Public Forum
March 8, 2013

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Draft

Sandy Subbasin Summary

May 17, 2002

Prepared for the
Northwest Power Planning Council

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DRAFT: This document has not yet been reviewed or approved by the Northwest Power Planning Council

and ranged between 86 mm and 116 mm, with an average length of 106 mm and an average weight of 12.2 grams (USFS, unpublished data, 1994). Age at return, sex ratios and weight for naturally produced spring chinook is unknown for the subbasin.

Hatchery Production

Spring chinook were trapped and propagated at various facilities in the Sandy Subbasin since the late 1890s. The first hatchery in the subbasin was located near the mouth of Boulder Creek, a tributary to the Salmon River (Craig and Suomela 1940). This facility trapped and propagated spring chinook on and off through 1912. The greatest egg take at this facility occurred in 1903, with about 3,551,000 eggs collected. Although progeny from these egg collections were generally released back into the Salmon River (Wallis 1966), some eggs were transferred out to other facilities (Craig and Suomela 1940).

Following the construction of Marmot Dam in 1912, hatchery operations moved downstream to a site immediately below the dam. Spring chinook and other salmonids were trapped here for artificial propagation because the Marmot diversion canal was not screened until 1951, and managers at the time felt that a significant proportion of juvenile migrants produced above Marmot Dam would be diverted out of the river and into Roslyn Lake. A rack was built below Marmot Dam that spanned the channel to trap spring chinook, coho and winter steelhead. Spring chinook were trapped here from 1913 to 1925 and 1938 to 1955, and egg takes at this site varied from a low of 10,280 in 1955 to a high of about 2.7 million in 1913. Egg takes at this site may not accurately reflect run size to the subbasin because severely reduced flows below Marmot Dam often prevented fish from reaching the dam.

Spring chinook were produced intermittently at Sandy Hatchery following commission in 1952 through the mid 1960s. Mostly Sandy stock spring chinook were used. The program was marginally successful as spring chinook spawning migration timing did not coincide with adequate flows in Cedar Creek and it was difficult to get adults back to the hatchery for production.

A more aggressive spring chinook hatchery program got underway in the early 1970s to supplement natural production and support commercial and sport fisheries (NWPPC 1990). Minimum stream flows below Marmot Dam were agreed upon by PGE to provide salmonids with the necessary flows for upstream migration. The spring chinook hatchery program in the subbasin has been supported almost exclusively with Willamette stock spring chinook. However, Carson Hatchery stock (Washington) was released in the subbasin in 1977 and 1978.

Hatchery releases averaged 199,526 smolts for years 1977-1985 and increased to an annual average of 420,985 for years 1986-1996. Significant numbers of presmolts and fry have also been released in some years. The ODFW STEP program has also provided Willamette stock spring chinook eggs to interested parties for development and release as unfed fry into the subbasin since 1985. However, egg distribution has been relatively low and ranged from 9,537 eggs in 1989 to a high of 91,405 in 1990. The focus of STEP has changed, and presently only a few thousand spring chinook eggs are distributed annually, primarily to local grade schools for educational purposes. Any remaining STEP releases of hatchery spring chinook are also made below Marmot Dam.

Table 6. Hatchery spring chinook smolts released in the Sandy Subbasin representing brood years 1979-1990, adult return for each age class, and brood year survival (adult return divided by representative smolt release)

	Hatchery Smolts Released[a]			Age Class Return[b]					Brood Year
Brood Year	Fall Sub-Yearling	Spring Yearling	Total Rel. Annually	3	4	5	6	Total	Survival Rate
1979	200,393	0	200,393	94	1,317	855	10	2,276	1.14%
1980	200,400	0	200,400	102	1,410	394	7	1,913	0.95%
1981	199,899	0	199,899	95	996	287	0	1,378	0.69%
1982	208,674	0	208,674	49	921	565	11	1,546	0.74%
1983	199,925	0	199,925	71	1,708	1,706	8	3,493	1.75%
1984	200,305	0	200,305	80	1,202	958	0	2,240	1.12%
1985	418,774	0	418,774	12	806	633	24	1,475	0.35%
1986	200,548	153,102	353,650	232	2,809	2,022	111	5,174	1.46%
1987	199,045	260,773	459,818	86	1,544	5,591	119	7,340	1.60%
1988	99,651	361,784	461,435	62	2,676	4,015	19	6,772	1.47%
1989	0	460,181	460,181	166	1,812	1,137	21	3,136	0.68%
1990	0	458,743	458,743	423	2,275	717[c]	--	3415[c]	0.74%

Average for 1979-84:	Smolts - 201599	Brood Year Returns:	2141
Average for 1985-90:	Smolts - 43534	Brood Year Returns:	4552

Note: Commercial and sport harvest occurring outside the Sandy Subbasin during the period varied annually and is not accounted for in this analysis.

a. Hatchery spring chinook presmolts and fry were also released in some years. Though presmolt and fry releases were significant in some years, survival to adult return was believed to be poor and was therefore not included in the analysis.

b. Numbers of spring chinook returning by age to the Sandy River for each brood year release are calculated using respective proportions of each age class in the Clackamas River sport fishery as reported in Bennett (1995) and shown in Appendix Table C. Age composition of spring chinook returning to the Sandy River are assumed to be similar to returns in the Clackamas River because both populations are largely represented by Willamette stock spring chinook originating from the Clackamas Hatchery. However, smolt release strategies for each basin differ which could affect age at return (see text).

c. Age 5 return reflects only counts of spring chinook at Marmot Dam. Harvest in 1995 is not yet available and therefore, is not accounted for in the figure. Actual figure is higher and will increase overall brood year survival rate.

d. Six year average brood year survival success for each time period, 1979-1984 and 1985-1990, is expressed as an average of total brood year age class returns divided by the representative number of spring chinook smolts released.

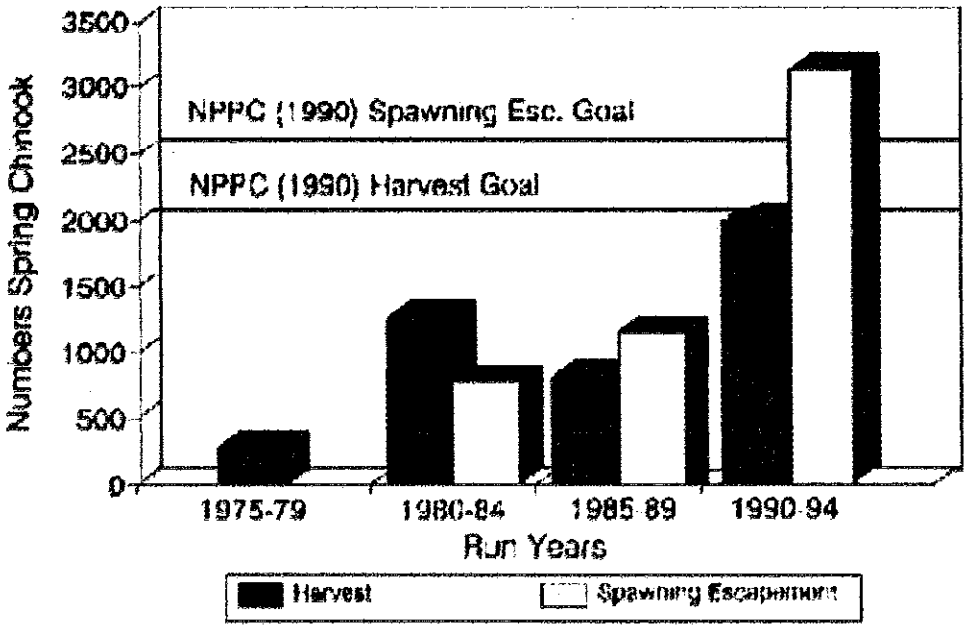
Hatchery spring chinook smolt releases averaged about 200,000 for brood years 1979-1984, and subsequent adult year class returns to the subbasin from these releases averaged 2,141 for return years 1982-1990 (Table 6). The average annual spring chinook smolt releases in the Sandy River more than doubled to 435,434 for brood years 1985-1990 (release years 1986-1992) due to mitigation negotiations with Portland and PGE in the early 1980s. Subsequent adult returns from these brood year releases more than doubled to an

and 5,118 for run years 1990-1994 (Figure 8). Note that large returns in 1992 and 1993 significantly increase the average for the 5-year period and variation between years is relatively large (Table 5). It is believed that most spring chinook returning to the Sandy River originate from hatchery releases or are the progeny of naturally producing hatchery fish in the basin. The hatchery and natural produced components are unknown.

The total run goal of 4,500 spring chinook set in the Northwest Power Planning Council's (NWPPC) *Sandy Fish Management Plan* (1990) was exceeded, on the average, for the 1990-1994 time period. In addition, both the in-basin harvest goals of 2,000 spring chinook and the spawning escapement goals of 2,500 spring chinook were also met, on the average, during these run years. However, it should be noted that the spawning escapement goal was only met in 2 of the 5 years.

Preliminary analysis of spring chinook returns to the Sandy River since 1982 suggests that although spring chinook naturally reproduce in the watershed, spring chinook run strength has grown largely in response to increased releases of hatchery smolts in the subbasin (Table 6). Analysis of age composition and brood year survival for annual hatchery spring chinook smolt releases provides a rough sketch of what may be driving spring chinook run trends in the subbasin.

Age composition of the annual spring chinook return to the Sandy River was estimated for return years 1982-1995 (Table 6) using age composition tables for spring chinook caught in the Clackamas River sport fishery (provided in Bennett 1995). Willamette stock spring chinook smolts released in both the Sandy and Clackamas Rivers are produced at the Clackamas Hatchery, and it is assumed that the age composition for each population at return is similar. However, certain factors may affect age at return between basins and are considered in the following text.



spawning. Poor spawning gravel and winter habitat complexity in this reach also limits natural production capability of spring chinook. However, variable levels of straying into the Bull Run River occurs annually. Sandy River water is diverted into the Bull Run basin for power production, mixes with Bull Run water, and attracts adult spring chinook migrants and other salmonids as well. Stray spring chinook may ascend the river above the PGE powerhouse (RM 1.5) in the spring or early summer when accretion flows or spill provide adequate water for migration. These fish may then become trapped in isolated mainstem pools below the Headworks Dam when flows decrease as a result of water storage in upstream reservoirs. It is believed that these spring chinook are subject to high mortality due to predation, or increased temperatures and poor water quality caused by reduced flows. Total annual losses of spring chinook due to these impacts are unknown.

Abundance

Historically, between 8,000 and 10,000 wild spring chinook may once have returned to the watershed, 5,000 to the Bull Run River and 3,000-5,000 to the upper Sandy Subbasin (Mattson 1955). Mattson (1955) reported from accounts of residents on the river that "prior to the construction of the Marmot Dam (1912) these fish were quite abundant in the main river and the Salmon and ZigZag rivers."

Presently, trends in run strength and timing of migration of spring chinook in the Sandy Subbasin are estimated from harvest in the lower basin and from fish counts made at Marmot Dam fish ladder/trap. The trapping facility is operated and maintained by PGE and provides a reasonable estimate of spring chinook escapement and spawning timing into the upper basin. A trap was monitored at the dam from 1953-1970 to assess anadromous salmonid migrations, and provides information on escapement during that time period. From 1971-1977, fish counts were not made at the dam and escapement estimates are unknown. However, anglers continued to catch spring chinook in the lower subbasin during the time period (Table 5) and it is likely some escapement above the dam also occurred. From 1977-1998, fish counts were made by an electronic and photographic counter. In November 1998, a trap at the top of the fish ladder was installed and also allowed sorting of fish. Only unmarked fish were allowed passage above Marmot Dam.

The estimated minimum escapement of spring chinook to the Sandy River in the 1950s, prior to large hatchery spring chinook releases, averaged about 336 fish annually). The estimate is based on harvest in the lower subbasin and escapement at Marmot Dam. However, adult spring chinook sometimes spawned in the lower subbasin, based on old survey records, probably because water diversions at Marmot Dam significantly reduced flows by late spring and early summer, thereby preventing passage upstream to the dam in some years. Those spring chinook forced to spawn in the lower subbasin, or in the lower Bull Run River (Mattson 1955), were not accounted for in escapement estimates. Marmot counts dropped to an average of 168 in the 1960s (Table 5).

Hatchery releases of Willamette stock spring chinook smolts began in earnest in the early 1970s in conjunction with increased flows below Marmot Dam in summer and fall, and greatly improved spring chinook returns to the Sandy Subbasin. The estimated annual return to the subbasin averaged 2,056 for run years 1980-1984, 2,005 for run years 1985-1989,