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Rogue Basin Fisheries Evaluation

Effects of Lost Creek Dam on Spring Chinook Salmon in the Rogue River

Phase II Completion Report

Volume II

February 2000

EFFECTS OF LOST CREEK DAM ON SPRING CHINOOK SALMON IN THE ROGUE RIVER. PHASE II COMPLETION REPORT.

VOLUME II

Rogue Basin Fisheries Evaluation Project

Oregon Department of Fish and Wildlife

2501 SW First Avenue
Portland, OR 97207

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APPENDIX A

Relation Between Gregorian Day, Day-of-Year and Week-of-Year.

Gregorian day	Day-of-year	Week-of-year
1-7 January	1-7	1
8-14 January	8-14	2
15-21 January	15-21	3
22-28 January	22-28	4
29 January-4 February	29-35	5
5-11 February	36-42	6
12-18 February	43-49	7
19-25 February	50-56	8
26 February-4 March	57-64	9[a]
5-11 March	65-71	10
12-18 March	72-78	11
19-25 March	79-85	12
26 March-1 April	86-92	13
2-8 April	93-99	14
9-15 April	100-106	15
16-22 April	107-113	16
23-29 April	114-120	17
30 April-6 May	121-127	18
7-13 May	128-134	19
14-20 May	135-141	20
21-27 May	142-148	21
28 May-3 June	149-155	22
4-10 June	156-162	23
11-17 June	163-169	24
18-24 June	170-176	25
25 June-1 July	177-183	26
2-8 July	184-190	27
9-15 July	191-197	28
16-22 July	198-204	29
23-29 July	205-211	30

[a] *Eight-day week during leap years.*

Gregorian day	Day-of-year	Week-of-year
30 July-5 August	212-218	31
6-12 August	219-225	32
13-19 August	226-232	33
20-26 August	233-239	34
27 August-2 September	240-246	35
3-09 September	247-253	36
10-16 September	254-260	37
17-23 September	261-267	38
24-30 September	268-274	39
1-7 October	275-281	40
8-14 October	282-288	41
15-21 October	289-295	42
22-28 October	296-302	43
29 October-4 November	303-309	44
5-11 November	310-316	45
12-18 November	317-323	46
19-25 November	324-330	47
26 November-2 December	331-337	48
3-9 December	338-344	49
10-16 December	345-351	50
17-23 December	352-358	51
24-31 December	359-366	52[b]

[b] *Eight-day week.*

APPENDIX B

Tables of Data and Analyses Related to
the Development of Methods

Appendix Table B-1. Juvenile spring chinook salmon reared at Butte Falls Hatchery and released in the Rogue River, 1944-73. Data were obtained from records located at Central Point office of ODFW and are likely incomplete for some years.

Brood year	Release date	Release site	Number released		Fin clip	Fish weight (g)
			Marked	Total		
1943	04/44	RK 163-173	0	860,183	--	1.5-2.0
1944	04/45	RK 163-173	0	819,759	--	unfed fry
1945	03/46	RK 173	0	488,919	--	0.6
1945	04/46	Big Butte Creek	0	111,072	--	0.9
1946	--	RK 173	0	243,600	--	unfed fry
1947	--	RK 169-173	0	492,338	--	unfed fry
1949	03/51	RK 173	19,301	19,301	AdLM	--
1949	03/51	RK 13	20,385	20,385	LVRVLM	--
1950	03/52	RK 173	15,169	15,169	AdLM	--
1950	03/52	RK 13	14,643	14,643	LVRVLM	--
1951	11/52	RK 173	23,996	23,996	RVLM	--
1951	02/53	RK 158-173	24,079	24,079	AdLM	--
1951	03/53	RK 13	24,236	24,236	LVRVLM	--
1952	11/53	RK 173	9,247	9,247	RVLM	--
1952	03/54	RK 172	23,188	23,188	AdLM	--
1952	03/54	RK 13	17,940	17,940	LVRVLM	--
1953	12/54	Big Butte Creek	27,532	27,532	RVLM	--
1953	12/54	RK 172	25,130	25,130	AdLM	--
1953	12/54	RK 13	24,999	24,999	LVRVLM	--
1954	10/55	Big Butte Creek	2,492	2,492	RVLM	--
1954	10/55	RK 172	24,930	24,930	AdLM	--
1954	10/55	RK 13	16,894	16,894	LVRVLM	--
1955	10/56	RK 172	26,179	26,179	AdLM	--
1955	10/56	RK 13	20,815	20,815	LVRVLM	--
1956	11/57	RK 118-172	34,703	34,703	AdLM	30.6
1956	11/57	RK 77	21,980	21,980	LVRVLM	30.6
1957	07/58	Big Butte Creek	6,002	6,002	RVLM	23.3
1957	11/58	RK 192	31,231	31,231	AdLM	56.7
1957	03/59	RK 116	22,564	22,564	LVRVLM	57-65
1958	12/59	RK 133	21,453	21,453	AdLM	63.0
1958	03/60	RK 133-139	18,099	18,099	LVRVLM	66.7
1959	12/60	Big Butte Creek	31,245	31,245	AdLM	64.8
1959	03/61	Big Butte Creek	24,792	24,792	RPLM	77-99
1960	12/61	Big Butte Creek	22,418	22,418	AnRV	77-87
1960	03/62	Big Butte Creek	25,494	25,494	AnRP	106-126

Appendix Table B-1. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Fish weight (g)
			Marked	Total		
1961	12/62	RK 256	31,526	31,526	AnRV	93.5
1961	03/63	Big Butte Creek	10,076	10,076	AnRP	108.0
1961	03/63	RK 256	21,846	21,846	AnRP	108.0
1962	12/63	Big Butte Creek	25,874	25,874	LPRM	--
1962	03/64	RK 256	25,910	25,910	LPLM	120.1
1963	09/64	Big Butte Creek	0	90,916	--	53.9
1964	11/65	Big Butte Creek	0	6,800	--	--
1964	12/65	Big Butte Creek	25,000	25,000	DORPRM	82.4
1964	01/66	RK 249	25,000	25,000	RPRM	90.7
1965	--	Big Butte Creek	0	22,610	--	0.4
1965	--	Big Butte Creek	0	8,862	--	0.8
1965	--	Big Butte Creek	0	780	--	30.2
1965	12/66	Big Butte Creek	55,598	55,598	LPRM	58.1
1966	01/68	RK 249	64,729	64,729	LVRM	64-72
1967	--	RK 212-269	0	18,699	--	0.7
1967	12/68	RK 250	63,818	63,818	AdLP	62.6
1968	--	Big Butte Creek	0	12,790	--	0.6
1968	02/70	RK 223-250	68,228	68,228	AdAn	64.8
1969	--	RK 212-269	0	30,676	--	0.6
1969	03/71	RK 212-250	52,074	52,074	DO	62.4
1970	--	RK 212-269	0	9,085	--	5.7
1970	01/72	RK 212-269	57,016	57,016	AnRP	58.1
1971	--	Big Butte Creek	0	1,369	--	3.3
1971	--	RK 212-269	0	35,900	--	0.5
1971	01/73	RK 212-269	57,232	57,232	LVRM	63.8

Appendix Table B-2. Juvenile spring chinook salmon reared at Cole M. Rivers Hatchery and released in the Rogue River, 1974-93. Data was obtained from Michael Evenson, ODFW, Central Point.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1972	12/15/73	RK 252	59,978	59,978	LVLM	--	75.8
1973	11/21/74	RK 252	98,404	98,404	LVRM	--	58.2
1973	12/16/74	RK 252	167,787	167,787	LVRM	--	61.5
1973	01/14/75	RK 252	154,186	154,186	LVRM	--	63.7
1973	02/10/75	RK 252	130,896	130,896	LVRM	--	68.5
1974	01/02/76	RK 252	19,487	20,152	AdLVRM	--	87.0
1974	01/02/76	RK 252	32,442	33,541	AdLVRM	--	79.4
1974	01/02/76	RK 252	3,952	4,261	AdLVRM	--	79.4
1974	01/02/76	RK 252	18,682	19,257	AdLVRM	--	69.9
1974	01/02/76	RK 252	20,709	22,832	AdLVRM	--	73.0
1974	01/02/76	RK 252	123,599	125,628	AdLVRM	--	78.1
1975	10/13/76	RK 252	73,945	77,393	Ad	(09 04 02)	80.8
1975	10/13/76	RK 252	63,484	75,428	Ad	(09 04 01)	39.3
1975	12/15/76	RK 252	72,036	77,240	Ad	(09 04 03)	80.6
1975	12/15/76	RK 252	33,037	36,440	Ad	(09 03 15)	84.0
1975	12/15/76	RK 252	63,140	65,613	Ad	(09 04 04)	38.1
1975	12/12/76	RK 252	0	524,242	--	--	84.0
1976	07/19/77	RK 2	135,884	135,884	RV	--	8.9
1976	10/17/77	RK 252	0	177,114	--	--	60.6
1976	10/18/77	RK 252	72,116	75,808	Ad	(09 16 17)	81.8
1976	10/18/77	RK 252	49,894	52,023	Ad	(09 16 20)	58.0
1976	10/18/77	RK 252	75,193	77,732	Ad	(09 16 33)	43.8
1976	12/12/77	RK 252	0	146,086	--	--	81.3
1976	12/13/77	RK 252	72,466	76,546	Ad	(09 16 19)	77.0
1976	12/13/77	RK 252	73,536	77,169	Ad	(09 16 18)	67.9
1976	12/13/77	RK 252	71,999	78,374	Ad	(09 16 16)	46.0
1977	10/18/78	RK 252	30,981	98,359	Ad	(07 16 29)	75.1
1977	10/18/78	RK 252	30,132	109,849	Ad	(07 16 30)	67.2
1977	10/18/78	RK 252	31,942	86,157	Ad	(07 16 32)	47.8
1977	10/18/78	RK 252	30,274	83,399	Ad	(07 16 31)	38.6
1977	12/18/78	RK 252	30,177	97,302	Ad	(07 16 34)	71.7
1977	12/18/78	RK 252	30,467	65,084	Ad	(07 16 33)	67.0
1977	12/18/78	RK 252	29,170	48,564	Ad	(07 16 35)	47.0
1977	12/18/78	RK 252	22,837	46,509	Ad	(07 16 37)	39.0
1977	03/14/79	RK 252	25,936	27,591	Ad	(07 16 39)	61.8
1977	03/14/79	RK 252	26,015	27,578	Ad	(07 16 38)	58.8

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1978	10/19/79	RK 252	27,906	89,763	Ad	(07 19 32)	68.0
1978	10/19/79	RK 252	25,196	82,494	Ad	(07 19 31)	67.6
1978	10/19/79	RK 252	30,549	100,447	Ad	(07 19 33)	39.3
1978	10/19/79	RK 252	29,631	95,781	Ad	(07 19 34)	37.1
1978	12/18/79	RK 252	29,846	98,424	Ad	(07 19 35)	60.1
1978	12/18/79	RK 252	29,447	95,968	Ad	(07 19 36)	58.0
1978	12/18/79	RK 252	27,900	91,584	Ad	(07 19 38)	44.5
1978	12/18/79	RK 252	29,052	96,832	Ad	(07 19 37)	44.2
1978	03/03/80	RK 252	24,394	25,097	Ad	(07 18 54)	66.7
1979	10/16/80	RK 252	33,132	85,791	Ad	(07 22 15)	54.0
1979	10/16/80	RK 252	32,105	84,205	Ad	(07 22 16)	59.7
1979	10/16/80	RK 252	32,041	32,345	Ad	(07 22 35)	54.0
1979	10/16/80	RK 252	31,710	77,732	Ad	(07 22 09)	52.0
1979	10/16/80	RK 252	31,878	77,072	Ad	(07 22 10)	47.8
1979	10/16/80	RK 252	32,169	49,282	Ad	(07 22 36)	43.7
1979	12/11/80	RK 252	31,832	83,098	Ad	(07 22 12)	59.0
1979	12/11/80	RK 252	29,626	95,672	Ad	(07 22 11)	60.9
1979	12/11/80	RK 252	27,888	73,541	Ad	(07 22 14)	42.2
1979	12/11/80	RK 252	27,319	79,636	Ad	(07 22 13)	45.7
1979	03/05/81	RK 252	24,446	24,904	Ad	(07 22 31)	74.0
1980	08/14/81	RK 252	30,076	31,602	Ad	(07 25 14)	49.0
1980	09/16/81	RK 252	31,297	32,442	Ad	(07 25 09)	74.4
1980	10/21/81	RK 252	31,102	31,561	Ad	(07 25 15)	89.6
1980	10/21/81	RK 252	31,966	32,250	Ad	(07 25 12)	81.8
1980	10/20/81	RK 252	0	584,998	--	--	83.3
1980	03/15/82	RK 252	28,080	28,785	Ad	(07 20 23)	127.4
1981	10/28/82	RK 252	15,296	15,762	Ad	(07 27 10)	54.7
1981	10/28/82	RK 252	19,648	20,043	Ad	(07 27 08)	58.2
1981	10/28/82	RK 252	20,029	20,639	Ad	(07 27 02)	60.8
1981	10/28/82	RK 252	19,256	19,545	Ad	(07 27 05)	70.0
1981	10/28/82	RK 252	18,843	19,922	Ad	(07 27 09)	61.9
1981	10/28/82	RK 252	19,133	19,796	Ad	(07 27 11)	56.4
1981	10/28/82	RK 252	20,824	21,458	Ad	(07 27 06)	68.2
1981	10/28/82	RK 252	20,371	21,538	Ad	(07 27 07)	63.6
1981	10/28/82	RK 252	15,503	15,895	Ad	(07 27 03)	42.3
1981	10/28/82	RK 252	18,801	18,989	Ad	(07 27 04)	40.0
1981	10/28/82	RK 252	26,829	26,829	AdLV	(07 26 50)	64.9
1981	10/28/82	RK 252	81,679	81,679	LV	--	64.9
1981	10/28/82	RK 212	25,042	26,235	AdRV	(07 26 51)	62.9
1981	10/28/82	RK 212	63,996	63,996	RV	--	62.9
1981	10/27/82	RK 252	0	369,600	--	--	62.1
1981	03/15/83	RK 252	19,555	19,790	Ad	(07 27 13)	67.6

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1982	09/07/83	RK 252	22,287	27,391	Ad	(07 28 46)	35.7
1982	10/13/83	RK 252	0	103,733	--	--	64.8
1982	10/14/83	RK 252	0	138,023	--	--	60.5
1982	10/17/83	RK 252	21,527	26,230	Ad	(07 28 53)	64.9
1982	10/17/83	RK 252	21,669	26,615	Ad	(07 28 57)	73.0
1982	10/17/83	RK 252	22,288	26,838	Ad	(07 28 49)	70.0
1982	10/17/83	RK 252	22,737	27,363	Ad	(07 28 50)	65.8
1982	10/17/83	RK 252	21,232	28,420	Ad	(07 28 51)	70.9
1982	10/17/83	RK 252	21,257	28,473	Ad	(07 28 52)	70.0
1982	10/17/83	RK 252	21,968	26,755	Ad	(07 28 48)	66.7
1982	10/17/83	RK 252	22,313	27,273	Ad	(07 28 47)	71.9
1982	10/17/83	RK 252	20,428	20,843	Ad	(07 28 45)	84.0
1982	10/17/83	RK 252	21,475	22,626	Ad	(07 28 44)	73.0
1982	10/18/83	RK 252	26,222	27,420	Ad	(07 28 55)	62.1
1982	10/18/83	RK 212	26,512	27,141	Ad	(07 28 56)	60.6
1982	10/18/83	RK 252	0	33,118	--	--	58.9
1982	10/18/83	RK 252	0	79,816	--	--	41.2
1982	10/18/83	RK 252	0	69,700	--	--	62.1
1982	10/18/83	RK 252	76,059	76,059	LP	--	62.1
1982	10/18/83	RK 212	75,518	75,518	RP	--	60.5
1983	06/20/84	RK 252	202,300	774,522	LV	--	8.4
1983	09/20/84	RK 252	21,729	22,753	Ad	(07 31 16)	58.8
1983	09/20/84	RK 252	21,885	22,446	Ad	(07 31 15)	58.8
1983	09/20/84	RK 252	21,620	22,404	Ad	(07 31 14)	57.5
1983	09/20/84	RK 252	21,565	22,347	Ad	(07 31 13)	58.1
1983	09/20/84	RK 252	21,500	22,051	Ad	(07 31 09)	58.1
1983	09/21/84	RK 252	22,166	22,618	Ad	(07 31 18)	56.7
1983	09/21/84	RK 252	23,869	24,356	Ad	(07 31 17)	57.4
1983	09/21/84	RK 252	22,223	22,910	Ad	(07 31 10)	55.2
1983	09/21/84	RK 252	21,904	22,238	Ad	(07 31 11)	57.5
1983	09/21/84	RK 252	22,021	22,586	Ad	(07 31 12)	57.5
1983	09/21/84	RK 252	26,481	26,865	AdLVLM	(07 30 10)	44.9
1983	09/21/84	RK 252	63,866	63,866	LVLM	--	44.9
1983	09/21/84	RK 183	26,368	26,990	AdRVLM	(07 30 09)	46.7
1983	09/21/84	RK 183	67,461	67,461	RVLM	--	46.7
1983	09/21/84	RK 252	0	702,987	--	--	46.8

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1984	08/15/85	RK 252	10,719	31,499	Ad	(07 34 10)	42.5
1984	08/15/85	RK 252	10,211	29,536	Ad	(07 34 07)	45.9
1984	08/15/85	RK 252	9,832	30,245	Ad	(07 34 04)	47.2
1984	08/16/85	RK 252	0	382,720	--	--	52.1
1984	09/12/85	RK 252	10,126	33,237	Ad	(07 34 03)	59.1
1984	09/12/85	RK 252	10,153	34,560	Ad	(07 34 09)	59.4
1984	09/12/85	RK 252	10,290	28,364	Ad	(07 34 06)	61.4
1984	09/12/85	RK 252	28,928	29,167	Ad	(07 31 60)	62.1
1984	09/12/85	RK 252	71,732	71,732	RP	--	62.1
1984	09/11/85	RK 212	29,072	29,424	Ad	(07 31 59)	65.7
1984	09/11/85	RK 212	72,355	72,355	LP	--	65.7
1984	09/12/85	RK 252	0	168,657	--	--	65.7
1984	10/15/85	RK 252	10,291	39,459	Ad	(07 34 02)	81.3
1984	10/15/85	RK 252	10,494	34,393	Ad	(07 34 08)	81.0
1984	10/15/85	RK 252	10,145	31,312	Ad	(07 34 05)	87.6
1984	10/15/85	RK 252	15,799	35,983	Ad	(07 31 35)	78.7
1984	10/15/85	RK 252	16,095	36,411	Ad	(07 31 38)	78.1
1984	10/15/85	RK 252	16,671	36,548	Ad	(07 31 36)	82.6
1984	10/15/85	RK 252	15,274	32,092	Ad	(07 31 39)	82.6
1984	10/15/85	RK 252	15,154	36,629	Ad	(07 31 34)	81.3
1984	10/15/85	RK 252	15,458	36,428	Ad	(07 31 37)	80.6
1984	10/15/85	RK 252	0	139,135	--	--	90.7
1985	06/20/86	RK 252	241,120	676,566	LV	--	8.9
1985	06/23/86	RK 252	10,638	33,209	Ad	(07 39 21)	8.5
1985	06/23/86	RK 252	10,509	40,049	Ad	(07 39 20)	9.2
1985	06/23/86	RK 252	10,426	35,458	Ad	(07 39 22)	7.9
1985	08/14/86	RK 252	10,504	36,664	Ad	(07 39 23)	30.0
1985	08/15/86	RK 252	10,361	36,402	Ad	(07 39 25)	30.2
1985	08/15/86	RK 252	10,358	36,220	Ad	(07 39 24)	31.2
1985	08/16/86	RK 252	0	539,514	--	--	28.3
1985	09/18/86	RK 252	9,909	38,206	Ad	(07 40 02)	46.7
1985	09/18/86	RK 252	10,123	38,564	Ad	(07 40 03)	45.1
1985	09/18/86	RK 252	10,087	36,900	Ad	(07 34 19)	44.0
1985	09/18/86	RK 252	9,201	37,722	Ad	(07 34 23)	52.1
1985	09/18/86	RK 252	10,553	38,423	Ad	(07 34 24)	51.5
1985	09/18/86	RK 252	9,433	36,063	Ad	(07 34 25)	50.9
1985	09/18/86	RK 252	9,073	37,695	Ad	(07 34 20)	47.2

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1985	09/18/86	RK 252	10.769	38,631	Ad	(07 34 21)	48.3
1985	09/19/86	RK 252	9,970	36,161	Ad	(07 34 22)	46.8
1985	09/19/86	RK 252	10,685	37,041	Ad	(07 39 17)	54.1
1985	09/19/86	RK 252	10,603	37,211	Ad	(07 39 18)	53.2
1985	09/19/86	RK 252	10,432	37,472	Ad	(07 39 19)	55.6
1985	09/19/86	RK 252	0	101,948	--	--	51.5
1985	10/15/86	RK 252	10,103	36,623	Ad	(07 40 01)	64.1
1985	10/15/86	RK 252	10,508	36,345	Ad	(07 39 27)	63.9
1985	10/15/86	RK 252	10,104	36,644	Ad	(07 39 26)	65.1
1985	10/14/86	RK 252	0	433,176	--	--	66.2
1986	06/23/87	RK 252	10,638	40,199	Ad	(07 41 20)	8.3
1986	06/23/87	RK 252	10,509	39,514	Ad	(07 41 15)	9.4
1986	06/23/87	RK 252	10,426	39,918	Ad	(07 41 09)	10.1
1986	06/24/87	RK 252	259,179	683,409	LP	--	9.4
1986	08/19/87	RK 252	10,504	40,090	Ad	(07 41 23)	32.4
1986	08/19/87	RK 252	10,358	39,744	Ad	(07 41 17)	35.4
1986	08/19/87	RK 252	10,361	39,915	Ad	(07 41 10)	33.0
1986	08/20/87	RK 252	0	391,924	--	--	29.1
1986	09/15/87	RK 252	10,123	39,303	Ad	(07 35 05)	43.8
1986	09/16/87	RK 252	10,087	39,880	Ad	(07 35 08)	43.7
1986	09/16/87	RK 252	9,909	41,286	Ad	(07 35 11)	48.1
1986	09/16/87	RK 252	10,685	37,059	Ad	(07 40 61)	46.4
1986	09/16/87	RK 252	10,603	36,914	Ad	(07 40 62)	45.9
1986	09/16/87	RK 252	10,432	36,908	Ad	(07 40 63)	44.4
1986	09/15/87	RK 252	10,698	39,323	Ad	(07 35 07)	46.7
1986	09/15/87	RK 252	10,496	39,803	Ad	(07 35 13)	42.7
1986	09/16/87	RK 252	10,486	39,936	Ad	(07 35 10)	45.5
1986	09/15/87	RK 252	10,683	39,467	Ad	(07 35 06)	43.7
1986	09/15/87	RK 252	10,556	41,076	Ad	(07 35 12)	43.3
1986	09/16/87	RK 252	10,424	39,775	Ad	(07 35 09)	43.7
1986	09/16/87	RK 252	0	74,512	--	--	42.4
1986	10/15/87	RK 252	10,104	40,194	Ad	(07 41 24)	53.5
1986	10/15/87	RK 252	10,508	39,318	Ad	(07 41 18)	63.9
1986	10/15/87	RK 252	10,103	39,875	Ad	(07 41 12)	58.0
1986	10/14/87	RK 252	0	432,789	--	--	54.6
1987	06/21/88	RK 252	10,825	10,825	Ad	(07 41 03)	11.9
1987	06/21/88	RK 252	10,832	10,832	Ad	(07 41 05)	12.0
1987	06/21/88	RK 252	10,831	10,831	Ad	(07 41 06)	12.8
1987	06/21/88	RK 252	95,078	95,154	LV	--	12.0
1987	08/18/88	RK 252	10,463	41,884	Ad	(07 46 15)	36.0

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1987	08/18/88	RK 252	10,543	42,624	Ad	(07 46 13)	38.8
1987	08/18/88	RK 252	10,591	42,361	Ad	(07 46 14)	36.3
1987	08/18/88	RK 252	0	419,564	--	--	35.2
1987	09/15/88	RK 252	9,928	42,030	Ad	(07 46 18)	54.2
1987	09/15/88	RK 252	9,829	42,320	Ad	(07 46 17)	54.6
1987	09/15/88	RK 252	9,850	41,897	Ad	(07 46 16)	53.8
1987	09/15/88	RK 252	10,651	42,568	Ad	(07 45 49)	52.2
1987	09/15/88	RK 252	10,521	43,511	Ad	(07 45 48)	47.7
1987	09/15/88	RK 252	10,553	42,497	Ad	(07 45 47)	52.6
1987	09/15/88	RK 252	0	284,460	--	--	49.3
1987	10/19/88	RK 252	10,499	42,042	Ad	(07 46 21)	66.4
1987	10/19/88	RK 252	10,510	41,848	Ad	(07 46 20)	68.8
1987	10/19/88	RK 252	9,997	42,523	Ad	(07 46 19)	70.9
1987	10/18/88	RK 252	0	415,771	--	--	63.0
1988	08/15/89	RK 252	10,394	42,148	Ad	(07 23 36)	37.6
1988	08/15/89	RK 252	10,358	42,235	Ad	(07 37 58)	36.7
1988	08/15/89	RK 252	10,510	42,147	Ad	(07 23 37)	37.3
1988	08/15/89	RK 252	0	420,183	--	--	32.6
1988	09/15/89	RK 252	9,770	41,564	Ad	(07 42 30)	52.0
1988	09/15/89	RK 252	10,342	41,787	Ad	(07 42 33)	52.0
1988	09/15/89	RK 252	9,076	41,418	Ad	(07 42 29)	54.8
1988	09/15/89	RK 252	9,438	41,922	Ad	(07 42 23)	50.6
1988	09/15/89	RK 252	10,061	41,535	Ad	(07 42 24)	51.1
1988	09/15/89	RK 252	10,097	41,727	Ad	(07 42 27)	52.8
1988	09/15/89	RK 252	0	288,837	--	--	50.4
1988	10/17/89	RK 252	9,949	41,663	Ad	(07 36 43)	71.1
1988	10/17/89	RK 252	10,225	41,683	Ad	(07 42 34)	71.9
1988	10/17/89	RK 252	10,342	41,578	Ad	(07 42 36)	73.0
1988	10/17/89	RK 252	0	412,581	--	--	70.9
1989	08/16/90	RK 252	9,866	53,869	Ad	(07 51 44)	36.9
1989	08/16/90	RK 252	9,602	54,581	Ad	(07 51 42)	37.3
1989	08/16/90	RK 252	9,975	54,010	Ad	(07 51 43)	37.3
1989	08/15/90	RK 252	0	366,876	--	--	33.8
1989	09/14/90	RK 252	10,237	45,339	Ad	(07 51 47)	52.8
1989	09/14/90	RK 252	10,074	45,167	Ad	(07 51 46)	51.6
1989	09/14/90	RK 252	9,888	45,155	Ad	(07 51 45)	52.2
1989	09/14/90	RK 252	9,856	45,030	Ad	(07 51 51)	53.9
1989	09/14/90	RK 252	10,100	45,109	Ad	(07 51 52)	52.3
1989	09/14/90	RK 252	9,912	45,120	Ad	(07 51 53)	52.7

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1989	09/12/90	RK 252	0	270,274	--	--	53.4
1989	10/16/90	RK 252	9,625	40,845	Ad	(07 51 50)	71.8
1989	10/16/90	RK 252	9,538	41,112	Ad	(07 51 49)	72.6
1989	10/16/90	RK 252	9,625	41,218	Ad	(07 51 48)	73.2
1989	10/16/90	RK 252	0	398,342	--	--	74.3
1990	08/13/91	RK 252	10,564	56,461	Ad	(07 53 13)	32.4
1990	08/13/91	RK 252	10,566	57,394	Ad	(07 53 12)	34.1
1990	08/13/91	RK 252	10,145	56,474	Ad	(07 53 14)	36.0
1990	08/14/91	RK 252	0	452,551	--	--	35.2
1990	09/10/91	RK 252	10,720	48,232	Ad	(07 53 17)	43.6
1990	09/10/91	RK 252	10,195	43,167	Ad	(07 53 20)	56.7
1990	09/10/91	RK 252	10,500	46,430	Ad	(07 36 44)	46.3
1990	09/11/91	RK 252	10,374	47,077	Ad	(07 53 16)	46.8
1990	09/11/91	RK 252	10,384	43,342	Ad	(07 53 19)	56.0
1990	09/11/91	RK 252	10,540	46,686	Ad	(07 36 45)	49.8
1990	09/12/91	RK 252	10,563	47,499	Ad	(07 53 15)	49.8
1990	09/12/91	RK 252	10,577	43,256	Ad	(07 53 18)	56.0
1990	09/12/91	RK 252	10,518	46,326	Ad	(07 36 46)	51.0
1990	09/14/91	RK 252	0	691,115	--	--	46.3
1991	08/18/92	RK 252	10,489	10,637	Ad	(07 59 07)	28.7
1991	08/18/92	RK 252	10,448	10,536	Ad	(07 59 06)	31.7
1991	08/18/92	RK 252	10,527	10,576	Ad	(07 59 08)	32.4
1991	08/18/92	RK 252	0	712,140	--	--	32.3
1991	09/08/92	RK 252	10,220	10,364	Ad	(07 59 09)	45.8
1991	09/09/92	RK 252	10,134	10,609	Ad	(07 59 10)	44.0
1991	09/10/92	RK 252	10,135	10,574	Ad	(07 59 11)	47.7
1991	09/08/92	RK 252	10,419	10,605	Ad	(07 59 20)	36.3
1991	09/09/92	RK 252	10,298	10,443	Ad	(07 59 19)	45.4
1991	09/10/92	RK 252	10,226	10,568	Ad	(07 59 18)	41.6
1991	09/08/92	RK 252	10,330	10,617	Ad	(07 59 16)	52.1
1991	09/09/92	RK 252	10,224	10,582	Ad	(07 59 17)	52.1
1991	09/10/92	RK 252	9,973	10,678	Ad	(07 59 15)	49.8
1991	09/09/92	RK 252	0	693,631	--	--	47.9
1991	10/13/92	RK 252	10,252	10,597	Ad	(07 59 12)	66.7
1991	10/13/92	RK 252	10,235	10,542	Ad	(07 59 13)	67.7
1991	10/13/92	RK 252	9,775	10,523	Ad	(07 59 14)	72.0
1991	10/14/92	RK 252	0	149,328	--	--	72.4

Appendix Table B-2. Continued.

Brood year	Release date	Release site	Number released		Fin clip	Tag Code	Fish weight (g)
			Marked	Total			
1992	08/18/93	RK 252	10,000	10,503	Ad	(07 63 44)	28.5
1992	08/18/93	RK 252	10,316	10,561	Ad	(07 63 43)	28.7
1992	08/18/93	RK 252	10,160	10,545	Ad	(07 63 42)	29.4
1992	08/19/93	RK 252	30,403	31,696	Ad	(07 63 62)	31.5
1992	08/19/93	RK 252	0	683,928	--	--	29.0
1992	09/20/93	RK 252	10,117	10,574	Ad	(07 63 40)	54.0
1992	09/20/93	RK 252	10,170	10,587	Ad	(07 63 47)	51.0
1992	09/20/93	RK 252	10,087	10,513	Ad	(07 63 51)	50.4
1992	09/21/93	RK 252	10,374	10,584	Ad	(07 63 41)	50.4
1992	09/21/93	RK 252	10,288	10,526	Ad	(07 63 46)	49.3
1992	09/21/93	RK 252	10,031	10,535	Ad	(07 63 53)	58.9
1992	09/22/93	RK 252	9,821	10,561	Ad	(07 63 39)	60.5
1992	09/22/93	RK 252	9,841	10,513	Ad	(07 63 48)	52.7
1992	09/22/93	RK 252	10,235	10,576	Ad	(07 63 52)	58.9
1992	09/21/93	RK 252	0	624,698	--	--	47.0
1992	10/20/93	RK 252	9,235	10,554	Ad	(07 63 49)	56.7
1992	10/20/93	RK 252	8,897	10,596	Ad	(07 63 50)	58.1
1992	10/20/93	RK 252	9,830	10,454	Ad	(07 63 45)	65.7
1992	10/21/93	RK 252	0	132,927	--	--	55.8

Appendix Table B-3. Juvenile fall chinook salmon reared at Cole M. Rivers Hatchery and released in the Rogue River upstream of Grants Pass, 1978-86. Data was obtained from Michael Evenson, ODFW, Central Point.

Brood year	Release date	Release site	Number released		Fin clip	Tag code	Fish weight (g)
			Marked	Total			
1978	10/25/79	--	27,344	--	Ad	(07 18 53)	62.1
1981	11/02/82	RK 212	22,239	23,229	Ad	(07 26 24)	52.1
1982	10/18/83	RK 252	26,775	28,072	Ad	(07 26 14)	63.9
1983	09/17/84	RK 183	24,295	29,640	Ad	(07 30 20)	69.8
1984	09/05/85	RK 252	26,779	36,805	Ad	(07 30 39)	38.4
1985	09/03/86	RK 169	27,168	55,213	Ad	(07 35 41)	42.0
1986	09/15/87	RK 169	27,449	58,656	Ad	(07 40 57)	43.6

Appendix Table B-4. Mean flow (cfs) at Grants Pass on days when juvenile chinook salmon were captured in the trap at Savage Rapids Dam, 1974-90. Week-of-year calendar is in **APPENDIX A.**

	Week-of-year									
Year	20	21	22	23	24	25	26	27	28	29
1974	4,250	3,845	4,561	5,164	4,845	4,104	3,092	2,565	2,322	1,990
1975	7,255	5,318	5,460	5,494	4,440	3,397	3,278	2,680	2,405	2,127
1976	3,792	3,150	2,918	2,648	2,662	2,444	2,012	1,758	1,714	1,536
1977	1,330	1,901	1,123	870	1,096	1,019	1,046	1,037	939	982
1978	2,480	2,410	1,985	1,838	2,278	2,244	2,265	2,390	2,350	2,467
1979	4,583	3,386	2,230	1,802	1,860	2,248	1,992	2,600	2,714	2,560
1980	2,172	2,073	2,170	2,082	2,105	2,097	2,012	1,855	1,894	1,924
1981	2,282	2,852	1,758	2,210	1,890	1,730	1,658	1,931	1,857	1,812
1982	2,707	3,750	3,455	2,545	2,968	2,788	2,808	2,338	2,195	2,293
1983	4,782	5,463	5,462	3,422	3,215	2,842	2,418	2,520	2,150	2,340
1984	6,530	4,328	5,048	4,360	4,470	4,015	3,184	3,105	3,050	3,045
1985	1,920	2,855	3,405	2,712	2,708	1,920	1,800	1,878	2,058	2,162
1986	2,687	3,327	2,958	2,412	2,007	2,020	1,902	2,412	2,325	2,295
1987	1,710	1,675	1,735	1,735	1,972	2,092	2,130	2,255	2,240	2,565
1988	2,747	2,040	3,398	4,160	2,442	2,082	2,050	1,848	1,760	1,518
1989	3,255	3,052	3,230	3,030	2,312	2,212	2,170	2,145	2,138	2,068
1990	1,860	2,598	3,532	3,010	2,283	1,885	1,800	1,985	1,898	1,662

	Week-of-year									
Year	30	31	32	33	34	35	36	37	38	39
1974	1,750	1,625	1,542	1,498	1,510	1,378	1,370	1,410	1,380	1,380
1975	1,644	1,548	1,396	1,270	1,568	1,448	1,290	1,212	1,480	1,267
1976	1,296	2,090	1,630	2,454	1,710	1,304	1,280	1,568	1,500	1,325
1977	897	906	946	895	976	1,026	1,020	1,130	1,338	1,783
1978	2,437	2,037	1,860	1,925	1,945	1,785	1,970	1,590	1,782	1,580
1979	2,494	2,176	1,878	1,928	1,998	1,980	1,737	1,282	1,420	1,522
1980	2,046	2,122	2,136	2,174	1,977	1,508	1,565	1,180	1,280	1,255
1981	1,790	1,952	2,002	2,038	1,798	1,625	1,730	2,376	1,662	1,255
1982	2,325	2,455	2,380	2,408	1,863	2,165	2,062	1,670	2,075	2,175
1983	2,270	2,230	2,297	2,638	3,040	3,365	3,025	2,785	2,135	2,340
1984	3,218	3,298	3,252	3,160	2,870	2,808	2,933	2,665	2,078	1,585
1985	2,155	2,298	2,248	2,275	2,378	2,280	2,510	2,498	1,717	1,578
1986	2,180	2,208	2,208	2,220	2,230	2,298	2,295	1,912	1,748	1,780
1987	2,700	2,248	2,152	2,170	2,480	2,700	2,920	1,975	1,320	1,315
1988	1,418	1,420	1,450	1,952	2,040	2,028	1,820	1,372	1,152	1,190
1989	2,084	2,070	2,130	2,572	2,630	2,825	2,698	2,415	1,640	1,560
1990	1,505	1,635	1,665	1,875	2,145	2,222	2,018	1,965	1,482	1,392

Appendix Table B-5. Mean weekly catch rates (fish per hour) of unmarked juvenile chinook salmon trapped at Savage Rapids Dam, 1974-90. Data include unmarked fish released from Cole M. Rivers Hatchery in June but do not include unmarked hatchery fish released in August or September. Week-of-year calendar is in **APPENDIX A.**

	Week-of-year									
Year	20	21	22	23	24	25	26	27	28	29
1974	--	--	--	--	--	--	--	--	--	2.00
1975	--	--	0.18	--	--	--	3.17	2.00	10.04	8.81
1976	0.60	0.78	0.66	1.98	3.40	8.91	28.72	60.53	40.78	22.70
1977	0.92	17.43	145.49	--	--	--	--	134.75	135.29	102.38
1978	0.08	0.30	0.31	1.43	1.84	4.41	2.81	4.97	4.19	5.39
1979	1.89	5.93	7.32	13.73	25.44	52.56	26.03	46.27	56.43	39.53
1980	10.15	10.14	10.09	10.39	10.43	13.76	18.06	20.02	17.34	17.92
1981	4.11	0.90	92.83	59.37	57.72	--	--	--	--	32.71
1982	0.04	0.05	0.10	0.31	0.08	0.06	0.41	2.69	4.80	6.11
1983	0.39	0.37	0.30	0.16	0.31	0.68	1.51	2.12	7.74	7.33
1984	0.04	0.80	0.70	0.80	2.20	1.80	4.80	2.89	2.04	3.40
1985	0.33	4.24	1.82	3.51	9.21	43.86	53.61	66.86	10.81	17.68
1986	0.37	0.79	1.19	1.77	9.78	49.21	50.32	58.56	74.91	89.36
1987	4.71	4.30	11.90	79.85	132.63	183.16	92.88	81.04	72.50	40.90
1988	11.16	242.41	194.71	8.91	73.50	168.01	164.67	58.66	64.59	78.41
1989	2.65	1.08	0.78	2.86	8.02	21.36	15.38	39.32	116.52	113.86
1990	19.38	46.15	49.50	111.40	137.19	175.64	65.07	82.40	34.04	61.14

	Week-of-year									
Year	30	31	32	33	34	35	36	37	38	39
1974	23.21	13.57	7.05	13.41	8.16	8.06	2.26	5.46	5.12	3.87
1975	70.79	50.13	67.23	56.02	35.36	45.54	65.16	35.33	21.98	24.14
1976	53.78	72.88	209.00	56.30	54.11	67.00	45.15	22.18	27.31	39.44
1977	127.70	83.13	152.03	251.93	200.57	129.86	94.94	98.25	50.18	24.27
1978	3.24	1.64	0.75	2.58	1.50	10.96	1.25	5.58	3.27	0.33
1979	92.19	72.54	87.95	18.64	8.87	13.04	38.45	98.33	64.52	49.19
1980	17.88	14.05	14.91	14.18	16.64	17.14	17.50	37.58	39.73	25.51
1981	24.35	21.20	22.72	19.01	9.89	11.25	9.87	14.86	4.27	8.97
1982	5.12	3.92	9.76	2.94	2.51	2.06	0.74	0.19	0.47	0.34
1983	3.56	1.88	4.39	6.74	9.08	8.29	5.04	5.61	2.79	2.00
1984	1.93	1.33	2.90	1.74	0.31	0.41	0.20	0.27	0.60	0.81
1985	15.14	20.21	12.18	14.15	6.12	6.63	3.66	3.54	2.54	3.31
1986	48.08	61.76	67.05	58.99	26.32	7.67	11.26	26.32	20.16	4.89
1987	13.70	45.18	24.24	14.30	7.60	4.74	6.08	7.47	11.34	10.04
1988	78.83	43.89	41.51	9.36	4.78	3.93	3.58	5.93	6.55	2.60
1989	67.00	89.90	52.51	43.27	16.00	12.86	27.01	22.19	6.00	4.96
1990	39.48	53.21	27.10	15.19	11.54	13.78	9.98	7.93	8.64	13.96

Appendix Table B-6. Mean weekly catch rates (fish per hour) of marked juvenile chinook salmon trapped at Savage Rapids Dam, 1984-88. Data includes only those marked fish released from Cole M. Rivers Hatchery in June. Week-of-year calendar is in **APPENDIX A.** Catch rates of fish with adipose clips are not presented for weeks when marked fish released from the hatchery in August and September were also caught in the trap.

	Week-of-year														
Year	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
							LV OR LP MARK								
1984	0.00	1.60	0.60	0.40	1.00	0.40	0.06	0.22	0.10	0.02	0.02	0.05	0.00	0.02	0.02
1986	14.05	4.45	1.45	4.70	8.12	6.03	3.63	3.16	1.38	0.19	0.02	0.08	0.08	0.02	0.00
1987	8.56	5.59	2.50	3.16	0.71	2.91	1.45	0.65	0.27	0.06	0.06	0.08	0.20	0.16	0.04
1988	10.66	5.38	2.29	2.37	4.36	2.75	1.28	0.90	0.25	0.06	0.04	0.04	0.02	0.02	0.00
							AD MARK								
1986	0.00	2.14	0.12	0.43	1.11	0.86	0.54	0.33	0.19	--	--	--	--	--	--
1987	0.00	0.91	0.08	0.19	0.39	0.23	0.27	0.30	0.12	--	--	--	--	--	--
1988	1.97	1.10	0.87	0.59	1.25	1.14	0.54	0.29	0.04	--	--	--	--	--	--

Appendix Table B-7. Comparison of mean lengths for six groups of juvenile chinook salmon that reared 250 days in the ODFW laboratory, 1976. Groups that share common lines did not differ significantly based on a Newman-Keuls multiple range test.

Analysis of variance					
Source of variation	Sum of squares	df	Mean square	*F*	*P*
Treatment	260.7	5	52.14	20.04	<0.001
Residual	450.2	173	2.60		

Mean length of group (cm)					
8.13	9.43	10.16	10.57	11.42	11.69

Appendix Table B-8. Summary statistics associated with the fork length (cm) of juvenile spring chinook salmon fed at six ration levels in the ODFW laboratory, 1976.

Days of rearing		Ration size (% of body weight fed per day)					
		0.75%	1.00%	1.25%	1.50%	1.75%	2.20%
68	Mean	5.93	6.01	5.95	5.99	--	--
	SD	0.43	0.62	0.51	0.53	--	--
	N	15	14	15	15	--	--
89	Mean	6.11	6.22	6.01	6.49	6.41	6.59
	SD	0.34	0.68	0.70	0.66	0.60	0.78
	N	15	14	15	15	15	15
125	Mean	6.39	7.23	7.11	7.47	7.55	7.45
	SD	0.56	0.70	0.74	0.74	0.82	0.76
	N	15	15	15	15	15	15
160	Mean	6.55	7.31	7.81	8.67	8.43	8.37
	SD	0.93	1.02	1.04	0.75	0.88	0.82
	N	15	15	15	15	15	15
221	Mean	7.84	8.59	9.06	9.70	10.90	10.73
	SD	1.05	0.82	1.34	1.35	1.24	1.09
	N	15	14	14	15	15	15
250	Mean	8.13	9.43	10.16	10.57	11.69	11.42
	SD	1.15	1.20	1.39	2.00	1.83	1.90
	N	30	30	30	29	30	30

Appendix Table B-9. Comparison of mean circuli spacing (mm at 88x) on scales taken from six groups of juvenile chinook salmon that reared 250 days in the ODFW laboratory, 1976. Groups that share common lines did not differ significantly based on a Newman-Keuls multiple range test.

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Treatment	3.373	5	0.674	14.86	<0.001
Residual	7.854	173	0.045		

Mean length of group (cm)

8.13	9.43	10.16	10.57	11.42	11.69

Appendix Table B-10. Summary statistics associated with the average spacing of circuli (mm at 88x) on scales of juvenile spring chinook salmon fed at six ration levels in the ODFW laboratory, 1976.

Days of rearing		Ration size (% of body weight fed per day)					
		0.75%	1.00%	1.25%	1.50%	1.75%	2.20%
68	Mean	2.26	2.37	2.38	2.36	--	--
	SD	0.15	0.17	0.20	0.19	--	--
	N	15	14	15	15	--	--
89	Mean	2.20	2.36	2.31	2.38	2.32	2.32
	SD	0.15	0.25	0.22	0.19	0.24	0.22
	N	15	14	15	15	15	15
125	Mean	2.19	2.40	2.38	2.37	2.48	2.44
	SD	0.17	0.22	0.19	0.19	0.18	0.27
	N	15	15	15	15	15	15
160	Mean	2.01	2.25	2.30	2.48	2.39	2.37
	SD	0.19	0.14	0.24	0.17	0.24	0.18
	N	15	15	15	15	15	15
221	Mean	2.11	2.24	2.21	2.38	2.52	2.37
	SD	0.26	0.17	0.20	0.20	0.20	0.25
	N	15	14	14	15	15	15
250	Mean	2.06	2.17	2.18	2.32	2.47	2.42
	SD	0.24	0.15	0.21	0.20	0.21	0.22
	N	30	30	30	29	30	30

Appendix Table B-11. Regression analysis of the average spacing of scale circuli (mm at 88x) on the change in length (mm/day) of juvenile spring chinook salmon reared in the ODFW laboratory, 1976.

Independent variable	Regression coefficient	Standard error	*P*
Length change	21.75×10^{-2}	1.70×10^{-2}	<0.001
Constant	1.791		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	5.380	1	5.380	162.8	<0.001
Residual	5.848	177	0.033		

Appendix Table B-12. Comparison of the mean number of circuli counted on scales taken from six groups of juvenile chinook salmon that reared 250 days in the ODFW laboratory, 1976. Groups that share common lines did not differ significantly based on a Newman-Keuls multiple range test.

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Treatment	484.0	5	96.80	16.81	<0.001
Residual	996.4	173	5.76		

Mean length of group (cm)

8.13	9.43	10.16	10.57	11.42	11.69

Appendix Table B-13. Summary statistics associated with the number of circuli on scales of juvenile spring chinook salmon fed at six ration levels in the ODFW laboratory, 1976.

Days of rearing		Ration size (% of body weight fed per day)					
		0.75%	1.00%	1.25%	1.50%	1.75%	2.20%
68	Mean	5.53	5.86	5.64	5.82	--	--
	SD	0.82	0.83	0.88	0.78	--	--
	N	15	14	15	15	--	--
89	Mean	6.35	6.47	6.45	7.05	6.45	6.97
	SD	0.82	1.53	0.87	1.54	0.98	1.00
	N	15	14	15	15	15	15
125	Mean	7.84	8.11	8.67	9.11	8.96	9.11
	SD	0.92	0.96	1.03	1.02	1.04	1.47
	N	15	15	15	15	15	15
160	Mean	8.28	9.68	10.35	11.65	10.96	10.89
	SD	1.70	1.79	1.43	1.70	1.43	1.40
	N	15	15	15	15	15	15
221	Mean	11.43	11.71	13.66	14.01	15.47	13.65
	SD	1.58	1.50	1.92	1.48	1.41	2.26
	N	15	14	14	15	15	15
250	Mean	11.83	14.14	14.56	15.10	16.60	16.61
	SD	2.05	2.17	1.74	2.84	2.37	3.00
	N	30	30	30	29	30	30

Appendix Table B-14. Regression analysis of day-of-year on fork length (cm) and the number of freshwater circuli on scales of yearling chinook salmon trapped at Table Rock, 1973-76 brood years.

Independent variable	Regression coefficient	Standard error	*P*
Length	14.72	1.10	<0.001
Circuli number	-1.292	0.58	0.021
Constant	359.1		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	153,880	2	76,940	162.8	<0.001
Residual	148,836	315	472		

Appendix Table B-15. Comparison of the mean scale radius (mm at 88x) for six groups of juvenile chinook salmon that reared 250 days in the ODFW laboratory, 1976. Groups that share common lines did not differ significantly based on a Newman-Keuls multiple range test.

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Treatment	3.373	5	0.674	14.86	<0.001
Residual	7.854	173	0.045		

Mean length of group (cm)

8.13	9.43	10.16	10.57	11.42	11.69

Appendix Table B-16. Summary statistics associated with the scale radius (mm at 88x) of juvenile spring chinook salmon fed at six ration levels in the ODFW laboratory, 1976.

Days of rearing		Ration size (% of body weight fed per day) 0.75%	1.00%	1.25%	1.50%	1.75%	2.20%
68	Mean	18.23	20.86	20.16	20.63	--	--
	SD	2.01	2.69	2.84	2.30	--	--
	N	15	14	15	15	--	--
89	Mean	21.02	22.02	21.77	23.25	22.20	23.03
	SD	2.23	4.10	3.38	3.69	2.54	3.36
	N	15	14	15	15	15	15
125	Mean	24.20	28.93	27.35	28.55	29.14	29.09
	SD	3.07	4.09	3.22	3.68	3.20	4.76
	N	15	15	15	15	15	15
160	Mean	23.48	28.51	30.79	35.65	33.27	32.68
	SD	4.96	5.01	4.98	3.90	5.71	4.05
	N	15	15	15	15	15	15
221	Mean	30.85	32.99	37.22	44.79	45.88	39.33
	SD	5.34	4.30	8.72	5.61	5.40	6.62
	N	15	14	14	15	15	15
250	Mean	31.55	38.20	38.72	42.41	48.37	47.18
	SD	6.01	5.73	5.99	8.95	8.40	9.54
	N	30	30	30	29	30	30

Appendix Table B-17. Juvenile life history parameters estimated by four scale analysts for 18 wild age 4 spring chinook salmon included in the measurement test as compared to mean values of parameters estimated for counterparts trapped at Gold Ray Dam in 1974-94. Values are for subyearling smolts only.

	Analyst 2	Analyst 3	Analyst 4	Analyst 5a	Analyst 5b	Estimates for 1974-94 (range)
BAND WIDTHS I+II (mm at 88x)						
Mean	22.72	23.14	21.74	21.75	21.79	20.6-25.5
SE	0.82	0.83	0.78	0.63	0.66	--
AVERAGE SPACING OF CIRCULI (mm at 88x)						
Mean	2.01	2.11	2.04	2.10	2.11	1.80-2.42
SE	0.06	0.07	0.05	0.06	0.06	--
NUMBER OF FRESHWATER CIRCULI						
Mean	19.61	18.56	20.67	19.83	19.81	15.46-21.74
SE	1.54	1.58	1.78	2.54	2.47	--
SCALE RADIUS AT OCEAN ENTRY (mm at 88x)						
Mean	45.08	45.22	47.31	48.08	48.28	37.31-53.99
SE	4.78	6.78	4.53	5.87	5.87	--

Appendix Table B-18. Scale indexes of freshwater life history from marked spring chinook salmon released from Cole M. Rivers Hatchery in June 1984 and August 1985 as compared to unmarked counterparts that spawned between Shady Cove and Gold Ray Dam in 1980-81.

	Age 2			Age 3			Age 4			Age 5		
	Wild	June	August	Wild	June	August	Wild	June	August	Wild	June	August
NUMBER OF FRESHWATER CIRCULI												
Mean	19.4	21.1	24.1	18.0	20.8	23.7	19.2	20.5	22.8	19.4	19.9	23.5
SD	3.52	1.68	1.30	2.68	2.35	1.37	3.36	1.89	1.48	4.09	1.95	0.71
N	46	30	27	42	23	29	47	30	29	16	30	2
FRESHWATER RADIUS (mm at 88x)												
Mean	46.4	60.8	61.3	44.3	57.7	59.7	43.5	60.1	56.0	44.1	55.8	58.4
SD	6.89	7.61	6.02	6.98	8.15	6.78	5.83	8.19	4.12	6.06	7.50	1.91
N	46	30	27	42	23	29	47	30	29	16	30	2
AVERAGE SPACING OF CIRCULI (mm at 88x)												
Mean	2.06	2.62	2.30	2.08	2.53	2.27	1.96	2.65	2.20	1.94	2.53	2.24
SD	0.23	0.26	0.18	0.26	0.32	0.22	0.28	0.31	0.16	0.38	0.28	0.16
N	46	30	27	42	23	29	47	30	29	16	30	2

Appendix Table B-19. Percentage of chinook salmon that were marked with fin clips as estimated from trap catches and as estimated from expanded counts of marked fish that passed the counting station at Gold Ray Dam, 1969-94.

Return year	Spring chinook salmon		Fall chinook salmon	
	Counter	Trap	Counter	Trap
1969	1.9%	--	0.0%	--
1970	1.5%	--	0.0%	--
1971	3.8%	--	0.0%	--
1972	2.7%	--	0.0%	--
1973	1.6%	--	0.0%	--
1974	3.0%	1.1%	0.0%	--
1975	4.3%	2.4%	0.0%	--
1976	5.3%	5.5%	0.0%	--
1977	9.3%	5.5%	0.0%	--
1978	8.7%	7.5%	0.0%	--
1979	8.5%	7.8%	0.2%	1.3%
1980	10.6%	8.1%	1.6%	--
1981	9.5%	5.1%	3.7%	--
1982	8.4%	9.2%	4.2%	--
1983	8.1%	12.1%	2.4%	--
1984	11.9%	15.2%	2.3%	--
1985	12.2%	14.7%	13.2%	--
1986	17.6%	15.4%	13.3%	8.5%
1987	14.8%	11.9%	8.2%	8.6%
1988	7.5%	7.6%	5.0%	5.1%
1989	8.7%	8.7%	6.0%	3.8%
1990	6.8%	5.3%	3.6%	1.2%
1991	4.2%	2.9%	3.7%	0.0%
1992	4.1%	3.6%	2.2%	0.6%
1993	4.3%	5.2%	1.6%	0.5%
1994	6.8%	4.6%	1.0%	0.4%

Appendix Table B-20. Relative abundance of marked fish among spring chinook salmon examined at canneries near Gold Beach in March-June, 1953-65. Data originated from unpublished records of the Oregon State Game Commission.

	Number of fish				Number of fish		
Year	Marked	Total	% marked	Year	Marked	Total	% marked
1953	6	1,357	0.44	1960	10	2,204	0.45
1954	5	1,045	0.48	1961	44	1,821	2.42
1955	9	1,403	0.64	1962	26	1,897	1.37
1956	24	2,134	1.13	1963	85	2,341	3.63
1957	132	1,880	6.74	1964	46	1,710	2.69
1958	64	1,815	3.53	1965	51	1,047	4.87
1959	4	1,038	0.39				

Appendix Table B-21. Mean proportion of chinook salmon that were landed upstream of Gold Ray Dam in 1970-83. Estimates apply only to large fish that anglers were required to record on salmon steelhead cards. Estimates were developed from the spatial and temporal estimates of harvest in 1983-94 (Appendix Tables F-28 and F-29).

Years	April	May	June	July
1970-77[a]	0.01	0.18	0.58	0.69
1978-83	0.01	0.23	0.78	0.88

[a] *Adjusted to account for closure of the fishery on 15 July. Fishery closed on 31 July in later years.*

APPENDIX C

Tables of Data and Analyses Related to Studies of Physical Parameters of the Rogue River

Appendix Table C-1. USACE estimates of peak flow (cfs) of the Rogue River at Grants Pass for regulated and unregulated conditions, 1977-78 through 1985-86.

Year	Regulated	Unregulated	Year	Regulated	Unregulated
1977-78	40,300	45,600	1982-83	50,400	57,300
1978-79	12,700	19,600	1983-84	27,600	37,700
1979-80	26,900	37,800	1984-85	19,000	19,200
1980-81	9,800	11,200	1985-86	27,800	34,900
1981-82	46,300	54,000			

Appendix Table C-2. Regression analysis of daily maximum water temperature (^{0}C) at Marial in May-June, 1977-87.

Independent variable	Regression coefficient	Standard error	*P*
Flow[a]	-1.080×10^{-3}	0.119×10^{-3}	<0.001
Air temperature[b]	1.211×10^{-1}	0.073×10^{-1}	<0.001
Date[c]	4.775×10^{-2}	0.571×10^{-3}	<0.001
Constant	4.74		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1,011.6	3	337.2	229.1	<0.001
Residual	376.9	256	1.5		

[a] *Mean daily flow (cfs) at Agness.*
[b] *Daily maximum air temperature (^{0}F) at Medford, Oregon.*
[c] *Day-of-year* **(APPENDIX A).**

Appendix Table C-3. Mean size of gravel estimated at three sites in the Rogue River and in Big Butte Creek at RK 0.2 in 1978 and 1981.

Gravel type	Hatchery		Sand Hole		Bridge Hole		Big Butte Creek	
	1978	1981	1978	1981	1978	1981	1978	1981
	GEOMETRIC MEAN PARTICLE SIZE (mm)							
Armor	94.1	140.7	105.5	142.8	84.6	97.1	66.5	184.6
Coarse	48.4	55.5	65.3	58.8	59.0	77.9	22.6	187.2
Medium	21.8	40.9	58.8	42.2	30.9	51.0	22.2	36.6
Fine	18.6	47.4	58.7	16.9	17.3	64.8	19.5	30.9
	FINES < 1.0 mm (%)							
Coarse	1.3	3.6	<0.1	2.4	0.2	1.8	0.7	1.8
Medium	2.1	2.8	<0.1	0.6	0.5	1.0	0.8	1.8
Fine	5.3	1.6	<0.1	9.5	2.6	2.0	1.4	3.3

APPENDIX D

Tables of Data and Analyses Related to Studies of
Juvenile Spring Chinook Salmon

Appendix Table D-1. Indexes of emergence timing for chinook salmon fry in the Rogue River Basin upstream of Gold Ray Dam, 1975-94. Date of emergence completion represents the first date when mean lengths of fry continually exceeded 4.5 cm.

Year	Date of first capture			Date of emergence completion		
	Sand Hole	High Banks	Big Butte	Sand Hole	High Banks	Big Butte
1975	03/15	03/21	02/20	06/04	05/23	05/30
1976	03/07	02/15	02/08	05/30	04/27	05/23
1977	03/01	03/01	02/02	05/17	04/19	05/10
1978	01/17	02/23	02/23	04/18	03/29	04/12
1979	02/06	01/23	03/06	05/15	04/10	04/24
1980	01/04	01/28	01/09	04/24	04/15	04/15
1981	01/06	02/10	02/25	05/11	03/30	04/27
1982	--	--	--	05/19	--	--
1983	--	--	--	05/11	04/27	--
1984	--	--	--	05/17	04/12	--
1985	--	--	--	05/14	04/15	--
1986	--	--	--	05/13	04/23	--
1987	--	--	--	05/11	04/14	--
1988	--	--	--	05/10	04/12	--
1989	--	--	--	05/16	04/17	--
1990	--	--	--	05/07	04/10	--
1991	--	--	--	05/20	04/22	--
1992	--	--	--	05/05	04/07	--
1993	--	--	--	05/18	04/21	--
1994	--	--	--	05/16	04/18	--

Appendix Table D-2. Estimated mean date of emergence for chinook salmon fry produced by parents that spawned at different times near RK 249, 1972-94.

Year	Date spawned			Year	Date spawned		
	09/15	10/01	10/15		09/15	10/01	10/15
1972	04/03	04/24	05/08	1984	02/03	03/09	04/01
1973	03/23	04/09	04/21	1985	03/09	03/31	04/15
1974	02/25	03/27	04/16	1986	03/17	04/06	04/19
1975	04/01	04/26	05/11	1987	02/13	03/10	03/30
1976	03/17	04/13	05/01	1988	02/12	03/05	03/22
1977	02/12	03/14	04/03	1989	02/25	03/23	04/11
1978	01/10	02/16	03/15	1990	02/03	03/04	03/23
1979	02/18	03/24	04/14	1991	02/21	03/19	04/05
1980	02/06	03/09	04/02	1992	02/05	03/01	03/17
1981	02/08	03/09	03/30	1993	02/03	03/09	03/28
1982	02/03	03/08	04/01	1994	02/08	03/07	03/26
1983	02/04	03/06	03/27				

Appendix Table D-3. Data used to assess factors related to the annual catch rates of wild chinook salmon fry seined at two sites in the Rogue River upstream of Gold Ray Dam, 1975-94.

Year	Fry abundance[a]	Spawner abundance[b]	Flow at spawning[c]	Peak flow[d]	Winter temperature[e]
1975	--	831	1,361	13,200	6.0
1976	585	597	1,596	12,400	6.1
1977	843	547	1,310	1,430	7.5
1978	47	275	1,273	23,000	8.8
1979	518	1,963	1,272	7,450	7.3
1980	193	1,258	1,245	14,000	7.5
1981	372	983	1,220	5,080	7.5
1982	--	423	1,189	19,500	7.7
1983	233	636	1,930	14,000	7.4
1984	164	287	1,888	12,900	7.5
1985	763	374	1,514	10,700	6.4
1986	767	1,069	1,457	12,600	5.5
1987	1,134	982	1,365	7,830	7.3
1988	1,704	1,605	1,135	6,470	7.5
1989	832	2,152	1,142	9,080	7.1
1990	1,319	1,116	1,257	4,950	7.5
1991	844	747	1,201	5,460	6.7
1992	672	290	1,156	3,960	7.3
1993	286	212	874	7,360	7.4
1994	558	523	1,170	2,360	7.5

[a] *Mean catch per seine haul at Sand Hole and High Banks four weeks after emergence completion.*
[b] *Count of spawned female carcasses between Cole Rivers Hatchery and Rogue Elk Park in previous year.*
[c] *Mean daily flow (cfs) at Dodge Bridge in previous October.*
[d] *Largest mean daily flow (cfs) at Dodge Bridge in previous November-February.*
[e] *Mean maximum water temperature (^{o}C) near McLeod in previous October-December.*

Appendix Table D-4. Regression analysis of annual catch rates of wild chinook salmon fry seined at two sites in the Rogue River upstream of Gold Ray Dam, 1975-94. Variables are described in Appendix Table D-3. Catch rates were transformed to natural logarithms before analysis.

Independent variable	Regression coefficient	Standard error	*P*
Peak flow	-10.422×10^{-5}	2.307×10^{-5}	<0.001
Female spawners	6.514×10^{-4}	2.131×10^{-4}	0.009
Water temperature	-0.4304	0.1654	0.021
Constant	9.653		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	9.825	3	3.275	13.87	<0.001
Residual	3.306	14	0.236		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Peak flow	0.53	--	--
Female spawners	0.16	0.20	--
Water temperature	0.10	0.12	0.29
Spawning flow	0.06	0.01	0.05

Appendix Table D-5. Correlation matrix for variables examined in the analysis of annual catch rates of wild chinook salmon fry seined at two sites in the Rogue River upstream of Gold Ray Dam, 1975-94. Variables are described in Appendix Table D-3. Catch rates were transformed to natural logarithms before analysis.

Variable	Fry abundance	Peak flow	Spawner abundance	Water temperature	Spawning flow
Fry abundance	1.00				
Peak flow	-0.73[a]	1.00			
Spawner abundance	0.40	-0.13	1.00		
Water temperature	-0.32	0.12	0.29	1.00	
Spawning flow	-0.24	0.43	-0.23	-0.07	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table D-6. Estimated number of wild juvenile chinook salmon that passed Savage Rapids Dam, 1974-90. Week-of-year calendar is in **APPENDIX A.**

Year	Week-of-year										
	20	21	22	23	24	25	26	27	28	29	30
1974	--	--	--	--	--	--	--	--	--	9,535	81,619
1975	--	--	77,952	--	--	--	79,672	23,140	81,461	50,030	217,837
1976	29,449	16,599	10,393	21,980	38,433	76,017	140,821	215,017	137,040	61,018	107,383
1977	1,915	74,207	235,257	--	--	--	--	196,449	175,481	139,759	157,609
1978	715	2,450	1,469	5,621	12,680	29,093	19,044	39,554	31,674	47,369	27,394
1979	260,367	171,521	47,431	51,561	102,818	348,527	124,419	482,759	682,250	391,675	838,885
1980	61,057	53,743	60,541	55,705	57,587	75,200	88,552	80,401	73,170	78,555	91,555
1981	28,469	13,010	329,755	374,959	242,330	--	--	--	--	124,402	90,066
1982	479	2,323	3,164	3,013	1,344	798	5,598	20,023	29,738	42,925	37,480
1983	69,668	160,864	130,260	4,850	7,178	9,703	12,458	19,949	45,267	54,702	24,282
1984	70,104	79,005	176,984	82,374	261,505	118,162	63,622	23,944	16,981	10,612	18,565
1985	1,439	61,530	53,960	42,327	110,490	191,292	200,817	276,461	56,207	105,001	89,114
1986	4,320	21,162	19,737	14,491	47,649	225,807	157,959	455,600	478,537	507,017	213,254
1987	15,748	13,758	41,062	275,533	618,009	918,518	463,102	513,377	438,472	385,632	98,621
1988	140,813	1,231,802	5,720,475	706,693	625,459	900,766	847,514	233,501	230,020	206,085	182,969
1989	64,640	20,236	18,418	52,079	57,736	135,248	92,282	228,493	671,074	599,629	360,132
1990	78,326	480,265	1,731,442	1,976,567	951,512	732,738	243,744	390,363	144,372	192,445	102,097

Appendix Table D-6. Continued.

Year	Week-of-year									Total
	31	32	33	34	35	36	37	38	39	
1974	40,774	19,093	34,378	21,234	17,804	4,943	12,548	11,338	8,570	--
1975	136,784	151,851	108,344	98,925	109,708	129,151	63,651	55,099	46,516	2,990,738[a]
1976	394,752	631,936	486,558	180,921	135,101	88,398	62,052	70,187	81,609	2,985,664
1977	103,696	198,838	310,202	271,848	186,841	135,620	160,221	105,508	88,979	5,137,059[b]
1978	8,302	3,031	11,324	6,753	40,283	5,810	16,047	11,973	937	321,523
1979	438,605	363,667	82,128	42,723	61,384	133,012	192,991	150,126	129,933	5,096,782
1980	79,279	85,652	85,519	78,032	44,491	48,776	65,117	77,787	48,439	1,389,158
1981	96,302	109,991	96,353	36,953	33,803	33,844	116,152	13,440	17,032	2,722,111[c]
1982	33,921	76,682	23,946	10,183	12,281	3,867	604	2,497	2,053	312,922
1983	12,182	31,000	73,861	167,504	233,319	91,183	74,354	16,007	14,926	1,253,517
1984	29,930	55,343	31,415	3,750	4,826	940	3,064	2,899	2,153	1,056,177
1985	142,898	80,766	97,138	47,960	45,807	33,999	32,379	8,568	9,377	1,687,528
1986	339,448	381,351	358,454	168,322	53,976	78,292	113,008	70,588	17,860	3,726,832
1987	278,946	131,073	81,178	67,041	55,113	93,921	33,409	22,782	20,387	4,565,683
1988	102,124	100,248	42,518	24,289	19,667	13,754	13,002	10,970	4,560	11,357,231
1989	474,658	299,342	435,426	173,534	179,508	319,867	182,375	18,371	13,738	4,396,786
1990	161,899	85,622	62,571	67,060	88,379	49,310	36,623	21,713	31,376	7,628,426

[a] *Total estimated with the assumption that the percentage of fish that passed during weeks 20-25 was equal to the mean percentage of fish that passed during the same weeks in 1983 and 1984.*

[b] *Total estimated with the assumption that the percentage of fish that passed during weeks 23-26 was equal to the mean percentage of fish that passed during the same weeks in 1987 and 1990.*

[c] *Total estimated with the assumption that the percentage of fish that passed during weeks 25-28 was equal to the mean percentage of fish that passed during the same weeks in 1987 and 1990.*

Appendix Table D-7. Estimated number of juvenile chinook salmon, released from Cole M. Rivers Hatchery in June, that passed Savage Rapids Dam, 1984-88. Numbers of unmarked fish were estimated by expanding the estimated numbers of marked fish based on the percentage marked at time of release. Week-of-year calendar is in **APPENDIX A.**

	Week-of-year							
Year	25	26	27	28	29	30	31	32
1984	0	58,391	46,108	28,620	71,086	35,600	5,925	20,465
1986	27,897	84,639	36,692	107,374	187,396	120,823	75,875	63,012
1987	122,583	103,430	46,113	59,356	33,211	101,324	32,049	16,626
1988	19,347	33,351	12,579	10,541	14,745	9,029	4,235	2,874

	Week-of-year							
Year	33	34	35	36	37	38	39	Total
1984	8,254	1,133	1,046	3,074	0	408	219	280,328
1986	28,955	3,454	397	1,581	969	197	0	739,262
1987	6,964	1,414	1,879	3,331	2,467	868	216	531,831
1988	1,317	305	200	154	44	33	0	108,754

Appendix Table D-8. Data used to assess factors related to the estimated numbers of wild subyearling chinook salmon that passed Savage Rapids Dam between 14 May and 30 September, 1975-90.

Year	Migrant abundance[a]	Spawner abundance[b]	Flow at spawning[c]	Peak flow[d]	Winter temperature[e]
1975	2,990,738	6,364	1,607	16,900	7.3
1976	2,985,664	5,729	2,226	13,300	7.5
1977	5,137,059	5,996	1,447	1,650	8.1
1978	321,523	4,099	2,228	33,000	8.8
1979	5,096,782	14,375	1,381	10,800	8.0
1980	1,389,158	10,130	1,977	19,100	8.8
1981	2,722,111	9,088	1,451	6,610	8.4
1982	312,922	4,829	2,293	35,600	8.6
1983	1,253,517	7,837	2,272	29,200	8.0
1984	1,056,177	4,732	3,035	25,100	7.5
1985	1,687,528	4,665	3,974	14,000	6.7
1986	3,726,832	8,445	1,800	22,400	8.0
1987	4,565,683	14,621	2,162	10,500	8.5
1988	11,357,231	22,586	1,144	9,130	8.6
1989	4,396,786	20,673	1,802	13,900	7.7
1990	7,628,426	10,907	1,398	8,260	7.5

[a] *Estimated number of wild subyearling chinook that passed Savage Rapids Dam.*
[b] *Estimated number of female chinook salmon that spawned upstream of Gold Ray Dam in year i-1.*
[c] *Mean daily flow (cfs) at Raygold in October-November of year i-1.*
[d] *Largest mean daily flow (cfs) at Raygold in November-February.*
[e] *Mean maximum water temperature (^{o}C) at Raygold in October-December of year i-1.*

Appendix Table D-9. Regression analysis of the estimated numbers of wild subyearling chinook salmon that passed Savage Rapids Dam between 14 May and 30 September, 1975-90. Variables are described in Appendix Table D-8. Migrant numbers were transformed to natural logarithms before analysis.

Independent variable	Regression coefficient	Standard error	*P*
Peak flow	-6.042×10^{-5}	0.818×10^{-5}	<0.001
Female spawners	8.621×10^{-5}	1.409×10^{-5}	<0.001
Water temperature	-0.597	0.122	<0.001
Constant	19.688		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	14.852	3	4.951	70.50	<0.001
Residual	0.843	14	0.070		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Peak flow	0.74	--	--
Female spawners	0.44	0.32	--
Water temperature	0.14	0.15	0.57
Spawning flow	0.29	0.14	0.03

Appendix Table D-10. Correlation matrix for variables examined in the analysis of the numbers of wild subyearling chinook salmon that passed Savage Rapids Dam between 14 May and 30 September, 1975-90. Variables are described in Appendix Table D-8. Migrant numbers were transformed to natural logarithms before analysis.

Variable	Migrant abundance	Peak flow	Spawner abundance	Water temperature	Spawning flow
Migrant abundance	1.00				
Peak flow	-0.86[a]	1.00			
Spawner abundance	0.66[a]	-0.43	1.00		
Water temperature	-0.37	0.20	0.20	1.00	
Spawning flow	-0.54[a]	0.41	-0.52[a]	-0.05	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table D-11. Mean sill depths (inches) for redds of spring chinook salmon found between Cole M. Rivers Hatchery and Rogue Elk Park, 1982-83. Within rows, values with different superscripts differed at $P \leq 0.05$ as determined with a Tukey test.

Year	Hatchery	Bridge Hole	McLeod channels		Obstinate J Ranch		Robber's Roost	Rogue Elk Park
			North	South	River	Side channel		
1982	17.1[a]	33.0[c]	29.9[c]	--	21.0[b]	13.7[a]	--	--
1983	--	49.8[e]	--	24.9[c]	28.0[d]	19.2[ab]	22.4[bc]	18.6[a]

Appendix Table D-12. Average spacing of freshwater circuli (mm at 88x) on the scales of wild age 2-6 adult spring chinook salmon, 1969-92 brood years. Subyearling smolts composed all age 2 adults. Data are adjusted for differences among scale analysts.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1969										
Mean	--	--	--	1.70	1.99	--	--	1.71	1.99	--
SD	--	--	--	0.19	--	--	--	0.22	--	--
N	--	--	--	75	1	--	--	84	1	--
BROOD YEAR 1970										
Mean	--	--	1.86	1.99	1.70	--	1.86	2.00	1.70	--
SD	--	--	0.23	0.24	--	--	0.23	0.23	--	--
N	--	--	123	48	1	--	126	50	1	--
BROOD YEAR 1971										
Mean	--	1.86	2.02	1.81	1.69	1.85	2.02	1.82	1.68	--
SD	--	0.23	0.27	0.25	0.20	0.23	0.27	0.23	0.16	--
N	--	52	136	26	3	55	140	34	4	--
BROOD YEAR 1972										
Mean	2.12	1.87	1.80	1.71	1.66	1.85	1.78	1.71	1.66	1.74
SD	0.36	0.33	0.29	0.20	--	0.31	0.29	0.19	--	0.30
N	5	101	110	47	1	127	121	58	1	312
BROOD YEAR 1973										
Mean	2.09	1.91	1.86	1.82	1.68	1.91	1.86	1.83	1.61	1.85
SD	0.23	0.23	0.18	0.21	--	0.22	0.19	0.20	0.10	0.27
N	46	49	82	37	1	52	89	43	2	232
BROOD YEAR 1974										
Mean	2.04	1.91	1.87	1.84	1.91	1.91	1.86	1.87	1.83	1.87
SD	0.29	0.28	0.23	0.21	0.35	0.29	0.24	0.22	0.28	0.31
N	80	76	146	46	2	77	151	69	3	380
BROOD YEAR 1975										
Mean	2.16	1.93	1.99	1.95	1.96	1.92	1.98	1.96	1.98	1.97
SD	0.34	0.29	0.22	0.25	0.18	0.28	0.22	0.25	0.16	0.29
N	46	83	106	55	12	93	118	61	16	334
BROOD YEAR 1976										
Mean	2.06	1.97	2.03	2.08	2.06	1.97	2.03	2.07	2.06	2.05
SD	0.26	0.23	0.24	0.25	0.35	0.21	0.24	0.25	0.35	0.40
N	53	70	132	111	4	85	133	119	4	396

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table D-12. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1977										
Mean	2.13	2.14	2.21	2.09	--	2.13	2.22	2.09	--	2.14
SD	0.28	0.24	0.26	0.32	--	0.24	0.26	0.32	--	0.47
N	17	20	82	16	0	21	83	16	0	137
BROOD YEAR 1978										
Mean	2.14	2.08	2.05	1.97	1.76	2.08	2.04	1.94	1.76	2.04
SD	0.25	0.22	0.25	0.23	--	0.22	0.25	0.23	--	0.27
N	79	87	139	48	1	91	143	55	1	369
BROOD YEAR 1979										
Mean	2.31	2.17	2.21	2.11	--	2.17	2.21	2.11	--	2.20
SD	0.22	0.24	0.25	0.27	--	0.24	0.25	0.27	--	0.26
N	23	62	137	19	0	63	138	19	0	243
BROOD YEAR 1980										
Mean	2.14	2.14	1.92	2.00	1.93	2.15	1.91	1.99	1.86	2.02
SD	0.29	0.27	0.28	0.29	--	0.27	0.29	0.30	--	0.35
N	80	82	52	42	1	83	53	44	1	261
BROOD YEAR 1981										
Mean	2.27	2.20	2.13	2.05	--	2.20	2.12	2.06	--	2.12
SD	0.25	0.24	0.21	0.26	--	0.24	0.22	0.28	--	0.31
N	33	32	38	16	0	32	40	18	0	123
BROOD YEAR 1982										
Mean	2.18	2.11	2.08	2.20	2.32	2.07	2.06	2.19	2.32	2.09
SD	0.26	0.29	0.26	0.18	--	0.29	0.25	0.17	--	0.32
N	50	39	37	9	1	46	47	10	1	154
BROOD YEAR 1983										
Mean	2.14	2.24	2.39	2.17	--	2.25	2.39	2.15	--	2.29
SD	0.26	0.24	0.30	0.24	--	0.25	0.30	0.24	--	0.35
N	58	41	39	28	0	43	39	28	0	168
BROOD YEAR 1984										
Mean	2.17	2.26	2.19	1.84	2.14	2.25	2.17	1.87	2.14	2.15
SD	0.21	0.27	0.22	0.23	--	0.27	0.22	0.23	--	0.27
N	38	45	49	37	1	46	53	38	1	176

Appendix Table D-12. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1985										
Mean	2.16	2.20	1.86	1.78	--	2.20	1.85	1.78	--	2.02
SD	0.24	0.22	0.26	0.28	--	0.21	0.26	0.28	--	0.25
N	41	39	43	16	0	40	45	16	0	142
BROOD YEAR 1986										
Mean	2.13	1.74	1.88	1.94	1.99	1.74	1.88	1.95	1.99	1.92
SD	0.22	0.31	0.20	0.24	--	0.31	0.20	0.24	--	0.24
N	40	17	58	32	1	17	58	33	1	149
BROOD YEAR 1987										
Mean	2.05	1.99	1.92	1.86	1.71	2.00	1.93	1.86	1.71	1.92
SD	0.30	0.20	0.28	0.21	0.39	0.20	0.27	0.21	0.39	0.26
N	11	20	42	19	3	21	48	19	3	102
BROOD YEAR 1988										
Mean	2.11	1.90	1.89	1.78	2.11	1.90	1.89	1.80	2.11	1.89
SD	0.27	0.23	0.23	0.26	0.30	0.23	0.23	0.26	0.30	0.27
N	13	20	57	30	7	20	58	32	7	130
BROOD YEAR 1989										
Mean	2.07	1.91	1.89	1.76	--	1.91	1.89	1.76	--	1.83
SD	0.32	0.37	0.23	0.31	--	0.37	0.23	0.31	--	0.31
N	3	23	39	32	--	23	39	32	--	97
BROOD YEAR 1990										
Mean	2.11	2.08	2.13	--	--	2.08	2.13	--	--	--
SD	0.22	0.22	0.22	--	--	0.22	0.20	--	--	--
N	22	34	37	--	--	34	37	--	--	--
BROOD YEAR 1991										
Mean	2.02	2.05	--	--	--	2.02	--	--	--	--
SD	0.23	0.20	--	--	--	0.23	--	--	--	--
N	14	14	--	--	--	15	--	--	--	--
BROOD YEAR 1992										
Mean	2.22	--	--	--	--	--	--	--	--	--
SD	0.07	--	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--	--

Appendix Table D-13. Correlation matrix for variables examined in the analyses of the average spacing of freshwater circuli on the scales of wild spring chinook salmon. Variables are described in Appendix Table D-14. Estimates of juvenile abundance were transformed to natural logarithms before analysis.

	Circuli spacing		Juvenile abundance			
	Age 4	Brood	Fry	Migrants	Flow	Water temperature
Age 4 circuli spacing	1.00					
Brood circuli spacing	0.93[a]	1.00				
Fry abundance	-0.68[a]	-0.73[a]	1.00			
Migrant abundance	-0.69[a]	-0.70[a]	0.94[a]	1.00		
Flow	0.12	0.14	-0.27	-0.34	1.00	
Water temperature	0.30	0.42	-0.15	-0.01	-0.67[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table D-14. Data used to assess factors related to estimates of the average spacing (mm at 88x) of freshwater circuli on the scales of wild age 2-6 adult spring chinook salmon, 1972-90 brood years.

Brood year	Circuli spacing		Juvenile abundance		Flow[e]	Water temperature[f]
	Age 4[a]	Brood[b]	Fry[c]	Migrants[d]		
1972	1.80	1.74	--	--	1,853	--
1973	1.86	1.85	--	--	3,793	12.1
1974	1.87	1.87	--	--	3,552	11.9
1975	1.99	1.97	585	2,990,78	2,823	12.7
1976	2.03	2.05	843	2,985,64	1,048	14.6
1977	2.21	2.14	47	5,137,09	2,109	13.6
1978	2.05	2.04	518	321,523	2,653	13.4
1979	2.21	2.20	193	5,096,782	2,211	13.2
1980	1.92	2.02	372	1,389,158	1,703	14.4
1981	2.13	2.12	--	2,722,111	3,024	12.6
1982	2.08	2.09	233	312,922	3,318	12.4
1983	2.39	2.29	164	1,253,517	3,863	13.3
1984	2.19	2.15	763	1,056,177	2,759	14.0
1985	1.86	2.02	767	1,687,528	2,283	12.6
1986	1.88	1.92	1,134	3,726,832	1,916	13.1
1987	1.92	1.92	1,704	4,565,683	1,983	12.8
1988	1.89	1.89	832	11,357,231	3,267	12.0
1989	1.89	1.83	1,319	4,396,786	2,096	13.3
1990	2.13	--	844	7,628,426	2,405	12.4

[a] *Subyearling smolts only.*
[b] *Subyearling and yearling smolts.*
[c] *Mean catch per seine haul of newly emergent fry.*
[d] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[e] *Mean daily flow (cfs) at Dodge Bridge in April-July.*
[f] *Mean maximum water temperature (^{o}C) at Dodge Bridge in April-July.*

Appendix Table D-15. Regression analysis of the average spacing of freshwater circuli on the scales of wild age 2-6 spring chinook, 1972-89 brood years. Estimates of smolt abundance were transformed to natural logarithms before analysis. Variables are described in Appendix Table D-14.

Independent variable	Regression coefficient	Standard error	*P*
Smolt abundance	-8.792×10^{-2}	2.168×10^{-2}	0.001
Water temperature	5.838×10^{-2}	2.854×10^{-2}	0.061
Constant	2.558		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	15.24×10^{-2}	2	7.62×10^{-2}	10.33	0.002
Residual	9.59×10^{-2}	10	0.74×10^{-2}		

Variables tested	Partial r^2 Step 1	Step 2
Smolt abundance	0.49	--
Water temperature	0.18	0.24
Flow	0.02	0.00

Appendix Table D-16. Mean widths (mm at 88x) of circuli bands I+II on the scales of wild juvenile chinook salmon that passed Savage Rapids Dam, 1981-84 brood years. Data from the 1983 brood year are not presented because some scale samples may have been taken from unmarked hatchery fish. Week-of-year calendar is in **APPENDIX A.**

	Week-of-year									
	27	28	29	30	31	32	33	34	35	36
					BROOD YEAR 1981					
Mean	25.43	25.06	25.56	24.60	23.56	23.43	23.21	23.50	23.22	23.36
SD	2.14	2.01	1.76	1.79	2.63	1.93	1.13	1.75	2.35	1.82
N	20	20	20	20	20	19	20	20	20	11
					BROOD YEAR 1982					
Mean	21.96	22.95	22.36	21.80	22.95	22.89	23.79	22.18	22.07	21.89
SD	4.22	2.11	1.90	1.96	3.05	3.07	2.41	3.26	2.63	2.74
N	20	20	20	20	20	38	20	40	33	20
					BROOD YEAR 1984					
Mean	25.26	24.75	24.22	22.93	24.88	23.20	23.60	23.73	22.62	22.61
SD	3.01	2.29	2.87	1.86	2.76	1.64	2.00	2.84	2.25	2.24
N	20	20	20	20	20	20	20	19	19	18

Appendix Table D-17. Mean widths (mm at 88x) of circuli bands I+II on the scales of wild age 2-6 adult spring chinook salmon, 1969-92 brood years. Band widths I+II reflect initial growth of fry in freshwater. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1969										
Mean	--	--	--	18.94	21.30	--	--	18.62	21.30	--
SD	--	--	--	2.92	--	--	--	3.00	--	--
N	--	--	--	75	1	--	--	84	1	--
BROOD YEAR 1970										
Mean	--	--	21.27	22.05	17.7	--	21.18	22.10	17.70	--
SD	--	--	2.82	3.23	--	--	2.87	3.19	--	--
N	--	--	123	48	1	--	126	50	1	--
BROOD YEAR 1971										
Mean	--	20.52	22.71	20.58	18.70	20.25	22.53	20.30	18.00	--
SD	--	3.05	3.52	2.26	2.71	3.36	3.65	2.25	2.62	--
N	--	52	136	26	3	55	140	34	4	--
BROOD YEAR 1972										
Mean	24.28	21.15	20.60	19.07	19.80	20.48	20.25	18.90	19.80	19.51
SD	5.12	3.97	3.61	2.27	--	4.10	3.70	2.32	--	3.68
N	5	101	110	47	1	127	121	58	1	312
BROOD YEAR 1973										
Mean	23.63	21.45	20.61	21.02	20.00	21.29	20.67	20.92	17.25	20.82
SD	2.59	2.64	2.47	2.71	--	2.64	2.46	2.60	3.89	3.71
N	46	49	82	37	1	52	89	43	2	232
BROOD YEAR 1974										
Mean	23.40	22.05	21.70	21.54	21.85	22.03	21.57	20.62	21.73	21.21
SD	2.99	3.26	2.78	2.43	2.62	3.25	2.87	2.73	1.90	3.64
N	80	76	146	46	2	77	151	69	3	380
BROOD YEAR 1975										
Mean	24.80	22.58	22.92	22.57	22.33	22.35	22.53	22.48	22.06	22.41
SD	4.35	3.63	2.66	3.10	2.83	3.56	2.84	3.02	2.56	3.92
N	46	83	106	55	12	93	118	61	16	334
BROOD YEAR 1976										
Mean	23.53	22.65	22.94	23.76	23.94	22.25	22.94	23.60	23.94	23.38
SD	2.85	2.80	2.90	2.82	3.04	2.81	2.89	2.82	3.04	3.98
N	53	70	132	111	4	85	133	119	4	396

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table D-17. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1977										
Mean	25.29	24.07	25.12	24.15	--	24.01	25.12	24.15	--	24.57
SD	3.33	2.74	3.12	4.00	--	2.68	3.10	4.00	--	6.06
N	17	20	82	16	0	21	83	16	0	137
BROOD YEAR 1978										
Mean	23.76	23.56	23.97	23.32	23.47	23.40	23.87	22.71	23.47	23.61
SD	2.90	2.66	2.99	2.64	--	2.73	3.01	3.00	--	3.26
N	79	87	139	48	1	91	143	55	1	369
BROOD YEAR 1979										
Mean	25.59	24.25	25.00	23.96	--	24.24	24.94	23.96	--	24.71
SD	2.52	2.85	3.03	3.33	--	2.83	3.05	3.33	--	3.14
N	23	62	137	19	0	63	138	19	0	243
BROOD YEAR 1980										
Mean	24.92	24.73	22.11	23.19	21.15	24.74	22.10	22.98	21.15	23.34
SD	2.99	3.47	3.55	3.26	--	3.44	3.55	3.34	--	4.01
N	80	82	52	42	1	83	53	44	1	261
BROOD YEAR 1981										
Mean	25.88	24.69	24.46	21.65	--	24.69	24.30	21.86	--	23.92
SD	3.07	2.53	2.67	2.63	--	2.53	2.71	2.85	--	3.75
N	33	32	38	16	0	32	40	18	0	123
BROOD YEAR 1982										
Mean	25.04	24.16	20.92	22.86	25.07	23.47	20.66	22.53	25.07	21.66
SD	3.58	3.13	3.14	2.46	--	3.49	3.10	2.57	--	4.09
N	50	39	37	9	1	46	47	10	1	154
BROOD YEAR 1983										
Mean	23.53	23.08	23.10	21.28	--	23.24	23.10	21.28	--	22.76
SD	2.88	3.28	3.18	2.68	--	3.43	3.18	2.68	--	3.86
N	58	41	39	28	0	43	39	28	0	168
BROOD YEAR 1984										
Mean	23.53	23.96	23.04	21.37	22.68	23.93	22.71	21.36	22.68	22.82
SD	2.82	3.28	2.49	2.52	--	3.26	2.76	2.49	--	3.31
N	38	45	49	37	1	46	53	38	1	176

Appendix Table D-17. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1985										
Mean	22.88	21.76	20.45	19.63	--	21.77	20.37	19.63	--	21.18
SD	2.60	2.30	3.26	2.79	--	2.27	3.25	2.79	--	2.93
N	41	39	43	16	0	40	45	16	0	142
BROOD YEAR 1986										
Mean	22.18	20.34	21.19	21.88	22.87	20.34	21.19	21.82	22.87	21.43
SD	2.62	3.38	2.53	2.66	--	3.38	2.53	2.65	--	2.87
N	40	17	58	32	1	17	58	33	1	149
BROOD YEAR 1987										
Mean	24.48	22.61	22.25	21.28	19.71	22.89	22.32	21.28	19.71	22.14
SD	3.03	2.30	3.69	2.70	4.44	2.62	3.50	2.70	4.44	3.32
N	11	20	42	19	3	21	48	19	3	102
BROOD YEAR 1988										
Mean	23.26	20.80	20.69	20.09	23.13	20.80	20.67	20.20	23.13	20.81
SD	3.46	2.65	2.79	2.34	3.71	2.65	2.78	2.31	3.71	2.86
N	13	20	57	30	7	20	58	32	7	130
BROOD YEAR 1989										
Mean	20.41	21.60	21.19	23.09	--	21.60	21.19	23.09	--	22.08
SD	3.48	3.22	2.41	3.00	--	3.22	2.41	3.00	--	3.07
N	3	23	39	32	--	23	39	32	--	97
BROOD YEAR 1990										
Mean	23.46	23.12	22.77	--	--	23.12	22.77	--	--	--
SD	2.41	2.14	2.75	--	--	2.14	2.75	--	--	--
N	22	34	37	--	--	34	37	--	--	--
BROOD YEAR 1991										
Mean	21.91	21.71	--	--	--	21.55	--	--	--	--
SD	3.29	3.23	--	--	--	3.18	--	--	--	--
N	14	14	--	--	--	15	--	--	--	--
BROOD YEAR 1992										
Mean	25.55	--	--	--	--	--	--	--	--	--
SD	1.13	--	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--	--

Appendix Table D-18. Correlation matrix for variables examined in the analyses of the mean widths of circuli bands I+II on the scales of completed broods of wild spring chinook salmon. Variables are described in Appendix Table D-19. Estimates of abundance were transformed to natural logarithms before analysis.

	Band widths I+II		Juvenile abundance			
	Age 4	Brood	Fry	Migrants	Flow	Water temperature
Age 4 circuli spacing	1.00					
Brood circuli spacing	0.93[a]	1.00				
Fry abundance	-0.58[a]	-0.62[a]	1.00			
Migrant abundance	-0.57[a]	-0.54[a]	0.94[a]	1.00		
Flow	-0.23	-0.29	-0.22	-0.30	1.00	
Water temperature	0.35	0.57[a]	-0.01	0.06	-0.86[a]	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table D-19. Data used to assess factors related to estimates of the mean widths of circuli bands I+II on the scales of wild age 2-6 adult spring chinook salmon, 1972-90 brood years.

Brood year	Band widths		Juvenile abundance		Flow[e]	Water temperature[f]
	Age 4[a]	Brood[b]	Fry[c]	Migrants[d]		
1972	20.60	19.51	--	--	2,093	--
1973	20.61	20.82	--	--	4,358	10.7
1974	21.70	21.21	--	--	4,039	10.2
1975	22.92	22.41	585	2,990,78	3,194	11.1
1976	22.94	23.34	843	2,985,64	1,015	13.6
1977	25.12	24.57	47	5,137,09	1,993	12.7
1978	23.97	23.61	518	321,523	2,703	12.4
1979	25.00	24.71	193	5,096,782	2,240	12.4
1980	22.11	23.34	372	1,389,158	1,609	13.8
1981	24.46	23.92	--	2,722,111	3,268	11.8
1982	20.92	21.66	233	312,922	3,668	11.4
1983	23.10	22.76	164	1,253,517	4,100	10.9
1984	23.04	22.82	763	1,056,177	2,939	12.9
1985	20.45	21.18	767	1,687,528	2,273	11.8
1986	21.19	21.43	1,134	3,726,832	1,849	12.7
1987	22.25	22.14	1,704	4,565,683	2,025	11.8
1988	20.69	20.81	832	11,357,231	3,588	10.9
1989	21.19	22.08	1,319	4,396,786	2,170	12.4
1990	22.77	--	844	7,628,426	2,505	11.4

[a] *Subyearling smolts only.*
[b] *Subyearling and yearling smolts.*
[c] *Mean catch per seine haul of newly emergent fry.*
[d] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[e] *Mean daily flow (cfs) at Dodge Bridge in April-June.*
[f] *Mean maximum water temperature (^{o}C) at Dodge Bridge in April-June.*

Appendix Table D-20. Regression analysis of the mean widths of circuli bands I+II on the scales of wild age 2-6 spring chinook, 1972-89 brood years. Estimates of fry abundance were transformed to natural logarithms before analysis. Variables are described in Appendix Table D-19.

Independent variable	Regression coefficient	Standard error	*P*
Fry abundance	-7.723×10^{-1}	2.170×10^{-1}	0.004
Water temperature	6.833×10^{-1}	2.347×10^{-1}	0.014
Constant	19.07		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	12.060	2	6.030	10.30	0.003
Residual	6.438	11	0.585		

Variables tested	Partial r^2 Step 1	Step 2
Fry abundance	0.38	--
Water temperature	0.33	0.44
Flow	0.08	0.35

Appendix Table D-21. Relative abundance of yearling migrants among wild age 2-6 adult spring chinook salmon, 1972-89 brood years. No age 2 fish migrated as yearling smolts. Data were not reported for groups where scales were interpreted from less than 10 fish. Estimates are adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.

Brood year	% age 1 smolts				
	Age 3	Age 4	Age 5	Age 6	Age 2-6
1972	22.7	5.5	23.8	--	16.9
1973	3.0	4.9	17.1	--	12.4
1974	1.4	1.8	32.8	--	16.7
1975	10.4	8.7	13.1	13.1	13.9
1976	12.4	0.7	6.7	--	4.3
1977	4.7	1.1	0.0	--	0.8
1978	4.3	2.6	15.8	--	4.6
1979	1.9	0.5	0.0	--	0.7
1980	1.0	1.1	4.0	--	1.9
1981	0.0	2.4	12.4	--	4.1
1982	10.6	18.3	16.3	--	15.9
1983	0.9	0.0	0.0	--	0.2
1984	1.7	1.7	8.3	--	2.3
1985	0.9	5.4	0.0	--	2.4
1986	0.0	0.0	3.3	--	1.0
1987	4.0	12.6	0.0	--	5.5
1988	0.0	2.8	7.1	--	3.9
1989	0.0	0.0	0.0	--	0.0

Appendix Table D-22. Correlation matrix for variables examined in the analyses of the relative abundance of yearling migrants among completed broods of wild spring chinook salmon. Variables are described in Appendix Table D-23. Estimates of juvenile abundance were transformed to natural logarithms before analysis. Estimates of the proportion of yearling smolts were transformed to logits before analysis.

	% age 1 smolts	Juvenile abundance		Growth rate	Flow	Water temperature
		Fry	Migrants			
% age 1 smolts	1.00					
Fry abundance	0.16	1.00				
Migrant abundance	0.07	0.94[a]	1.00			
Growth rate	-0.39	-0.73[a]	0.70[a]	1.00		
Flow	0.20	-0.27	-0.34	0.14	1.00	
Water temperature	-0.43	-0.11	0.00	0.42	-0.70[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table D-23. Data used to assess factors related to the relative abundance of yearling migrants among wild age 2-6 adult spring chinook salmon, 1972-89 brood years.

Brood year	% age 1 smolts[a]	Juvenile abundance		Growth rate[d]	Flow[e]	Water temperature[f]
		Fry[b]	Migrants[c]			
1972	16.9	--	--	1.74	1,853	--
1973	12.4	--	--	1.85	3,793	12.1
1974	16.7	--	--	1.87	3,552	11.9
1975	13.9	585	2,990,78	1.97	2,823	12.7
1976	4.3	843	2,985,64	2.05	1,048	14.6
1977	0.8	47	5,137,09	2.14	2,109	13.6
1978	4.6	518	321,523	2.04	2,653	13.4
1979	0.7	193	5,096,782	2.20	2,211	13.2
1980	1.9	372	1,389,158	2.02	1,703	14.4
1981	4.1	--	2,722,111	2.12	3,024	12.6
1982	15.9	233	312,922	2.09	3,318	12.4
1983	0.2	164	1,253,517	2.29	3,863	13.3
1984	2.3	763	1,056,177	2.15	2,759	14.0
1985	2.4	767	1,687,528	2.02	2,283	12.6
1986	1.0	1,134	3,726,832	1.92	1,916	13.1
1987	5.5	1,704	4,565,683	1.92	1,983	12.8
1988	3.9	832	11,357,231	1.89	3,267	12.0
1989	0.0	1,319	4,396,786	1.83	2,096	13.3

[a] *Completed broods only.*
[b] *Mean catch per seine haul of newly emergent fry.*
[c] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[d] *Average spacing of freshwater circuli for completed broods.*
[e] *Mean daily flow (cfs) at Dodge Bridge in April-July.*
[f] *Mean maximum water temperature (^{o}C) at Dodge Bridge in April-July.*

Appendix Table D-24. Correlation matrix for variables examined in the analyses of the migration timing of wild subyearling chinook salmon that passed Savage Rapids Dam, 1975-89 brood years. Variables are described in Table 26 and Appendix Table D-25. Estimates of migration timing and spawner composition were logit transformed prior to analysis.

	Percent that passed by			Juvenile abundance	Growth rate	Emergence timing	Spawner composition	Flow	Water temperature
	06/17	07/15	08/19						
% passage by 06/17	1.00								
% passage by 07/15	0.85[a]	1.00							
% passage by 08/19	0.65[a]	0.85[a]	1.00						
Juvenile abundance	0.51	0.67[a]	0.62[a]	1.00					
Growth rate	0.05	-0.17	-0.16	-0.69[a]	1.00				
Emergence timing	-0.30	-0.49	-0.31	-0.04	-0.17	1.00			
Spawner composition	0.13	0.14	0.33	-0.29	0.34	0.11	1.00		
Flow	0.04	-0.26	-0.06	-0.31	0.32	0.38	0.58[a]	1.00	
Water temperature	-0.33	-0.17	-0.27	-0.11	0.00	-0.40	-0.46	-0.81[a]	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table D-25. Independent variables used to assess factors related to estimates of the migration timing of wild subyearling chinook salmon that passed Savage Rapids Dam, 1975-89 brood years. Dependent variables are in Table 26.

Brood year	Juvenile abundance[a]	Growth rate[b]	Emergence timing[c]	Spawner composition[d]	Flow[e]	Water temperature[f]
1975	2,985,664	1.97	04/27	15.9%	3,459	14.8
1976	5,137,059	2.05	04/19	11.5%	1,326	16.5
1977	321,523	2.14	03/29	17.7%	2,296	15.5
1978	5,096,782	2.04	04/10	18.6%	3,168	15.1
1979	1,389,158	2.20	04/15	14.6%	2,336	15.1
1980	2,722,111	2.02	03/30	11.7%	1,914	16.8
1981	312,922	2.12	--	33.0%	3,186	15.0
1982	1,253,517	2.09	04/27	19.6%	4,089	14.2
1983	1,056,177	2.29	04/12	35.0%	4,587	13.7
1984	1,687,528	2.15	04/15	33.7%	2,648	15.8
1985	3,726,832	2.02	04/23	18.0%	2,692	14.6
1986	4,565,683	1.92	04/14	19.2%	1,934	15.6
1987	11,357,231	1.92	04/12	16.7%	2,570	14.3
1988	4,396,786	1.89	04/17	21.1%	3,430	14.2
1989	7,628,426	1.83	04/10	24.1%	2,349	14.8

[a] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[b] *Average spacing of freshwater circuli from completed broods.*
[c] *Date of emergence completion at High Banks. Date was changed to day-of-year before analysis.*
[d] *Percent of wild spawners upstream of Gold Ray Dam estimated to be fall chinook salmon.*
[e] *Mean daily flow (cfs) at Raygold in May-June.*
[f] *Mean maximum water temperature (^{o}C) at Raygold in May-June.*

Appendix Table D-26. Mean date of ocean entry by wild juvenile spring chinook salmon as estimated from the scales of age 2-6 adults, 1973-80 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1973										
Mean	08/26	09/20	09/25	09/03	08/15	10/05	10/14	10/11	12/23	10/12
SD	18.4	30.9	29.1	28.7	--	67.2	71.8	97.2	184.9	139.9
N	46	49	82	37	1	52	89	43	2	232
BROOD YEAR 1974										
Mean	09/07	09/17	09/08	09/07	09/30	09/21	09/16	12/08	12/22	10/27
SD	17.0	23.0	22.9	21.3	31.5	41.6	52.3	133.0	144.8	156.0
N	80	76	146	46	2	77	151	69	3	380
BROOD YEAR 1975										
Mean	09/04	09/04	08/19	09/12	09/24	10/03	09/18	10/11	12/05	10/14
SD	24.4	27.2	22.3	22.6	26.7	87.6	92.0	90.3	131.2	162.4
N	46	83	106	55	12	93	118	61	16	334
BROOD YEAR 1976										
Mean	08/31	09/09	09/23	09/20	09/10	10/25	09/25	10/07	09/10	09/30
SD	32.6	35.1	28.4	32.0	20.3	105.1	35.5	70.6	20.3	69.0
N	53	70	132	111	4	85	133	119	4	394
BROOD YEAR 1977										
Mean	08/02	08/18	08/11	08/04	--	09/02	08/15	08/04	--	08/10
SD	24.3	19.0	19.4	17.3	--	71.4	43.0	17.3	--	76.9
N	17	20	82	16	0	21	83	16	0	137
BROOD YEAR 1978										
Mean	08/24	09/01	08/28	09/10	08/25	09/13	09/04	10/13	08/25	08/31
SD	18.8	20.5	24.9	25.6	--	60.8	52.2	88.9	--	63.5
N	79	87	139	48	1	91	143	55	1	369
BROOD YEAR 1979										
Mean	08/11	08/17	08/13	08/26	--	08/23	08/15	08/26	--	08/18
SD	15.0	22.7	18.8	24.1	--	47.0	31.3	24.1	--	34.1
N	23	62	137	19	0	63	138	19	0	243
BROOD YEAR 1980										
Mean	08/27	08/22	08/28	08/26	09/04	08/27	09/02	09/09	09/04	09/03
SD	22.2	30.1	21.2	20.4	--	47.8	43.7	65.4	--	38.0
N	80	82	52	42	1	83	53	44	1	182

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table D-27. Mean number of freshwater circuli counted on the scales of wild age 2-6 spring chinook salmon, 1969-92 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1969									
Mean	--	--	--	20.79	19.00	--	--	21.25	19.00
SD	--	--	--	4.04	--	--	--	4.12	--
N	--	--	--	75	1	--	--	84	1
BROOD YEAR 1970									
Mean	--	--	18.19	20.25	21.00	--	18.30	20.56	21.00
SD	--	--	3.15	3.30	--	--	3.21	3.67	--
N	--	--	123	48	1	--	126	50	1
BROOD YEAR 1971									
Mean	--	18.33	19.97	20.58	23.67	18.76	20.28	22.32	25.75
SD	--	3.28	3.32	3.36	2.52	3.70	3.73	4.58	4.65
N	--	52	136	26	3	55	140	34	4
BROOD YEAR 1972									
Mean	13.80	18.48	19.41	21.43	24.00	19.92	20.11	22.22	24.00
SD	1.48	3.62	3.53	3.53	--	4.43	4.20	3.81	--
N	5	101	110	47	1	127	121	58	1
BROOD YEAR 1973									
Mean	18.26	21.16	21.74	19.27	17.00	21.64	22.24	20.23	21.50
SD	2.11	3.55	3.34	3.30	--	3.96	3.71	4.02	6.36
N	46	49	82	37	1	52	89	43	2
BROOD YEAR 1974									
Mean	17.92	19.24	17.97	17.80	21.00	19.36	18.34	20.84	24.00
SD	2.29	3.09	3.08	2.87	4.24	3.26	3.64	5.17	6.00
N	80	76	146	46	2	77	151	69	3
BROOD YEAR 1975									
Mean	17.20	17.26	15.46	18.06	19.33	18.31	16.67	19.16	22.44
SD	2.60	2.90	2.37	2.40	2.84	4.28	4.40	4.20	6.46
N	46	83	106	55	12	93	118	61	16
BROOD YEAR 1976									
Mean	17.09	17.81	19.01	18.77	16.75	19.52	19.11	19.34	16.75
SD	2.75	2.96	2.39	2.69	1.71	4.76	2.67	3.56	1.71
N	53	70	132	111	4	85	133	119	4

Appendix Table D-27. Continued.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1977									
Mean	17.65	19.70	18.76	16.31	--	20.33	18.87	16.31	--
SD	3.10	2.43	2.48	2.21	--	3.75	2.67	2.21	--
N	17	20	82	16	0	21	83	16	0
BROOD YEAR 1978									
Mean	18.40	19.22	17.32	18.67	17.00	19.69	17.58	19.29	17.00
SD	2.09	2.27	2.77	2.85	--	3.19	3.15	3.41	--
N	79	87	139	48	1	91	143	55	1
BROOD YEAR 1979									
Mean	19.13	18.34	17.82	19.32	--	18.57	17.87	19.32	--
SD	1.87	2.83	2.34	3.00	--	3.36	2.41	3.00	--
N	23	62	137	19	0	63	138	19	0
BROOD YEAR 1980									
Mean	18.24	17.78	18.35	18.14	22.00	17.90	18.57	18.75	22.00
SD	2.42	3.28	2.32	2.23	--	3.45	2.80	3.56	--
N	80	82	52	42	1	83	53	44	1
BROOD YEAR 1981									
Mean	17.09	17.66	17.05	21.31	--	17.66	17.58	22.33	--
SD	3.01	2.32	2.30	2.58	--	2.32	3.23	3.86	--
N	33	32	38	16	0	32	40	18	0
BROOD YEAR 1982									
Mean	18.06	18.00	20.97	18.89	22.00	19.78	22.92	19.70	22.00
SD	2.83	2.60	2.08	2.26	--	5.02	4.30	3.34	--
N	50	39	37	9	1	46	47	10	1
BROOD YEAR 1983									
Mean	18.48	20.54	20.33	19.57	--	20.81	20.33	19.57	--
SD	1.92	1.45	1.56	1.77	--	1.91	1.56	1.77	--
N	58	41	39	28	0	43	39	28	0
BROOD YEAR 1984									
Mean	19.10	19.04	19.33	18.68	14.00	19.17	20.13	18.95	14.00
SD	2.30	2.03	1.88	2.37	--	2.19	3.37	2.88	--
N	38	45	49	37	1	46	53	38	1

Appendix Table D-27. Continued.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1985									
Mean	19.85	20.69	18.51	18.19	--	20.98	18.64	18.19	--
SD	2.34	2.10	2.64	2.01	--	2.74	2.90	2.01	--
N	41	39	43	16	0	40	45	16	0
BROOD YEAR 1986									
Mean	19.25	18.65	16.79	17.72	22.00	18.65	16.79	18.03	22.00
SD	1.89	2.32	2.11	2.48	--	2.32	2.11	3.03	--
N	40	17	58	32	1	17	58	33	1
BROOD YEAR 1987									
Mean	16.18	16.20	17.24	18.37	17.33	17.19	19.04	18.37	17.33
SD	1.17	2.02	2.63	2.85	2.89	4.95	5.50	2.85	2.89
N	11	20	42	19	3	21	48	19	3
BROOD YEAR 1988									
Mean	17.23	18.10	19.00	20.57	19.14	18.10	19.02	21.16	19.14
SD	2.39	3.08	2.97	3.07	2.34	3.08	2.95	3.78	2.34
N	13	20	57	30	7	20	58	32	7
BROOD YEAR 1989									
Mean	16.33	19.13	19.23	20.50	--	19.13	19.23	20.50	--
SD	3.22	3.65	2.73	2.68	--	3.65	2.73	2.68	--
N	3	23	39	32	--	23	39	32	--
BROOD YEAR 1990									
Mean	18.64	18.76	20.81	--	--	18.76	20.81	--	--
SD	2.84	2.31	2.41	--	--	2.31	2.41	--	--
N	22	34	37	--	--	34	37	--	--
BROOD YEAR 1991									
Mean	21.93	22.00	--	--	--	22.73	--	--	--
SD	2.53	2.32	--	--	--	3.62	--	--	--
N	14	14	--	--	--	15	--	--	--
BROOD YEAR 1992									
Mean	17.50	--	--	--	--	--	--	--	--
SD	2.12	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--

Appendix Table D-28. Correlation matrix for variables examined in the analyses of the mean date (day-of-year) of ocean entry as estimated from scales of completed broods of wild spring chinook salmon. Variables are described in Appendix Table D-29. Estimates of juvenile abundance were transformed to natural logarithms before analysis.

	Date of ocean entry	Migrant abundance	Growth rate	Flow	Water temperature
Date of ocean entry	1.00				
Migrant abundance	0.65	1.00			
Growth rate	-0.88[a]	-0.54	1.00		
Flow	-0.46	-0.55	0.20	1.00	
Water temperature	0.82[a]	0.44	0.60	-0.68	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table D-29. Data used to assess factors related to estimates of the mean date (day-of-year) of ocean entry from scales of wild age 2-6 adult spring chinook salmon, 1973-80 brood years. Day-of-year calendar is in **APPENDIX A.**

Brood year	Date of entry: Age 4[a]	Date of entry: Brood[b]	Migrant abundance[c]	Growth rate[d]	Flow[e]	Water temperature[f]
1973	269	286	--	1.85	1,895	18.4
1974	252	301	2,990,738	1.87	1,977	18.8
1975	232	288	2,985,664	1.97	1,916	19.4
1976	267	274	5,137,059	2.05	1,147	19.4
1977	224	223	321,523	2.14	2,342	17.5
1978	241	254	5,096,782	2.04	2,259	17.4
1979	226	231	1,389,158	2.20	2,088	16.8
1980	241	247	2,722,111	2.02	1,978	17.5

[a] *Subyearling smolts only.*
[b] *Subyearling and yearling smolts.*
[c] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[d] *Average spacing of freshwater circuli from completed broods.*
[e] *Mean daily flow (cfs) at Raygold in July-August.*
[f] *Mean maximum water temperature (^{o}C) at Raygold in July-August.*

Appendix Table D-30. Regression analysis of the mean date (day-of-year) of ocean entry as estimated from the scales of wild age 2-6 spring chinook, 1973-80 brood years. Variables are described in Appendix Table D-29.

Independent variable	Regression coefficient	Standard error	*P*
Growth rate	-144.2	39.38	0.015
Water temperature	13.05	4.81	0.042
Constant	317.4		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	5,177	2	2,589	25.74	0.002
Residual	503	5	101		

	Partial r^2	
Variables tested	Step 1	Step 2
Growth rate	0.78	--
Migrant abundance	0.43	0.26
Water temperature	0.67	0.38
Flow	0.21	0.37

Appendix Table D-31. Data used to assess factors related to estimates of the mean lengths of wild subyearling chinook salmon that passed Savage Rapids Dam, 1975-89 brood years.

Brood year	Length[a]	Migration timing[b]	Juvenile abundance[c]	Growth rate[d]	Spawner composition[e]	Flow[f]	Water temperature[g]
1975	8.8	3.9	2,985,664	1.97	15.9	3,459	14.8
1976	9.1	--	5,137,059	2.05	11.5	1,326	16.5
1977	10.9	7.1	321,523	2.14	17.7	2,296	15.5
1978	9.0	12.4	5,096,782	2.04	18.6	3,168	15.1
1979	10.6	20.8	1,389,158	2.20	14.6	2,336	15.1
1980	9.6	--	2,722,111	2.02	11.7	1,914	16.8
1981	10.9	3.3	312,922	2.12	33.0	3,186	15.0
1982	9.7	29.7	1,253,517	2.09	19.6	4,089	14.2
1983	9.9	63.4	1,056,177	2.29	35.0	4,587	13.7
1984	9.7	16.0	1,687,528	2.15	33.7	2,648	15.8
1985	9.8	2.9	3,726,832	2.02	18.0	2,692	14.6
1986	9.3	21.1	4,565,683	1.92	19.2	1,934	15.6
1987	8.8	74.2	11,357,231	1.92	16.7	2,570	14.3
1988	9.2	4.9	4,396,786	1.89	21.1	3,430	14.2
1989	8.0	68.4	7,628,426	1.83	24.1	2,349	14.8

[a] *Mean length (cm) of fish that passed between 14 May and 30 September.*
[b] *Percent that passed by 17 June.*
[c] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[d] *Average spacing of freshwater circuli from completed broods.*
[e] *Percent of wild spawners upstream of Gold Ray Dam estimated to be fall chinook salmon.*
[f] *Mean daily flow (cfs) at Raygold in May-June.*
[g] *Mean maximum water temperature (^{o}C) at Raygold in May-June.*

Appendix Table D-32. Correlation matrix for variables examined in the analyses of the mean lengths of wild subyearling chinook salmon that passed Savage Rapids Dam, 1975-89 brood years. Variables are described in Appendix Table D-31. Estimates of migration timing and spawner composition were logit transformed prior to analysis.

	Length	Migration timing	Juvenile abundance	Growth rate	Spawner composition	Flow	Water temperature
Length	1.00						
Migration timing	-0.42	1.00					
Juvenile abundance	-0.77[a]	0.51	1.00				
Growth rate	0.66[a]	0.05	-0.69[a]	1.00			
Spawner composition	0.19	0.13	-0.29	0.34	1.00		
Flow	0.09	0.04	-0.31	0.32	-0.58[a]	1.00	
Water temperature	0.09	-0.33	-0.11	0.00	-0.46	-0.81[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table D-33. Mean scale radius (mm at 88x) at ocean entry estimated from the scales of wild age 2-6 spring chinook salmon, 1969-92 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts						All smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1969										
Mean	--	--	--	41.62	47.00	--	--	--	42.59	47.00
SD	--	--	--	7.06	--	--	--	--	7.66	--
N	--	--	--	75	1	--	--	--	84	1
BROOD YEAR 1970										
Mean	--	--	40.41	46.58	40.60	--	--	40.54	47.33	40.60
SD	--	--	6.62	6.95	--	--	--	6.60	7.98	--
N	--	--	123	48	1	--	--	126	50	1
BROOD YEAR 1971										
Mean	--	40.16	46.58	42.52	44.40	--	40.97	47.06	45.79	47.30
SD	--	6.19	7.03	6.59	7.41	--	7.07	7.48	8.82	8.38
N	--	52	136	26	3	--	55	140	34	4
BROOD YEAR 1972										
Mean	36.14	40.41	39.54	41.23	43.40	40.56	42.65	40.38	42.45	43.40
SD	4.88	6.18	7.22	9.23	--	12.17	7.53	7.56	9.30	--
N	5	101	110	47	1	264	127	121	58	1
BROOD YEAR 1973										
Mean	44.87	44.71	44.94	40.28	34.50	42.47	45.54	45.81	42.41	40.25
SD	5.68	7.07	5.94	6.67	--	8.76	7.68	6.56	8.34	8.13
N	46	49	82	37	1	215	52	89	43	2
BROOD YEAR 1974										
Mean	42.13	41.08	38.49	38.54	46.00	38.97	41.48	39.01	44.91	49.83
SD	5.47	5.21	5.44	4.49	1.41	6.39	6.25	6.29	11.07	6.71
N	80	76	146	46	2	350	77	151	69	3
BROOD YEAR 1975										
Mean	41.83	38.22	37.31	41.02	44.38	40.00	39.92	39.35	43.45	50.81
SD	6.36	5.82	5.53	5.09	5.49	7.62	7.68	8.38	9.35	12.80
N	46	83	106	55	12	302	93	118	61	16
BROOD YEAR 1976										
Mean	40.28	41.08	44.42	45.44	42.00	44.18	44.48	44.56	46.52	42.00
SD	5.52	5.73	5.16	5.30	8.50	9.29	9.42	5.40	6.84	8.50
N	53	70	132	111	4	370	85	133	119	4

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table D-33. Continued.

	Subyearling smolts						All smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1977										
Mean	44.09	48.52	48.44	42.80	--	45.36	49.61	48.81	42.80	--
SD	8.48	7.39	7.07	7.24	--	11.23	8.74	7.76	7.24	--
N	17	20	82	16	0	135	21	83	16	0
BROOD YEAR 1978										
Mean	45.41	46.86	43.43	45.19	37.00	44.31	47.63	43.77	45.74	37.00
SD	6.00	6.18	6.60	6.72	--	7.14	7.20	6.87	7.22	--
N	79	87	139	48	1	354	91	143	55	1
BROOD YEAR 1979										
Mean	50.46	47.57	47.74	49.15	--	48.00	47.99	47.80	49.15	--
SD	4.64	6.55	5.97	7.97	--	5.69	7.28	5.99	7.97	--
N	23	62	137	19	0	241	63	138	19	0
BROOD YEAR 1980										
Mean	46.52	45.88	42.78	44.10	49.00	44.66	46.24	43.03	44.92	49.00
SD	6.72	6.18	6.66	5.70	--	7.28	6.95	6.84	6.82	--
N	80	82	52	42	1	261	83	53	44	1
BROOD YEAR 1981										
Mean	46.97	47.40	44.32	49.14	--	45.40	47.40	45.08	52.24	--
SD	8.06	5.90	5.82	3.82	--	7.88	5.90	6.63	10.05	--
N	33	32	38	16	0	119	32	40	18	0
BROOD YEAR 1982										
Mean	48.36	45.75	50.04	49.21	57.10	49.13	48.57	53.37	50.64	57.10
SD	6.81	4.52	6.24	6.44	--	8.83	9.28	8.91	7.57	--
N	50	39	37	9	1	136	46	47	10	1
BROOD YEAR 1983										
Mean	48.07	52.54	54.99	49.32	--	52.75	53.23	54.99	49.32	--
SD	6.09	5.34	6.98	5.02	--	7.91	6.41	6.98	5.02	--
N	58	41	39	28	0	166	43	39	28	0
BROOD YEAR 1984										
Mean	47.58	49.18	49.70	42.66	38.60	48.44	49.29	50.91	43.04	38.60
SD	4.96	6.11	4.89	5.07	--	6.05	6.10	6.41	5.53	--
N	38	45	49	37	1	170	46	53	38	1

Appendix Table D-33. Continued.

	Subyearling smolts						All smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1985										
Mean	49.23	53.18	42.71	40.63	--	47.45	53.79	42.68	40.63	--
SD	7.28	6.59	6.68	5.22	--	6.97	7.55	6.70	5.22	--
N	41	39	43	16	0	139	40	45	16	0
BROOD YEAR 1986										
Mean	48.00	40.95	39.97	42.89	53.10	41.72	40.95	39.97	43.80	53.10
SD	4.81	6.33	4.69	5.36	--	5.48	6.33	4.69	7.42	--
N	40	17	58	32	1	148	17	58	33	1
BROOD YEAR 1987										
Mean	41.72	40.68	41.81	42.22	37.60	41.70	43.13	45.95	42.22	37.60
SD	3.85	5.39	5.71	5.73	5.48	6.20	12.39	12.54	5.73	5.47
N	11	20	42	19	3	95	21	48	19	3
BROOD YEAR 1988										
Mean	45.13	43.10	43.94	44.15	49.44	44.44	43.10	43.93	45.91	49.44
SD	7.18	7.51	6.98	5.53	4.55	6.55	7.52	6.92	8.81	4.55
N	13	20	57	30	7	127	20	58	32	7
BROOD YEAR 1989										
Mean	36.57	44.03	44.65	50.48	--	46.08	44.03	44.65	50.48	--
SD	0.31	7.29	7.06	7.01	--	7.78	7.29	7.06	7.01	--
N	3	23	39	32	--	97	23	39	32	--
BROOD YEAR 1990										
Mean	47.17	47.50	53.10	--	--	--	47.50	53.10	--	--
SD	5.70	6.90	7.06	--	--	--	6.90	7.06	--	--
N	22	34	37	--	--	--	34	37	--	--
BROOD YEAR 1991										
Mean	52.39	53.59	--	--	--	--	54.05	--	--	--
SD	7.38	7.70	--	--	--	--	7.63	--	--	--
N	14	14	--	--	--	--	15	--	--	--
BROOD YEAR 1992										
Mean	47.10	--	--	--	--	--	--	--	--	--
SD	5.66	--	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--	--

Appendix Table D-34. Mean length (cm) at ocean entry of wild juvenile spring chinook salmon as estimated from the scales of age 2-6 adults, 1969-92 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1969										
Mean	--	--	--	10.05	11.03	--	--	10.23	11.03	--
SD	--	--	--	1.28	--	--	--	1.39	--	--
N	--	--	--	75	1	--	--	84	1	--
BROOD YEAR 1970										
Mean	--	--	9.84	10.95	9.87	--	9.86	11.10	9.87	--
SD	--	--	1.20	1.26	--	--	1.20	1.44	--	--
N	--	--	123	48	1	--	126	50	1	--
BROOD YEAR 1971										
Mean	--	9.79	10.95	10.22	10.56	9.94	11.00	10.80	11.08	--
SD	--	1.12	1.27	1.19	1.34	1.28	1.40	1.60	1.52	--
N	--	52	136	26	3	55	140	34	4	--
BROOD YEAR 1972										
Mean	9.06	9.83	9.68	9.98	10.38	10.24	9.83	10.20	10.38	10.08
SD	0.88	1.12	1.31	1.67	--	1.36	1.37	1.68	--	2.33
N	5	101	110	47	1	127	121	58	1	312
BROOD YEAR 1973										
Mean	10.92	10.89	10.93	10.10	9.07	11.04	11.09	10.48	10.10	10.74
SD	1.01	1.26	1.06	1.19	--	1.37	1.17	1.48	1.45	1.97
N	46	49	82	37	1	52	89	43	2	232
BROOD YEAR 1974										
Mean	10.55	10.33	9.80	9.81	11.35	10.41	9.91	11.12	12.14	10.57
SD	1.13	1.07	1.12	0.92	0.29	1.29	1.30	2.28	1.38	2.67
N	80	76	146	46	2	77	151	69	3	380
BROOD YEAR 1975										
Mean	10.74	10.05	9.87	10.59	11.23	10.37	10.26	11.06	12.48	11.03
SD	1.23	1.12	1.07	0.98	1.06	1.48	1.62	1.81	2.47	3.07
N	46	83	106	55	12	93	118	61	16	334
BROOD YEAR 1976										
Mean	9.39	9.53	10.12	10.30	9.66	10.13	10.14	10.49	9.69	10.22
SD	0.97	1.01	0.91	0.93	1.50	1.66	0.95	1.21	1.50	1.78
N	53	70	132	111	4	85	133	119	4	394

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table D-34. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1977										
Mean	10.58	11.41	11.40	10.31	--	11.62	11.47	10.31	--	10.85
SD	1.60	1.39	1.33	1.36	--	1.64	1.46	1.36	--	2.14
N	17	20	82	16	0	21	83	16	0	137
BROOD YEAR 1978										
Mean	10.49	10.74	10.13	10.43	9.03	10.88	10.19	10.52	9.03	10.35
SD	1.02	1.06	1.13	1.15	--	1.23	1.18	1.24	--	1.28
N	79	87	139	48	1	91	143	55	1	369
BROOD YEAR 1979										
Mean	11.37	10.82	10.85	11.11	--	10.90	10.86	11.11	--	10.92
SD	0.84	1.18	1.08	1.44	--	1.32	1.08	1.44	--	1.22
N	23	62	137	19	0	63	138	19	0	243
BROOD YEAR 1980										
Mean	10.91	10.79	10.23	10.47	10.99	10.86	10.28	10.62	10.99	10.63
SD	1.22	1.12	1.21	1.03	--	1.26	1.24	1.24	--	1.48
N	80	82	52	42	1	83	53	44	1	261
BROOD YEAR 1981										
Mean	10.99	11.07	10.51	11.02	--	11.07	10.65	11.56	--	10.85
SD	1.49	1.07	1.05	0.69	--	1.07	1.20	1.82	--	1.78
N	33	32	38	16	0	32	40	18	0	123
BROOD YEAR 1982										
Mean	11.24	10.77	11.17	11.03	12.41	11.28	11.75	11.28	12.41	11.56
SD	1.23	0.82	1.13	1.16	--	1.68	1.61	1.37	--	2.13
N	50	39	37	9	1	46	47	10	1	154
BROOD YEAR 1983										
Mean	11.19	11.61	12.03	11.05	--	11.72	12.03	11.05	--	11.69
SD	1.10	0.97	1.26	0.91	--	1.16	1.26	0.91	--	1.46
N	58	41	39	28	0	43	39	28	0	168
BROOD YEAR 1984										
Mean	10.74	11.02	11.12	9.77	9.07	11.04	11.33	9.84	9.07	11.01
SD	0.90	1.11	0.89	0.92	--	1.10	1.16	1.00	--	1.35
N	38	45	49	37	1	46	53	38	1	176

Appendix Table D-34. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1985										
Mean	11.03	11.72	9.78	9.42	--	11.83	9.78	9.42	--	10.69
SD	1.32	1.19	1.21	0.95	--	1.37	1.21	0.95	--	1.35
N	41	39	43	16	0	40	45	16	0	142
BROOD YEAR 1986										
Mean	10.82	9.47	9.30	9.81	11.57	9.47	9.30	9.97	11.57	9.67
SD	0.87	1.15	0.85	0.97	--	1.15	0.85	1.34	--	1.15
N	40	17	58	32	1	17	58	33	1	149
BROOD YEAR 1987										
Mean	9.61	9.43	9.63	9.69	8.90	9.85	10.34	9.69	8.90	9.94
SD	0.70	0.98	1.03	1.04	0.99	2.24	2.27	1.04	0.99	1.70
N	11	20	42	19	3	21	48	19	3	102
BROOD YEAR 1988										
Mean	10.20	9.85	9.99	10.03	10.94	9.85	9.99	10.33	10.94	10.19
SD	1.30	1.36	1.26	1.00	0.82	1.36	1.25	1.60	0.82	1.51
N	13	20	57	30	7	20	58	32	7	130
BROOD YEAR 1989										
Mean	9.67	10.01	10.03	11.12	--	10.01	10.11	11.12	--	10.30
SD	0.06	1.32	1.28	1.27	--	1.32	1.28	1.27	--	1.41
N	3	23	39	32	--	23	39	32	--	97
BROOD YEAR 1990										
Mean	10.55	10.60	11.57	--	--	10.60	11.57	--	--	--
SD	1.03	1.25	1.28	--	--	1.25	1.28	--	--	--
N	22	34	37	--	--	34	37	--	--	--
BROOD YEAR 1991										
Mean	11.45	11.66	--	--	--	11.73	--	--	--	--
SD	1.34	1.40	--	--	--	1.38	--	--	--	--
N	14	14	--	--	--	15	--	--	--	--
BROOD YEAR 1992										
Mean	10.51	--	--	--	--	--	--	--	--	--
SD	1.02	--	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--	--

Appendix Table D-35. Correlation matrix for variables examined in the analyses of the mean length at time of ocean entry as estimated from scales of completed broods of wild spring chinook salmon. Variables are described in Appendix Table D-36. Estimates of juvenile abundance were transformed to natural logarithms before analysis.

		Juvenile abundance				
	Length	Fry	Migrants	Growth rate	Flow	Water temperature
Length	1.00					
Fry abundance	-0.66[a]	1.00				
Migrant abundance	-0.65[a]	0.94[a]	1.00			
Growth rate	0.69[a]	-0.73[a]	-0.70[a]	1.00		
Flow	0.58[a]	-0.43	-0.45	0.60[a]	1.00	
Water temperature	-0.09	0.19	0.33	-0.29	-0.62[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table D-36. Data used to assess factors related to estimates of the mean lengths at the time of ocean entry from scales of wild age 2-6 adult spring chinook salmon, 1970-90 brood years.

Brood year	Lengths		Juvenile abundance		Growth rate[e]	Flow[f]	Water temperature[g]
	Age 4[a]	Brood[b]	Fry[c]	Migrants[d]			
1972	9.68	10.08	--	--	1.74	1,086	--
1973	10.93	10.74	--	--	1.85	1,895	18.4
1974	9.80	10.57	--	--	1.87	1,977	18.8
1975	9.87	11.03	585	2,990,78	1.97	1,916	19.4
1976	10.12	10.22	843	2,985,64	2.05	1,147	19.4
1977	11.40	10.85	47	5,137,09	2.14	2,342	17.5
1978	10.13	10.35	518	321,523	2.04	2,259	17.4
1979	10.85	10.92	193	5,096,782	2.20	2,088	16.8
1980	10.23	10.63	372	1,389,158	2.02	1,978	17.5
1981	10.51	10.85	--	2,722,111	2.12	2,302	16.3
1982	11.17	11.56	233	312,922	2.09	2,535	16.2
1983	12.03	11.69	164	1,253,517	2.29	3,137	17.4
1984	11.12	11.01	763	1,056,177	2.15	2,287	17.8
1985	9.78	10.69	767	1,687,528	2.02	2,265	17.3
1986	9.30	9.67	1,134	3,726,832	1.92	2,212	16.6
1987	9.63	9.94	1,704	4,565,683	1.92	1,933	17.6
1988	9.99	10.19	832	11,357,231	1.89	2,415	16.8
1989	10.03	10.30	1,319	4,396,786	1.83	2,019	17.6
1990	11.57	--	844	7,628,426	--	2,169	17.3

[a] *Subyearling smolts only.*
[b] *Subyearling and yearling smolts.*
[c] *Mean catch per seine haul of newly emergent fry.*
[d] *Estimated number of wild subyearlings that passed Savage Rapids Dam.*
[e] *Average spacing of freshwater circuli from completed broods.*
[f] *Mean daily flow (cfs) at Raygold in July-August.*
[g] *Mean maximum water temperature (^{o}C) at Raygold in July-August.*

APPENDIX E

Tables of Data and Analyses Related to Studies of
Adult Spring Chinook Salmon

Appendix Table E-1. Estimated number of adult chinook salmon that passed Gold Ray Dam, 1942-94 return years. Fish that passed prior to 16 August were classified as spring chinook salmon and later migrants were classified as fall chinook salmon. Fish were classified as jacks when smaller than 50 cm in 1942-76 and when smaller than 60 cm in 1977-94.

Return year	Spring chinook salmon			Fall chinook salmon			All chinook salmon		
	Jacks	Adults	Total	Jacks	Adults	Total	Jacks	Adults	Total
1942	6,220	35,559	41,779	537	1,042	1,579	6,757	36,601	43,358
1943	4,535	31,601	36,136	678	1,248	1,926	5,213	32,849	38,062
1944	3,746	26,886	30,632	437	870	1,307	4,183	27,756	31,939
1945	5,251	26,747	31,998	732	990	1,722	5,983	27,737	33,720
1946	4,620	23,754	28,374	348	1,333	1,681	4,968	25,087	30,055
1947	3,074	30,563	33,637	196	907	1,103	3,270	31,470	34,740
1948	2,923	24,056	26,979	63	700	763	2,986	24,756	27,742
1949	1,808	17,002	18,810	327	891	1,218	2,135	17,893	20,028
1950	2,717	12,813	15,530	265	975	1,240	2,982	13,788	16,770
1951	4,858	14,685	19,543	458	1,110	1,568	5,316	15,795	21,111
1952	3,794	12,094	15,888	481	2,119	2,600	4,275	14,213	18,488
1953	4,233	27,232	31,465	397	1,686	2,083	4,630	28,918	33,548
1954	5,208	19,496	24,704	451	630	1,081	5,659	20,126	25,785
1955	2,806	12,908	15,714	120	716	836	2,926	13,624	16,550
1956	3,912	24,156	28,068	195	1,689	1,884	4,107	25,845	29,952
1957	3,032	14,678	17,710	144	916	1,060	3,176	15,594	18,770
1958	1,930	13,086	15,016	136	564	700	2,066	13,650	15,716
1959	2,618	11,354	13,972	318	417	735	2,936	11,771	14,707
1960	5,460	18,914	24,374	808	1,035	1,843	6,268	19,949	26,217
1961	5,370	26,405	31,775	340	920	1,260	5,710	27,325	33,035
1962	5,306	26,089	31,395	304	952	1,256	5,610	27,041	32,651
1963	6,937	33,630	40,567	324	636	960	7,261	34,266	41,527
1964	6,241	31,652	37,390	108	1,032	1,140	6,349	32,684	38,530
1965	8,140	41,261	49,401	609	1,092	1,701	8,749	42,353	51,102
1966	3,454	28,324	31,778	98	997	1,095	3,552	29,321	32,873
1967	2,447	12,632	15,079	977	861	1,838	3,424	13,493	16,917
1968	7,530	13,315	20,845	--	--	--	--	--	--
1969	6,732	52,172	58,904	790	1,249	2,039	7,522	53,421	60,943
1970	7,389	38,160	45,549	1,239	1,867	3,106	8,628	40,027	48,655
1971	6,113	23,772	29,885	855	1,545	2,400	6,968	25,317	32,285
1972	5,657	24,585	30,242	600	2,139	2,739	6,257	26,724	32,981
1973	4,978	30,592	35,570	1,212	1,607	2,819	6,190	32,199	38,389
1974	3,528	13,736	17,264	664	1,658	2,322	4,192	15,394	19,586

Appendix Table E-1. Continued.

Return year	Spring chinook salmon			Fall chinook salmon			All chinook salmon		
	Jacks	Adults	Total	Jacks	Adults	Total	Jacks	Adults	Total
1975	4,564	16,845	21,409	467	1,843	2,310	5,031	18,688	23,719
1976	6,867	14,828	21,695	1,622	1,026	2,648	8,489	15,854	24,343
1977	3,031	13,364	16,395	3,181	2,000	5,181	6,212	15,364	21,576
1978	11,333	35,891	47,224	2,325	3,563	5,888	13,658	39,454	53,112
1979	5,798	32,734	38,532	568	2,543	3,111	6,366	35,277	41,643
1980	7,831	28,820	36,651	897	2,093	2,990	8,728	30,913	39,641
1981	3,049	14,236	17,285	1,452	3,417	4,869	4,501	17,553	22,054
1982	10,144	19,799	29,943	2,502	2,100	4,602	12,646	21,899	34,545
1983	4,654	7,857	12,511	1,909	1,930	3,839	6,563	9,787	16,350
1984	3,797	8,844	12,641	939	2,247	3,186	4,736	11,091	15,827
1985	15,503	25,537	41,040	3,147	5,305	8,452	18,650	30,842	49,492
1986	30,073	59,449	89,522	7,602	6,637	14,239	37,675	66,086	103,761
1987	16,229	65,353	81,582	3,103	7,597	10,700	19,332	72,950	92,282
1988	18,430	64,455	82,885	2,171	9,332	11,503	20,601	73,787	94,388
1989	6,550	53,780	60,330	1,468	5,435	6,903	8,018	59,215	67,233
1990	3,050	21,540	24,590	799	2,854	3,653	3,849	24,394	28,243
1991	2,370	10,543	12,913	718	2,487	3,205	3,088	13,030	16,118
1992	1,293	4,508	5,801	3,256	3,541	6,797	4,549	8,049	12,598
1993	6,756	19,347	26,103	2,938	3,773	6,711	9,694	23,120	32,814
1994	2,648	11,428	14,076	3,909	7,621	11,530	6,557	19,049	25,606

Appendix Table E-2. Estimated number of wild and hatchery chinook salmon that passed Gold Ray Dam, 1953-94.

Return year	Spring chinook salmon		Fall chinook salmon		All chinook salmon	
	Wild	Hatchery	Wild	Hatchery[a]	Wild	Hatchery
1953	31,327	138	2,083	0	33,410	138
1954	24,585	119	1,081	0	25,666	119
1955	15,613	101	836	0	16,449	101
1956	27,751	317	1,884	0	29,635	317
1957	16,517	1,193	1,060	0	17,577	1,193
1958	14,486	530	700	0	15,186	530
1959	13,918	54	735	0	14,653	54
1960	24,264	110	1,843	0	26,107	110
1961	31,006	769	1,260	0	32,266	769
1962	30,965	430	1,256	0	32,221	430
1963	39,094	1,473	960	0	40,054	1,473
1964	36,384	1,006	1,140	0	37,524	1,006
1965	51,807	2,406	1,701	0	53,508	2,406
1966	30,825[b]	953[b]	1,095	0	31,920	953
1967	14,627[b]	452[b]	1,838	0	16,465	452
1968	20,220[b]	625[b]	--	--	--	--
1969	57,797	1,107	2,039	0	59,836	1,107
1970	44,857	692	3,106	0	47,963	692
1971	28,761	1,124	2,400	0	31,161	1,124
1972	29,424	818	2,739	0	32,163	818
1973	34,987	583	2,819	0	37,806	583
1974	16,756	508	2,322	0	19,078	508
1975	20,391	1,018	2,310	0	22,701	1,018
1976	20,542	1,153	2,648	0	23,190	1,153
1977	14,884	1,511	5,181	0	20,065	1,511
1978	40,381	6,843	5,888	0	46,269	6,843
1979	29,536	8,996	3,067	5	32,603	9,001
1980	26,484	10,167	2,853	137	29,337	10,304
1981	12,079	5,206	4,289	480	16,368	5,686
1982	21,043	8,900	4,078	524	25,121	9,424
1983	8,957	3,554	3,607	232	12,564	3,786
1984	7,417	5,224	2,971	215	10,388	5,439
1985	24,020	17,020	6,085	2,367	30,105	19,387
1986	41,530	47,992	10,616	3,623	52,146	51,615
1987	33,886	47,696	8,445	2,255	42,331	49,951
1988	52,488	30,397	9,397	2,106	61,885	32,503
1989	14,161	46,169	5,567	1,336	19,728	47,505
1990	8,428	16,162	3,007	646	11,435	16,808
1991	3,991	8,922	3,042	163	7,033	9,085
1992	1,618	4,183	6,100	697	7,718	4,880
1993	8,060	18,043	6,001	710	14,061	18,753
1994	4,470	9,606	11,014	516	15,484	10,122

[a] *Assumes none passed Gold Ray Dam before 1969.*
[b] *Assumes 3% of the run was of hatchery origin.*

Appendix Table E-3. Estimated number of wild age 2-6 spring chinook salmon that passed Gold Ray Dam, 1974-94.

Year	Age 2	Age 3	Age 4	Age 5	Age 6
1974	310	3,495	7,749	5,092	110
1975	2,276	4,357	8,489	5,161	107
1976	2,618	2,292	11,581	3,940	111
1977	385	2,446	7,610	4,316	128
1978	7,768	5,989	21,352	5,192	80
1979	908	6,758	15,105	6,667	98
1980	6,425	1,020	14,524	4,375	140
1981	833	3,225	3,113	4,333	576
1982	5,534	3,579	10,609	1,108	213
1983	639	1,887	4,920	1,510	0
1984	1,650	819	4,557	368	23
1985	4,890	3,937	10,403	4,789	0
1986	9,769	18,547	11,305	1,703	207
1987	3,739	9,991	18,862	1,294	0
1988	3,117	11,977	33,407	3,987	0
1989	756	1,660	7,967	3,777	0
1990	465	826	5,880	1,108	149
1991	88	655	1,957	1,290	0
1992	211	97	855	456	0
1993	421	1,385	4,058	2,100	96
1994	28	323	2,045	1,893	180

Appendix Table E-4. Estimated number of hatchery age 2-6 spring chinook salmon that passed Gold Ray Dam, 1974-94.

Return	August-March releases from hatchery					June releases from hatchery				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1974	0	0	218	290	0	0	0	0	0	0
1975	129	258	509	122	0	0	0	0	0	0
1976	53	105	828	168	0	0	0	0	0	0
1977	0	84	1,343	84	0	0	0	0	0	0
1978	904	3,423	908	1,608	0	0	0	0	0	0
1979	337	2,043	6,178	439	0	0	0	0	0	0
1980	2,232	755	6,080	1,031	69	0	0	0	0	0
1981	310	2,353	1,450	995	99	0	0	0	0	0
1982	2,292	989	5,160	361	97	0	0	0	0	0
1983	216	1,183	1,477	678	0	0	0	0	0	0
1984	2,644	390	1,971	219	0	0	0	0	0	0
1985	1,983	6,109	4,489	1,742	0	2,697	0	0	0	0
1986	7,966	12,380	17,277	461	0	0	9,907	0	0	0
1987	4,969	5,742	24,225	2,990	0	1,251	0	8,519	0	0
1988	1,544	8,505	12,177	4,568	0	890	1,961	0	751	0
1989	1,378	8,103	29,308	823	0	189	1,538	4,831	0	0
1990	573	1,629	9,248	2,140	0	0	211	1,727	634	0
1991	300	1,292	5,012	1,778	28	0	0	159	354	0
1992	218	369	2,571	908	56	0	0	0	62	0
1993	2,044	3,290	10,379	2,330	0	0	0	0	0	0
1994	331	1,481	3,654	4,053	85	0	0	0	0	0

Appendix Table E-5. Length-frequency distribution of unmarked spring chinook salmon trapped at Gold Ray Dam in May-July, 1974-94.

	Mid-point of interval for fork length (cm)														
Year	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
1974	5	14	18	21	40	55	48	61	91	128	122	67	27	6	0
1975	31	60	40	27	32	34	36	53	75	110	92	72	27	11	4
1976	21	28	4	10	19	20	24	38	62	73	49	34	11	2	1
1977	1	4	4	7	14	15	18	25	71	69	55	19	5	3	0
1978	37	173	66	48	62	47	55	92	157	213	136	67	14	4	0
1979	0	11	25	20	46	48	70	81	97	103	87	47	21	15	5
1980	31	140	69	23	23	33	55	118	201	179	91	53	19	2	3
1981	3	11	17	14	27	45	47	62	59	83	70	35	9	2	1
1982	24	68	53	11	10	16	37	34	63	75	78	48	19	11	4
1983	25	14	6	32	46	42	38	53	90	103	49	41	38	16	10
1984	36	92	16	15	12	18	29	74	109	52	24	4	1	1	0
1985	5	58	81	25	26	23	44	38	55	91	98	80	30	8	0
1986	34	120	48	6	34	62	78	151	104	106	54	32	15	4	0
1987	24	62	54	17	42	65	72	108	207	238	124	62	11	2	0
1988	10	66	45	26	96	175	187	255	282	289	219	107	20	11	4
1989	4	20	15	12	21	39	64	162	255	234	107	56	22	7	3
1990	6	16	12	5	17	25	37	83	174	184	160	40	14	1	0
1991	0	7	10	8	8	27	42	90	96	88	57	27	10	1	0
1992	1	6	9	2	3	4	13	21	39	73	43	16	7	1	0
1993	16	52	24	15	37	68	128	161	156	111	75	38	24	5	0
1994	0	17	7	5	29	64	118	195	276	212	104	27	7	0	1

Appendix Table E-6. Length-frequency distribution of marked spring chinook salmon of hatchery origin trapped at Gold Ray Dam in May-July, 1974-94.

	Mid-point of interval for fork length (cm)														
Year	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
1974	0	0	0	0	0	0	0	2	0	0	3	1	1	0	0
1975	3	0	0	0	2	5	2	0	4	3	1	2	0	0	0
1976	0	1	0	0	0	3	1	2	7	5	1	1	1	0	0
1977	0	0	0	0	0	0	1	5	11	1	0	0	0	0	0
1978	0	2	2	6	3	4	6	12	14	11	15	10	5	0	1
1979	0	1	0	0	4	4	16	9	9	8	5	2	1	0	0
1980	1	4	3	5	4	3	3	13	23	11	9	3	1	0	0
1981	0	1	4	0	2	3	1	5	8	2	2	1	0	0	0
1982	2	3	7	1	3	3	6	6	9	9	6	4	0	1	0
1983	2	4	0	3	5	4	10	15	15	9	5	6	2	4	0
1984	19	42	5	4	2	4	1	5	4	1	0	0	0	0	0
1985	2	10	4	5	8	20	23	9	11	14	6	1	1	0	0
1986	6	6	1	4	8	17	21	18	22	35	13	1	2	0	0
1987	0	6	2	1	6	2	10	34	44	37	24	3	1	1	0
1988	1	2	3	4	9	14	22	30	26	21	7	7	2	0	0
1989	1	1	0	0	0	4	10	19	24	27	9	2	0	0	0
1990	0	0	1	0	2	1	4	7	13	13	3	0	0	0	0
1991	0	0	0	0	0	0	1	3	7	1	1	0	1	0	0
1992	0	1	1	0	0	0	0	2	1	2	2	0	0	0	0
1993	0	2	0	1	5	5	6	11	10	5	5	0	0	0	0
1994	0	1	2	2	1	6	2	6	17	11	3	0	0	0	0

Appendix Table E-7. Estimated age composition of wild spring chinook salmon trapped at Gold Ray Dam in May-July, 1974-94. No yearling smolts matured at age 2.

Return year	Fish sampled		Percentage among wild fish								
			Subyearling smolts					Yearling smolts			
	Lengths[a]	Scales[b]	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
1974	703	272	1.85	19.08	45.24	26.76	0.00	1.78	1.01	3.63	0.66
1975	704	364	11.16	16.52	40.74	24.23	0.52	4.85	0.90	1.08	0.00
1976	396	289	12.75	10.82	53.26	14.80	0.54	0.34	3.11	4.38	0.00
1977	310	274	2.59	16.20	48.61	22.10	0.71	0.23	2.52	6.90	0.15
1978	1,171	341	19.24	13.29	51.92	10.66	0.20	1.54	0.96	2.20	0.00
1979	676	292	3.07	20.05	46.68	15.16	0.17	2.83	4.46	7.41	0.17
1980	1,040	314	24.26	3.67	54.46	14.35	0.41	0.18	0.37	2.17	0.12
1981	485	337	6.89	25.55	25.48	33.49	3.57	1.15	0.29	2.39	1.19
1982	551	312	26.30	16.69	49.08	5.27	1.01	0.32	1.33	0.00	0.00
1983	603	308	7.14	20.86	54.67	14.19	0.00	0.22	0.26	2.67	0.00
1984	483	240	22.25	11.04	60.76	4.96	0.32	0.00	0.67	0.00	0.00
1985	662	272	20.36	14.65	42.26	19.15	0.00	1.74	1.05	0.79	0.00
1986	848	239	23.52	44.26	22.23	3.59	0.50	0.40	4.99	0.51	0.00
1987	1,088	214	11.04	29.00	55.66	3.20	0.00	0.49	0.00	0.62	0.00
1988	1,792	311	5.94	22.60	62.56	7.60	0.00	0.21	1.09	0.00	0.00
1989	1,021	111	5.34	11.72	53.20	24.46	0.00	0.00	3.06	2.21	0.00
1990	774	109	5.52	9.41	69.77	13.14	1.76	0.39	0.00	0.00	0.00
1991	471	104	2.21	16.41	42.87	31.27	0.00	0.00	6.18	1.06	0.00
1992	238	57	13.02	5.97	51.37	28.18	0.00	0.00	1.46	0.00	0.00
1993	910	139	5.23	17.18	50.35	24.20	1.19	0.00	0.00	1.86	0.00
1994	1,062	102	0.64	6.89	45.76	42.34	4.04	0.34	0.00	0.00	0.00

[a] *Includes wild and unmarked hatchery fish.*
[b] *Includes only wild fish.*

Appendix Table E-8. Estimated age composition of unmarked spring chinook salmon of hatchery origin that were trapped at Gold Ray Dam in May-July, 1978-94. Unmarked hatchery fish that returned in 1974-77 were not aged and no fish released in June matured at age 6.

Return year	Fish sampled		Percentage among unmarked hatchery fish								
			August-March releases (smolts)					June releases (presmolts)			
	Lengths[a]	Scales[b]	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5
1978	1,171	42	14.82	70.94	2.79	11.45	0.00	0.00	0.00	0.00	0.00
1979	676	51	4.92	20.71	72.89	1.48	0.00	0.00	0.00	0.00	0.00
1980	1,040	67	26.25	7.79	56.32	9.64	0.00	0.00	0.00	0.00	0.00
1981	485	103	0.88	37.82	34.98	23.58	2.75	0.00	0.00	0.00	0.00
1982	551	92	27.89	8.43	57.85	4.32	1.50	0.00	0.00	0.00	0.00
1983	603	105	5.68	40.23	35.01	19.08	0.00	0.00	0.00	0.00	0.00
1984	483	122	40.64	7.24	46.65	5.47	0.00	0.00	0.00	0.00	0.00
1985	662	158	13.67	30.00	26.52	11.17	0.00	18.65	0.00	0.00	0.00
1986	848	198	20.44	27.26	32.73	0.62	0.00	0.00	18.96	0.00	0.00
1987	1,088	237	12.30	14.56	54.04	7.56	0.00	3.24	0.00	8.30	0.00
1988	1,792	167	5.72	29.81	38.29	14.91	0.00	3.21	6.38	0.00	1.67
1989	1,021	271	3.10	18.53	63.55	0.93	0.00	0.46	3.75	9.68	0.00
1990	774	204	3.69	10.45	56.32	13.71	0.00	0.00	0.64	11.08	4.11
1991	471	212	3.58	14.95	55.65	19.37	0.33	0.00	0.00	1.90	4.22
1992	238	139	4.78	8.60	61.40	22.25	1.42	0.00	0.00	0.00	1.56
1993	910	274	11.81	18.25	57.51	12.43	0.00	0.00	0.00	0.00	0.00
1994	1,062	242	2.81	14.39	38.32	43.50	0.98	0.00	0.00	0.00	0.00

[a] *Includes wild and unmarked hatchery fish.*
[b] *Includes only unmarked hatchery fish.*

Appendix Table E-9. Estimated age composition of marked spring chinook salmon of hatchery origin trapped at Gold Ray Dam in May-July, 1974-94. No fish released in June matured at age 6.

Return year	Fish sampled		Percentage among marked hatchery fish								
			August-March releases (smolts)					June releases (presmolts)			
	Lengths	Scales	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5
1974	8[a]	0	0.00	0.00	42.86	57.14	0.00	0.00	0.00	0.00	0.00
1975	21[a]	0	13.64	27.27	50.00	9.09	0.00	0.00	0.00	0.00	0.00
1976	22[a]	0	4.55	9.09	72.73	13.64	0.00	0.00	0.00	0.00	0.00
1977	18[a]	0	0.00	5.56	88.88	5.56	0.00	0.00	0.00	0.00	0.00
1978	91[b]	71	12.09	35.32	20.63	31.96	0.00	0.00	0.00	0.00	0.00
1979	59[b]	57	1.69	26.21	61.25	10.85	0.00	0.00	0.00	0.00	0.00
1980	83	81	14.86	6.83	65.55	10.96	1.81	0.00	0.00	0.00	0.00
1981	29	28	17.24	61.58	11.99	9.20	0.00	0.00	0.00	0.00	0.00
1982	60	60	20.00	18.33	58.33	3.33	0.00	0.00	0.00	0.00	0.00
1983	84	84	7.14	15.48	58.33	19.05	0.00	0.00	0.00	0.00	0.00
1984	90	87	75.86	8.05	15.13	0.96	0.00	0.00	0.00	0.00	0.00
1985	114	91	6.63	50.55	26.03	7.92	0.00	8.87	0.00	0.00	0.00
1986	154	79	8.44	22.68	42.96	1.69	0.00	0.00	24.23	0.00	0.00
1987	171	74	4.56	4.19	40.68	2.25	0.00	0.70	0.00	47.62	0.00
1988	148	39	2.55	20.72	47.08	15.49	0.00	1.81	6.71	0.00	5.63
1989	97	92	2.06	9.78	62.92	8.55	0.00	0.00	0.00	16.68	0.00
1990	44	42	2.27	6.82	65.15	9.09	0.00	0.00	7.20	7.20	2.27
1991	14	14	0.00	7.14	64.29	28.57	0.00	0.00	0.00	0.00	0.00
1992	9	9	12.50	12.50	62.50	12.50	0.00	0.00	0.00	0.00	0.00
1993	50	50	4.00	18.00	57.73	20.27	0.00	0.00	0.00	0.00	0.00
1994	51	50	9.80	25.49	35.29	29.41	0.00	0.00	0.00	0.00	0.00

[a] *All fish were aged based on fish clips.*
[b] *Some fish were aged based on fin clips.*

Appendix Table E-10. Estimated number of wild and hatchery age 2-6 fall chinook salmon that passed Gold Ray Dam, 1974-94.

Return year	Wild fish					Hatchery fish				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1974	439	629	1,070	163	21	0	0	0	0	0
1975	273	450	1,310	260	18	0	0	0	0	0
1976	1,095	461	909	183	0	0	0	0	0	0
1977	3,503	863	667	147	0	0	0	0	0	0
1978	956	2,220	2,382	330	0	0	0	0	0	0
1979	164	309	2,460	134	0	2	4	35	2	0
1980	980	314	811	748	0	47	15	39	36	0
1981	1,105	2,083	749	312	41	124	233	84	35	5
1982	1,116	1,085	1,761	112	4	143	140	226	14	0
1983	534	1,755	1,211	107	0	34	113	78	7	0
1984	688	1,111	1,070	86	16	50	80	77	6	1
1985	3,537	670	1,588	290	0	1,375	261	617	113	0
1986	6,111	2,996	1,298	211	0	902	1,832	890	0	0
1987	1,925	4,320	2,127	71	0	424	1,317	513	0	0
1988	1,259	1,836	6,156	147	0	241	787	1,005	72	0
1989	1,334	903	2,460	870	0	91	493	752	0	0
1990	644	556	1,592	215	0	43	64	453	86	0
1991	545	590	1,457	450	0	0	0	45	0	0
1992	2,179	979	2,320	577	47	443	83	123	47	0
1993	1,009	2,685	1,792	514	0	289	185	162	74	0
1994	3,685	1,084	3,527	2,524	194	211	256	0	48	0

Appendix Table E-11. Length-frequency distribution of marked fall chinook salmon trapped at Gold Ray Dam after 15 August, 1974-94.

	Mid-point of interval for fork length (cm)														
Year	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
1986	0	0	1	0	3	0	3	3	1	0	3	0	0	0	0
1987	1	0	1	0	1	3	4	7	4	2	0	0	0	0	0
1988	0	0	0	0	0	0	4	5	6	1	1	1	0	0	0
1989	0	0	0	0	0	1	2	1	0	3	2	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Appendix Table E-12. Length-frequency distribution of unmarked fall chinook salmon trapped at Gold Ray Dam after 15 August, 1974-94.

	Mid-point of interval for fork length (cm)														
Year	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
1986	2	18	31	14	3	8	11	15	16	13	5	9	3	0	3
1987	2	8	19	21	11	21	32	31	29	35	19	10	4	2	0
1988	0	5	20	20	9	4	9	31	52	67	60	36	15	7	2
1989	0	11	20	20	0	3	11	20	27	55	37	16	11	1	0
1990	1	6	7	2	1	2	3	8	15	14	12	7	1	2	1
1991	1	5	5	1	3	1	4	4	6	10	17	6	4	0	1
1992	1	2	25	34	11	4	3	8	14	14	25	15	7	2	2
1993	0	13	19	6	11	13	30	42	24	20	7	2	3	0	4
1994	2	13	49	22	6	6	15	24	38	43	34	14	7	2	0

Appendix Table E-13. Estimated age composition of wild fall chinook salmon trapped at Gold Ray Dam after 15 August, 1986-94. No yearling smolts matured at age 2 or age 6.

Return year	Fish sampled		Percentage among wild fish							
			Subyearling smolts					Yearling smolts		
	Lengths[a]	Scales[b]	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5
1986	151	28	57.56	28.22	10.84	1.99	0.00	0.00	1.39	0.00
1987	292	141	22.80	49.74	24.22	0.47	0.00	1.42	0.97	0.37
1988	337	202	13.39	16.76	62.92	1.56	0.00	2.77	2.59	0.00
1989	232	175	23.97	16.22	43.60	15.62	0.00	0.00	0.59	0.00
1990	82	68	21.42	18.51	52.94	7.14	0.00	0.00	0.00	0.00
1991	68	57	17.91	19.40	47.89	14.80	0.00	0.00	0.00	0.00
1992	170	143	35.71	15.40	38.02	9.45	0.76	0.64	0.00	0.00
1993	194	163	16.81	44.75	29.86	8.57	0.00	0.00	0.00	0.00
1994	275	187	33.46	9.84	32.02	22.92	1.76	0.00	0.00	0.00

[a] *Includes wild and unmarked hatchery fish.*
[b] *Includes only wild fish.*

Appendix Table E-14. Estimated age composition of fall chinook salmon of hatchery origin that were trapped at Gold Ray Dam after 15 August, 1986-94. No fish matured at age 6.

Return year	Unmarked fish						Marked fish					
	Fish sampled		% of return				Fish sampled		% of return			
	Lengths[a]	Scales[b]	Age 2	Age 3	Age 4	Age 5	Lengths	Scales	Age 2	Age 3	Age 4	Age 5
1986	151	41	36.50	43.35	20.14	0.00	57	28	14.29	57.14	28.57	0.00
1987	292	103	22.51	48.49	29.00	0.00	23	19	13.04	73.91	13.04	0.00
1988	337	113	15.77	26.36	55.24	2.62	18	18	0.00	66.67	27.78	5.56
1989	232	29	9.87	28.58	61.54	0.00	9	9	0.00	55.56	44.44	0.00
1990	82	11	8.36	12.54	62.38	16.72	1	1	0.00	0.00	100.00	0.00
1991	68	1	0.00	0.00	100.00	0.00	0	0	0.00	0.00	0.00	0.00
1992	170	13	53.65	15.25	22.58	8.52	1	1	100.00	0.00	0.00	0.00
1993	194	16	30.23	30.64	26.91	12.22	1	1	100.00	0.00	0.00	0.00
1994	275	8	22.90	64.88	0.00	12.22	1	1	100.00	0.00	0.00	0.00

[a] *Includes wild and unmarked hatchery fish.*
[b] *Includes only unmarked hatchery fish.*

Appendix Table E-15. Number of adult chinook salmon that returned to Cole M. Rivers Hatchery, 1974-94 return years. Fish that entered before 11 October were classified as spring chinook salmon and later migrants were classified as fall chinook salmon. Fish were classified as jacks when smaller than 50 cm in 1974-76 and when smaller than 60 cm in 1977-94. Returns through 1980 included significant, but unknown, numbers of wild fish.

Return year	Spring chinook salmon			Fall chinook salmon			All chinook salmon		
	Jacks	Adults	Total	Jacks	Adults	Total	Jacks	Adults	Total
1974	--	--	--	--	--	--	--	--	2,428
1975	972	3,320	4,292	1	7	8	973	3,327	4,300
1976	1,212	2,958	4,170	0	0	0	1,212	2,958	4,170
1977	562	1,797	2,359	43	4	47	605	1,801	2,406
1978	2,211	3,875	6,086	25	72	97	2,236	3,947	6,183
1979	721	6,766	7,487	9	62	71	730	6,828	7,558
1980	951	7,203	8,154	15	45	60	966	7,248	8,214
1981	545	1,676	2,221	20	121	141	565	1,797	2,362
1982	2,095	3,646	5,741	88	51	139	2,183	3,697	5,880
1983	1,273	1,864	3,137	145	140	285	1,418	2,004	3,422
1984	3,265	1,919	5,184	25	68	93	3,290	1,987	5,277
1985	5,356	7,917	13,273	97	108	205	5,453	8,025	13,478
1986	5,849	30,383	36,232	421	1,314	1,735	6,270	31,697	37,967
1987	3,171	20,769	23,940	221	801	1,022	3,392	21,570	24,962
1988	4,238	19,846	24,084	86	438	524	4,324	20,284	24,608
1989	1,000	30,859	31,859	24	212	236	1,024	31,071	32,095
1990	469	4,646	5,115	1	65	66	470	4,711	5,181
1991	318	3,998	4,316	11	41	52	329	4,039	4,368
1992	776	1,596	2,372	25	69	94	801	1,665	2,466
1993	3,072	9,891	12,963	36	11	47	3,108	9,902	13,010
1994	680	3,725	4,405	118	229	347	798	3,954	4,752

Appendix Table E-16. Estimated number of all chinook salmon that spawned upstream of Gold Ray Dam, 1974-94. Carcasses smaller than 50 cm in 1974-76, and smaller than 60 cm in 1977-94, were classified as jacks. Estimates reflect returns to Gold Ray Dam minus (1) returns to Cole M. Rivers Hatchery, (2) angler harvest, and (3) prespawning mortality.

Year	Females	Males	Jacks	Year	Females	Males	Jacks
1974	7,455	6,199	1,752	1985	7,503	6,653	7,994
1975	6,564	6,272	3,859	1986	11,207	12,244	31,205
1976	7,319	6,160	2,482	1987	20,252	18,852	16,841
1977	4,529	4,945	3,827	1988	20,403	18,093	13,047
1978	14,553	12,019	13,217	1989	9,321	8,266	6,816
1979	11,260	8,613	6,365	1990	7,489	6,641	2,214
1980	9,047	6,965	8,845	1991	4,263	3,780	1,476
1981	5,432	4,216	3,534	1992	2,721	2,413	2,158
1982	8,009	7,103	7,389	1993	6,364	5,644	3,819
1983	4,654	4,128	1,947	1994	6,228	5,523	4,220
1984	3,587	3,181	2,297				

Appendix Table E-17. Number of chinook salmon carcasses found during spawning surveys in September-November, 1974-94.

Year	Females		Males	Jacks	Unknown[a]
	Spawned	Unspawned			
SAND HOLE CHANNEL					
1974	114	4	79	81	0
1975	167	5	85	15	1
1976	111	4	114	17	0
1977	77	1	78	14	2
1978	363	5	155	28	1
1979	215	2	85	23	0
1980	135	4	67	3	1
1981	72	2	35	8	1
1982	80	5	63	14	0
1983	37	1	18	6	0
1984	47	0	31	14	0
1985	140	2	90	33	0
1986	319	3	218	25	6
1987	405	6	143	26	0
1988	207	6	94	15	0
1989	258	3	154	5	0
1990	251	10	92	58	1
1991	62	0	12	0	0
1992	27	0	9	3	0
1993	73	1	36	8	0
1994	41	0	19	1	0
BIG BUTTE CREEK					
1974	475	5	343	81	26
1975	441	4	257	82	7
1976	410	6	268	129	6
1977	245	8	181	64	6
1978	1,149	23	749	281	6
1979	520	5	304	105	7
1980	495	8	306	68	10
1981	207	6	144	57	0
1986	515	5	536	157	20
1987	748	15	675	139	4

[a] *Almost all were adults rather than jacks.*

Appendix Table E-17. Continued.

Year	Females		Males	Jacks	Unknown[a]
	Spawned	Unspawned			
			RK 245-253		
1974	836	10	750	130	4
1975	608	11	626	125	3
1976	572	15	456	153	0
1977	280	17	296	106	5
1978	2,002	30	1,690	666	31
1979	1,279	18	1,019	277	53
1980	996	26	779	183	36
1981	433	15	253	115	36
1982	656	4	399	176	23
1983	287	1	181	78	1
1984	374	2	241	76	1
1985	1,069	10	833	294	10
1986	1,072	10	1,148	276	6
1987	1,593	36	1,469	407	49
1988	2,176	46	1,707	274	41
1989	1,116	42	965	101	42
1990	747	44	569	55	13
1991	290	3	195	28	1
1992	218	7	119	59	0
1993	523	1	460	104	0
1994	249	10	235	43	0
			RK 235-245		
1974	442	7	373	104	4
1975	310	5	374	83	9
1976	344	5	342	167	4
1977	120	9	169	59	15
1978	1,618	32	1,369	592	56
1979	929	21	643	187	50
1980	963	17	775	259	54
1981	352	5	220	96	15
1986	818	20	988	394	49
1987	1,116	22	1,041	339	10
1988	1,737	62	1,420	259	50
1989	813	36	746	86	40
1990	400	27	306	51	7

Appendix Table E-17. Continued.

Year	Females		Males	Jacks	Unknown[a]
	Spawned	Unspawned			
			RK 223-235		
1974	407	5	326	64	6
1975	306	10	362	42	0
1976	312	1	321	121	0
1977	107	7	121	52	11
1978	843	15	841	288	43
1979	553	6	454	115	36
1980	595	9	477	172	27
1981	191	5	159	91	17
1986	853	13	991	242	15
1987	1,042	43	1,095	328	97
			RK 212-223		
1974	196	6	144	369	3
1975	161	1	145	28	0
1976	269	2	220	120	0
1977	70	5	93	59	8
1978	325	3	315	77	29
1979	213	5	149	44	8
1980	300	5	181	38	12
1981	176	2	143	50	35
1986	633	9	696	192	40
1987	755	31	800	202	62
			RK 206-212		
1974	109	2	89	16	0
1975	161	2	176	41	0
1976	112	3	93	64	1
1977	53	7	88	55	6
1978	232	5	165	70	22
1979	85	9	157	18	21
1980	160	5	107	32	11
1981	141	1	151	41	30
1986	316	4	375	132	15
1987	675	11	663	216	16

Appendix Table E-18. Estimated number of wild and hatchery age 2-6 spring chinook salmon that returned to the Rogue River, 1974-94. Estimates do not include fish released in June from Cole M. Rivers Hatchery.

Return	Wild fish					Hatchery fish				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1974	321	3,992	10,560	6,939	150	0	0	297	395	0
1975	2,311	4,777	10,162	6,178	128	131	283	609	146	0
1976	2,670	2,512	13,774	4,686	132	54	115	985	200	0
1977	591	3,956	13,050	7,401	220	0	136	2,303	144	0
1978	7,948	6,354	23,573	5,732	88	925	3,632	1,002	1,775	0
1979	962	7,593	18,123	7,999	118	357	2,296	7,412	527	0
1980	6,507	1,073	15,918	4,795	153	2,261	794	6,664	1,130	76
1981	893	3,657	3,758	5,230	695	332	2,668	1,750	1,201	120
1982	5,718	3,921	12,414	1,297	249	2,368	1,084	6,038	422	114
1983	651	2,037	5,669	1,740	0	220	1,277	1,702	781	0
1984	1,670	855	4,919	397	25	2,677	407	2,127	236	0
1985	5,449	4,509	12,271	5,649	0	2,210	6,996	5,295	2,055	0
1986	10,912	21,349	13,444	2,025	246	8,898	14,250	20,547	548	0
1987	5,202	14,135	27,170	1,864	0	6,914	8,123	34,895	4,307	0
1988	3,250	12,965	37,679	4,497	0	1,610	9,207	13,734	5,152	0
1989	774	1,794	9,141	4,334	0	1,411	8,756	33,628	944	0
1990	494	941	7,243	1,365	184	609	1,855	11,392	2,636	0
1991	91	730	2,374	1,565	0	310	1,440	6,081	2,157	34
1992	702	343	3,235	1,725	0	775	1,304	9,728	3,435	212
1993	430	1,593	5,380	2,784	127	2,089	3,785	13,760	3,089	0
1994	69	792	5,579	5,164	491	814	3,631	9,968	11,057	232

Appendix Table E-19. Estimated number of wild and hatchery age 2-6 fall chinook salmon that returned to the Rogue River, 1974-94.

Return	Wild fish					Hatchery fish				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1974	483	692	1,178	179	23	0	0	0	0	0
1975	291	480	1,397	277	19	0	0	0	0	0
1976	1,275	537	1,058	213	0	0	0	0	0	0
1977	3,789	934	722	159	0	0	0	0	0	0
1978	1,132	2,629	2,821	391	0	0	0	0	0	0
1979	897	1,690	2,738	733	0	11	22	191	11	0
1980	2,352	754	1,947	826	0	113	36	94	86	0
1981	1,344	2,534	911	380	50	151	283	102	43	0
1982	1,234	1,200	1,947	124	4	158	155	250	15	0
1983	640	2,104	1,452	128	0	41	135	94	8	0
1984	788	1,272	1,225	98	18	57	92	88	7	0
1985	4,550	862	2,043	373	0	1,769	336	794	145	0
1986	6,697	3,283	1,422	231	0	989	2,008	975	0	0
1987	2,150	4,824	2,375	79	0	473	1,471	573	0	0
1988	1,526	2,225	7,459	178	0	292	954	1,218	87	0
1989	1,490	1,008	2,747	972	0	102	551	840	0	0
1990	719	621	1,778	240	0	48	71	506	96	0
1991	609	659	1,627	503	0	132	0	50	0	0
1992	2,433	1,093	2,591	644	52	495	93	137	52	0
1993	1,127	2,998	2,001	574	0	323	207	181	83	0
1994	4,115	1,210	3,939	2,819	217	236	286	0	54	0

Appendix Table E-20. Estimated number of wild and hatchery spring chinook salmon from the 1972-89 brood years that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83. Estimates do not include fish released in June from Cole M. Rivers Hatchery.

Brood	Wild					Hatchery				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1972	321	5,102	24,178	40,599	1,514	0	302	1,729	790	0
1973	2,311	2,682	22,907	31,442	2,016	131	123	4,043	9,738	0
1974	2,670	4,225	41,377	43,878	2,715	54	145	1,760	2,889	0
1975	591	6,787	29,365	25,063	18,171	0	3,879	12,011	5,906	0
1976	7,948	8,110	34,852	57,258	10,494	925	2,452	14,590	13,148	1,338
1977	962	1,147	6,190	8,214	0	357	849	2,883	2,676	3,123
1978	6,507	3,950	23,601	7,190	277	2,261	2,882	11,479	3,229	4,779
1979	893	4,212	12,481	2,364	0	332	1,164	13,032	4,893	0
1980	5,718	2,147	5,927	9,324	635	2,368	3,958	7,539	9,975	0
1981	651	909	13,468	3,473	0	220	433	5,811	940	0
1982	1,670	4,630	20,021	6,939	0	2,677	7,185	30,597	16,034	0
1983	5,449	22,117	44,773	20,584	0	2,210	14,763	57,503	23,584	0
1984	10,912	14,983	57,912	12,111	916	8,898	8,611	21,109	2,639	0
1985	5,202	13,795	13,898	3,705	0	6,914	9,796	51,125	7,156	236
1986	3,250	1,874	16,898	9,362	0	1,610	9,150	26,577	12,904	1,604
1987	774	982	3,301	3,036	233	1,411	1,937	8,453	6,045	0
1988	494	775	4,333	3,885	770	609	1,528	13,030	4,310	364
1989	91	350	6,064	6,540	403	310	1,331	15,508	14,001	718

Appendix Table E-21. Estimated number of Ad-CWT marked spring chinook salmon from the 1975-89 brood years that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83. Estimates apply only to pooled releases of fish in September and October.

Brood year	Age 2	Age 3	Age 4	Age 5	Age 6
1975	118	291	2,105	1,524	120
1976	200	396	4,864	5,744	290
1977	34	90	579	174	0
1978	75	149	1,614	324	0
1979	69	291	1,914	529	21
1980	307	713	1,166	1,302	20
1981	155	313	3,895	951	16
1982	1,501	5,103	11,520	230	0
1983	715	3,217	10,647	3,224	72
1984	282	233	2,679	900	106
1985	290	1,175	5,620	1,085	15
1986	50	164	1,010	558	0
1987	12	27	255	289	0
1988	9	46	596	215	0
1989	5	80	908	70	0

Appendix Table E-22. Estimated number of hatchery spring chinook salmon released in June that would have returned to freshwater had there been no age selective fishing mortality, 1983 and 1985-87 brood years.

Brood year	Age 2	Age 3	Age 4	Age 5	Age 6
1983	3,005	11,814	20,937	4,014	0
1985	1,741	2,259	8,668	6,784	0
1986	928	1,737	5,269	2,728	0
1987	194	251	269	475	0

Appendix Table E-23. Estimated number of wild and hatchery fall chinook salmon from the 1972-89 brood years that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83. Estimates do not include fish released in June from Cole M. Rivers Hatchery.

Brood	Wild					Hatchery				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1972	499	597	1,178	227	0	0	0	0	0	0
1973	301	667	1,397	558	0	0	0	0	0	0
1974	1,317	1,161	1,178	1,110	0	0	0	0	17	0
1975	3,914	3,170	1,397	2,889	359	0	0	292	144	0
1976	1,170	2,272	1,058	568	24	0	29	156	68	0
1977	929	914	722	183	0	11	44	162	21	0
1978	2,432	3,234	2,821	195	65	117	362	342	12	0
1979	1,379	1,613	2,738	125	0	155	208	137	18	0
1980	1,272	2,245	1,947	436	0	163	145	102	177	0
1981	649	1,292	911	312	0	41	93	968	0	0
1982	802	1,021	1,947	108	0	58	398	1,393	0	0
1983	4,683	4,035	1,452	230	0	1,821	2,468	842	113	0
1984	6,905	5,712	1,225	1,246	0	1,019	1,742	1,571	0	0
1985	2,197	2,618	2,043	345	0	484	1,122	1,077	138	0
1986	1,558	1,394	1,422	566	75	298	762	728	0	0
1987	1,534	709	2,375	671	252	105	82	56	54	0
1988	727	735	7,459	607	226	49	0	140	87	0
1989	610	1,147	2,747	2,921	314	132	97	191	56	0

Appendix Table E-24. Estimated number of Ad-CWT marked spring chinook salmon, released from Cole M. Rivers Hatchery, that were landed in the ocean fisheries and returned to the hatchery, 1975-89 brood years.

	Ocean harvest				Hatchery return				
Tag code	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	Age 6
1975 BROOD YEAR									
09 04 01	12	147	414	14	7	85	404	99	0
09 04 02	27	502	795	20	17	110	453	107	0
09 04 04	0	6	734	26	0	53	135	103	4
09 03 15	0	2	133	20	0	12	28	23	0
09 04 03	0	8	108	6	0	29	43	23	0
1976 BROOD YEAR									
09 16 33	3	1,814	675	14	11	48	320	45	0
09 16 20	11	1,547	688	7	54	81	388	72	1
09 16 17	15	3,930	1,163	17	87	120	598	104	1
09 16 16	0	455	294	3	0	7	104	17	4
09 16 18	2	386	422	0	0	7	84	7	3
09 16 19	1	625	402	9	3	13	143	16	0
1977 BROOD YEAR									
07 16 31	0	13	3	0	1	4	3	0	0
07 16 32	0	35	7	0	1	8	13	6	0
07 16 30	0	78	29	0	4	14	30	6	0
07 16 29	0	193	47	0	19	35	66	6	0
07 16 37	0	13	37	0	0	10	10	3	0
07 16 35	0	24	34	4	0	22	16	11	0
07 16 33	0	50	45	0	0	13	18	4	0
07 16 34	0	18	45	0	0	16	13	2	0
07 16 38	0	21	63	0	0	48	58	11	0
07 16 39	0	0	36	0	0	28	24	6	0
1978 BROOD YEAR									
07 19 37	0	65	31	0	0	1	37	11	0
07 19 34	0	110	5	0	4	9	47	3	0
07 19 33	0	123	20	0	7	6	58	9	0
07 19 31	0	425	36	0	4	6	139	17	0
07 19 32	0	427	29	0	43	41	152	17	0
07 19 38	0	75	38	0	0	4	36	4	0
07 19 36	0	203	39	0	1	7	123	15	0
07 19 35	0	217	59	12	0	6	113	12	0
07 18 54	0	154	269	3	0	51	267	72	0

Appendix Table E-24. Continued.

Tag code	Ocean harvest				Hatchery return				
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	Age 6
1979 BROOD YEAR									
07 22 36	0	366	57	0	11	58	126	11	0
07 22 10	0	120	11	0	7	17	53	5	0
07 22 09	0	252	16	0	7	42	70	6	0
07 22 15	0	139	36	0	7	34	54	8	1
07 22 35	0	449	79	0	39	108	126	12	0
07 22 16	0	63	9	0	17	22	30	1	0
07 22 14	0	44	30	0	1	40	57	13	3
07 22 13	0	64	39	0	0	37	47	11	0
07 22 12	0	83	30	0	0	27	43	6	2
07 22 11	0	29	6	0	0	13	23	3	1
07 22 31	0	43	34	0	3	46	46	18	1
1980 BROOD YEAR									
07 25 14	17	64	36	0	174	67	71	32	0
07 25 09	13	64	51	0	132	69	97	48	0
07 25 23	3	11	20	0	3	15	23	29	0
07 25 12	18	32	45	0	60	47	58	23	0
07 25 15	5	15	15	4	31	17	27	15	0
1981 BROOD YEAR									
07 27 04	0	3	0	0	0	2	8	1	0
07 27 03	0	3	0	0	4	0	16	0	0
07 27 02	0	24	35	3	10	31	192	61	0
07 27 11	2	20	38	0	7	24	125	31	1
07 27 08	2	8	28	0	0	12	83	19	0
07 27 10	0	24	12	0	6	16	110	32	0
07 27 09	5	16	48	0	11	14	99	31	0
07 27 05	5	40	52	0	20	36	250	48	0
07 27 06	3	33	35	0	27	32	204	63	0
07 27 07	2	29	42	1	22	32	186	49	1
07 27 51	0	11	48	3	6	8	64	5	0
07 27 50	2	3	22	0	7	22	107	16	0
07 27 13	0	0	0	0	0	1	14	3	0
1982 BROOD YEAR									
07 28 53	0	393	5	0	86	245	451	3	0
07 28 50	2	319	14	0	73	247	474	6	0
07 28 48	2	505	25	0	158	227	569	5	0
07 28 49	8	358	5	0	98	218	424	6	0
07 28 52	0	368	4	0	86	195	402	1	0
07 28 51	2	341	4	0	90	200	417	2	0

Appendix Table E-24. Continued.

Tag code	Ocean harvest				Hatchery return				
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	Age 6
1982 BROOD YEAR (continued)									
07 28 47	0	462	10	0	151	232	597	4	0
07 28 57	0	456	11	0	105	263	427	4	0
07 28 44	2	326	1	0	129	179	310	0	0
07 28 45	0	310	15	0	146	237	315	1	0
07 28 56	0	187	9	0	55	69	165	0	0
07 28 55	0	194	12	0	41	84	208	0	0
07 28 46	0	26	0	0	11	14	30	0	0
1983 BROOD YEAR									
07 31 14	10	689	126	9	38	232	384	34	1
07 31 09	4	562	109	0	29	235	333	27	0
07 31 13	8	731	154	0	21	267	362	30	0
07 31 15	8	572	122	0	30	223	307	33	0
07 31 16	13	588	142	0	23	184	313	30	0
07 30 10	3	176	192	5	5	41	86	28	0
07 30 09	1	190	199	3	5	25	49	28	0
07 31 10	10	734	109	0	32	223	339	30	0
07 31 18	4	530	125	0	55	174	231	32	0
07 31 11	8	520	85	0	43	196	317	37	0
07 31 12	4	587	105	0	35	204	272	39	0
07 31 17	8	566	117	0	47	196	254	23	0
1984 BROOD YEAR									
07 31 35	0	126	67	0	20	9	90	9	0
07 31 38	2	89	50	0	26	11	93	6	0
07 31 37	0	167	65	0	18	7	85	3	0
07 34 02	0	76	61	0	12	6	58	9	0
07 34 08	0	72	31	3	15	5	54	9	1
07 31 34	0	69	58	0	18	9	89	7	0
07 31 36	0	128	42	5	16	11	94	8	0
07 31 39	0	112	53	5	21	11	69	7	0
07 34 05	0	106	28	0	10	6	53	7	0
07 34 10	0	151	27	6	20	20	66	1	0
07 34 07	2	183	5	0	21	12	64	1	0
07 34 04	0	203	30	0	35	25	66	2	0
07 34 03	0	108	56	0	10	14	63	4	0
07 34 09	0	116	36	0	13	16	55	5	0
07 34 06	0	82	13	0	9	8	62	5	0
07 31 60	6	59	19	7	10	9	43	4	0
07 31 59	3	50	40	0	12	5	34	8	0

Appendix Table E-24. Continued.

Tag code	Ocean harvest				Hatchery return				
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	Age 6
1985 BROOD YEAR									
07 40 01	0	158	47	0	7	29	126	3	0
07 39 27	3	163	44	0	5	29	141	7	0
07 39 26	0	156	28	0	9	34	142	3	0
07 39 22	0	40	0	0	0	11	25	1	0
07 39 20	0	32	17	0	5	22	33	0	0
07 39 21	0	65	2	0	3	18	28	0	0
07 39 23	0	170	27	0	19	79	145	1	0
07 39 25	0	205	25	0	20	77	130	1	0
07 39 24	0	205	35	0	25	87	132	2	0
07 34 22	0	231	73	0	8	51	154	1	0
07 40 02	0	129	29	2	13	42	136	3	0
07 34 21	1	191	38	0	12	72	185	0	0
07 34 19	0	143	40	0	12	51	117	3	0
07 34 25	0	137	37	0	8	60	148	8	0
07 34 24	0	180	68	0	12	63	150	2	0
07 34 20	0	117	48	0	13	49	135	0	0
07 40 03	0	176	56	0	11	53	172	7	0
07 34 23	0	140	53	0	17	67	145	3	0
07 34 19	3	163	56	0	10	54	149	1	0
07 39 17	0	108	71	0	20	53	138	7	0
07 39 18	0	133	69	0	17	42	138	6	0
1986 BROOD YEAR									
07 41 24	0	64	13	0	1	7	8	3	0
07 41 18	0	65	36	0	0	9	15	4	0
07 41 12	0	59	8	0	1	2	11	4	0
07 41 20	0	15	2	0	0	5	7	1	0
07 41 15	0	47	4	0	2	7	7	1	0
07 41 09	0	31	0	0	0	6	5	1	0
07 41 23	0	210	10	0	9	27	25	5	0
07 41 17	0	134	8	0	14	32	32	5	0
07 41 10	0	187	11	0	15	30	29	2	0
07 35 13	0	69	14	0	1	5	8	2	0
07 35 05	0	91	10	0	2	6	13	2	0
07 35 12	0	59	7	0	2	11	8	6	0
07 35 06	0	41	8	0	2	3	15	3	0
07 35 07	0	94	29	0	5	10	14	2	0
07 35 09	2	60	7	0	3	6	15	4	0
07 35 08	0	54	11	0	3	12	16	2	0
07 40 63	0	83	10	0	4	10	10	6	0
07 35 11	0	59	12	0	2	5	13	3	0
07 35 10	0	60	7	0	4	6	11	4	0
07 40 61	2	85	5	0	1	11	21	5	0
07 40 62	0	93	0	0	5	6	14	2	0

Appendix Table E-24. Continued.

Tag code	Ocean harvest				Hatchery return				
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	Age 6
1987 BROOD YEAR									
07 46 19	0	25	7	0	1	1	15	0	0
07 46 20	0	10	29	0	0	1	20	1	0
07 46 21	0	45	21	0	2	3	24	1	0
07 41 03	0	0	0	0	1	1	2	0	0
07 41 05	0	0	0	0	0	4	5	3	0
07 41 06	0	0	0	0	2	4	4	1	0
07 41 13	0	0	0	0	2	3	20	1	0
07 41 14	0	0	0	0	0	4	20	1	0
07 41 15	0	0	0	0	0	6	14	1	0
07 46 16	0	0	0	0	1	2	10	4	0
07 46 17	0	0	0	0	0	1	4	1	0
07 46 18	0	0	0	0	1	3	5	2	0
07 45 47	0	0	0	0	4	0	8	2	0
07 45 48	0	0	0	0	0	3	9	1	0
07 45 49	0	0	0	0	0	1	7	2	0
1988 BROOD YEAR									
07 36 43	0	27	0	0	1	7	6	13	0
07 42 34	0	20	6	0	0	1	4	15	0
07 42 36	0	12	0	0	0	5	6	12	0
07 23 36	0	28	0	0	2	6	8	4	0
07 23 37	0	18	8	0	2	4	10	6	0
07 23 58	3	22	3	0	5	9	8	5	0
07 42 23	0	17	0	0	0	3	7	7	0
07 42 24	0	14	4	0	0	2	5	7	0
07 42 27	0	36	0	0	1	3	5	4	0
07 42 29	0	32	3	0	1	5	4	6	0
07 42 30	0	17	0	0	2	3	5	5	0
07 42 33	0	25	0	0	1	2	3	11	0
1989 BROOD YEAR									
07 51 48	0	15	0	0	0	1	51	2	0
07 51 49	0	17	10	0	0	2	40	1	0
07 51 50	0	5	8	0	0	0	65	0	0
07 51 45	0	6	0	0	1	3	43	1	0
07 51 46	0	17	9	0	0	1	41	0	0
07 51 47	0	8	3	0	0	1	45	0	0
07 51 51	0	10	0	0	1	1	44	1	0
07 51 52	0	15	9	0	2	0	50	0	0
07 51 53	0	15	0	0	0	0	48	1	0
07 51 42	0	21	0	0	0	2	41	0	0
07 51 43	0	11	0	0	0	1	44	0	0
07 51 44	0	8	0	0	1	5	51	2	0

Appendix Table E-25. Estimated rates of freshwater harvest and prespawning mortality used in the cohort analyses of Ad-CWT marked spring chinook salmon released from Cole M. Rivers Hatchery. Rates of natural spawning were assumed to be 5%. Rates of prespawning mortality are from Appendix Tables E-91 and E-100 or were predicted from water temperature data with regressions in Appendix Tables E-90, E-98, and E-99. Harvest rates are from Appendix Table F-47 and selectivity ratios for age 2 and age 3 fish in Tables 75 and 76.

	Downstream of Gold Ray Dam				Upstream of Gold Ray Dam			
		Harvest rate				Harvest rate		
Year	Mortality	Age 2	Age 3	Age 4-6	Mortality	Age 2	Age 3	Age 4-6
1974	0.0146	0.0204	0.1116	0.2553	0.0302	0.0640	0.0744	0.1409
1975	0.0020	0.0130	0.0861	0.1630	0.0626	0.0490	0.0570	0.1080
1976	0.0071	0.0123	0.0809	0.1532	0.2355	0.0533	0.0620	0.1175
1977	0.3425	0.0090	0.0597	0.1131	0.6277	0.0746	0.0868	0.1644
1978	0.0164	0.0063	0.0418	0.0791	0.0747	0.0649	0.0755	0.1430
1979	0.0467	0.0101	0.0664	0.1257	0.0361	0.0883	0.1026	0.1944
1980	0.0061	0.0066	0.0433	0.0820	0.0272	0.0802	0.0932	0.1766
1981	0.0584	0.0096	0.0635	0.1202	0.2824	0.1300	0.1512	0.2863
1982	0.0223	0.0101	0.0665	0.1259	0.0323	0.0968	0.1126	0.2133
1983	0.0082	0.0100	0.0659	0.1249	0.0246	0.0805	0.0936	0.1773
1984	0.0069	0.0054	0.0354	0.0671	0.0369	0.0493	0.0574	0.1087
1985	0.0983	0.0048	0.0316	0.0598	0.3185	0.0694	0.0807	0.1528
1986	0.1000	0.0053	0.0347	0.0657	0.0294	0.0546	0.0635	0.1202
1987	0.2791	0.0030	0.0195	0.0370	0.0267	0.0592	0.0689	0.1305
1988	0.0346	0.0065	0.0431	0.0816	0.0378	0.0954	0.1110	0.2102
1989	0.0142	0.0093	0.0612	0.1159	0.0336	0.0729	0.0848	0.1606
1990	0.0476	0.0118	0.0779	0.1476	0.0928	0.1022	0.1188	0.2250
1991	0.0213	0.0126	0.0833	0.1578	0.0389	0.0634	0.0738	0.1397
1992	0.7023	0.0104	0.0688	0.1303	0.5286	0.0464	0.0540	0.1022
1993	0.0023	0.0195	0.1288	0.2440	0.0086	0.0715	0.0831	0.1574
1994	0.5885	0.0087	0.0577	0.1092	0.2806	0.0755	0.0878	0.1663

Appendix Table E-26. Estimates of the number of Ad-CWT marked spring chinook salmon alive in the ocean during spring and the subsequent rate of harvest in the ocean fisheries, 1975-89 brood years. Estimates were adjusted for increased natural mortality during the El Niño event of 1982-83. Estimates for the 1990 brood year assume that no fish were alive at age 6.

	Number in ocean during spring				Rate of ocean harvest			
Tag code	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1975 BROOD YEAR								
09 04 01	4,356	2,026	1,402	180	0.0030	0.0774	0.6484	1.0000
09 04 02	6,612	3,056	1,900	199	0.0044	0.1745	0.7617	1.0000
09 04 04	3,461	1,627	1,237	198	0.0000	0.0039	0.7476	1.0000
09 03 15	729	343	259	58	0.0000	0.0061	0.6454	1.0000
09 04 03	755	355	245	44	0.0000	0.0255	0.6602	1.0000
1976 BROOD YEAR								
09 16 33	7,947	3,727	1,400	152	0.0004	0.5089	0.7802	1.0000
09 16 20	8,117	3,776	1,625	230	0.0015	0.4324	0.7049	0.7454
09 16 17	16,170	7,539	2,586	339	0.0010	0.5487	0.7332	0.8767
09 16 16	2,498	1,174	549	65	0.0000	0.3987	0.7841	0.2388
09 16 18	2,478	1,164	598	29	0.0009	0.3404	0.9218	0.0000
09 16 19	3,341	1,568	714	58	0.0003	0.4119	0.8470	1.0000
1977 BROOD YEAR								
07 16 31	75	34	12	0	0.0000	0.4600	1.0000	--
07 16 32	268	124	61	11	0.0000	0.3137	0.3279	--
07 16 30	586	270	135	11	0.0000	0.3154	0.6690	--
07 16 29	1,273	580	264	11	0.0000	0.3691	0.7661	--
07 16 37	260	121	75	6	0.0000	0.1220	0.8376	--
07 16 35	426	198	114	25	0.0000	0.1437	0.5207	1.0000
07 16 33	446	208	110	8	0.0000	0.2670	0.8247	--
07 16 34	328	153	90	4	0.0000	0.1383	0.9039	--
07 16 38	906	422	267	21	0.0000	0.0591	0.7055	--
07 16 39	415	193	124	11	0.0000	0.0000	0.7150	--
1978 BROOD YEAR								
07 19 37	495	228	126	19	0.0000	0.2925	0.5638	--
07 19 34	575	262	101	5	0.0000	0.4645	0.4333	--
07 19 33	727	331	151	16	0.0000	0.3952	0.5048	--
07 19 31	1,924	883	339	30	0.0000	0.5008	0.4928	--
07 19 32	2,196	985	357	30	0.0000	0.4891	0.4390	--
07 19 38	504	232	116	7	0.0000	0.3417	0.8134	--
07 19 36	1,332	612	307	26	0.0000	0.3460	0.5439	--
07 19 35	1,383	637	316	33	0.0000	0.3543	0.5891	1.0000
07 18 54	3,152	1,451	940	129	0.0000	0.1158	0.6260	1.0000

Appendix Table E-26. Continued.

Tag code	Number in ocean during spring				Rate of ocean harvest			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1979 BROOD YEAR								
07 22 36	2,923	1,343	297	16	0.0000	0.2954	0.7400	--
07 22 10	1,056	482	113	7	0.0000	0.2661	0.5471	--
07 22 09	1,666	765	149	9	0.0000	0.3651	0.5942	--
07 22 15	1,382	633	149	15	0.0000	0.2414	0.6622	0.0000
07 22 35	3,479	1,574	321	17	0.0000	0.3226	0.7833	--
07 22 16	649	284	63	1	0.0000	0.2533	0.8317	--
07 22 14	1,274	589	164	28	0.0000	0.0834	0.4611	0.0000
07 22 13	1,159	537	141	16	0.0000	0.1337	0.6607	--
07 22 12	1,059	490	124	15	0.0000	0.1860	0.6183	0.0000
07 22 11	459	213	55	7	0.0000	0.1512	0.3932	0.0000
07 22 31	1,209	557	151	29	0.0000	0.0884	0.4818	0.0000
1980 BROOD YEAR								
07 25 14	3,702	457	237	78	0.0052	0.1779	0.2703	--
07 25 09	4,620	586	338	117	0.0031	0.1315	0.2592	--
07 25 23	1,589	209	142	70	0.0020	0.0585	0.1851	--
07 25 12	2,731	348	199	56	0.0072	0.1138	0.3919	--
07 25 15	1,336	171	105	40	0.0041	0.1027	0.2288	1.0000
1981 BROOD YEAR								
07 27 04	69	33	21	2	0.0000	0.1006	0.0000	--
07 27 03	116	52	39	0	0.0000	0.0582	--	--
07 27 02	1,827	850	628	101	0.0000	0.0297	0.2163	1.0000
07 27 11	1,208	561	407	52	0.0018	0.0378	0.3678	0.0000
07 27 08	768	359	268	31	0.0028	0.0233	0.4221	--
07 27 10	1,022	475	344	52	0.0000	0.0529	0.1567	--
07 27 09	1,030	473	351	50	0.0053	0.0352	0.4342	--
07 27 05	2,236	1,033	756	77	0.0024	0.0406	0.3493	--
07 27 06	1,954	898	658	102	0.0017	0.0386	0.2159	--
07 27 07	1,775	818	597	82	0.0012	0.0374	0.2893	0.2905
07 27 51	634	293	217	11	0.0000	0.0389	0.7762	1.0000
07 27 50	916	424	314	26	0.0024	0.0076	0.4053	--
07 27 13	110	51	40	5	0.0000	0.0000	0.0000	--
1982 BROOD YEAR								
07 28 53	3,891	1,843	740	5	0.0000	0.2981	0.4056	--
07 28 50	3,864	1,836	794	12	0.0005	0.2433	0.4886	--
07 28 48	4,700	2,192	956	10	0.0005	0.2971	0.6718	--
07 28 49	3,631	1,705	704	12	0.0023	0.2892	0.2544	--
07 28 52	3,408	1,607	655	2	0.0000	0.3100	0.6209	--
07 28 51	3,446	1,622	682	4	0.0006	0.2857	0.4502	--
07 28 47	4,689	2,192	983	8	0.0000	0.2732	0.5058	--

Appendix Table E-26. Continued.

Tag code	Number in ocean during spring				Rate of ocean harvest			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1982 BROOD YEAR (continued)								
07 28 57	4,049	1,908	710	8	0.0000	0.3394	0.5296	--
07 28 44	2,908	1,338	501	0	0.0007	0.3422	1.0000	--
07 28 45	3,201	1,471	526	2	0.0000	0.3205	0.8600	--
07 28 56	1,470	683	275	0	0.0000	0.3521	1.0000	--
07 28 55	1,717	811	348	0	0.0000	0.3086	1.0000	--
07 28 46	253	117	48	0	0.0000	0.3005	--	--
1983 BROOD YEAR								
07 31 14	4,777	2,261	969	74	0.0022	0.3626	0.5762	0.8092
07 31 09	4,105	1,948	822	50	0.0010	0.3535	0.6354	--
07 31 13	4,836	2,307	931	56	0.0017	0.3858	0.6890	--
07 31 15	4,035	1,912	798	61	0.0021	0.3644	0.6148	--
07 31 16	4,012	1,905	823	56	0.0034	0.3637	0.6714	--
07 30 10	1,635	781	431	57	0.0019	0.2462	0.7297	1.0000
07 30 09	1,440	689	363	55	0.0007	0.2949	0.7436	1.0000
07 31 10	4,505	2,135	841	56	0.0023	0.4112	0.6106	--
07 31 18	3,462	1,614	651	59	0.0012	0.3946	0.6277	--
07 31 11	3,848	1,809	790	69	0.0022	0.3449	0.4979	--
07 31 12	3,833	1,812	727	72	0.0011	0.3925	0.5375	--
07 31 17	3,635	1,703	667	43	0.0023	0.4045	0.6871	--
1984 BROOD YEAR								
07 31 35	1,013	464	253	15	0.0000	0.2850	0.7782	--
07 31 38	901	406	235	10	0.0025	0.2325	0.7971	--
07 31 37	1,031	474	229	5	0.0000	0.3685	0.9108	--
07 34 02	706	325	188	15	0.0000	0.2448	0.7616	--
07 34 08	617	281	157	21	0.0000	0.2680	0.5415	0.5239
07 31 34	843	385	238	12	0.0000	0.1884	0.7961	--
07 31 36	984	453	239	19	0.0000	0.2996	0.6439	1.0000
07 31 39	856	389	202	17	0.0000	0.3073	0.7152	1.0000
07 34 05	647	298	141	12	0.0000	0.3754	0.6534	--
07 34 10	860	392	159	8	0.0000	0.4318	0.7373	1.0000
07 34 07	817	370	126	2	0.0027	0.5380	0.7021	--
07 34 04	1,008	452	157	3	0.0000	0.5091	0.8761	--
07 34 03	788	364	181	7	0.0000	0.3228	0.8684	--
07 34 09	730	335	149	8	0.0000	0.3845	0.7724	--
07 34 06	593	273	139	8	0.0000	0.3214	0.5507	--
07 31 60	492	222	116	14	0.0133	0.2893	0.5243	1.0000
07 31 59	468	211	120	14	0.0071	0.2500	0.7021	--

Appendix Table E-26. Continued.

Tag code	Number in ocean during spring				Rate of ocean harvest			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1985 BROOD YEAR								
07 40 01	1,175	545	269	7	0.0000	0.3196	0.8518	--
07 39 27	1,275	592	302	15	0.0025	0.3013	0.6975	--
07 39 26	1,211	560	277	7	0.0000	0.3105	0.7739	--
07 39 22	245	115	45	2	0.0000	0.4147	0.0000	--
07 39 20	344	157	73	0	0.0000	0.2596	1.0000	--
07 39 21	339	157	50	0	0.0000	0.5122	1.0000	--
07 39 23	1,397	639	276	2	0.0000	0.3302	0.9083	--
07 39 25	1,398	639	248	2	0.0000	0.3977	0.9017	--
07 39 24	1,480	674	264	4	0.0000	0.3827	0.8652	--
07 34 22	1,591	739	337	2	0.0000	0.3541	0.9640	--
07 40 02	1,165	535	271	9	0.0000	0.2762	0.7309	1.0000
07 34 21	1,615	746	352	0	0.0007	0.3027	1.0000	--
07 34 19	1,159	534	247	7	0.0000	0.3168	0.8302	--
07 34 25	1,336	619	310	17	0.0000	0.2612	0.6291	--
07 34 24	1,497	692	328	4	0.0000	0.3051	0.9258	--
07 34 20	1,178	541	277	0	0.0000	0.2525	1.0000	--
07 40 03	1,559	721	367	15	0.0000	0.2773	0.7458	--
07 34 23	1,373	630	307	7	0.0000	0.2671	0.8663	--
07 34 19	1,386	640	312	2	0.0023	0.2950	0.9536	--
07 39 17	1,308	597	324	15	0.0000	0.2104	0.7882	--
07 39 18	1,311	601	320	13	0.0000	0.2498	0.8084	--
1986 BROOD YEAR								
07 41 24	267	123	37	5	0.0000	0.5811	0.6681	--
07 41 18	384	177	77	7	0.0000	0.4021	0.8070	--
07 41 12	251	115	41	7	0.0000	0.5376	0.4816	--
07 41 20	102	47	19	2	0.0000	0.3819	0.4816	--
07 41 15	188	86	21	2	0.0000	0.6371	0.6501	--
07 41 09	124	57	13	2	0.0000	0.6651	0.0000	--
07 41 23	774	352	75	9	0.0000	0.6905	0.4816	--
07 41 17	659	296	89	9	0.0000	0.5476	0.4263	--
07 41 10	748	336	79	3	0.0000	0.6557	0.7187	--
07 35 13	270	124	36	3	0.0000	0.6069	0.7648	--
07 35 05	343	157	43	3	0.0000	0.6305	0.6990	--
07 35 12	271	124	37	10	0.0000	0.5581	0.3514	--
07 35 06	232	106	47	5	0.0000	0.4101	0.5533	--
07 35 07	423	192	64	3	0.0000	0.5408	0.8707	--
07 35 09	291	132	48	7	0.0076	0.4983	0.4484	--
07 35 08	298	136	50	3	0.0000	0.4625	0.7187	--
07 40 63	345	157	45	10	0.0000	0.5975	0.4363	--
07 35 11	278	127	47	5	0.0000	0.5021	0.6501	--
07 35 10	267	121	40	7	0.0000	0.5479	0.4484	--
07 40 61	396	181	62	9	0.0000	0.5248	0.3172	--
07 40 62	330	150	35	3	0.0000	0.6811	0.0000	--

Appendix Table E-26. Continued.

Tag code	Number in ocean during spring				Rate of ocean harvest			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1987 BROOD YEAR								
07 46 19	152	69	33	0	0.0000	0.3785	1.0000	--
07 46 20	233	107	76	10	0.0000	0.0955	0.7017	--
07 46 21	320	146	75	10	0.0000	0.3253	0.6301	--
07 41 03	68	31	6	0	0.0000	0.7129	1.0000	--
07 41 05	189	87	46	30	0.0000	0.2785	0.0000	--
07 41 06	143	64	19	10	0.0000	0.5712	0.0000	--
07 41 13	238	108	49	10	0.0000	0.3962	0.1420	--
07 41 14	253	116	49	10	0.0000	0.4300	0.1420	--
07 41 15	287	132	44	10	0.0000	0.5314	0.3984	--
07 46 16	222	101	72	39	0.0000	0.0821	0.0921	--
07 46 17	96	44	26	10	0.0000	0.2155	0.3622	--
07 46 18	143	65	35	20	0.0000	0.2539	0.0750	--
07 45 47	161	72	41	20	0.0000	0.2684	0.1085	--
07 45 48	133	61	30	10	0.0000	0.3256	0.1396	--
07 45 49	147	67	37	20	0.0000	0.2928	0.0000	--
1988 BROOD YEAR								
07 36 43	321	150	90	24	0.0000	0.1944	0.0000	--
07 42 34	262	123	80	28	0.0000	0.1658	0.1462	--
07 42 36	274	129	87	22	0.0000	0.0992	0.0000	--
07 23 36	319	148	88	7	0.0000	0.2025	0.0000	--
07 23 37	376	175	121	11	0.0000	0.1066	0.3633	--
07 23 58	336	153	94	9	0.0098	0.1583	0.2043	--
07 42 23	274	129	85	13	0.0000	0.1374	0.0000	--
07 42 24	223	105	70	13	0.0000	0.1385	0.1965	--
07 42 27	247	115	59	7	0.0000	0.3293	0.0000	--
07 42 29	238	111	56	11	0.0000	0.3120	0.1763	--
07 42 30	212	98	61	9	0.0000	0.1823	0.0000	--
07 42 33	211	98	55	21	0.0000	0.2657	0.0000	--
1989 BROOD YEAR								
07 51 48	329	159	108	10	0.0000	0.1000	0.0000	--
07 51 49	307	149	91	5	0.0000	0.1299	0.6116	--
07 51 50	345	167	129	0	0.0000	0.0300	1.0000	--
07 51 42	279	135	77	0	0.0000	0.1798	--	--
07 51 43	254	123	82	0	0.0000	0.0967	--	--
07 51 44	386	187	108	10	0.0000	0.0559	0.0000	--
07 51 45	291	141	87	5	0.0000	0.0524	0.0000	--
07 51 46	275	134	86	0	0.0000	0.1371	1.0000	--
07 51 47	260	126	87	0	0.0000	0.0684	1.0000	--
07 51 51	269	130	89	5	0.0000	0.0828	0.0000	--
07 51 52	299	144	102	0	0.0000	0.1048	1.0000	--
07 51 53	280	136	96	5	0.0000	0.1110	0.0000	--

Appendix Table E-26. Continued.

Tag code	Number in ocean during spring				Rate of ocean harvest			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1989 BROOD YEAR								
07 53 12	318	142	61	5	0.0000	0.1543	0.3781	--
07 53 13	461	213	128	13	0.0000	0.0363	0.0000	--
07 53 14	384	169	89	17	0.0000	0.2066	0.0868	--
07 53 18	403	176	74	11	0.0000	0.3600	0.4318	--
07 53 19	335	146	90	9	0.0000	0.1820	0.5033	--
07 53 20	407	202	117	11	0.0000	0.2067	0.3473	--
07 53 15	295	130	72	13	0.0000	0.2186	0.3878	--
07 53 16	307	148	102	17	0.0000	0.0519	0.0000	--
07 53 17	316	145	100	23	0.0000	0.0875	0.0000	--
07 36 44	340	157	94	11	0.0000	0.0560	0.0000	--
07 36 45	441	187	101	11	0.0000	0.1916	0.5637	--
07 36 46	353	158	86	16	0.0063	0.1370	0.2021	--

Appendix Table E-27. Estimated freshwater returns and ocean abundance of Ad-CWT marked groups of spring chinook salmon released from Cole M. Rivers Hatchery in September and October, 1975-89 brood years. Freshwater returns were estimated from data in Appendix Tables E-24 and E-25. Estimates of ocean abundance for individual Ad-CWT marked groups are in Appendix Table E-26.

Brood year	Freshwater return				Number in ocean during spring			
	Age 2	Age 3	Age 4	Age 5	Age 3	Age 4	Age 5	Age 6
1975	118	273	1,620	345	5,081	3,302	379	0
1976	201	372	2,184	678	15,042	5,612	721	4
1977	34	83	344	34	1,009	473	34	0[a]
1978	75	140	828	99	2,689	1,074	99[a]	0
1979	178	416	800	63	5,082	1,091[a]	66	2
1980	304	186	265	209	1,105[a]	642	213	0
1981	115	292	3,508	575	6,268	4,601	587	4
1982	1,500	4,964	7,730	63	19,325	7,923	63	0
1983	713	3,094	6,345	688	20,878	8,813	707	2
1984	282	219	1,746	154	4,880	2,586	177	2
1985	290	1,100	3,693	118	9,291	4,600	120	0
1986	50	151	419	90	2,124	708	90	0
1987	12	25	176	138	732	424	138	0
1988	9	44	444	150	1,058	644	150	0
1989	5	78	798	30	1,285	875	30	0

[a] *Groups primarily affected by the El Niño event of 1982-83.*

Appendix Table E-28. Results of a cohort analysis for wild spring chinook salmon of Rogue River origin, 1968-89 brood years. Estimates include (1) number of survivors that remained in the ocean after harvest by the fisheries, (2) harvest in the ocean fisheries, and (3) number of fish alive in the ocean in spring. All age 6 fish returned to freshwater.

	Age 5			Age 4		
Brood year	Survivors[a]	Ocean harvest[b]	Number alive[c]	Survivors[d]	Ocean harvest[b]	Number alive[c]
1969	160	340	7,439	--	--	--
1970	165	351	6,694	8,368	17,781	36.709
1971	274	583	5,544	6,929	14,725	31,817
1972	110	235	7,746	9,683	20,576	44,033
1973	147	312	6,191	7,739	16,446	37,235
1974	192	427	8,618	10,772	22,891	57,236
1975	869	3,476	9,141	11,426	25,432	54,981
1976	312	887	6,429	8,036	32,143	56,098
1977	0	0	1,297	1,621	4,613	9,991
1978	31	53	1,824	2,280	2,676	17,369
1979	0	0	397	497	845	7,011
1980	308	173	6,130	7,662	2,834	15,415
1981	0	0	2,025	2,532	1,424	16,227
1982	0	0	1,864	2,330	3,495	19,269
1983	0	0	4,497	5,621	9,993	42,784
1984	229	180	4,743	5,929	4,851	48,459
1985	0	0	1,365	1,706	1,340	12,188
1986	0	0	1,565	1,956	3,060	12,259
1987	159	7	1,891	2,364	628	5,366
1988	614	76	3,474	4,342	181	7,758
1989	373[e]	28	5,562	6,953	859	13,192

[a] *Freshwater returns at age 6 (Appendix Table E-18) divided by an assumed overwinter survival rate of 80%.*
[b] *Annual harvest rates in the ocean fisheries (Table 34).*
[c] *Includes survivors, ocean harvest and freshwater returns.*
[d] *Overwinter survival rate assumed to be 80%.*
[e] *Data not available for age 6 cohorts. Estimate was derived from the mean probability of maturity for age 5 fish from the 1985-88 brood years.*

Appendix Table E-28. Continued.

Brood year	Age 3 Survivors[d]	Age 3 Shaker mortality[f]	Age 3 Ocean harvest[b]	Age 3 Number alive[c]	Age 2 Survivors[g]	Age 2 Shaker mortality[f]	Age 2 Number alive[c]
1971	39,771	1,219	24,376	69,358	--	--	--
1972	55,041	1,687	33,735	95,240	190,481	12,953	203,755
1973	46,543	1,426	28,527	79,008	158,016	10,745	171,072
1974	71,545	2,193	43,850	121,544	243,088	16,530	262,287
1975	68,726	1,692	33,850	110,623	221,245	15,045	236,881
1976	70,122	3,506	70,122	151,344	302,688	20,583	331,218
1977	12,489	322	6,434	20,317	40,633	2,804	44,399
1978	21,712	786	15,722	41,878	83,755	6,700	96,963
1979	26,964[h]	1,348	26,964	59,197	118,395	8,761	128,049
1980	19,268	131	2,628	24,064	141,554[i]	7,644	154,916
1981	20,283	31	627	21,797	43,594	2,746	46,991
1982	24,087	516	10,323	39,434	78,868	2,129	82,668
1983	53,480	1,504	30,082	106,415	212,830	7,662	225,941
1984	60,574	1,298	25,960	101,967	203,934	12,236	227,083
1985	15,235	311	6,223	34,733	69,467	4,446	79,115
1986	15,324	899	17,989	36,006	72,012	3,241	78,502
1987	6,708	106	2,118	9,873	19,745	869	21,388
1988	9,698	121	2,424	12,973	25,947	1,583	28,024
1989	16,490	82	1,631	18,545	37,090	779	37,960

[f] *Estimation described in* **Ocean Harvest Rates**, *page 43).*
[g] *Overwinter survival rate assumed to be 50%.*
[h] *Survival rate estimated as 0.26 in winter of 1982-83.*
[i] *Survival rate estimated as 0.17 in winter of 1982-83.*

Appendix Table E-29. Data used to assess factors related to the estimated number of wild age 2 spring chinook salmon alive in the ocean, 1974-89 brood years.

Brood year	Age 2 recruits[a]	Juvenile abundance[b]	Growth rate[c]	Smolt length[d]	Flow[e]	Water temperature[f]	Upwelling[g]		Ocean temperature[h]	
							Summer	Autumn	Summer	Autumn
1972	202,755	--	1.74	10.08	1,086	--	403	-16	12.0	11.6
1973	171,072	--	1.85	10.74	1,895	18.4	260	57	12.6	11.1
1974	262,287	2,990,738	1.87	10.57	1,977	18.8	328	44	12.3	11.8
1975	236,881	2,985,664	1.97	11.03	1,916	19.4	191	36	12.5	11.4
1976	331,218	5,137,059	2.05	10.22	1,147	19.4	303	18	12.4	11.8
1977	44,399	321,523	2.14	10.85	2,342	17.5	273	45	12.8	11.8
1978	96,963	5,096,782	2.04	10.35	2,259	17.4	116	-84	14.2	13.4
1979	128,049	1,389,158	2.20	10.92	2,088	16.8	360	-20	11.9	12.0
1980	154,916	2,722,111	2.02	10.63	1,978	17.5	294	-55	12.7	12.7
1981	46,991	312,922	2.12	10.85	2,302	16.3	185	-35	12.6	12.5
1982	82,668	1,253,517	2.09	11.56	2,535	16.2	165	-81	13.6	12.6
1983	225,941	1,056,177	2.29	11.69	3,137	17.4	275	-90	12.2	12.3
1984	227,083	1,687,528	2.15	11.01	2,287	17.8	164	23	11.6	10.9
1985	79,115	3,726,832	2.02	10.69	2,265	17.3	206	4	11.2	11.1
1986	78,502	4,565,683	1.92	9.67	2,212	16.6	244	7	11.5	11.4
1987	21,388	11,357,231	1.92	9.94	1,933	17.6	302	-8	11.0	11.7
1988	28,024	4,396,786	1.89	10.19	2,415	16.8	264	29	12.3	11.4
1989	37,960	7,628,426	1.83	10.30	2,019	17.6	213	58	12.9	12.2

[a] *Estimated number alive in ocean at age 2.*
[b] *Estimated number of wild subyearling migrants that passed Savage Rapids Dam.*
[c] *Average spacing (mm at 88x) of freshwater circuli from completed broods.*
[d] *Estimated mean length (cm) at ocean entry from completed broods.*
[e] *Mean daily flow (cfs) at Raygold in July-August.*
[f] *Mean maximum water temperature (^{o}C) at Raygold in July-August.*
[g] *Sum of Bakun units near Crescent City, California. Summer represents the period of July-September; autumn represents the period of September-November.*
[h] *Mean surface temperature (^{o}C) at Coos Bay, Oregon. Summer represents the period of July-September; autumn represents the period of September-November.*

Appendix Table E-30. Correlation matrix for variables examined in the analysis of the number of age 2 wild spring chinook salmon alive in the ocean, 1974-89 brood years. Data are described in Appendix Table E-29.

	Age 2 recruits	Juvenile abundance	Growth rate	Smolt length	Flow	Water temperature	Upwelling		Ocean temperature	
							Summer	Autumn	Summer	Autumn
Age 2 recruits	1.00									
Juvenile abundance	-0.24	1.00								
Growth rate	0.08	-0.67[a]	1.00							
Smolt length	0.21	-0.71[a]	0.69[a]	1.00						
Flow	-0.38	-0.43	0.60[a]	0.58[a]	1.00					
Water temperature	0.74[a]	0.21	-0.29	-0.09	-0.62[a]	1.00				
Summer upwelling	0.27	0.09	-0.26	-0.28	-0.47[a]	0.20	1.00			
Autumn upwelling	0.06	0.23	-0.50[a]	-0.36	-0.38	0.50[a]	0.18	1.00		
Summer temperature	-0.04	-0.26	0.08	0.28	0.13	-0.05	-0.43	-0.32	1.00	
Autumn temperature	-0.18	-0.08	0.28	0.18	0.22	-0.32	-0.23	-0.71[a]	0.73[a]	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-31. Regression analysis of the number of age 2 wild spring chinook salmon alive in the ocean, 1974-84 brood years. Data are described in Appendix Table E-29.

Independent variable	Regression coefficient	Standard error	*P*
Juvenile abundance	6.273×10^{-2}	0.983×10^{-2}	<0.001
Summer temperature	-10.204×10^{4}	1.654×10^{4}	<0.001
Smolt length	9.834×10^{4}	3.531×10^{4}	0.027
Constant	242,345		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	81.982×10^{9}	3	27.327×10^{9}	20.90	<0.001
Residual	9.146×10^{9}	7	1.307×10^{9}		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Juvenile abundance	0.29	--	--
Growth rate	0.07	0.00	0.01
Smolt length	0.05	0.05	0.27
Flow	0.19	0.02	0.07
Water temperature	0.64	0.32	0.08
Summer upwelling	0.11	0.19	0.00
Autumn upwelling	0.11	0.17	0.01
Summer temperature	0.26	0.63	--
Autumn temperature	0.23	0.53	0.02

Appendix Table E-32. Correlation matrix for variables examined in the analysis of the number of age 2 wild spring chinook salmon alive in the ocean, 1974-84 brood years. Data are described in Appendix Table E-29.

	Age 2 recruits	Juvenile abundance	Growth rate	Smolt length	Flow	Water temperature	Upwelling		Ocean temperature	
							Summer	Autumn	Summer	Autumn
Age 2 recruits	1.00									
Juvenile abundance	0.54	1.00								
Growth rate	-0.26	-0.55	1.00							
Smolt length	-0.22	-0.69[a]	0.65[a]	1.00						
Flow	-0.43	-0.64[a]	0.72[a]	0.84[a]	1.00					
Water temperature	0.80[a]	0.62[a]	-0.56[a]	-0.46	-0.64[a]	1.00				
Summer upwelling	0.34	-0.08	-0.32	-0.35	-0.49	0.23	1.00			
Autumn upwelling	0.33	0.03	-0.41	-0.32	-0.45	0.66[a]	0.25	1.00		
Summer temperature	-0.50	0.32	-0.01	-0.01	0.22	-0.27	-0.58[a]	-0.45	1.00	
Autumn temperature	-0.48	0.19	0.28	0.03	0.33	-0.54	-0.28	-0.82[a]	0.73[a]	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-33. Results of a cohort analysis for hatchery spring chinook salmon of Rogue River origin, 1969-89 brood years. Estimates include (1) number of survivors that remained in the ocean after harvest by the fisheries, (2) harvest in the ocean fisheries, and (3) number of fish alive in the ocean in spring. All age 6 fish returned to freshwater. Estimates do not include fish released in June from Cole M. Rivers Hatchery.

	Age 5			Age 4		
Brood year	Survivors[a]	Ocean harvest[b]	Number alive[c]	Survivors[d]	Ocean harvest[b]	Number alive[c]
1969	0	0	395	--	--	--
1970	0	0	146	183	388	868
1971	0	0	200	250	531	1,390
1972	0	0	144	180	383	1,547
1973	0	0	1,775	2,219	4,715	9,238
1974	95	210	832	1,040	2,209	4,251
1975	149	598	1,877	2,346	5,222	14,980
1976	142	404	1,747	2,183	8,734	17,581
1977	0	0	422	528	1,503	3,781
1978	0	0	781	976	1,146	8,161
1979	0	0	236	295	503	2,500
1980	0	0	2,055	2,568	950	5,646
1981	0	0	548	685	385	6,366
1982	0	0	4,307	5,384	8,076	34,006
1983	0	0	5,152	6,440	11,449	52,784
1984	0	0	944	1,180	966	15,880
1985	42	66	2,745	3,431	2,696	39,755
1986	265	70	2,492	3,115	4,873	19,380
1987	0	0	3,435	4,294	1,142	11,516
1988	290	36	3,415	4,268	178	14,174
1989	702[e]	53	11,811	14,764	1,825	30,349

[a] *Freshwater returns at age 6 (Appendix Table E-18) divided by an assumed overwinter survival rate of 80%.*
[b] *Annual harvest rates in the ocean fisheries (Table 34).*
[c] *Includes survivors, ocean harvest and freshwater returns.*
[d] *Overwinter survival rate assumed to be 80%.*
[e] *Data not available for age 6 cohorts. Estimate was derived from the mean probability of maturity for age 5 fish from the 1985-88 brood years.*

Appendix Table E-33. Continued.

Brood year	Age 3				Age 2		
	Survivors[d]	Shaker mortality[f]	Ocean harvest[b]	Number alive[c]	Survivors[g]	Shaker mortality[f]	Number alive[c]
1971	1,737	53	1,065	2,855	--	--	--
1972	1,934	59	1,186	3,462	6,924	471	7,395
1973	11,547	354	7,077	19,093	38,186	2,597	40,914
1974	5,314	163	3,257	8,869	17,739	1,206	18,999
1975	18,726	461	9,223	32,042	64,083	4,358	68,441
1976	21,976	1,099	21,976	47,347	94,694	6,439	102,058
1977	4,726	122	2,435	8,077	16,154	1,115	17,626
1978	10,201	369	7,387	20,625	41,251	3,300	46,811
1979	10,871[h]	544	10,871	23,369	46,739	3,459	50,530
1980	7,057	48	962	9,345	54,969[i]	2,968	60,306
1981	7,957	12	246	8,623	17,246	1,086	18,552
1982	42,507	911	18,217	68,632	137,263	3,706	143,646
1983	65,980	1,856	37,114	119,200	238,400	8,582	249,192
1984	19,850	425	8,507	36,906	73,813	4,429	87,140
1985	49,693	1,015	20,297	80,212	160,424	10,267	177,605
1986	24,225	1,422	28,438	62,840	125,680	5,656	132,946
1987	14,396	227	4,546	21,024	42,048	1,850	45,309
1988	17,717	221	4,429	23,808	47,616	2,905	51,130
1989	37,856	187	3,744	43,092	86,183	1,810	88,304

[f] *Estimation described in* **METHODS**.
[g] *Overwinter survival rate assumed to be 50%.*
[h] *Survival rate estimated as 0.23 in winter of 1982-83.*
[i] *Survival rate estimated as 0.17 in winter of 1982-83.*

Appendix Table E-34. Regression analysis of the number of age 2 spring chinook salmon of hatchery origin alive in the ocean, 1972-89 brood years. Data are described in Appendix Table E-36.

Independent variable	Regression coefficient	Standard error	*P*
Juvenile abundance	0.0674	0.0249	0.016
Autumn upwelling	-555.7	257.1	0.047
Constant	9,085		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	28.91×10^9	2	14.46×10^9	5.51	0.016
Residual	39.35×10^9	15	2.62×10^9		

Variables tested	Partial r^2 Step 1	Step 2
Juvenile abundance	0.24	--
Release date	0.34	0.02
Smolt weight	0.21	0.02
Summer upwelling	0.06	0.00
Autumn upwelling	0.14	0.24
Winter upwelling	0.06	0.10
Summer temperature	0.03	0.00
Autumn temperature	0.00	0.02
Winter temperature	0.08	0.10

Appendix Table E-35. Correlation matrix for variables examined in the analysis of the number of age 2 spring chinook salmon of hatchery origin alive in the ocean, 1972-89 brood years. Data are described in Appendix Table E-36.

	Age 2 recruits	Juvenile numbers	Release date	Smolt weight	Upwelling			Ocean temperature		
					Summer	Autumn	Winter	Summer	Autumn	Winter
Age 2 recruits	1.00									
Juvenile numbers	0.49[a]	1.00								
Release date	-0.58[a]	-0.90[a]	1.00							
Smolt weight	-0.46	-0.70[a]	0.60[a]	1.00						
Summer upwelling	-0.25	-0.40	0.31	0.25	1.00					
Autumn upwelling	-0.38	0.09	0.18	0.12	0.18	1.00				
Winter upwelling	-0.24	0.08	0.03	0.05	-0.01	0.38	1.00			
Summer temperature	-0.16	-0.40	0.37	0.21	-0.43	-0.32	-0.10	1.00		
Autumn temperature	-0.02	-0.25	0.07	0.03	-0.23	-0.71[a]	-0.21	0.73[a]	1.00	
Winter temperature	0.29	0.03	-0.26	-0.03	0.21	-0.36	-0.70[a]	-0.09	0.21	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-36. Data used to assess factors related to the estimated number of age 2 spring chinook salmon of hatchery origin alive in the ocean, 1972-89 brood years. Estimates of fish numbers and release characteristics pertain to only those juveniles released after 1 August.

Brood year	Age 2 recruits[a]	Juveniles released			Upwelling[d]			Ocean temperature[e]		
		Number	Date[b]	Weight[c]	Summer	Autumn	Winter	Summer	Autumn	Winter
1972	7,395	60,000	350.0	75.8	403	-16	-185	12.0	11.6	9.6
1973	40,914	592,000	368.4	63.2	260	57	-141	12.6	11.1	9.8
1974	18,999	225,671	368.0	77.9	328	44	-99	12.3	11.8	9.7
1975	68,441	853,030	337.1	75.9	191	36	-26	12.5	11.4	9.0
1976	102,058	760,852	319.4	65.7	303	18	-105	12.4	11.8	10.0
1977	17,626	690,392	330.4	59.2	273	45	-348	12.8	11.8	11.1
1978	46,811	776,390	327.0	52.4	116	-84	-96	14.2	13.4	8.8
1979	50,530	763,278	319.0	53.2	360	-20	-277	11.9	12.0	10.9
1980	60,306	741,638	295.4	83.4	294	-55	-334	12.7	12.7	11.6
1981	18,552	781,716	305.0	61.8	185	-35	-143	12.6	12.5	10.3
1982	143,646	919,355	289.3	61.7	165	-81	-566	13.6	12.6	11.5
1983	249,192	1,114,878	264.9	48.8	275	-90	-124	12.2	12.3	10.9
1984	87,140	1,399,886	257.7	66.1	164	23	-27	11.6	10.9	10.0
1985	177,605	1,743,625	257.9	47.0	206	4	-421	11.2	11.1	10.0
1986	132,946	1,609,091	260.9	43.7	244	7	-203	11.5	11.4	10.6
1987	45,309	1,627,900	260.7	50.2	302	-8	-130	11.0	11.7	10.4
1988	51,130	1,623,008	259.2	51.9	264	29	-5	12.3	11.4	9.4
1989	88,304	1,592,047	258.3	53.8	213	58	-48	12.9	12.2	9.8

[a] *Estimated number alive in ocean at age 2.*
[b] *Mean day-of-year that fish were released. Day-of-year calendar is in* **APPENDIX A.**
[c] *Mean weight (gms) at time of release.*
[d] *Sum of Bakun units near Crescent City, California. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February.*
[e] *Mean surface temperature (^{o}C) at Coos Bay, Oregon. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February..*

Appendix Table E-37. Regression analysis of the number of Ad-CWT marked spring chinook salmon alive in the ocean, 1975-89 brood years. Fish numbers were transformed to natural logarithms before analysis. Data are described in Appendix Tables B-2, E-26, and E-36. Mark groups with more than 5,000 fish alive at age 2 were excluded from the analyses. Values reported for ocean physical factors reflect one observation per year as in Appendix Table E-36.

Independent variable	Regression coefficient	Standard error	*P*
Juvenile abundance	1.0589	0.1524	<0.001
Release date	-0.0079	0.0017	<0.001
Smolt weight	0.0230	0.0042	<0.001
Autumn upwelling	-0.0117	0.0017	<0.001
Winter upwelling	-0.0023	0.0004	<0.001
Autumn temperature	-0.4145	0.1177	<0.001
Winter temperature	-0.3442	0.1018	0.001
Constant	5.2196		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	111.7	7	15.96	38.2	<0.001
Residual	65.7	157	0.42		

Appendix Table E-38. Correlation matrix for variables examined in the analysis of the number of Ad-CWT marked spring chinook salmon estimated to be alive in the ocean at age 2, 1975-89 brood years. Data are described in Appendix Tables B-2, E-26, and E-36. Mark groups with more than 5,000 fish alive at age 2 were excluded from the analyses. Fish numbers were transformed to natural logarithms before analysis. Values reported for ocean physical factors reflect one observation per year as in Appendix Table E-36.

	Age 2 recruits	Juvenile numbers	Release date	Smolt weight	Upwelling			Ocean temperature		
					Summer	Autumn	Winter	Summer	Autumn	Winter
Age 2 recruits	1.00									
Juvenile numbers	0.50[a]	1.00								
Release date	0.13	0.58[a]	1.00							
Smolt weight	0.33[a]	0.29[a]	0.47[a]	1.00						
Summer upwelling	-0.14	0.14	0.04	-0.13	1.00					
Autumn upwelling	-0.61[a]	-0.48[a]	-0.18[a]	-0.16[a]	0.18	1.00				
Winter upwelling	-0.44[a]	-0.24[a]	-0.16	-0.05	-0.01	0.38	1.00			
Summer temperature	0.24[a]	0.51[a]	0.39[a]	0.19[a]	-0.43	-0.32	-0.10	1.00		
Autumn temperature	0.29[a]	0.57[a]	0.39	0.13	-0.23	-0.71[a]	-0.21	0.73[a]	1.00	
Winter temperature	0.33[a]	0.36[a]	0.13	0.22[a]	0.21	-0.36	-0.70[a]	-0.09	0.21	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table E-39. Results of a cohort analysis for wild fall chinook salmon destined to return upstream of Gold Ray Dam, 1968-89 brood years. Estimates include (1) number of survivors that remained in the ocean after harvest by the fisheries, (2) harvest in the ocean fisheries, and (3) number of fish alive in the ocean in spring.

Brood year	Age 5				Age 4			
		Ocean harvest		Number alive[d]		Ocean harvest		Number alive[d]
	Survivors[a]	Immature[b]	Mature[c]		Survivors[e]	Immature[b]	Mature[c]	
1969	36	77	131	385	--	--	--	--
1970	0	0	143	420	525	1,116	1,165	3,426
1971	0	0	110	323	404	857	1,149	3,378
1972	0	0	82	241	301	640	865	2,545
1973	0	0	201	592	740	1,573	1,158	3,406
1974	0	0	386	1,119	1,398	2,971	2,939	8,644
1975	99	396	1,395	3,487	4,359	9,702	6,365	18,449
1976	8	22	234	632	789	3,158	2,876	7,191
1977	0	0	46	170	212	604	837	2,262
1978	26	45	82	259	323	380	910	3,371
1979	0	0	15	114	142	242	789	2,504
1980	0	0	82	455	569	210	296	2,195
1981	0	0	99	330	413	232	565	3,137
1982	0	0	37	117	146	219	719	2,396
1983	0	0	52	230	287	511	1,373	4,291
1984	0	0	274	1,246	1,557	1,274	2,802	12,455
1985	0	0	105	345	432	339	944	4,293
1986	67	18	68	646	808	1,263	1,412	4,629
1987	0	0	13	657	822	218	300	2,858
1988	281[f]	35	51	923	1,153	48	77	3,845
1989	364[f]	27	116	3,312	4,140	512	372	6,770

[a] *Freshwater returns at age 6 (Appendix Table E-19) + ocean harvest prior to maturity divided by an assumed overwinter survival rate of 80%.*
[b] *Annual harvest rates for fish that did not mature (Table 34).*
[c] *Estimated for fish that matured in summer by dividing annual harvest rates (Table 34) by two.*
[d] *Includes survivors, ocean harvest and freshwater returns (Appendix Table E-19).*
[e] *Overwinter survival rate assumed to be 80%.*
[f] *Data not available for age 6 cohorts. Estimate was derived from the mean probability of maturity for age 5 fish from the 1985-88 brood years.*

Appendix Table E-39. Continued.

Brood year	Age 3					Age 2		
		Ocean harvest						
	Survivors[e]	Immature[b]	Mature[c]	Shaker mortality[g]	Number alive[d]	Survivors[h]	Shaker mortality[g]	Number alive[d]
1971	4,223	2,588	162	138	7,803	--	--	--
1972	3,181	1,949	113	103	5,826	11,652	809	12,948
1973	4,258	2,610	126	137	7,667	15,334	1,053	16,680
1974	10,805	6,622	219	342	18,922	37,844	2,617	41,744
1975	23,061	11,359	520	594	38,163	76,325	5,319	85,456
1976	8,989	8,989	563	478	20,708	41,417	2,897	45,587
1977	2,827	1,456	154	81	5,272	10,544	879	13,050
1978	4,214	3,051	674	186	10,658	21,316	1,664	26,664
1979	9,630[i]	9,630	400	502	21,362	42,724	2,343	46,567
1980	2,744	374	134	25	5,382	31,658[j]	2,033	34,975
1981	3,921	121	19	7	5,340	10,681	297	11,618
1982	2,996	1,284	152	72	5,365	10,731	400	11,922
1983	5,364	3,017	721	187	12,572	25,143	1,645	31,366
1984	15,569	6,673	851	376	28,293	56,587	3,836	67,160
1985	5,366	2,192	377	128	10,288	20,577	974	23,712
1986	5,786	6,793	373	358	14,319	28,638	1,294	31,583
1987	3,573	1,128	85	61	5,467	10,934	712	13,144
1988	4,806	1,202	73	64	6,804	13,607	293	14,623
1989	8,462	837	52	44	10,488	20,977	85	21,673

g *Includes immature fish and fish that matured during season.*
h *Overwinter survival rate assumed to be 50%.*
i *Survival rate estimated as 0.26 in winter of 1982-83.*
j *Survival rate estimated as 0.17 in winter of 1982-83.*

Appendix Table E-40. Results of a cohort analysis for hatchery fall chinook salmon destined to return upstream of Gold Ray Dam, 1968-89 brood years. Estimates include (1) number of survivors that remained in the ocean after harvest by the fisheries, (2) harvest in the ocean fisheries, and (3) number of fish alive in the ocean in spring.

Brood year	Age 5				Age 4			
		Ocean harvest		Number alive[d]		Ocean harvest		Number alive[d]
	Survivors[a]	Immature[b]	Mature[c]		Survivors[e]	Immature[b]	Mature[c]	
1969	0	0	0	0	--	--	--	--
1970	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0
1974	0	0	6	17	21	44	22	65
1975	0	0	58	144	180	401	301	873
1976	0	0	25	68	84	338	231	578
1977	0	0	6	21	27	75	98	264
1978	0	0	4	12	15	18	101	376
1979	0	0	1	8	10	17	51	163
1980	0	0	32	177	222	82	55	405
1981	0	0	0	0	0	0	174	968
1982	0	0	0	0	0	0	418	1,393
1983	0	0	25	113	141	250	395	1,233
1984	0	0	0	0	0	0	354	1,571
1985	0	0	42	138	173	136	305	1,385
1986	0	0	0	0	0	0	222	728
1987	0	0	1	54	67	18	15	141
1988	0	0	5	87	109	5	5	254
1989	0[f]	0	2	56	69	9	15	269

[a] *No fish survived to mature at age 6.*
[b] *Estimated for immature fish from annual harvest rates (Appendix Table E-19).*
[c] *Estimated for fish that matured in summer by dividing annual harvest rates (Table 34) by two.*
[d] *Includes survivors, ocean harvest and freshwater returns (Appendix Table E-19).*
[e] *Overwinter survival rate assumed to be 80%.*
[f] *Value assumed as data was not available for age 6 cohorts.*

Appendix Table E-40. Continued.

Brood year	Age 3					Age 2		
		Ocean harvest						
	Survivors[e]	Immature[b]	Mature[c]	Shaker mortality[g]	Number alive[d]	Survivors[h]	Shaker mortality[g]	Number alive[d]
1971	0	0	0	0	0	--	--	--
1972	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0
1974	82	50	0	2	134	268	18	286
1975	1,091	537	0	27	1,655	3,311	225	3,536
1976	723	723	7	37	1,512	3,023	209	3,232
1977	330	170	7	9	553	1,105	89	1,214
1978	470	340	75	21	1,189	2,378	180	2,735
1979	628[i]	628	52	34	1,497	2,994	166	3,328
1980	507	69	9	4	724	4,259[j]	273	4,696
1981	1,210	37	1	2	1,342	2,685	73	2,799
1982	1,742	746	59	40	2,923	5,847	212	6,116
1983	1,542	867	441	65	4,923	9,845	644	12,269
1984	1,964	842	260	55	4,591	9,182	619	10,796
1985	1,731	707	162	43	3,597	7,194	334	8,005
1986	910	1,068	204	64	2,796	5,591	252	6,160
1987	176	56	10	3	316	632	42	776
1988	318	79	0	4	401	802	17	867
1989	337	33	4	2	469	938	4	1,075

[g] *Includes immature fish and fish that matured during season.*
[h] *Overwinter survival rate assumed to be 50%.*
[i] *Survival rate estimated as 0.26 in winter of 1982-83.*
[j] *Survival rate estimated as 0.17 in winter of 1982-83.*

Appendix Table E-41. Regression analysis of the number of wild age 2 chinook salmon alive in the ocean, 1974-84 brood years. Data are described in Appendix Table E-29, except that the number of age 2 fish also include wild fall chinook salmon (Appendix Table E-39).

Independent variable	Regression coefficient	Standard error	*P*
Juvenile abundance	7.441×10^{-2}	0.931×10^{-2}	<0.001
Summer temperature	-12.546×10^{4}	1.566×10^{4}	<0.001
Smolt length	11.847×10^{4}	3.344×10^{4}	0.001
Constant	330,260		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	118.756×10^{9}	3	39.585×10^{9}	20.90	<0.001
Residual	8.201×10^{9}	7	1.172×10^{9}		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Juvenile abundance	0.28	--	--
Growth rate	0.08	0.00	0.01
Smolt length	0.03	0.05	0.33
Flow	0.21	0.02	0.07
Water temperature	0.70	0.36	0.11
Summer upwelling	0.08	0.15	0.03
Autumn upwelling	0.17	0.22	0.00
Summer temperature	0.28	0.67	--
Autumn temperature	0.33	0.62	0.06

Appendix Table E-42. Estimated survival rates to age 2 for juvenile spring chinook salmon released from Cole M. Rivers Hatchery and survival rate indexes to age 2 for wild juvenile chinook salmon that migrated past Savage Rapids Dam. Survival rate estimates for Ad-CWT groups are the means for juveniles released in September-October.

Brood year	Hatchery		Wild (index)	Brood year	Hatchery		Wild (index)
	Ad-CWT	All			Ad-CWT	All	
1972	--	0.123	--	1981	0.057	0.024	0.187
1973	--	0.069	--	1982	0.121	0.156	0.076
1974	--	0.084	0.102	1983	0.161	0.224	0.244
1975	0.080	0.080	0.130	1984	0.050	0.062	0.174
1976	0.164	0.134	0.073	1985	0.133	0.102	0.028
1977	0.018	0.026	0.179	1986	0.032	0.083	0.024
1978	0.048	0.060	0.024	1987	0.017	0.028	0.003
1979	0.037	0.066	0.126	1988	0.025	0.032	0.010
1980	0.093	0.081	0.070	1989	0.030	0.056	0.008

Appendix Table E-43. Estimated recruitment rates of wild spring chinook salmon and all wild chinook salmon that originated upstream of Gold Ray Dam, 1974-89 brood years. Recruitment rates are expressed as the number of age 2 fish estimated to be alive in the ocean during spring divided by estimated number of parents that spawned.

Brood year	Spring chinook salmon	All chinook salmon
1974	20.0	19.7
1975	16.5	19.3
1976	24.9	23.6
1977	5.5	4.3
1978	2.9	3.1
1979	5.5	6.7
1980	7.0	7.6
1981	5.3	4.4
1982	4.5	4.2
1983	31.7	24.0
1984	37.3	32.5
1985	4.5	4.4
1986	1.8	2.0
1987	0.5	0.6
1988	0.7	0.8
1989	2.0	2.4

Appendix Table E-44. Estimated harvest rates for chinook salmon that originated from the area upstream of Gold Ray Dam, 1972-89 brood years. Harvest estimates were estimated as harvest divided by freshwater escapement. Data used to derive the estimates are in Appendix Tables E-28, E-33, E-39, F-48, and F-49.

Brood year	Spring chinook salmon				Wild fall chinook salmon	
	Wild		Hatchery			
	Ocean	Total[a]	Ocean	Total[a]	Ocean	Total[a]
1972	0.674	0.695	0.526	0.563	0.613	0.627
1973	0.656	0.677	0.732	0.743	0.723	0.729
1974	0.636	0.663	0.760	0.770	0.691	0.696
1975	0.672	0.699	0.550	0.585	0.677	0.681
1976	0.736	0.753	0.735	0.747	0.732	0.733
1977	0.609	0.675	0.542	0.582	0.515	0.522
1978	0.431	0.511	0.421	0.476	0.410	0.426
1979	0.718	0.741	0.772	0.780	0.729	0.736
1980	0.233	0.312	0.198	0.266	0.170	0.251
1981	0.115	0.246	0.089	0.187	0.170	0.274
1982	0.391	0.449	0.432	0.468	0.424	0.464
1983	0.407	0.460	0.472	0.491	0.352	0.408
1984	0.316	0.406	0.231	0.296	0.357	0.392
1985	0.209	0.332	0.306	0.386	0.338	0.378
1986	0.603	0.651	0.580	0.614	0.655	0.666
1987	0.317	0.437	0.308	0.387	0.278	0.327
1988	0.257	0.366	0.236	0.329	0.240	0.294
1989	0.185	0.338	0.175	0.313	0.189	0.249

[a] *Includes ocean harvest and river harvest.*

Appendix Table E-45. Mean fork length (cm) of wild age 2-6 adult spring chinook salmon, 1969-92 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1969									
Mean	--	--	--	85.4	98.0	--	--	85.4	98.0
SD	--	--	--	7.3	--	--	--	7.1	--
N	--	--	--	75	1	--	--	84	1
BROOD YEAR 1970									
Mean	--	--	76.0	83.7	90.5	--	75.7	83.6	90.5
SD	--	--	8.1	8.6	--	--	8.3	8.6	--
N	--	--	123	48	1	--	126	50	1
BROOD YEAR 1971									
Mean	--	57.1	73.7	86.6	94.8	57.0	73.5	85.1	95.0
SD	--	6.6	8.7	4.8	2.8	6.9	8.8	6.0	2.4
N	--	52	136	26	3	55	140	34	4
BROOD YEAR 1972									
Mean	38.3	53.7	74.7	86.7	88.0	51.7	73.6	85.6	88.0
SD	1.0	7.3	8.1	6.9	--	7.7	8.8	7.2	--
N	5	101	110	47	1	127	121	58	1
BROOD YEAR 1973									
Mean	39.8	55.9	76.4	88.6	101.5	55.3	75.6	88.3	99.8
SD	4.3	4.6	6.8	6.9	--	5.1	7.4	6.9	2.5
N	46	49	82	37	1	52	89	43	2
BROOD YEAR 1974									
Mean	38.1	57.8	76.2	90.3	90.0	57.7	75.8	90.2	92.5
SD	3.2	6.3	9.3	9.1	7.8	6.4	9.4	8.1	7.0
N	80	76	146	46	2	77	151	69	3
BROOD YEAR 1975									
Mean	39.8	55.3	79.0	88.1	85.0	54.3	77.5	87.8	84.7
SD	3.2	6.3	10.2	7.1	4.2	6.7	10.8	7.2	4.7
N	46	83	106	55	12	93	118	61	16
BROOD YEAR 1976									
Mean	39.2	57.8	73.5	83.5	97.0	55.9	73.5	83.6	97.0
SD	3.1	7.1	8.7	6.3	4.5	7.7	8.7	6.2	4.5
N	53	70	132	111	4	85	132	119	4

Appendix Table E-45. Continued.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1977									
Mean	43.6	58.1	74.9	89.8	--	57.6	74.9	89.8	--
SD	1.9	5.1	7.0	10.0	--	5.5	7.0	10.0	--
N	17	20	82	16	0	21	83	16	0
BROOD YEAR 1978									
Mean	42.2	62.2	83.0	93.1	98.5	61.5	82.7	92.2	98.5
SD	4.2	5.9	8.6	8.3	--	6.7	8.7	8.5	--
N	79	87	139	48	1	91	143	55	1
BROOD YEAR 1979									
Mean	42.8	65.1	80.8	79.8	--	64.8	80.7	79.8	--
SD	3.0	6.4	9.5	6.2	--	6.9	9.6	6.2	--
N	23	62	137	19	0	63	138	19	0
BROOD YEAR 1980									
Mean	41.7	57.8	74.4	90.1	72.0	57.6	74.3	90.3	72.0
SD	4.5	6.6	6.9	6.7	--	6.7	6.9	6.6	--
N	80	82	52	42	1	83	53	44	1
BROOD YEAR 1981									
Mean	37.2	54.1	81.8	93.5	--	54.1	81.8	93.2	--
SD	3.1	9.5	6.6	4.5	--	9.5	6.5	4.3	--
N	33	32	38	16	0	32	40	18	0
BROOD YEAR 1982									
Mean	38.6	64.4	82.5	87.1	91.0	62.1	80.3	86.8	91.0
SD	2.8	7.6	9.0	5.7	--	9.0	9.9	5.4	--
N	50	39	37	9	1	46	47	10	1
BROOD YEAR 1983									
Mean	43.4	66.8	82.3	87.7	--	65.7	82.3	87.7	--
SD	4.1	8.4	6.6	8.1	--	9.8	6.6	8.1	--
N	58	41	39	28	0	43	39	28	0
BROOD YEAR 1984									
Mean	38.6	61.5	79.5	83.0	80.0	61.4	77.9	83.0	80.0
SD	4.0	7.0	8.6	24.5	--	6.9	10.0	24.1	--
N	38	45	49	37	1	46	53	38	1

Appendix Table E-45. Continued.

	Subyearling smolts					Subyearling + yearling smolts			
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1985									
Mean	41.9	62.2	82.4	86.6	--	61.9	81.9	86.6	--
SD	4.9	7.5	8.6	5.7	--	7.8	8.9	5.7	--
N	41	39	43	16	0	40	45	16	0
BROOD YEAR 1986									
Mean	41.2	60.6	80.4	85.7	--	60.7	80.4	85.6	--
SD	3.2	6.5	7.2	6.2	--	6.5	7.2	6.1	--
N	40	17	58	32	0	17	58	33	0
BROOD YEAR 1987									
Mean	40.8	61.7	77.9	88.4	94.3	61.3	77.1	88.4	94.3
SD	3.0	5.0	8.6	4.5	2.3	5.2	8.5	4.5	2.3
N	11	20	42	13	3	21	48	13	3
BROOD YEAR 1988									
Mean	40.4	57.9	77.8	86.9	88.3	57.9	77.5	86.5	88.3
SD	5.1	5.8	4.9	6.5	3.7	5.8	5.0	6.5	3.7
N	13	20	28	30	7	20	29	32	7
BROOD YEAR 1989									
Mean	43.7	64.8	78.0	80.7	--	64.8	78.0	80.7	--
SD	2.5	6.7	9.1	7.5	--	6.7	9.1	7.5	--
N	3	6	39	32	--	6	39	32	--
BROOD YEAR 1990									
Mean	41.9	55.9	70.4	--	--	55.9	70.4	--	--
SD	3.3	4.2	7.8	--	--	4.2	7.8	--	--
N	9	34	37	--	--	34	37	--	--
BROOD YEAR 1991									
Mean	40.0	58.7	--	--	--	58.5	--	--	--
SD	4.3	5.6	--	--	--	5.4	--	--	--
N	14	14	--	--	--	15	--	--	--
BROOD YEAR 1992									
Mean	42.0	--	--	--	--	--	--	--	--
SD	2.1	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--

Appendix Table E-46. Mean scale radius (mm at 88x) at the first annulus for wild adult spring chinook salmon, 1969-92 brood years. Subyearling smolts composed all age 2 adults.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1969										
Mean	--	--	--	89.1	103.6	--	--	83.0	103.6	--
SD	--	--	--	16.6	--	--	--	23.8	--	--
N	--	--	--	75	1	--	--	84	1	--
BROOD YEAR 1970										
Mean	--	--	93.6	104.8	100.7	--	92.2	102.5	100.7	--
SD	--	--	17.0	18.3	--	--	19.4	21.5	--	--
N	--	--	123	48	1	--	126	50	1	--
BROOD YEAR 1971										
Mean	--	98.9	108.2	90.4	87.7	95.7	106.4	77.5	77.3	--
SD	--	19.4	22.8	21.0	2.4	23.2	24.9	30.0	25.0	--
N	--	52	136	26	3	55	140	34	4	--
BROOD YEAR 1972										
Mean	96.7	86.3	84.5	87.6	97.1	75.3	79.7	77.1	97.1	78.4
SD	12.4	17.3	19.6	15.5	--	26.9	24.1	26.1	--	36.8
N	5	101	110	47	1	127	121	58	1	312
BROOD YEAR 1973										
Mean	115.8	93.0	106.8	103.3	108.0	89.8	101.4	94.0	71.5	96.7
SD	18.6	22.0	18.6	12.0	--	25.1	25.7	25.8	51.6	39.0
N	46	49	82	37	1	52	89	43	2	232
BROOD YEAR 1974										
Mean	101.5	100.3	112.6	108.8	124.6	99.6	110.0	84.2	96.7	97.0
SD	15.6	18.6	17.5	15.4	19.2	19.5	22.4	37.4	50.1	46.4
N	80	76	146	46	2	77	151	69	3	380
BROOD YEAR 1975										
Mean	107.4	112.3	120.6	122.2	111.3	103.6	111.5	115.1	94.4	108.0
SD	17.2	20.4	14.8	14.6	15.3	31.7	30.5	26.4	33.0	43.9
N	46	83	106	55	12	93	118	61	16	334
BROOD YEAR 1976										
Mean	121.5	120.0	125.6	123.9	121.9	105.6	125.0	118.2	121.9	119.9
SD	16.0	15.9	12.6	13.7	26.7	34.5	14.2	25.2	26.7	33.5
N	53	70	132	111	4	85	133	119	4	394

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table E-46. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1977										
Mean	128.9	131.7	138.0	138.9	--	128.9	137.0	138.9	--	136.9
SD	19.4	16.5	14.4	20.3	--	20.8	16.9	20.3	--	31.0
N	17	20	82	16	0	21	83	16	0	137
BROOD YEAR 1978										
Mean	124.6	134.9	133.8	133.1	114.4	130.8	131.2	120.9	114.0	128.2
SD	13.7	14.0	16.3	15.6	--	23.8	22.3	35.5	--	26.7
N	79	87	139	48	1	91	143	55	1	369
BROOD YEAR 1979										
Mean	146.6	133.7	143.7	127.5	--	132.7	143.0	127.5	--	139.1
SD	11.6	18.0	18.1	14.8	--	19.3	20.0	14.8	--	19.5
N	23	62	137	19	0	63	138	19	0	243
BROOD YEAR 1980										
Mean	118.8	129.9	116.3	123.5	89.2	128.9	115.2	120.3	89.2	118.6
SD	17.3	18.9	17.4	13.4	--	20.7	19.2	19.9	--	23.3
N	80	82	52	42	1	83	53	44	1	261
BROOD YEAR 1981										
Mean	112.9	116.2	118.9	109.8	--	116.2	115.2	103.4	--	113.0
SD	19.6	20.0	13.6	11.5	--	20.0	20.9	21.5	--	28.8
N	33	32	38	16	0	32	40	18	0	123
BROOD YEAR 1982										
Mean	113.4	117.0	114.0	124.2	123.9	106.7	99.5	116.8	123.9	104.8
SD	11.2	13.9	17.2	14.9	--	28.3	32.3	27.2	--	42.3
N	50	39	37	9	1	46	47	10	1	154
BROOD YEAR 1983										
Mean	124.3	129.0	140.5	119.9	--	125.3	140.5	119.9	--	131.4
SD	13.7	14.6	11.6	13.1	--	21.9	11.6	13.1	--	17.1
N	58	41	39	28	0	43	39	28	0	168
BROOD YEAR 1984										
Mean	131.1	133.5	124.2	108.4	75.1	131.4	117.7	107.1	75.1	119.6
SD	12.2	15.6	14.6	11.0	--	21.0	27.0	13.7	--	30.5
N	38	45	49	37	1	46	53	38	1	176

Appendix Table E-46. Continued.

	Subyearling smolts					Subyearling + yearling smolts				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 2-6[a]
BROOD YEAR 1985										
Mean	135.8	133.5	117.0	106.2	--	131.1	113.7	106.1	--	122.6
SD	16.7	14.5	21.2	13.9	--	21.1	25.8	13.9	--	23.8
N	41	39	43	16	0	40	45	16	0	142
BROOD YEAR 1986										
Mean	116.3	108.5	111.5	113.5	126.0	108.5	111.5	112.2	126.0	112.0
SD	10.4	15.5	13.7	13.8	--	15.5	13.7	15.3	--	15.7
N	40	17	58	32	1	17	58	33	1	149
BROOD YEAR 1987										
Mean	128.1	124.0	124.8	117.3	108.9	122.5	118.6	117.3	108.9	119.2
SD	10.4	18.4	18.8	15.6	7.9	19.3	24.3	15.6	7.9	20.2
N	11	20	42	19	3	21	48	19	3	102
BROOD YEAR 1988										
Mean	129.8	120.7	117.4	107.4	133.1	120.7	116.6	105.2	133.1	114.5
SD	14.4	12.6	14.2	12.5	11.0	12.6	15.3	14.9	11.0	15.7
N	13	20	57	30	7	20	58	32	7	130
BROOD YEAR 1989										
Mean	123.5	125.1	115.3	118.9	--	125.1	115.3	118.9	--	113.9
SD	1.2	19.4	13.0	13.0	--	19.4	13.0	13.0	--	14.4
N	3	23	39	32	--	23	39	32	--	97
BROOD YEAR 1990										
Mean	127.0	118.7	122.3	--	--	118.7	122.3	--	--	--
SD	15.0	11.9	16.9	--	--	11.9	16.9	--	--	--
N	22	34	37	--	--	34	37	--	--	--
BROOD YEAR 1991										
Mean	119.0	112.2	--	--	--	108.8	--	--	--	--
SD	25.5	9.7	--	--	--	16.0	--	--	--	--
N	14	14	--	--	--	15	--	--	--	--
BROOD YEAR 1992										
Mean	130.6	--	--	--	--	--	--	--	--	--
SD	0.1	--	--	--	--	--	--	--	--	--
N	2	--	--	--	--	--	--	--	--	--

Appendix Table E-47. Regression analysis of the mean scale radius of wild spring when the first annulus formed on scales of fish that entered the ocean as subyearlings, 1972-89 brood years. Data are described in Appendix Table E-49.

Independent variable	Regression coefficient	Standard error	*P*
Freshwater growth rate	68.05	25.96	<0.001
Constant	-17.12		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1,669	1	1,669	27.87	<0.001
Residual	958	16	60		

Appendix Table E-48. Correlation matrix for variables examined in the analysis of the size of wild spring at the time the first annulus formed, 1972-89 brood years. Data are described in Appendix Table E-49.

	Size at annulus 1	Size at ocean entry	Freshwater growth rate	Upwelling			Ocean temperature		
				Summer	Autumn	Winter	Summer	Autumn	Winter
Size at annulus 1	1.00								
Size at ocean entry	0.57[a]	1.00							
Freshwater growth rate	0.80[a]	0.78[a]	1.00						
Summer upwelling	-0.26	-0.44	-0.28	1.00					
Autumn upwelling	-0.25	-0.49[a]	-0.52[a]	0.23	1.00				
Winter upwelling	-0.22	-0.24	-0.44	0.14	0.11	1.00			
Summer temperature	0.01	0.08	-0.01	-0.26	-0.09	0.14	1.00		
Autumn temperature	0.28	0.24	0.30	-0.16	-0.74[a]	-0.12	0.28	1.00	
Winter temperature	0.25	0.36	0.44	-0.13	-0.48	-0.71[a]	-0.12	0.43	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table E-49. Data used to assess factors related to the size of wild spring chinook salmon when the first annulus formed, 1972-89 brood years. Data includes only those fish that entered the ocean as subyearlings.

Brood year	Size at annulus 1[a]	Size at ocean entry[b]	Freshwater growth rate[c]	Upwelling[d]			Ocean temperature[e]		
				Summer	Autumn	Winter	Summer	Autumn	Winter
1972	86.6	40.6	1.76	509	-16	-141	12.2	11.6	9.8
1973	104.8	42.5	1.85	399	57	-99	12.0	11.1	9.7
1974	110.5	39.0	1.87	476	44	-26	11.9	11.8	9.0
1975	118.4	40.0	1.97	305	36	-105	12.5	11.4	10.0
1976	123.8	44.2	2.05	474	18	-348	12.0	11.8	11.1
1977	137.5	45.4	2.14	352	45	-96	12.3	11.8	8.8
1978	132.2	44.3	2.05	261	-84	-277	13.0	13.4	10.9
1979	139.8	48.0	2.20	414	-20	-334	12.3	12.0	11.6
1980	120.2	44.7	2.02	357	-55	-143	12.7	12.7	10.3
1981	117.0	45.4	2.12	214	-35	-566	12.1	12.5	11.5
1982	116.5	49.1	2.12	181	-81	-124	13.4	12.6	10.9
1983	132.3	52.8	2.29	345	-90	-27	11.7	12.3	10.0
1984	124.1	48.4	2.16	232	23	-421	11.5	10.9	10.0
1985	124.9	47.4	2.03	230	4	-203	11.6	11.1	10.6
1986	112.4	41.7	1.91	287	7	-130	11.6	11.4	10.4
1987	121.7	41.7	1.91	323	-8	-5	11.5	11.7	9.4
1988	115.8	44.4	1.88	315	29	-48	12.4	11.4	9.8
1989	113.9	46.1	1.83	213	58	-64	12.8	12.2	9.6

[a] *Mean scale radius (mm at 88x) at annulus 1 for subyearling smolts.*
[b] *Mean scale radius (mm at 88x) at ocean entry for subyearling smolts.*
[c] *Average spacing (mm at 88x) of freshwater circuli for subyearling smolts.*
[d] *Sum of Bakun units near Crescent City, California. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February.*
[e] *Mean surface temperature (^{o}C) at Coos Bay, Oregon. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February..*

Appendix Table E-50. Mean scale radius (mm at 88x) at the second annulus for wild adult spring chinook salmon, 1969-91 brood years.

	Subyearling smolts				Subyearling + yearling smolts				
	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3-6[a]
BROOD YEAR 1969									
Mean	--	--	186.4	228.1	--	--	180.4	228.1	--
SD	--	--	21.7	--	--	--	27.0	--	--
N	--	--	75	1	--	--	84	1	--
BROOD YEAR 1970									
Mean	--	196.5	207.0	207.6	--	194.8	206.2	207.6	--
SD	--	25.5	27.3	--	--	27.9	27.1	--	--
N	--	123	48	1	--	126	50	1	--
BROOD YEAR 1971									
Mean	199.1	215.2	207.4	214.5	195.9	213.5	194.6	203.4	--
SD	28.0	29.8	29.9	38.8	30.5	31.1	35.2	38.7	--
N	52	136	26	3	55	140	34	4	--
BROOD YEAR 1972									
Mean	214.7	218.6	211.6	215.7	203.1	212.0	201.0	215.7	205.2
SD	30.8	23.2	22.6	--	36.8	30.6	31.8	--	44.9
N	101	110	47	1	127	121	58	1	307
BROOD YEAR 1973									
Mean	222.5	227.7	199.0	219.0	218.0	222.4	194.9	180.8	206.1
SD	22.1	25.8	15.2	--	28.1	31.7	19.4	54.1	33.2
N	49	82	37	1	52	89	43	2	186
BROOD YEAR 1974									
Mean	232.7	219.1	209.0	223.8	231.6	217.3	199.8	209.6	209.4
SD	31.3	25.8	21.9	41.5	32.6	27.3	26.2	38.4	33.3
N	76	146	46	2	77	151	69	3	300
BROOD YEAR 1975									
Mean	217.6	227.2	228.4	218.0	212.0	221.0	224.4	207.6	218.2
SD	28.9	25.0	22.2	28.2	32.0	30.4	24.9	31.2	39.3
N	83	106	55	12	93	118	61	16	288
BROOD YEAR 1976									
Mean	229.4	240.1	227.6	216.0	219.9	239.8	224.5	216.0	228.2
SD	29.5	23.3	20.4	27.6	34.6	23.5	23.1	27.6	34.0
N	70	132	111	4	85	133	119	4	341

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table E-50. Continued.

	Subyearling smolts				Subyearling + yearling smolts				
	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3-6[a]
BROOD YEAR 1977									
Mean	247.8	242.2	237.7	--	244.2	241.9	237.7	--	239.9
SD	28.8	20.9	36.3	--	32.6	20.9	36.3	--	53.8
N	20	82	16	0	21	83	16	0	120
BROOD YEAR 1978									
Mean	257.4	253.0	239.4	222.4	253.5	251.3	231.7	224.4	247.3
SD	21.9	27.0	21.0	--	28.3	28.5	29.1	--	31.1
N	87	139	48	1	91	143	55	1	290
BROOD YEAR 1979									
Mean	259.4	260.7	238.9	--	257.2	260.0	238.9	--	256.8
SD	26.0	32.3	21.9	--	30.8	33.1	21.9	--	31.5
N	61	137	19	0	62	138	19	0	219
BROOD YEAR 1980									
Mean	245.8	224.8	212.5	185.1	245.1	224.1	211.5	185.1	218.7
SD	27.2	26.2	18.5	--	27.5	26.5	18.6	--	25.7
N	82	52	42	1	83	53	44	1	181
BROOD YEAR 1981									
Mean	205.4	211.3	199.6	--	205.4	208.8	198.5	--	206.6
SD	38.8	23.1	17.8	--	38.8	25.1	18.4	--	29.7
N	32	38	16	0	32	40	18	0	90
BROOD YEAR 1982									
Mean	243.7	239.3	237.0	204.5	234.6	226.2	229.1	204.5	228.1
SD	29.0	24.4	16.1	--	34.9	37.0	29.1	--	41.2
N	39	37	9	1	46	47	10	1	104
BROOD YEAR 1983									
Mean	264.8	257.7	224.2	--	260.3	257.7	224.2	--	250.5
SD	24.2	22.9	23.9	--	31.4	23.0	23.9	--	26.0
N	41	39	28	0	43	39	28	0	110
BROOD YEAR 1984									
Mean	247.9	235.2	210.1	176.1	246.7	230.3	209.4	176.1	229.6
SD	26.9	24.9	21.0	--	27.8	29.4	21.2	--	33.5
N	45	49	37	1	46	53	38	1	138

Appendix Table E-50. Continued.

	Subyearling smolts				Subyearling + yearling smolts				
	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3-6[a]
BROOD YEAR 1985									
Mean	246.4	226.1	205.4	--	244.6	223.4	205.4	--	230.6
SD	25.4	25.5	25.0	--	27.6	28.0	25.0	--	27.8
N	39	43	16	0	40	45	16	0	101
BROOD YEAR 1986									
Mean	213.5	226.5	212.8	222.6	213.5	226.5	211.4	222.6	220.6
SD	25.4	23.2	20.7	--	25.4	23.2	21.9	--	23.6
N	17	58	32	1	17	58	33	1	109
BROOD YEAR 1987									
Mean	220.1	225.1	205.6	179.8	219.0	221.1	205.6	179.8	213.3
SD	22.5	25.9	22.0	15.7	22.6	26.5	22.0	15.7	26.0
N	20	42	19	3	21	48	19	3	91
BROOD YEAR 1988									
Mean	197.7	198.2	185.2	215.2	197.7	197.7	184.1	215.2	193.7
SD	21.3	22.9	21.5	22.8	21.3	23.0	21.8	22.8	23.6
N	20	57	30	7	20	58	32	7	117
BROOD YEAR 1989									
Mean	218.8	204.9	205.6	--	218.9	204.8	205.6	--	199.4
SD	38.6	23.7	18.2	--	38.6	23.7	18.2	--	22.6
N	22	39	32	--	22	39	32	--	93
BROOD YEAR 1990									
Mean	206.4	205.2	--	--	206.4	205.2	--	--	--
SD	21.3	21.6	--	--	21.3	21.6	--	--	--
N	34	37	--	--	34	37	--	--	--
BROOD YEAR 1991									
Mean	230.0	--	--	--	228.1	--	--	--	--
SD	32.5	--	--	--	32.0	--	--	--	--
N	14	--	--	--	15	--	--	--	--

Appendix Table E-51. Regression analysis of the mean scale radius at the second annulus for wild spring chinook salmon, 1972-89 brood years. Data are described in Appendix Table E-53.

Independent variable	Regression coefficient	Standard error	*P*
Size at annulus one	9.847×10^{-1}	1.353×10^{-1}	<0.001
Autumn upwelling	-3.734×10^{-1}	0.608×10^{-1}	<0.001
Spring upwelling	1.322×10^{-1}	0.308×10^{-1}	0.001
Autumn temperature	-22.876	4.317	<0.001
Winter temperature	-6.020	2.685	0.045
Constant	430.4		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	4,919	5	984	19.18	<0.001
Residual	616	12	51		

Variables tested	Partial r^2				
	Step 1	Step 2	Step 3	Step 4	Step 5
Size at annulus one	0.52	--	--	--	--
Summer upwelling	0.00	0.11	0.18	0.31	0.18
Autumn upwelling	0.26	0.12	--	--	--
Winter upwelling	0.11	0.00	0.01	0.01	0.13
Spring upwelling	0.01	0.01	0.06	0.35	--
Summer temperature	0.01	0.11	0.14	0.04	0.00
Autumn temperature	0.04	0.02	0.23	--	--
Winter temperature	0.08	0.00	0.01	0.02	0.20
Spring temperature	0.05	0.01	0.05	0.04	0.01

Appendix Table E-52. Correlation matrix for variables examined in the analysis of the size of wild spring at the time the second annulus formed , 1974-89 brood years. Data are described in Appendix Table E-48.

	Size at annulus 2	Size at annulus 1	Upwelling				Ocean temperature			
			Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Size at annulus 2	1.00									
Size at annulus 1	0.72[a]	1.00								
Summer upwelling	-0.03	-0.35	1.00							
Autumn upwelling	-0.51[a]	-0.40	0.27	1.00						
Winter upwelling	-0.33	-0.41	0.18	0.10	1.00					
Spring upwelling	-0.08	-0.22	0.63[a]	0.34	-0.24	1.00				
Summer temperature	-0.09	0.21	-0.18	-0.16	0.10	0.14	1.00			
Autumn temperature	0.19	0.40	-0.22	-0.73[a]	-0.09	-0.12	0.45[a]	1.00		
Winter temperature	0.28	0.38	-0.24	-0.46[a]	-0.71[a]	0.00	0.08	0.37	1.00	
Spring temperature	0.21	0.33	-0.05	-0.39	0.25	-0.25	0.48[a]	0.36	0.16	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-53. Data used to assess factors related to the size of wild spring chinook salmon when the second annulus formed, 1972-89 brood years. Data includes fish of all smolt ages.

Brood year	Size at annulus 2[a]	Size at annulus 1[b]	Upwelling[c]				Ocean temperature[d]			
			Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1972	205.2	78.3	399	57	-99	167	12.0	11.1	9.7	9.7
1973	206.1	95.9	476	44	-26	196	11.9	11.8	9.0	9.0
1974	209.4	96.9	305	36	-105	167	12.5	11.4	10.0	10.0
1975	218.2	108.0	474	18	-348	107	12.0	11.8	11.1	11.1
1976	228.2	119.8	352	45	-96	121	12.3	11.8	8.8	8.8
1977	239.9	137.4	261	-84	-277	116	13.0	13.4	10.9	10.9
1978	247.3	128.9	414	-20	-334	150	12.3	12.0	11.6	11.6
1979	256.8	138.8	357	-55	-143	109	12.7	12.7	10.3	10.3
1980	218.7	118.6	214	-35	-566	190	12.1	12.5	11.5	11.5
1981	206.6	113.0	181	-81	-124	-65	13.4	12.6	10.9	10.9
1982	228.1	104.4	345	-90	-27	30	11.7	12.3	10.0	10.0
1983	250.5	131.8	232	23	-421	58	11.5	10.9	10.0	10.0
1984	229.6	118.1	230	4	-203	42	11.6	11.1	10.6	10.6
1985	230.6	120.4	287	7	-130	42	11.6	11.4	10.4	10.4
1986	220.6	111.5	323	-8	-5	30	11.5	11.7	9.4	9.4
1987	213.3	118.3	315	29	-48	28	12.4	11.4	9.8	9.8
1988	193.7	113.7	213	58	-64	57	12.8	12.2	9.6	9.6
1989	199.4	113.8	389	105	-269	185	11.6	11.3	10.4	10.4

[a] *Mean scale radius (mm at 88x) at annulus 2.*
[b] *Mean scale radius (mm at 88x) at annulus 1.*
[c] *Sum of Bakun units near Crescent City, California. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February; spring represents the period of March-May.*
[d] *Mean surface temperature (^{o}C) at Coos Bay, Oregon. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February; spring represents the period of March-May.*

Appendix Table E-54. Mean scale radius (mm at 88x) at the third annulus for wild adult spring chinook salmon, 1969-90 brood years.

	Subyearling smolts			Subyearling + yearling smolts			
	Age 4	Age 5	Age 6	Age 4	Age 5	Age 6	Age 4-6[a]
BROOD YEAR 1969							
Mean	--	256.4	292.2	--	252.5	292.2	--
SD	--	28.9	--	--	30.7	--	--
N	--	75	1	--	84	1	--
BROOD YEAR 1970							
Mean	266.6	280.2	274.0	265.4	280.1	274.0	--
SD	30.8	36.9	--	31.7	36.2	--	--
N	123	48	1	126	50	1	--
BROOD YEAR 1971							
Mean	297.7	300.7	312.4	296.9	291.4	307.2	--
SD	36.6	27.6	36.1	36.3	30.7	31.2	--
N	136	26	3	140	34	4	--
BROOD YEAR 1972							
Mean	296.2	290.8	291.3	293.3	283.2	291.3	287.1
SD	30.8	28.2	--	31.3	32.2	--	37.4
N	110	47	1	121	58	1	180
BROOD YEAR 1973							
Mean	312.7	286.7	289.0	309.5	284.4	257.0	293.6
SD	33.1	24.2	--	34.4	24.7	45.3	32.6
N	82	37	1	89	43	2	134
BROOD YEAR 1974							
Mean	302.0	294.7	282.8	300.0	290.1	269.4	294.1
SD	38.7	30.9	42.9	40.3	32.5	38.3	38.5
N	146	46	2	151	69	3	223
BROOD YEAR 1975							
Mean	307.3	308.5	279.6	302.7	306.3	277.6	297.7
SD	36.9	29.7	21.1	39.2	30.9	18.9	32.4
N	106	55	12	118	61	16	195
BROOD YEAR 1976							
Mean	321.6	299.7	277.4	321.6	298.9	277.4	304.4
SD	38.8	27.4	24.4	38.8	27.4	24.4	35.2
N	132	111	4	133	119	4	256

[a] *Adjusted for age selective mortality that resulted from ocean harvest and the El Niño event of 1982-83.*

Appendix Table E-54. Continued.

	Subyearling smolts			Subyearling + yearling smolts			
	Age 4	Age 5	Age 6	Age 4	Age 5	Age 6	Age 4-6[a]
BROOD YEAR 1977							
Mean	328.8	317.2	--	328.8	317.2	--	322.2
SD	31.9	44.8	--	31.6	44.8	--	57.4
N	58	16	0	59	16	0	75
BROOD YEAR 1978							
Mean	342.4	328.1	298.5	341.3	321.8	298.5	336.4
SD	36.2	29.3	--	36.2	33.1	--	35.7
N	130	48	1	134	55	1	190
BROOD YEAR 1979							
Mean	336.5	300.4	--	336.5	300.4	--	330.8
SD	37.6	28.4	--	37.6	28.4	--	36.2
N	120	19	0	120	19	0	139
BROOD YEAR 1980							
Mean	285.2	270.0	228.2	284.2	269.3	228.2	273.2
SD	32.3	25.5	--	32.8	25.3	--	27.7
N	52	42	1	53	44	1	98
BROOD YEAR 1981							
Mean	315.2	299.2	--	313.2	299.6	--	310.4
SD	33.8	30.7	--	34.4	31.0	--	34.9
N	38	16	0	40	18	0	58
BROOD YEAR 1982							
Mean	327.1	290.6	291.5	317.7	288.5	291.5	310.2
SD	35.2	21.1	--	40.2	21.0	--	35.6
N	36	9	1	46	10	1	57
BROOD YEAR 1983							
Mean	337.8	301.2	--	337.8	301.2	--	326.3
SD	31.4	32.2	--	31.4	32.2	--	32.3
N	39	28	0	39	28	0	67
BROOD YEAR 1984							
Mean	314.5	280.7	257.8	309.7	280.0	257.8	304.0
SD	34.4	24.7	--	37.6	24.6	--	41.0
N	49	37	1	53	38	1	92

Appendix Table E-54. Continued.

	Subyearling smolts			Subyearling + yearling smolts			
	Age 4	Age 5	Age 6	Age 4	Age 5	Age 6	Age 4-6[a]
BROOD YEAR 1985							
Mean	308.8	274.3	--	307.3	274.3	--	300.4
SD	41.5	29.7	--	41.2	29.7	--	39.9
N	42	16	0	44	16	0	60
BROOD YEAR 1986							
Mean	300.0	285.5	312.4	300.0	284.2	312.4	294.4
SD	30.9	24.8	--	30.9	25.5	--	29.3
N	57	32	1	57	33	1	91
BROOD YEAR 1987							
Mean	287.3	265.1	246.9	282.5	265.1	246.9	273.2
SD	31.3	29.2	14.3	32.1	29.2	14.3	32.5
N	42	19	3	48	19	3	70
BROOD YEAR 1988							
Mean	280.1	267.8	280.0	279.9	266.0	280.0	273.9
SD	28.1	30.2	25.2	27.9	30.2	25.2	29.5
N	54	30	7	55	32	7	94
BROOD YEAR 1989							
Mean	276.7	271.7	--	276.7	271.7	--	265.6
SD	30.4	26.5	--	30.4	26.5	--	27.6
N	39	32	--	39	32	--	71
BROOD YEAR 1990							
Mean	279.3	--	--	279.3	--	--	--
SD	30.0	--	--	30.0	--	--	--
N	37	--	--	37	--	--	--

Appendix Table E-55. Regression analysis of the mean scale radius at the third annulus for wild spring chinook salmon, 1972-89 brood years. Data are described in Appendix Table E-57.

Independent variable	Regression coefficient	Standard error	*P*
Size at annulus two	9.717×10^{-1}	1.191×10^{-1}	<0.001
Summer upwelling	5.798×10^{-2}	2.258×10^{-2}	0.023
Autumn upwelling	-10.118×10^{-2}	3.897×10^{-2}	0.022
Summer temperature	-10.897	3.343	0.006
Constant	200.0		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	6,627	4	1,657	32.70	<0.001
Residual	659	13	51		

Variables tested	Partial r^2 Step 1	Step 2	Step 3	Step 4
Size at annulus two	0.74	--	--	--
Summer upwelling	0.00	0.26	0.18	--
Autumn upwelling	0.22	0.02	0.16	0.23
Winter upwelling	0.18	0.00	0.01	0.01
Spring upwelling	0.01	0.06	0.04	0.00
Summer temperature	0.09	0.31	--	--
Autumn temperature	0.02	0.02	0.07	0.05
Winter temperature	0.13	0.01	0.00	0.00
Spring temperature	0.03	0.13	0.01	0.01

Appendix Table E-56. Correlation matrix for variables examined in the analysis of the size of wild spring at the time the third annulus formed , 1974-89 brood years. Data are described in Appendix Table E-57.

	Size at annulus 3	Size at annulus 2	Upwelling				Ocean temperature			
			Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Size at annulus 3	1.00									
Size at annulus 2	0.86[a]	1.00								
Summer upwelling	-0.38	-0.38	1.00							
Autumn upwelling	-0.45	-0.45	0.30	1.00						
Winter upwelling	-0.49[a]	-0.49[a]	0.15	0.08	1.00					
Spring upwelling	-0.05	-0.05	0.51[a]	0.40	-0.35	1.00				
Summer temperature	-0.02	-0.02	-0.27	-0.32	0.13	-0.11	1.00			
Autumn temperature	0.23	0.23	-0.13	-0.70[a]	-0.06	0.00	0.66[a]	1.00		
Winter temperature	0.45	0.45	-0.16	-0.43	-0.72[a]	0.05	0.16	0.31	1.00	
Spring temperature	0.02	0.02	-0.11	-0.38	0.27	-0.35	0.53[a]	0.37	0.17	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table E-57. Data used to assess factors related to the size of wild spring chinook salmon when the second annulus formed, 1972-89 brood years. Data includes fish of all smolt ages.

Brood year	Size at annulus 3[a]	Size at annulus 2[b]	Upwelling[c]				Ocean temperature[d]			
			Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
1972	287.1	205.2	476	44	-26	196	11.9	11.8	9.0	9.0
1973	293.6	206.1	305	36	-105	167	12.5	11.4	10.0	10.0
1974	294.1	209.4	474	18	-348	107	12.0	11.8	11.1	11.1
1975	297.7	218.2	352	45	-96	121	12.3	11.8	8.8	8.8
1976	304.4	228.2	261	-84	-277	116	13.0	13.4	10.9	10.9
1977	322.2	239.9	414	-20	-334	150	12.3	12.0	11.6	11.6
1978	336.4	247.3	357	-55	-143	109	12.7	12.7	10.3	10.3
1979	330.8	256.8	214	-35	-566	190	12.1	12.5	11.5	11.5
1980	273.2	218.7	181	-81	-124	-65	13.4	12.6	10.9	10.9
1981	310.4	206.6	345	-90	-27	30	11.7	12.3	10.0	10.0
1982	310.2	228.1	232	23	-421	58	11.5	10.9	10.0	10.0
1983	326.3	250.5	230	4	-203	42	11.6	11.1	10.6	10.6
1984	304.0	229.6	287	7	-130	42	11.6	11.4	10.4	10.4
1985	300.4	230.6	323	-8	-5	30	11.5	11.7	9.4	9.4
1986	294.4	220.6	315	29	-48	28	12.4	11.4	9.8	9.8
1987	273.2	213.3	213	58	-64	57	12.8	12.2	9.6	9.6
1988	273.9	193.7	389	105	-269	185	11.6	11.3	10.4	10.4
1989	265.6	199.4	342	31	-96	142	12.8	11.8	10.1	12.8

[a] *Mean scale radius (mm at 88x) at annulus 3.*
[b] *Mean scale radius (mm at 88x) at annulus 2.*
[c] *Sum of Bakun units near Crescent City, California. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February; spring represents the period of March-May.*
[d] *Mean surface temperature (^{o}C) at Coos Bay, Oregon. Summer represents the period of July-September; autumn represents the period of September-November; winter represents the period of December-February; spring represents the period of March-May.*

Appendix Table E-58. Estimated probability of maturation at age 2 through age 5 for spring chinook salmon produced upstream of Gold Ray Dam, 1969-89 brood years. Probability of maturity at age 6 equaled 1.0.

Brood	Wild				Hatchery[a]			
year	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1969	--	--	--	0.933	--	--	--	1.000
1970	--	--	0.288	0.923	--	--	0.342	1.000
1971	--	0.058	0.319	0.845	--	0.000	0.438	1.000
1972	0.0016	0.050	0.313	0.955	0.0000	0.082	0.636	1.000
1973	0.0135	0.032	0.350	0.926	0.0032	0.006	0.249	1.000
1974	0.0102	0.033	0.412	0.928	0.0028	0.015	0.236	0.633
1975	0.0025	0.057	0.330	0.525	0.0000	0.113	0.495	0.602
1976	0.0240	0.050	0.284	0.814	0.0091	0.048	0.379	0.688
1977	0.0217	0.053	0.376	1.000	0.0203	0.098	0.463	1.000
1978	0.0671	0.087	0.715	0.954	0.0483	0.129	0.740	1.000
1979	0.0070	b	0.809	1.000	0.0066	b	0.681	1.000
1980	b	0.085	0.319	0.922	b	0.137	0.377	1.000
1981	0.0138	0.039	0.756	1.000	0.0119	0.047	0.832	1.000
1982	0.0202	0.114	0.698	1.000	0.0186	0.102	0.604	1.000
1983	0.0241	0.201	0.635	1.000	0.0089	0.120	0.661	1.000
1984	0.0481	0.139	0.778	0.914	0.1021	0.220	0.865	1.000
1985	0.0658	0.373	0.750	1.000	0.0389	0.115	0.846	0.960
1986	0.0414	0.050	0.591	1.000	0.0121	0.139	0.588	0.866
1987	0.0362	0.095	0.442	0.912	0.0311	0.088	0.528	1.000
1988	0.0176	0.056	0.417	0.801	0.0119	0.060	0.686	0.905
1989	0.0024	0.018	0.408	--	0.0035	0.030	0.454	--

[a] *Includes only those fish released after 1 August.*
[b] *Not estimated because of the El Niño event of 1982-83.*

Appendix Table E-59. Indexes of ocean physical factors examined in analyses of factors related to maturity rates of chinook salmon. Variables are described in Appendix Table E-60. Data for spring represent conditions in year i+1.

	Upwelling				Water temperature			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Summer upwelling	1.00							
Autumn upwelling	0.29	1.00						
Winter upwelling	0.01	0.05	1.00					
Spring upwelling	0.12	0.12	0.14	1.00				
Summer temperature	-0.16	0.05	0.06	0.45[a]	1.00			
Autumn temperature	-0.25	-0.72[a]	-0.14	-0.03	0.23	1.00		
Winter temperature	-0.11	-0.39[a]	-0.68[a]	-0.06	0.01	0.44[a]	1.00	
Spring temperature	0.06	-0.10	-0.18	-0.39[a]	0.02	0.12	0.15	1.00

Appendix Table E-60. Indexes of ocean physical factors examined in analyses of factors related to maturity rates of chinook salmon.

	Upwelling[a]				Water temperature[b]			
Year	Summer[c]	Autumn[d]	Winter[e]	Spring[f]	Summer[c]	Autumn[d]	Winter[e]	Spring[f]
1969	535	38	-337	--	12.5	11.4	10.3	--
1970	412	23	-60	63	11.6	10.7	9.0	11.0
1971	246	44	-76	226	13.7	11.1	8.7	10.6
1972	369	70	-185	148	13.4	11.1	9.6	10.1
1973	509	-16	-141	127	12.2	11.6	9.8	11.1
1974	399	57	-99	263	12.0	11.1	9.7	11.5
1975	476	44	-26	167	11.9	11.8	9.0	10.5
1976	305	36	-105	196	12.5	11.4	10.0	10.2
1977	474	18	-348	167	12.0	11.8	11.1	9.8
1978	352	45	-96	107	12.3	11.8	8.8	10.6
1979	261	-84	-277	121	13.0	13.4	10.9	11.2
1980	414	-20	-334	116	12.3	12.0	11.6	10.9
1981	357	-55	-143	150	12.7	12.7	10.3	11.5
1982	214	-35	-566	109	12.1	12.5	11.5	11.6
1983	181	-81	-124	190	13.4	12.6	10.9	10.5
1984	345	-90	-27	-65	11.7	12.3	10.0	12.3
1985	232	23	-421	30	11.5	10.9	10.0	11.4
1986	230	4	-203	58	11.6	11.1	10.6	9.9
1987	287	7	-130	42	11.6	11.4	10.4	11.2
1988	323	-8	-5	42	11.5	11.7	9.4	11.0
1989	315	29	-48	30	12.4	11.4	9.8	10.7
1990	213	58	-64	28	12.8	12.2	9.6	10.9
1991	389	105	-269	57	11.6	11.3	10.4	11.0
1992	342	31	-96	185	12.8	11.8	10.1	10.4
1993	397	83	-146	142	13.5	11.1	10.5	12.8
1994	386	47	-441	-42	12.7	11.8	10.5	12.4

[a] *Sum of Bakun units near Crescent City, California.*
[b] *Mean surface temperature (^{o}C) at Coos Bay, Oregon.*
[c] *June-August.*
[d] *September-November.*
[e] *December-February.*
[f] *March-May in year i+1.*

Appendix Table E-61. Correlation matrix for biological variables examined in the analysis of the maturation probability at age 2 for wild spring chinook salmon, 1972-89 brood years. Maturity rates were logit transformed prior to analysis. Correlation matrix for physical parameters of the ocean are in Appendix Table E-59.

	Maturity rate	Size at annulus 1[b]	Smolt length[c]	Growth rate[d]
Maturity rate	1.00			
Size at annulus 1	0.50[a]	1.00		
Smolt length	0.33	0.57[a]	1.00	
Freshwater growth rate	0.43	0.80[a]	0.78[a]	1.00
Summer upwelling	-0.35	-0.26	-0.44	-0.28
Autumn upwelling	-0.31	-0.25	-0.49[a]	-0.52[a]
Winter upwelling	-0.19	-0.22	-0.24	-0.44
Spring upwelling	-0.46	-0.23	-0.34	-0.43
Summer temperature	-0.32	0.01	0.08	-0.01
Autumn temperature	0.04	0.28	0.24	0.30
Winter temperature	0.17	0.25	0.36	0.44
Spring temperature	0.28	0.34	0.24	0.40

[a] *Significant at <0.05.*
[b] *Scale radius at annulus 1 for completed broods.*
[c] *Scale radius at ocean entry for completed broods.*
[d] *Average spacing of freshwater circuli for completed broods.*

Appendix Table E-62. Correlation matrix for biological variables examined in the analyses of the maturation probability at age 3-5 wild spring chinook salmon. Maturity rates were logit transformed prior to analysis. Correlation matrix for physical parameters of the ocean are in Appendix Table E-59.

	Age 3		Age 4		Age 5	
	Maturity rate	Size at annulus 2[b]	Maturity rate	Size at annulus 3[c]	Maturity rate	Size at annulus 4[d]
Maturity rate	1.00		1.00		1.00	
Size at annulus 2	0.62[a]	1.00	--	--	--	--
Size at annulus 3	--	--	0.58[a]	1.00	--	--
Size at annulus 4	--	--	--	--	0.13	1.00
Summer upwelling	-0.31	-0.03	-0.39	-0.07	-0.50[a]	-0.23
Autumn upwelling	-0.26	-0.51[a]	-0.25	-0.47[a]	0.04	-0.36
Winter upwelling	-0.18	-0.33	-0.18	-0.42	0.06	-0.59[a]
Spring upwelling	-0.50[a]	-0.12	-0.54[a]	-0.07	-0.12	-0.01
Summer temperature	-0.36	-0.09	-0.49[a]	-0.30	-0.03	-0.06
Autumn temperature	-0.21	0.19	-0.07	0.12	-0.28	0.18
Winter temperature	0.19	0.28	0.14	0.35	-0.04	0.24
Spring temperature	-0.16	0.02	0.00	-0.16	-0.21	-0.10

[a] *Significant at P <0.05.*
[b] *Scale radius at annulus 2 for completed broods.*
[c] *Scale radius at annulus 3 for completed broods.*
[d] *Scale radius at annulus 4 for completed broods.*

Appendix Table E-63. Correlation matrix for biological variables examined in the analyses of the maturation probability at age 2, 3, and 4 for spring chinook salmon of hatchery origin as identified by scale interpretations. Maturity rates were logit transformed prior to analysis. Estimates are the means for those fish released from the hatchery after 1 August. Correlation matrix for physical parameters of the ocean are in Appendix Table E-59.

	Maturity rate at age 2			Maturity rate at age 3			Maturity rate at age 4		
	Maturity rate	Release date	Release weight	Maturity rate	Release date	Release weight	Maturity rate	Release date	Release weight
Maturity rate	1.00			1.00			1.00		
Release date	-0.57[a]	1.00		-0.65[a]	1.00		-0.58[a]	1.00	
Release weight	-0.55[a]	0.60[a]	1.00	-0.15	0.57[a]	1.00	-0.40	0.50[a]	1.00
Summer upwelling	-0.54[a]	0.63[a]	0.43	-0.55[a]	0.61[a]	0.12	-0.20	0.57[a]	0.17
Autumn upwelling	-0.31	0.18	0.12	-0.18	-0.10	0.00	-0.11	-0.08	-0.16
Winter upwelling	-0.33	-0.02	-0.05	-0.30	0.06	-0.30	0.17	-0.11	-0.02
Spring upwelling	-0.51[a]	0.55[a]	0.46[a]	-0.50[a]	0.51[a]	-0.03	-0.29	0.50[a]	0.16
Summer temperature	-0.18	0.20	0.23	-0.17	0.32	0.12	-0.55[a]	0.12	0.22
Autumn temperature	0.11	0.07	0.03	0.07	0.17	0.05	-0.06	0.08	0.19
Winter temperature	0.20	-0.11	-0.18	0.40	-0.07	0.20	-0.16	-0.01	0.00
Spring temperature	0.48[a]	-0.17	-0.23	0.28	-0.33	0.01	-0.12	-0.37	-0.20

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-64. Correlation matrix for biological variables examined in the analyses of the maturation probability for age 2-4, Ad-CWT marked, spring chinook salmon released from Cole M. Rivers Hatchery. Maturity rates were logit transformed prior to analysis. Correlation matrix for physical parameters of the ocean are in Appendix Table E-58. Analyses include only those Ad-CWT groups with a minimum of 200 age 3 fish alive in spring or 50 age 4 fish alive in spring (Appendix Table E-26).

	Maturity rate at age 2			Maturity rate at age 3			Maturity rate at age 4		
	Maturity rate	Release date	Release weight	Maturity rate	Release date	Release weight	Maturity rate	Release date	Release weight
Maturity rate	1.00			1.00			1.00		
Release date	-0.74[a]	1.00		-0.36[a]	1.00		-0.36[a]	1.00	
Release weight	0.07	0.37[a]	1.00	-0.10	0.46[a]	1.00	-0.09	0.36[a]	1.00
Summer upwelling	-0.44[a]	0.32[a]	-0.04	-0.10	0.34[a]	-0.12	-0.09	0.16	-0.22[a]
Autumn upwelling	-0.11	-0.01	-0.03	-0.33[a]	-0.23[a]	-0.22[a]	0.39[a]	-0.01	-0.03
Winter upwelling	0.03	-0.04	-0.08	0.05	-0.19	-0.15	-0.17	-0.04	-0.07
Spring upwelling	-0.37[a]	0.39[a]	0.09	-0.40[a]	0.46[a]	-0.05	-0.25[a]	0.39[a]	0.01
Summer temperature	-0.17	0.43[a]	0.22[a]	-0.39[a]	0.48[a]	0.10	-0.51[a]	0.43[a]	0.16
Autumn temperature	-0.24[a]	0.37[a]	0.09	0.03	0.49[a]	0.18	-0.58[a]	0.37[a]	-0.07
Winter temperature	-0.08	0.06	-0.14	-0.08	0.28[a]	0.12	-0.24[a]	0.06	0.11
Spring temperature	-0.13	0.24[a]	0.02	-0.41[a]	0.29[a]	0.06	-0.01	0.24[a]	-0.07

[a] *Significant at $P \leq 0.05$.*

Appendix Table E-65. Estimated probability of maturation at age 2 through age 5 for fall chinook salmon produced upstream of Gold Ray Dam, 1981-89 brood years. Probability of maturity at age 6 equaled 1.0.

Brood year	Wild				Hatchery			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1981	--	--	--	1.000	--	--	--	a
1982	--	--	0.848	1.000	--	--	1.000	a
1983	--	0.321	0.814	1.000	--	0.501	0.683	1.000
1984	0.1028	0.202	0.773	1.000	0.0944	0.379	1.000	a
1985	0.0927	0.254	0.820	1.000	0.0605	0.312	0.777	1.000
1986	0.0493	0.097	0.553	0.869	0.0484	0.272	1.000	a
1987	0.1167	0.130	0.636	1.000	0.1348	0.258	0.398	1.000
1988	0.0497	0.108	0.687	0.658	0.0559	0.000	0.552	1.000
1989	0.0281	0.109	0.313	--	0.1229	0.207	0.710	--

[a] *Not estimated because no fish returned at age 5 or age 6.*

Appendix Table E-66. Estimated probability of maturation at age 2 through age 5 for all chinook salmon produced upstream of Gold Ray Dam, 1969-89 brood years. Probability of maturity at age 6 equaled 1.0.

Brood year	Wild				Hatchery[a]			
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5
1969	--	--	--	0.922	--	--	--	1.000
1970	--	--	0.308	0.928	--	--	0.342	1.000
1971	--	0.063	0.349	0.854	--	0.000	0.438	1.000
1972	0.0038	0.053	0.330	0.957	0.0000	0.082	0.636	1.000
1973	0.0139	0.037	0.348	0.932	0.0032	0.006	0.249	1.000
1974	0.0131	0.036	0.423	0.936	0.0028	0.015	0.232	0.641
1975	0.0140	0.064	0.307	0.618	0.0000	0.108	0.486	0.630
1976	0.0242	0.057	0.303	0.826	0.0088	0.048	0.376	0.699
1977	0.0329	0.078	0.425	1.000	0.0196	0.097	0.473	1.000
1978	0.0723	0.131	0.727	0.925	0.0480	0.139	0.747	1.000
1979	0.0130	b	0.818	1.000	0.0090	b	0.690	1.000
1980	b	0.145	0.360	0.927	b	0.141	0.368	1.000
1981	0.0222	0.079	0.762	1.000	0.0122	0.050	0.854	1.000
1982	0.0261	0.123	0.714	1.000	0.0183	0.103	0.620	1.000
1983	0.0394	0.213	0.651	1.000	0.0154	0.135	0.662	1.000
1984	0.0606	0.152	0.777	0.932	0.1013	0.238	0.877	1.000
1985	0.0720	0.346	0.768	1.000	0.0399	0.123	0.844	0.962
1986	0.0437	0.063	0.580	0.962	0.0137	0.145	0.603	1.000
1987	0.0668	0.108	0.510	0.935	0.0329	0.091	0.526	1.000
1988	0.0286	0.074	0.507	0.771	0.0126	0.060	0.684	0.907
1989	0.0118	0.051	0.376	--	0.0050	0.032	0.457	--

[a] *Includes only those fish released after 1 August.*
[b] *Not estimated because of the El Nino event of 1982-83.*

Appendix Table E-67. Correlation matrix for biological variables examined in the analyses of the maturation probability at age 2-5 for all wild chinook salmon. Maturity rates were logit transformed prior to analysis. Correlation matrix for physical parameters of the ocean are in Appendix Table E-59.

	Maturity rate			
	Age 2	Age 3	Age 4	Age 5
Maturity rate	1.00	1.00	1.00	1.00
Size at annulus 1[b]	0.60[a]	--	--	--
Size at annulus 2[c]	--	0.61[a]	--	--
Size at annulus 3[d]	--	--	0.56[a]	--
Size at annulus 4[e]	--	--	--	0.16
Summer upwelling	-0.55[a]	-0.45	-0.40	-0.43
Autumn upwelling	-0.29	-0.31	-0.24	-0.01
Winter upwelling	-0.11	-0.36	-0.21	0.06
Spring upwelling	-0.52[a]	-0.62[a]	-0.49[a]	-0.16
Summer temperature	-0.28	-0.30	-0.51[a]	-0.12
Autumn temperature	0.07	-0.09	-0.06	-0.34
Winter temperature	0.10	0.40	0.18	-0.02
Spring temperature	0.28	0.15	0.02	-0.18

[a] *Significant at $P \leq 0.05$.*
[b] *Scale radius at annulus 1 for completed broods.*
[c] *Scale radius at annulus 2 for completed broods.*
[d] *Scale radius at annulus 3 for completed broods.*
[e] *Scale radius at annulus 4 for completed broods.*

Appendix Table E-68. Estimated age composition of spring chinook salmon from the 1972-89 brood years that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83.

Brood	Wild					Hatchery[a]				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1972	0.004	0.071	0.337	0.566	0.021	0.000	0.107	0.613	0.280	0.000
1973	0.038	0.044	0.373	0.512	0.033	0.009	0.009	0.288	0.694	0.000
1974	0.028	0.044	0.436	0.462	0.029	0.011	0.030	0.363	0.596	0.000
1975	0.007	0.085	0.367	0.313	0.227	0.000	0.178	0.551	0.271	0.000
1976	0.067	0.068	0.294	0.482	0.088	0.028	0.076	0.450	0.405	0.041
1977	0.058	0.070	0.375	0.497	0.000	0.036	0.086	0.292	0.271	0.316
1978	0.157	0.095	0.568	0.173	0.007	0.092	0.117	0.466	0.131	0.194
1979	0.045	0.211	0.626	0.118	0.000	0.017	0.060	0.671	0.252	0.000
1980	0.241	0.090	0.250	0.393	0.027	0.099	0.166	0.316	0.418	0.000
1981	0.035	0.049	0.728	0.188	0.000	0.030	0.058	0.785	0.127	0.000
1982	0.050	0.139	0.602	0.209	0.000	0.047	0.127	0.542	0.284	0.000
1983	0.059	0.238	0.482	0.222	0.000	0.022	0.151	0.586	0.240	0.000
1984	0.113	0.155	0.598	0.125	0.010	0.216	0.209	0.512	0.064	0.000
1985	0.142	0.377	0.380	0.101	0.000	0.092	0.130	0.680	0.095	0.003
1986	0.104	0.060	0.538	0.298	0.000	0.031	0.176	0.513	0.249	0.031
1987	0.093	0.118	0.396	0.365	0.028	0.079	0.108	0.474	0.339	0.000
1988	0.048	0.076	0.422	0.379	0.075	0.031	0.077	0.657	0.217	0.018
1989	0.007	0.026	0.451	0.486	0.030	0.010	0.042	0.487	0.439	0.022

[a] *Includes only those fish released after 1 August.*

Appendix Table E-69. Estimated age composition of spring chinook salmon, for Ad-CWT marked hatchery fish released in September and October, that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83.

Brood year	Age 2	Age 3	Age 4	Age 5	Age 6
1975	0.029	0.072	0.495	0.374	0.030
1976	0.017	0.034	0.423	0.500	0.025
1977	0.039	0.102	0.660	0.198	0.000
1978	0.035	0.069	0.746	0.150	0.000
1979	0.024	0.103	0.678	0.188	0.007
1980	0.088	0.203	0.332	0.371	0.006
1981	0.029	0.059	0.731	0.178	0.003
1982	0.082	0.278	0.628	0.013	0.000
1983	0.040	0.180	0.596	0.180	0.004
1984	0.067	0.056	0.638	0.214	0.025
1985	0.035	0.144	0.687	0.133	0.002
1986	0.028	0.092	0.567	0.313	0.000
1987	0.020	0.046	0.438	0.496	0.000
1988	0.010	0.054	0.688	0.248	0.000
1989	0.005	0.075	0.854	0.066	0.000

Appendix Table E-70. Estimated age composition of fall chinook salmon from the 1984-89 brood years that would have returned to freshwater had there been no age selective fishing mortality.

Brood	Wild					Hatchery[a]				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1984	0.294	0.243	0.410	0.053	0.000	0.235	0.402	0.363	0.000	0.000
1985	0.253	0.302	0.406	0.040	0.000	0.172	0.398	0.382	0.049	0.000
1986	0.253	0.227	0.416	0.092	0.012	0.167	0.426	0.407	0.000	0.000
1987	0.308	0.142	0.365	0.135	0.051	0.354	0.276	0.189	0.182	0.000
1988	0.147	0.149	0.535	0.123	0.046	0.178	0.000	0.507	0.315	0.000
1989	0.086	0.161	0.298	0.411	0.044	0.277	0.204	0.401	0.118	0.000

[a] *Includes only those fish released after 1 August.*

Appendix Table E-71. Estimated age composition of all chinook salmon from the 1972-89 brood years that would have returned to freshwater had there been no age selective fishing mortality and no changes in mortality rates that resulted from the El Niño event of 1982-83.

Brood	Wild					Hatchery[a]				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1972	0.011	0.076	0.345	0.547	0.020	0.000	0.107	0.613	0.280	0.000
1973	0.041	0.052	0.375	0.500	0.032	0.009	0.009	0.288	0.694	0.000
1974	0.039	0.052	0.444	0.438	0.026	0.011	0.030	0.362	0.597	0.000
1975	0.048	0.105	0.356	0.295	0.196	0.000	0.174	0.553	0.272	0.000
1976	0.072	0.082	0.302	0.459	0.084	0.028	0.076	0.451	0.404	0.041
1977	0.095	0.103	0.382	0.420	0.000	0.036	0.088	0.301	0.266	0.308
1978	0.178	0.143	0.524	0.147	0.007	0.093	0.127	0.464	0.127	0.178
1979	0.090	0.231	0.580	0.099	0.000	0.024	0.069	0.661	0.246	0.000
1980	0.240	0.151	0.252	0.335	0.022	0.104	0.168	0.313	0.416	0.000
1981	0.056	0.095	0.687	0.163	0.000	0.031	0.062	0.797	0.110	0.000
1982	0.066	0.152	0.592	0.189	0.000	0.047	0.130	0.548	0.275	0.000
1983	0.096	0.248	0.458	0.197	0.000	0.039	0.167	0.565	0.229	0.000
1984	0.148	0.172	0.561	0.111	0.008	0.218	0.227	0.498	0.058	0.000
1985	0.163	0.362	0.385	0.089	0.000	0.095	0.140	0.669	0.094	0.003
1986	0.128	0.087	0.518	0.264	0.002	0.036	0.185	0.509	0.241	0.030
1987	0.173	0.127	0.385	0.278	0.036	0.084	0.111	0.469	0.336	0.000
1988	0.080	0.099	0.459	0.296	0.066	0.033	0.076	0.655	0.219	0.018
1989	0.034	0.073	0.398	0.460	0.035	0.014	0.044	0.485	0.435	0.022

[a] *Includes only those fish released after 1 August.*

Appendix Table E-72. Regression analysis of the percentage of fall chinook salmon among wild chinook salmon produced in areas upstream of Gold Ray Dam, 1972-89 brood years. Percent composition data were logit transformed prior to analysis. Data are described in Appendix Table E-74.

Independent variable	Regression coefficient	Standard error	*P*
% fall race among spawners	0.9214	0.3574	0.021
Spawning flow	-1.279×10^{-3}	0.649×10^{-3}	0.067
Constant	2.1132		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	2.066	2	1.033	3.41	0.060
Residual	4.540	15	0.303		

Appendix Table E-73. Correlation matrix for variables examined in the analysis of the percentage of fall chinook salmon among wild chinook salmon produced in areas upstream of Gold Ray Dam, 1972-89 brood years. Percent composition data were logit transformed prior to analysis. Data are described in Appendix Table E-74.

	Run composition	Spawner composition	Incubation temperature	Flow	
				Spawning	Migration
Run composition	1.00				
Spawning composition	0.26	1.00			
Incubation temperature	0.40	0.25	1.00		
Spawning flow	-0.09	0.65[a]	-0.15	1.00	
Migration flow	0.31	0.42	0.08	0.46[a]	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-74. Independent variables used to assess factors related to the percentage of fall chinook salmon among wild chinook salmon produced in areas upstream of Gold Ray Dam, 1972-89 brood years.

Brood year	Run composition[a]	Spawner composition[b]	Incubation temperature[c]	Flow	
				Spawning[d]	Migration[e]
1972	6.0	10.0[f]	5.0	1,749	1,666
1973	8.9	10.0[f]	6.8	1,253	1,766
1974	13.8	13.8	6.0	1,508	1,097
1975	26.5	15.9	6.1	1,708	1,547
1976	12.1	11.5	7.5	1,501	1,599
1977	22.7	17.7	8.8	1,443	1,793
1978	21.6	18.6	7.3	1,552	1,296
1979	26.7	14.6	7.5	1,498	1,918
1980	18.4	11.7	7.5	1,408	1,771
1981	19.8	33.0	7.7	1,573	1,746
1982	12.6	19.6	7.4	2,029	1,895
1983	12.2	35.0	7.5	2,309	2,117
1984	22.8	33.7	6.4	2,057	2,584
1985	23.1	18.0	6.5	1,834	2,732
1986	28.7	19.2	7.3	1,743	2,213
1987	38.1	16.7	7.5	1,543	2,071
1988	34.3	21.1	7.1	1,429	2,054
1989	36.3	24.1	7.5	1,785	1,827

[a] *Percent of age 2 recruits (Appendix Tables E-28 and E-39) that were fall chinook salmon.*
[b] *Percent of spawners estimated to be fall chinook salmon.*
[c] *Mean maximum water temperature (^{o}C) near McLeod in October-December in year of spawning.*
[d] *Mean flow at Raygold in September-October in year of spawning.*
[e] *Mean flow at Raygold in August-September in year of spawning.*
[f] *Assumed value.*

Appendix Table E-75. Estimated number of adult chinook salmon that passed Gold Ray Dam through 15 August, 1942-94 return years. Adults were classified as fish larger than 50 cm in 1942-76 and larger than 60 cm in 1977-94. A few fish that passed in March are included in the data for 1-15 April.

Return year	April		May		June		July		August
	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15
1942	3	366	4,926	7,774	6,817	9,334	4,472	1,396	471
1943	106	1,081	5,589	9,222	4,679	5,318	2,678	1,954	974
1944	0	105	3,643	7,700	3,116	6,722	3,551	1,767	282
1945	24	311	2,057	2,987	6,734	7,674	4,388	2,140	432
1946	23	119	1,836	3,896	3,693	6,594	3,542	3,254	797
1947	18	471	5,691	7,125	4,687	5,490	4,783	1,365	933
1948	24	47	3,124	6,195	5,913	4,952	2,298	1,241	262
1949	19	164	1,698	5,075	4,046	3,529	1,644	520	307
1950	1	54	1,614	3,179	1,885	4,054	1,241	513	272
1951	2	25	845	2,955	4,326	3,364	1,511	1,452	205
1952	0	7	288	2,622	2,235	2,546	1,462	1,677	1,257
1953	0	21	992	1,335	4,368	6,899	7,540	4,700	1,377
1954	14	30	3,056	5,044	2,681	5,251	2,807	427	186
1955	0	9	401	2,071	3,510	4,073	1,522	883	439
1956	0	19	1,497	2,392	3,293	9,696	3,987	2,531	741
1957	2	162	1,940	2,469	3,296	4,606	1,381	509	313
1958	0	17	782	2,954	2,396	3,824	1,839	1,083	191
1959	14	156	665	2,044	5,713	1,592	735	352	83
1960	11	49	1,636	3,423	7,609	4,539	1,299	196	152
1961	7	445	2,465	6,908	8,633	5,001	2,471	194	281
1962	0	60	989	8,599	8,335	5,373	1,300	1,094	339
1963	5	13	4,360	15,872	7,836	2,782	1,664	891	207
1964	0	120	2,168	7,258	10,392	5,698	4,089	1,671	256
1965	8	477	6,421	19,123	10,179	2,905	1,517	337	294
1966	11	384	3,589	9,125	9,012	3,731	1,806	487	179
1967	2	4	940	3,982	4,845	2,151	544	106	58
1968	17	143	1,208	3,891	5,950	1,350	160	463	133
1969	4	87	2,585	18,963	19,589	6,577	3,474	779	114
1970	56	433	3,422	17,045	11,967	4,284	462	150	341
1971	0	103	776	5,289	9,237	3,873	3,323	1,031	140
1972	0	179	3,797	8,850	6,677	3,295	1,381	217	189
1973	66	1,077	4,945	10,547	8,860	4,350	558	135	54
1974	3	54	927	2,915	4,465	3,248	1,240	667	217
1975	0	73	373	4,092	5,619	3,232	2,417	780	259
1976	12	138	2,908	3,039	3,516	3,311	1,079	582	243
1977	51	354	1,628	3,428	6,608	1,059	113	85	38
1978	41	354	1,808	6,456	11,632	9,873	3,932	1,229	566
1979	32	454	4,270	12,082	8,238	3,589	2,263	937	869

Appendix Table E-75. Continued.

Return year	April		May		June		July		August
	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15
1980	40	258	1,987	6,300	8,946	7,930	2,306	784	269
1981	0	219	2,011	3,017	4,560	3,002	789	395	243
1982	0	51	2,962	5,124	4,379	3,226	1,825	1,502	730
1983	0	46	328	1,138	2,594	1,874	941	701	235
1984	3	20	81	1,512	2,871	2,669	851	588	249
1985	3	174	2,436	8,779	8,285	3,133	1,320	682	725
1986	63	1,227	4,113	14,397	20,109	11,424	3,473	3,214	1,429
1987	33	882	11,555	13,726	18,775	7,932	4,175	5,140	3,135
1988	0	446	3,633	20,659	15,777	13,794	5,183	3,700	1,263
1989	41	508	9,662	17,455	15,792	5,003	1,841	1,799	1,679
1990	0	578	1,870	3,891	6,757	4,812	1,458	1,725	449
1991	3	73	1,213	2,110	3,058	2,078	945	721	342
1992	204	526	1,259	790	340	341	542	341	165
1993	8	156	1,693	4,828	4,670	4,373	1,327	1,202	1,090
1994	25	425	635	1,993	1,825	4,090	1,509	186	740

Appendix Table E-76. Estimated number of jack chinook salmon that passed Gold Ray Dam through 15 August, 1942-94 return years. Jacks were classified as fish less than 50 cm in 1942-76 and less than 60 cm in 1977-94.

Return year	April		May		June		July		August
	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15
1942	0	24	270	498	898	1,688	1,663	904	275
1943	2	62	369	481	413	551	753	1,273	631
1944	0	8	196	724	694	890	748	313	173
1945	2	11	155	312	764	1,054	1,260	831	862
1946	0	1	39	548	880	1,217	893	664	378
1947	0	1	250	503	636	902	359	236	187
1948	0	3	255	817	552	617	506	141	32
1949	0	4	136	318	394	424	270	154	108
1950	0	3	84	240	364	521	1,045	341	119
1951	0	0	49	542	756	2,078	638	582	213
1952	0	0	6	139	1,200	645	746	663	395
1953	0	0	123	253	675	1,147	1,034	674	327
1954	0	0	530	1,272	719	1,371	810	323	183

Appendix Table E-76. Continued.

Return year	April		May		June		July		August
	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15
1955	0	2	49	483	751	685	386	339	111
1956	0	0	137	178	601	1,692	576	507	221
1957	0	1	228	468	794	1,011	326	138	66
1958	0	0	84	366	410	581	295	148	46
1959	0	1	53	202	896	691	586	180	9
1960	0	3	271	775	2,130	1,112	616	386	167
1961	0	24	264	1,052	2,150	1,045	589	227	19
1962	0	3	135	1,394	2,022	909	410	150	283
1963	0	1	354	2,276	2,364	710	537	457	238
1964	0	0	142	1,044	2,313	1,506	888	284	64
1965	0	18	751	4,124	2,081	595	401	114	56
1966	0	7	263	1,090	1,249	430	303	92	20
1967	0	0	15	196	318	730	323	557	308
1968	0	6	230	2,332	4,104	613	58	161	26
1969	0	0	40	1,525	2,283	1,444	1,108	235	97
1970	0	3	92	1,676	1,673	1,390	831	678	1,046
1971	0	0	0	379	2,101	1,648	1,221	645	119
1972	0	0	234	1,534	1,797	1,088	749	147	108
1973	0	53	331	1,507	1,402	978	451	199	57
1974	0	0	54	315	915	1,433	417	339	55
1975	0	0	13	566	1,599	1,085	892	318	91
1976	0	0	218	393	821	1,933	1,763	1,119	620
1977	0	0	83	541	1,482	470	233	186	36
1978	0	0	60	466	1,682	2,851	3,599	2,035	640
1979	0	11	119	1,541	1,663	1,129	706	298	331
1980	0	3	38	534	676	1,936	3,456	980	208
1981	0	0	80	425	980	754	330	302	178
1982	0	0	89	551	778	2,089	4,662	1,450	525
1983	0	0	3	122	758	1,292	1,385	911	183
1984	0	3	9	211	495	1,168	1,243	504	164
1985	0	56	738	2,786	3,951	2,600	3,306	1,242	824
1986	0	14	336	6,376	7,894	6,507	4,242	3,581	1,123
1987	0	43	918	1,459	3,523	3,293	2,943	2,703	1,347
1988	0	80	976	5,876	4,502	3,917	1,840	1,005	234
1989	0	13	806	1,993	1,751	756	470	402	359
1990	0	23	137	345	721	736	393	506	189
1991	0	3	388	567	364	431	307	222	88
1992	3	9	77	80	67	112	488	286	171
1993	0	15	91	777	935	1,371	882	1,578	1,107
1994	0	23	85	352	409	981	456	49	293

Appendix Table E-77. Estimated number of adult chinook salmon that passed Gold Ray Dam from 16 August - 31 December, 1942-94 return years. Adults were classified as fish larger than 50 cm in 1942-76 and larger than 60 cm in 1977-94.

Return year	August	September		October		November		December	
	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
1942	314	360	190	103	59	16	0	0	0
1943	633	352	137	106	20	0	0	0	0
1944	333	149	109	166	112	1	0	0	0
1945	419	193	160	151	64	3	0	0	0
1946	811	240	148	117	17	0	0	0	0
1947	336	120	220	221	10	0	0	0	0
1948	248	182	188	68	14	0	0	0	0
1949	158	346	264	123	0	0	0	0	0
1950	310	152	252	261	0	0	0	0	0
1951	326	82	192	508	2	0	0	0	0
1952	326	1,283	294	197	19	0	0	0	0
1953	613	487	326	139	121	0	0	0	0
1954	152	74	376	28	0	0	0	0	0
1955	139	194	119	254	10	0	0	0	0
1956	985	246	297	152	9	0	0	0	0
1957	176	168	411	161	0	0	0	0	0
1958	228	133	115	83	5	0	0	0	0
1959	118	75	138	82	4	0	0	0	0
1960	266	306	344	104	15	0	0	0	0
1961	204	234	233	233	16	0	0	0	0
1962	425	205	157	63	102	0	0	0	0
1963	54	199	133	195	55	0	0	0	0
1964	233	178	233	293	95	0	0	0	0
1965	234	262	266	282	48	0	0	0	0
1966	84	363	430	86	34	0	0	0	0
1967	39	146	297	284	95	0	0	0	0
1968	--	--	--	--	--	--	--	--	--
1969	195	384	297	155	218	0	0	0	0
1970	547	478	331	426	70	15	0	0	0
1971	203	370	334	470	133	35	0	0	0
1972	896	389	254	460	105	35	0	0	0
1973	495	379	320	243	149	21	0	0	0
1974	387	377	335	303	227	23	6	0	0
1975	391	531	344	434	98	45	0	0	0
1976	326	233	206	212	40	9	0	0	0
1977	93	553	612	590	148	4	0	0	0
1978	843	743	985	734	231	27	0	0	0
1979	724	455	617	506	200	41	0	0	0

Appendix Table E-77. Continued.

Return year	August	September		October		November		December	
	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
1980	385	535	621	373	176	3	0	0	0
1981	200	879	245	640	1,335	18	0	0	0
1982	552	401	635	431	69	12	0	0	0
1983	258	287	438	507	290	142	8	0	0
1984	840	488	486	327	104	2	0	0	0
1985	1,589	1,658	1,007	713	277	56	5	0	0
1986	557	912	2,299	1,385	1,316	162	6	0	0
1987	1,622	1,353	1,494	1,995	864	236	33	0	0
1988	2,773	1,579	2,398	2,092	369	121	0	0	0
1989	1,294	1,368	1,625	531	524	89	4	0	0
1990	1,169	750	488	269	155	20	3	0	0
1991	679	346	504	320	365	238	35	0	0
1992	570	1,387	682	370	263	178	69	19	3
1993	1,160	748	669	850	314	31	1	0	0
1994	2,346	1,653	2,213	873	459	72	5	0	0

Appendix Table E-78. Estimated number of jack chinook salmon that passed Gold Ray Dam from 16 August - 31 December, 1942-94 return years. Jacks were classified as fish less than 50 cm in 1942-76 and less than 60 cm in 1977-94.

Return year	August	September		October		November		December	
	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
1942	133	288	79	25	10	2	0	0	0
1943	342	215	84	29	8	0	0	0	0
1944	196	75	54	72	39	1	0	0	0
1945	420	202	67	38	5	0	0	0	0
1946	203	82	29	27	7	0	0	0	0
1947	115	51	10	15	5	0	0	0	0
1948	22	27	14	0	0	0	0	0	0
1949	69	98	70	88	2	0	0	0	0
1950	99	64	64	38	0	0	0	0	0
1951	141	104	100	113	0	0	0	0	0
1952	145	225	63	38	10	0	0	0	0
1953	120	120	59	25	73	0	0	0	0
1954	127	141	117	66	0	0	0	0	0

Appendix Table E-78. Continued.

Return year	August	September		October		November		December	
	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
1955	41	30	19	26	4	0	0	0	0
1956	183	6	4	2	0	0	0	0	0
1957	37	47	45	15	0	0	0	0	0
1958	76	28	20	12	0	0	0	0	0
1959	234	43	24	16	1	0	0	0	0
1960	309	354	107	32	6	0	0	0	0
1961	74	84	88	89	5	0	0	0	0
1962	122	59	80	33	10	0	0	0	0
1963	38	142	51	75	18	0	0	0	0
1964	29	2	35	36	6	0	0	0	0
1965	122	119	103	248	17	0	0	0	0
1966	10	44	40	2	2	0	0	0	0
1967	201	160	323	265	28	0	0	0	0
1968	--	--	--	--	--	--	--	--	--
1969	137	178	221	115	139	0	0	0	0
1970	462	321	216	201	35	4	0	0	0
1971	320	144	143	161	63	24	0	0	0
1972	163	106	130	153	39	9	0	0	0
1973	421	286	213	170	108	14	0	0	0
1974	133	196	175	85	67	8	0	0	0
1975	89	170	117	79	12	0	0	0	0
1976	682	420	274	188	40	18	0	0	0
1977	211	904	1,028	790	229	19	0	0	0
1978	481	316	763	616	130	19	0	0	0
1979	142	115	110	107	72	22	0	0	0
1980	159	136	241	266	95	0	0	0	0
1981	112	184	475	478	203	0	0	0	0
1982	548	449	804	490	163	48	0	0	0
1983	170	236	431	496	338	238	0	0	0
1984	664	115	94	46	16	4	0	0	0
1985	710	767	577	510	437	146	0	0	0
1986	869	1,392	1,940	2,083	1,180	120	18	0	0
1987	641	714	536	683	403	122	4	0	0
1988	628	363	403	448	289	40	0	0	0
1989	332	369	412	145	182	26	2	0	0
1990	208	279	148	98	60	3	3	0	0
1991	177	116	141	52	62	150	20	0	0
1992	593	1,289	753	372	154	58	35	2	0
1993	731	555	563	676	388	25	0	0	0
1994	963	1,008	989	364	477	106	2	0	0

Appendix Table E-79. Data used to assess factors related to the migration timing of spring chinook salmon that passed Gold Ray Dam, 1942-94.

Year	% passage by calendar date				Flow[a]	Water temperature[b]	% hatchery	
	Adults		Jacks				Adults	Jacks
	05/31	06/30	05/31	06/30				
1942	36.8	82.2	12.7	54.3	3,382	--	--	--
1943	50.6	82.3	20.2	41.4	3,630	--	--	--
1944	42.6	79.2	24.8	67.1	2,430	--	--	--
1945	20.1	74.0	9.1	43.8	4,138	--	--	--
1946	24.7	68.0	12.7	58.1	3,549	--	--	--
1947	43.5	76.8	24.5	74.6	2,137	--	--	--
1948	39.0	84.2	36.8	76.8	4,609	--	--	--
1949	40.9	85.5	25.3	70.6	4,042	--	--	--
1950	37.8	84.2	12.0	44.6	4,110	--	--	--
1951	26.1	78.4	12.2	70.5	3,036	--	--	--
1952	24.1	63.7	3.8	52.5	5,020	--	--	--
1953	8.6	50.0	8.9	51.9	5,612	--	--	--
1954	41.8	82.5	34.6	74.7	3,329	--	--	--
1955	19.2	78.0	19.0	70.2	3,430	--	--	--
1956	16.2	69.9	8.1	66.7	5,288	--	--	--
1957	31.2	85.0	23.0	82.5	2,967	--	--	--
1958	28.7	76.2	23.3	74.7	4,172	--	--	--
1959	25.4	89.7	9.8	70.4	2,346	--	--	--
1960	27.1	91.3	19.2	78.6	3,181	--	--	--
1961	37.2	88.8	25.0	84.5	3,069	--	--	--
1962	37.0	89.5	28.9	84.1	2,715	--	--	--
1963	60.2	91.8	37.9	82.2	3,652	--	--	--
1964	30.2	81.0	19.0	80.2	3,810	--	--	--
1965	63.1	94.8	60.1	93.0	2,704	--	--	--
1966	46.3	91.3	39.4	88.0	2,402	--	--	--
1967	39.0	94.4	8.6	51.5	3,858	--	--	--
1968	39.5	94.3	34.1	96.7	1,481	--	--	--
1969	41.5	91.6	23.2	78.6	3,938	--	--	--
1970	54.9	97.5	24.0	65.4	2,577	--	--	--
1971	25.9	81.1	6.2	67.5	5,122	--	--	--
1972	52.2	92.7	31.3	82.3	4,169	--	--	--
1973	54.4	97.6	38.0	85.8	1,909	--	--	--
1974	28.4	84.5	10.5	77.0	4,632	13.0	3.1	0.0

[a] *Mean flow at Raygold in May-June.*
[b] *Mean maximum water temperature (^{o}C) at Raygold in May-June.*

Appendix Table E-79. Continued.

Year	% passage by calendar date: Adults 05/31	Adults 06/30	Jacks 05/31	Jacks 06/30	Flow[a]	Water temperature[b]	% hatchery: Adults	Jacks
1975	26.9	79.5	12.7	71.5	5,218	13.2	4.8	4.7
1976	41.1	87.2	8.9	49.0	3,459	14.8	5.7	3.2
1977	40.9	98.2	20.6	85.0	1,326	16.5	9.5	3.8
1978	24.1	84.0	4.6	44.6	2,296	15.5	11.9	19.3
1979	51.4	87.6	28.8	77.0	3,168	15.1	23.3	22.4
1980	29.8	88.3	7.3	40.7	2,336	15.1	27.6	28.1
1981	36.9	90.0	16.6	73.4	1,914	16.8	27.0	39.7
1982	41.1	79.5	6.3	34.6	3,186	15.1	29.4	30.0
1983	19.2	76.1	2.7	46.7	4,089	14.3	25.4	36.8
1984	18.3	80.9	5.9	49.7	4,587	13.7	30.1	56.3
1985	44.6	89.3	23.1	65.3	2,648	15.8	35.2	53.3
1986	33.3	86.3	22.4	70.3	2,692	14.6	54.1	52.8
1987	40.1	80.9	14.9	56.9	1,934	15.6	60.5	51.8
1988	38.4	84.3	37.6	83.3	2,570	14.3	33.4	47.6
1989	51.4	90.1	42.9	81.2	3,430	14.2	76.3	77.6
1990	29.4	83.1	16.6	64.3	2,349	14.8	66.1	62.3
1991	32.2	81.0	40.4	74.0	3,265	14.3	70.1	60.9
1992	61.6	76.8	13.1	26.9	1,627	16.9	73.2	62.1
1993	34.6	81.3	13.1	47.2	4,569	13.8	68.3	71.2
1994	26.9	78.7	17.4	69.9	2,134	15.5	66.2	83.6

Appendix Table E-80. Correlation matrixes for variables examined in analyses of the migration timing of spring chinook salmon that passed Gold Ray Dam, 1942-94. Variables are described in Appendix Table E-79. Percentage data were logit transformed prior to analysis.

	% passage by calendar date: Adults 05/31	Adults 06/30	Jacks 05/31	Jacks 06/30	Flow	Water temperature	% hatchery: Adults	Jacks
% adults by 05/31	1.00							
% adults by 06/30	0.62[a]	1.00						
% jacks by 05/31	0.64[a]	0.47[a]	1.00					
% jacks by 06/30	0.29[a]	0.51[a]	0.73[a]	1.00				
Flow	-0.47[a]	-0.50[a]	-0.35[a]	-0.26	1.00			
Water temperature	0.48[a]	0.37	0.06	-0.16	-0.89[a]	1.00		
% hatchery-adults	0.28	-0.28	0.41	-0.12	-0.32	0.23	1.00	
% hatchery-jacks	0.09	-0.37	0.29	-0.14	-0.23	0.17	0.94[a]	1.00

[a] $P \leq 0.05$.

Appendix Table E-81. Mean date of capture for age 2-6 spring chinook salmon trapped at Gold Ray Dam, 1969-92 brood years.

	Wild					Hatchery				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1969										
Mean	--	--	--	06/05	05/07	--	--	--	06/09	06/09
SD	--	--	--	12.0	--	--	--	--	11.7	--
N	--	--	--	85	1	--	--	--	5	1
BROOD YEAR 1970										
Mean	--	--	06/02	05/14	05/31	--	--	06/21	06/05	--
SD	--	--	12.3	19.5	--	--	--	26.2	11.6	--
N	--	--	126	50	1	--	--	2	7	0
BROOD YEAR 1971										
Mean	--	06/05	05/21	05/25	05/24[a]	--	--	06/08	05/22	--
SD	--	11.5	11.7	14.8	26.7	--	--	26.7	10.3	--
N	--	55	140	34	4	--	0	3	3	0
BROOD YEAR 1972										
Mean	06/13	05/26	05/25	05/06[a]	04/27	--	06/20	06/18	06/02[a]	--
SD	12.2	12.6	13.5	19.5	--	--	20.7	12.1	0.0	--
N	5	127	121	58	1	0	8	14	2	0
BROOD YEAR 1973										
Mean	06/04	05/26	05/13[a]	05/23	06/11	07/05	06/12	06/02[a]	05/31	--
SD	7.1	12.7	21.4	13.8	1.4	--	14.7	3.4	20.6	--
N	46	53	89	43	2	1	3	16	20	0
BROOD YEAR 1974										
Mean	06/10	05/28[a]	05/28	05/31	06/15	06/28	--	06/09	05/28	06/08
SD	10.8	20.1	13.0	14.5	18.1	--	--	21.7	12.4	14.8
N	80	77	151	69	3	1	0	14	8	2
BROOD YEAR 1975										
Mean	06/14[a]	06/13	05/29	06/05	06/09	--	06/19	06/02	06/03	05/25
SD	7.7	9.2	14.7	19.3	18.2	--	14.2	7.7	12.2	16.5
N	46	93	118	64	16	0	27	64	16	3
BROOD YEAR 1976										
Mean	06/25	06/12	06/14	06/05	06/16	07/04	06/05	06/07	05/25	05/19
SD	6.7	19.0	20.5	15.2	8.7	12.5	15.7	14.8	16.0	--
N	53	86	143	120	4	10	30	81	27	1

[a] *Estimate probably affected by prespawning mortality.*

Appendix Table E-81. Continued.

	Wild					Hatchery				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1977										
Mean	07/11	06/15	06/12	05/27	--	07/10	06/17	06/11	05/29	--
SD	21.4	18.5	15.4	15.1	--	22.7	9.1	12.5	11.7	--
N	17	24	85	17	0	6	16	39	6	0
BROOD YEAR 1978										
Mean	07/05	06/18	06/09	06/08	06/27	07/02	06/11	06/06	06/10	--
SD	11.7	11.4	17.5	18.5	--	9.2	14.2	17.2	11.4	--
N	82	91	143	55	1	33	56	87	21	0
BROOD YEAR 1979										
Mean	07/05	06/20	06/16	06/18	--	06/26	06/12	06/13	06/12	--
SD	12.4	13.7	16.4	17.0	--	17.3	13.1	15.9	6.8	--
N	25	66	137	13	0	6	21	56	9	0
BROOD YEAR 1980										
Mean	06/30	06/22	06/17	06/12	05/21	07/01	06/22	06/15	06/05	--
SD	10.3	11.2	13.9	17.0	--	12.9	12.9	15.0	16.9	--
N	82	83	140	55	1	37	49	67	23	0
BROOD YEAR 1981										
Mean	07/11	06/22	06/11	06/20	--	07/14	06/19	06/06	05/24	--
SD	10.1	13.7	15.2	31.5	--	10.4	17.7	17.2	11.1	--
N	33	31	97	18	0	8	19	55	3	0
BROOD YEAR 1982										
Mean	07/01	06/18	06/20	06/25[a]	--	06/27	06/09	06/06	06/01[a]	--
SD	10.9	15.6	23.8	20.1	--	11.1	12.7	24.1	13.4	--
N	55	62	69	10	0	117	108	98	13	0
BROOD YEAR 1983										
Mean	06/27	06/25	06/17[a]	06/11	--	06/28	06/18	06/11[a]	05/29	--
SD	15.1	22.4	25.1	23.2	--	18.4	18.4	18.7	15.5	--
N	85	127	95	31	0	36	92	148	35	0
BROOD YEAR 1984										
Mean	07/02	06/29[a]	06/20	06/18	05/20	07/07	06/19[a]	06/05	06/03	--
SD	11.4	23.1	22.6	19.7	--	11.8	21.3	20.7	17.6	--
N	58	79	157	38	1	50	62	62	14	0

Appendix Table E-81. Continued.

	Wild					Hatchery				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
BROOD YEAR 1985										
Mean	07/12[a]	06/08	06/13	06/11	--	07/08[a]	05/31	06/03	06/06	06/09
SD	14.2	23.1	24.5	27.8	--	13.8	16.3	23.6	23.3	--
N	56	82	66	23	0	61	56	211	31	1
BROOD YEAR 1986										
Mean	07/09	06/16	06/23	06/05	--	07/08	06/14	06/08	05/26	05/26[a]
SD	15.3	19.8	21.2	20.4	--	12.0	20.4	18.9	16.8	33.2
N	69	33	75	45	0	25	76	125	42	2
BROOD YEAR 1987										
Mean	07/04	06/24	06/12	06/05[a]	06/20	06/29	06/13	06/05	05/13[a]	--
SD	16.7	15.3	18.6	28.3	24.6	19.8	16.1	15.5	13.7	--
N	14	23	47	16	3	22	46	122	31	0
BROOD YEAR 1988										
Mean	07/03	06/19	06/12[a]	06/11	06/12[a]	07/05	06/23	05/28[a]	06/02	05/13[a]
SD	13.5	13.8	21.8	18.2	24.0	11.7	13.3	22.1	18.1	22.5
N	13	21	30	39	8	18	39	89	47	6
BROOD YEAR 1989										
Mean	06/29	07/18[a]	06/19	06/15[a]	--	07/09	06/03[a]	06/05	06/07[a]	--
SD	14.4	19.0	22.7	17.4	--	11.9	24.4	18.5	21.0	--
N	3	4	45	37	--	10	14	137	87	--
BROOD YEAR 1990										
Mean	07/19[a]	06/21	06/09[a]	--	--	07/08[a]	06/17	06/11[a]	--	--
SD	7.0	15.5	19.4	--	--	11.2	17.9	18.5	--	--
N	9	38	40	--	--	10	70	90	--	--
BROOD YEAR 1991										
Mean	07/09	06/15[a]	--	--	--	07/14	06/13[a]	--	--	--
SD	14.0	15.5	--	--	--	12.3	15.8	--	--	--
N	14	15	--	--	--	70	83	--	--	--
BROOD YEAR 1992										
Mean	07/04[a]	--	--	--	--	06/27[a]	--	--	--	--
SD	9.9	--	--	--	--	6.7	--	--	--	--
N	2	--	--	--	--	26	--	--	--	--

Appendix Table E-82. Correlation matrixes for variables examined in analyses of the mean date of capture for wild and hatchery age 2 spring chinook salmon trapped at Gold Ray Dam, 1974-94. Variables are described in Appendix Table E-86.

	Date of capture		Migration	Water temperature	
	Wild	Hatchery	flow	Migration	Incubation
Capture date-wild	1.00				
Capture date-hatchery	0.60[a]	1.00			
Migration flow	-0.18	-0.03	1.00		
Migration temperature	0.06	-0.03	-0.89[a]	1.00	
Incubation temperature	0.50[a]	-0.25	0.05	0.06	1.00

[a] $P \leq 0.05$.

Appendix Table E-83. Correlation matrixes for variables examined in analyses of the mean date of capture for wild and hatchery age 3 spring chinook salmon trapped at Gold Ray Dam, 1974-94. Variables are described in Appendix Table E-86.

	Date of capture		Migration	Water temperature	
	Wild	Hatchery	flow	Migration	Incubation
Capture date-wild	1.00				
Capture date-hatchery	0.61[a]	1.00			
Migration flow	-0.17	0.38	1.00		
Migration temperature	0.11	-0.39	-0.89[a]	1.00	
Incubation temperature	0.54[a]	0.05	-0.28	0.31	1.00

[a] $P \leq 0.05$.

Appendix Table E-84. Correlation matrixes for variables examined in analyses of the mean date of capture for wild and hatchery age 4 spring chinook salmon trapped at Gold Ray Dam, 1974-94. Variables are described in Appendix Table E-86.

	Date of capture		Migration	Water temperature	
	Wild	Hatchery	flow	Migration	Incubation
Capture date-wild	1.00				
Capture date-hatchery	0.02	1.00			
Migration flow	-0.04	0.35	1.00		
Migration temperature	-0.10	-0.28	-0.89[a]	1.00	
Incubation temperature	0.55[a]	0.01	-0.28	0.30	1.00

[a] $P \leq 0.05$.

Appendix Table E-85. Correlation matrixes for variables examined in analyses of the mean date of capture for wild and hatchery age 5 spring chinook salmon trapped at Gold Ray Dam, 1974-94. Variables are described in Appendix Table E-86.

	Date of capture		Migration	Water temperature	
	Wild	Hatchery	flow	Migration	Incubation
Capture date-wild	1.00				
Capture date-hatchery	0.32	1.00			
Migration flow	0.01	0.45	1.00		
Migration temperature	-0.15	-0.55[a]	-0.89[a]	1.00	
Incubation temperature	0.46[a]	0.05	-0.17	0.30	1.00

[a] $P \leq 0.05$.

Appendix Table E-86. Data used to assess factors related to the mean date of capture for wild and hatchery age 2-5 spring chinook salmon trapped at Gold Ray Dam, 1974-94. Capture dates are not reported when less than 10 fish were caught.

Year	Date of capture[a]								Migration flow[b]	Water temperature	
	Wild				Hatchery						
	Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5		Migration[c]	Incubation[d]
1974	--	157.3	154.2	156.5	--	--	--	--	4,632	13.0	5.2
1975	155.8	146.6	141.6	135.5	--	--	--	--	5,218	13.2	5.9
1976	161.9	147.1	146.0	145.9	--	--	169.9	--	3,459	14.8	5.2
1977	166.4	149.2	134.4	125.7	--	--	155.2	--	1,326	16.5	5.4
1978	176.5	165.0	148.8	144.0	186.5	170.7	160.6	151.6	2,296	15.5	6.8
1979	192.6	164.4	150.3	151.6	--	157.0	153.6	--	3,168	15.1	7.6
1980	186.9	166.6	166.1	157.4	184.0	169.0	159.1	155.3	2,336	15.1	6.3
1981	186.7	169.9	163.6	155.5	--	163.1	163.0	146.0	1,914	16.8	6.8
1982	182.2	171.6	161.4	148.0	183.4	164.0	160.4	--	3,186	15.1	6.9
1983	193.2	174.2	167.8	159.9	--	174.3	165.4	162.4	4,089	14.3	6.6
1984	182.8	173.6	168.5	169.9	178.6	170.6	167.0	--	4,587	13.7	6.6
1985	179.0	169.5	163.1	164.3	179.7	160.5	158.9	156.9	2,648	15.8	6.5
1986	184.0	176.5	171.6	171.6	189.2	170.1	158.5	--	2,692	14.6	5.8
1987	194.2	181.3	169.4	177.2	190.1	171.2	162.9	152.8	1,934	15.6	5.4
1988	191.4	160.5	171.6	163.4	189.7	151.7	156.6	149.7	2,570	14.3	6.5
1989	185.6	168.1	165.4	170.3	181.4	165.9	154.6	154.7	3,430	14.2	6.7
1990	184.8	176.4	175.4	163.0	186.9	165.3	159.7	158.1	2,349	14.8	6.1
1991	--	171.0	164.4	156.6	191.1	174.6	157.4	147.1	3,265	14.3	6.7
1992	--	--	164.1	156.5	191.4	154.8	149.3	133.6	1,627	16.9	6.1
1993	190.6	173.1	171.3	163.3	196.4	169.1	157.5	154.3	4,569	13.8	6.8
1994	--	167.0	160.9	166.6	179.2	165.1	162.5	158.9	2,134	15.5	6.6

[a] *Mean day-of-year. Day-of-year calendar is in* **APPENDIX A.**
[b] *Mean flow at Raygold in May-June.*
[c] *Mean maximum water temperature (^{o}C) at Raygold in May-June.*
[d] *Mean maximum water temperature (^{o}C) near McLeod in October-February when eggs and alevins incubated in the gravel.*

Appendix Table E-87. Numbers of spring chinook salmon found as unspawned carcasses in the Rogue River canyon in May-July, 1975-94.

1975		1976		1977		1978		1979	
Date	Number	Date	Number	Date	Number	Date	Number	Date	Number
06/17	0	06/02	1	05/03	0	05/07	0	05/17	0
06/30	0	06/16	0	05/27	16	05/23	0	05/31	0
07/17	1	07/01	0	06/09	92	06/08	12	06/14	1
		07/14	0	06/22	116	06/26	8	06/28	5
		07/21	5	07/08	14	07/12	2	07/05	3
		07/29	2	07/27	9	07/27	1	07/19	40
								07/25	63

1981		1987		1992		1994	
Date	Number	Date	Number	Date	Number	Date	Number
05/07	0	06/23	450	05/29	210	05/26	184
05/27	0	07/01	589	06/19	201	06/08	216
06/04	1	07/14	128	06/26	119	06/23	140
06/18	9	07/30	18	07/03	18	06/30	127
07/02	18			07/10	5	07/08	135
07/16	7			07/17	5	07/15	111
				07/23	30	07/22	189
				07/31	20	07/29	58

Appendix Table E-88. Estimated number of carcasses of unspawned spring chinook salmon that would been recovered if the Rogue River canyon had been conducted weekly in May-July, 1975-81, 1987, 1992, and 1994. Estimates were developed by adjusting data in Appendix Table E-87 to account for weeks without surveys.

Year	Number	Year	Number
1975	3	1980	16
1976	11	1981	76
1977	502	1987	2,365
1978	56	1992	918
1979	134	1994	372

Appendix Table E-89. Predicted numbers of age 2-5 wild spring chinook salmon that would have returned to Gold Ray Dam without any prespawning mortality in 1987, 1992, and 1994 as estimated from abundance indexes of cohorts that naturally spawned among fall chinook salmon that returned to the Rogue River and Klamath River basins.

Year	95% confidence interval	
	Rogue River cohorts	Klamath River cohorts
	AGE 2	
1987	8,614 ± 3,254	3,777 ± 1,061
1992	1,392 ± 526	1,825 ± 513
1994	1,601 ± 605	1,436 ± 404
	AGE 3	
1987	12,468 ± 3,533	14,814 ± 5,506
1992	497 ± 141	1,080 ± 401
1994	1,111 ± 315	5,824 ± 2,164
	AGE 4	
1987	45,874 ± 14,644	13,846 ± 12,80
1992	3,445 ± 1,100	3,098 ± 2,866
1994	13,332 ± 4,256	2,888 ± 2,671
	AGE 5	
1987	1,046 ± 470	--
1992	1,392 ± 625	--
1994	2,324 ± 1,044	--

Appendix Table E-90. Regression analysis of the percentage of wild spring chinook salmon that died downstream of Gold Ray Dam on mean maximum water temperature at Mariel in May-June, 1975-81, 1987, 1992, and 1994. Percentage data were logit transformed prior to analysis.

Independent variable	Regression coefficient	Standard error	r^2
Water temperature	1.399	0.114	0.94
Constant	-28.074		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	F	P
Regression	51.64	1	51.74	150.6	<0.001
Residual	2.74	8	0.34		

Appendix Table E-91. Data used to assess factors related to the rate of prespawning mortality for spring chinook salmon in the Rogue River downstream of Gold Ray Dam, 1975-81, 1987, 1992, and 1994.

Year	Mortality rate (%)	Water temperature[a]	Flow[b]	Fish abundance[c]
1975	0.20	15.4	7,576	21,452
1976	0.71	16.6	3,942	21,851
1987	34.25	19.2	1,725	24,934
1978	1.64	17.6	3,122	48,014
1979	4.67	17.7	4,905	40,421
1980	0.61	16.8	3,382	36,877
1981	5.84	18.4	2,359	18,356
1987	27.91	18.9	2,472	113,161
1992	70.23	21.2	1,973	19,485
1994	58.85	19.9	2,634	34,210

[a] *Mean maximum water temperature (^{o}C) at Mariel in May-June.*
[b] *Mean flow (cfs) at Agness in May-June.*
[c] *Estimated number of spring chinook salmon that passed Gold Ray Dam + estimated number that died downstream from Gold Ray Dam.*

Appendix Table E-92. Correlation matrix for variables examined in the regression analysis of the rate of prespawning mortality among spring chinook salmon in the Rogue River downstream of Gold Ray Dam. Description of variables can be found in Appendix Table E-90. Percentages were transformed to logits prior to analysis.

	% mortality	Water temperature	Flow	Fish abundance
% mortality	1.00			
Water temperature	0.97[a]	1.00		
Flow	-0.73[a]	-0.79[a]	1.00	
Fish abundance	0.18	0.09	-0.17	1.00

[a] $P \leq 0.05$.

Appendix Table E-93. Numbers of spring chinook salmon found as unspawned carcasses in the RK 212-235 survey area in June-August, 1977-81.

	Unmarked				Marked				
Date	Males	Females	Adults[a]	Jacks	Males	Females	Adults[a]	Jacks	Unknown
				1977					
06/16	3	7	11	0	2	11	19	0	8
06/23	1	10	33	6	3	1	15	2	0
06/30	6	8	15	6	4	10	14	0	23
07/07	8	7	24	4	1	2	4	0	5
07/14	14	13	29	4	1	6	9	0	16
07/21	8	17	25	3	1	2	3	0	3
07/29	6	27	34	4	0	6	6	0	2
08/04	9	8	19	3	0	6	6	0	0
08/11	1	10	11	1	1	0	1	0	2
08/19	2	3	5	4	0	0	0	0	6

[a] *Includes males, females, and adults of undetermined sex.*

Appendix Table E-93. Continued.

Date	Unmarked				Marked				
	Males	Females	Adults[a]	Jacks	Males	Females	Adults[a]	Jacks	Unknown
				1978					
06/15	0	1	2	0	4	3	7	0	0
06/23	2	1	3	2	3	3	6	0	0
06/29	0	1	2	0	0	2	3	0	1
07/06	1	3	4	1	2	11	16	0	2
07/16	6	4	12	7	4	4	9	0	3
07/21	3	7	12	3	2	5	8	0	0
07/27	1	4	5	0	1	1	2	1	0
08/03	5	6	11	12	1	1	2	0	0
08/08	2	5	7	3	0	0	0	0	0
08/15	7	6	14	8	0	2	2	0	0
08/24	9	10	21	8	0	2	2	1	0
09/01	11	9	21	6	1	0	1	0	1
				1979					
06/19	1	1	2	0	2	0	2	0	0
07/03	2	0	2	0	2	0	2	1	1
07/10	3	4	7	2	0	0	0	0	0
07/20	5	6	11	3	0	4	4	0	1
07/30	2	6	8	0	0	0	0	0	0
08/08	2	9	11	0	1	0	1	1	0
08/23	6	13	19	0	0	0	0	0	0
08/30	4	8	12	3	1	0	1	0	1
				1980					
06/30	2	1	4	0	0	0	1	0	0
07/07	6	4	12	0	1	0	2	0	0
07/14	4	6	10	0	2	2	4	0	0
07/21	1	4	6	0	1	0	1	0	0
07/28	1	3	7	1	0	2	2	0	0
08/04	0	3	3	0	0	0	0	0	0
08/29	1	2	16	2	0	1	1	0	0
				1981					
06/11	2	7	9	0	0	3	3	0	0
06/18	5	12	17	2	0	7	7	1	0
06/26	2	6	8	2	0	0	0	0	0
07/01	2	6	8	4	0	2	2	0	0
07/09	7	10	17	0	0	4	4	0	0
07/23	3	2	5	0	0	0	0	0	0
07/30	2	4	6	0	0	1	1	0	0

Appendix Table E-94. Numbers of spring chinook salmon found as unspawned carcasses in the RK 235-253 survey area in June-August, 1977 and 1988-90.

	Unmarked				Marked				
Date	Males	Females	Adults[a]	Jacks	Males	Females	Adults[a]	Jacks	Unknown
				1977					
07/15	8	31	40	2	8	10	18	0	4
07/21	13	29	42	0	12	12	24	0	4
07/29	16	26	42	0	10	10	20	0	3
08/05	11	16	27	2	2	4	6	0	2
08/12	6	15	21	1	1	2	3	0	0
08/18	10	17	27	0	0	0	0	0	2
08/25	6	20	26	1	1	2	3	0	0
				1988					
07/05	1	14	15	3	0	2	2	0	0
07/13	8	10	18	7	1	2	3	0	0
07/19	7	43	50	10	2	1	3	0	1
07/26	16	28	44	11	3	4	7	0	2
08/02	10	25	35	6	2	1	3	0	1
08/09	9	21	30	13	0	1	1	0	4
08/15	9	20	29	5	0	1	1	0	5
08/23	11	17	28	3	0	1	1	0	0
08/30	9	15	24	1	0	1	1	0	4
				1989					
07/05	4	7	11	0	0	0	0	0	0
07/12	1	10	11	0	1	0	1	0	0
07/19	7	12	19	1	0	0	0	0	1
07/26	10	11	21	2	0	4	4	0	6
08/01	8	20	28	1	1	3	4	0	1
08/08	8	15	23	0	1	4	5	0	3
08/15	3	23	26	0	0	0	0	0	1
08/22	3	9	12	1	1	1	2	0	0
08/29	6	14	20	0	1	3	4	0	2
				1990					
07/03	7	16	23	0	0	1	1	0	6
07/11	8	9	17	0	0	2	2	0	3
07/17	4	26	30	0	1	4	5	0	2
07/24	3	27	30	1	0	4	4	0	0
07/31	5	27	32	2	1	2	3	0	2
08/07	4	10	14	1	0	0	0	0	0
08/14	4	10	14	0	0	0	0	0	2
08/20	3	8	11	0	0	0	0	0	1
08/28	6	9	15	1	0	0	0	0	0

[a] *Includes males, females, and adults of undetermined sex.*

Appendix Table E-95. Estimated number and composition for carcasses of unspawned adult spring chinook salmon that would been recovered if all areas upstream of Gold Ray Dam had been surveyed weekly in June-August, 1977-81 and 1988-90. Estimates were developed by adjusting data in Appendix Tables E-93 and E-94 to account for weeks without surveys. Jacks are not included in estimates.

	Number			% marked	
Year	RK 202-212[a]	RK 212-235[b]	RK 235-253[c]	RK 202-235[d]	RK 235-253[e]
1977	533	1,395	1,536	29.0	16.8
1978	166	434	478	33.0	17.8
1979	143	375	412	14.0	7.6
1980	116	305	336	15.4	8.4
1981	332	870	958	18.2	9.8
1988	350	918	1,010	8.4	8.4
1989	234	614	676	10.8	10.8
1990	242	634	697	8.8	8.3

[a] *Estimated in all years as RK 212-235 estimates multiplied by 0.382.*
[b] *Estimated in 1988-90 as RK 235-253 estimates divided by 1.101.*
[c] *Estimated in 1978-81 as RK 212-235 estimates multiplied by 1.101.*
[d] *Estimated in 1988-90 to be equal to estimates for RK 235-253. Assumes equal mark rates among fish harvested in RK 202-212 and RK 212-235.*
[e] *Estimated in 1978-81 as RK 212-235 estimates divided by 0.541.*

Appendix Table E-96. Estimation of recovery rates for carcasses of adult chinook salmon in the Rogue River upstream of Gold Ray Dam, 1977-81. Jacks are not included in estimates.

	Number	Carcasses recovered			
Year	alive in river[a]	Unspawned	Spawned	Total	Recovery rate[b]
1977	11,366	907	2,070	2,977	0.262
1978	30,374	442	12,003	12,445	0.410
1979	22,086	297	6,754	7,051	0.319
1980	18,574	274	6,437	6,711	0.361
1981	11,662	619	2,721	3,340	0.286

[a] *Number that passed Gold Ray Dam - (angler harvest + hatchery returns).*
[b] *Carcasses recovered/number alive in river.*

Appendix Table E-97. Estimation of the rates of prespawning mortality among adult spring chinook salmon that passed Gold Ray Dam, 1977-81 and 1988-90. Jacks are not included in estimates.

Year	Number dead[a]		% marked[b]	% mortality[c]	
	Marked	Unmarked		Wild	Hatchery
1977	799	2,664	100.0	22.0	62.8
1978	283	795	89.6	2.4	7.5
1979	104	826	37.5	2.6	3.6
1980	93	664	43.2	2.6	2.7
1981	313	1,847	29.3	10.4	28.2
1988	191	2,087	23.4	3.4	3.8
1989	164	1,360	11.9	1.2	3.4
1990	138	1,435	10.4	3.4	9.3

[a] *Estimated from data in Appendix Tables E-95 and E-96. Recovery rates in 1988-90 were assumed to be equal to the mean of 1977-81.*
[b] *Percentage of hatchery fish that were marked as estimated by from scales sampled at Gold Ray Dam.*
[c] *Estimates of prespawning mortalities divided by the estimated number of wild and hatchery fish that passed Gold Ray Dam.*

Appendix Table E-98. Regression analysis of the percentage of wild spring chinook salmon that died upstream of Gold Ray Dam prior to spawning on mean maximum water temperature at Raygold in June-July, 1977-81 and 1988-90. Percentage data were logit transformed prior to analysis.

Independent variable	Regression coefficient	Standard error	r^2
Water temperature	0.970	0.181	0.80
Constant	-19.735		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	5.85	1	5.85	28.50	0.002
Residual	1.23	6	0.20		

Appendix Table E-99. Regression analysis of the percentage of hatchery spring chinook salmon that died upstream of Gold Ray Dam prior to spawning on mean maximum water temperature at Raygold in June-July, 1977-81 and 1988-90. Percentage data were logit transformed prior to analysis.

Independent variable	Regression coefficient	Standard error	r^2
Water temperature	1.389	0.2579	0.80
Constant	-26.046		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	12.00	1	12.00	29.14	0.002
Residual	2.47	6	0.41		

Appendix Table E-100. Data used to assess factors related to the rate of prespawning mortality for wild and hatchery spring chinook salmon in the Rogue River upstream of Gold Ray Dam, 1977-81 and 1988-90.

Year	Mortality rate (%) Wild	Mortality rate (%) Hatchery	Water temperature[a]	Flow[b]	Fish abundance[c]
1977	22.0	62.8	18.7	1,166	16,395
1978	2.4	7.5	17.7	2,442	47,224
1989	2.6	3.6	17.4	2,274	38,532
1980	2.6	2.7	17.3	2,134	36,651
1981	10.4	28.2	18.2	1,905	17,285
1988	3.4	3.8	15.1	2,288	82,885
1989	1.2	3.4	15.3	2,532	60,330
1990	3.4	9.3	16.0	2,082	24,590

[a] *Mean maximum water temperature (^{o}C) at Raygold in June-July.*
[b] *Mean flow (cfs) at Raygold in June-July.*
[c] *Estimated number of spring chinook salmon that passed Gold Ray Dam.*

Appendix Table E-101. Correlation matrix for variables examined in the regression analysis of the rate of prespawning mortality among spring chinook salmon in the Rogue River upstream of Gold Ray Dam. Description of variables can be found in Appendix Table E-100. Percentages were transformed to logits prior to analysis.

	% mortality		Water		Fish
	Wild	Hatchery	temperature	Flow	abundance
% mortality-wild fish	1.00				
% mortality-hatchery fish	0.93[a]	1.00			
Water temperature	0.91[a]	0.91[a]	1.00		
Flow	-0.94[a]	-0.89[a]	-0.84[a]	1.00	
Fish abundance	-0.63	-0.68	-0.77[a]	0.67	1.00

[a] $P \leq 0.05$.

Appendix Table E-102. Estimated number of wild and hatchery age 2-6 spring chinook salmon that died upstream of Gold Ray Dam, 1974-94. Estimates for hatchery fish do not include fish released in June from Cole M. Rivers Hatchery.

Return	Wild fish					Hatchery fish				
year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1974	5	52	115	75	2	0	0	3	4	0
1975	5	9	17	10	0	0	1	1	0	0
1976	19	16	83	28	1	0	1	6	1	0
1977	201	1,274	3,964	2,248	67	0	44	700	44	0
1978	130	100	356	87	1	15	57	15	27	0
1979	44	331	740	327	5	16	99	299	21	0
1980	39	6	89	27	1	14	5	37	6	0
1981	52	200	193	269	36	19	145	90	62	6
1982	126	82	242	25	5	52	22	117	8	2
1983	5	16	41	12	0	2	10	12	6	0
1984	11	6	32	3	0	18	3	14	2	0
1985	533	429	1,134	522	0	216	663	488	189	0
1986	1,085	2,061	1,256	189	23	885	1,374	1,917	51	0
1987	1,448	3,868	7,303	501	0	1,921	2,220	9,354	1,156	0
1988	112	429	1,197	143	0	55	305	436	164	0
1989	11	24	115	54	0	20	117	421	12	0
1990	23	41	294	55	7	29	81	462	107	0
1991	2	14	43	28	0	7	28	109	39	1
1992	483	222	1,958	1,044	0	497	843	5,875	2,075	128
1993	1	3	9	5	0	5	8	24	5	0
1994	40	462	2,925	2,707	257	473	2,115	5,220	5,792	122

Appendix Table E-103. Distribution of tagged spring chinook salmon recovered as spawned carcasses in the Rogue River basin, 1974-78 and 1986-87. Data were grouped so that areas of the mainstem were of similar distance.

Year	River kilometer of the Rogue River				Big Butte Creek
	205-216	217-228	229-240	241-252	
1974	8	2	17	24	9
1975	3	2	3	18	6
1976	4	7	9	21	5
1977	1	0	0	4	1
1978	11	14	16	59	16
1986	10	11	19	22	12
1987	32	17	36	43	11

Appendix Table E-104. Distribution of tagged fall chinook salmon recovered as spawned carcasses in the Rogue River basin, 1974-78 and 1986-87. Data were grouped so that areas of the mainstem were of similar distance.

Year	River kilometer of the Rogue River				Big Butte Creek
	205-216	217-228	229-240	241-252	
1974	0	0	0	0	0
1975	1	0	0	0	0
1976	4	0	0	0	0
1977	2	1	2	0	0
1978	6	2	1	0	0
1986	21	4	8	3	1
1987	17	4	5	6	0

Appendix Table E-105. Data used to estimate the number of wild female chinook salmon recovered as spawned carcasses, 1974-81 and 1986-87. Females of hatchery origin were 100% marked in 1974-77.

Parameter	Rogue River RK 206-212	Rogue River RK 212-223	Rogue River RK 223-235	Rogue River RK 235-245	Rogue River RK 245-252	Sand Hole channel	Big Butte Creek
				1974			
# marked	0	2	3	2	5	3	5
# wild	109	194	404	440	831	111	470
				1975			
# marked	1	0	2	2	11	7	11
# wild	160	161	304	308	597	160	430
				1976			
# marked	0	1	1	1	21	13	3
# wild	112	268	311	343	551	98	407
				1977			
# marked	1	3	2	1	5	5	1
# wild	52	67	105	119	275	72	244
				1978			
# unmarked	232	325	840	1,594	1,963	337	1,127
# marked	0	0	3	24	39	26	22
% marked[a]	85.1	85.1	85.1	85.1	85.1	85.1	85.1
# wild	232	325	839	1,590	1,956	332	1,123

[a] *Percent marked among age 4-6 adults of hatchery origin.*

Appendix Table E-105. Continued.

Parameter	Rogue River RK 206-212	RK 212-223	RK 223-235	RK 235-245	RK 245-252	Sand Hole channel	Big Butte Creek
				1979			
# unmarked	85	213	553	927	1,250	199	517
# marked	0	0	0	2	29	16	3
% marked[a]	35.6	35.6	35.6	35.6	35.6	35.6	35.6
# wild	85	213	553	923	1,197	170	512
				1980			
# unmarked	160	300	594	962	983	127	489
# marked	0	0	1	1	13	8	6
% marked[a]	30.1	30.1	30.1	30.1	30.1	30.1	30.1
# wild	160	300	592	960	953	108	475
				1981			
# unmarked	141	174	190	348	423	64	205
# marked	0	2	1	4	10	8	2
% marked[a]	39.6	39.6	39.6	39.6	39.6	39.6	39.6
# wild	141	171	188	342	408	52	202
				1986			
# unmarked	312	604	842	778	907	240	471
# marked	4	29	11	40	75	79	44
% marked[a]	40.6	40.6	40.6	40.6	40.6	40.6	40.6
# wild	306	562	826	720	797	125	407
				1987			
# unmarked	665	735	1,005	1,080	1,510	363	716
# marked	10	20	37	36	95	42	32
% marked[a]	27.5	27.5	27.5	27.5	27.5	27.5	27.5
# wild	639	682	908	985	1,260	252	632

Appendix Table E-106. Data used to estimate the number of wild female chinook salmon recovered as spawned carcasses, 1982-85 and 1988-94.

Parameter	Rogue River (RK) 235-245	Rogue River (RK) 245-252	Sand Hole channel	Parameter	Rogue River (RK) 235-245	Rogue River (RK) 245-252	Sand Hole channel
	1982				1983		
# unmarked	--	640	67	# unmarked	--	279	33
# marked	--	16	13	# marked	--	8	4
% marked[a]	--	33.8	33.8	% marked[a]	--	39.9	39.9
# wild	--	609	41	# wild	--	267	27
	1984				1985		
# unmarked	--	372	40	# unmarked	--	1,010	102
# marked	--	2	7	# marked	--	59	38
% marked[a]	--	32.8	32.8	% marked[a]	--	35.3	35.3
# wild	--	368	26	# wild	--	902	32
	1988				1989		
# unmarked	1,703	2,141	195	# unmarked	793	1,057	232
# marked	34	35	12	# marked	20	59	26
% marked[a]	18.3	18.3	18.3	% marked[a]	18.9	18.9	18.9
# wild	1,551	1,985	141	# wild	707	804	120
	1990				1991		
# unmarked	397	716	233	# unmarked	--	283	56
# marked	3	31	18	# marked	--	7	6
% marked[a]	10.0	10.0	10.0	% marked[a]	--	8.2	8.2
# wild	370	437	71	# wild	--	205	0
	1992				1993		
# unmarked	--	210	25	# unmarked	--	506	65
# marked	--	8	2	# marked	--	17	8
% marked[a]	--	7.1	7.1	% marked[a]	--	8.4	8.4
# wild	--	105	0	# wild	--	320	0
	1994						
# unmarked	--	245	37				
# marked	--	4	4				
% marked[a]	--	8.5	8.5				
# wild	--	202	0				

[a] *Percent marked among age 4-6 adults of hatchery origin.*

Appendix Table E-107. Correlation matrix for variables examined in the analysis of the percentage of wild female chinook salmon that spawned upstream of Shady Cove, 1974-81 and 1986-87. Percentage data were logit transformed prior to analysis. Data are described in Appendix Table E-108.

	Spawner distribution	Water temperature		Flow	
		Incubation	Spawning	Spawning	Migration
Spawning distribution	1.00				
Incubation temperature	-0.39	1.00			
Spawning temperature	0.73[a]	-0.42	1.00		
Spawning flow	0.61	0.14	-0.69[a]	1.00	
Migration flow	-0.62	0.56	-0.86[a]	0.64[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table E-108. Independent variables used to assess factors related to the estimated spawning distribution of wild female chinook salmon in the area upstream of Gold Ray Dam, 1974-81 and 1986-87.

Year	Spawner distribution[a]	Water temperature		Flow	
		Incubation[b]	Spawning[c]	Spawning[d]	Migration[e]
1974	72.4	5.8	9.7	1,393	1,504
1975	70.5	4.6	10.4	1,481	1,447
1976	66.9	5.0	10.5	1,327	1,525
1977	76.0	6.8	12.9	1,252	1,179
1978	78.2	6.0	10.8	1,398	1,733
1979	76.7	6.1	10.6	1,358	1,721
1980	70.3	7.5	10.0	1,254	1,658
1981	66.8	8.8	9.0	1,473	1,879
1986	54.7	7.4	9.0	1,537	1,963
1987	58.4	7.5	8.5	1,472	2,021

[a] *Estimated percentage that spawned upstream of Shady Cove.*
[b] *Mean maximum water temperature (^{o}C) near McLeod in September-October.*
[c] *Mean maximum water temperature (^{o}C) near McLeod in October-December in year i-4.*
[d] *Mean flow at Dodge Bridge in September-October.*

Appendix Table E-109. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the RK 206-212 survey area, 1974-87. The area was not surveyed in 1982-85.

1974		1975		1976		1977		1978	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/01	0	10/10	19	10/14	23	10/19	5	10/10	60
10/14	6	10/17	55	10/21	30	10/27	5	10/18	70
10/21	23	10/24	44	10/28	36	11/04	14	10/24	55
10/29	40	11/31	6	11/03	14	11/10	20	10/30	47
11/04	19	11/07	24	11/11	9	11/18	8	--	--
11/12	21	11/14	12	--	--	--	--	--	--

1979		1980		1981		1986		1987	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/17	43	10/10	21	10/12	6	09/19	1	09/24	3
10/23	32	10/17	43	10/19	21	09/25	0	10/01	5
10/30	10	10/23	56	10/26	45	10/02	3	10/08	38
--	--	10/31	20	11/02	45	10/09	34	10/15	77
--	--	--	--	11/09	24	10/16	43	10/22	119
--	--	--	--	--	--	10/23	115	10/29	225
--	--	--	--	--	--	10/30	45	11/05	113
--	--	--	--	--	--	11/06	36	11/12	76
--	--	--	--	--	--	11/13	35	11/19	9

Appendix Table E-110. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the RK 212-223 survey area, 1974-87. The area was not surveyed in 1982-85.

1974		1975		1976		1977		1978	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/01	32	10/03	29	10/08	47	10/12	10	10/03	43
10/14	80	10/10	39	10/14	58	10/19	8	10/11	91
10/21	36	10/16	44	10/21	91	10/25	20	10/16	77
10/29	46	10/23	43	10/28	58	11/03	24	10/23	76
--	--	10/30	6	11/02	14	11/09	5	11/01	38

1979		1980		1981		1986		1987	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/10	112	10/03	33	10/08	11	09/18	0	09/24	11
10/18	82	10/10	52	10/15	19	09/25	5	10/01	29
10/24	19	10/17	73	10/22	71	10/02	14	10/08	43
--	--	10/24	41	10/29	34	10/09	112	10/15	145
--	--	10/31	30	11/06	19	10/16	154	10/22	176
--	--	11/06	71	11/13	20	10/23	134	10/29	147
--	--	--	--	--	--	10/30	95	11/05	101
--	--	--	--	--	--	11/06	60	11/12	60
--	--	--	--	--	--	11/13	30	11/19	23

Appendix Table E-111. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the RK 223-235 survey area, 1974-87. The area was not surveyed in 1982-85.

1974		1975		1976		1977		1978	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/20	4	09/21	20	09/30	45	10/11	24	09/28	62
09/25	16	10/03	69	10/08	101	10/20	47	10/03	209
10/02	70	10/09	71	10/13	82	10/27	23	10/11	264
10/09	150	10/16	49	10/20	52	11/02	11	10/17	197
10/16	70	10/23	60	10/27	31	--	--	10/24	92
10/23	55	10/29	35	--	--	--	--	10/31	16
10/31	39	--	--	--	--	--	--	--	--

1979		1980		1981		1986		1987	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/01	158	10/02	102	10/07	37	09/18	5	09/22	10
10/08	229	10/09	214	10/14	58	09/23	11	09/29	30
10/15	102	10/16	183	10/22	70	09/30	32	10/06	103
10/22	50	10/23	57	10/28	25	10/07	146	10/13	173
10/29	14	10/30	38	--	--	10/14	233	10/20	271
--	--	--	--	--	--	10/21	198	10/27	161
--	--	--	--	--	--	10/28	122	11/03	145
--	--	--	--	--	--	11/04	74	11/10	66
--	--	--	--	--	--	11/11	21	11/17	46

Appendix Table E-112. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the RK 235-245 survey area, 1974-90. The area was not surveyed in 1982-85.

1974		1975		1976		1977		1978	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/19	8	09/24	42	09/22	31	09/27	5	09/14	7
09/26	52	09/30	59	09/29	78	10/03	18	09/22	21
10/03	78	10/07	75	10/07	102	10/11	35	09/28	176
10/10	131	10/15	73	10/13	56	10/18	27	10/05	381
10/17	87	10/22	55	10/20	49	10/25	25	10/12	508
10/24	52	10/28	4	10/27	27	10/31	9	10/19	290
10/31	32	--	--	--	--	--	--	10/26	167
--	--	--	--	--	--	--	--	11/02	44

1979		1980		1981		1986		1987	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/24	201	09/26	64	09/30	19	09/17	2	09/22	18
10/01	218	10/01	111	10/06	40	09/23	14	09/29	47
10/08	345	10/08	241	10/13	75	09/30	48	10/06	109
10/15	104	10/15	318	10/21	95	10/07	110	10/13	211
10/22	41	10/22	155	10/27	84	10/14	158	10/20	195
10/29	18	10/29	62	11/03	35	10/21	221	10/27	237
--	--	11/05	11	--	--	10/28	127	11/03	137
--	--	--	--	--	--	11/04	68	11/10	103
--	--	--	--	--	--	11/11	30	11/17	23

1988		1989		1990	
Date	*N*	Date	*N*	Date	*N*
09/19	20	09/18	12	09/19	12
09/26	66	09/26	79	09/26	15
10/04	160	10/03	134	10/03	36
10/11	384	10/10	176	10/10	71
10/18	462	10/17	171	10/17	93
10/25	360	10/24	110	10/24	102
11/01	155	10/31	165	10/31	47
11/08	96	11/07	46	11/07	21

Appendix Table E-113. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the RK 245-252 survey area, 1974-94.

1974		1975		1976		1977		1978		1979	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/19	5	09/19	26	09/16	4	09/27	9	09/14	16	09/13	2
09/26	89	09/25	92	09/22	35	10/03	45	09/22	81	09/19	30
09/30	84	10/02	165	09/28	88	10/10	82	09/29	255	09/25	61
10/04	160	10/08	109	10/06	148	10/17	73	10/06	441	10/02	272
10/11	162	10/14	85	10/12	142	10/24	46	10/13	482	10/09	380
10/18	130	10/21	72	10/19	95	10/31	16	10/20	441	10/16	255
10/25	95	10/28	17	10/26	32	11/07	4	10/27	205	10/23	136
11/01	76	11/04	31	11/01	7	--	--	11/03	42	10/30	102
11/08	30	--	--	--	--	--	--	--	--	11/06	12

1980		1981		1982		1983		1984		1985	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/16	8	09/30	6	09/22	7	09/21	13	09/20	1	09/19	9
09/25	56	10/06	59	09/29	34	09/28	25	09/27	7	09/26	36
09/30	107	10/12	98	10/05	126	10/05	52	10/03	21	10/03	112
10/06	206	10/20	94	10/14	138	10/12	65	10/10	52	10/10	160
10/14	202	10/26	97	10/20	186	10/19	52	10/18	121	10/17	239
10/21	252	11/03	51	10/27	87	10/26	26	10/25	112	10/24	170
10/28	114	11/10	18	11/03	42	11/01	27	11/01	47	10/31	178
11/04	38	--	--	11/10	20	11/08	19	11/07	11	11/07	71
--	--	--	--	--	--	--	--	--	--	11/14	35

1986		1987		1988		1989		1990		1991	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/16	8	09/20	14	09/19	23	09/18	16	09/17	7	09/18	3
09/22	16	09/28	43	09/26	64	09/25	69	09/24	12	09/25	11
09/29	35	10/05	104	10/03	137	10/02	128	10/01	47	10/02	23
10/06	91	10/12	250	10/10	410	10/09	248	10/08	90	10/09	43
10/13	164	10/19	343	10/17	613	10/17	268	10/15	148	10/17	73
10/20	238	10/26	282	10/24	414	10/23	171	10/22	183	10/23	54
10/27	211	11/02	272	10/31	293	10/30	88	10/29	126	10/30	46
11/03	96	11/09	149	11/07	129	11/06	69	11/05	80	11/06	21
11/10	48	11/16	53	11/15	58	--	--	11/12	23	11/13	9

1992		1993		1994	
Date	*N*	Date	*N*	Date	*N*
09/21	5	09/20	9	09/20	2
09/28	11	09/27	26	09/27	13
10/05	25	10/04	59	10/04	26
10/12	34	10/11	113	10/11	36
10/19	42	10/18	123	10/18	57
10/26	47	10/25	102	10/25	54
11/02	27	11/01	55	11/01	31
11/09	13	11/08	19	11/08	18
11/16	6	--	--	11/15	8

Appendix Table E-114. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the Sand Hole channel (RK 252) survey area, 1974-94.

1974		1975		1976		1977		1978		1979	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/22	8	09/18	0	09/16	2	09/29	4	09/14	3	09/24	2
09/27	5	10/02	32	09/22	4	10/06	9	09/20	3	10/01	15
10/01	18	10/09	48	09/28	2	10/13	25	09/29	33	10/08	29
10/03	4	10/16	47	10/06	10	10/21	21	10/05	72	10/15	18
10/08	33	10/23	24	10/12	15	10/28	13	10/11	75	10/22	10
10/13	21	10/30	4	10/19	42	--	--	10/18	91	10/29	5
11/10	22	11/06	5	10/26	18	--	--	10/25	42	11/05	6
--	--	11/12	0	11/01	5	--	--	10/30	18	--	--
--	--	--	--	--	--	--	--	--	--	--	--

1980		1981		1982		1983		1984		1985	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/22	1	09/25	1	09/22	0	09/21	1	09/20	0	09/19	0
10/06	15	10/02	8	09/28	6	09/28	2	09/27	1	09/26	0
10/13	42	10/09	9	10/05	10	10/05	6	10/03	2	10/03	6
10/20	35	10/16	13	10/14	15	10/12	6	10/10	4	10/10	12
10/27	20	10/23	12	10/20	22	10/19	4	10/18	12	10/17	26
11/04	5	10/30	4	10/27	7	10/26	7	10/25	7	10/24	22
--	--	11/06	15	11/03	7	11/01	5	11/01	9	10/31	21
--	--	11/13	2	--	--	11/08	2	11/08	5	11/07	12
--	--	--	--	--	--	--	--	--	--	11/14	3

1986		1987		1988		1989		1990		1991	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/16	1	09/21	10	09/19	4	09/18	0	09/17	3	09/18	1
09/22	3	09/28	19	09/26	5	09/25	15	09/24	10	09/25	2
09/29	15	10/05	46	10/03	12	10/02	27	10/01	8	10/02	5
10/06	20	10/12	52	10/10	31	10/09	42	10/08	17	10/09	8
10/13	35	10/19	58	10/17	51	10/17	74	10/15	37	10/17	13
10/20	66	10/26	66	10/24	36	10/23	40	10/22	44	10/23	8
10/27	50	11/02	64	10/31	26	10/30	25	10/29	70	10/30	11
11/03	41	11/09	30	11/07	26	11/06	9	11/05	31	11/06	6
11/10	9	11/16	18	11/15	4	--	--	11/12	13	11/13	2

1992		1993		1994	
Date	*N*	Date	*N*	Date	*N*
09/21	2	09/20	3	09/20	0
09/28	11	09/27	1	09/27	0
10/05	3	10/04	7	10/04	1
10/12	3	10/11	13	10/11	10
10/19	5	10/18	21	10/18	9
10/26	0	10/25	15	10/25	7
11/02	1	11/01	4	11/01	3
11/09	0	11/08	1	11/08	4
--	--	--	--	11/15	3

Appendix Table E-115. Daily recoveries of spawned carcasses of unmarked female chinook salmon in the Big Butte Creek survey area, 1974-90. The area was not surveyed in 1982-85.

1974		1975		1976		1977		1978	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
10/03	78	09/17	6	09/16	5	10/04	43	09/20	24
10/08	58	09/25	36	09/23	18	10/13	60	09/26	126
10/14	105	10/02	96	09/29	118	10/21	71	10/02	268
10/23	63	10/09	92	10/06	83	10/28	48	10/09	255
10/28	57	10/16	101	10/12	68	11/04	19	10/16	287
11/06	85	10/23	46	10/18	40	11/08	3	10/23	111
11/14	17	10/30	28	10/25	27	--	--	10/30	56
11/27	7	11/06	20	11/04	40	--	--	--	--
--	--	11/12	5	11/10	8				

1979		1980		1981		1986		1987	
Date	*N*	Date	*N*	Date	*N*	Date	*N*	Date	*N*
09/24	55	09/22	12	09/25	0	09/16	0	09/21	4
10/01	64	09/29	48	10/02	3	09/22	3	09/28	20
10/08	104	10/06	93	10/09	21	09/29	11	10/05	56
10/15	86	10/13	113	10/16	42	10/06	58	10/12	112
10/22	137	10/20	72	10/23	75	10/13	90	10/19	175
10/29	71	10/27	89	10/30	24	10/20	144	10/26	193
--	--	11/03	55	11/06	38	10/27	84	11/02	113
--	--	11/10	7	11/13	2	11/03	70	11/09	43
--	--	--	--	--	--	11/10	11	--	--

Appendix Table E-116. Estimated mean day-of-year that unmarked female chinook salmon spawned in the Rogue River upstream of Gold Ray Dam and the median day-of-year that female spring chinook salmon were ready to spawn at Cole M. Rivers Hatchery. Day-of-year calendar is in **APPENDIX A.**

	Rogue River							
Year	RK 206-212	RK 212-223	RK 223-235	RK 235-245	RK 245-252	Sand Hole channel	Big Butte Creek	Cole Rivers Hatchery[a]
1974	283.4 ± 1.9	276.9 ± 1.4	274.0 ± 0.9	272.8 ± 1.0	274.3 ± 0.8	272.8 ± 2.1	274.9 ± 1.2	--
1975	285.4 ± 1.6	276.2 ± 1.2	273.8 ± 1.3	270.2 ± 1.1	269.6 ± 0.9	274.0 ± 1.5	273.2 ± 1.2	275
1976	286.8 ± 1.6	281.0 ± 0.9	273.8 ± 0.9	269.9 ± 1.1	270.6 ± 0.8	277.9 ± 2.0	271.8 ± 1.2	279
1977	298.6 ± 2.4	288.0 ± 2.0	281.9 ± 1.3	276.7 ± 1.7	275.8 ± 1.1	277.7 ± 1.9	279.9 ± 1.2	279
1978	281.4 ± 1.0	278.1 ± 0.9	273.0 ± 0.5	273.3 ± 0.5	273.5 ± 0.5	274.4 ± 0.5	271.4 ± 0.6	277
1979	282.6 ± 2.0	275.7 ± 1.3	270.6 ± 0.6	270.0 ± 0.6	273.0 ± 0.6	277.5 ± 1.6	275.9 ± 1.1	284
1980	284.1 ± 1.4	283.0 ± 1.3	274.1 ± 0.6	274.3 ± 0.6	275.3 ± 0.7	277.5 ± 1.6	277.6 ± 1.0	281
1981	290.5 ± 1.3	287.2 ± 1.5	278.8 ± 1.0	280.8 ± 1.0	281.5 ± 0.9	282.4 ± 3.2	284.9 ± 1.3	273
1982	--	--	--	--	278.1 ± 0.8	278.0 ± 2.4	--	279
1983	--	--	--	--	276.5 ± 1.5	279.4 ± 4.4	--	278
1984	--	--	--	--	281.4 ± 0.9	284.3 ± 3.4	--	282
1985	--	--	--	--	280.9 ± 0.8	284.5 ± 0.7	--	276
1986	286.7 ± 1.2	282.9 ± 0.9	279.6 ± 0.7	280.4 ± 0.8	281.5 ± 0.8	282.2 ± 1.4	281.6 ± 0.9	275
1987	289.1 ± 0.8	285.9 ± 0.9	283.8 ± 0.8	283.3 ± 0.8	284.6 ± 0.6	282.8 ± 1.5	283.2 ± 0.8	274
1988	--	--	--	279.3 ± 0.5	280.6 ± 0.5	282.0 ± 1.7	--	280
1989	--	--	--	275.3 ± 0.8	276.2 ± 0.8	277.0 ± 1.4	--	276
1990	--	--	--	278.9 ± 1.1	281.6 ± 0.9	284.1 ± 1.6	--	278
1991	--	--	--	--	280.2 ± 1.4	281.0 ± 3.4	--	276
1992	--	--	--	--	281.4 ± 1.7	267.1 ± 4.3	--	274
1993	--	--	--	--	278.4 ± 1.0	277.8 ± 2.5	--	273
1994	--	--	--	--	281.4 ± 1.6	284.2 ± 3.8	--	279

[a] *Median date of spawning. Estimates included females that were not spawned, but were judged to be ready for spawning. Data received from Michael Evenson, ODFW, Cole M. Rivers Hatchery, Trail, Oregon.*

Appendix Table E-117. Regression analysis of the mean date of spawning for wild female chinook salmon that spawned between Cole M. Rivers Hatchery and Rogue Elk Park, 1974-94. Spawner composition data were logit transformed prior to analysis. Data are described in Appendix Tables E-116 and E-119.

Independent variable	Regression coefficient	Standard error	*P*
Incubation temperature	2.094	0.590	0.002
Spawning temperature	-1.420	0.537	0.017
Spawner composition	1.368	0.650	0.050
Constant	278.9		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	252.9	3	84.3	16.92	<0.001
Residual	84.7	17	5.0		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Incubation temperature	0.59	--	--
Spawning temperature	0.39	0.17	--
Spawner composition	0.21	0.11	0.18
Spawning flow	0.03	0.01	0.07
Spawning date - hatchery fish	0.09	0.04	0.02

Appendix Table E-118. Correlation matrix for variables examined in the analysis of the mean date of spawning for wild female salmon that spawned between Cole M. Rivers Hatchery and Rogue Elk Park, 1974-94. Spawner composition data were logit transformed prior to analysis. Data are described in Appendix Tables E-116 and E-119.

	Spawning		Water temperature		Spawner	Hatchery
	Date	Flow	Spawning	Incubation	composition	fish
Spawning date	1.00					
Spawning flow	0.17	1.00				
Spawning temperature	-0.62[a]	-0.46[a]	1.00			
Incubation temperature	0.77[a]	0.28	-0.46[a]	1.00		
Spawner composition	0.46[a]	0.05	-0.07	0.32	1.00	
Hatchery fish	-0.30	0.04	0.22	-0.22	-0.32	1.00

[a] *Significant at* $P \leq 0.05$.

Appendix Table E-119. Independent variables used to assess factors related to the mean date of spawning by wild female spring chinook salmon between Cole M. Rivers Hatchery and Rogue Elk Park, 1974-94.

Year	Spawning flow[a]	Water temperature		Spawner composition[d]	Spawning time at hatchery[e]
		Spawning[b]	Incubation[c]		
1974	1,393	9.7	5.8	13.8	--
1975	1,481	10.4	4.6	15.9	275
1976	1,327	10.5	5.0	11.5	279
1977	1,252	12.9	6.8	17.7	279
1978	1,398	10.8	6.0	18.6	277
1979	1,358	10.6	6.1	14.6	284
1980	1,254	10.0	7.5	11.7	281
1981	1,473	9.0	8.8	33.0	273
1982	1,863	9.5	7.3	19.6	279
1983	2,044	9.5	7.5	35.0	278
1984	1,837	8.7	7.5	33.7	282
1985	1,652	8.0	7.7	18.0	276
1986	1,537	9.0	7.4	19.2	275
1987	1,472	8.5	7.5	16.7	274
1988	1,379	8.7	6.4	21.1	280
1989	1,600	9.7	5.5	24.1	276
1990	1,471	9.2	7.3	16.7	278
1991	1,439	9.2	7.5	31.0	276
1992	1,253	10.4	7.1	76.4	274
1993	1,436	9.5	7.5	41.6	273
1994	1,402	9.7	6.7	62.4	279

[a] *Mean flow at Dodge Bridge in September-October.*
[b] *Mean maximum water temperature (^{o}C) near McLeod in September-October.*
[c] *Mean maximum water temperature (^{o}C) near McLeod in October-December in year i-4.*
[d] *Estimated percentage of spawners that were fall chinook salmon.*
[e] *Median date of spawning for female spring chinook salmon held at Cole M. Rivers Hatchery.*

APPENDIX F

Tables of Data and Analyses Related to Studies of the Freshwater Fisheries for Spring Chinook Salmon

Appendix Table F-1. Mean annual counts of bank anglers and boats seen in the lower river (RK 5-28) fishery for spring chinook salmon in April-May, 1966-81.

Year	95% confidence interval 0800 hours	1000 hours	1700 hours
	BANK ANGLERS		
1966	27.2 ± 7.7	33.9 ± 9.1	20.0 ± 6.1
1967	55.0 ± 13.9	67.4 ± 15.0	37.1 ± 10.7
1968	21.2 ± 6.7	27.4 ± 8.0	12.6 ± 2.9
1977	28.3 ± 3.6	25.0 ± 2.9	14.6 ± 2.9
1978	56.5 ± 4.9	55.2 ± 4.3	32.6 ± 4.7
1979	61.2 ± 10.6	64.7 ± 12.4	39.7 ± 10.0
1980	55.6 ± 8.8	53.2 ± 8.1	33.6 ± 5.6
1981	40.1 ± 4.8	41.1 ± 5.3	24.1 ± 3.3
	BOATS		
1966	50.0 ± 9.8	62.8 ± 12.4	31.1 ± 7.9
1967	47.0 ± 9.7	56.7 ± 12.1	24.2 ± 7.4
1968	24.6 ± 2.6	29.8 ± 3.2	14.8 ± 2.5
1977	20.6 ± 3.5	20.0 ± 2.8	11.8 ± 2.8
1978	29.5 ± 5.6	30.0 ± 5.5	18.1 ± 4.1
1979	29.7 ± 6.2	30.6 ± 6.2	16.9 ± 5.1
1980	32.3 ± 5.4	25.8 ± 4.7	16.8 ± 3.2
1981	25.4 ± 2.4	23.0 ± 2.5	14.4 ± 1.9

Appendix Table F-2. Regression analysis of the weekly indexes of effort by bank anglers who fished for spring chinook salmon in the RK 5-28 survey area, 1977-81. Variables are described in Appendix Table F-3.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	4.13×10^{-3}	1.18×10^{-3}	0.001
Flow	2.91×10^{-3}	0.55×10^{-3}	<0.001
Constant	14.4		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	9,808	2	4,904	22.76	<0.001
Residual	8,186	38	215		

Variables tested	Partial r^2 Step 1	Partial r^2 Step 2
Fish abundance	0.21	0.23
Flow	0.44	--
Flow decrease	0.21	0.01
Water temperature	0.16	0.01
Turbidity	0.18	0.04

Appendix Table F-3. Data used to assess factors that affected weekly indexes of angler effort and weekly catch rates in the RK 5-28 fishery for spring chinook salmon, 1977-81. Catch rates are not reported when weekly interviews totaled less than 100 hours of angler effort.

Year	Week[a]	Catch rate[b]		Effort[c]		Fish abundance[d]	Flow[e]	Flow decrease[f]	Water temperature[g]	Turbidity[h]
		Bank	Boat	Bank	Boat					
1977	14	0.0000	0.0000	17.0	11.0	1,335	3,774	80	13.5	6.7
1977	15	0.0000	0.0000	31.0	14.3	976	3,169	480	14.4	6.2
1977	16	0.0000	0.0108	26.2	12.8	1,329	2,227	330	15.3	4.4
1977	17	0.0038	0.0268	27.3	16.3	4,517	2,009	200	16.7	4.8
1977	18	0.0171	0.0290	31.3	25.3	3,324	3,484	50	15.7	4.8
1977	19	0.0081	0.0113	32.3	33.0	i	3,662	390	15.3	4.1
1977	20	0.0113	0.0287	25.3	25.8	i	3,175	180	15.8	2.4
1977	21	0.0166	0.0295	18.3	24.8	i	3,416	430	16.4	3.7
1977	22	0.0244	0.0321	17.3	17.3	i	3,015	1,440	18.6	0.9
1978	14	0.0017	0.0266	39.0	8.3	1,080	10,964	2,470	9.9	7.6
1978	15	0.0111	0.0030	66.0	15.5	2,144	8,002	1,050	12.6	4.8
1978	16	0.0043	0.0182	55.8	16.0	2,814	11,473	190	10.6	7.4
1978	17	0.0098	0.0116	65.3	33.3	4,013	10,996	1,340	12.6	5.0
1978	18	0.0072	0.0101	59.0	45.5	8,209	7,379	1,600	14.0	4.0
1978	19	0.0037	0.0279	56.8	44.8	3,816	5,082	400	15.9	2.8
1978	20	0.0319	0.0411	59.0	44.8	8,472	7,566	1,190	15.9	5.4
1978	21	0.0146	0.0314	46.8	35.3	3,962	5,524	360	15.1	3.3
1978	22	0.0275	0.0436	19.0	19.0	3,446	4,430	710	19.2	1.7

[a] *Week-of-year* (**APPENDIX A**).
[b] *Mean catch rates (fish per hour) by bank and boat anglers.*
[c] *Mean counts of bank anglers and boats at 1000 hours.*
[d] *Estimated passage at Gold Ray Dam five weeks later.*
[e] *Mean flow (cfs) at Agness + Illinois River at the mouth.*
[f] *Greatest decrease in flow (cfs) at Agness during week.*
[g] *Mean maximum water temperature (^{o}C) at Agness.*
[h] *Mean turbidity (JTU) at Ferry Hole (RK 8).*
[i] *Data excluded because of extensive prespawning mortality.*

Appendix Table F-3. Continued.

Year	Week[a]	Catch rate[b]		Effort[c]		Fish abundance[d]	Flow[e]	Flow decrease[f]	Water temperature[g]	Turbidity[h]
		Bank	Boat	Bank	Boat					
1979	14	0.0082	0.0056	44.3	14.8	2,082	4,975	640	12.3	2.9
1979	15	0.0056	0.0118	38.8	13.3	3,922	9,980	2,200	10.9	9.5
1979	16	0.0299	0.0621	88.0	28.5	7,029	15,207	6,240	11.0	11.3
1979	17	0.0214	0.0229	101.3	46.8	6,748	9,362	2,220	13.3	5.3
1979	18	0.0217	0.0270	62.5	26.5	3,809	11,637	560	14.3	8.7
1979	19	0.0274	0.0484	81.3	30.0	2,241	22,490	13,080	12.0	22.8
1979	20	0.0359	0.0283	86.3	52.0	2,211	10,041	2,390	17.1	3.7
1979	21	0.0184	0.0440	50.5	40.0	2,720	6,460	1,360	18.3	2.6
1979	22	0.0042	0.0276	16.5	20.3	2,249	4,413	1,150	18.4	1.6
1980	14	0.0000	--	33.3	8.0	813	11,319	1,490	9.4	5.1
1980	15	0.0063	0.0076	54.5	13.5	1,796	15,846	3,890	11.6	9.2
1980	16	0.0027	0.0301	61.3	27.8	1,805	11,877	280	13.0	5.8
1980	17	0.0054	0.0212	81.5	35.0	4,894	10,277	2,850	14.4	7.6
1980	18	0.0041	0.0041	66.3	34.5	4,521	7,325	1,110	16.2	3.2
1980	19	0.0057	0.0121	62.5	30.0	5,212	6,251	220	14.0	2.7
1980	20	0.0042	0.0216	49.8	33.0	5,506	4,756	940	16.7	4.2
1980	21	0.0026	0.0203	28.5	26.0	3,179	4,778	0	15.9	1.9
1980	22	0.0084	0.0000	21.8	19.5	3,408	3,918	1,000	17.7	1.9
1981	14	0.0057	0.0080	40.8	15.8	1,413	8,479	1,210	10.7	3.6
1981	15	0.0059	0.0186	48.3	20.0	876	6,931	820	11.6	3.4
1981	16	0.0014	0.0090	71.3	29.0	1,137	5,278	560	15.1	2.0
1981	17	0.0000	0.0054	44.5	29.3	3,636	4,507	370	15.3	1.8
1981	18	0.0027	0.0019	42.8	24.8	2,475	3,882	280	16.6	2.0
1981	19	0.0039	0.0167	40.5	24.0	1,769	3,252	330	17.3	1.7
1981	20	0.0045	0.0115	35.5	25.3	1,991	3,577	40	16.8	2.1
1981	21	0.0148	0.0114	30.5	23.8	1,319	4,325	1,080	17.7	3.7
1981	22	0.0000	0.0211	16.3	15.5	546	3,367	1,230	20.4	2.6

Appendix Table F-4. Correlation matrix for variables included in analyses of weekly indexes of effort and weekly catch rates for anglers who fished for spring chinook salmon in the RK 5-28 survey area, 1977-81. Variables are described in Appendix Table F-3.

	Catch rate		Angler effort		Fish		Flow	Water	
	Bank	Boat	Bank	Boat	abundance	Flow	decrease	temperature	Turbidity
Bank catch rate	1.00								
Boat catch rate	0.69[a]	1.00							
Bank angler effort	0.36[a]	0.20	1.00						
Boat angler effort	0.46[a]	0.31[a]	0.61[a]	1.00					
Fish abundance	0.42[a]	0.33[a]	0.45[a]	0.63[a]	1.00				
Flow	0.32[a]	0.35[a]	0.66[a]	0.10	0.11	1.00			
Flow decrease	0.42[a]	0.44[a]	0.46[a]	0.10	0.09	0.78[a]	1.00		
Water temperature	0.15	0.10	-0.40[a]	0.26	0.03	-0.65[a]	-0.31[a]	1.00	
Turbidity	0.27	0.33[a]	0.43[a]	-0.06	0.07	0.82[a]	0.85[a]	-0.55[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table F-5. Regression analysis of the weekly indexes of effort by boat anglers who fished for spring chinook salmon in the RK 5-28 survey area, 1977-81. Variables are described in Appendix Table F-3.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	3.26×10^{-3}	0.64×10^{-3}	<0.001
Water temperature	2.10	0.60	<0.001
Flow	0.94×10^{-3}	0.38×10^{-3}	0.020
Constant	-22.2		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	2,785	3	928	14.88	<0.001
Residual	2,309	38	62		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Fish abundance	0.40	--	--
Flow	0.01	0.00	0.08
Flow decrease	0.01	0.00	0.04
Water temperature	0.07	0.13	--
Turbidity	0.00	0.02	0.00

Appendix Table F-7. Data used to assess factors that affected weekly indexes of angler effort and weekly catch rates by boat anglers in the RK 212-235 fishery for spring chinook salmon, 1978-81. Catch rates are not reported when weekly interviews totaled less than 100 hours of boat angler effort and are not reported for bank anglers because few were surveyed.

Year	Week[a]	Catch rate[b]	Effort[c]	Fish abundance		Flow[f]	Water temperature[g]	Turbidity[h]
				Weekly[d]	Cumulative[e]			
1978	20	0.0445	17.8	977	1,605	2,257	12.8	1.8
1978	21	0.0229	7.4	1,886	3,491	1,964	12.4	1.8
1978	22	0.0479	17.5	2,516	6,007	1,872	15.0	1.6
1978	23	0.0459	10.0	3,154	9,161	1,947	15.4	1.5
1978	24	0.0516	15.6	7,106	16,267	2,238	14.8	1.7
1978	25	0.1517	16.2	3,510	19,777	2,184	15.2	1.5
1978	26	0.1135	23.0	8,135	27,912	2,170	15.9	1.4
1978	27	0.1127	18.0	3,806	31,718	2,241	16.8	1.4
1978	28	0.1005	18.0	3,349	35,067	2,457	17.0	1.4
1979	20	0.0319	8.0	1,124	1,864	3,617	13.3	3.7
1979	21	0.0400	14.0	3,188	5,052	2,921	14.0	2.7
1979	22	0.0639	22.7	6,692	11,744	2,125	15.0	2.6
1979	23	0.0528	15.7	4,944	16,688	1,791	15.6	3.1
1979	24	0.0625	13.6	2,921	19,609	1,965	14.2	2.4
1979	25	0.0622	25.4	2,197	21,806	1,975	14.6	2.5
1979	26	0.0978	27.0	2,206	24,012	1,970	15.1	3.0
1979	27	0.0602	26.5	2,711	26,723	2,470	17.2	3.2
1979	28	0.0526	15.2	2,127	28,850	2,524	17.5	3.2
1980	20	0.0150	6.8	709	1,186	1,871	13.6	1.9
1980	21	0.0183	20.3	1,020	2,206	2,305	11.6	2.3
1980	22	0.0189	19.8	1,243	3,449	1,785	13.8	1.5
1980	23	0.0310	24.2	3,754	7,203	1,748	14.2	2.4
1980	24	0.0317	26.0	3,604	10,807	2,007	14.1	1.7
1980	25	0.0337	27.4	4,295	15,102	2,060	15.6	1.0
1980	26	0.0471	24.0	4,543	19,645	2,018	14.6	0.9
1980	27	0.0608	19.0	2,704	22,349	2,034	16.2	1.3
1980	28	0.1147	15.5	3,190	25,539	2,018	15.0	1.6
1981	20	--	2.3	1,114	1,644	1,779	13.4	1.6
1981	21	0.0081	10.0	545	2,189	2,090	14.7	1.7
1981	22	0.0217	19.8	905	3,094	1,696	16.8	0.7
1981	23	0.0192	15.2	3,458	6,552	1,775	15.6	0.9
1981	24	0.0333	13.3	2,252	8,804	1,829	16.4	0.7
1981	25	0.0292	12.2	1,745	10,549	1,767	17.6	0.5
1981	26	0.0431	17.6	1,936	12,485	1,782	18.1	0.5
1981	27	0.0466	13.0	1,301	13,786	1,958	17.0	0.7
1981	28	0.0317	12.8	516	14,302	1,990	17.3	0.6

[a] *Week-of-year* (**APPENDIX A**).
[b] *Mean catch rate (fish per hour) by boat anglers.*
[c] *Mean daily counts of boat trailers.*
[d] *Estimated passage at Gold Ray Dam in week i-1 minus returns to Cole M. Rivers Hatchery in week i+3.*
[e] *Includes estimates from previous weeks.*
[f] *Mean flow (cfs) at Dodge Bridge.*
[g] *Mean maximum water temperature (^{o}C) at Dodge Bridge.*
[h] *Mean turbidity (JTU) at Dodge Bridge.*

Appendix Table F-8. Correlation matrix for variables included in analyses of weekly indexes of effort and weekly catch rates by boat anglers who fished for spring chinook salmon in the RK 212-235 survey area, 1978-81. Variables are described in Appendix Table F-10.

	Catch rate	Effort	Fish abundance		Water		
			Weekly	Cumulative	Flow	temperature	Turbidity
Catch rate	1.00						
Effort	0.32	1.00					
Weekly abundance	0.50[a]	0.41[a]	1.00				
Cumulative abundance	0.84[a]	0.43[a]	0.46[a]	1.00			
Flow	0.14	-0.08	0.02	0.11	1.00		
Water temperature	0.29	0.15	0.11	0.55[a]	-0.17	1.00	
Turbidity	0.13	0.10	0.08	0.08	0.56[a]	-0.38[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table F-9. Regression analysis of the weekly indexes of effort by bank anglers who fished for spring chinook salmon in the RK 235-253 survey area, 1977-81. Estimates of fish abundance were transformed to natural logarithms before analysis. Variables are described in Appendix Table F-10.

Independent variable	Regression coefficient	Standard error	*P*
Cumulative fish abundance	15.086	2.218	<0.001
Constant	-54.25		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	24,020	1	24,020	46.25	<0.001
Residual	22,333	43	519		

Appendix Table F-10. Data used to assess factors that affected weekly indexes of angler effort and weekly catch rates in the RK 235-253 fishery for spring chinook salmon, 1977-81. Catch rates are not reported when weekly interviews totaled less than 100 hours of angler effort.

Year	Week[a]	Catch rate[b]		Effort[c]		Fish abundance		Flow[e]	Water temperature[g]	Turbidity[h]
		Bank	Boat	Bank	Boat	Weekly[d]	Cumulative[e]			
1977	20	--	--	15.3	10.0	226	343	831	10.2	2.5
1977	21	0.0276	0.0033	18.7	7.3	215	558	907	10.5	5.1
1977	22	0.0219	0.0504	28.0	15.3	1,253	1,811	851	11.6	1.8
1977	23	0.0267	0.0642	37.2	19.0	903	2,714	909	12.1	1.5
1977	24	0.0276	0.0438	63.7	29.2	1,250	3,964	1,047	11.6	1.4
1977	25	0.0105	0.0594	73.3	30.0	4,340	8,304	1,048	11.9	3.1
1977	26	0.0386	0.0643	70.2	30.8	3,265	11,569	1,082	12.3	1.2
1977	27	0.0281	0.0563	83.0	28.0	657	12,226	1,056	12.3	1.2
1977	28	0.0328	0.0553	82.8	22.2	630	12,856	1,065	13.0	1.2
1978	20	0.0000	--	11.8	8.3	232	291	2,242	10.2	1.8
1978	21	0.0089	0.0427	12.0	6.0	337	628	1,911	10.4	1.7
1978	22	0.0207	0.0798	32.3	17.5	977	1,605	1,824	10.6	1.7
1978	23	0.0308	0.0611	50.0	17.6	1,886	3,491	1,932	11.6	1.5
1978	24	0.0220	0.0408	68.2	29.0	2,516	6,007	2,228	11.5	1.5
1978	25	0.0328	0.0393	65.6	25.0	3,154	9,161	2,135	12.3	1.6
1978	26	0.0253	0.0571	75.6	19.6	6,926	16,987	2,108	12.8	1.3
1978	27	0.0311	0.0848	104.4	32.2	3,510	19,777	2,177	13.5	1.4
1978	28	0.0419	0.0776	118.8	31.4	8,135	27,912	2,451	13.4	1.4

[a] *Week-of-year* (**APPENDIX A**).
[b] *Mean catch rates (fish per hour) by bank and boat anglers.*
[c] *Mean daily counts of bank anglers and boats.*
[d] *Estimated passage at Gold Ray Dam in week i-3 minus returns to Cole M. Rivers Hatchery in week i+1.*
[e] *Includes estimates from previous weeks.*
[f] *Mean flow (cfs) near McLeod.*
[g] *Mean maximum water temperature (^{o}C) near McLeod.*
[h] *Mean turbidity (JTU) near McLeod.*

Appendix Table F-10. Continued.

Year	Week[a]	Catch rate[b]		Effort[c]		Fish abundance		Flow[e]	Water temperature[g]	Turbidity[h]
		Bank	Boat	Bank	Boat	Weekly[d]	Cumulative[e]			
1979	20	0.0000	--	27.2	4.4	346	402	3,353	10.0	3.3
1979	21	0.0132	0.0574	33.8	8.4	338	740	2,797	10.4	3.0
1979	22	0.0190	0.0468	37.8	26.3	1,124	1,864	2,051	10.8	2.9
1979	23	0.0281	0.0404	101.5	17.3	3,188	5,052	1,757	10.9	2.4
1979	24	0.0371	0.0395	83.8	13.8	6,692	11,744	1,939	10.9	2.6
1979	25	0.0286	0.0397	106.8	14.8	4,944	16,688	1,941	9.8	2.9
1979	26	0.0300	0.0494	102.4	16.8	2,921	19,610	1,955	10.7	2.2
1979	27	0.0173	0.0268	113.0	18.3	2,197	21,806	2,472	14.0	2.5
1979	28	0.0196	0.0415	75.6	11.8	2,206	24,012	2,479	13.7	2.8
1980	20	0.0153	0.0344	24.8	6.8	79	164	1,802	10.4	1.9
1980	21	0.0223	0.0202	70.8	14.3	211	373	2,115	9.8	2.0
1980	22	0.0176	0.0331	53.8	11.4	37	410	1,717	11.0	1.9
1980	23	0.0211	0.0252	87.0	20.4	1,234	1,644	1,856	11.7	1.7
1980	24	0.0231	0.0157	131.0	27.0	665	2,309	1,881	11.6	1.1
1980	25	0.0320	0.0452	129.6	30.8	3,977	6,286	1,833	13.7	1.9
1980	26	0.0362	0.0394	102.2	27.3	3,604	9,890	1,856	11.9	1.3
1980	27	0.0378	0.0373	112.6	30.2	4,249	14,139	2,042	14.1	1.2
1980	28	0.0319	0.0258	105.0	26.5	5,031	19,170	2,066	12.0	1.1
1981	20	0.0190	--	31.8	6.5	35	82	1,673	11.7	2.3
1981	21	0.0224	0.0263	65.3	20.2	448	530	2,109	12.0	1.6
1981	22	0.0263	0.0189	60.8	27.8	1,114	1,644	1,587	13.1	0.9
1981	23	0.0272	0.0390	71.0	19.8	545	2,189	1,574	13.1	1.1
1981	24	0.0320	0.0179	73.5	28.3	905	3,094	1,878	13.0	0.8
1981	25	0.0384	0.0385	72.0	23.0	3,458	6,552	1,950	13.3	0.8
1981	26	0.0283	0.0325	75.4	19.8	2,252	8,804	1,928	13.5	0.8
1981	27	0.0400	0.0340	66.3	20.3	1,745	10,549	1,942	13.4	0.7
1981	28	0.0397	0.0340	55.8	15.0	1,936	12,485	1,941	13.1	0.7

Appendix Table F-11. Correlation matrix for variables included in analyses of weekly indexes of effort and weekly catch rates for anglers who fished for spring chinook salmon in the RK 235-253 survey area, 1977-81. Variables are described in Appendix Table F-10.

	Catch rate		Angler effort		Fish abundance			Water	
	Bank	Boat	Bank	Boat	Weekly	Cumulative	Flow	temperature	Turbidity
Bank catch rate	1.00								
Boat catch rate	0.07	1.00							
Bank angler effort	0.54[a]	-0.02	1.00						
Boat angler effort	0.56[a]	0.24	0.65[a]	1.00					
Weekly abundance	0.51[a]	0.33[a]	0.61[a]	0.45[a]	1.00				
Cumulative abundance	0.47[a]	0.32[a]	0.65[a]	0.38[a]	0.73[a]	1.00			
Flow	-0.26	-0.04	0.17	-0.16	0.19	0.23	1.00		
Water temperature	0.54[a]	0.08	0.52[a]	0.59[a]	0.34[a]	0.52[a]	0.01	1.00	
Turbidity	-0.46[a]	-0.11	-0.29[a]	-0.51[a]	-0.11	-0.14	0.04	-0.54[a]	1.00

[a] *Significant at $P \leq 0.05$.*

Appendix Table F-12. Regression analysis of the weekly indexes of effort by boat anglers who fished for spring chinook salmon in the RK 235-253 survey area, 1977-81. Estimates of fish abundance were transformed to natural logarithms before analysis. Variables are described in Appendix Table F-10.

Independent variable	Regression coefficient	Standard error	*P*
Cumulative fish abundance	2.734	0.605	<0.001
Turbidity	-3.311	1.088	0.004
Constant	3.420		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1,470	2	735	20.95	<0.001
Residual	1,473	42	35		

Variables tested	Partial r^2 Step 1	Step 2
Cumulative fish abundance	0.39	--
Flow	0.03	0.06
Water temperature	0.35	0.07
Turbidity	0.26	0.16

Appendix Table F-13. Annual catch rates (fish per hour) of spring chinook salmon in three areas of the Rogue River, 1965-76. Estimates include only those years when samplers surveyed a minimum of 1,500 hours of angler effort.

	RK 5-28		RK 212-235	RK 235-253	
Year	Bank	Boat	Boat	Bank	Boat
1965	--	0.0272	--	--	--
1966	0.0100	0.0319	--	--	--
1967	0.0145	0.0292	--	--	--
1968	0.0041	0.0369	--	--	--
1969	0.0135	0.0598	--	--	--
1970	0.0047	0.0397	--	--	--
1971	0.0125	0.0348	--	--	--
1972	0.0137	0.0477	--	--	--
1973	0.0035	0.0174	--	--	--
1974	0.0110	0.0325	--	--	--
1975	0.0140	0.0189	--	--	--
1976	0.0090	0.0206	--	--	--
1977	0.0091	0.0243	--	0.0293	0.0551
1978	0.0105	0.0232	0.0889	0.0292	0.0604
1979	0.0217	0.0307	0.0617	0.0258	0.0429
1980	0.0044	0.0141	0.0417	0.0293	0.0315
1981	0.0037	0.0116	0.0358	0.0303	0.0343

Appendix Table F-14. Regression analysis of the annual catch rates of spring chinook salmon by bank anglers in the RK 5-28 survey area, 1966-81. Variables are described in Appendix Table F-16. Percentage data for migration timing and run composition were logit transformed prior to analysis.

Independent variable	Regression coefficient	Standard error	*P*
Flow	12.04×10^{-7}	4.23×10^{-7}	0.013
Constant	2.79×10^{-3}		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1.41×10^{-4}	1	1.41×10^{-4}	8.11	0.013
Residual	2.44×10^{-4}	14	0.17×10^{-4}		

Appendix Table F-15. Regression analysis of the annual catch rates of spring chinook salmon by boat anglers in the RK 5-28 survey area, 1965-81. Variables are described in Appendix Table F-16. Percentage data for migration timing and run composition were logit transformed prior to analysis.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	3.87×10^{-8}	1.76×10^{-8}	0.045
Run composition	-5.05×10^{-3}	2.21×10^{-3}	0.038
Constant	2.09×10^{-3}		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1.16×10^{-3}	2	0.58×10^{-3}	6.46	0.010
Residual	1.26×10^{-3}	14	0.09×10^{-3}		

Variables tested	Partial r^2 Step 1	Step 2
Fish abundance	0.30	--
Run composition	0.29	0.25
Migration timing	0.06	0.00
Flow	0.09	0.05

Appendix Table F-16. Data used to assess factors related to annual catch rates of spring chinook salmon in the lower river, 1965-81. Jacks are not included in any of the variables.

Year	Catch rate[a]		Fish abundance[b]	Migration timing[c]	Percent hatchery[d]	Flow[e]	Water temperature[f]
	Bank	Boat					
1965	--	0.0272	48,245	63.1	2.0	6,059	--
1966	0.0100	0.0319	33,557	46.3	2.0	6,828	12.2
1967	0.0145	0.0292	15,903	39.0	2.0	6,906	11.8
1968	0.0041	0.0369	18,539	39.5	2.0	2,944	14.2
1969	0.0125	0.0598	64,713	41.5	2.0	7,122	13.1
1970	0.0137	0.0397	49,744	54.9	2.0	4,177	12.2
1971	0.0035	0.0348	30,507	25.9	4.0	10,185	10.7
1972	0.0110	0.0477	31,754	52.2	2.8	7,189	12.8
1973	0.0140	0.0174	37,726	54.4	1.7	3,792	13.6
1974	0.0090	0.0325	18,720	28.4	3.1	10,404	--
1975	0.0091	0.0189	20,167	26.9	4.8	8,909	10.6
1976	0.0105	0.0206	17,635	41.1	5.7	5,456	13.4
1977	0.0217	0.0243	22,917	40.9	9.5	1,818	15.4
1978	0.0044	0.0232	39,622	24.1	11.8	4,569	13.4
1979	0.0037	0.0307	39,276	51.4	23.4	6,929	13.8
1980	0.0000	0.0141	31,588	29.8	27.4	5,558	14.0
1981	0.0000	0.0116	17,184	36.9	26.6	2,935	15.4

[a] *Fish per hour.*
[b] *Estimated number of adults at river entry.*
[c] *Percent that passed Gold Ray Dam by 31 May.*
[d] *Assumed to equal 2% for 1961-69.*
[e] *Mean flow (cfs) at Agness April-May.*
[f] *Mean maximum temperature (^{o}C) at Agness in April-May.*

Appendix Table F-17. Correlation matrix for variables examined in the regression analyses of mean annual catch rates of spring chinook salmon in the lower river fishery. Description of variables are in Appendix Table F-16. Percentage data were logit transformed prior to analysis.

	Catch rate		Fish	Migration	Percent		Water
	Bank	Boat	abundance	timing	hatchery	Flow	temperature
Bank catch rate	1.00						
Boat catch rate	0.36	1.00					
Fish abundance	0.13	0.53[a]	1.00				
Migration timing	-0.04	0.24	0.42	1.00			
Percent hatchery	0.05	-0.55[a]	-0.22	-0.37	1.00		
Flow	0.61[a]	0.30	0.02	-0.32	-0.21	1.00	
Water temperature	-0.39	-0.27	-0.10	0.22	0.50[a]	-0.84[a]	1.00

[a] $P \leq 0.05$.

Appendix Table F-18. Regression analysis of the weekly catch rates of spring chinook salmon by bank anglers in the RK 5-28 survey area, 1977-81. Variables are described in Appendix Table F-3.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	1.59×10^{-6}	0.61×10^{-6}	0.013
Flow	1.60×10^{-6}	0.37×10^{-3}	<0.001
Water temperature	1.90×10^{-3}	0.57×10^{-3}	0.002
Constant	-0.035		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1.78×10^{-3}	3	0.59×10^{-3}	10.50	<0.001
Residual	2.09×10^{-3}	37	0.06×10^{-3}		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Fish abundance	0.18	--	--
Flow	0.10	0.20	--
Flow decrease	0.17	0.15	0.03
Water temperature	0.02	0.01	0.13
Turbidity	0.07	0.11	0.00

Appendix Table F-19. Regression analysis of the weekly catch rates of spring chinook salmon by boat anglers in the RK 5-28 survey area, 1977-81. Variables are described in Appendix Table F-3.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	1.65×10^{-6}	0.87×10^{-6}	0.055
Flow	2.24×10^{-6}	0.55×10^{-6}	<0.001
Water temperature	2.31×10^{-3}	0.75×10^{-3}	0.004
Constant	-0.036		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	3.22×10^{-3}	3	1.07×10^{-3}	7.68	<0.001
Residual	5.03×10^{-3}	36	0.14×10^{-3}		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Fish abundance	0.10	0.09	--
Flow	0.20	--	--
Flow decrease	0.12	0.04	0.03
Water temperature	0.01	0.08	0.09
Turbidity	0.10	0.00	0.00

Appendix Table F-20. Regression analysis of the weekly catch rates of spring chinook salmon by boat anglers in the RK 212-235 survey area, 1978-81. Variables are described in Appendix Table F-7.

Independent variable	Regression coefficient	Standard error	*P*
Cumulative fish abundance	2.83×10^{-6}	0.31×10^{-6}	<0.001
Water temperature	-3.99×10^{-3}	1.95×10^{-3}	0.045
Constant	0.072		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	2.08×10^{-2}	2	1.04×10^{-2}	46.18	<0.001
Residual	7.22×10^{-3}	32	0.02×10^{-3}		

Variables tested	Partial r^2 Step 1	Step 2
Cumulative fish abundance	0.71	--
Flow	0.02	0.02
Water temperature	0.08	0.09
Turbidity	0.02	0.01

Appendix Table F-21. Regression analysis of the weekly catch rates of spring chinook salmon by boat anglers in the RK 235-253 survey area, 1977-81. Fish abundance was transformed to a square root prior to analysis. Variables are described in Appendix Table F-10.

Independent variable	Regression coefficient	Standard error	*P*
Cumulative fish abundance	1.30×10^{-4}	0.59×10^{-4}	0.035
Constant	0.032		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	1.35×10^{-3}	1	1.35×10^{-3}	4.77	0.035
Residual	1.11×10^{-2}	39	0.03×10^{-2}		

Appendix Table F-22. Regression analysis of the weekly catch rates of spring chinook salmon by bank anglers in the RK 235-253 survey area, 1977-81. Fish abundance was transformed to a square root prior to analysis. Variables are described in Appendix Table F-10.

Independent variable	Regression coefficient	Standard error	*P*
Cumulative fish abundance	1.16×10^{-4}	0.24×10^{-4}	<0.001
Flow	-5.44×10^{-6}	2.12×10^{-6}	0.014
Turbidity	3.66×10^{-3}	1.28×10^{-3}	0.006
Constant	0.034		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	2.19×10^{-3}	3	0.73×10^{-3}	14.75	<0.001
Residual	1.98×10^{-3}	40	0.05×10^{-3}		

Variables tested	Partial r^2 Step 1	Step 2	Step 3
Cumulative fish abundance	0.33	--	--
Flow	0.06	0.15	0.14
Water temperature	0.29	0.07	0.01
Turbidity	0.21	0.17	--

Appendix Table F-23. Number of spring chinook salmon that anglers brought to canneries near Gold Beach, 1950-64. Week-of-year calendar is in **APPENDIX A.**

	Week-of-year														
Year	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1950	0	15	211	329	934	646	262	565	298	234	105	61	121	80	39
1951	0	12	213	274	118	145	605	502	568	71	52	35	62	60	157
1952	0	4	31	125	314	362	796	895	853	494	281	169	262	266	200
1953	0	63	250	457	467	638	2,244	1,290	422	24	559	274	737	67	225
1954	0	284	38	981	817	551	427	264	179	195	47	120	220	17	64
1955	0	13	207	171	96	389	575	369	347	181	54	12	50	16	13
1956	0	5	143	125	366	254	604	125	491	167	215	193	175	11	56
1957	2	0	60	159	548	286	347	308	259	457	40	25	19	84	2
1958	0	17	19	239	284	575	270	187	200	295	157	55	40	12	2
1959	17	0	99	143	91	186	235	98	169	92	36	20	24	122	58
1960	0	35	62	200	195	759	421	363	328	159	244	74	10	13	7
1961	0	140	247	158	171	689	751	528	654	302	108	42	8	72	9
1962	1	27	143	186	185	225	920	357	181	82	46	19	2	1	0
1963	7	9	34	12	307	1,470	382	215	685	348	62	19	37	11	5
1964	0	42	58	167	217	141	336	348	328	332	207	264	104	22	55

Appendix Table F-24. Number of spring chinook salmon examined by clerks who surveyed anglers during April-July in five areas of the Rogue River, 1977-90.

	Bank anglers				Boat anglers			
	Jacks		Adults		Jacks		Adults	
Year	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked
				RK 5-28				
1977	0	2	4	28	3	17	27	64
1978	0	6	16	50	0	7	4	68
1979	1	12	12	158	3	10	4	94
1980	0	0	2	21	0	0	0	6
1981	0	4	4	21	1	4	5	33
				RK 171-173				
1982	--	--	--	--	1	4	1	33
1983	--	--	--	--	1	5	2	9
				RK 212-235				
1978	--	--	--	--	7	165	5	238
1979	--	--	--	--	2	102	27	411
1980	0	2	0	6	2	145	5	214
1981	0	0	0	1	2	33	6	105
				RK 223-235				
1987	0	0	1	10	1	13	8	49
1988	0	1	1	24	0	10	5	112
1989	0	1	0	6	1	6	1	43
1990	0	1	0	14	0	3	3	74
				RK 235-253				
1977	1	15	8	149	0	53	35	234
1978	0	5	9	153	2	53	16	205
1979	1	12	26	281	0	3	13	164
1980	2	16	12	284	0	11	4	89
1981	0	17	10	304	2	23	4	140
1987	0	16	48	261	0	3	16	94
1988	0	17	36	559	0	10	7	177
1989	2	4	7	237	0	3	5	124
1990	0	7	15	245	1	18	10	127

Appendix Table F-25. Age of spring chinook salmon harvested in the lower river as estimated from scale samples taken by survey clerks, 1967-71. Hatchery fish were not differentiated from wild fish.

	Number at each age (years)					Age composition (%)				
Year	2	3	4	5	6	2	3	4	5	6
1967	1	7	126	16	0	0.7	4.7	84.0	10.7	0.0
1968	0	13	96	8	0	0.0	11.1	82.0	6.8	0.0
1969	0	11	173	16	0	0.0	5.5	86.5	8.0	0.0
1970	0	12	119	19	0	0.0	8.0	79.3	12.7	0.0
1971	0	14	23	9	0	0.0	30.5	50.0	19.5	0.0

Appendix Table F-26. Origin and age of spring chinook salmon harvested in the lower river as estimated from scale samples taken by survey clerks, 1979-81.

	Number at each age (years)					Age composition (%)				
Year	2	3	4	5	6	2	3	4	5	6
					WILD					
1979	0	5	30	12	0	0	11	64	26	0
1980	0	0	35	14	0	0	0	71	29	0
1981	1	9	9	20	5	2	21	21	45	11
					HATCHERY					
1979	0	3	13	1	0	0	18	76	6	0
1980	0	0	20	3	0	0	0	87	13	0
1981	0	7	5	4	2	0	39	28	22	11

Appendix Table F-27. Age of unmarked spring chinook salmon harvested by anglers who fished upstream of Gold Ray Dam as estimated by scale analysis, 1980-81.

	Age of jacks (years)						Age of adults (years)							
	Wild			Hatchery			Wild				Hatchery			
Year	2	3	4	2	3	4	3	4	5	6	3	4	5	6
RK 212-235														
1980	98	5	1	20	9	0	5	83	22	0	0	7	4	0
1981	10	18	0	1	6	0	14	36	35	5	4	9	8	1
RK 235-253														
1980	19	5	1	5	1	0	3	109	32	2	0	30	8	0
1981	8	9	1	2	17	0	12	49	105	12	3	18	12	2

Appendix Table F-28. Length-frequency distribution of spring chinook salmon harvested by anglers who fished upstream of Gold Ray Dam, 1987-90. Data includes only those fish that were randomly encountered by the survey clerk.

	Mid-point of interval for fork length (cm)														
Year	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110
MARKED															
1987	0	1	0	0	0	2	10	17	22	13	7	1	1	0	0
1988	0	0	0	0	4	6	8	8	14	4	2	3	0	0	0
1989	0	0	0	2	1	0	1	5	4	1	2	0	0	0	0
1990	0	0	1	0	0	2	2	10	7	5	2	0	0	0	0
UNMARKED															
1987	6	7	5	8	14	18	34	80	128	87	43	9	5	1	1
1988	5	6	4	7	44	48	77	144	212	169	122	39	23	7	3
1989	0	3	1	5	8	21	40	100	110	77	41	10	7	1	0
1990	3	5	10	7	11	22	47	87	133	97	53	7	5	2	0

Appendix Table F-29. Angler harvest of large chinook salmon in the Rogue River as estimated from returns of salmon-steelhead cards, 1956-83. All years were adjusted for a non-response bias. July estimates include some fall chinook salmon.

Year	February	March	April	May	June	July	Total
1956	12	22	1,030	1,636	1,270	694	4,663
1957	4	7	757	853	478	588	2,686
1958	--	--	--	--	--	--	--
1959	19	39	836	851	1,132	1,261	4,138
1960	48	77	1,415	1,231	1,439	492	4,702
1961	15	76	1,258	2,047	1,563	518	5,478
1962	33	58	1,069	1,476	1,375	335	4,345
1963	27	31	2,383	2,414	1,756	612	7,223
1964	48	95	649	1,660	1,617	486	4,554
1965	17	159	472	4,344	3,013	534	8,539
1966	29	37	1,251	1,860	1,722	529	5,427
1967	28	35	1,297	959	1,036	754	4,018
1968	26	51	146	1,679	1,827	705	4,434
1969	57	135	2,647	3,606	5,294	1,190	12,929
1970	130	251	1,045	3,335	2,904	834	8,499
1971	19	39	1,178	3,375	3,578	1,146	9,335
1972	70	140	1,697	3,146	3,146	1,378	9,577
1973	132	156	810	994	2,687	1,810	6,589
1974	0	32	981	3,841	1,209	773	6,836
1975	0	135	837	1,841	1,664	746	5,223
1976	0	95	688	1,368	1,618	797	4,566
1977	0	153	245	1,532	1,758	1,303	4,991
1978	6	41	603	2,136	3,164	2,463	8,413
1979	3	57	1,561	2,988	3,869	3,003	11,481
1980	12	65	585	1,478	2,839	2,876	7,855
1981	8	33	387	1,254	2,500	2,084	6,266
1982	0	40	1,009	1,666	1,999	2,580	7,294
1983	13	22	275	756	952	538	2,556

Appendix Table F-30. Angler harvest of spring chinook salmon in the Rogue River as estimated from returns of salmon-steelhead cards, 1984-92. All years were adjusted for a non-response bias.

Year	February	March	April	May	June	July[a]	Total
				DOWNSTREAM OF GOLD RAY DAM			
1984	--	--	--	--	--	--	641[b]
1985	0	12	388	855	423	122	1,800
1986	0	90	575	2,996	829	156	4,646
1987	0	87	568	1,499	810	519	3,483
1988	0	19	494	2,502	2,288	629	5,932
1989	0	71	2,234	3,590	870	389	7,154
1990	0	41	679	1,488	1,402	305	3,915
1991	0	168	568	828	229	225	2,018
1992	0	74	999	538	343	315	2,269
				UPSTREAM OF GOLD RAY DAM			
1984	0	0	6	29	530	396	961
1985	0	0	4	298	2,176	1,423	3,901
1986	0	0	4	622	3,720	2,797	7,143
1987	0	0	15	873	3,881	3,760	8,529
1988	0	0	8	910	6,388	6,240	13,546
1989	0	0	7	1,446	4,591	2,592	8,636
1990	0	0	6	206	2,481	2,154	4,847
1991	0	0	0	98	730	645	1,473
1992	0	0	0	222	215	0	437

[a] *Assumes that 50% of the fish harvested downstream of Gold Ray Dam were fall chinook salmon.*

[b] *Assumes that 40% of the harvest occurred downstream of Gold Ray Dam to account for missing data.*

Appendix Table F-31. Angler harvest of spring chinook salmon in the Rogue River as estimated from returns of salmon-steelhead cards, 1993-94. Both years were adjusted for a non-response bias.

Year	February	March	April	May	June	July	Total
MOUTH TO ELEPHANT ROCK							
1993	4	4	172	762	126	43[a]	1,111
1994	0	0	66	73	28	182[a]	349
ELEPHANT ROCK TO GRAVE CREEK							
1993	0	103	1,183	1,489	888	98[b]	3,761
1994	0	32	424	838	440	112[b]	1,846
GRAVE CREEK TO GOLD RAY DAM							
1993	0	8	11	689	525	155[c]	1,388
1994	0	3	28	319	756	103[c]	1,209
UPSTREAM OF GOLD RAY DAM							
1993	0	0	0	161	1,711	1,172	3,044
1994	0	0	0	85	734	1,082	1,901

[a] *Assumes that 90% of the harvest was fall chinook salmon.*
[b] *Assumes that 50% of the harvest was fall chinook salmon.*
[c] *Assumes that 10% of the harvest was fall chinook salmon.*

Appendix Table F-32. Angler harvest of large spring chinook salmon in the Rogue River downstream of Gold Ray Dam as estimated from returns of salmon-steelhead cards, 1956-83. All years were adjusted for a non-response bias.

Year	February	March	April[a]	May[b]	June[c]	July[d]	Total
1956	12	22	1,020	1,423	787	347	3,611
1957	4	7	749	742	296	294	2,092
1958	--	--	--	--	--	--	--
1959	19	39	827	740	702	630	2,958
1960	48	77	1,401	1,071	892	246	3,735
1961	15	76	1,245	1,781	969	259	4,346
1962	33	58	1,059	1,284	852	168	3,453
1963	27	31	2,359	2,100	1,089	306	5,912
1964	48	95	642	1,445	1,002	243	3,474
1965	17	159	468	3,779	1,868	140	6,432
1966	29	37	1,238	1,618	1,067	139	4,129
1967	28	35	1,284	834	642	198	3,021
1968	26	51	144	1,460	1,133	185	3,000
1969	57	135	2,620	3,137	3,282	313	9,545
1970	130	251	1,035	2,901	1,800	219	6,336
1971	19	39	1,167	2,936	2,218	301	6,680
1972	70	140	1,680	2,580	1,321	213	6,005
1973	132	156	802	815	1,129	280	3,314
1974	0	32	971	3,150	508	120	4,780
1975	0	135	829	1,510	699	116	3,288
1976	0	95	681	1,122	680	123	2,701
1977	0	153	243	1,256	738	202	2,592
1978	6	41	597	1,645	696	148	3,133
1979	3	57	1,545	2,301	851	180	4,938
1980	12	65	579	1,138	625	173	2,591
1981	8	33	383	966	550	125	2,065
1982	0	40	999	1,283	440	155	2,916
1983	13	22	272	582	209	32	1,131

[a] *Assumes that 99% were harvested downstream of Gold Ray Dam.*

[b] *Assumes that harvest downstream of Gold Ray Dam accounted for 87% of the river harvest in 1956-69, 82% of the river harvest in 1970-77, and 77% of the river harvest in 1978-83.*

[c] *Assumes that harvest downstream of Gold Ray Dam accounted for 62% of the river harvest in 1956-69, 42% of the river harvest in 1970-77, and 22% of the river harvest in 1978-83.*

[d] *Assumes that harvest downstream of Gold Ray Dam accounted for 100% of the river harvest in 1956-64, 53% of the river harvest in 1965-71, 31% of the river harvest in 1972-77, and 22% of the river harvest in 1978-83. Also assumes that 50% of the harvest downstream of Gold Ray Dam were fall chinook salmon.*

Appendix Table F-33. Correlation matrix for variables examined in the regression analysis of the harvest rate of spring chinook salmon in the Rogue River downstream of Gold Ray Dam. Variables are described in Appendix Table F-34. Estimates of harvest and fish abundance were transformed to natural logarithms prior to analysis.

	Harvest	Fish abundance	Migration timing	Percent hatchery	Flow	Water temperature
Harvest	1.00					
Fish abundance	0.73[a]	1.00				
Migration timing	0.47[a]	0.42[a]	1.00			
% hatchery	-0.26	-0.03	-0.21	1.00		
Flow	0.10	-0.23	-0.13	-0.23	1.00	
Water temperature	-0.22	0.22	0.14	0.52[a]	0.72[a]	1.00

[a] $P \leq 0.05$.

Appendix Table F-34. Data used to assess factors related to the harvest of spring chinook salmon in the Rogue River downstream of Gold Ray Dam, 1961-94. Jacks are not included in any of the variables.

Year	Harvest[a]	Fish abundance[b]	Migration timing[c]	Percent hatchery[d]	Flow[e]	Water temperature[f]
1961	4,346	31,273	37.2	2.0	6,448	13.3
1962	3,453	30,302	37.0	2.0	5,373	13.2
1963	5,912	40,621	60.2	2.0	12,665	11.9
1964	3,474	35,413	30.2	2.0	5,624	12.4
1965	6,432	48,245	63.1	2.0	6,059	--
1966	4,129	33,557	46.3	2.0	6,828	12.2
1967	3,021	15,903	39.0	2.0	6,906	11.8
1968	3,000	18,539	39.5	2.0	2,944	14.2
1969	9,545	64,713	41.5	2.0	7,122	13.1
1970	6,336	49,744	54.9	2.0	4,177	12.2
1971	6,680	30,507	25.9	4.0	10,185	10.7
1972	6,005	31,754	52.2	2.8	7,189	12.8
1973	3,314	37,726	54.4	1.7	3,792	13.6
1974	4,780	18,720	28.4	3.1	10,404	--
1975	3,288	20,167	26.9	4.8	8,909	10.6
1976	2,701	17,635	41.1	5.7	5,456	13.4
1977	2,592	22,917	40.9	9.5	1,818	15.4
1978	3,133	39,622	24.1	11.8	4,569	13.4
1979	4,938	39,276	51.4	23.4	6,929	13.8
1980	2,591	31,588	29.8	27.4	5,558	14.0
1981	2,065	17,184	36.9	26.6	2,935	15.4
1982	2,916	23,167	41.1	29.4	10,630	12.8
1983	1,131	9,053	19.2	25.5	9,991	12.8
1984	641	9,546	18.3	30.1	8,356	12.6
1985	1,800	30,121	44.6	35.2	5,742	14.1
1986	4,646	70,700	33.3	53.7	4,051	14.0
1987	3,483	94,138	40.1	60.6	3,040	16.2
1988	5,932	72,697	38.4	33.4	2,843	--
1989	7,154	61,709	51.4	76.3	7,095	--
1990	3,915	26,532	29.4	66.1	3,198	--
1991	2,018	12,790	32.2	70.2	6,183	--
1992	2,269	17,412	60.9	72.8	2,548	--
1993	6,259	25,651	34.6	68.3	9,143	--
1994	3,404	31,176	26.9	66.2	2,320	--

[a] *As estimated from salmon-steelhead cards.*
[b] *Estimated number of fish at river entry long enough to require entry on salmon-steelhead cards if caught.*
[c] *Percent that passed Gold Ray Dam by 31 May.*
[d] *Assumed to equal 2% for 1961-69.*
[e] *Mean flow (cfs) at Agness April-May.*
[f] *Mean maximum temperature (^{o}C) at Agness in April-May.*

Appendix Table F-35. Regression analysis of the annual harvest of large spring chinook salmon in the Rogue River downstream of Gold Ray Dam, 1961-94. Estimates of harvest and fish abundance were transformed to natural logarithms before analysis. Variables are described in Appendix Table F-34.

Independent variable	Regression coefficient	Standard error	*P*
Fish abundance	7.783×10^{-1}	1.143×10^{-1}	<0.001
Flow	5.596×10^{-5}	2.310×10^{-5}	0.021
Constant	-0.172		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	5.99	2	3.00	23.56	<0.001
Residual	3.94	31	0.13		

Variables tested	Partial r^2 Step 1	Partial r^2 Step 2
Fish abundance	0.53	--
Flow	0.10	0.15
Migration timing	0.22	0.06
Percent hatchery	0.07	0.13

Appendix Table F-36. Estimated harvest of age 2-6 spring chinook salmon caught downstream of Gold Ray Dam, 1979-81.

Year	Wild					Hatchery				
	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1979	0	423	2,539	1,016	0	0	254	1,100	85	0
1980	0	0	1,303	521	0	0	0	745	112	0
1981	37	337	337	749	187	0	262	187	187	75

Appendix Table F-37. Estimated number of large spring chinook salmon harvested in the Rogue River upstream of Gold Ray Dam, 1970-83. Estimates were developed from data in Appendix Table F-29.

Year	April[a]	May[b]	June[c]	July[d]	Total
1970	10	434	1,103	396	1,943
1971	12	439	1,360	544	2,354
1972	17	566	1,825	951	3,359
1973	8	179	1,558	1,249	2,995
1974	10	691	701	534	1,936
1975	8	331	965	515	1,820
1976	7	246	938	550	1,742
1977	2	276	1,020	899	2,197
1978	6	491	2,468	2,167	5,133
1979	16	687	3,018	2,643	6,363
1980	6	340	2,214	2,531	5,091
1981	4	288	1,950	1,834	4,076
1982	10	383	1,559	2,270	4,223
1983	3	174	743	473	1,393

[a] *Assumes that 1% were harvested upstream of Gold Ray Dam.*
[b] *Assumes that harvest upstream of Gold Ray Dam accounted for 18% of the river harvest in 1970-77 and 23% of the river harvest in 1978-83.*
[c] *Assumes that harvest upstream of Gold Ray Dam accounted for 58% of the river harvest in 1970-77 and 78% of the river harvest in 1978-83.*
[d] *Assumes that harvest upstream of Gold Ray Dam accounted for 69% of the river harvest in 1970-77 and 88% of the river harvest in 1978-83.*

Appendix Table F-38. Regression analysis of the annual harvest of spring chinook salmon in the Rogue River upstream of Gold Ray Dam, 1978-94. Percentage data were logit transformed prior to analysis. Variables are described in Appendix Table F-39.

Independent variable	Regression coefficient	Standard error	*P*
Wild fish abundance	0.2152	0.0276	<0.001
Hatchery fish abundance	0.1156	0.0251	<0.001
Constant	85		

Analysis of variance

Source of variation	Sum of squares	df	Mean square	*F*	*P*
Regression	16.50×10^7	2	8.25×10^7	65.05	<0.001
Residual	1.78×10^7	14	0.13×10^7		

Variables tested	Partial r^2 Step 1	Step 2
Wild fish abundance	0.76	--
Hatchery fish abundance	0.48	0.51
Migration timing	0.08	0.13
Flow	0.04	0.00
Water temperature	0.04	0.08

Appendix Table F-39. Data used to assess factors related to the harvest of spring chinook salmon in the Rogue River upstream of Gold Ray Dam, 1978-94. Fish less than 60 cm in length are not included in any of the variables.

Year	Harvest[a]	Fish abundance[b]		Migration timing[c]	Flow[d]	Water temperature[e]
		Wild	Hatchery			
1978	5,133	27,134	3,649	24.1	2,278	16.8
1979	6,363	23,268	7,084	51.4	2,018	16.4
1980	5,091	19,224	7,337	29.8	2,150	16.2
1981	4,076	9,545	3,522	36.9	1,834	18.2
1982	4,223	14,208	5,918	41.1	2,894	15.8
1983	1,393	6,941	2,364	19.2	3,211	15.6
1984	961	5,080	2,185	18.3	4,241	14.8
1985	3,901	17,478	9,489	44.6	2,467	17.5
1986	7,143	25,645	30,174	33.3	2,223	15.8
1987	8,529	24,330	37,256	40.1	1,857	16.3
1988	13,546	42,624	21,397	38.4	2,713	15.1
1989	8,636	12,526	40,418	51.4	2,744	15.3
1990	4,847	7,491	14,605	29.4	2,273	16.0
1991	1,473	3,435	8,043	32.2	2,467	15.7
1992	437	1,391	3,802	60.9	1,649	18.1
1993	3,044	6,254	13,489	34.6	4,426	14.8
1994	1,901	4,197	8,204	26.9	2,276	16.0

[a] *As estimated from salmon-steelhead cards.*
[b] *Estimated passage of adults longer than 60 cm at Gold Ray Dam.*
[c] *Percent that passed Gold Ray Dam by 31 May.*
[d] *Mean flow (cfs) at Raygold in June.*
[e] *Mean maximum temperature (^{o}C) at Raygold in June.*

Appendix Table F-40. Correlation matrix for variables examined in the regression analysis of the harvest rate of spring chinook salmon in the Rogue River upstream of Gold Ray Dam. Description of variables can be found in Appendix Table F-39. Percentage data were logit transformed prior to analysis.

	Harvest	Fish abundance		Migration timing	Flow	Water temperature
		Wild	Hatchery			
Harvest	1.00					
Wild fish abundance	0.87[a]	1.00				
Hatchery fish abundance	0.69[a]	0.39	1.00			
Migration timing	0.28	0.12	0.32	1.00		
Flow	-0.21	-0.23	-0.12	-0.45	1.00	
Water temperature	-0.21	-0.09	-0.30	-0.43	-0.73[a]	1.00

[a] $P \leq 0.05$.

Appendix Table F-41. Numbers of boats and boat anglers who fished for spring chinook in the Rogue River upstream of Gold Ray Dam as estimated during angler surveys, 1980.

Count time (hours)	RK 204-235			RK 235-253			Estimated numbers			
	Strata sampled	Mean count of trailers	Expanded count	Strata sampled	Mean count of trailers	Expanded count	RK 204-235		RK 235-235	
							Boats[a]	Anglers[b]	Boats[a]	Anglers[b]
MAY 1980										
0900	7	6.43	103	7	8.57	137	138	337	102	288
1400	7	10.14	162	8	13.00	208	213	520	157	444
1900	8	4.88	78	7	4.86	78	90	219	66	187
JUNE 1980										
0900	16	15.63	469	14	22.93	688	568	1,170	589	1,619
1400	13	11.00	330	12	17.33	520	417	860	433	1,190
1900	15	9.73	292	15	13.93	418	349	718	361	994
JULY 1980										
0900	16	8.88	275	17	20.06	622	440	951	457	1,114
1400	12	6.08	188	11	15.64	485	331	714	343	836
1900	12	7.33	227	16	11.75	364	290	627	301	735

[a] *Number of trailers (RK 204-253) weighted by boat distribution (Appendix Table F-41).*
[b] *Estimated from anglers/boat data collected in 1980.*

Appendix Table F-42. Numbers of boats and boat anglers who fished for spring chinook in the Rogue River upstream of Gold Ray Dam as estimated during angler surveys, 1981.

Count time (hours)	RK 204-235			RK 235-253			Estimated numbers			
	Strata sampled	Mean count of trailers	Expanded count	Strata sampled	Mean count of trailers	Expanded count	RK 204-235		RK 235-235	
							Boats[a]	Anglers[b]	Boats[a]	Anglers[b]
MAY 1981										
0900	9	4.00	64	9	12.00	192	147	360	109	307
1400	7	8.71	139	7	14.57	233	215	523	158	447
1900	8	2.00	32	8	9.75	156	108	264	80	226
JUNE 1981										
0900	17	9.65	290	16	21.81	654	463	955	480	1,321
1400	12	6.00	180	13	12.85	386	278	572	288	792
1900	15	5.93	178	15	8.80	264	217	447	225	619
JULY 1981										
0900	13	6.62	205	13	13.85	429	312	673	323	788
1400	13	2.85	88	12	9.42	292	187	403	194	472
1900	14	4.86	151	15	10.13	314	228	493	237	577

[a] *Number of trailers (RK 204-253) weighted by boat distribution (Appendix Table F-41).*
[b] *Estimated from anglers/boat data collected in 1980.*

Appendix Table F-43. Distribution of boats used to fish for spring chinook salmon in the Rogue River upstream of Gold Ray Dam as estimated during flights in 1986-87.

	June 1986	May 1987	June 1987	July 1987
RK 204-235	49.8%	57.6%	49.1%	49.1%
RK 235-253	50.2%	42.4%	50.9%	50.9%

Appendix Table F-44. Numbers of bank anglers who fished for spring chinook from Shady Cove to Cole M. Rivers Hatchery as estimated during angler surveys, 1980-81.

Count time (hours)	1980			1981		
	Strata sampled	Mean count of anglers	Expanded count	Strata sampled	Mean count of anglers	Expanded count
			MAY			
0900	7	22.43	359	9	22.11	354
1400	8	28.38	454	7	36.71	587
1900	7	21.71	347	8	23.13	370
			JUNE			
0900	14	54.07	1,622	16	30.25	1,140
1400	12	68.50	1,815	13	35.54	1,066
1900	15	49.20	1,476	15	33.67	1,010
			JULY			
0900	17	45.18	1,401	13	21.38	663
1400	11	38.27	1,186	12	20.25	628
1900	16	45.50	1,411	15	28.07	870

Appendix Table F-45. Monthly estimates of the number of spring chinook salmon caught by boat anglers who fished the Rogue River upstream of Gold Ray Dam as estimated by angler surveys, 1980-81.

	RK 204-235					RK 235-253				
		Jacks		Adults			Jacks		Adults	
Month	Angler hours	Catch rate[a]	Catch	Catch rate[a]	Catch	Angler hours	Catch rate[a]	Catch	Catch rate[a]	Catch
					1980					
May	4,996	0.0000	0	0.0204	102	4,265	0.0013	6	0.0293	125
June	12,435	0.0065	81	0.0278	345	17,209	0.0019	32	0.0427	735
July	10,361	0.0458	475	0.0388	402	12,134	0.0068	83	0.0365	443
					1981					
May	5,293	0.0017	9	0.0121	64	4,519	0.0044	20	0.0256	116
June	8,944	0.0053	48	0.0255	228	12,377	0.0014	18	0.0299	370
July	7,017	0.0144	101	0.0346	243	8,217	0.0117	96	0.0298	245

[a] *Fish caught per hour.*

Appendix Table F-46. Monthly estimates of the number of spring chinook salmon caught by bank anglers who fished the Rogue River upstream of Shady Cove as estimated by angler surveys, 1980-81.

	1980					1981				
		Jacks		Adults			Jacks		Adults	
Month	Angler hours	Catch rate[a]	Catch	Catch rate[a]	Catch	Angler hours	Catch rate[a]	Catch	Catch rate[a]	Catch
May	5,275	0.0000	0	0.0161	85	6,009	0.0009	5	0.0208	125
June	22,278	0.0005	12	0.0278	619	14,535	0.0013	19	0.0302	439
July	17,876	0.0032	58	0.0338	605	9,602	0.0027	26	0.0309	297

[a] *Fish caught per hour.*

Appendix Table F-47. Number of spring chinook salmon harvested upstream of Gold Ray Dam as estimated from angler surveys and from salmon-steelhead cards, 1980-81.

	Angler surveys					
	Jacks		Adults			Salmon-steelhead card estimate
	RK 204-235	RK 235-253	RK 204-235	RK 235-253	Total	
			1980			
Bank	27[a]	70	42[a]	1,309	1,351	--
Boat	556	121	849	1,303	2,152	--
Total	583	153	891	2,612	3,503	5,091
			1981			
Bank	11[a]	50	38[a]	861	899	--
Boat	158	134	535	731	1,266	--
Total	169	184	573	1,592	2,165	4,076

[a] *Harvest by bank anglers in the RK 204-235 area was assumed to be 5% of the total harvest by bank anglers and the proportion of jacks in the harvest was assumed to be the same as in the boat fishery.*

Appendix Table F-48. Estimated harvest of age 2-6 spring chinook salmon caught upstream of Gold Ray Dam, 1980-81.

	Wild					Hatchery				
Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 2	Age 3	Age 4	Age 5	Age 6
1980	793	187	3,042	863	39	188	72	806	243	0
1981	159	530	999	1,752	209	31	334	396	288	44

Appendix Table F-49. Estimated freshwater harvest rates of spring chinook salmon large enough to require entry on salmon-steelhead cards, 1961-94.

Year	Below Gold Ray Dam	Above Gold Ray Dam	Entire river	Year	Below Gold Ray Dam	Above Gold Ray Dam	Entire river
1961	0.139	--	0.167	1978	0.079	0.143	0.209
1962	0.114	--	0.138	1979	0.126	0.194	0.288
1963	0.146	--	0.170	1980	0.082	0.177	0.243
1964	0.098	--	0.122	1981	0.120	0.286	0.357
1965	0.133	--	0.174	1982	0.126	0.213	0.308
1966	0.123	--	0.158	1983	0.125	0.177	0.279
1967	0.190	--	0.246	1984	0.067	0.109	0.168
1968	0.162	--	0.229	1985	0.060	0.153	0.189
1969	0.148	--	0.195	1986	0.066	0.120	0.167
1970	0.127	--	0.166	1987	0.037	0.131	0.128
1971	0.219	0.099	0.296	1988	0.082	0.210	0.268
1972	0.189	0.137	0.295	1989	0.116	0.161	0.256
1973	0.088	0.098	0.167	1990	0.148	0.225	0.330
1974	0.255	0.141	0.359	1991	0.158	0.140	0.273
1975	0.163	0.108	0.253	1992	0.130	0.102	0.155
1976	0.153	0.117	0.252	1993	0.244	0.157	0.363
1977	0.113	0.164	0.209	1994	0.109	0.166	0.170

Appendix Table F-50. Estimated harvest rates of age 2-6 spring chinook salmon in the area downstream of Gold Ray Dam, 1974-94. Values for age 2 and age 3 fish represent the harvest rates in Appendix Table F-47 multiplied by constants (0.08 for age 2 fish and 0.44 for age 3 fish).

Year	Age 2	Age 3	Age 4-6	Year	Age 2	Age 3	Age 4-6
1974	0.020	0.112	0.255	1985	0.005	0.026	0.060
1975	0.013	0.071	0.163	1986	0.005	0.029	0.066
1976	0.012	0.067	0.153	1987	0.003	0.016	0.037
1977	0.009	0.049	0.113	1988	0.007	0.036	0.082
1978	0.006	0.035	0.079	1989	0.009	0.051	0.116
1979	0.010	0.055	0.126	1990	0.012	0.065	0.148
1980	0.007	0.036	0.082	1991	0.013	0.069	0.158
1981	0.010	0.053	0.120	1992	0.010	0.057	0.130
1982	0.010	0.055	0.126	1993	0.020	0.107	0.244
1983	0.010	0.055	0.125	1994	0.009	0.048	0.109
1984	0.005	0.029	0.067				

Appendix Table F-51. Estimated harvest rates of age 2-6 spring chinook salmon in the area upstream of Gold Ray Dam, 1974-94. Values for age 4-6 fish were calculated from data in Appendix Table F-49 with the assumption that the harvest rate of hatchery fish was 0.537 (Appendix Table F-35) of the harvest rate of wild fish. Values for age 2 and age 3 fish represent the harvest rate of age 4-6 counterparts multiplied by constants (0.57 for wild age 2 fish, 0.69 for wild age 3 fish, 0.45 for age 2 hatchery fish, and 0.53 for age 3 hatchery fish).

	Wild fish			Hatchery fish		
Year	Age 2	Age 3	Age 4-6	Age 2	Age 3	Age 4-6
1974	0.070	0.083	0.121	0.030	0.034	0.065
1975	0.065	0.078	0.114	0.028	0.032	0.061
1976	0.055	0.066	0.096	0.024	0.028	0.052
1977	0.085	0.102	0.148	0.036	0.042	0.080
1978	0.101	0.121	0.176	0.043	0.050	0.095
1979	0.135	0.161	0.235	0.057	0.066	0.126
1980	0.126	0.151	0.220	0.054	0.062	0.118
1981	0.205	0.245	0.357	0.087	0.101	0.191
1982	0.139	0.166	0.243	0.060	0.069	0.131
1983	0.097	0.116	0.170	0.041	0.048	0.091
1984	0.088	0.105	0.154	0.038	0.044	0.083
1985	0.099	0.118	0.173	0.042	0.049	0.093
1986	0.098	0.117	0.170	0.042	0.049	0.092
1987	0.111	0.132	0.193	0.047	0.054	0.103
1988	0.144	0.172	0.250	0.061	0.071	0.135
1989	0.144	0.172	0.251	0.062	0.072	0.136
1990	0.181	0.216	0.316	0.077	0.090	0.170
1991	0.109	0.130	0.190	0.046	0.054	0.102
1992	0.074	0.088	0.128	0.031	0.036	0.068
1993	0.130	0.155	0.226	0.055	0.064	0.121
1994	0.126	0.151	0.220	0.054	0.063	0.119

APPENDIX G

Sensitivity Analyses from Model Simulations of
Chinook Salmon Produced Upstream of Gold Ray Dam

Appendix Table G-1. Sensitivity of simulated ocean harvest for all chinook salmon produced upstream of Gold Ray Dam to variations of input parameters. Inputs were varied by ± 0.2 standard deviations (SD). Inputs of average values predicted a mean ocean harvest of 32,360 fish.

Input Parameter	Predicted harvest		Sensitivity	
	Input-(SD*0.2)	Input+(SD*0.2)	Input-(SD*0.2)	Input+(SD*0.2)
Number of female spawners	31,006	33,863	0.04	0.05
Peak flow during embryo incubation	34,190	30,744	0.06	0.05
Water temperature during embryo incubation	33,444	31,358	0.03	0.03
Water temperature during juvenile growth	32,396	32,324	<0.01	<0.01
Race composition of recruits	32,345	32,371	<0.01	<0.01
Number of hatchery smolts released	31,223	33,497	0.04	0.04
Release date at hatchery	31,598	33,097	0.02	0.02
Weight of hatchery smolts	32,360	32,360	0.00	0.00
Survival rate of hatchery smolts	27,102	34,787	0.16	0.08
Ocean harvest rate-age 3 fish	29,682	35,035	0.08	0.08
Ocean harvest rate-age 4 fish	31,419	33,283	0.03	0.03
Ocean upwelling-summer	32,229	32,490	<0.01	<0.01
Ocean upwelling-autumn	32,138	32,573	<0.01	<0.01
Ocean upwelling-winter	32,360	32,360	0.00	0.00
Ocean upwelling-spring	32,392	32,318	<0.01	<0.01
Ocean temperature-summer	31,560	33,122	0.02	0.02
Ocean temperature-autumn	32,502	32,221	<0.01	<0.01
Ocean temperature-winter	32,513	32,190	<0.01	<0.01
Ocean temperature-spring	32,245	32,470	<0.01	<0.01
Flow in canyon during lower river fishery	32,360	32,360	0.00	0.00
May-June water temperature in canyon	32,360	32,360	0.00	0.00
June-July water temperature in upper river	32,360	32,360	0.00	0.00
August-September water temperature in canyon	32,360	32,360	0.00	0.00

Appendix Table G-2. Sensitivity of simulated freshwater returns for all chinook salmon produced upstream of Gold Ray Dam to variations of input parameters. Inputs were varied by ± 0.2 standard deviations (SD). Inputs of average values predicted a mean freshwater return of 57,343 fish.

Input Parameter	Predicted return		Sensitivity	
	Input-(SD*0.2)	Input+(SD*0.2)	Input-(SD*0.2)	Input+(SD*0.2)
Number of female spawners	55,291	59,611	0.04	0.04
Peak flow during embryo incubation	60,103	54,893	0.05	0.04
Water temperature during embryo incubation	58,980	55,824	0.03	0.03
Water temperature during juvenile growth	57,278	57,409	<0.01	<0.01
Race composition of recruits	57,235	57,417	<0.01	<0.01
Number of hatchery smolts released	55,168	59,517	0.04	0.04
Release date at hatchery	58,640	56,123	0.02	0.02
Weight of hatchery smolts	57,343	57,343	0.00	0.00
Survival rate of hatchery smolts	48,025	61,644	0.16	0.08
Ocean harvest rate-age 3 fish	59,395	55,294	0.04	0.04
Ocean harvest rate-age 4 fish	58,511	56,191	0.02	0.02
Ocean upwelling-summer	57,571	57,124	<0.01	<0.01
Ocean upwelling-autumn	57,646	57,055	<0.01	<0.01
Ocean upwelling-winter	57,343	57,343	0.00	0.00
Ocean upwelling-spring	57,308	57,393	<0.01	<0.01
Ocean temperature-summer	58,405	56,343	0.02	0.02
Ocean temperature-autumn	57,188	57,497	<0.01	<0.01
Ocean temperature-winter	57,102	57,610	<0.01	<0.01
Ocean temperature-spring	57,306	57,415	<0.01	<0.01
Flow in canyon during lower river fishery	57,343	57,343	0.00	0.00
May-June water temperature in canyon	57,343	57,343	0.00	0.00
June-July water temperature in upper river	57,343	57,343	0.00	0.00
August-September water temperature in canyon	57,343	57,343	0.00	0.00

Appendix Table G-3. Sensitivity of simulated freshwater harvest for all chinook salmon produced upstream of Gold Ray Dam to variations of input parameters. Inputs were varied by ± 0.2 standard deviations (SD). Inputs of average values predicted a mean freshwater harvest of 11,056 fish.

Input Parameter	Predicted harvest		Sensitivity	
	Input-(SD*0.2)	Input+(SD*0.2)	Input-(SD*0.2)	Input+(SD*0.2)
Number of female spawners	10,685	11,495	0.04	0.04
Peak flow during embryo incubation	11,590	10,581	0.05	0.04
Water temperature during embryo incubation	11,373	10,761	0.03	0.03
Water temperature during juvenile growth	11,048	11,064	<0.01	<0.01
Race composition of recruits	11,171	10,977	0.01	<0.01
Number of hatchery smolts released	10,699	11,411	0.03	0.03
Release date at hatchery	11,164	10,946	0.01	0.01
Weight of hatchery smolts	11,056	11,056	0.00	0.00
Survival rate of hatchery smolts	9,418	11,806	0.15	0.07
Ocean harvest rate-age 3 fish	11,480	10,631	0.04	0.04
Ocean harvest rate-age 4 fish	11,282	10,832	0.02	0.02
Ocean upwelling-summer	11,096	11,015	<0.01	<0.01
Ocean upwelling-autumn	11,113	10,999	<0.01	<0.01
Ocean upwelling-winter	11,056	11,056	0.00	0.00
Ocean upwelling-spring	11,040	11,073	<0.01	<0.01
Ocean temperature-summer	11,279	10,843	0.02	0.02
Ocean temperature-autumn	11,019	11,091	<0.01	<0.01
Ocean temperature-winter	11,052	11,061	<0.01	<0.01
Ocean temperature-spring	11,098	11,012	<0.01	<0.01
Flow in canyon during lower river fishery	10,931	11,186	0.01	0.01
May-June water temperature in canyon	11,088	11,009	<0.01	<0.01
June-July water temperature in upper river	11,056	11,056	0.00	0.00
August-September water temperature in canyon	11,102	10,984	<0.01	<0.01

Appendix Table G-4. Sensitivity of simulated prespawning mortality for all chinook salmon produced upstream of Gold Ray Dam to variations of input parameters. Inputs were varied by ± 0.2 standard deviations (SD). Inputs of average values predicted a mean prespawning mortality of 4,312 fish.

Input Parameter	Predicted mortality		Sensitivity	
	Input-(SD*0.2)	Input+(SD*0.2)	Input-(SD*0.2)	Input+(SD*0.2)
Number of female spawners	4,154	4,487	0.04	0.04
Peak flow during embryo incubation	4,524	4,123	0.05	0.04
Water temperature during embryo incubation	4,438	4,195	0.03	0.03
Water temperature during juvenile growth	4,308	4,315	<0.01	<0.01
Race composition of recruits	4,200	4,388	0.03	0.02
Number of hatchery smolts released	4,145	4,479	0.04	0.04
Release date at hatchery	4,421	4,210	0.02	0.02
Weight of hatchery smolts	4,312	4,312	0.00	0.00
Survival rate of hatchery smolts	3,599	4,641	0.16	0.08
Ocean harvest rate-age 3 fish	4,460	4,164	0.03	0.03
Ocean harvest rate-age 4 fish	4,401	4,224	0.02	0.02
Ocean upwelling-summer	4,322	4,302	<0.01	<0.01
Ocean upwelling-autumn	4,326	4,299	<0.01	<0.01
Ocean upwelling-winter	4,312	4,312	0.00	0.00
Ocean upwelling-spring	4,310	4,314	<0.01	<0.01
Ocean temperature-summer	4,378	4,249	0.02	0.02
Ocean temperature-autumn	4,294	4,329	<0.01	<0.01
Ocean temperature-winter	4,288	4,337	<0.01	<0.01
Ocean temperature-spring	4,305	4,322	<0.01	<0.01
Flow in canyon during lower river fishery	4,322	4,301	<0.01	<0.01
May-June water temperature in canyon	4,064	4,667	0.06	0.08
June-July water temperature in upper river	3,783	4,982	0.12	0.16
August-September water temperature in canyon	3,853	5,026	0.11	0.17

Appendix Table G-5. Sensitivity of simulated natural spawning for all chinook salmon produced upstream of Gold Ray Dam to variations of input parameters. Inputs were varied by ± 0.2 standard deviations (SD). Inputs of average values predicted a mean spawning population of 11,056 fish.

Input Parameter	Predicted number of spawners		Sensitivity	
	Input-(SD*0.2)	Input+(SD*0.2)	Input-(SD*0.2)	Input+(SD*0.2)
Number of female spawners	15,973	19,080	0.08	0.09
Peak flow during embryo incubation	19,434	15,687	0.11	0.10
Water temperature during embryo incubation	18,626	16,357	0.07	0.06
Water temperature during juvenile growth	17,394	17,504	<0.01	<0.01
Race composition of recruits	17,325	17,533	<0.01	<0.01
Number of hatchery smolts released	17,354	17,542	<0.01	<0.01
Release date at hatchery	17,500	17,399	<0.01	<0.01
Weight of hatchery smolts	17,448	17,448	0.00	0.00
Survival rate of hatchery smolts	14,560	18,783	0.17	0.08
Ocean harvest rate-age 3 fish	18,037	16,862	0.03	0.03
Ocean harvest rate-age 4 fish	17,870	17,034	0.02	0.02
Ocean upwelling-summer	17,623	17,283	0.01	0.01
Ocean upwelling-autumn	17,680	17,231	0.01	0.01
Ocean upwelling-winter	17,448	17,448	0.00	0.00
Ocean upwelling-spring	17,433	17,478	<0.01	<0.01
Ocean temperature-summer	17,752	17,178	0.02	0.02
Ocean temperature-autumn	17,603	17,301	0.01	<0.01
Ocean temperature-winter	17,487	17,412	<0.01	<0.01
Ocean temperature-spring	17,447	17,452	<0.01	<0.01
Flow in canyon during lower river fishery	17,487	17,408	<0.01	<0.01
May-June water temperature in canyon	17,522	17,343	<0.01	<0.01
June-July water temperature in upper river	17,540	17,336	<0.01	<0.01
August-September water temperature in canyon	17,861	16,806	0.02	0.04