large enough to avoid designation as threatened or endangered under the ESA.

The states and tribes with co-management authorities and responsibilities for this stock continue to recognize the life history differences between the fall- and summer-run chinook. In their Salmon and Steelhead Stock Inventory report (WDF et al. 1993), the Washington Department of Fisheries (WDF), western Washington treaty tribes and Washington Department of Wildlife (WDW) considered the MCR summer chinook to be depressed in the Methow and Okanogan Rivers, and healthy in the Wenatchee River. These organizations also regard the summer chinook in the Entiat River to be at or near extirpation (Nehlsen et al. 1991, WDF et al. 1993). Overall, the present total population of MCR summer chinook is much reduced from historical levels. While MCR summer chinook are harvested in ocean fisheries, there has not been a directed commercial fishery in-river for tribal or non-tribal parties since 1964, although the State of Washington allowed for a sport fishery in central Washington in 2001. Summer chinook from this region are only harvested incidentally, typically in lower Columbia River fisheries targeted at other species (NMFS et al. 1998).

Summary of available spawning assessment surveys

MCR summer-run chinook preferentially spawn in large, low elevation rivers (United States versus Oregon Technical Advisory Committee 1997). Historically, spawning has been observed in the Wenatchee, Entiat, Chelan, Methow, Okanogan, Similkameen, and mainstem Columbia rivers. Several reports have noted that there is no historical evidence of spawning in the Entiat or Methow rivers prior to 1940 (Brennan 1938, and Craig and Suomela 1941 as cited by Chapman et al. 1994), however, habitat was already severely degraded by the time these observations were made. Bryant and Parkhurst (1950) inferred that there was abundant spawning in the Entiat River, but runs were nearly extirpated by 1925 due to small dams and diversion of water that destroyed an estimated 200,000 square yards (165,000 m²) of suitable spawning area in the lower 28 miles (45 km) of the river. Historical spawning in the Methow River was depleted by 1902 due to irrigation and dam construction and decimated by 1915 by dam construction near the mouth of the river, but subsequent habitat improvements have re-opened the river to fish passage (Bryant and Parkhurst 1950).

Following the construction of the Wells Dam in 1967, redds have been observed in the Wenatchee, Entiat, Chelan, Methow, Okanogan, and Similkameen rivers (Peven 1992). In recent years no redds have been observed in the mainstem Columbia River upstream of Wells Dam chiefly due to inundation of spawning habitat from the construction of the dams (Chapman et al. 1994). According to Peven and Duree (1992), spawning distributions within the MCR tributaries have changed little since the 1950's. Maps from French and Wahle (1965) show historical distributions of summer chinook spawning areas in the Wenatchee, Entiat, Methow, and Okanogan rivers for 1964 (Appendix C-1- C-4). There are no current spawning distribution maps available for MCR summer chinook.

Aerial redd surveys have been conducted annually since 1956 in the Wenatchee, Methow, and Okanogan basins, and ground redd surveys have been performed from 1987 to present (Appendix C-5, Figure 5). Spawning ground surveys have only been conducted since 1999 on the lower Chelan River and the river bar at its confluence with the mainstem Columbia River. Redd surveys were conducted sporadically on the mainstem Columbia River between Rocky Reach Dam and Wells Dam.

Many differences exist in the methodology used in the collection of redd data. Redd surveys in the Methow and Okanogan categorize the chinook population as either spring or summer/fall chinook salmon. All data from the Wenatchee River and data from aerial counts in the three other basins prior to 1998 were recorded as peak counts, while other ground surveys reported the cumulative number of redds. Furthermore, many of the historic ground counts were estimated, rather than enumerated, based on expansion factors of 1.43 aerial-counted redds per ground-counted redd. Redds have typically been expanded by a factor of 3.1 to estimate number of spawners (Meekin 1967).

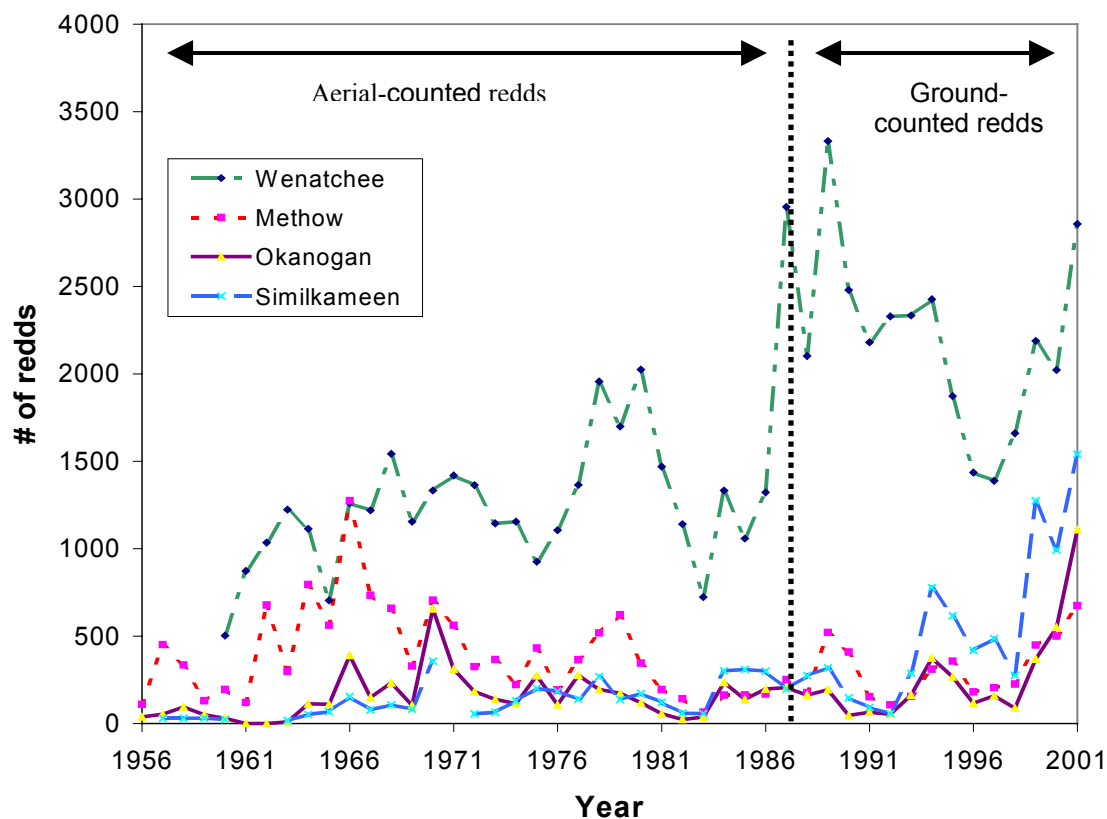


Figure 5. Trends in summer chinook redd counts taken from aerial and ground spawning surveys (1956-2001).

Since 1987, ground surveys for the Wenatchee River have shown a range of 1435 (1996) to 3331 (1989) redds, with an average of 2250 (Kohn 1989, Hillman and Miller 1997, Mosey and Murphy 2002) (Appendix C-5). Ground spawning surveys indicate a range of 107 (1991) to 674 (2001) redds in the Methow River, a range of 53 (1992) to 1108 (2001) redds in the Okanogan River, and 57 (1992) to 1540 (2001) redds in the Similkameen River (Kohn 1989, Hillman and Ross 1992, Hillman and Miller 1993, Hillman and Miller 1995, Murdoch and Miller 2001). Redd counts from 1999-2001 in the Methow, Okanogan, and Similkameen rivers are much higher than the counts from 1987-1998.

In recent years, there has been an upward trend in the number of redds observed (Figure 5). The 1993 increase in the Methow and Okanogan subbasins has been attributed to artificially propagated fish released from Carlton and Similkameen acclimation ponds spawning with wild fish (U.S. v. Oregon TAC 1997). Redd counts from 1999-2001 in the Methow, Okanogan, and Similkameen rivers show peak numbers significantly higher than historical data.

Carcass recovery data

MCR summer chinook carcasses have been surveyed since 1988 (Appendix C-6). Data gathered from each carcass has included gender, origin, and hypural length (measured from post-orbital to hypural plate) (Appendix C-7). Scale samples were collected from each carcass to determine age. A subset of the female carcasses was further sampled to determine egg voidance.

The number of carcasses that are recovered annually is highly variable and dependent upon channel conditions (velocity, turbidity, depth) and level of sampling effort. Figure 6 compares the number of carcasses recovered and the number of redds counted during spawning ground surveys in the Wenatchee River basin. Since the number of redds are indicative of the volume of escapement to spawning grounds and therefore the number of carcasses, one would expect there to be similar trends between the number of carcasses and number of redds observed. There was no correlation between the two data sets ($r^2 = 0.003$). Between 1988 and 1990, the number of summer chinook carcasses recovered remained constant despite fluctuations in the number of redds observed. Redd counts peaked in 2001 with 2857 redds and 885 carcasses reported, while the number of carcass recoveries peaked in 1999 with 2188 redds and 1753 carcasses recorded. During the 1999 peak, there was a cooperative sampling effort between WDFW and Public Utility District No. 1 of Chelan County (Mosey and Murdoch 2000). Carcass counts are also biased against jacks, as they are more difficult to locate (T. Mosey, Public Utility District No. 1 of Chelan County, Wenatchee, WA, pers. comm. 2002).

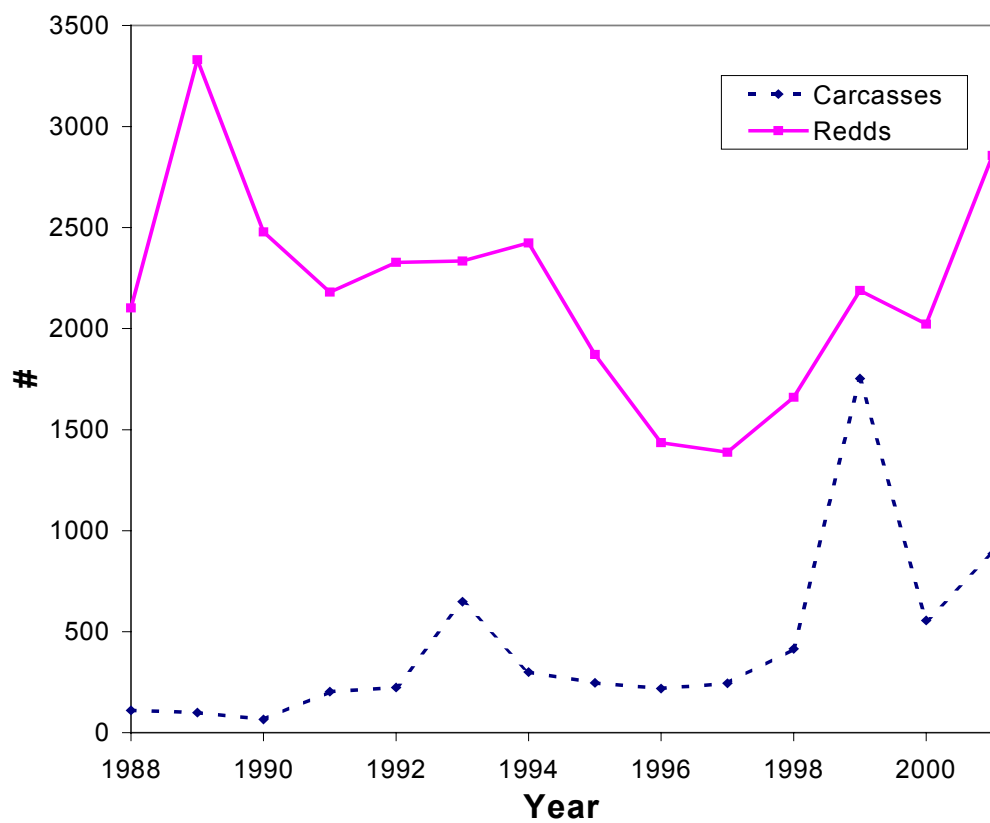


Figure 6. Wenatchee River basin redd counts and carcass recoveries (1988-2001).

Scale pattern analysis

In their analyses of scale samples, WDFW categorized the origin of MCR summer chinook as hatchery, wild, or wild-reservoir (Appendix C-7). Fish in the wild reservoir category are thought to have spent one winter rearing in reservoirs downstream of natal tributaries prior to ocean entry (J. Sneva, WDFW, Olympia, WA, pers. comm. 2002). These fish exhibit a scale pattern indicative of one year of freshwater growth, yet the pattern differs from the typical stream-type chinook annulus (J. Sneva pers. comm. 2002). In some years, up to 70% of the fish analyzed have displayed this wild-reservoir pattern.

Age Composition at spawning grounds

Since 1993, summer chinook scale samples have been analyzed to determine the age composition at spawning escapement (Appendix C-8). The analysis indicates that the majority of MCR summer chinook returning to spawning grounds are 4 and 5 year-old fish (Figure 7). All four river basins display similar distribution pattern of ages of returning summer chinook. The preponderance of these returns to spawning grounds also have had a life history that included one year of rearing in freshwater prior to ocean entry.

Summer hatchery and enhancement projects since 1972

Current WDFW enhancement programs for artificial propagation of ocean-type chinook salmon include the Rock Island Hatchery summer-run chinook supplementation program which includes Eastbank Hatchery program and Dryden, Carlton and Similkameen acclimation ponds, the Wells Hatchery program, the Rocky Reach Hatchery program, and the Priest Rapids Hatchery program. Figure 8 is a diagrammatic representation of the current artificial production program. The USFWS facilities in the mid-Columbia no longer produce ocean-type chinook (Table 8), including Leavenworth, Entiat, and Winthrop fish hatcheries.

The Rock Island Hatchery Complex (RIHC) is managed to supplement the wild population of chinook salmon above Rock Island Dam. Eastbank Fish Hatchery was built in 1989 as part of the RIHC. It is intended to mitigate for fishery losses due to the Rock Island Dam while maintaining genetically distinct populations. This facility provides artificially propagated yearlings to three acclimation ponds; these include Dryden (Wenatchee River), Carlton (Methow River), and Similkameen (Similkameen River) acclimation ponds. Wenatchee broodstock is collected from the Wenatchee River and Methow/Okanogan Composite broodstock is currently collected from the east fish ladder of Wells Dam

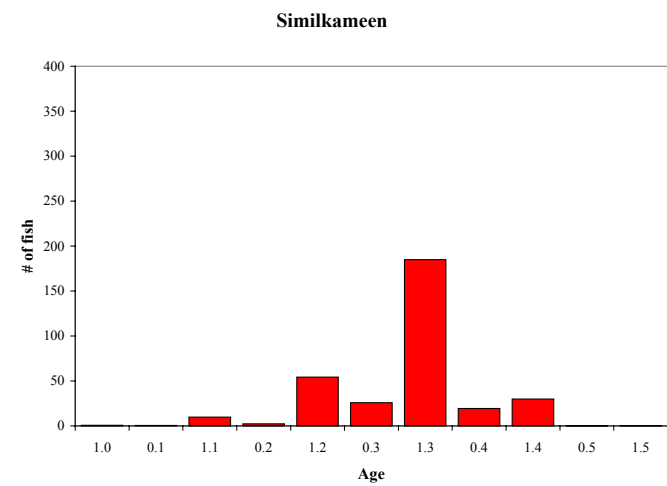
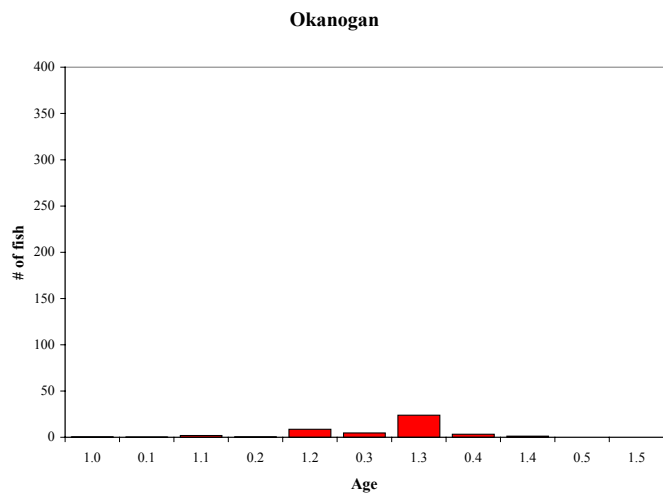
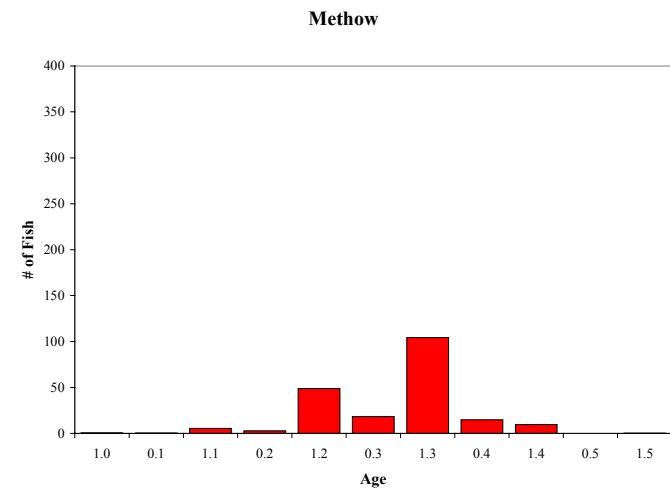
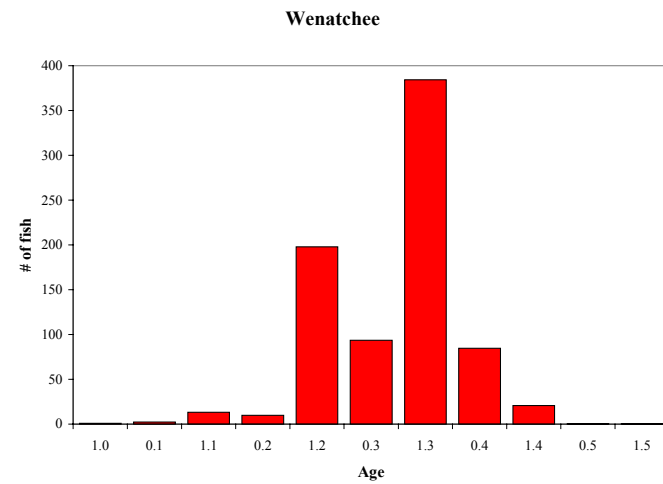


Figure 7. Average age distribution of mid-Columbia River summer chinook returns to spawning grounds in the Wenatchee, Methow, Okanogan, and Similkameen river basins (1993-2000).

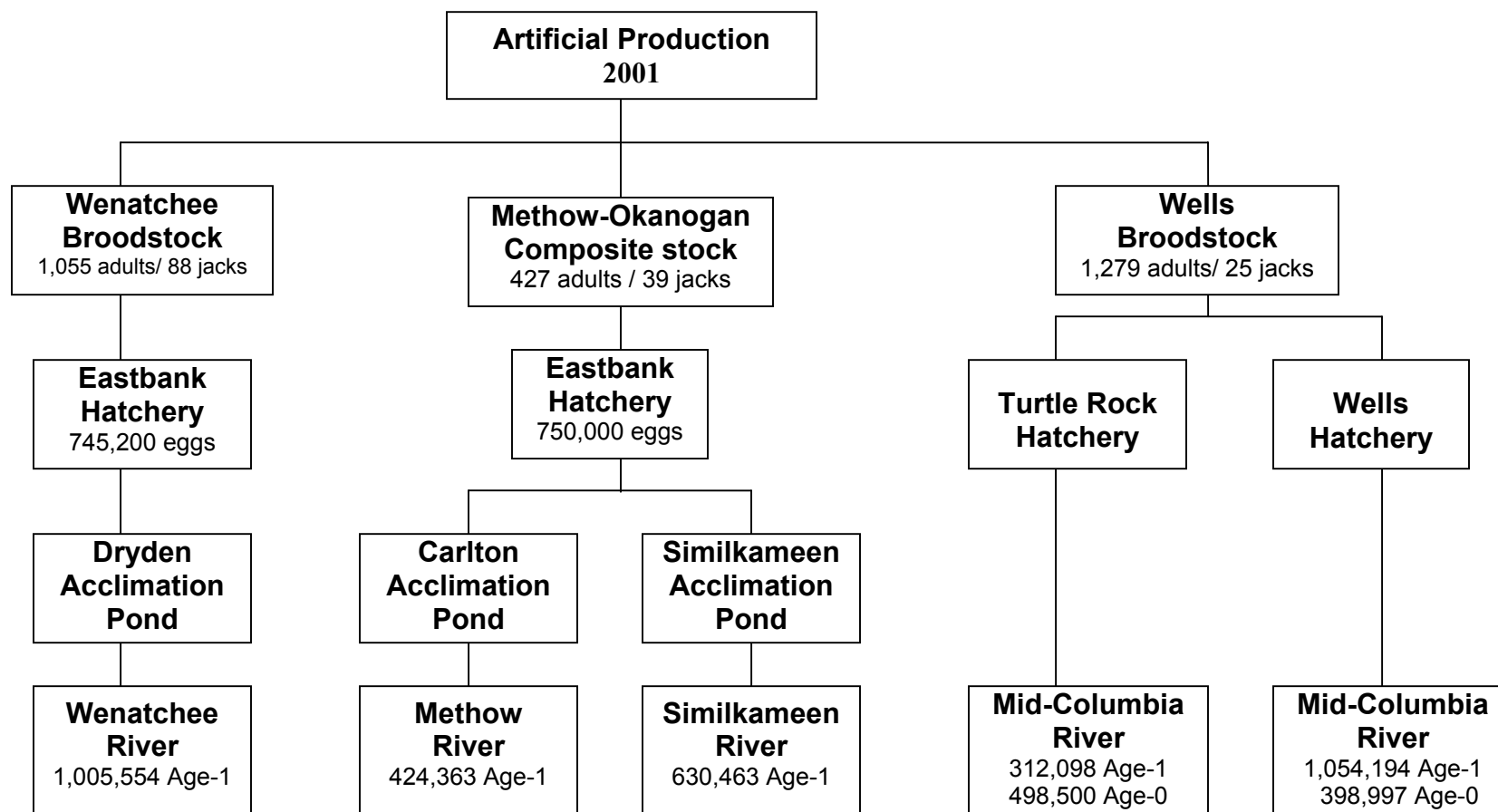


Figure 8. Diagram showing the 2001 artificial production program for mid-Columbia summer chinook.

¹ This stock is composed of migrating adults collected at the east fish ladder of Wells Dam. Prior to 1996, returns to Wells Hatchery were used.

(Appendix B-4), although Wells broodstock was used for artificial production in the Methow and Okanogan basins until 1996.

Current production objectives include the release of 864,000 summer chinook yearlings of Wenatchee stock into the Wenatchee River, 400,000 of Methow/ Okanogan stock into the Methow River and 576,000 Methow/ Okanogan stock into the Similkameen River (Montgomery Watson 1996c). There were over 6.6 million summer-run chinook salmon yearlings released from Dryden Acclimation Ponds (1990-1999), 2.8 million released from the Carlton facility (1993-1999), and 2.7 million released from the Similkameen facility (1989-1993). In 2001, Eastbank Fish hatchery produced 192,426 summer chinook yearlings that were transferred to Turtle Rock Hatchery for release into the mainstem Columbia River, and 1.0 million that were transferred to Dryden Acclimation Pond for release into the Wenatchee River.

In 1978, Wells Hatchery spawning channel was discontinued at which time conventional hatchery rearing began. Broodstock is primarily composed of adults returning to the hatchery (80%), varying numbers of which are natural stock volunteers, and approximately 20% of fish trapped at Wells Dam (NMFS et al. 1998). Smolts are released in late spring. To minimize interactions with natural stocks, the operations of this hatchery are geared to minimize the amount of time the fish spend in freshwater by releasing smolts that are ready to migrate to the ocean (NMFS et al. 1998). Through 1991, Wells Hatchery progeny were released at Wells Dam (Chapman et al. 1994). From 1978 to 2001, over 5.5 million yearlings and 27.4 subyearlings were released from this hatchery (Appendix B-2 and B-3). Approximately 630,000 yearlings were released into the Methow River (2000-2001), while 3.1 million were released into the Okanogan Basin (1996-2001) and nearly 5.7 million yearlings and 27.4 million subyearlings were released into the mid-Columbia River (1978-1999).

Wells hatchery is currently managed to produce 320,000 yearlings at approximately 10 fish per pound for April release, 484,000 subyearlings at 20 fish per pound for late June-early July release, and to trap, hold and spawn adult summer chinook for transfer of 1,300,000 green eggs to Eastbank Hatchery (Montgomery Watson 1996a). In 2001, 312,098 yearlings at 10 fish per pound and 498,500 subyearlings at 28.9 per pound were released (Fish Passage Center 2002), which is approximately 10,000 pounds less than the objective of 56,000 pounds.

The Rocky Reach facility currently works in conjunction with the Turtle Rock Satellite facility. Broodstock for this hatchery currently originates from Wells Fish Hatchery volunteers, but drew from Priest Rapids Hatchery Broodstock in the past. From 1982 to 2001, over 1.3 million yearling and over 5.5 million subyearlings were released from Rocky Reach/ Turtle Rock into the mid-Columbia River (Appendix B-2 and B-3). Current production goals for this facility include 200,000 yearling and 1.6 million subyearling summer chinook released

per year (Montgomery Watson 1996b). This facility released 1.0 million subyearling and 93,281 yearling summer chinook salmon in 2001.

Built in 1963, Priest Rapids Fish Hatchery objectives include the production of 100,000 pounds of upriver bright (URB) fall chinook, 1.7 million URB fall chinook smolts, and to provide URB fall chinook eyed eggs to facilities that rear the stock (Montgomery Watson 1997). No summer-run chinook salmon are currently produced at this facility.

Summary of coded-wire tag information

All available coded-wire tag data were collected from the Regional Mark Information System (www.rmis.org) and the Fish Passage Center (www.fpc.org) database. The data are summarized by location of release and broodyear and are presented in Appendix D. Total fish returns are the observed CWT recoveries expanded to account for the portion of the tagged population that was not sampled. CWT returns are further adjusted for losses due to dam passage. CWT data can be used to estimate total hatchery returns instead of per spawner analysis.

Prior to 1990, all tagged summer chinook were released from Wells Fish Hatchery, except for 1978 and 1979 releases from Winthrop National Fish Hatchery. Currently, coded-wire tagged summer chinook are released from Wells and Turtle Rock hatcheries, and Dryden, Carlton, and Similkameen acclimation ponds. Both age-0 fingerlings and age-1 smolts are tagged.

Proportions of coded-wire tags recovered per number of fish released are given by release location and life history type in Figure 9. Generally, coded-wire tag recoveries of fish originating from the Similkameen Acclimation Pond were considerably higher than releases from other facilities. The anomalously low proportion of recoveries from Similkameen Acclimation Pond in broodyear 1993 may be attributed to an outbreak of bacterial kidney disease (BKD) and fungus in the pond, which prompted the release of all fish in early April (T. Holder, WDFW, Olympia, WA, pers. comm. 2002). The high overall proportions of CWTs recovered from broodyears 1989, 1994, and 1995 may be the result of greater than average spring runoff during run years 1991, 1996, and 1997.

According to the CWT data, most fish were detected in ocean harvest, mainly off the coast of Alaska and British Columbia, or as returns to hatcheries and spawning grounds (Figure 10). Between 1989 and 1997, ocean harvest averaged over 40% of the CWTs recovered in the Wenatchee, Methow, and mainstem Columbia rivers, while in the Similkameen River, tag recoveries were greater on the spawning grounds (68%) than in ocean fisheries (29%). Generally, in-river harvest comprises a smaller fraction of the CWT recoveries than ocean fisheries.

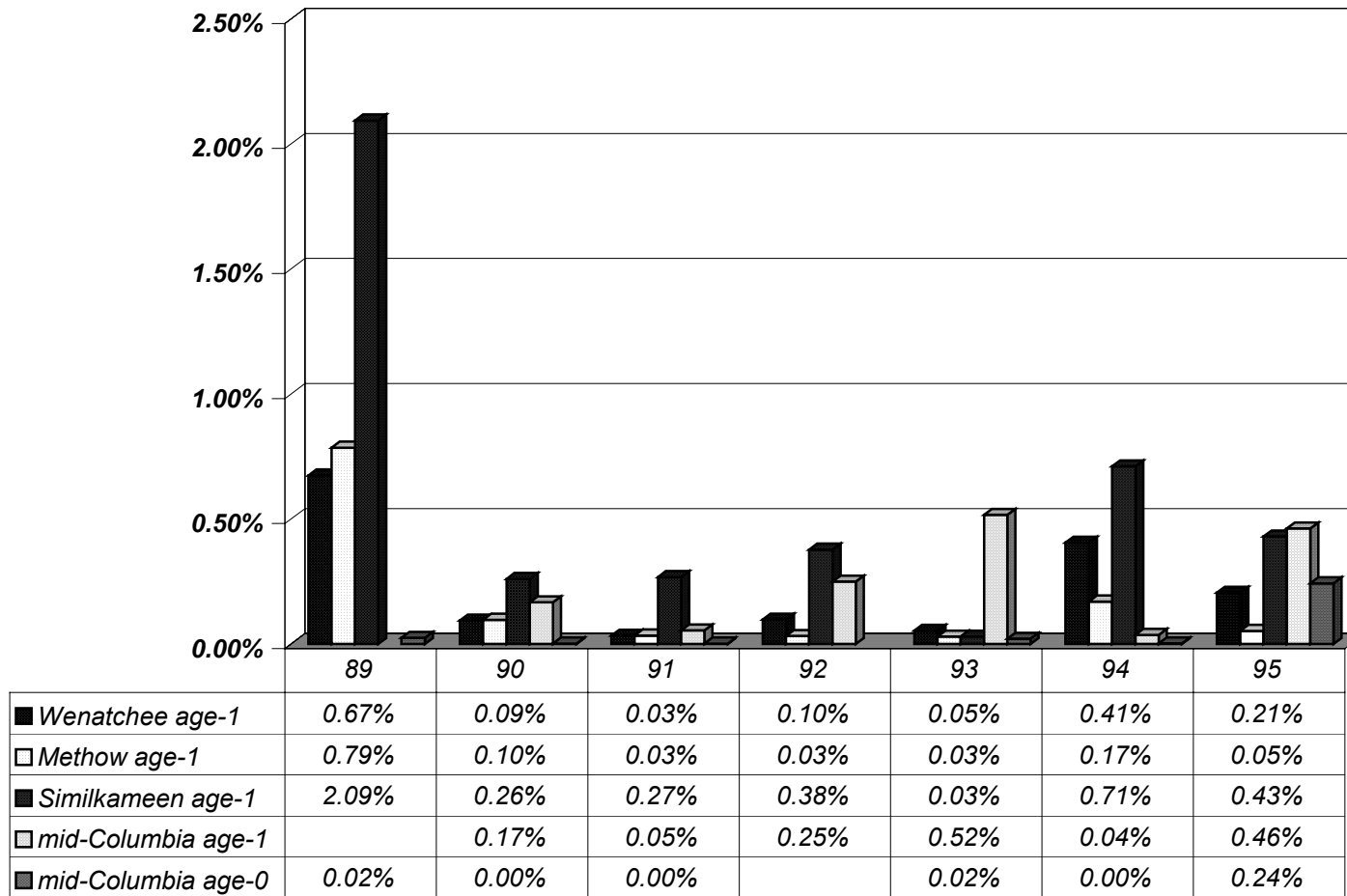


Figure 9. Percentage of coded-wire tags recovered from broodyears 1989-1995 categorized by release river.

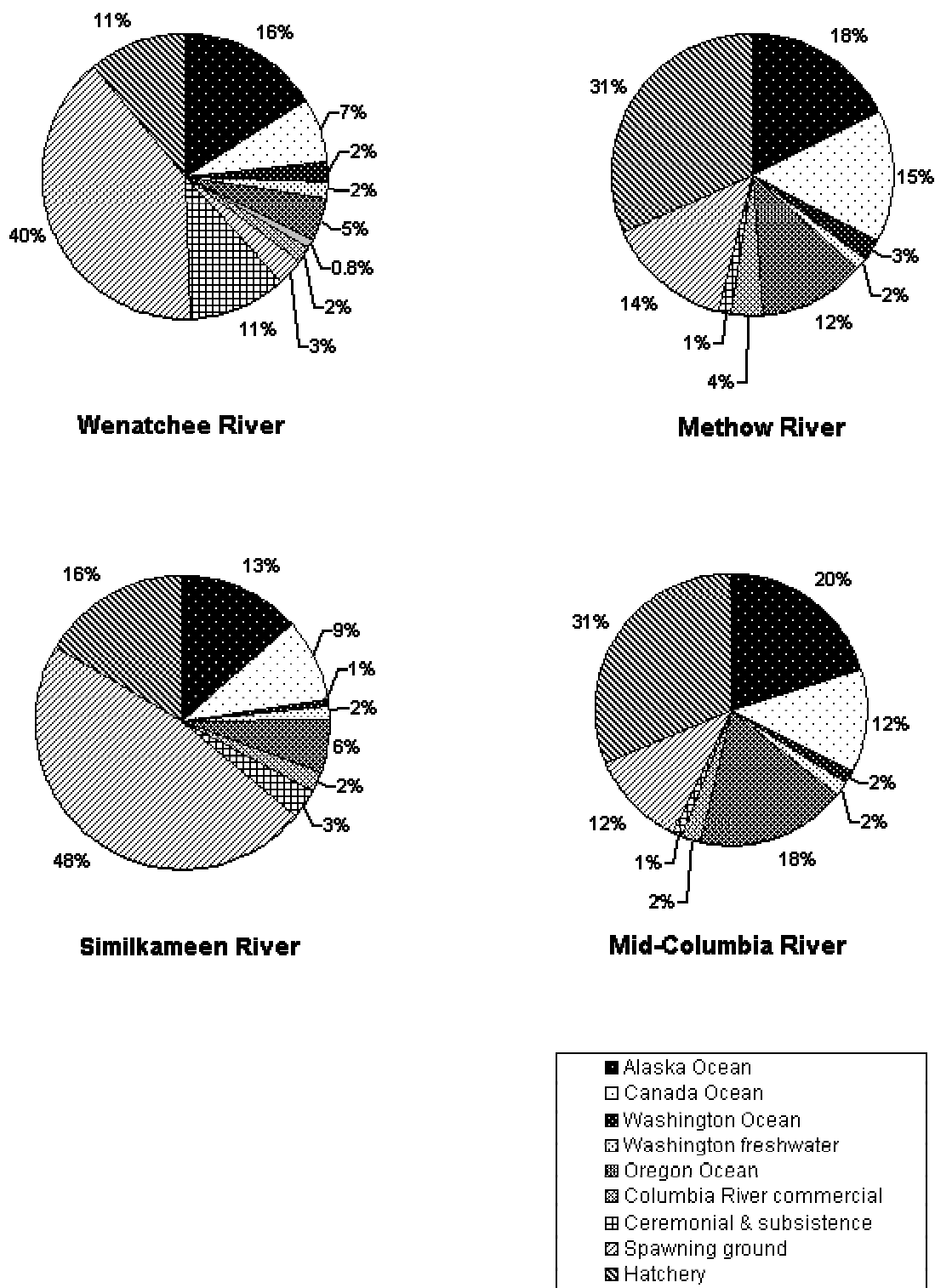


Figure 10. Average distributions of coded-wire tags recovered from hatchery-reared summer chinook salmon yearlings released into the Wenatchee, Methow, Similkameen, and mainstem mid-Columbia rivers between 1989-1997.

The largest proportion of in-river harvest typically consists of ceremonial and subsistence fishing, primarily due to restrictions on non-tribal harvest.

A comparison of the average distribution of CWTs recovered for ocean type (age-0 migrants) and stream type (age-1 migrants) fish (Figure 11) suggests that the differing life history patterns affect ocean distribution. According to the CWT data, ocean type summer chinook salmon have a more northerly ocean distribution than stream type. For the nine-year time series of CWT data analyzed, Washington and Oregon ocean fisheries comprised a larger share of the harvest of yearling runs (19%) than subyearling runs (6%), while Alaska fisheries harvested a larger proportion of the of subyearling runs (27%) than yearling runs (19%).

Figure 12 displays the yearly variation on the Similkameen River from 1989 to 1995. Returns to the Similkameen Acclimation Pond and to spawning grounds make up the largest share (61%-82%) of the CWTs recovered. The high proportion of CWT recoveries on the spawning ground are due, in part, to the ease of recovering carcasses on the 8 miles of river accessible to salmon and to the overall success of the artificial production program.

Figure 13 shows spawning escapement as classified by CWT detections. In general, fish returned in low numbers in 1993, 1996, 1997, and 1998, while spawning ground escapement was comparatively higher in 1994, 1995, 1999, and 2000. The low returns observed in 1993, 1996, 1997 and 1998 are coincident with low water conditions during smolt out migration in 1988-1989, and 1992-1995.

Current Run Size

Returning adults

Since 1967, there have been four projects monitoring adult summer chinook salmon escapement at the mid-Columbia dams: Priest Rapids (June 14-August 13), Rock Island (June 18-August 17), Rocky Reach (June 20- August 19), and Wells (June 22-August 21). Since monitoring does not occur continuously, numbers are recorded as expanded counts (Appendix A). Trends are similar for all four projects (Figure 14). In the last 30 years (1972-present) median dam counts of returning summer chinook include 15,225 adults at Priest Rapids, 13,415 adults at Rock Island Dam, 5,392 adults at Rocky Reach Dam, and 3,296 returning adults at Wells Dam. Data from 1973 to 1998 exhibit small oscillations in ocean-type chinook returns primarily fluctuating within a range of 10,000 fish. Counts for 1982-83 and 1991-92 were the lowest recorded numbers in 40 years, falling well below averages. In 1999, the number of adult returns increased significantly with fish returns totaling more than 20,000 fish in excess of the

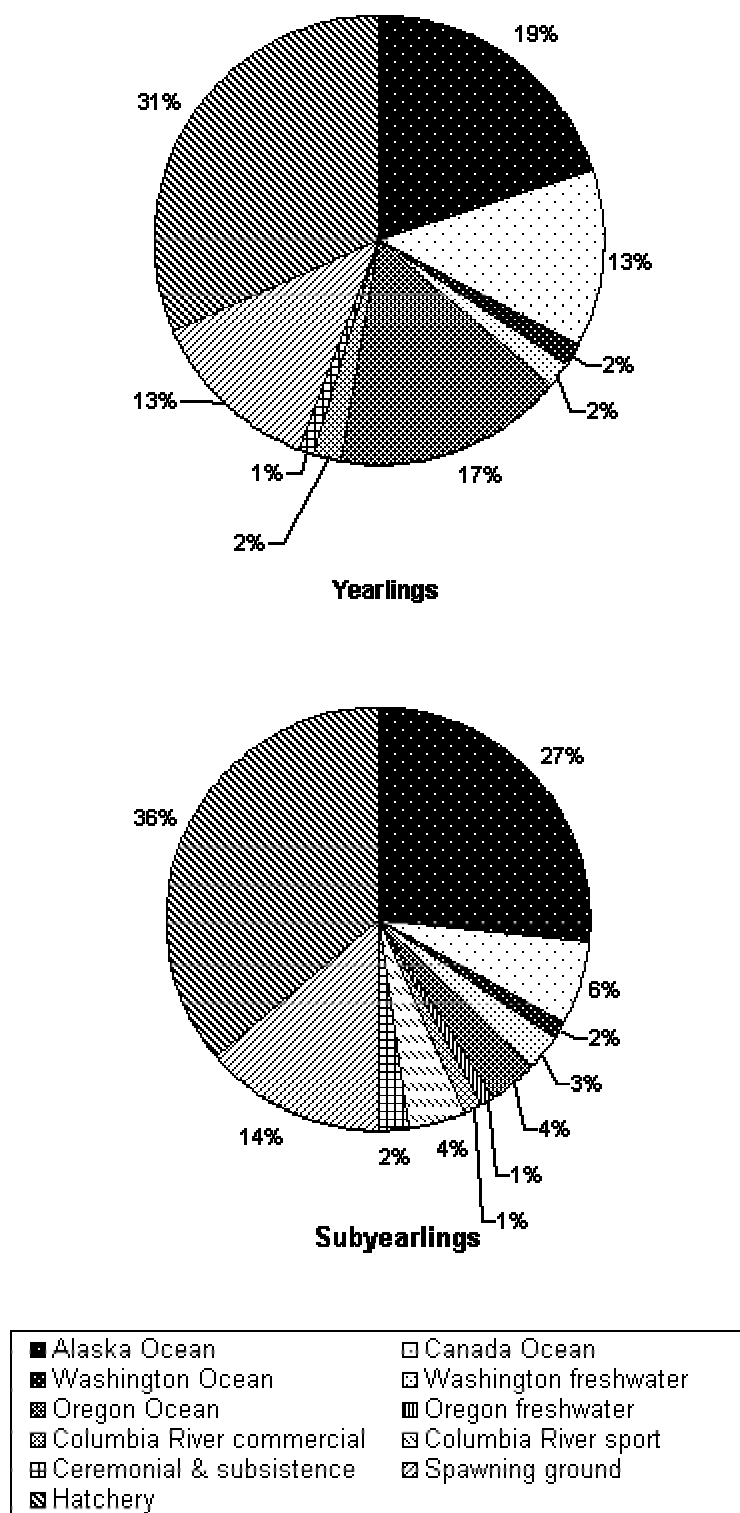


Figure 11. Average distribution of coded-wire tags recovered from hatchery-reared summer chinook salmon released into the mainstem mid-Columbia as yearlings and as subyearlings (1989-1997).

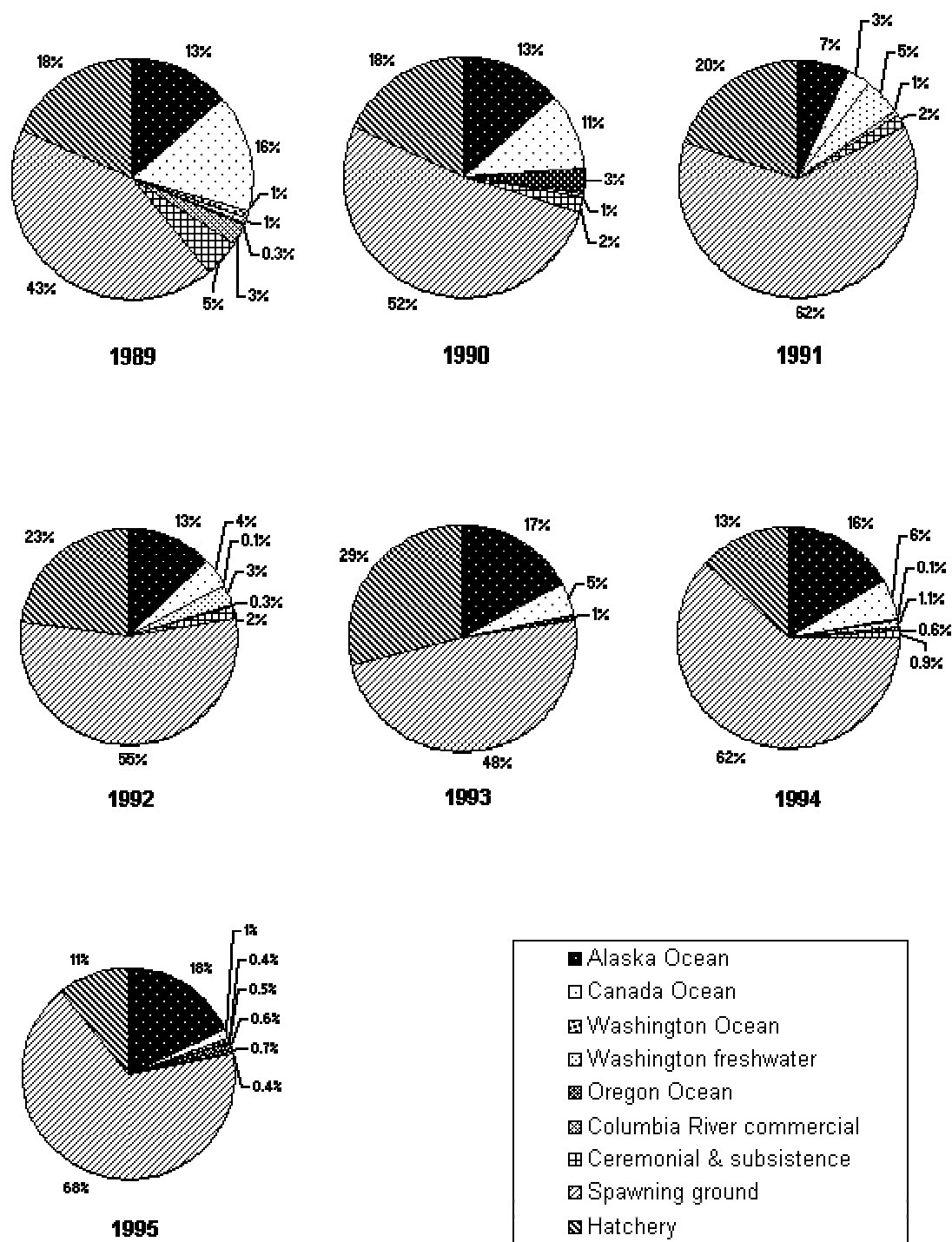


Figure 12. Distribution of coded-wire tag recoveries from summer chinook released from the Similkameen Acclimation Pond for broodyears 1989-1995.

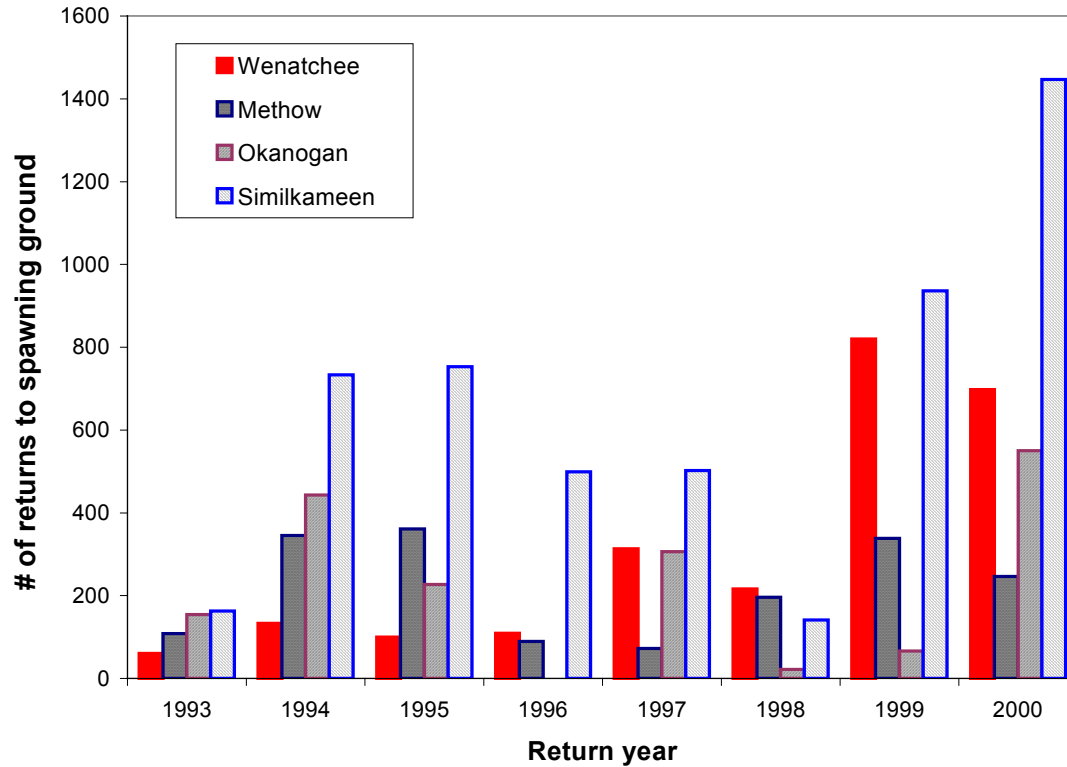


Figure 13. Spawning escapement of hatchery-reared summer chinook salmon as detected by CWT (1993-2000).

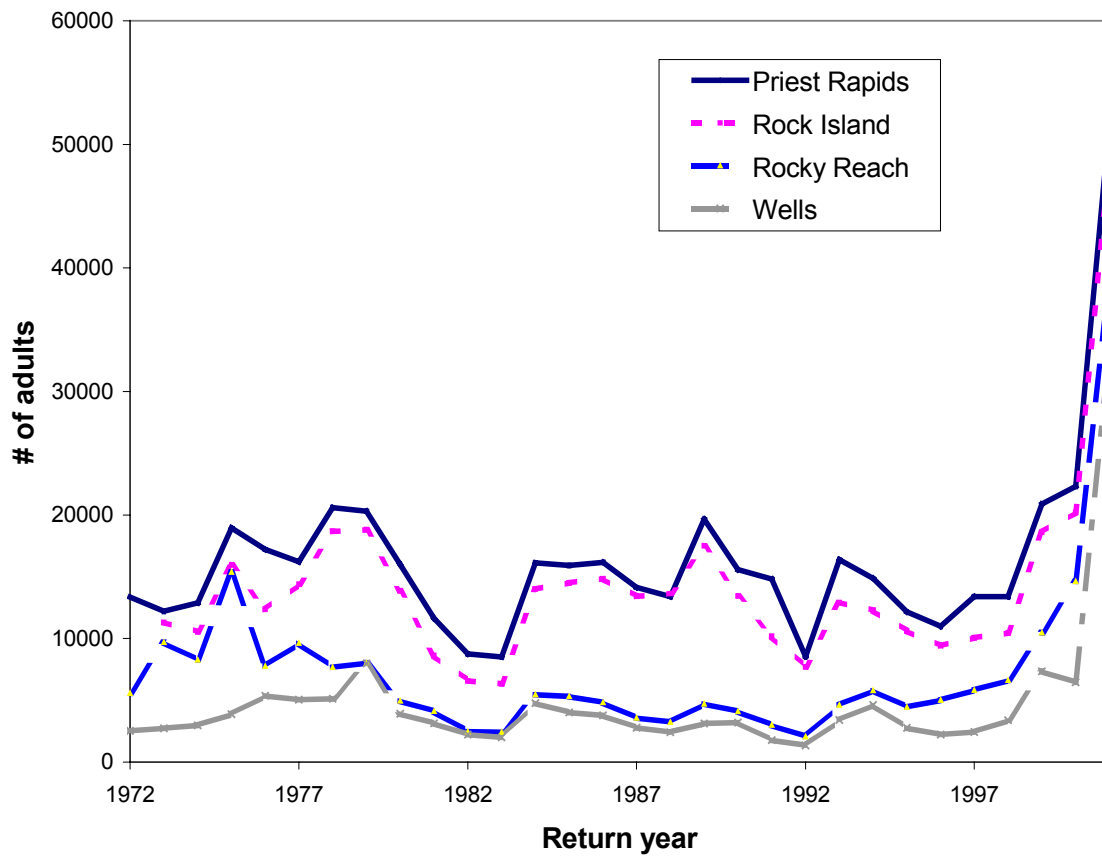


Figure 14. Trends in number of adult summer- and fall-run chinook returns counted at Priest Rapids, Rock Island, Rock Reach, and Wells dams (1972-2001).

previous twenty-year average and exceeding 1967 peak year counts. The 1999 peak is unprecedented in the 66 years of documented dam counts. The number of adult summer-chinook returns has continued to increase through 2001.

Tributary escapement

A spawner to redd ratio of 3.1 has become the typical expansion factor for estimates of tributary escapement of summer chinook (Meekin 1967). This expansion factor of 3.1 was originally calculated for the Methow River in 1965 based on adult counts and aerial redd surveys, and excluded jacks. Currently, ground-counted redds are the basis for escapement estimates despite the aerial-counted redd foundation for the derivation of this factor.

The Public Utility District No. 1 of Chelan County has developed another method for estimating escapement in the Wenatchee River basin. They calculate spawner to redd ratios based on the difference between summer chinook adult and jack counts at Rocky Reach and Rock Island dams, adjusted for broodstock collection for the Rock Island Hatchery Complex. From 1990 to 2001, these ratios have varied from 2.75 to 4.10 spawners per redd (Mosey and Murdoch 2000).

Since 1997, Washington Department of Fish and Wildlife has estimated tributary escapement for the Methow and Okanogan River basins based on male to female ratios of returning runs. Tributary escapement estimates were calculated using the total ground counts of redds multiplied by the male to female ratio of the Methow/Okanogan hatchery broodstock, which was randomly collected from the run-at-large at the Wells Dam east ladder trap (Murdoch and Miller 1999). To estimate escapement, they assumed that the male to female ratio observed at Wells Dam is representative of the natural run, that each female created one redd, and that each male only spawned with one female.

Tributary escapement was calculated for the Wenatchee, Entiat, Methow, Okanogan, and Similkameen rivers (Table 9) based on ground-surveyed redd counts expanded by 3.1 spawners per redd (Meekin 1967). Where ground spawning surveys were not available, aerial counts were adjusted to ground counts. An expansion factor of 1.79 ground-counted redds per aerial-counted redd was used in previous studies (Langness 1991). Since 1987, both aerial and ground surveys have been made in the Wenatchee, Methow, Okanogan, and Similkameen basins in most years. When these data pairs were compared to aerial redd counts adjusted by a factor of 1.79, the 1.79 expansion factor appeared too large. A linear regression model based on the 37 currently available data pairs of aerial/ground-counted redds yielded the following model:

$$\text{ground counts} = 29.245 + 1.429 \times \text{aerial counts} \quad (1)$$

$$R^2 = 0.944 \quad (2)$$

Table 9. Estimated tributary escapement for the Wenatchee, Entiat, Methow, Okanogan, and Similkameen rivers (1972-2001).¹

Year	Wenatchee River	Methow River	Okanogan River	Similkameen River	Entiat River	Total
1972	6131 ²	1461	818	247	22	8680
1973	5142	1645	620	288	108	7803
1974	5192	1002	508	584	0	7286
1975	4158	1942	1227	903	0	8230
1976	4971	859	481	827	27	7165
1977	6136	1641	1241	625	18	9660
1978	8792	2328	877	1205	58	13260
1979	7633	2796	778	620	27	11853
1980	9098	1551	530	773	36	11988
1981	6603	877	247	544	0	8271
1982	5124	638	103	265	22	6154
1983	3250	292	162	256	13	3974
1984	5987	728	1056	1353	0	9125
1985	4756	737	620	1389	0	7502
1986	5942	760	886	1349	0	8936
1987	9161	778	636	611	63	11248
1988	6516	683	627	1060	22	8908
1989	10326	1612	744	1226	0	13908
1990	7685	1029	146	456	0	9316
1991	6758	539	198	282	9	7787
1992	7217	332	164	177	0	7890
1993	7235	477	502	893	0	9108
1994	7514	961	1159	2409	67	12111
1995	5803	1107	828	1910	207	9854
1996	4449	561	360	1299	238	6906
1997	4303	636	490	1507	135	7070
1998	5146	698	273	856	207	7179
1999	6783	1389	1144	3953	211	13479
2000	6268	1550	1702	3078	445	13043
2001	8857	2089	3435	4774	279	19434

¹ Escapement figures are calculated from an expansion factor of 3.1 spawners per redd.² Italicized numbers have been calculated from aerial redd counts adjusted to ground counts by a factor of 1.43 as determined by a linear regression model of available aerial/ ground data pairs

Based on this model, an expansion factor of 1.43 was used to adjust aerial-counted redds to ground-counted redds.

Juvenile outmigrants

Migrational timing of yearling and subyearling chinook salmon is recorded at Rock Island Dam annually from April 1st to August 31st between 7:00 p.m. and 7:00 a.m. as part of the Smolt Monitoring Program (Fielder 1995). The program uses gatewell dipping to collect juveniles at an estimated 1% level sampling effort. Data collected includes passage numbers of downstream migrants indexed as collection counts, which is the actual number counted divided by the sample rate (Table 10), total number of fin clipped and PIT tagged fish by species, daily average river discharge, and daily average spill over Rock Island Dam. Numbers of fish entering the collection facility are recorded by species. Yearlings and subyearlings are distinguished by size.

Median values of 25,300 yearlings and 18,650 subyearlings have been calculated for the 16-year record. Figure 15 illustrates trends in the smolt passage counts. Although the trends are dissimilar, both age-0 and age-1 smolts demonstrate high variability between 1985 and 1992, with year-to-year differences as large as 48,000 fish. Between 1992 and 2001, the number of subyearlings remained relatively constant, averaging 16,100 smolts. During the same time period, yearlings increased appreciably to a 1997 peak of nearly 54,000 smolts before declining sharply to 6,500 in 2001 despite consistency in the number of hatchery released age-1 fish. Much of the variability in the number of smolts detected can be attributed to tributary discharge patterns and the number of hatchery releases.

The chinook stocks migrating through Rock Island Dam are composed of spring-, summer-, and fall-run fish. Since it is not possible to identify individual stocks at this life history stage, accurate estimation of yearling summer chinook passage is problematic. Any discernible relationship between hatchery release date and number of summer chinook detected at Rock Island Dam is masked by the magnitude of spring chinook released and is further confounded by the dependence of downstream migration on river discharge (Figure 16). Accurate estimates of yearling survival at Rock Island Dam cannot be made under the current program.

The subyearling chinook detected at Rock Island Dam are predominantly summer stocks. Spring chinook do not typically migrate at this life history stage. Some age-0 fall chinook are released from Wells hatchery, however summer chinook dominate the run. Even though the fall chinook component of the run may be negligible, it is difficult to expand subyearling summer chinook dam count indices into dam passage estimates.

Table 10. Number of yearlings and subyearlings detected by the Smolt Monitoring Project at Rock Island Dam (1985-2001). Numbers are reported as passage indices.

Year	Yearlings	Subyearlings
1985	38,891	24,374
1986	26,115	72,980
1987	21,275	18,360
1988	52,050	38,292
1989	15,502	44,198
1990	20,853	54,682
1991	54,682	34,448
1992	18,573	10,245
1993	15,447	16,085
1994	12,334	14,323
1995	30,753	14,193
1996	42,517	15,308
1997	53,754	19,240
1998	24,996	17,207
1999	25,609	18,641
2000	25,298	13,693
2001	6,575	22,638

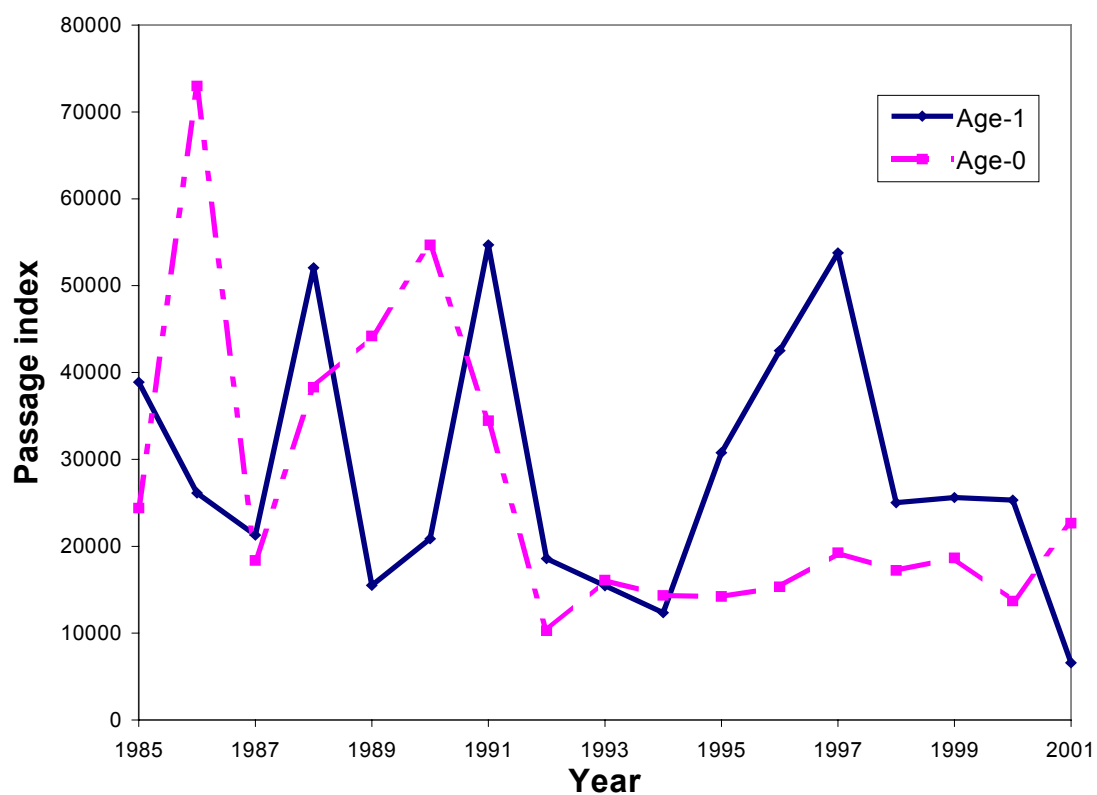


Figure 15. Yearling and subyearling chinook salmon smolt passage counts through Rock Island Dam (1985-2001).

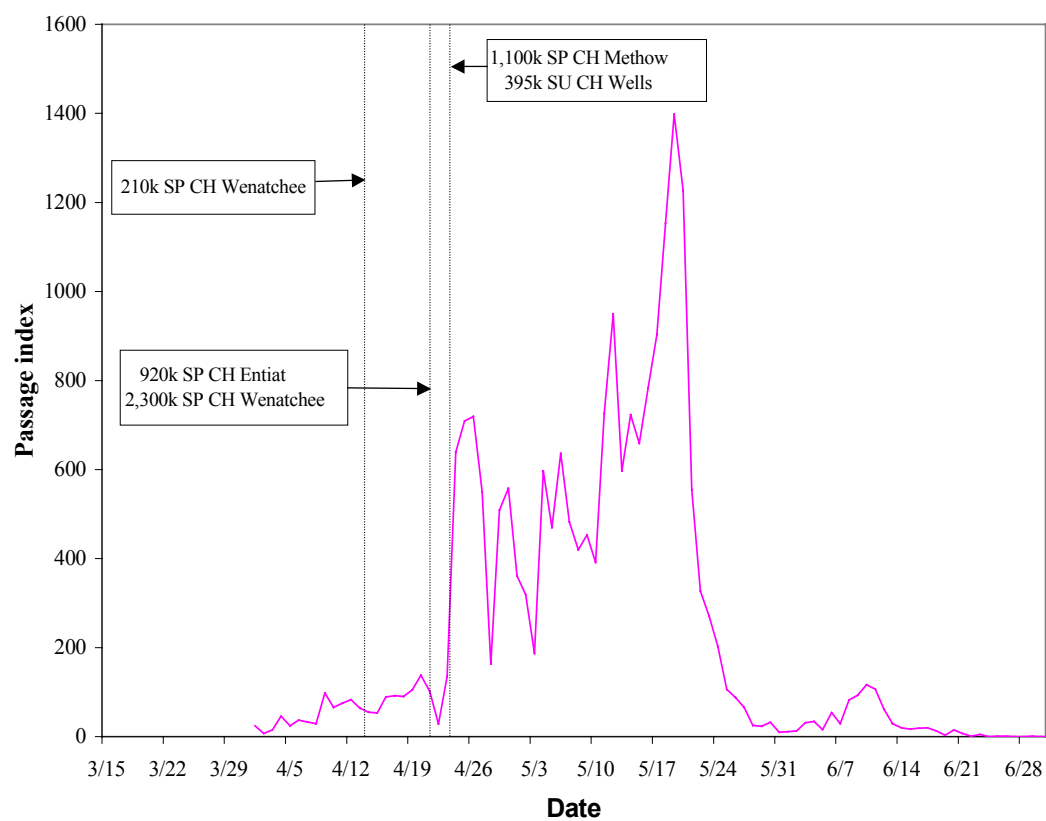


Figure 16. 1987 Rock Island Dam yearling chinook salmon passage indices and mid-Columbia hatchery releases.

Data Gaps

The ability to conduct a comprehensive stock assessment on MCR summer chinook is limited by a lack of data at specific life history stages. Assembly of these baseline data will be essential for analysis of stock productivity, development of future management plans, and in the review and evaluation of current escapement goals used by co-managers. Significant MCR summer chinook data gaps include:

Geo-spatial analysis of recent spawning distribution data. The most current maps available on distribution of redds are from 1965. Spatially referenced data on spawning areas is accessible in annual spawning ground surveys available from Public Utility District No. 1 of Chelan County (Wenatchee basin) and Washington Department of Fisheries and Wildlife (Methow and Okanogan basins). The data needs to be digitized to generate a geo-spatial representation of redd data. The goal is to produce accurate redd distribution maps that can be compared to the 1965 maps produced by French and Wahle to evaluate any changes in the present day geographic range of spawning relative to historic distributions.

Egg to smolt survival. This can be estimated by first calculating egg production. This involves data on percent female spawners, age composition of female spawners, and fecundity (eggs/ female). Next, data is needed on egg to parr survival. Finally, parr to smolt survival would need to be estimated. This will be difficult to estimate; weir counts could possibly be used.

Estimates of summer chinook parr and smolt productivity. This can potentially be estimated from weir counts on small tributaries. The data must be calibrated per redd based on egg deposition, so that estimates of production can be expanded by the number of redds to calculate productivity for the subbasin.

Number of outmigrant smolts per tributary. Data on baseline production of MCR summers is a key component of a stock assessment that is presently deficient. Currently, the number of summer chinook at this life history stage is estimated directly from the number of redds. Since there is little direct information, the feasibility of tagging a large number of wild summer juveniles needs to be investigated. The Similkameen River is likely to be the best location as it has the most distinctive run separation from the spring chinook. The feasibility of using a smolt production model based on redd counts and estimates of parr production may also need to be investigated.

Survival of smolts through hydro-electric facilities

Data on the ecological interaction between hatchery and wild juveniles. Direct observation and underwater video of behaviors in rearing areas.

Magnitude of escapement to spawning grounds. Accurate estimates of tributary escapement are an important component of a comprehensive stock assessment, but current estimates contain a lot of variance in estimates. Escapement is calculated directly from the number of redds observed multiplied by an expansion factor, typically 3.1 spawners per redd in the mid-Columbia (Meekin 1967) and has been as high as 4.1 spawners per redd in the Wenatchee in recent years (Mosey and Truscott 1999). Current data needs to be collected to obtain more accurate estimates of escapement, and to verify the existing expansion factor.

Synthesis of available information on habitat and life history. Information on habitat limiting factors is available from the State of Washington Limiting Factors Analyses. This information needs to be specifically applied to MCR summers by life history stage.

Success of artificially propagated fish spawning in the wild. Figure 17 illustrates a similar trend for hatchery returns to spawning grounds as number of redds constructed ($r^2 = 0.677$). This may indicate that artificially propagated fish contribute a significant share of the spawning recruitment base and the number of redds constructed. To evaluate this hypothesis, the magnitude of the contribution of hatchery fish to natural production and recruitment will need to be examined. This can be estimated by analytical methods utilizing data collected from mark-recapture studies and from capping redds to determine the rate of emergence. Egg to smolt survival of hatchery progeny can also be evaluated from these data and recruit to spawner relationships can be analyzed.

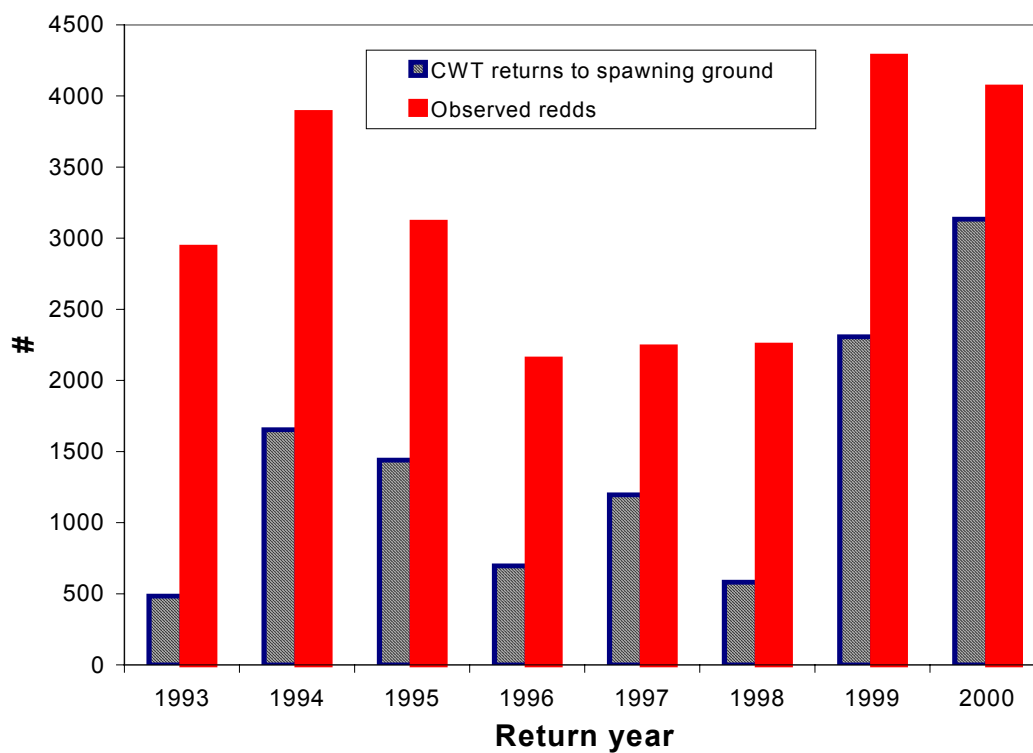


Figure 17. Coded wire tagged hatchery fish returns to spawning grounds and observed number of chinook redds in the mid-Columbia River basin (1993-2000)

Statement of Work

To address some of the data gaps, Columbia River Inter-Tribal Fish Commission cooperating with Yakama Nation has proposed research on mid-Columbia summer chinook using monies from the Alaska Governor's Fund. This study will focus on the factors affecting freshwater life history parameters and overall stock productivity. The primary focus will be on smolt-to-adult life history. Schaller et al. (1999) and Petrosky et al. (2001) demonstrated that declines of Snake River stream-type chinook were not due to freshwater spawning and rearing life histories. The proposed analysis will address uncertainties regarding the production base of the stock, the parameters of population health, the factors limiting population health, current natural population trends, and the accuracy of the current methods used to estimate escapement. The proposed study will provide baseline information for managers including formation of appropriate stock recovery and escapement goals. Actions that address freshwater limiting factors necessary to reach population health will be identified.

To examine some of critical uncertainties pertinent to mid-Columbia summer chinook, CRITFC proposes to collect data on smolt and spawner abundances, to collect data on distribution via coded-wire and PIT tags, and to analyze temporal genetic variability to allow discrimination between chinook stocks or races. From these data, we will conduct analyses to evaluate the current condition of the population and identify the key factors influencing population health. Funds from this project will be used to cover the costs of special equipment (e.g. rotary-screw trap), supplies (e.g. measuring boards, dip nets) personnel, planning/coordination, analysis, and generation of reports.

Study objectives include:

1. Determine total escapement and timing of escapement to the Methow River using tower-count methods, and compare these estimates with past and current methods of estimating escapement and spawner/recruit modeling.
2. Estimate abundance of naturally produced juvenile summer chinook salmon emigrating from the Methow River using a screw trap; collect data on life-history characteristics such as time of downstream migration, fork length, and degree of smoltification.
3. Determine genetic variability of temporal subyearling chinook collected in the lower Methow River smolt trap using microsatellite loci.
4. Determine migration parameters and life history characteristics of subyearling chinook collected at the lower Methow River smolt trap using PIT tags
5. Determine the distribution of naturally produced summer chinook salmon collected at the lower Methow River smolt trap in ocean and freshwater environments using coded-wire tags.
6. Estimate performance measures including smolts per spawner ratios.

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Appendix A

Appendix A-1. Summer chinook adult and jacks counts taken at Priest Rapids, Rock Island, Rocky Reach, and Wells Dams (1933-2001).

year	Priest Rapids			Rock Island			Rocky Reach			Wells		
	adults	jacks	total	adults	jacks	total	adults	jacks	total	adults	jacks	total
1933				4732		4732						
1934				6482		6482						
1935				10643		10643						
1936				4535		4535						
1937				4088		4088						
1938				2747		2747						
1939				6294		6294						
1940				4926		4926						
1941				1014		1014						
1942				4777	305	5082						
1943				2897	472	3369						
1944				1298	611	1909						
1945				3328		3328						
1946				5695		5695						
1947				3424		3424						
1948				5256		5256						
1949				8609		8609						
1950				5744	1527	7271						
1951				8645	961	9606						
1952				11691	2063	13754						
1953				11504	6195	17699						
1954				13310	4437	17747						
1955				14330	6438	20768						
1956				17403	4908	22311						
1957				23022	6877	29899						
1958				17446	3323	20769						

Appendix A-1. (continued)

year	Priest Rapids			Rock Island			Rocky Reach			Wells		
	adults	jacks	total	adults	jacks	total	adults	jacks	total	adults	jacks	total
1959				10194	3964	14158						
1960	15500	3300	18800	10707	2165	12872						
1961	12800	2300	15100	12632	4423	17055						
1962	14527	3230	17757	15421	4906	20327	9295		9295			
1963	12099	4173	16272	9674	5549	15223	5776		5776			
1964	14848	6323	21171	14472	7279	21751	10752		10752			
1965	14457	7399	21856	14456	7683	22139	15975		15975			
1966	20801	6704	27505	21284	7531	28815	19445		19445			
1967	16906	4418	21324	15210	4937	20147	15558		15558	8412	3854	12266
1968	17630	4465	22095	Used for Hatchery Project			14721		14721	4798	4120	8918
1969	13195	3833	17028				12996		12996	2978	3876	6854
1970	13443	4512	17955	Used for Hatchery Project			11822		11822	4474	3567	8041
1971	15511	2187	17698				10031		10031	3862	2145	6007
1972	13361	1400	14761				5577		5577	2525	1533	4058
1973	12211	2063	14274	11317	3075	14392	9683		9683	2737	2352	5089
1974	12884	819	13703	10554	1114	11668	8274		8274	2979	1593	4572
1975	18950	3255	22205	15948	6994	22942	15367		15367	3866	4666	8532
1976	17216	2128	19344	12353	6227	18580	7771	4121	11892	5363	2526	7889
1977	16223	3382	19605	14403	6516	20919	9637	3859	13496	5055	2472	7527
1978	20596	1984	22580	18667	3230	21897	7664	1797	9461	5127	1292	6419
1979	20321	2368	22689	18797	3812	22609	8023	1963	9986	7995	2974	10969
1980	15999	2709	18708	13854	2096	15950	4959	1109	6068	3910	982	4892
1981	11634	747	12381	8639	1035	9674	4112	624	4736	3141	1135	4276
1982	8762	1121	9883	6587	2901	9488	2474	1037	3511	2223	1126	3349
1983	8514	1059	9573	6334	2780	9114	2407	756	3163	2002	819	2821
1984	16125	1247	17372	13984	3584	17568	5463	838	6301	4768	1173	5941

Appendix A-1. (continued)

year	Priest Rapids			Rock Island			Rocky Reach			Wells		
	adults	jacks	total	adults	jacks	total	adults	jacks	total	adults	jacks	total
1985	15912	1412	17324	14505	1902	16407	5320	592	5912	4018	499	4517
1986	16166	913	17079	14850	1892	16742	4833	579	5412	3787	515	4302
1987	14131	442	14573	13415	1959	15374	3570	489	4059	2790	347	3137
1988	13400	441	13841	13634	1828	15462	3245	447	3692	2411	360	2771
1989	19659	503	20162	17484	1108	18592	4720	218	4938	3115	223	3338
1990	15576	400	15976	13432	800	14232	4089	272	4361	3207	217	3424
1991	14815	358	15173	10191	833	11024	2985	289	3274	1774	270	2044
1992	8523	1373	9896	7706	2005	9711	2059	951	3010	1343	631	1974
1993	16377	799	17176	12927	476	13403	4618	225	4843	3404	170	3574
1994	14874	641	15515	12292	772	13064	5789	401	6190	4613	371	4984
1995	12162	446	12608	10623	696	11319	4452	252	4704	2767	289	3056
1996	10995	321	11316	9417	855	10272	5006	224	5230	2225	165	2390
1997	13394	528	13922	10063	595	10658	5808	686	6494	2424	139	2563
1998	13387	601	13988	10455	1047	11502	6626	349	6975	3385	729	4114
1999	20898	517	21415	18588	1548	20136	10479	1111	11590	7351	436	7787
2000	22306	2504	24810	20218	12056	32274	14633	4198	18831	6447	3709	10156
2001	51722	3149	54871	48844	13086	61930	39174	5548	44722	33244	4882	38126

- Italics represent data taken from Chapman et al. (1994)
- All other data taken from DART web site at www.cbr.washington.edu/dart/

Appendix B

Appendix B-1. Summer chinook hatchery releases (1941-1971). Data are adapted from Waknitz et al. (1995).

Hatchery	Stock	Release River	Class	Year of Plant	Stream	Number Planted
Leavenworth	GCFMP	Entiat	fingerling	41	Entiat R.	640,800
Entiat	GCFMP	Entiat	unknown	41	Entiat R.	150,000
Leavenworth	GCFMP	Entiat	fingerling	42	Entiat R.	85,500
Entiat	GCFMP	Entiat	unknown	42	Entiat R.	50,400
Entiat	GCFMP	Entiat	fingerling	43	Entiat R.	55,900
Entiat	GCFMP	Entiat	unknown	44	Entiat R.	24,900
Entiat	GCFMP	Entiat	unknown	45	Entiat R.	25,700
Entiat	Methow	Entiat	yearling	45	Entiat R.	27,700
Entiat	Carson	Entiat	yearling	45	Entiat R.	8,200
Entiat	Entiat	Entiat	yearling	46	Entiat R.	192,400
Entiat	Entiat	Entiat	unknown	46	Entiat R.	22,300
Entiat	Entiat	Entiat	fingerling	47	Entiat R.	251,400
Entiat	Entiat	Entiat	fingerling	49	Entiat R.	235,200
Entiat	Entiat	Entiat	fingerling	50	Entiat R.	432,600
Entiat	Entiat	Entiat	fingerling	51	Entiat R.	488,500
Entiat	Entiat	Entiat	unknown	51	Entiat R.	110,300
Entiat	Entiat	Entiat	fingerling	48	Entiat R.	396,700
Entiat	Entiat	Entiat	fingerling	52	Entiat R.	281,000
Entiat	Entiat	Entiat	fingerling	53	Entiat R.	404,500
Entiat	Entiat	Entiat	yearling	53	Entiat R.	254,600
Entiat	Entiat	Entiat	yearling	54	Entiat R.	212,000
Entiat	Entiat	Entiat	fingerling	55	Entiat R.	228,800
Entiat	Entiat	Entiat	yearling	55	Entiat R.	212,000
Entiat	Entiat	Entiat	yearling	56	Entiat R.	250,500
Entiat	Entiat	Entiat	fingerling	57	Entiat R.	32,900
Entiat	Entiat	Entiat	yearling	57	Entiat R.	273,900
Entiat	Entiat	Entiat	fingerling	58	Entiat R.	251,300
Entiat	Entiat	Entiat	yearling	58	Entiat R.	137,500
Entiat	Entiat	Entiat	fingerling	59	Entiat R.	522,500
Entiat	Entiat	Entiat	yearling	60	Entiat R.	143,800
Entiat	Entiat	Entiat	yearling	61	Entiat R.	152,300
Entiat	Entiat	Entiat	yearling	62	Entiat R.	316,500
Entiat	Entiat	Entiat	yearling	63	Entiat R.	229,800
Entiat	Entiat	Entiat	fingerling	64	Entiat R.	230,100
Entiat	Sprng Cr.	Entiat	fingerling	64	Entiat R.	990,800
Entiat	Wells	Entiat	yearling	76	Entiat R.	294,000

Appendix B-1. (continued)

Hatchery	Stock	Release River	Class	Year of Plant	Stream	Number Planted
Leavenworth	GCFMP	Methow	fingerling	41	Methow R.	182,000
Winthrop	GCFMP	Methow	fingerling	43	Methow R.	66,600
Winthrop	GCFMP	Methow	fingerling	44	Methow R.	10,600
Winthrop	Entiat	Methow	fingerling	46	Methow R.	480,600
Winthrop	Entiat	Methow	fingerling	47	Methow R.	112,131
Winthrop	Entiat	Methow	fry	47	Methow R.	94,681
Winthrop	Methow	Methow	fry	51	Methow R.	150,341
Winthrop	Methow	Methow	fingerling	52	Methow R.	31,390
Winthrop	Methow	Methow	fry	52	Methow R.	151,140
Winthrop	Methow	Methow	fingerling	56	Methow R.	69,487
Winthrop	Methow	Methow	fry	57	Methow R.	66,937
Leavenworth	GCFMP	Wenatchee	fingerling	41	Icicle R.	135,500
Leavenworth	GCFMP	Wenatchee	fingerling	42	Icicle R.	200,800
Leavenworth	GCFMP	Wenatchee	fingerling	44	Icicle R.	59,000
Leavenworth	Leavenworth	Wenatchee	unknown	46	Icicle R.	9,000
Leavenworth	Leavenworth	Wenatchee	yearling	47	Icicle R.	73,000
Leavenworth	Leavenworth	Wenatchee	fingerling	53	Icicle R.	80,700
Leavenworth	Leavenworth	Wenatchee	fingerling	55	Icicle R.	21,200
Leavenworth	Leavenworth	Wenatchee	fingerling	56	Icicle R.	1,200
Leavenworth	Leavenworth	Wenatchee	fingerling	57	Icicle R.	6,700
Leavenworth	Leavenworth	Wenatchee	fingerling	58	Icicle R.	79,800
Leavenworth	Leavenworth	Wenatchee	fingerling	59	Icicle R.	3,700
Leavenworth	Leavenworth	Wenatchee	fingerling	60	Icicle R.	19,000
Leavenworth	Leavenworth	Wenatchee	fingerling	61	Icicle R.	10,200
Leavenworth	Leavenworth	Wenatchee	fingerling	62	Icicle R.	6,500
Wells	Wells	Mid-Columbia	fingerling	68	Columbia R.	61,000
Wells	Wells	Mid-Columbia	fry	68	Columbia R.	2,077,000
Wells	Wells	Mid-Columbia	fry	69	Columbia R.	3,443,654
Wells	Wells	Mid-Columbia	fry	70	Columbia R.	3,074,086
Wells	Wells	Mid-Columbia	fingerling	70	Columbia R.	989,700
Wells	Wells	Mid-Columbia	yearling	71	Columbia R.	359,000
Wells	Wells	Mid-Columbia	fry	71	Columbia R.	1,452,000

Appendix B-2. Total yearling summer chinook hatchery releases (1979-2001).

Hatchery	Migration year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Winthrop ¹	1978	Winthrop H	Methow	Wells	1976			596000		50% ad+CWT; 80542 #63-17-23; 86733 #63-17-24; 91395 #63-17-31
Winthrop ¹	1979	Winthrop H	Methow	Wells	1977	4/20/79	4/24/79	314000	13.0	Ad+CWT 86,237 #63-18-11; 67,320 of #63-18-12
Winthrop ¹	1982	Winthrop H	Methow	Wells	1980	3/16/82	3/16/82	268000	20.0	
Eastbank	1991	Carlton Acclim Pd	Methow	Met-Oka Comp. ²	1989	4/22/91	5/20/91	420000	10.0	ad+CWT 200,670 #63-56-14; 157,567 #63-8-56.
Eastbank	1992	Carlton Acclim Pd	Methow	Met-Oka Comp.	1990	4/15/92	5/10/92	391650	13.0	100% ad+CWT; 371,483 #63-44-18.
Eastbank	1993	Carlton Acclim Pd	Methow	Met-Oka Comp.	1991	5/12/93	5/12/93	540900	10.0	ad+CWT 377097 #63-46-03.
Eastbank	1994	Carlton Acclim Pd	Methow	Met-Oka Comp.	1992	4/21/94	4/22/94	402641	13.0	100% ad+CWT; 102,241 #63-49-43; 87,252 #63-49-45; 99,588 #63-50-30; 103,555 #63-50-33.
Eastbank	1995	Carlton Acclim Pd	Methow	Met-Oka Comp.	1993	4/24/95	5/11/95	433375	13.0	50% ad+CWT 198,119 #63-57-09; 50% R. Elast. Blue tag; 1.5k PIT tag.
Winthrop ¹	1996	Winthrop H	Methow	Met-Oka Comp.	1994	4/11/96	4/11/96	40498	10.0	100% ad+CWT.
Eastbank	1996	Carlton Acclim Pd	Methow	Met-Oka Comp.	1994	4/26/96	4/30/96	406560	13.0	100% ad+CWT; 192,342 #63-57-60; 195628 #63-57-61; 1.8k PIT tag.
Eastbank	1997	Carlton Acclim Pd	Methow	Met-Oka Comp.	1995	4/20/97	4/20/97	187292	9.0	100% ad+CWT 176,999 #63-60-53; 1.5k PIT Tag; Emerg rel. due to pump failure.
Eastbank	1997	Carlton Acclim Pd	Methow	Met-Oka Comp.	1995	4/8/97	4/9/97	165890	12.4	100% ad+CWT 161,599 #63-60-52; Emerg rel due to high BKD.
Eastbank	1998	Carlton Acclim Pd	Methow	Met-Oka Comp.	1996	4/15/98	4/15/98	298844	4.3	100% ad+CWT; 170,896 #63-01-43; 95,713 #63-03-45.
Eastbank	1999	Carlton Acclim Pd	Methow	Met-Oka Comp.	1997	4/15/99	4/25/99	384909	11.4	100% ad+CWT 365,537 #63-0+9-36; Volitional Rel.

Appendix B-2. continued

Hatchery	Migration year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Eastbank	2000	Carlton Acclim Pd	Methow	Met-Oka Comp.	1998	5/2/00	5/2/00	205269	8.8	100% ad+CWT; 202544 of #63-10-33
Eastbank	2001	Carlton Acclim Pd	Methow	Met-Oka Comp	1999	4/18/01	4/18/01	424363	10.0	100% ad+CWT 63-4-71.
Rocky Reach	1982	Turtle Rock H	Mid-Columbia	Wells	1980	5/13/82	5/13/82	101500	8.0	
Rocky Reach	1983	Turtle Rock H	Mid-Columbia	Wells	1981	3/24/83	3/24/83	176000	17.0	
Turtle Rock	1997	Turtle Rock H	Mid-Columbia	Wells	1995	4/17/97	4/17/97	150000	7.5	100% ad+CWT 143,691 #63-46-07.
Turtle Rock	1998	Turtle Rock H	Mid-Columbia	Wells	1996	4/15/98	5/5/98	202727	6.5	100% ad+CWT 173,445 #63-01-24. 100% PIT tag for Mid-Col Surv
Turtle Rock	1999	Turtle Rock H	Mid-Columbia	Wells	1997	4/21/99	4/21/99	202989	6.1	100% ad+CWT 194,651 #63-06-06.
Turtle Rock	2000	Turtle Rock H	Mid-Columbia	Wells	1998	4/19/00	6/30/00	217319	9.8	100% ad+CWT 215,646 #63-10-32.
Turtle Rock	2001	Turtle Rock H	Mid-Columbia	Wells	1999	4/26/01	4/26/01	192426	8.5	100% ad+CWT #63-4-70.
Turtle Rock	2001	Rocky Reach Dam	Mid-Columbia	Wells	1999	4/17/01	5/27/01	93281	7.0	100% ad+CWT 63-04-70+PIT tag; Transf to Chelan PUD for Study
Turtle Rock	2001	Rocky Reach Dam	Mid-Columbia	Wells	1999	4/26/01	5/22/01	113290	10.0	100% ad+CWT+PIT; Transf to Grant PUD - Surv Sty; Rel Wan/Priest dams.
Wells ³	1974	Wells Fish H	Mid-Columbia	Wells	1972			875800		
Wells ³	1975	Wells Fish H	Mid-Columbia	Wells	1973			673250		
Wells ³	1976	Wells Fish H	Mid-Columbia	Wells	1974	3/16/74	3/16/74	155024	9.0	ad+CWT 118,416 #13-05-11

Appendix B-2. continued

Hatchery	Migration year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Wells ³	1977	Wells Fish H	Mid-Columbia	Wells	1975	4/29/77	4/29/77	94353	7.0	100% ad+CWT 89348 #13-12-03
Wells ³	1978	Wells Fish H	Mid-Columbia	Wells	1976	5/16/77	5/16/77	347185	8.0	ad+CWT 132,677 #63-16-43
Wells	1980	Wells Fish H	Mid-Columbia	Wells	1978	4/6/80	4/6/80	314000	12.0	
Wells	1985	Wells Fish H	Mid-Columbia	Wells	1983	4/16/85	4/16/85	186000	12.0	ad+CWT 73,819 #63-23-26.
Wells	1986	Wells Fish H	Mid-Columbia	Wells	1984	4/22/86	4/30/86	200440	12.0	50% ad+CWT; 49754 of 63-32-24; 50075 of 63-32-25
Wells	1987	Wells Fish H	Mid-Columbia	Wells	1985	4/23/87	4/24/87	394500	9.0	ad+CWT; 51233 #B1-03-08; 51135 #B1-03-09; 51178 #B1-03-10; US/Canada Index.
Wells	1988	Wells Fish H	Mid-Columbia	Wells	1986	4/20/88	4/27/88	193324	10.0	100% ad+CWT; 59,849 #63-44-02; 59405 #63-44-04
Wells	1989	Wells Fish H	Mid-Columbia	Wells	1987	4/24/89	4/25/89	429042	11.0	ad+CWT; 61,740 #63-50-37; 60,818 #63-50-38
Wells	1990	Wells Fish H	Mid-Columbia	Wells	1988	4/9/90	4/28/90	391579	8.0	ad+CWT 153,645 #63-02-62.
Wells	1992	Wells Fish H	Mid-Columbia	Wells	1990	4/20/92	4/27/92	371369	8.0	ad+CWT 122,657 # 63-41-33.
Wells	1993	Wells Fish H	Mid-Columbia	Wells	1991	4/16/93	4/21/93	392330	15.0	ad+CWT 123,585 # 63-46-09.
Wells	1994	Wells Fish H	Mid-Columbia	Wells	1992	4/15/94	4/27/94	331353	12.0	65% ad+CWT 209,245 #63-50-5; 111K Rt Elastomer Rocket Rd tag.
Wells	1995	Wells Fish H	Mid-Columbia	Wells	1993	4/15/95	4/30/95	388248	8.0	100% ad+CWT; 128,528 #63-46-10; 237,154 #63-57-02; 1.5k PIT tag.
Wells	1996	Wells Fish H	Mid-Columbia	Wells	1994	3/26/96	4/9/96	365000	9.0	100% ad+CWT; 108,380 #63-53-24; 242,538 #63-58-38; 1.5k PIT tag.

Appendix B-2. continued

Hatchery	Migration year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Wells	1997	Wells Fish H	Mid-Columbia	Wells	1995	4/1/97	4/18/97	290000	8.6	100% ad+CWT; 182308 #63-41-29; 96,147 #63-41-30; 1.5k PIT Tagged.
Wells	1998	Wells Fish H	Mid-Columbia	Wells	1996	4/15/98	4/24/98	356707	7.5	100% ad+CWT; 189,531 #63-01-34; 136,077 #63-02-17; 23k PIT tag - Surv Study by Douglas PUD.
Wells	1999	Wells Fish H	Mid-Columbia	Wells	1997	4/19/99	6/9/99	381687	6.0	100% ad+CWT; 362,677 #63-06-11; % PIT tag for Surv Study by Douglas PUD.
Wells	2000	Wells Fish H	Mid-Columbia	Wells	1998	4/18/00	5/12/00	457770	7.0	100% ad+CWT; 428,720 #63-10-61
Wells	2001	Wells Fish H	Mid-Columbia	Wells	1999	4/16/01	5/7/01	312098	10.0	100% ad+CWT 63-04-68.
Eastbank	1991	Similkameen Acclim Pd	Similkameen	Met-Oka Comp.	1989	5/1/91	5/21/91	352600	11.0	ad+CWT; 85,304 #63-56-13; 116,821 #63-7-59; Most Migrate - 5/21.
Eastbank	1992	Similkameen Acclim Pd	Similkameen	Met-Oka Comp.	1990	4/10/92	5/19/92	540000	12.0	ad+CWT 367,207 #63-44-17; Volit Rel.
Eastbank	1993	Similkameen Acclim Pd	Similkameen	Met-Oka Comp.	1991	4/5/93	4/9/93	675500	20.0	50% ad+CWT; 361k #63-46-04.
Eastbank	1994	Similkameen Acclim Pd	Similkameen	Met-Oka Comp.	1992	3/24/94	4/7/94	548182	18.0	67% ad+CWT 129,574 # 63-53-15; 124,751 # 63-51-48; 133,923 #63-51-54; 16,729 #63-51-56 Vol rel;
Eastbank	1995	Similkameen Acclim Pd	Similkameen	Met-Oka Comp.	1993	4/1/95	4/2/95	586000	13.0	67% ad +CWT: 180,115 #63-57-06; 191,059 #63-57-08; 33% 200k L. Blue Elastomer Tag.

Appendix B-2. Continued

Hatchery	Migration Year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Eastbank	1996	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1994	3/22/96	4/23/96	536299	13.0	40% ad +CWT 212,446 #63-57-62; 60% 364k L. OR & RD Elast. Tag; 1.5k PIT tag; Vol. Rel.
Eastbank	1997	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1995	4/1/97	4/1/97	587000	13.8	100% ad +CWT: 180,826 #63-55-34; 181,510 #63-55-36; 206,733 #63-60-51. Trans. From Wells H; 1.5k PIT
Eastbank	1998	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1996	3/13/98	3/18/98	507913	17.7	100% ad +CWT; 178,038 #63-01-36; no returns 63-02-18; 148,523 #63-02-20; Rel 1 mo early due to high losses of BKD.
Eastbank	1999	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1997	4/12/99	4/26/99	589591	11.0	100% ad+CWT 558336 #63-06-10
Eastbank	2000	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1998	4/13/00	4/26/00	293064	9.0	100% ad+CWT 282148 #63-11-48
Eastbank	2001	Similkameen Acclim Pd	Similkameen	Met-Ok Comp.	1999	4/11/01	4/25/01	630463	12.8	100% ad+CWT; 63-4-69. No returns.
Eastbank	1991	Dryden Acclim Pd	Wenatchee	Wenatchee	1989	4/19/91	5/24/91	720000	10.0	ad+CWT; 144,905 #63-11-19. Major Migr - May; Vol. Rel.
Eastbank	1992	Dryden Acclim Pd	Wenatchee	Wenatchee	1990	4/15/92	5/22/92	124440	10.0	100% ad+CWT; 119,214 #63-43-37. Volit Rel;
Eastbank	1993	Dryden Acclim Pd	Wenatchee	Wenatchee	1991	4/22/93	5/25/93	191179	11.0	100% ad+CWT: 94,844 #63-46-13; 95,527 #63-42-15. Volit Rel;
Eastbank	1994	Dryden Acclim Pd	Wenatchee	Wenatchee	1992	4/21/94	5/24/94	627331	10.0	100% ad+CWT: 154,550 #63-50-20; 152,661 #63-51-47; 151,641 #63-51-49; 146,213 #63-51-50; 79.5k Apr rel; Volit. Rel.
Eastbank	1995	Dryden Acclim Pd	Wenatchee	Wenatchee	1993	4/20/95	5/17/95	900429	13.0	ad+CWT; 209,347 #63-57-07. 315k rel in Apr; 585k rel in May; 1.2k PIT tag

Appendix B-2. Continued

Hatchery	Migration Year	Release site	Release River	Stock	Brood year	Release start	Release finish	Number released	# per pound	Comment
Eastbank	1996	Dryden Acclim Pd	Wenatchee	Wenatchee	1994	4/10/96	6/4/96	695655	10.0	100% ad+CWT; 222,562 #63-58-39; 223,334 #63-58-40; 352k BWT; Vol Rel; 1.8k PIT tag
Eastbank	1997	Dryden Acclim Pd	Wenatchee	Wenatchee	1995	5/8/97	5/8/97	687439	10.7	100% ad+CWT; 176,104 #63-60-49; 173,253 #63-60-50; 93,709 #63-53-19; 120,184 #63-53-20; 99,614 #63-53-21.
Eastbank	1998	Dryden Acclim Pd	Wenatchee	Wenatchee	1996	4/28/98	4/28/98	600127	10.5	67% ad+CWT 166,637 #63-01-39; 170,184 #63-01-45; 99,047 #63-05-22; 3k PIT tag.
Eastbank	1999	Dryden Acclim Pd	Wenatchee	Wenatchee	1997	4/27/99	4/28/99	438223	10.6	85% ad+CWT 383,399 #63-06-12
Eastbank	2000	Dryden Acclim Pd	Wenatchee	Wenatchee	1998	5/1/00	5/1/00	649612	8.5	100% ad+CWT 629,143 #63-11-51
Eastbank	2001	Dryden Acclim Pd	Wenatchee	Wenatchee	1999	4/27/01	4/27/01	1005554	13.1	100% ad+CWT 63-4-74,75

¹ Data are from Chris Pasley pers. comm. (2/6/02)

² Met-Oka Comp. = Methow-Okanogan Composite stock. This stock is composed of migrating adults trapped at the east fish ladder of Wells Dam. This stock designation is distinguished from the Wells stock that is composed of returns to Wells Hatchery.

³ Data are from the Wells Hatchery (WDFW Fish50_94) database

Appendix B-3. Total sub-yearling summer chinook hatchery releases (1979-2001).

Hatchery	Migration year	Release site	Release river	Stock	Brood year	Release start	Release finish	Total release	Fish per lb	Comment
Rocky Reach	1982	Turtle Rock H	Mid-Columbia	Wells	1980	9/17/81	9/17/81	29500	21.0	
Turtle Rock	1996	Turtle Rock H	Mid-Columbia	Wells	1995	6/27/96	6/28/96	1243600	36.0	50% ad+CWT 164,876 rel at 17/lb as accel. growth fish w/134k # 63-59-63; 197,633 Production # 63-58-46; 3k PIT;
Turtle Rock	1997	Turtle Rock H	Mid-Columbia	Wells	1996	6/30/97	6/30/97	385215	29.1	67% ad+CWT; 175,171 # 63-63-24 & 92,588 #63-01-20; Accelerated Lot; 1.5k PIT Tagged.
Turtle Rock	1997	Turtle Rock H	Mid-Columbia	Wells	1996	6/30/97	6/30/97	477300	61.5	40% ad+CWT 187,017 #63-01-23; Production Lot; 40%- 187,017 PIT tag;
Turtle Rock	1998	Turtle Rock H	Mid-Columbia	Wells	1997	6/26/98	6/26/98	521480	44.5	ad+CWT 192,649 #63-05-16.
Turtle Rock	1998	Turtle Rock H	Mid-Columbia	Wells	1997	6/26/98	6/26/98	508060	24.1	100% ad+CWT 490,729 #63-02-14; Accel rearing program.
Turtle Rock	1999	Turtle Rock H	Mid-Columbia	Wells	1998	6/23/99	6/23/99	307571	23.4	100% ad+CWT 277,022 #63-06-31; Accelerated Rearing Program.
Turtle Rock	1999	Turtle Rock H	Mid-Columbia	Wells	1998	6/18/99	6/18/99	301777	47.8	100% ad+CWT 284,747 #63-09-37; Normal Rearing Program.
Turtle Rock	2000	Turtle Rock H	Mid-Columbia	Wells	1999	7/5/00	7/5/00	369026	46.0	200k ad+CWT 200,293 #63-01-76.
Turtle Rock	2000	Turtle Rock H	Mid-Columbia	Wells	1999	7/5/00	7/5/00	347946	24.0	200k ad+CWT 186,900 #63-01-77; Accel. Growth.
Turtle Rock	2001	Turtle Rock H	Mid-Columbia	Wells	2000	7/5/01	7/5/01	604892	42.0	217k ad+CWT #63-06-71.
Turtle Rock	2001	Turtle Rock H	Mid-Columbia	Wells	2000	7/5/01	7/5/01	449302	27.0	200k ad+CWT #63-06-67; Accel. growth
<i>Wells</i>	<i>1974</i>	<i>Wells H Fish</i>	<i>Mid-Columbia</i>	<i>CR</i>	<i>1973</i>	<i>6/12/74</i>	<i>6/12/74</i>	<i>1575000</i>	<i>107.0</i>	
<i>Wells</i>	<i>1974</i>	<i>Wells H Fish</i>	<i>Mid-Columbia</i>	<i>CR</i>	<i>1973</i>	<i>6/30/74</i>	<i>6/30/74</i>	<i>872800</i>	<i>25.0</i>	
<i>Wells</i>	<i>1975</i>	<i>Wells H Fish</i>	<i>Mid-Columbia</i>	<i>Wells</i>	<i>1974</i>	<i>6/20/75</i>	<i>6/20/75</i>	<i>284700</i>	<i>17.0</i>	
<i>Wells</i>	<i>1975</i>	<i>Wells H Fish</i>	<i>Mid-Columbia</i>	<i>Wells</i>	<i>1974</i>	<i>6/26/75</i>	<i>6/26/75</i>	<i>1042000</i>	<i>112.0</i>	

Appendix B-3. (continued)

Hatchery	Migration year	Release site	Release river	Stock	Brood year	Start date	End date	Total release	# per lb	Comment
Wells	1976	Wells H Fish	Mid-Columbia	Wells	1975	6/7/76	6/7/76	668390	33.0	
Wells ¹	1976	Wells H Fish	Mid-Columbia	Wells	1975	6/7/76	6/7/76	3000904	167.0	
Wells	1977	Wells H Fish	Mid-Columbia	Wells	1976	5/27/77	6/14/77	761243	34.0	ad+CWT; 149,308 #63-16-07, 99113 #63-16-54; 145,946 #63-16-42 @ 160/lb
Wells ¹	1978	Wells H Fish	Mid-Columbia	Wells	1977	5/26/78	5/26/78	100000	70.0	
Wells	1978	Wells H Fish	Mid-Columbia	Wells	1977	6/13/78	6/16/78	397682	43.0	ad+CWT 153,604 #63-17-62
Wells	1978	Wells H Fish	Mid-Columbia	Wells	1977	6/26/78	6/26/78	155000	45.0	100% ad+CWT 154,060 #63-17-49
Wells	1979	Wells H Fish	Mid-Columbia	Wells	1978	5/11/79	5/11/79	586955	89.0	
Wells	1979	Wells H Fish	Mid-Columbia	Wells	1978	5/18/79	5/19/79	1677110	130.0	
Wells	1980	Wells H Fish	Mid-Columbia	Wells	1979	5/31/80	5/31/80	2323963	61.0	
Wells	1981	Wells H Fish	Mid-Columbia	Wells	1980	5/6/81	5/13/81	2271500	50.0	
Wells	1982	Wells H Fish	Mid-Columbia	Wells	1981	4/27/82	5/26/82	2611500	43.0	40k Rel - 4/27.
Wells	1983	Wells H Fish	Mid-Columbia	Wells	1982	5/17/83	5/17/83	1433000	34.0	
Wells	1984	Wells H Fish	Mid-Columbia	Wells	1983	5/30/84	5/30/84	1240865	46.0	ad+CWT 202,276 #63-28-45; 101,653 FB LA-S-1.
Wells	1985	Wells H Fish	Mid-Columbia	Wells	1984	5/10/85	5/18/85	630660	75.0	Volit rel; 20k FB.
Wells	1985	Wells H Fish	Mid-Columbia	Wells	1984	5/29/85	5/31/85	701312	72.0	ad+CWT 102,605 #63-32-19; 104,678 #63-32-20; 100k ad+FB.
Wells	1985	Wells H Fish	Mid-Columbia	Wells	1984	7/25/85	7/25/85	112350	35.0	50% ad+CWT; 53,040 #63-32-34.
Wells	1986	Wells H Fish	Mid-Columbia	Wells	1985	5/29/86	6/2/86	1644967	60.0	ad+CWT 49,996 #63-34-60; 49,996 #63-34-61; 49,996 #63-34-62; 48,447 #63-34-63; 100k FB;
Wells	1986	Wells H Fish	Mid-Columbia	Wells	1985	7/30/86	7/30/86	146650	40.0	ad+CWT 35,004 #H1-07-07.

Appendix B-3. (continued)

Hatchery	Migration year	Release site	Release river	Stock	Brood year	Release date	Detection date	Total release	# per lb	Comment
Wells	1987	Methow R	Methow	Wells	1986	6/12/87	6/12/87	212500	45.0	100% ad+CWT 212,413 #63-31-13.
Wells	1987	Wells H Fish	Mid-Columbia	Wells	1986	6/30/87	6/30/87	313000	33.0	35% ad+CWT 115,271 #63-42-56
Wells	1987	Wells H Fish	Mid-Columbia	Wells	1986	5/26/87	5/28/87	493000	60.0	35% ad+CWT 119,857 #63-42-55
Wells	1988	Wells H Fish	Mid-Columbia	Wells	1987	5/22/88	5/24/88	1562500	46.0	250k #63-52-01 none recovered; 124,313 #63-52-02
Wells	1988	Wells H Fish	Mid-Columbia	Wells	1987	7/17/88	7/17/88	197000	21.0	
Wells	1989	Wells H Fish	Mid-Columbia	Wells	1988	5/27/89	5/27/89	1370401	59.0	100kFB.
Wells	1989	Wells H Fish	Mid-Columbia	Wells	1988	5/9/89	5/9/89	386269	111.0	
Wells	1989	Wells H Fish	Mid-Columbia	Wells	1988	7/21/89	7/21/89	411387	29.0	
Wells	1990	Wells H Fish	Mid-Columbia	Wells	1989	5/22/90	5/25/90	1310656	55.0	ad+CWT 99,749 #63-13-47; 75,600 #63-13-52; 100k FB; Most migrated 5/25.
Wells	1990	Wells H Fish	Mid-Columbia	Wells	1989	7/19/90	7/20/90	210473	16.0	25% ad+CWT 48,966 #63-11-49.
Wells	1991	Wells H Fish	Mid-Columbia	Wells	1990	6/24/91	6/24/91	329669	36.0	65% ad+CWT 215,672 #63-59-13 & 70k FB.
Wells	1991	Wells H Fish	Mid-Columbia	Wells	1990	6/8/91	6/8/91	436024	18.0	151.9 mm mean len; Accel. Growth Group.
Wells	1992	Wells H Fish	Mid-Columbia	Wells	1991	6/19/92	6/22/92	493919	25.0	50% ad+CWT 220,930 #63-41-39; 70k FB.
Wells	1992	Wells H Fish	Mid-Columbia	Wells	1991	1/21/92	4/19/92	630238	146.0	Excess Rel - Size range = 70-550/lb.
Wells	1994	Wells H Fish	Mid-Columbia	Wells	1993	6/22/94	6/28/94	187382	27.0	100% ad+CWT 183,199 #63-51-45; 3.6k PIT tag; Vol rel.
Wells	1995	Wells H Fish	Mid-Columbia	Wells	1994	6/15/95	6/26/95	450935	20.0	100% ad+CWT 203,921 #63-55-46; 218,042 #63-57-03
Wells	1996	Wells H Fish	Mid-Columbia	Wells	1995	6/13/96	6/15/96	408000	25.0	100% ad+CWT 156,542 #63-60-44; 225,604 #63-58-41
Wells	1997	Wells H Fish	Mid-Columbia	Wells	1996	6/18/97	6/25/97	473000	23.0	100% ad+CWT 226,880 #63- 63-23; 228,703 #63-60-54; 3k PIT Tagged.
Wells	1998	Wells H Fish	Mid-Columbia	Wells	1997	6/4/98	6/15/98	541923	33.0	100% ad+CWT 513,016 #63-06-02.

Appendix B-3. (continued)

Hatchery	Migration year	Release site	Release river	Stock	Brood year	Release date	Detection date	Total release	# per lb	Comment
Wells	1999	Wells H Fish	Mid-Columbia	Wells	1998	6/18/99	6/21/99	370617	24.8	100% ad+CWT 354,477 #63-10-18.
Wells	2000	Wells H Fish	Mid-Columbia	Wells	1999	6/19/00	6/19/00	363600	18.5	100% ad+CWT 340,755 #63-02-67; 6k PIT tag.
Wells	2001	Wells H Fish	Mid-Columbia	Wells	2000	6/20/01	6/21/01	498500	28.9	100% ad+CWT #63-07-75; 6k PIT tag.

¹ Released as fry.

Italicized entries are as reported in the Wells Hatchery (WDFW Fish50_94) database

Appendix B-4. Location and number of summer chinook trapped for upper Columbia River hatchery broodstock purposes, 1980-2001. Table courtesy of Washington Department of Fish and Wildlife, 2002.

Brood Year	Trapping Location	Broodstock #	Brood Year	Trapping Location	Broodstock #
1980	5/	2394	1993	2/	483
1981	5/	1764	1994	4/	1707
1982	5/	1369	1994	3/	700
1983	5/	1770	1994	2/	417
1984	5/	1319	1995	4/	1651
1985	5/	1689	1995	3/	641
1986	5/	1812	1995	2/	402
1986	1/	46	1996	4/	1393
1987	5/	1275	1996	3/	550
1988	5/	1364	1996	2/	336
1989	4/	1342	1997	4/	1329
1989	1/	300	1997	3/	522
1989	2/	336	1997	2/	243
1990	4/	703	1998	4/	1233
1990	1/	455	1998	3/	587
1990	2/	84	1998	2/	474
1991	4/	969	1999	4/	1245
1991	3/	322	1999	3/	555
1991	2/	128	1999	2/	510
1992	4/	618	2000	4/	1262
1992	3/	122	2000	3/	557
1992	2/	335	2000	2/	493
1993	4/	430	2001	4/	1361
1993	3/	822	2001	3/	558
			2001	2/	461

1/- Summer chinook trapped from the West ladder at Wells Dam.

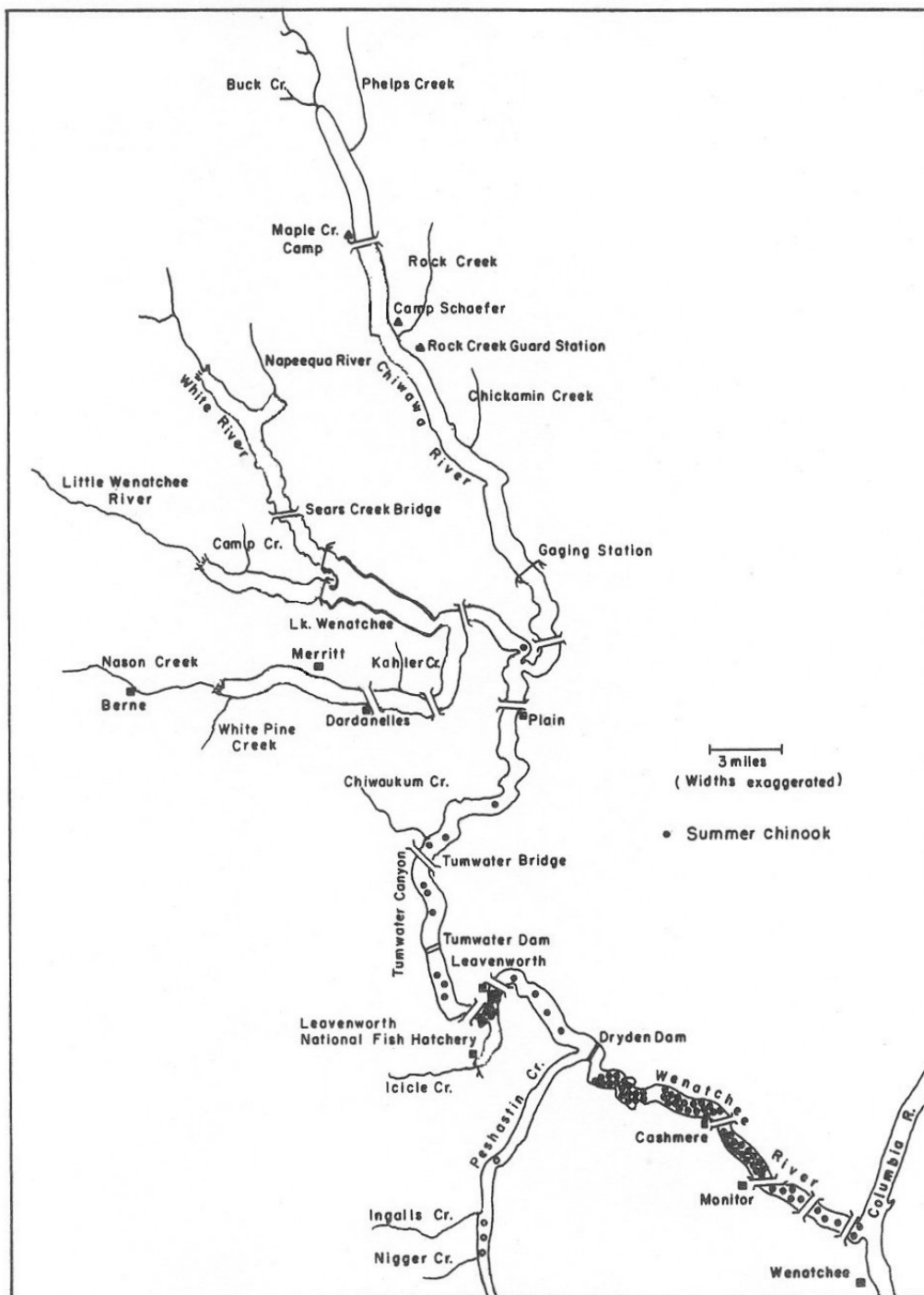
2/- Summer chinook trapped at Dryden and Tumwater Dams in the Wenatchee River Basin.

3/- Summer chinook trapped from the East ladder at Wells Dam.

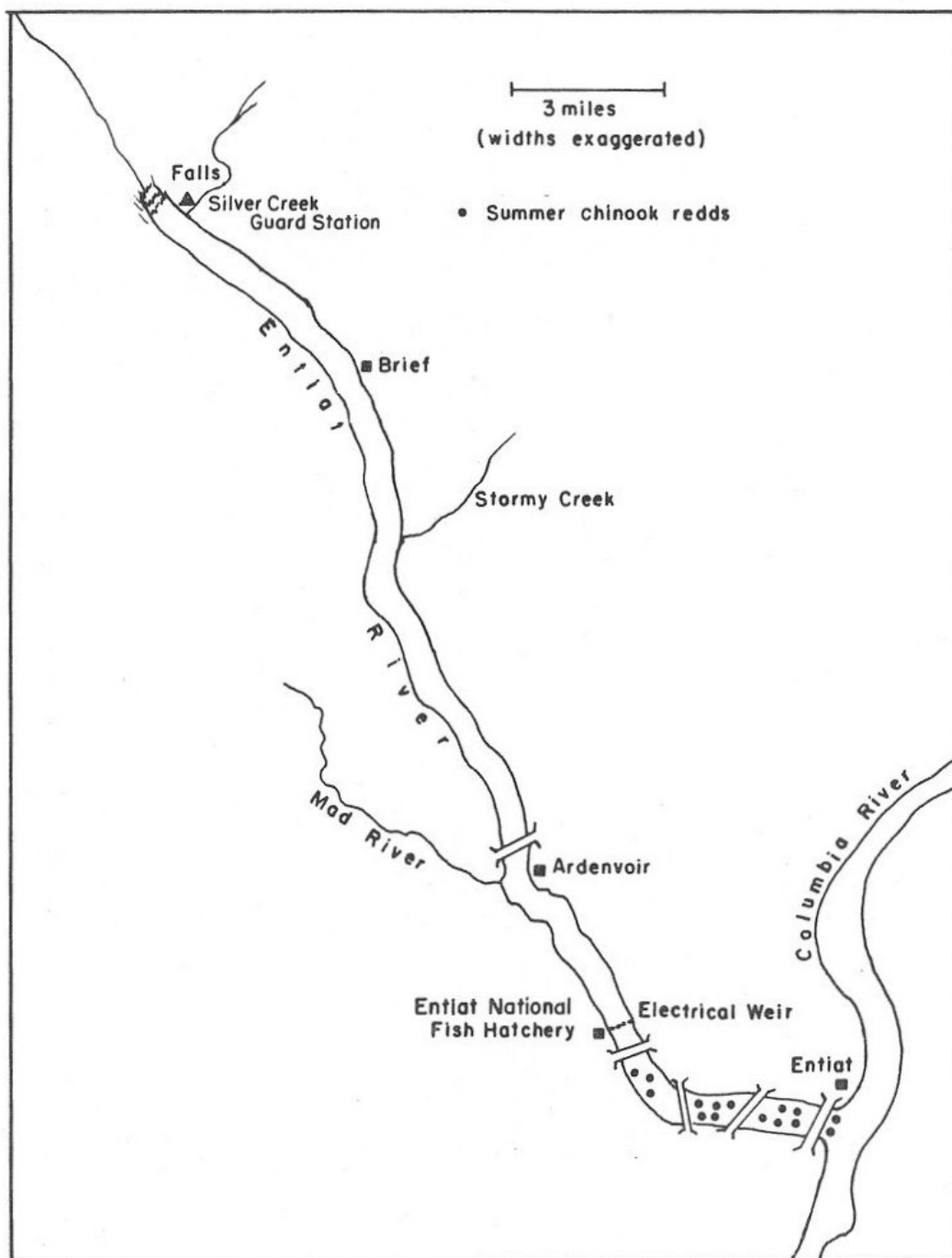
4/- Summer chinook trapped from the volunteer channel at Wells Dam Fish Hatchery.

5/- Summer chinook trapped from the West ladder at Wells Dam and from the volunteer channel at Wells Dam Fish Hatchery. The proportions from each location are unknown.

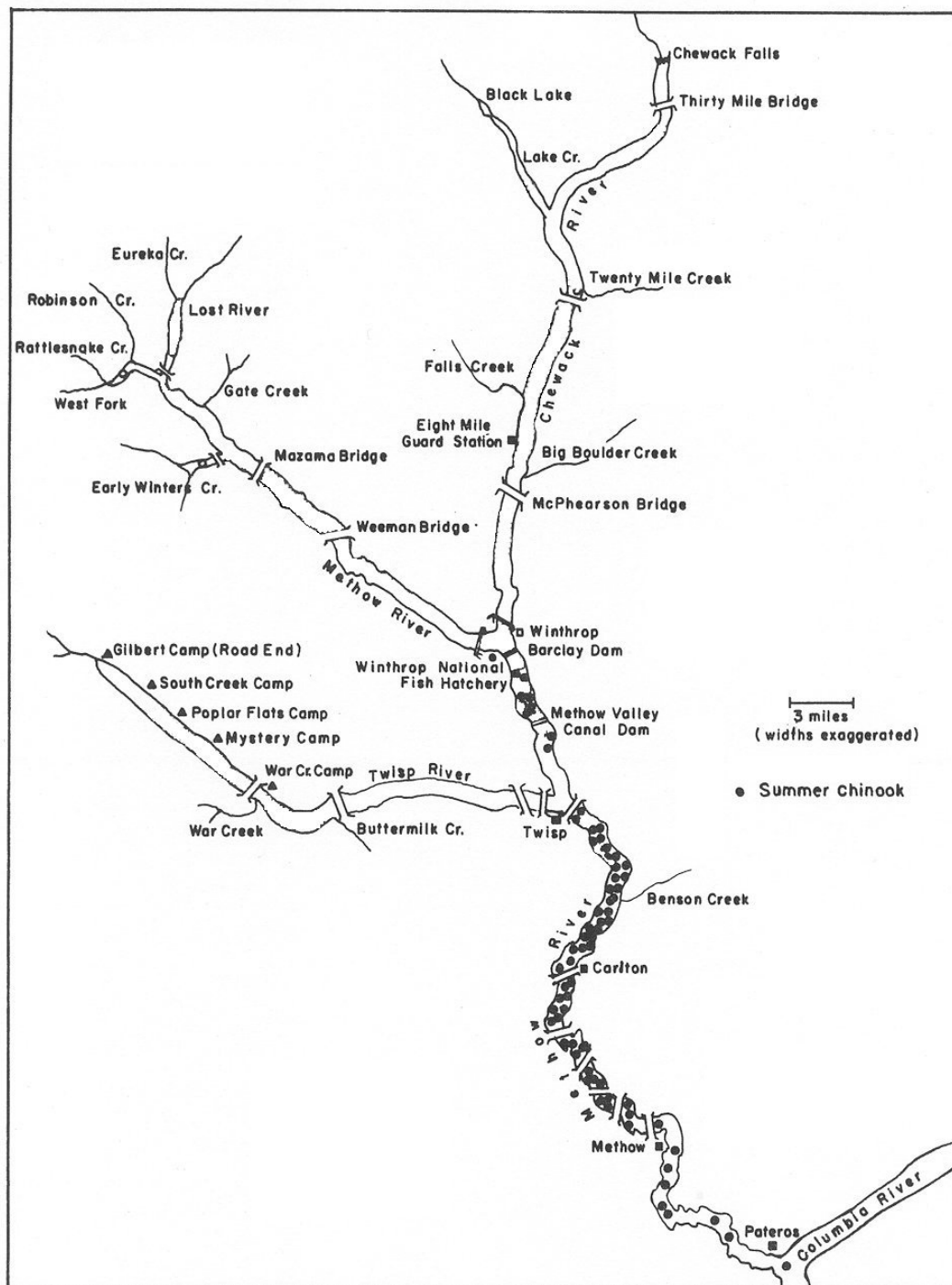
Appendix C



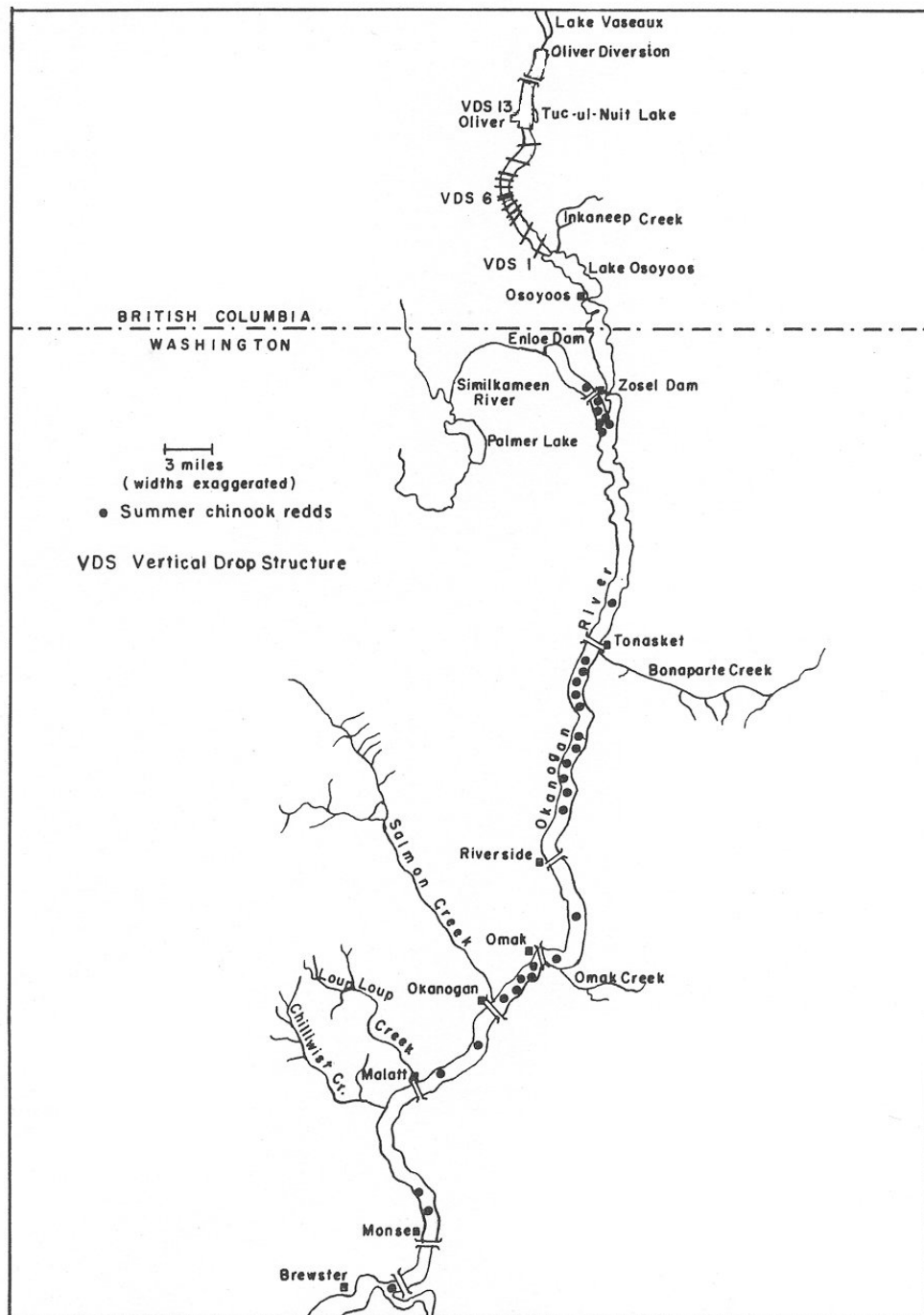
Appendix C-1. Map showing 1964 Wenatchee River basin summer chinook spawning areas. Data are from French and Wahle (1965).



Appendix C-2. Map showing 1964 Entiat River basin summer chinook spawning areas. Data are from French and Wahle (1965).



Appendix C-3. Map showing 1964 Methow River basin summer chinook spawning areas. Data are from French and Wahle (1965).



Appendix C-4. Map showing 1964 Okanogan River basin summer chinook spawning areas. Data are from French and Wahle (1965).

Appendix C-5. Number of summer chinook salmon redds counted during aerial and ground surveys in the Wenatchee, Methow, Okanogan, Similkameen, and Entiat rivers (1956-2000).

Year	Wenatchee River ^a		Methow River		Okanogan River		Similkameen River		Entiat River	
	Aerial	Ground	Aerial	Ground	Aerial	Ground	Aerial	Ground	Aerial	Ground
1956			109		37					
1957			451		53		30			
1958			335		94		30			
1959			130		50		31			
1960	502		194		29		23			
1961	872		120		NA					
1962	1035		678		NA					
1963	1223		298		9		17			
1964	1113		795		112		51			
1965	704		562		109		67			
1966	1260		1275		389		154			
1967	1219		733		149		77		55	
1968	1542		659		232		107			
1969	1154		329		103		83			
1970	1333		705		656		357			
1971	1419		562		310					
1972	1364		325		182		55		5	
1973	1144		366		138		64		24	
1974	1155		223		113		130		0	
1975	925		432		273		201		0	
1976	1106		191		107		184		6	
1977	1365		365		276		139		4	
1978	1956		518		195		268		13	
1979	1698 ^b		622		173		138		6	
1980	2024		345		118		172		8	
1981	1469		195		55		121		0	
1982	1140 ^b		142		23		59		5	
1983	723		65		36		57		3	
1984	1332		162		235		301		0	
1985	1058		164		138		309		0	
1986	1322		169		197		300		0	
1987	2025	2955	211	251	201	205	164	197	14	
1988	1494	2102	123	NA	113	NA	191	NA	5	
1989	1849	3331	126	520	134	NA	221	NA	0	
1990	2205	2479	229	409	88	47	94	147	0	
1991	1838	2180	120	153	55	64	68	91		3
1992	1213	2328	91	107	35	53	48	57		0
1993	1530	2334	116	154	144	162	152	288		0
1994	1615	2424	280	310	372	374	463	777		15

Appendix C-5. (Continued)

Year	Wenatchee River ^a		Methow River		Okanogan River		Similkameen River		Entiat River	
	Aerial	Ground	Aerial	Ground	Aerial	Ground	Aerial	Ground	Aerial	Ground
1995	1179	1872	296	357	260	267	337	616		46
1996	NA	1435	NA	181	100	116	252	419		53
1997	NA	1388	NA	205	149	158	297	486		30
1998	NA	1660	NA	225	75	88	238	276		46
1999	NA	2188	NA	448	222	369	903	1275		47
2000	NA	2022	NA	500	384	549	549	993		99
2001	NA	2857	NA	674	883	1108	865	1540		119

^a Recorded as peak counts.

Appendix C-6. Number of mid-Columbia River summer chinook carcasses recovered in the Wenatchee, Methow, Okanogan, and Similkameen river basins (1988-2001). Data are from Washington Department of Fish and Wildlife and Chelan County Public Utility District spawning ground surveys.

year	Wenatchee			Methow			Okanogan			Similkameen		
	male	female	total	male	female	total	male	female	total	male	female	total
1988	38	72	110	7	16	23	0	1	1	13	22	25
1989	36	63	99	NA	NA	NA	NA	NA	NA	6	14	20
1990	24	41	65	12	9	21	1	0	1	5	8	13
1991	77	126	203	10	16	26	2	1	3	6	9	15
1992	76	148	224	27	26	53	16	3	19	70	34	104
1993	386	562	648	33	32	65	21	20	41	48	26	74
1994	154	146	300	55	32	87	14	13	27	29	96	125
1995	63	184	247	23	86	109	18	13	31	74	164	238
1996	84	134	218	32	57	89	4	5	9	60	162	222
1997	77	167	245	21	55	76	3	11	14	52	174	226
1998	145	270	415	186	134	320	8	16	24	166	177	343
1999	NA	NA	1753	213	239	452	34	43	77	146	495	641
2000	236	317	556	138	209	347	41	52	93	210	411	621
2001	488	397	885	536	317	853	210	142	352	779	447	1246

Italicized figures are reported as the number of carcasses that were scale-sampled carcass data, and therefore may underestimate of the number of carcasses.

Appendix C-7. Sex, origin, and length data for mid-Columbia River summer chinook carcasses sampled in the Wenatchee, Entiat, Methow, Okanogan, and Similkameen river basins (1993-2000). Data for the Entiat River are from the US Fish and Wildlife Service spawning surveys. All other data are from the Washington Department of Fish and Wildlife mid-Columbia summer chinook carcass database.

River	Year	Number sampled	Sex		Origin			Average Length	
			M	F	H ¹	W ²	WR ³	Fork ⁴	POH ⁵
Wenatchee	1993	964	443	520	67	488	409	78	72
Wenatchee	1994	230	125	105	25	143	62	67	73
Wenatchee	1995	185	58	127	22	43	120	67	74
Wenatchee	1996	440	180	260	21	128	291	91	74
Wenatchee	1997	600	228	371	67	172	358	90	73
Wenatchee	1998	1151	527	624	164	216	759	89	72
Wenatchee	1999	1458	635	814	478	207	764	89	72
Wenatchee	2000	1435	611	821	340	347	748	90	71
Entiat	1998	8	6	2	1	7	NA	78	NA
Entiat	1999	8	4	4	3	5	NA	84	NA
Entiat	2000	54	24	30	15	35	NA	90	NA
Entiat	2001	182	68	90	107	51	NA	NA	NA
Methow	1993	56	28	28	20	25	11	71	70
Methow	1994	207	88	119	107	62	38	84	68
Methow	1995	109	23	86	56	18	35	89	73
Methow	1996	80	34	46	24	16	40	85	70
Methow	1997	72	19	53	16	22	34	91	75
Methow	1998	311	181	130	122	59	130	81	65
Methow	1999	452	213	239	202	37	213	87	66
Methow	2000	344	138	206	98	80	166	88	72
Okanogan	1993	34	17	17	19	13	2	74	68
Okanogan	1994	84	27	57	56	20	8	85	70
Okanogan	1995	31	18	13	21	3	7	89	71
Okanogan	1996	8	4	4	4	2	2	81	64

Appendix C-7. (Continued)

River	Year	Number sampled	Sex		Origin			Average Length	
			M	F	H ¹	W ²	WR ³	Fork ⁴	POH ⁵
Okanogan	1997	13	2	11	10	1	2	89	74
Okanogan	1998	21	7	14	8	3	10	84	67
Okanogan	1999	77	34	43	47	12	18	86	69
Okanogan	2000	93	41	52	47	23	23	82	67
Similkameen	1993	82	58	24	41	39	2	72	69
Similkameen	1994	334	150	184	228	100	6	87	70
Similkameen	1995	238	72	164	181	21	36	91	74
Similkameen	1996	190	57	132	144	28	5	87	73
Similkameen	1997	209	46	163	139	43	27	89	73
Similkameen	1998	308	149	159	173	58	77	84	67
Similkameen	1999	641	146	495	410	72	159	89	72
Similkameen	2000	621	209	411	458	73	90	86	69

¹H = hatchery propagated fish²W = wild origin fish³WR = wild reservoir, WDFW scale analysis indicated that these fish spent one winter rearing in reservoirs prior to ocean entry⁴Fork = fork length⁵POH = length measured post orbital to hypural plate

Appendix C-8. Age composition of mid-Columbia summer chinook at Wenatchee, Methow, Okanogan, and Similkameen river basin spawning grounds (1993-2000). Data are from the WDFW database on carcass surveys

River	Year	Sample size	Age										
			0.1	0.2	0.3	0.4	0.5	1.0	1.1	1.2	1.3	1.4	1.5
Wenatchee	1993	964	1	14	200	122	0	1	20	301	302	3	0
Wenatchee	1994	230	2	4	53	54	0	0	4	45	67	1	0
Wenatchee	1995	185	0	1	7	23	0	0	5	32	87	30	0
Wenatchee	1996	440	0	3	61	31	0	0	6	125	199	13	2
Wenatchee	1997	600	2	5	81	82	0	2	6	142	257	23	0
Wenatchee	1998	1152	1	10	125	88	1	0	23	310	575	19	0
Wenatchee	1999	1458	3	2	96	107	0	1	8	404	814	23	0
Wenatchee	2000	1435	10	40	126	170	1	3	34	224	773	54	0
Methow	1993	56	0	0	9	3	0	0	2	23	18	1	0
Methow	1994	207	1	0	28	19	0	0	2	36	121	0	0
Methow	1995	109	0	1	0	10	0	0	1	5	62	30	0
Methow	1996	80	0	0	9	2	0	0	3	18	33	14	1
Methow	1997	72	0	0	8	14	0	0	2	13	30	5	0
Methow	1998	311	0	8	35	17	0	1	19	127	100	4	0
Methow	1999	452	0	2	24	12	0	1	2	141	261	9	0
Methow	2000	344	1	11	32	40	0	1	12	27	209	12	0
Okanogan	1993	34	0	0	7	2	0	0	0	21	4	0	0
Okanogan	1994	84	0	1	7	4	0	0	0	7	65	0	0
Okanogan	1995	31	0	0	1	2	0	0	1	5	16	6	0
Okanogan	1996	8	0	1	1	0	0	0	1	2	3	0	0
Okanogan	1997	13	0	0	1	0	0	0	0	0	11	1	0
Okanogan	1998	21	1	0	2	1	0	0	1	8	6	2	0
Okanogan	1999	77	0	0	7	5	0	2	0	21	42	0	0
Okanogan	2000	92	0	2	12	13	0	1	13	6	45	1	0

Appendix C-8. (Continued)

River	Year	Sample size	Age										
			0.1	0.2	0.3	0.4	0.5	1.0	1.1	1.2	1.3	1.4	1.5
Similkameen	1993	82	0	0	23	4	0	0	1	48	6	0	0
Similkameen	1994	335	1	1	33	38	0	1	9	34	217	0	0
Similkameen	1995	238	0	1	5	14	0	0	1	38	86	93	0
Similkameen	1996	190	0	4	11	3	0	1	3	41	95	31	1
Similkameen	1997	209	0	1	29	11	0	0	3	22	126	17	0
Similkameen	1998	308	0	1	41	16	0	0	11	132	69	38	0
Similkameen	1999	641	0	0	33	40	1	0	0	92	468	6	1
Similkameen	2000	621	3	10	32	28	0	4	50	27	413	54	0

Appendix D

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearling releases for broodyear 1989.

Release year: 1991

CWT codes: Total tagged= 144905
 63-11-19 144905 Total released= 720000

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			58	35	12		105
Canada ocean		33	72	25	10		140
Washington ocean			11				11
Washington estuary sport		4					4
Washington freshwater		5		4			9
Oregon ocean		2	18				20
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		21		5	2		28
Columbia River sport							
California ocean				4			4
Ceremonial & subsistence			1	239	22		262
Spawning ground							
Wenatchee River			56	133	75	8	272
Methow River							
Okanogan River				15			15
Similkameen River							
Columbia River- Hanford							
Hatchery							
Dryden		1	7	4			12
Eastbank							
Tumwater/ Chiwawa							
Leavenworth							
Crisp							
Big Creek							
Cowlitz							
Priest Rapids				2			2
Wells		20	16	44	11	2	93
Total	0	86	239	510	132	10	977

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1990.

Release year: 1992

CWT codes: Total tagged= 119214
 63-43-37 119214 Total released= 124440

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			4		3	7
Canada ocean		4	11	6		21
Washington ocean						
Washington estuary sport						
Washington freshwater						
Oregon ocean						
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River		4		25	42	71
Methow River						
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden			1			1
Eastbank						
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells		3	3	5	1	12
Total	0	11	19	36	46	112

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1991.

Release year: 1993

CWT codes:		Total tagged=	190371
63-46-13	94844	Total released=	191179
63-46-15	95527		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean				11		11
Canada ocean		11				11
Washington ocean						
Washington estuary sport						
Washington freshwater	18			1		19
Oregon ocean					2	2
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River					14	14
Methow River						
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden						
Eastbank						
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells		1	3	3		7
Total	18	12	3	15	16	64

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1992

Release year: 1994

CWT codes:		Total tagged=	605065
63-50-20	154550	Total released=	627331
63-51-47	152661		
63-51-49	151641		
63-51-50	146213		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			47	31	3	81
Canada ocean		20	1	8	2	31
Washington ocean			1	4		5
Washington estuary sport						
Washington freshwater						
Oregon ocean			4	16		20
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence			16	11		27
Spawning ground						
Wenatchee River			59	278	24	361
Methow River						
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden			1		6	7
Eastbank						
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells			19	35	6	60
Total	0	20	148	383	41	592

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1993.

Release year: 1995

CWT codes:		Total tagged=	209347
63-57-07	209347	Total released=	900429

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			3	8	4	15
Canada ocean		2				2
Washington ocean						
Washington estuary sport						
Washington freshwater						
Oregon ocean			3			3
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River			14	35	18	67
Methow River				4		4
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden				4		4
Eastbank						
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells			5	7	5	17
Total	2	0	25	58	27	112

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1994.

Release year: 1996

CWT codes:		Total tagged=	445896
63-58-39	222562	Total released=	695655
63-58-40	223334		

		Age					Total
		1.0	1.1	1.2	1.3	1.4	
Fishery							
	Alaska ocean		1	236	176	6	419
	Canada ocean		18	15	75	5	113
	Washington ocean		9		10		19
	Washington estuary sport						
	Washington freshwater						
	Oregon ocean			11	15	5	31
	Oregon estuary sport						
	Oregon freshwater						
	Columbia River commercial		1	5	1		7
	Columbia River sport						
	California ocean						
	Ceremonial & subsistence			2	3		5
Spawning ground							
	Wenatchee River		7	148	635	79	869
	Methow River			21	16	3	40
	Okanogan River						
	Similkameen River				3		3
	Columbia River- Hanford				13		13
Hatchery							
	Dryden			42	134	23	199
	Eastbank			1	3	1	5
	Tumwater/ Chiwawa			3			3
	Leavenworth			2			2
	Crisp		1				1
	Big Creek						
	Cowlitz						
	Priest Rapids						
	Wells		4	36	37	3	80
Total		0	41	522	1121	125	1809

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1995.

Release year: 1997

CWT codes:		Total tagged=	662864
63-60-49	176104	Total released=	687439
63-60-50	173253		
63-53-19	93709		
63-53-20	120184		
63-53-21	99614		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean		7	137	167		311
Canada ocean		11	46	28		85
Washington ocean			19	4		23
Washington estuary sport						
Washington freshwater						
Oregon ocean			7	6	3	16
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial			3	5		8
Columbia River sport						
California ocean			5	3		8
Ceremonial & subsistence			24	1		25
Spawning ground						
Wenatchee River		9	159	497		665
Methow River			4	18		22
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden		3	54	73		130
Eastbank			2	4		6
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Priest Rapids						
Wells		13	16	34		63
Total	0	43	476	840	3	1362

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1996.

Release year: 1998

CWT codes:		Total tagged=	435868
63-01-39	166637	Total released=	600127
63-01-45	170184		
63-05-22	99047		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			45			45
Canada ocean		5	37			42
Washington ocean						
Washington estuary sport						
Washington freshwater						
Oregon ocean			5	10		15
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River		5	51			56
Methow River			3			3
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden		2	21			23
Eastbank						
Tumwater/ Chiwawa			1			1
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells			9			9
Total	0	12	172	10	0	194

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1997.

Release year: 1999

CWT codes:		Total tagged=	383399
63-06-12	383399	Total released=	438223

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean						
Canada ocean		48				48
Washington ocean		23				23
Washington estuary sport						
Washington freshwater						
Oregon ocean			186			186
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport	8	14				22
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River		48				48
Methow River		12				12
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden		38				38
Eastbank	1					1
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek						
Cowlitz						
Priest Rapids						
Wells		2				2
Total	9	185	186	0	0	380

Appendix D-1. Fate of Wenatchee River CWT summer chinook yearlings releases for broodyear 1998

Release year: 2000

CWT codes:		Total tagged=	629143
63-11-51	629143	Total released=	649612

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean						
Canada ocean						
Washington ocean						
Washington estuary sport						
Washington freshwater	12					12
Oregon ocean		42				42
Oregon estuary sport						
Oregon freshwater	4					4
Columbia River commercial	11					11
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Wenatchee River						
Methow River						
Okanogan River	13					13
Similkameen River						
Columbia River- Hanford						
Hatchery						
Dryden						
Eastbank						
Tumwater/ Chiwawa						
Leavenworth						
Crisp						
Big Creek	1					1
Cowlitz	1					1
Priest Rapids						
Wells						
Total	42	42	0	0	0	84

Appendix D-2. Fate of Methow River CWT summer chinook yearlings releases for broodyear 1976.

Release year: 1978

CWT codes:	Total tagged=	258670
63-17-23 80542	Total released=	596000
63-17-24 86733		
63-17-31 91395		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			22	4			26
Alaska freshwater							
Canada ocean		27	69	19			115
Canada freshwater							
Washington ocean		8	12	5			25
Washington estuary sport							
Washington freshwater							
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean			2				2
Ceremonial & subsistence				1	1		2
Spawning ground							
Methow River							
Okanogan River							
Similkameen River							
Columbia River- Hanford							
Hatchery							
Wells		1	10	13	1		25
Priest Rapids			1	1			2
Lyons Ferry							
Total	0	36	116	43	2	0	197

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1977

Release year: 1979

CWT codes: Total tagged= 153557
 63-18-11 86237 Total released= 314000
 63-18-12 67320

	Age						total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean				2			2
Canada ocean		3	4				7
Washington ocean							
Washington estuary sport							
Washington freshwater							
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial	3						3
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Methow River							
Okanogan River							
Similkameen River							
Columbia River- Hanford							
Hatchery							
Wells	1	5	11	1			18
Priest Rapids			1	3			4
Lyons Ferry							
Total	4	8	16	6	0	0	34

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1989.

Release year: 1991

CWT codes:		Total tagged=	358237
63-56-14	200670	Total released=	420000
63-08-56	157567		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			107	134	20	2	263
Canada ocean		78	221	133	49		481
Washington ocean			59				59
Washington estuary sport		9	6				15
Washington freshwater		3	15		3		21
Oregon ocean		8	15				23
Oregon estuary sport		4					4
Oregon freshwater							
Columbia River commercial	7	16	21	15	13		72
Columbia River sport		24					24
California ocean							
Ceremonial & subsistence		15	17	629	60	7	728
Spawning ground							
Methow River			103	322	227	7	659
Okanogan River				61			61
Similkameen River					8		8
Columbia River- Hanford							
Hatchery							
Wells	1	10	74	163	141	1	390
Priest Rapids	2			3			5
Lyons Ferry				1			1
Total	10	167	638	1461	521	17	2814

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1990.

Release year: 1992

CWT codes:	Total tagged=	371483
63-44-18 371483	Total released=	391650

		Age					Total
		1.0	1.1	1.2	1.3	1.4	
Fishery							
	Alaska ocean			8	27		35
	Canada ocean		6		5		11
	Washington ocean						
	Washington estuary sport						
	Washington freshwater					9	9
	Oregon ocean				5	3	8
	Oregon estuary sport						
	Oregon freshwater						
	Columbia River commercial	3		1			4
	Columbia River sport						
	California ocean						
	Ceremonial & subsistence			1	5	30	36
Spawning ground							
	Methow River		5	23	113	48	189
	Okanogan River						
	Similkameen River						
	Columbia River- Hanford						
Hatchery							
	Wells		3	10	35	20	68
	Priest Rapids						
	Lyons Ferry						
Total		3	14	43	190	110	360

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1991.

Release year: 1993

CWT codes: Total tagged= 377097
 63-46-03 377097 Total released= 540900

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean				2	3	5
Canada ocean						
Washington ocean			3			3
Washington estuary sport						
Washington freshwater				1		1
Oregon ocean						
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence			5	15	14	34
Spawning ground						
Methow River			21	27	9	57
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Wells		4	4	15	6	29
Priest Rapids						
Lyons Ferry						
Total	0	4	33	60	32	129

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1992.

Release year: 1994

CWT codes:		Total tagged=	392636
63-49-43	102241	Total released=	402641
63-49-45	87252		
63-50-30	99588		
63-50-33	103555		

		Age						Total
		1.0	1.1	1.2	1.3	1.4	1.5	
Fishery								
	Alaska ocean			2	9	3		14
	Canada ocean		2					2
	Washington ocean							0
	Washington estuary sport							0
	Washington freshwater			4				4
	Oregon ocean							
	Oregon estuary sport							
	Oregon freshwater							
	Columbia River commercial							
	Columbia River sport							
	California ocean							
	Ceremonial & subsistence				5			5
Spawning ground								
	Methow River			7	54	6		67
	Okanogan River							
	Similkameen River							
	Columbia River- Hanford							
Hatchery								
	Wells			4	25	6	1	36
	Priest Rapids							
	Lyons Ferry							
Total		0	2	17	93	15	1	128

Appendix D-2. Fate of Methow River CWT summer chinook yearling releases for broodyear 1993.

Release year: 1995

CWT codes: Total tagged= 198119
 63-57-09 198119 Total released= 433375

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			3	5		8
Canada ocean		6				6
Washington ocean						
Washington estuary sport						
Washington freshwater		1				1
Oregon ocean						
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial				2		2
Columbia River sport						
California ocean						
Ceremonial & subsistence			5			5
Spawning ground						
Methow River				23	2	25
Okanogan River						
Similkameen River					3	3
Columbia River- Hanford						
Hatchery						
Wells			4	5		9
Priest Rapids						
Lyons Ferry						
Total	0	7	12	35	5	59

Appendix D-2. Fate of Methow River CWT summer chinook yearlings releases for broodyear 1994.

Release year: 1996

CWT codes:		Total tagged=	387970
63-57-60	192342	Total released=	406560
63-57-61	195628		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			29	64	3	96
Canada ocean		4	1	21	1	27
Washington ocean				2		2
Washington estuary sport						
Washington freshwater						
Oregon ocean				9	1	10
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial			2	1		3
Columbia River sport						
California ocean						
Ceremonial & subsistence				2		2
Spawning ground						
Methow River		9	84	300	21	414
Okanogan River						
Similkameen River				3	3	6
Columbia River- Hanford				7		7
Hatchery						
Wells		6	42	43	3	94
Priest Rapids						
Lyons Ferry						
Total	0	19	158	452	32	661

Appendix D-2. Fate of Methow River CWT summer chinook yearlings releases for broodyear 1995.

Release year: 1997

CWT codes:		Total tagged=	338598
63-60-53	176999	Total released=	353182
63-60-52	161599		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			10	7		17
Canada ocean		5	8	6		19
Washington ocean				2		2
Washington estuary sport						
Washington freshwater						
Oregon ocean				10		10
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial			1			1
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Methow River		2	10	92		104
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Wells		5	7	14		26
Priest Rapids						
Lyons Ferry						
Total	0	12	36	131	0	179

Appendix D-2.Fate of Methow River CWT summer chinook yearlings releases for broodyear 1996.

Release year: 1998

CWT codes:		Total tagged=	266609
63-01-43	170896	Total released=	298844
63-03-45	95713		

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean			2			2
Canada ocean			10			10
Washington ocean						
Washington estuary sport						
Washington freshwater						
Oregon ocean						
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Methow River			6			6
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Wells		1	1	1		3
Priest Rapids						
Lyons Ferry						
Total	1	1	19	0	0	21

Appendix D-2. Fate of Methow River CWT summer chinook yearlings releases for broodyear 1997.

Release year: 1999

CWT codes:		Total tagged=	365537
63-09-36	365537	Total released=	384909

	Age					Total
	1.0	1.1	1.2	1.3	1.4	
Fishery						
Alaska ocean						
Alaska freshwater						
Canada ocean						
Canada freshwater						
Washington ocean						
Washington estuary sport						
Washington freshwater						
Oregon ocean			9			9
Oregon estuary sport						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
California ocean						
Ceremonial & subsistence						
Spawning ground						
Methow River		3				3
Okanogan River						
Similkameen River						
Columbia River- Hanford						
Hatchery						
Wells		1				1
Priest Rapids						
Lyons Ferry						
Total	0	4	9	0	0	13

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1989.

Release year: 1991

CWT codes:

63-56-13	85304	Total tagged=	202125
63-07-59	116821	Total released=	352600

		Age					Total	
		1.0	1.1	1.2	1.3	1.4		1.5
Fishery								
	Alaska ocean		1	233	255	66	555	
	Canada ocean		53	284	283	61	681	
	Washington ocean		5	28	4		37	
	Washington estuary sport		8	13			21	
	Washington freshwater			23	3		2	28
	Oregon ocean		7	5				12
	Oregon estuary sport		3	6				9
	Oregon freshwater			2				2
	Columbia River commercial		15	48	47	6		116
	Columbia River sport			8				8
	California ocean				4			4
	Ceremonial & subsistence		3	9	183	16		211
Spawning ground								
	Methow River							
	Okanogan River			154	352	57		563
	Similkameen River			159	670	390		1219
	Chelan							
	Eastbank							
	Columbia River- Hanford							
Hatchery								
	Dryden							
	Tumwater				1			1
	Priest Rapids		3			2		5
	Wells		24	119	402	213	2	760
Total		0	122	1091	2204	811	4	4232

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1990.

Release year: 1992

CWT codes:

63-44-17 367207 Total tagged= 367207

Total released= 540000

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		3	39	76	8		126
Canada ocean		24	45	33			102
Washington ocean							
Washington estuary sport							
Washington freshwater		4			28		32
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			3	2			5
Columbia River sport					4		4
California ocean							
Ceremonial & subsistence				11	7		18
Spawning ground							
Methow River							
Okanogan River			15	85			100
Similkameen River		4	38	228	126		396
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden							
Tumwater							
Priest Rapids			1				1
Wells		5	35	85	45	1	171
Total	0	40	176	520	218	1	955

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1991.

Release year: 1993

CWT codes: Total tagged= 360380
 63-46-04 360380 Total released= 675500

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			31	26	10		67
Canada ocean		4	24		2		30
Washington ocean							
Washington estuary sport							
Washington freshwater				50			50
Oregon ocean			2	3			5
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean			2				2
Ceremonial & subsistence			5	15			20
Spawning ground							
Methow River							
Okanogan River			57		38		95
Similkameen River		25	135	284	59		503
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden							
Tumwater							
Priest Rapids							
Wells		22	44	102	23	1	192
Total	0	51	300	480	132	1	964

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1992.

Release year: 1994

CWT codes:		Total tagged=	404977
63-53-15	129574	Total released=	548182
63-51-48	124751		
63-51-54	133923		
63-51-56	16729		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			61	89	43		193
Canada ocean		24	21	20			65
Washington ocean				2			2
Washington estuary sport							
Washington freshwater		6	40				46
Oregon ocean			3	12			15
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial				4			4
Columbia River sport			4				4
California ocean							
Ceremonial & subsistence			8	20			28
Spawning ground							
Methow River							
Okanogan River		28		230	11	11	280
Similkameen River			89	428	31		548
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden							
Tumwater							
Priest Rapids		1					1
Wells		5	77	235	26		343
Total	1	63	303	1040	111	11	1529

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1993.

Release year: 1995

CWT codes:		Total tagged=	371174
63-57-06	180115	Total released=	586000
63-57-08	191059		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		1	2	8	8		19
Canada ocean		5					5
Washington ocean							
Washington estuary sport							
Washington freshwater		1					1
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Methow River							
Okanogan River							
Similkameen River			15	26	13		54
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden							
Tumwater							
Priest Rapids			1				1
Wells		2	14	12	3		31
Total	0	9	32	46	24	0	111

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1994.

Release year: 1996

CWT codes:		Total tagged=	212446
63-57-62	212446	Total released=	536299

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			105	131	10		246
Canada ocean		7	43	39			89
Washington ocean					2		2
Washington estuary sport							
Washington freshwater							
Oregon ocean			6	10			16
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			6	3			9
Columbia River sport			3	4			7
California ocean				3			3
Ceremonial & subsistence		5		8			13
Spawning ground							
Methow River							
Okanogan River			11				11
Similkameen River			67	738	108		913
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden				1			1
Tumwater							
Priest Rapids							
Wells		19	70	102	9		200
Total	0	31	311	1039	129	0	1510

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1995.

Release year: 1997

CWT codes:		Total tagged=	569069
63-55-34	180826	Total released=	587000
63-55-36	181510		
63-60-51	206733		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		7	190	241			438
Canada ocean		4	23	9			36
Washington ocean		1	8				9
Washington estuary sport							
Washington freshwater				12			12
Oregon ocean			11	2	2		15
Oregon estuary sport		2	9				11
Oregon freshwater							
Columbia River commercial		5	4	7			16
Columbia River sport			4				4
California ocean				3			3
Ceremonial & subsistence			8	1			9
Spawning ground							
Methow River				6			6
Okanogan River			55	188			243
Similkameen River		17	176	1158			1351
Chelan				30			30
Eastbank				1			1
Columbia River- Hanford				3			3
Hatchery							
Dryden							
Tumwater							
Priest Rapids							
Wells		28	56	177			261
Total	0	64	544	1838	2	0	2448

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1996.

Release year: 1998

CWT codes:		Total tagged=	
63-01-36	178038	Total released=	507913
63-02-18	no return		
63-02-20	148523		

		Age						Total
		1.0	1.1	1.2	1.3	1.4	1.5	
Fishery								
	Alaska ocean							
	Canada ocean			2				2
	Washington ocean							
	Washington estuary sport							
	Washington freshwater							
	Oregon ocean							
	Oregon estuary sport							
	Oregon freshwater							
	Columbia River commercial							
	Columbia River sport							
	California ocean							
	Ceremonial & subsistence							
Spawning ground								
	Methow River							
	Okanogan River							
	Similkameen River			3				3
	Chelan							
	Eastbank							
	Columbia River- Hanford							
Hatchery								
	Dryden							
	Tumwater							
	Priest Rapids							
	Wells							
Total		0	0	5	0	0	0	5

Appendix D-3. Fate of Similkameen River summer chinook CWT releases for broodyear 1997.

Release year: 1999

CWT codes:		Total tagged=	558336
63-06-10	558336	Total released=	589591

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		3					3
Canada freshwater		138					138
Washington ocean		26					26
Washington estuary sport							
Washington freshwater	2	16					18
Oregon ocean		11	428				439
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		2	66				68
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Methow River							
Okanogan River	11	148					159
Similkameen River		162					162
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Dryden							
Tumwater							
Priest Rapids							
Wells		78					78
Total	13	584	494	0	0	0	1091

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1974.

Release year: 1976

CWT codes: Total tagged= 118416
 13-05-11 118416 Total released= 155024

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			7	6			13
Canada ocean		49	87	17			153
Washington ocean		4	25	10			39
Washington estuary sport			4	3			7
Washington freshwater							
Oregon ocean		11					11
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids				2			2
Wells		1	39	14	1		55
Total	0	65	162	52	1	0	280

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1975.

Release year: 1977

CWT codes: Total tagged= 89348
 13-12-03 89348 Total released= 94353

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		4	25	21			50
Canada ocean		50	113	26	1		190
Washington ocean		11	27	10			48
Washington estuary sport			10				10
Washington freshwater							
Oregon ocean		4					4
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean				8			8
Ceremonial & subsistence			2	3			5
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids			2	1			3
Wells	15	17	54	54	2		142
Total	15	86	233	123	3	0	460

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1978.

Release year: 1976

CWT codes: Total tagged= 132677
 63-16-43 132677 Total released= 347185

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		2	124	43			169
Canada ocean	8	144	359	41	4		556
Washington ocean		51	42	12			105
Washington estuary sport		26	3	3			32
Washington freshwater							
Oregon ocean		2	10				12
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			2	2			4
Columbia River sport							
California ocean		5	4				9
Ceremonial & subsistence			7	7			14
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford			16		15		31
Hatchery							
Tumwater							
Priest Rapids			4	6			10
Wells		100	120	135	6		361
Total	8	330	691	249	25	0	1303

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1983.

Release year: 1985

CWT codes: Total tagged= 73819
63-23-26 73819 Total released= 186000

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			7				7
Canada ocean		10	3	17			30
Washington ocean	3		6	2			11
Washington estuary sport							
Washington freshwater							
Oregon ocean	1	4	11				16
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		4	7				11
Columbia River sport							
California ocean				4			4
Ceremonial & subsistence			4				4
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids		1					1
Wells		10	13	13			36
Total	4	29	51	36	0	0	120

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1984.

Release year: 1986

CWT codes: Total tagged= 99829
 63-32-24 49754 Total released= 200440
 63-32-25 50075

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			3	3			6
Canada ocean		12	42	4	5		63
Washington ocean			5				5
Washington estuary sport							
Washington freshwater							
Oregon ocean			1				1
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			12	5	2		19
Columbia River sport							
California ocean							
Ceremonial & subsistence			1				1
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells		6	16	35	6		63
Total	0	18	80	47	13	0	158

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1985.

Release year: 1987

CWT codes: Total tagged= 153546
 B1-03-08 51233 Total released= 394500
 B1-03-09 51178
 B1-03-10 51135

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		4	33	47	3		87
Canada ocean		51	139	62	3		255
Washington ocean		5	47	6			58
Washington estuary sport							
Washington freshwater	4						4
Oregon ocean		2	35	8			45
Oregon estuary sport		3					3
Oregon freshwater				2			2
Columbia River commercial		23	45	63	8	2	141
Columbia River sport							
California ocean							
Ceremonial & subsistence			23				23
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids				3	1		4
Wells		24	135	112	23		294
Total	4	112	457	303	38	2	916

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1986.

Release year: 1988

CWT codes: Total tagged= 119254
 63-44-02 59849 Total released= 193324
 63-44-04 59405

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			35	14	3		52
Canada ocean		46	187	28			261
Washington ocean			22	2			24
Washington estuary sport							
Washington freshwater					3		3
Oregon ocean			24	7			31
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			8	4			12
Columbia River sport							
California ocean							
Ceremonial & subsistence		9	8				17
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids				3			3
Wells		4	73	96	12		185
Total	0	59	357	154	18	0	588

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1987.

Release year: 1989

CWT codes: Total tagged= 122558
 63-50-37 61740 Total released= 429042
 63-50-38 60818

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			16	27	3		46
Canada ocean		15	36	18			69
Washington ocean		2	13	2	2		19
Washington estuary sport				4			4
Washington freshwater			6				6
Oregon ocean		2	5				7
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		6	23				29
Columbia River sport							
California ocean							
Ceremonial & subsistence		2	2				4
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids			2	1			3
Wells		26	78	77	10		191
Total	0	53	181	129	15	0	378

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1988.

Release year: 1990

CWT codes: Total tagged= 153645
 63-02-62 153645 Total released= 391579

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			3	14			17
Canada ocean		31	45	18	4		98
Washington ocean			4	5			9
Washington estuary sport							
Washington freshwater				3			3
Oregon ocean			8	4			12
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		2	2	5			9
Columbia River sport							
California ocean							
Ceremonial & subsistence			3		2		5
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids			1	1			2
Wells		12	32	50	1		95
Total	0	45	98	100	7	0	250

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1990.

Release year: 1992

CWT codes: Total tagged= 122657
 63-41-33 122657 Total released= 371369

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			7	20			27
Canada ocean		15	18	5			38
Washington ocean			9		2		11
Washington estuary sport				4			4
Washington freshwater			6				6
Oregon ocean		2	5				7
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		6	7				13
Columbia River sport							
California ocean							
Ceremonial & subsistence		1					1
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids			2				2
Wells		13	32	46	5		96
Total	0	37	86	75	7	0	205

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1991.

Release year: 1993

CWT codes:		Total tagged=	123585
63-46-09	123585	Total released=	392330

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean				4			4
Canada ocean		7	5	7			19
Washington ocean							
Washington estuary sport							
Washington freshwater							
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells	2	6	13	17	6		44
Total	2	13	18	28	6	0	67

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1992.

Release year: 1994

CWT codes: Total tagged= 209245
 63-50-05 209245 Total released= 331354

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			33	25			58
Canada ocean			9	2	5		16
Washington ocean		3					3
Washington estuary sport							
Washington freshwater			1				1
Oregon ocean			12	13	9		34
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial			4				4
Columbia River sport							
California ocean							
Ceremonial & subsistence		4	9	5			18
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River				38			38
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells		12	134	186	18	1	351
Total	0	19	202	269	32	1	523

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1993.

Release year: 1995

CWT codes: Total tagged= 365682
 63-46-10 128528 Total released= 388248
 63-57-02 237154

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		358	92	112			562
Canada ocean		14	29	14	6		63
Washington ocean					8		8
Washington estuary sport			2				2
Washington freshwater		3		3			6
Oregon ocean			18	17			35
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial		4	8	14			26
Columbia River sport							
California ocean							
Ceremonial & subsistence		7		2			9
Spawning ground							
Wenatchee River							
Methow River				54			54
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells	72	40	313	627	73		1125
Total	72	426	462	843	87	0	1890

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1994.

Release year: 1996

CWT codes:		Total tagged=	350918
63-53-24	108380	Total released=	365000
63-58-38	242538		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean			16	16			32
Canada ocean				2			2
Washington ocean							
Washington estuary sport							
Washington freshwater							
Oregon ocean							
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial							
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Wenatchee River							
Methow River				2			2
Okanogan River							
Similkameen River							
Chelan							
Eastbank							
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells		2	29	58	3		92
Total	0	2	45	78	3	0	128

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1995.

Release year: 1997

CWT codes:		Total tagged=	422146
63-41-29	182308	Total released=	440000
63-41-30	96147		
63-46-07	143691		

		Age					Total	
		1.0	1.1	1.2	1.3	1.4		1.5
Fishery								
	Alaska ocean		14	212	300			526
	Canada ocean	3	16	124	31			174
	Washington ocean		3	20	5			28
	Washington estuary sport							
	Washington freshwater		5	19	28			52
	Oregon ocean			21	32	2		55
	Oregon estuary sport			5				5
	Oregon freshwater				1			1
	Columbia River commercial		3	35	46			84
	Columbia River sport		3	28	19			50
	California ocean							
	Ceremonial & subsistence	5		31	1			37
Spawning ground								
	Wenatchee River				18			18
	Methow River		2	2	37			41
	Okanogan River				121			121
	Similkameen River				13			13
	Chelan			15	143			158
	Eastbank			7	5			12
	Columbia River- Hanford				7			7
Hatchery								
	Tumwater							
	Priest Rapids		1		1			2
	Wells		39	227	301			567
Total		8	86	746	1109	2	0	1951

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1996.

Release year: 1998

CWT codes:		Total tagged=	499053
63-02-17	136077	Total released=	559434
63-01-24	189531		
63-01-34	173445		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		28	598				626
Canada ocean		75	147				222
Washington ocean			12				12
Washington estuary sport							
Washington freshwater	3	4	10				17
Oregon ocean		4	35	59			98
Oregon estuary sport			2				2
Oregon freshwater							
Columbia River commercial		4	5				9
Columbia River sport							
California ocean			3				3
Ceremonial & subsistence			1				1
Spawning ground							
Wenatchee River		3	5				8
Methow River			33				33
Okanogan River			66				66
Similkameen River							
Chelan			30				30
Eastbank			4				4
Columbia River- Hanford			3				3
Hatchery							
Tumwater							
Priest Rapids							
Wells		42	392				434
Total	3	160	1346	59	0	0	1568

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1997.

Release year: 1999

CWT codes:		Total tagged=	557328
63-06-11	362677	Total released=	584676
63-06-06	194651		

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean		7					7
Canada ocean		401					401
Washington ocean		62					62
Washington estuary sport							
Washington freshwater	8	21					29
Oregon ocean		17	833				850
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial	7	3					10
Columbia River sport	8	13					21
California ocean		4					4
Ceremonial & subsistence		6					6
Spawning ground							
Wenatchee River							
Methow River	2	12					14
Okanogan River		27					27
Similkameen River							
Chelan		10					10
Eastbank		1					1
Columbia River- Hanford							
Hatchery							
Tumwater		1					1
Priest Rapids							
Wells		71					71
Total	25	656	833	0	0	0	1514

Appendix D-4. Fate of mid-Columbia River CWT summer chinook yearling releases for broodyear 1998.

Release year: 2000

CWT codes: Total tagged= 644366
 63-10-32 215646 Total released= 675089
 63-10-61 428720

	Age						Total
	1.0	1.1	1.2	1.3	1.4	1.5	
Fishery							
Alaska ocean							
Canada ocean							
Washington ocean							
Washington estuary sport							
Washington freshwater	6						6
Oregon ocean	31	43					74
Oregon estuary sport							
Oregon freshwater							
Columbia River commercial	7						7
Columbia River sport							
California ocean							
Ceremonial & subsistence							
Spawning ground							
Wenatchee River							
Methow River							
Okanogan River							
Similkameen River							
Chelan							
Eastbank	1						1
Columbia River- Hanford							
Hatchery							
Tumwater							
Priest Rapids							
Wells							
Total	45	43	0	0	0	0	88

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1976.

Release year: 1977

CWT codes:	Total tagged=	394,367
63-16-07 149,308	Total released=	750,453
63-16-54 99,113		
63-16-42 145,946		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean		16	141	16	173
Canada ocean	47	75	111	24	257
Washington ocean		4		1	5
Washington freshwater			4	2	6
Oregon ocean		5			5
Oregon freshwater					
Columbia River commercial		22	8		30
Columbia River sport					
Ceremonial & subsistence			8		8
Spawning ground					
Hanford Reach				18	18
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Kalama			1		1
Ringold			1		1
Priest Rapids	1		3		4
Bonneville		1			1
Wells	7	22	40	48	117
Total	55	145	317	109	626

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1977.

Release year: 1978

CWT codes: Total tagged= 307,664
 63-17-49 154,060 Total released= 552,682
 63-17-62 153,604

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean		3	12	2	17
Canada ocean	32	54	74	9	169
Washington ocean			3		3
Washington freshwater					
Oregon ocean			1		1
Oregon freshwater					
Columbia River commercial	3				3
Columbia River sport					
Ceremonial & subsistence		3	3		6
Spawning ground					
Methow River					
Okanogan River					
Wenatchee River					
Hatchery					
Turtle Rock					
Priest Rapids	7	3	5	3	18
Wells	14	18	32	5	69
Total	56	81	130	19	286

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1983.

Release year: 1984

CWT codes: 63-28-45 202,726 Total tagged= 202,726
Total released= 1,240,865

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean			8		8
Canada ocean	5	31	10	8	54
Washington ocean					
Washington freshwater					
Oregon ocean			6		6
Oregon freshwater					
Columbia River commercial		10	12		22
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock		2			2
Priest Rapids	1				1
Wells	1	7	4		12
Total	7	50	40	8	105

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1984.

Release year: 1985

CWT codes:		Total tagged=	260,323
63-32-19	102,605	Total released=	813,662
63-32-20	104,678		
63-32-34	53,040		

	Age					Total
	0.1	0.2	0.3	0.4	0.4	
Fishery						
Alaska ocean		5	17	7		29
Canada ocean	18	32	40	30		120
Washington ocean		2	2			4
Washington freshwater		1				1
Oregon ocean		8		30		38
Oregon freshwater						
Columbia River commercial	7	74	80	21		182
Columbia River sport						
Ceremonial & subsistence						
Spawning ground						
Hanford Reach				17		17
Methow River						
Okanogan River						
Hatchery						
Turtle Rock						
Priest Rapids		1				1
Wells	10	14	27	16	1	68
Total	35	137	166	121		460

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1985.

Release year: 1986

	CWT codes:		Total tagged=			233,447	
	63-34-60	49,996	Total released=			1,791,617	
	63-34-61	50,000					
	63-34-62	50,000					
	63-34-63	48,447					
	H1-07-07	35,004					
		Age					
		0.1	0.2	0.3	0.4	0.5	Total
Fishery							
	Alaska ocean		3	2			5
	Canada ocean			19	5		24
	Washington ocean			4			4
	Washington freshwater			2			2
	Oregon ocean						
	Oregon freshwater		3				3
	Columbia River commercial	2	3	3	2		10
	Columbia River sport						
	Ceremonial & subsistence						
Spawning ground							
	Hanford Reach						
	Methow River						
	Okanogan River						
Hatchery							
	Turtle Rock						
	Ringold			1	1		2
	Priest Rapids			1	1		2
	Bonneville			8			8
	Wells		5	43	13	2	63
Total							
		2	14	83	22	2	123

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1986.

Release year: 1987

CWT codes:		Total tagged=	447,541
63-31-13	212,413	Total released=	1,018,500
63-42-56	115,271		
63-42-55	119,857		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean					
Canada ocean					
Washington ocean				3	3
Washington freshwater					
Oregon ocean					
Oregon freshwater					
Columbia River commercial			4		4
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Dryden					
Priest Rapids					
Wells		5	1	1	7
Total	0	5	5	4	14

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1988.

Release year: 1989

CWT codes:		Total tagged=	249,313
63-52-01	125,000	Total released=	1,562,500
63-52-02	124,313		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean					
Canada ocean					
Washington ocean					
Washington freshwater					
Oregon ocean					
Oregon freshwater					
Columbia River commercial					
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Priest Rapids					
Wells			1		1
Total	0	0	1	0	1

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1989.

Release year: 1990

CWT codes:	Total tagged=	224,315
63-13-47 99,749	Total released=	1,521,129
63-13-52 75,600		
63-11-49 48,966		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean			3	2	5
Canada ocean		6	15		21
Washington ocean					
Washington freshwater					
Oregon ocean					
Oregon freshwater					
Columbia River commercial		2	2	2	6
Columbia River sport					
Ceremonial & subsistence		1			1
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Priest Rapids					
Wells	4	8	5	6	23
Total	4	17	22	8	56

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1990.

Release year: 1991

CWT codes: Total tagged= 215,672
 63-59-13 215,672 Total released= 329,669

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean					
Canada ocean					
Washington ocean					
Washington freshwater					
Oregon ocean					
Oregon freshwater					
Columbia River commercial			2		2
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Priest Rapids					
Wells		1	1		2
Total	0	1	3	0	4

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1991.

Release year: 1992

CWT codes: Total tagged= 220,930
 63-41-39 220,930 Total released= 493,919

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean			3		3
Canada ocean					
Washington ocean					
Washington freshwater					
Oregon ocean					
Oregon freshwater					
Columbia River commercial					
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River					
Okanogan River					
Hatchery					
Turtle Rock					
Priest Rapids					
Wells				1	1
Total	0	0	3	1	4

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1993.

Release year: 1994

CWT codes: Total tagged= 183,199
 63-51-45 183,199 Total released= 187,382

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean		2	10		12
Canada ocean			3		3
Washington ocean					
Washington freshwater		1			1
Oregon ocean					
Oregon freshwater					
Columbia River commercial				3	3
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Methow River					
Okanogan River					
Wenatchee River					
Hatchery					
Turtle Rock					
Priest Rapids			1		1
Wells			9	10	19
Total	0	3	23	13	39

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1994.

Release year: 1995

CWT codes:		Total tagged=	421,963
63-55-46	203,921	Total released=	450,935
63-57-03	218,042		

	Age					Total
	0.1	0.2	0.3	0.4	0.5	
Fishery						
Alaska ocean						
Canada ocean		2				2
Washington ocean						
Washington freshwater						
Oregon ocean						
Oregon freshwater						
Columbia River commercial						
Columbia River sport						
Ceremonial & subsistence						
Spawning ground						
Hanford Reach						
Methow River						
Okanogan River						
Hatchery						
Turtle Rock						
Priest Rapids						
Wells	1		2	3	3	9
Total	1	2	2	3	3	11

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1995.

Release year: 1996

CWT codes:	Total tagged=	713,779
63-60-44 156,542	Total released=	1,651,600
63-58-41 225,604		
63-59-63 134,000		
63-58-46 197,633		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean	1	13	86	39	139
Canada ocean			20	1	21
Washington ocean			3		3
Washington freshwater					
Oregon ocean			8		8
Oregon freshwater					
Columbia River commercial	1			2	3
Columbia River sport		7	14		21
Ceremonial & subsistence		3	6		9
Spawning ground					
Hanford Reach			2		2
Methow River		3	2		5
Chelan River				10	10
Okanogan River			2		2
Hatchery					
Turtle Rock					
Dryden		1			1
Tumwater		4	28	12	44
Kalama		28	135	50	213
Priest Rapids					
Wells		7	45	12	64
Total	2	66	351	126	545

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1996.

Release year: 1997

CWT codes:		Total tagged=	910,359
63-63-23	226,880	Total released=	1,335,515
63-60-54	228,703		
63-63-24	175,171		
63-01-20	92,588		
63-01-23	187,017		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean	4	95	196		295
Canada ocean	5	22	35		62
Washington ocean		6			6
Washington freshwater	10	3	2		15
Oregon ocean				6	6
Oregon freshwater			4		4
Columbia River commercial		4	2		6
Columbia River sport			5		5
Ceremonial & subsistence		9			9
Spawning ground					
Hanford Reach			1		1
Methow River			18		18
Chelan River			30		30
Okanogan River			42		42
Wenatchee River			6		6
Hatchery					
Turtle Rock			13		13
Dryden		1	1		2
Tumwater	3	18	39		60
Kalama	11	42	165		218
Priest Rapids	1				1
Wells	10	78	175		263
Total	44	278	734	6	1062

Appendix D-5. Fate of mid-Columbia River subyearling summer chinook CWT releases for broodyear 1997.

Release year: 1998

CWT codes:		Total tagged=	970,679
63-06-02	513,016	Total released=	1,571,463
63-05-16	225,604		
63-02-14	232,059		

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska ocean		11			11
Canada ocean		3			3
Washington ocean					
Washington freshwater					
Oregon ocean		5	13		18
Oregon freshwater			2		2
Columbia River commercial					
Columbia River sport					
Ceremonial & subsistence					
Spawning ground					
Hanford Reach					
Methow River		5			5
Okanogan River					
Hatchery					
Turtle Rock					
Kalama		5	2		7
Priest Rapids					
Wells	2	6			8
Total	2	35	17	0	54

Appendix D-6. Fate of Methow River subyearling summer chinook CWT releases for broodyear 1986.

Release year: 1987

CWT codes:			
63-31-13	212,413	Total tagged=	212,413
		Total released=	212,500

	Age				Total
	0.1	0.2	0.3	0.4	
Fishery					
Alaska troll					
Alaska sport					
Alaska Net					
Canada troll					
Canada sport					
Canada net					
Washington troll					
Washington sport					
Washington net					
Oregon troll					
Oregon sport					
Oregon net					
Columbia River net					
Columbia River sport					
Others					
Spawner					
Hatchery returns- Wells					
Total	0	0	0	0	0