MEMORANDUM

OREGON DEPARTMENT OF FISH AND WILDLIFE

INTRADEPARTMENT

DATE: June 4, 1992

JUN 11 1992

TO: Distribution

FROM: Alan McGie

SUBJ: Sandy River Coho Salmon

I have analyzed the counts of coho salmon at Marmot Dam, Sandy River, compiled by PGE since 1960 and came up with the conclusion presented in the attached status report. If there are any "wild" fish left in the Sandy River, they have taken on the spawning characteristics of the hatchery stock. Let me know if you have any comments on the report.

amt
Attachment
Distribution Barry McPherson
Jay Nicholas
Jay Massey
Mark Chilcote
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Fish Division

Status of Wild Coho Salmon Passing Marmot Dam, Sandy River

Abstract

The number of wild coho salmon counted at Marmot Dam on the Sandy River has declined from an average annual return of 1,444 fish in 1960-66 to an average annual return of only 129 fish in 1987-91. In contrast, the total escapement of coho salmon has remained virtually unchanged, averaging 1,447 fish in 1987-91, reflecting an increase in hatchery fish returns. Wild fish currently compose 8.9% of the coho salmon counted at Marmot Dam. A shift in peak time of arrival in November in 1960-66 to a peak time of arrival in October in subsequent years is indicative of the increase in early-run hatchery fish and commensurate decline of late-run wild fish in the run. The loss in production of wild fish is likely the result of competition and introgression with hatchery fish that have been extensively transplanted above Marmot Dam since 1964.

Analysis and Discussion

Monthly counts of jack and adult coho salmon have been made in the Sandy River by Portland General Electric Company personnel at Marmot Dam (RM 30) from 1960 through 1969 and from 1977 through 1991 (Table 1). No counts were made from 1970 through 1976. Incomplete counts were made in 1977 and 1983 and were excluded from analysis. The count in 1979-80 was excluded because of a disproportionately large return in February 1980 (310 fish) that was far above the next highest count of 23 fish in February 1985. There is no plausible explanation for the high count in February 1980, although the possibility exists that it may be from a recording or video tape reading error (Douglas Cramer, PGE).

The Oregon Department of Fish and Wildlife (ODFW) has reared early-run coho salmon at Sandy River Hatchery since 1950. Late-run wild stock has never been propagated at Sandy River Hatchery (ODFW 1990). The hatchery is located on Cedar Creek 0.5 mile above the confluence with Sandy River. Cedar Creek enters the Sandy River 8.2 miles below Marmot Dam. Production at the hatchery is targeted for 1 million smolts per year which are liberated in late April or early May. Data on hatchery fish releases in the Sandy River (ODFW 1990) indicate that about 1.1 million fry and about 98 thousand presmolts were liberated above Marmot Dam from the 1960-62 brood years. Beginning with the 1964 brood year, extensive offstation transplants of hatchery coho salmon fry, presmolts, and adults were made in most tributary streams above Marmot Dam to supplement the wild stock (Table 2). Smolt releases have been confined to Cedar Creek; therefore, few hatchery adults from this source likely appeared at Marmot Dam.

I assumed that counts obtained at Marmot Dam from 1960-66 primarily consisted of wild fish and counts obtained since 1967 consisted of a mixture of wild, hatchery, or wild and hatchery introgressed stocks as a result of the extensive offstation releases above Marmot Dam. The liberation of relative small numbers of hatchery fry and presmolts from the 1960-62 brood years probably did not have any major impact on the production of wild coho salmon above Marmot Dam prior to 1967. The survival of these small hatchery fish was

likely very poor when the upper Sandy River basin was inhabited by a healthy population of wild coho salmon. The impact of hatchery coho salmon on wild coho salmon is more likely after 1967 as a consequence of persistent releases of fry, presmolts, and adults into the upper Sandy River basin.

Hatchery fish (early-run stock) are assumed to migrate in August through November compared with a migration period of September through February for the late-run wild stock (Willis 1962). I assumed that all fish counted from December through February consisted of late-run wild fish. Peak time of passage occurred in November from 1960 through 1966 when wild fish were counted at Marmot Dam compared with an October peak from 1967 through 1991 when hatchery fish dominated the run (Figure 1).

The average count at Marmot Dam during 1960-66 totaled 148.3 wild fish from December through February among a total average run of 1,444.2 wild fish during the time period. In contrast, the latest 5-year average count (1987-91) totaled 13.2 wild fish in December through February among a total average count of 1,447.2 hatchery and wild fish (Table 1). The percentage change in run size from December through February between 1960-66 and 1987-91 was -91.1%. This suggests the run averaged only 1,444.2(1 - 0.911) = 129 wild fish in 1987-91, assuming the calculated decline from December through February was indicative of the loss of wild fish throughout the run (Figure 2). Based on these estimates, wild fish have averaged 8.9% of the coho salmon counted at Marmot Dam in the past 5 years. However, no coho salmon have been counted in the December-February time period in the last 2 years (Table 1) which suggests the wild population may now be extinct.

The loss in production of wild fish is likely the result of competition and introgression with early-run hatchery fish, although excessive exploitation by ocean and inriver fisheries possibly further exacerbated the decline. However, there is no indication that the temporal distribution of the run has changed as a result of increased exploitation by the ocean and inriver fisheries similar to that observed in the hatchery and wild stocks of coho salmon returning to North Fork Dam in the Clackamas River. The peak arrival at Marmot Dam has shifted from November when late-run wild fish dominated the run to October as the influence of early-run hatchery fish increased. The shift in run timing is indicative of the increasing strength of hatchery fish and commensurate loss of wild fish in the run over the past 31 years.

Solazzi et al. (1990) found that wild juvenile coho salmon were significantly less abundant (44% lower) in streams stocked with hatchery presmolts than in unstocked streams on the Oregon coast. In this study, adult returns to the stocked streams were similar to unstocked streams, but returns tended to be earlier in the stocked streams than in unstocked streams, reflecting the return of early-run hatchery fish. Although similar numbers of adults spawned in the stocked and unstocked streams during years adults returned to spawn from transplanted hatchery presmolts, the resulting density of juveniles in the stocked streams averaged 32% lower than the density of juveniles in unstocked streams. The early time of spawning of the hatchery coho salmon was largely responsible for the decreased survival of juveniles in the stocked streams. The poor survival of hatchery fish progeny presumably occurred because of the increased probability of the eggs being washed out of the gravel during winter freshets and the early emergence of fry under poor

environmental conditions in winter when forage is low. Similar mechanisms have presumably led to the decline of wild coho salmon in Sandy River as a result of the persistent releases of early-run hatchery fish above Marmot Dam since 1964.

The dangers of supportive breeding programs on wild populations have been analyzed and discussed by Ryman and Laikre (1991). They found that supportive breeding may reduce the total effective number of spawners far below what it would have been without any supportive breeding at all. Serious depletion of heterozygosity in the wild stock is more likely when the population is supported for multiple generations such as in the Sandy River.

References

ODFW (Oregon Department of Fish and Wildlife). 1990. Sandy River subbasin salmon and steelhead production plan. Oregon Department of Fish and Wildlife, Portland.

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Solazzi, M.F., T.E. Nickelson, and S.L. Johnson. 1990. An evaluation of the use of coho salmon presmolts to supplement wild production in Oregon coastal streams. Oregon Department of Fish and Wildlife, Fishery Research Report Number 10, Portland.

Willis, R.A. 1962. Gnat Creek weir studies. Fish Commission of Oregon, Fish Research Project 14-17-0001-469, Final Report, Portland.

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06/04/92

Table 1

Monthly count of jack and adult coho salmon passing Marmot Dam, Sandy River, 1960-91.

Year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total jacks	Total adults	Total run
1960	0	38	1,091	252	288	1	0	--	--	1,670
1961	0	10	1,107	436	158	20	2	--	--	1,733
1962	0	16	399	990	50	3	0	--	--	1,458
1963	0	43	993	1,135	28	0	0	--	--	2,199
1964	0	14	83	759	270	0	0	--	--	1,126
1965	0			801	213	4	0	--	--	1,018
1966	0		96	132	1	0	0	--	--	229
1967	0		343	234	71	21	0	--	--	669
1968	0	108	855	236	67	15	0	--	--	1,281
1969	0	122	363	148	82	0	1	--	--	716
1970										
1971										
1972										
1973										
1974										
1975										
1976										
1977										
1978	0		111	308	3	3	1	15	411	426
1979	0	102	241	2	20	7	310	2	680	682
~~1980~~	~~0~~		~~219~~	~~373~~	~~27~~	~~23~~	~~3~~	~~13~~	~~632~~	~~645~~
1981	0	170	393	57	0	0	0	14	606	620
1982	1	493	197	11	35	0	0	20	717	737
1983										
1984	0	40	586	143	7	0	23	8	791	799
1985	0	404	922	133	1	12	0	27	1,445	1,472
1986	0	202	952	403	37	0	0	48	1,546	1,594
1987	0	357	308	732	5	1	0	198	1,205	1,403
1988	5	563	703	316	3	0	0	84	1,506	1,590
1989	0	281	896	1,061	57	0	0	113	2,182	2,295
1990	0	165	189	102	0	0	0	80	376	456
1991	0	742	272	478	0	0	0	1	1,491	1,492
60-66 Ave	0.0	24.2	628.2	643.6	144.0	4.0	0.3	--	--	1,444.2
67-91 Ave	0.4	303.9	487.3	315.7	26.3	5.0	1.9	51.8	1,075.7	1,140.5
87-91 Ave	1.0	421.6	473.6	537.8	13.0	0.2	0.0	95.2	1,352.0	1,447.2

Note: 1979 excluded from analysis because of disproportionately large count in February.

Table 2

Releases of early-run hatchery coho salmon above Marmot Dam by brood year. Data from ODFW (1990).

Brood year	Fry	Presmolts	Smolts	Adults
1960	0	97,840	0	0
1961	100,346	0	0	0
1962	973,262	0	0	0
1963	0	0	0	0
1964	939,980	0	0	6,925
1965	340,355	0	0	1,376
1966	489,838	0	0	785
1967	500,361	0	0	1,250
1968	309,602	0	0	872
1969	187,917	0	0	238
1970	0	0	0	480
1971	798,056	0	0	386
1972	0	644,110	0	327
1973	0	6,402	0	0
1974	0	0	0	0
1975	0	0	0	0
1976	0	0	0	0
1977	0	0	0	0
1978	0	0	0	0
1979	0	152,700	0	0
1980	0	0	0	1,200
1981	0	216,341	0	348
1982	39,100	204,898	0	926
1983	104,506	216,977	0	0
1984	98,645	279,405	0	800
1985	118,178	0	0	600
1986	136,540	140,890	0	1,000
Total				
1960-63	1,073,608	97,840	0	0
1964-86	4,063,078	1,861,723	0	17,513

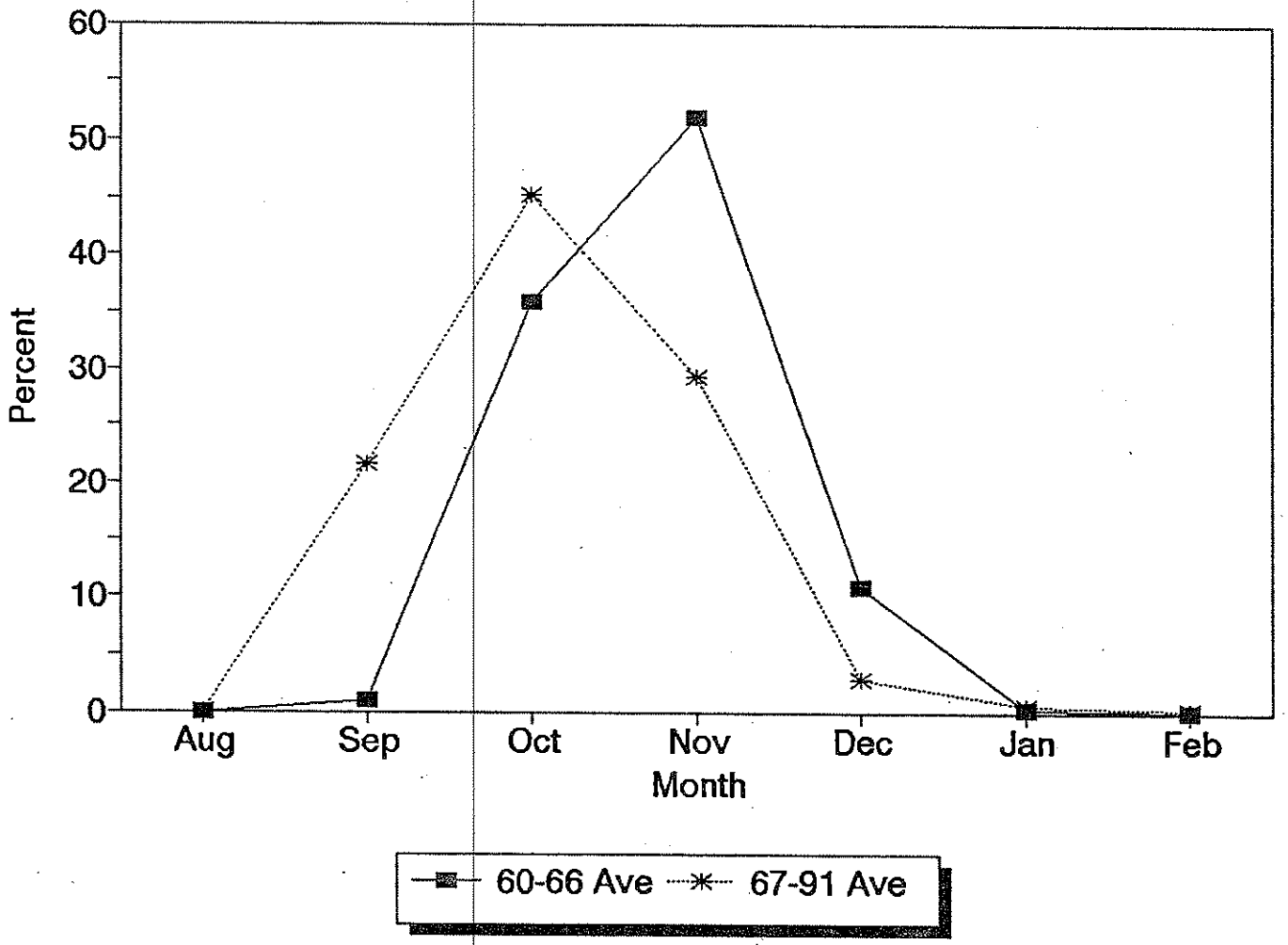

Figure 1. Comparative monthly distribution of coho salmon passing Marmot Dam, Sandy River, before hatchery coho salmon were transplanted above the dam (1960-66) and after hatchery coho salmon were transplanted above the dam (1967-91).

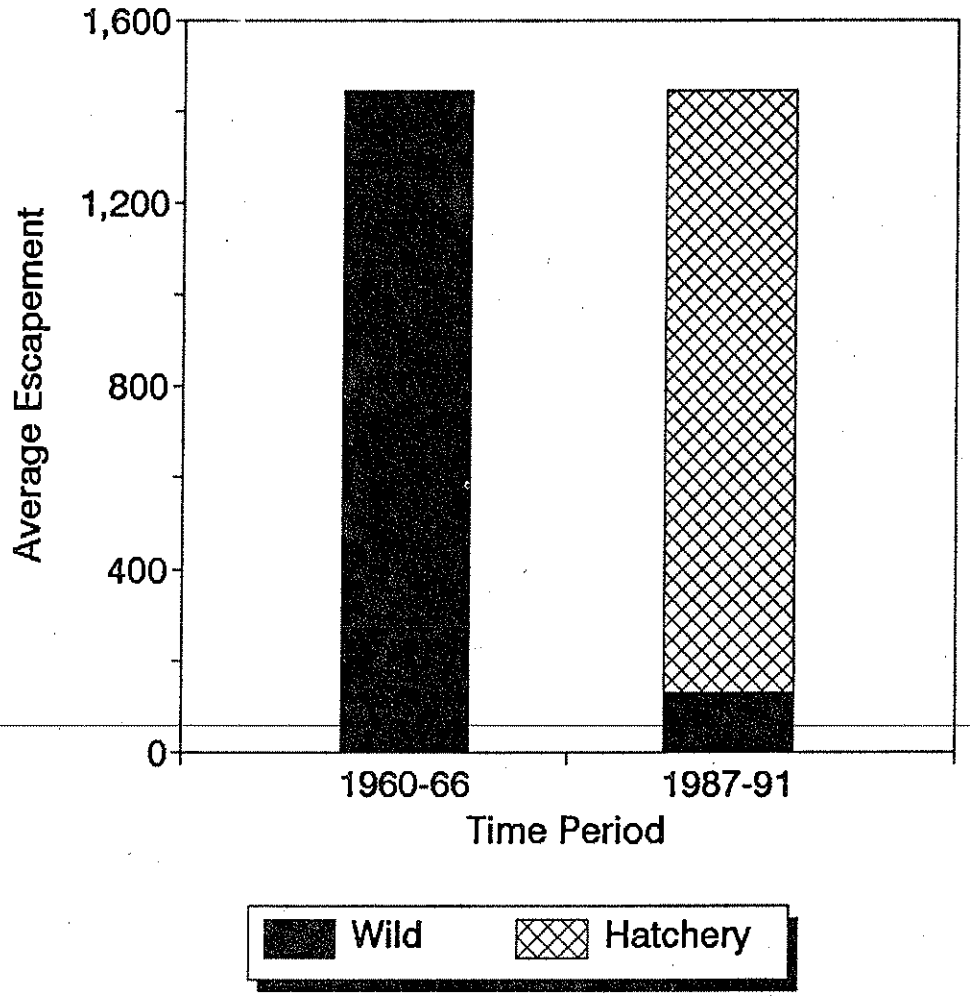

Figure 2. Estimated average escapement of wild and hatchery coho salmon at Marmot Dam, Sandy River, in 1960-66 and 1987-91.