1985 FRASER RIVER SOCKEYE FORECAST

GENERAL

The 1981 return of Fraser sockeye was characterized by the excellent return of 3.8 x 10^6 Quesnel Lake stock adults; Horsefly River and Mitchell River returns were at the rates of 25.59 and 30.36 4/2's per effective female, respectively. The Horsefly rate of return was the highest recorded for the dominant cycle for BY 1949 to 1977. The Late Stuart return equalled 18.56 4/2's/eff. female and Early Stuart was 13.82 4/2's/eff. female, both good but not exceptional rates of return for the cycle. These latter two returns were close to the spawner-recruit forecasts for the stocks. Other stocks which produced well included Late Nadina, with a 1.04% fry to 4/2 survival, Gates, Scotch and Fennell sockeye. The total 4/2 return of 7.4 million fish was the largest on the cycle since 1913 (Table 1). Escapement was, likewise, the largest on the cycle and totaled 1,384,000 adult spawners, of which 749,000 or 54.1% were in the Quesnel Lake watershed. Of the effective female spawners, 50.9% or 332,000 were in the Quesnel system (Table 2).

The average size of fish in 1981 was much below normal. While this was masked in fishery average weights by the high proportion of larger Horsefly sockeye in the return, spawning ground lengths in many cases were the smallest on the cycle. Horsefly females were the second smallest on the cycle; Late Nadina at 47.98 cm were the smallest age 4/2 females of any year and stock of record; Early Stuart age 4/2 females (Kynoch Creek) were the smallest on record by over 0.5 cm, an amazing amount considering that the total range of 4/2 female lengths has varied only 3.4 cm from the smallest (51.03 - 1981) to largest (54.43 - 1968).

TABLE 1. 1985 CYCLE YEAR FRASER RIVER SOCKEYE

RETURNS BY AGE GROUP

RETURN YEAR	3(2)	4(3)	4(2)	5(2)	5(3)	6(2)	6(3)	TOTAL JACKS	TOTAL ADULTS	TOTAL RETURN	TOTAL NON-4(2) RETURN
1953	643,214	11,519	4,711,522	199,597	273,939	0	7,045	654,733	5,192,103	5,846,836	1,135,314
1957	795,705	7,017	4,351,108	184,379	53,360	0	5,131	802,722	4,593,978	5,396,700	1,045,592
1961	169,433	10,590	4,251,933	226,399	39,732	2,790	4,888	180,023	4,525,742	4,705,765	453,832
1965	130,628	3,469	2,847,356	86,585	91,120	0	689	134,097	3,025,750	3,159,847	312,491
1969	181,876	3,884	4,179,514	340,342	177,041	0	1,179	185,760	4,698,076	4,883,836	704,322
1973	323,107	2,882	6,322,197	162,332	65,990	0	820	325,989	6,551,339	6,877,328	555,131
1977	238,771	6,708	5,323,873	175,607	34,119	0	0	245,479	5,533,599	5,779,078	455,205
1981	165,164 p	0 p	7,416,236 e	256,777 e	27,303 e	0 e	2,384 e	165,164	7,702,700	7,867,864	451,628
LANS:	330,987	5,759	4,925,467	204,002	95,326	349	2,767	336,746	5,227,911	5,564,657	639,189

TABLE 2. Basic data used in forecasting the 1985 Fraser River sockeye returns.

	Brood Eff. Females	Fry ($X 10^6$)	Age I Smolts ($X 10^6$)	1984 # 3(2)	3(2) Length	3(2) C.C. wo/sg	3(2) Mar. Gr.	Ranking[5] Length	Ranking[5] Mar. Gr.
E. Stuart	67,225	-	-	40	39.00	17.14	92.48	11/15	5/8
Bowron	562	-	-	0	-	-	-	-	-
Fennell	1,067	-	-	0	-	-	-	-	-
U. Pitt	11,878[1]	-	-	0	-	-	-	-	-
Gates	1,907[2]	4.112	-	521	37.80	19.24	92.57	17/26	4/15
L. Nadina	10,924[2]	17.003	-	6	35.00	18.50	80.48	-	-
E. Chilko	80	-	0.007	467	-	-	-	-	-
Horsefly	296,136	-	-	20,342	40.29	15.83	105.79	8/9	1/9
Mitchell	36,154	-	-	209	39.00	13.00	87.87	-	-
Raft	312	-	-	77	36.50	16.00	93.96	-	-
Seymour	5,354	-	-	0	-	-	-	-	-
Scotch	6,887	-	-	126	36.40	21.00	80.40	-	-
L. Stuart	120,124	-	-	0	-	-	-	-	-
Chilko	20,083	-	1.698	1,211	37.69	14.13	80.79	31/34	33/34
Stellako	12,030	-	-	106	38.00	19.33	81.95	17/17	10/11
Birkenhead	27,175	-	-	4,244	33.19	18.00	82.04	31/34	22/25
Adams	4,161	-	-	0	-	-	-	-	-
L. Shuswap	1,789	-	-	16	36.50	10.00	95.70	-	-
Weaver	22,627[2]	27.213	-	2,848	40.99	19.95	99.09	25/27	21/24
Harrison	4,686[3]	-	-	-	-	-	-	-	-
Portage	2,951	-	-	248	40.00	17.14	93.70	11/13	-
Cultus	144[4]	-	-	371	41.92	21.61	107.45	25/30	15/21
Totals	652,381			30,816	-	-	-	-	-

1. Does not include egg take females.
2. Combined channel and wild.
3. 1982 Brood year.
4. Total females.
5. Rank from largest to smallest: 1985 rank/number of years of record with at least 5 jacks sampled.

Success of spawning was good in most areas. Horsefly sockeye had an 81.5% sucess of spawning and, for the watershed as a whole, 87.4% of the female population successfully deposited eggs.

Winter 1981-82 incubation conditions appear to have been reasonably good. In the Interior of B.C., temperatures were below average but snowfall was abundant. Fort St. James late winter (February-March) air temperatures in 1981-82 at 16.5°F were the coldest since 1974 and the coldest recorded for a dominant cycle. Average December to March temperatures for Blue River (North Thompson) and Big Creek (Chilcotin) were slightly above the brood year, 1977-78, winter temperatures. Relatively high freshet discharges were recorded in 1982 but would not be expected to affect fry survival.

Lake surveys in 1982 provide estimates of juvenile abundance for Quesnel, Takla, Trembleur and Stuart Lakes. Abundance estimates were generally comparable to 1978 juvenile estimates for these lakes. Growth in the lakes, based on trawl catches, was poorer than observed in 1978, suggesting density effects but possibly related to later emergence owing to the cold winter. However, total freshwater growth, based on 3/2 circuli counts, was better than average for the cycle except for Horsefly fish which had the second lowest wo/sg circuli count on the cycle. Comparison of juvenile samples from the lake survey trawl catches confirm that Quesnel Lakes juvenile samples were smaller in 1982 than in 1978. Takla, Trembleur and Stuart Lake juveniles were also smaller than in some recent years, however, the presence of large numbers of juvenile kokanee probably had a major impact on length as well as abundance estimates. No separation of the sockeye from the kokanee has been attempted, thus, we cannot determine the size of juvenile sockeye.

Winter 1982-83 temperatures were generally mild at Interior, B.C. stations. Discharge of the Fraser River was below normal in spring, 1983;

weighted discharge for Chilko smolts was low at 137,000 cfs.

Early marine residence could have been adversely affected by the apparent poor productivity of the coastal and offshore waters of the North Pacific related to the 1983 "El Nino" event. First year marine growth would be expected to be low if, in fact, oceanographic events limited the basic productivity processes. Surprisingly, first year marine growth measurements on 3/2 scales showed a vast difference between stocks (Table 2). Whereas Chilko, Stellako, Birkenhead, Weaver and Cultus jacks were quite low, Horsefly jacks showed the best first-year marine growth for the cycle (105.8 vs a mean of 95.8 for 8 previous cycle year returns). It may be that juvenile Horsefly sockeye migrated northward ahead of the coastal warming or may have simply experienced better growth after reaching the offshore Gulf of Alaska.

Interestingly, the length of jack sockeye was uniformly low. Horsefly jacks were the second smallest for the cycle (Table 2). Birkenhead and Stellako jacks were the smallest on record for those stocks. Weaver were 3rd smallest and Chilko 4th smallest on record.

In an attempt to obtain an index or rough estimate of second year incremental growth for jacks, I used the linear regressions for scale circuli to length and scale measurement to length to obtain estimates of (a) smolt length from circuli count, (b) length at first marine annulus formation and, by subtraction from converted spawning ground standard length of jacks, (c) an index of the incremental growth acquired by jacks from marine annulus formation to maturity. This value has been regressed on 4/2:3/2 ratio in order to determine if second year or incremental growth is related to maturation rate. The index value for Horsefly was the lowest recorded but was not unusually low for Chilko owing to the very low 1st year marine growth for that stock.

Jack abundance was low again in 1984 (Table 3) and, as such, the

TABLE 3.

1985 PREDICTIONS

FRASER RIVER (TOTAL) SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females All Races Year i	Effective Females Excl. Birken. Year i	Jack 3(2) Return All Races Year i+3	Jack 3(2) Return Excl. Birk. Year i+3	Adult 4(2) Return All Races Year i+4	Adult 4(2) Return Excl. Birk. Year i+4	4(2)/3(2) Ratio All Races	4(2)/3(2) Ratio Excl. Birk.	4(2) Return Per Eff. Female Ratio All Races	4(2) Return Per Eff. Female Ratio Excl. Birk.
BRYR	RTNYR	EF	EFEB	32	32EB	42	42EB	4232	4232EB	A42RPEF	A42RPEFEB
1948	1952	520,762	466,040	85,000 e	-	2,709,258	2,529,621	32	-	5.20	5.43
1949	1953	392,551	349,223	81,848	36,490	4,711,522	4,483,060	58	123	12.00	12.84
1950	1954	800,431	759,061	643,214	610,496	11,924,843	11,740,924	19	19	14.90	15.47
1951	1955	301,019	287,430	44,975	15,853	2,438,157	2,330,760	54	147	8.10	8.11
1952	1956	377,153	352,409	42,131	20,697	2,409,903	2,229,116	57	108	6.39	6.33
1953	1957	396,060	379,773	19,653	9,498	4,351,108	4,248,902	221	447	10.99	11.19
1954	1958	1,257,748	1,249,113	795,705	762,233	18,431,009	18,302,787	23	24	14.65	14.65
1955	1959	206,915	198,730	81,558	46,235	4,357,254	4,136,094	53	89	21.06	20.81
1956	1960	474,576	447,420	40,192	16,808	3,163,657	2,954,530	79	176	6.67	6.60
1957	1961	731,744	724,676	13,778	8,219	4,251,933	4,214,438	309	513	5.81	5.82
1958	1962	1,920,769	1,915,259	169,433	137,007	3,281,816	3,207,190	19	23	1.71	1.67
1959	1963	505,491	494,103	66,525	33,532	3,705,699	3,517,306	56	105	7.33	7.12
1960	1964	335,211	316,013	30,092	7,677	1,498,507	1,378,981	50	180	4.47	4.36
1961	1965	446,274	435,724	66,336	32,647	2,847,356	2,780,252	43	85	6.38	6.38
1962	1966	841,871	827,560	130,628	106,691	5,003,237	4,937,120	38	46	5.94	5.97
1963	1967	290,873	270,104	226,272	129,943	6,409,198	6,127,557	28	47	22.03	22.69
1964	1968	202,743	174,765	54,957	17,449	2,631,801	2,405,903	48	138	12.98	13.77
1965	1969	326,137	316,368	51,360	22,266	4,179,514	4,070,491	81	183	12.82	12.87
1966	1970	908,285	894,823	181,876	132,885	5,827,188	5,672,172	32	43	6.42	6.34
1967	1971	614,973	597,393	162,004	107,358	7,239,137	6,873,779	45	64	11.77	11.51
1968	1972	257,568	226,526	74,357	54,447	3,337,587	3,119,364	45	57	12.96	13.77
1969	1973	389,211	374,887	101,149	27,177	6,322,197	5,871,013	63	216	16.24	15.66
1970	1974	932,958	913,706	323,107	203,999	7,929,928	7,398,714	25	36	8.50	8.10
1971	1975	384,878	368,735	186,624	124,308	3,354,724	3,108,830	18	25	8.72	8.43
1972	1976	425,299	399,097	104,728	61,887	4,005,947	3,581,005	38	58	9.42	8.97
1973	1977	510,823	482,449	83,692	39,575	5,323,873 e	5,094,606 e	64	129	10.42	10.56
1974	1978	912,879	827,384	238,771 e	188,210 e	9,227,062 e	8,603,318 e	39	46	10.11	10.40
1975	1979	427,029	407,376	63,857 e	56,269 e	5,884,976 e	5,798,489 e	92	103	13.78	14.23
1976	1980	431,326	381,303	59,926 e	19,762 e	2,869,280	2,389,924	48	121	6.65	6.27
1977	1981	402,998	390,199	33,918	18,338	7,416,236 e	7,253,522 e	219	396	18.40	18.59
1978	1982	1,320,649	1,272,491	165,164 e	127,538 e	13,522,649 e	12,924,206 e	82	101	10.24	10.16
1979	1983	693,355	658,187	31,896 e	19,446 e	4,421,508 e	4,177,696 e	139	215	6.38	6.35
1980	1984	446,469	413,683	27,746 e	17,360 e	5,266,608 p	5,144,298 p	190	296	11.80	12.44
1981	1985	652,381	625,206	30,816 p	26,572 p						

Does not include Cultus.

estimates of return abundance are low to average. A total of 30,800 3/2 jacks returned in 1984. Omitting Birkenhead, the total was estimated at 26,600 3/2's. These figures compare with averages of 56,500 and 24,300 jacks, respectively, for cycle years. Linear regression of cycle year 4/2's on 3/2 abundance for all stocks combined ($r = 0.141^{ns}$) and excluding Birkenhead jacks ($r = -0.079$) indicate that jack abundance per se cannot be used to forecast the 1985 return. Cycle year data show an average 4/2:3/2 ratio of 132:1 (range: 43 to 309:1). The average ratio would yield 4,068,000 4/2's (range: 1,300,000 to 9,500,000). Given jack lengths in the general order of BY 1977, a similar ratio may hold (i.e. about 219:1) which would give 6,750,000 total 4/2's. Excluding Birkenhead jacks, the BY 1977 ratio of 396:1 would yield an estimated 10,500,000 4/2's plus additional Birkenhead production.

EARLY STUART

The 1985 cycle year return of Early Stuart sockeye is the dominant cycle due to the typical large production of Takla Lake streams only on this cycle. An average of 70% of the 1957-81 cycle year spawners have utilized Takla Lake tributaries with Driftwood River accounting for 34% or about one-half of the Takla Lake total. It is, therefore, important in forecasting to analyse these components of the run as well as the Middle River tributary stream component. In 1981, 35.4% of the effective females were in Driftwood River, 23.8% in Takla Lake streams and 34.3% were in Middle River tributaries. The remaining 6.6% were in Trembleur Lake tributaries. The spawning of 67,000 effective females (Table 4) was close to the geometric mean of 71,000 effective females in the 8 prior cycle years (range: 11,000-168,000). The overall spawner-recruit curve for the cycle (Figure 1) suggests a return of 900,000 fish (Table 5) or approximately 850,000 4/2's from the BY 1981 spawning

TABLE 4.

1985 PREDICTIONS

EARLY STUART SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	3(2) Standard Length (n)	3(2) Standard Length (cm)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count w/sg	3(2) Marine Growth (n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF	32SL		32WOSG	32WSG	32MG	
1948	1952	10,859	N.D	179,412	NA	16.52	0	-	157	18.78	18.93	0	-
1949	1953	168,458	6,218	1,029,437	166	6.11	0	-	0	-	-	124	92.84
1950	1954	25,658	579	240,545	415	9.38	0	-	30	18.03	18.37	0	-
1951	1955	29,785	9	158,428	17,603	5.32	0	-	0	-	-	0	-
1952	1956	15,484	28	78,012	2,786	5.04	0	-	0	-	-	0	-
1953	1957	78,336	294	537,711	1,829	6.86	1	39.00	25	17.08	17.24	19	97.89
1954	1958	18,010	341	154,781	454	8.59	0	-	18	17.61	17.61	0	-
1955	1959	1,397	11	25,824	2,348	18.49	0	-	0	-	-	0	-
1956	1960	16,661	0	101,035	NA	6.06	0	-	0	-	-	0	-
1957	1961	119,273	730	1,215,763	1,665	10.19	56	40.60	43	17.05	18.16	32	85.34
1958	1962	22,196	755	102,112	135	4.60	0	-	21	18.05	18.05	0	-
1959	1963	1,297	0	14,682	NA	11.32	0	-	0	-	-	0	-
1960	1964	7,401	22	69,925	3,178	9.45	0	-	0	-	-	0	-
1961	1965	87,812	630	252,123	400	2.87	8	41.25	4	18.00	19.50	3	95.67
1962	1966	14,076	0	67,661	NA	4.81	0	-	0	-	-	0	-
1963	1967	2,590	332	90,397	272	34.90	0	-	0	-	-	0	-
1964	1968	1,300	1,027	25,940	25	19.95	11	39.18	11	17.09	19.00	0	-
1965	1969	11,241	432	415,253	961	36.94	14	38.79	11	16.64	18.91	10	83.50
1966	1970	5,959	1,746	83,040	48	13.94	33	42.39	33	16.88	20.24	0	-
1967	1971	11,167	423	326,142	771	29.21	19	39.37	22	16.00	19.09	0	-
1968	1972	793	11	10,412	947	13.13	1	42.00	1	17.00	21.00	0	-
1969	1973	48,688	648	1,366,181	2,108	28.06	63	38.75	57	17.33	20.42	45	95.10
1970	1974	15,806	1,212	178,232	147	11.28	75	40.87	56	16.09	19.29	0	-
1971	1975	45,610	311	423,510	1,362	9.29	16	42.81	16	15.44	18.31	0	-
1972	1976	2,253	25	32,207	1,288	14.30	4	39.25	3	17.67	20.33	0	-
1973	1977	153,876	4,591	1,332,552 e	290	8.66	165	40.68	144	14.85	17.88	100	92.90
1974	1978	21,604	2,179 e	136,488 e	63	6.32	128	42.80	177	16.46	19.19	0	-
1975	1979	26,247	150 e	220,974 e	1,473	8.42	48	38.65	37	17.16	19.46	0	-
1976	1980	6,792	20 e	28,800 e	1,440	4.24	2	40.00	2	19.00	23.00	0	-
1977	1981	53,380	572 e	737,851 e	1,290	13.82	29	38.34	27	16.48	21.00	28	89.79
1978	1982	20,004	195 e	54,566 e	280	2.73	16	41.00	15	17.67	21.20	0	-
1979	1983	36,170	41 e	90,898 e	2,217	2.51	0	-	0	-	-	0	-
1980	1984	7,361	7 e	38,567 p	5,510	5.24	1	42.00	1	15.00	19.00	1	93.09
1981	1985	67,225	40 p				14	39.00	14	17.14	21.21	13	92.48

TABLE 5. Forecasts of 1985 Early Stuart sockeye 4/2 returns.

Y Variable	X_1 Variable	Equation	r	Prediction	Forecast
Recruits	S-R curves	(Composite Curve)	-	890,000	850,000
"	"	(Indiv. Components)	-	1,030,000	980,000
% dev.S-R	Winter Air	(CY) Y = -3.050+0.138X	0.848**	-77%	294,000
	Ft. St. J.	(All) Y = -0.890+0.0257X	0.206^{ns}	-46%	481,000
4/2 return	3/2 return	(CY) Y = 714,146+83.2X	0.439^{ns}	717,000	717,000
		(All) Y = 177,787.9+167.8X	0.568**	185,000	185,000
4/2:3/2	3/2 length	(CY) Y = 15,272-354.55XX	0.590^{ns}	1,444	58,000
		(All) Y = 2,152-24.74X	-0.030^{ns}	1,187	47,000
4/2:3/2	1st yr.mar.gr.	(CY) Y = 936.9+1.657X	0.0112^{ns}	1,090	44,000
		(All) Y = -1,473.5+33.26X	0.097^{ns}	1,603	64,000
4/2:3/2	2nd yr.mar.gr.	(CY) Y = 15,272-329.51X	-0.590^{ns}	1,444	58,000

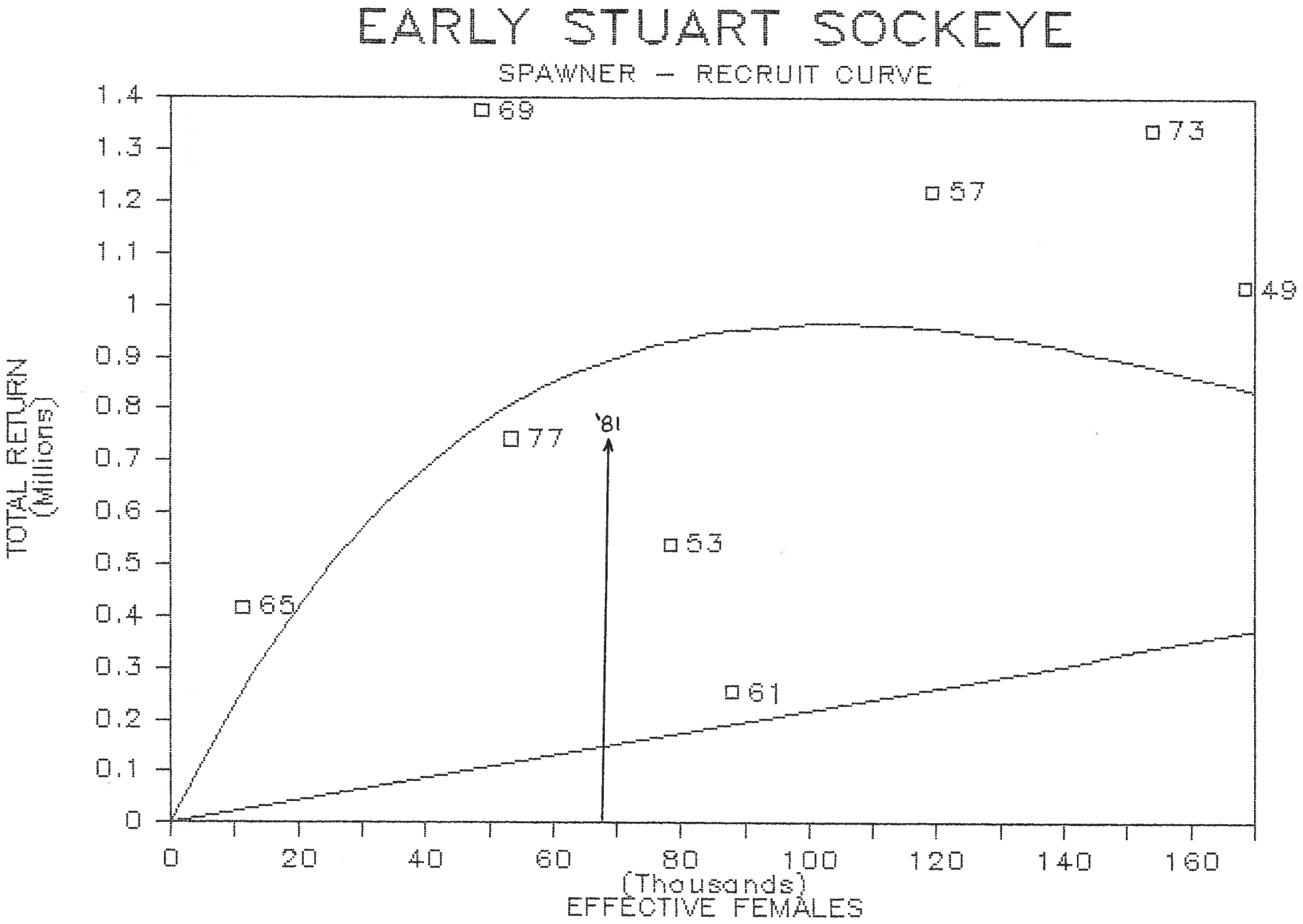

FIGURE 1. Early Stuart sockeye spawner-recruit curve - 1985 cycle - BY 1949-1977.

(using 5% non-4/2's for current rates of maturation). Individual spawner-recruit curves for the Driftwood, Takla Lake and Middle River tributary spawners give, respectively: 470,000, 280,000 and 260,000 total returns. Adding 50,000 Trembleur Lake tributary production and using 95% 4/2's would give a total return of 1,000,000 4/2's in 1985. Return per effective female regressed on number of effective females also has been used to forecast Early Stuart returns. The 1981 escapement of 67,000 effective females would be expected to give a return of 13.1/eff. female (log fit) or 840,000 4/2's in 1985.

Analysis of the deviations of individual year returns from the S-R curves indicates that the BY 1961 return was particularly disastrous for Takla Lake streams and Driftwood River. Regression of these deviations on incubation winter air temperatures (February-March) at Fort St. James ($r = 0.848^{**}$; Figure 2) to forecast the BY 1981 return (air temperature = 16.5°F) suggests a large negative deviation (i.e. -77%) from the S-R curve for BY 1981. This translates into estimated total return of 207,000 fish of which 195,000 would be 4/2's.

Juvenile sockeye/kokanee abundance in Takla, Trembleur and Stuart Lakes (Table 6) can be regressed against the estimated sockeye spawning populations (all stocks) to factor out the kokanee. Alternately, the prior year estimate of juvenile populations should be a good indicator of kokanee since the 1976-1980 cycle years had few adult spawners. The first method suggests a kokanee population of 50.7×10^6 juvenile equivalents and, by subtraction, would give 22.8×10^6 juvenile Early and Late Stuart sockeye in 1982 vs 15.7×10^6 in 1978. The second method applied to Takla Lake only gave an estimate of 5.5×10^6 juvenile sockeye in 1982. Since Takla Lake had had about 21% of the total effective females in the system, an estimated 26.2×10^6 juveniles would

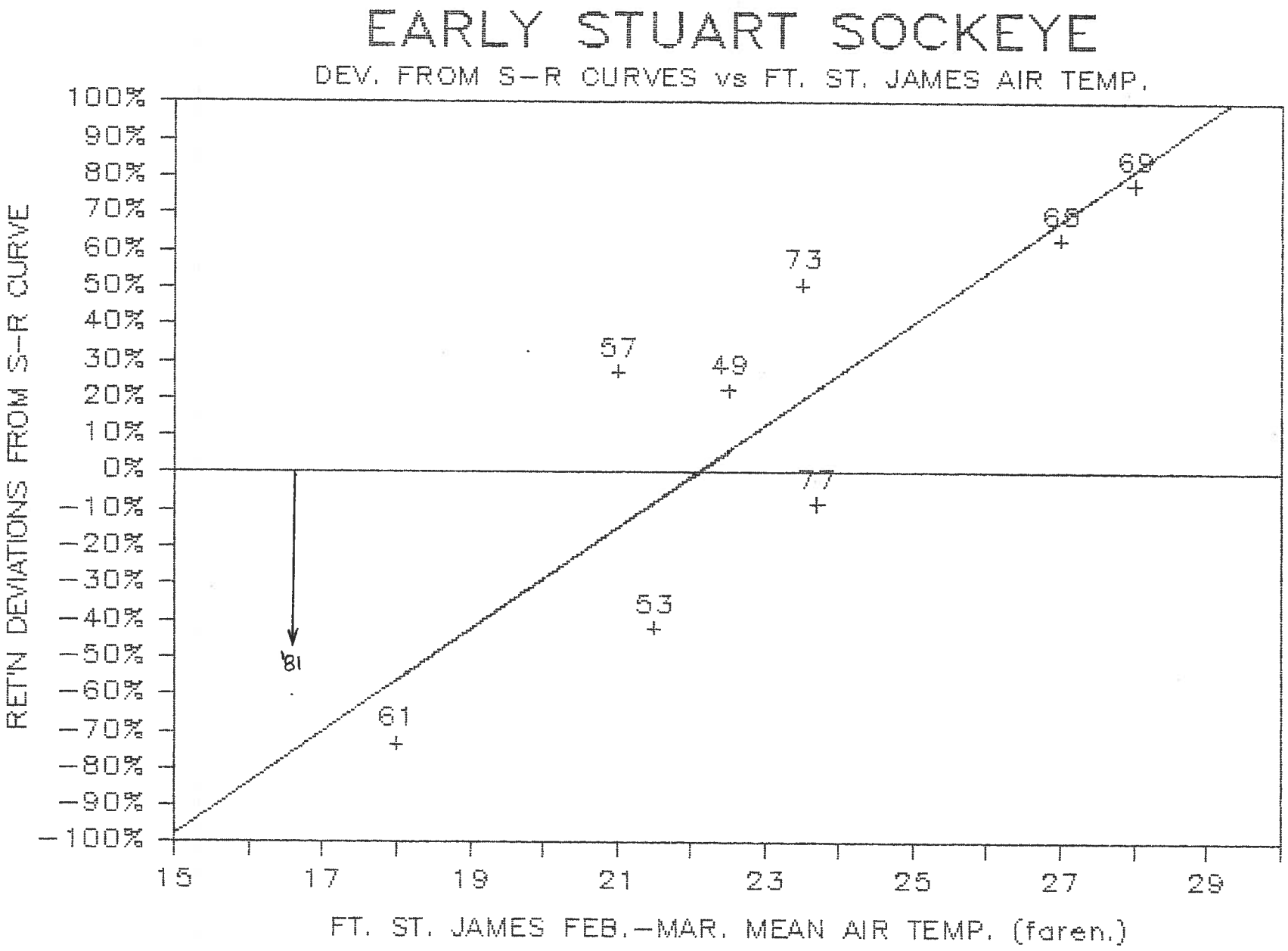

FIGURE 2. Early Stuart sockeye deviations from spawner-recruit curve vs Fort St. James mean winter air temperatures - 1985 cycle - BY 1949-1977.

TABLE 6. Stuart Area lakes total fish (a) and juvenile sockeye/kokanee (b) population estimates and total 4/2 sockeye returns.

	Brood Year	Takla	Trembleur	Stuart	Total	Total 4/2 Return
(a)	1973	26.0×10^6	10.1×10^6	21.8×10^6	57.9×10^6	1.94×10^6
	1977	23.5×10^6	15.3×10^6	27.6×10^6	66.4×10^6	2.15×10^6
	1981	24.1×10^6	8.2×10^6	41.1×10^6	73.5×10^6	
(b)	1973	-	-	-	-	1.94×10^6
	1977	15.6×10^6	10.7×10^6	19.5×10^6	45.8×10^6	2.15×10^6
	1981	18.8×10^6	6.2×10^6	30.8×10^6	55.8×10^6	

be estimated for the system. Although the juvenile estimates cannot be used for prediction, these data suggest good juvenile production.

Growth of juvenile sockeye cannot be estimated directly at this time owing to the unknown mixture of sockeye and kokanee. Total freshwater growth can be deduced from scales of mature 3/2 jacks. The circuli counts for 1984 jacks was 17.14 (wo/sg), which was 3rd highest of 8 years of data. Unfortunately, no coverage of Driftwood River was made in 1984, so no jacks were recovered there. While circuli counts of Middle River and Trembleur Lake fish approximate the growth of Takla Lake components, only two 3/2 scales from Takla Lake streams were available. These two averaged 19.0 circuli (wo/sg).

Smolts were captured at Fort St. James on April 27, 1983. The mean length of these fish was 90.3 mm and the circuli count was high at 18.55 (wo/sg). However, previous smolt sampling has shown high counts early in the migration which suggests that early migrants are Stuart Lake reared Late Stuart smolts. We therefore have no firm data on size of Early Stuart smolts from sampling.

Scale growth of 3/2's tends to be higher than that of returning 4/2's and with so few 3/2's available, I would expect quite a large difference between wo/sg circuli counts of 3/2's and 4/2's.

Age 3/2 jack abundance was estimated to 40 fish, all in the escapement. However, Driftwood River was not covered for jacks and the report of a few jacks in the Fort St. James Indian gill net fishery suggests that additional jacks were probably present but not observed or sampled in the Driftwood River. If the abundance there was proportional to the brood year escapement, an additional 22 jacks would be estimated. Still, the revised total of 62 jacks is only 21% of the lowest previous jack estimate on the cycle (294 for BY 1953). The regression of 4/2 return on 3/2 abundance ($r = 0.439^{ns}$) is

a poor predictor. The regression of 4/2:3/2 ratio on jack length ($r = -590^{ns}$) is only slightly better but would predict a 4/2:3/2 ratio of 1,444:1 or 90,000 4/2's in 1985. First-year marine growth is not related to the 4/2:3/2 ratio ($r = 0.011$). Thus, while the low abundance of jacks is disconcerting, the lack of good relationships may suggest that we need not be overly concerned.

The Takla Lake juvenile abundance was good while Trembleur Lake abundance was poor. In addition, there were low jack numbers in Middle River tributaries. For these reasons, I suggest that while temperatures may have been related to the low production of BY 1961 spawning, the low 1981-82 winter temperatures may not have harmed the 1981 Driftwood River production, but that Takla Lake and Middle River tributaries may have suffered some losses. The forecast has been based on spawner-recruit curves for the individual stock components with a reduction of 50% for all but Driftwood River streams. The best estimate is for a return of 700,000 4/2's in 1985.

PITT

Reworking of the Upper Pitt River discharge data has resulted in revised estimates of wild fry output for the 1978 to 1981 broods (Table 7). Late October flooding in 1981 would have caused significant losses. The total output from the 1981 spawning of 12,200 effective females was estimated to be 2.215×10^6 fry in addition to 3.818×10^6 fry from the incubation channel. The resulting total of 6.034×10^6 fry would be expected to experience an average survival of 1.17% based on the log-log relationship and, thus, a total return of 71,000 adults. Regression of the proportion of eggs spawned by 5/2's vs. the ocean age of return suggest we could expect 16% of these to mature at age 4/2 which would yield a return of 11,000 4/2 adults. Survival

TABLE 7.

1985 PREDICTIONS

UPPER PITT RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Wild Effective Females Year i	Channel Fry Product. (millions)	Total Fry Product. (millions)	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	Adult 5(2) Return Year i+5	Total Adult Return
BRYR	RTNYR	TEF	FRYCO	FRY	32	42	52	TADULT
1948	1952	20,340	-	-	ND	26,803	95,917	122,720
1949	1953	4,449	-	-	0	6,085	13,251	20,778
1950	1954	13,313	-	-	62	91,231	55,044	146,275
1951	1955	17,922	-	-	0	41,761	78,541	120,302
1952	1956	21,904	-	-	0	39,952	31,890	72,178
1953	1957	9,303	-	-	0	12,688	12,372	25,807
1954	1958	8,332	-	-	42	37,926	13,126	51,052
1955	1959	11,812	-	-	5	78,394	85,616	166,932
1956	1960	11,107	-	-	15	28,169	38,686	70,308
1957	1961	5,130	-	-	0	3,474	24,544	29,207
1958	1962	6,658	-	-	12	12,978	3,157	16,523
1959	1963	6,096	-	-	10	21,800	39,932	62,483
1960	1964	11,801	2.508	4.617	0	5,842	27,406	33,314
1961	1965	5,749	3.022	7.028	74	26,282	74,479	102,961
1962	1966	8,177	1.163	3.460	46	24,085	32,679	57,229
1963	1967	4,986	2.250	3.026	68	88,616	54,052	142,867
1964	1968	5,544	3.074	4.188	68	48,016	142,584	192,026
1965	1969	2,890	1.654	1.983	0	14,943	24,041	38,984
1966	1970	9,989	2.868	7.266	65	24,568	51,336	77,636
1967	1971	4,219	3.300	4.858	29	24,122	42,747	67,751
1968	1972	7,474	2.673	10.000	45	38,212	67,282	105,543
1969	1973	10,717	4.192	8.881	0	9,262	51,821	61,083
1970	1974	2,626	1.744	4.339	81	21,806	32,749	55,317
1971	1975	6,107	2.291	11.297	462	91,337	123,848	217,012
1972	1976	5,721	2.998	7.109	31	78,300	59,553 e	138,126
1973	1977	4,271	1.793	3.752	11	16,231 e	26,795 e	43,152
1974	1978	8,140	2.622	13.254	128 e	33,185 e	80,679 e	118,009
1975	1979	20,292	4.119	7.909	92 e	44,640 e	20,578 e	65,641
1976	1980	18,472	3.861	18.928	32 e	13,812 e	84,886 e	99,069
1977	1981	6,770	3.648	10.661	57 e	19,014 e	10,591 e	29,763
1978	1982	13,011	3.543	18.936	0 e	6,180 e	24,327 e	30,643
1979	1983	19,342	3.397	8.973	21 e	3,503 e	25,205 p	28,708
1980	1984	8,101	3.908	4.930	8 e	11,797 p		
1981	1985	12,242	3.818	6.034	0 e			

TABLE 7 (cont'd).

1985 PREDICTIONS

UPPER PITT RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	Fry Survial to 4(2) (%)	to Adult	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87%)
BRYR	RTNYR	4232	42/EF	F42SURV	FTASURV		32SL		32WOSG	32WSG		32MG
1948	1952	NA	1.32	NA	NA	0	-	0	-	-	0	-
1949	1953	NA	1.37	NA	NA	0	-	0	-	-	0	-
1950	1954	1,471	6.85	NA	NA	0	-	0	-	-	0	-
1951	1955	NA	2.33	NA	NA	0	-	0	-	-	0	-
1952	1956	NA	1.82	NA	NA	0	-	0	-	-	0	-
1953	1957	NA	1.36	NA	NA	0	-	0	-	-	0	-
1954	1958	903	4.55	NA	NA	0	-	0	-	-	0	-
1955	1959	15,679	6.64	NA	NA	0	-	0	-	-	0	-
1956	1960	1,878	2.54	NA	NA	0	-	0	-	-	0	-
1957	1961	NA	0.68	NA	NA	0	-	0	-	-	0	-
1958	1962	1,082	1.95	NA	NA	0	-	0	-	-	0	-
1959	1963	2,180	3.58	NA	NA	0	-	0	-	-	0	-
1960	1964	NA	0.50	0.13%	0.72%	0	-	0	-	-	0	-
1961	1965	355	4.57	0.37%	1.47%	0	-	0	-	-	0	-
1962	1966	524	2.95	0.70%	1.65%	0	-	0	-	-	0	-
1963	1967	1,303	17.77	2.93%	4.72%	0	-	4	14.00	16.00	0	-
1964	1968	706	8.66	1.15%	4.58%	0	-	2	16.50	16.50	0	-
1965	1969	NA	5.17	0.75%	1.97%	0	-	0	-	-	0	-
1966	1970	378	2.46	0.34%	1.07%	0	-	0	-	-	0	-
1967	1971	832	5.72	0.50%	1.39%	0	-	9	19.33	20.44	0	-
1968	1972	849	5.11	0.38%	1.06%	0	-	5	17.00	19.60	0	-
1969	1973	NA	0.86	0.10%	0.69%	0	-	2	11.50	17.50	0	-
1970	1974	269	8.30	0.50%	1.27%	7	37.14	6	15.00	17.00	0	-
1971	1975	198	14.96	0.81%	1.92%	38	41.61	33	14.94	17.64	0	-
1972	1976	2,526	13.69	1.10%	1.94%	0	-	3	21.00	21.67	0	-
1973	1977	1,476	3.80	0.43%	1.15%	1	34.00	0	-	-	0	-
1974	1978	259	4.08	0.25%	0.89%	4	39.50	4	12.75	15.50	0	-
1975	1979	485	2.20	0.56%	0.83%	2	41.00	2	19.00	20.50	0	-
1976	1980	432	0.75	0.07%	0.52%	3	38.33	3	13.67	16.00	0	-
1977	1981	334	2.81	0.18%	0.28%	3	35.33	2	19.50	19.50	3	81.14
1978	1982	NA	0.47	0.03%	0.16%	0	-	0	-	-	0	-
1979	1983	167	0.18	0.04%	0.32%	6	35.00	6	16.67	19.17	5	79.09
1980	1984	1,475	1.46	0.24%		1	35.00	1	19.00	19.00	1	87.00
1981	1985					0	-	0	-	-	0	-

of Pitt fry to adult for recent brood years has been quite poor, averaging 0.32% (BY 1976-1979) compared to a geometric mean of 1.44% (BY 1960-1975), in part due to larger fry outputs. Continued reduced survival would then be expected to lead to a lower 4/2 return in 1985, i.e. about 2,500 4/2's.

No jacks were observed in 1984 in the Upper Pitt River tagging and dead recovery work. We therefore have no samples for scale growth, size, etc. The apparent absence of jacks is not particularly disturbing given the normal low rate of maturation as age 3/2. The regression of 4/2 abundance on 3/2 returns has an intercept of 24,000 fish which would be the forecast for 1985 based on 3/2 production.

Age 5/2 returns may be forecast on the basis of age 4/2 abundance. The 1984 age 4/2 production was estimated to be 11,800 fish. The regression of 5/2's on 4/2 return ($r = 0.518^{**}$) gives a forecast of 35,000 5/2 adults. The total BY 1980 return would, thus, be 47,000 adults or 0.95% fry to adult survival for the revised figure of 4.93×10^6 fry. This survival would be 67% the predicted figure of 1.41% suggesting an improved rate of survival relative to other recent years.

The age of adult spawners suggest that about 66% of the 1980 brood return would be as 5/2's. This would lead to an estimate of only 23,000 5/2's in 1985.

Two interesting features of the 1980 brood were noted in the analysis: a high overwinter mean temperature was reflected in record early emergence of fry (mean date March 31; average = April 25) and the highest freshwater wo/sg circuli count on record. While the small emergence would have given a high circuli count from a density-dependent relationship, the actual count of 22.13 circuli was about 4 circuli higher than expected. The early emergence appears to have led to the good growth. The better first year

growth may, in turn, be responsible for the reasonably good 4/2 return.

The combined age 4/2 (11,000) and age 5/2 (35,000) forecasts should yield a total run of 46,000 adults in 1985.

GATES

The 1985 Gates sockeye return will be from 4.11×10^6 fry which emerged in 1982. This was the largest non-dominant cycle fry production on record (Table 8). The relationship of fry output to 4/2 return is non-linear and whereas returns from other recent odd years have averaged 1.28% survival, the expectation would be for a lower rate of survival. A value of 0.6% fry to 4/2 adult survival is indicated which would result in approximately 25,000 4/2's in 1985.

Lake growth appears to have been good (3/2 wo/sg c.c. = 19.24). However, the good growth may be due to a lack of competition since the Portage Creek sockeye juvenile abundance would have been relatively low.

The age 3/2 jack return in 1984 was estimated to be 521 fish, a low total for the cycle (BY 1969 - 1977 mean = 1,025). The relationship between 4/2 return and 3/2 abundance for non-dominant years is poor ($r = 0.516^{ns}$). The 4/2:3/2 ratio has been quite high in recent years. The BY 1977 ratio of 30:1 should approximate the BY 1981 value and give a return of 16,000 4/2's.

My best estimate is for a return of 20,000 4/2's in 1985.

LATE NADINA

The 1981 spawning in Nadina channel and River produced an estimated 17.0×10^6 fry which was the second largest on record (Table 9). The odd year cycle average 4/2 survival rate has been 1.06% (range: 0.37-2.17%). No trend in survival with fry output is immediately obvious. The geometric mean survival (0.86%) would be best used owing to the large range in the annual values. This would yield an estimate of 146,000 4/2's in 1985.

TABLE 8.

1985 PREDICTIONS

GATES CREEK SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Total Effective Females Year i	Fry In Channel Only (millions) Year i	Total Fry Production (millions) Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	Adult 5(2) Return Year i+5	Total Adult Return
BRYR	RTNYR	TEF	FRYCO	FRY	32	42	52	TADULT
1948	1952	-	-	-	N.D.	30,026	0	30,026
1949	1953	-	-	-	0	590	0	590
1950	1954	-	-	-	0	300	0	300
1951	1955	-	-	-	0	623	0	623
1952	1956	4,147	-	-	0	37,343	657	38,000
1953	1957	29	-	-	74	7,811	0	7,811
1954	1958	18	-	-	0	418	0	698
1955	1959	31	-	-	33	2,149	323	2,472
1956	1960	4,147	-	-	552	14,244	571	15,438
1957	1961	429	-	-	82	1,051	30	1,081
1958	1962	31	-	-	13	398	128	428
1959	1963	370	-	-	1,212	8,846	0	9,443
1960	1964	2,772	-	-	1,219	82,760	183	82,830
1961	1965	120	-	-	1,038	13,460	71	13,668
1962	1966	68	-	-	141	312	0	383
1963	1967	1,068	-	-	879	6,769	680	6,769
1964	1968	8206	-	-	4,850	99,530	610	100,210
1965	1969	941	-	-	279	2,198	18	2,808
1966	1970	30	-	-	608	310	0	328
1967	1971	351	-	-	1,585	5,076	263	5,076
1968	1972	3,835	6.971	7.645	3,891	78,371	403	78,634
1969	1973	360	0.334	0.374	1,042	3,556	168	3,959
1970	1974	14	-	0.004	258	154	0	322
1971	1975	115	0.216	0.238	4,926	7,721	0	7,721
1972	1976	3,128	6.365	6.831	4,180	128,111	326 e	128,437
1973	1977	351	0.899	0.932	1,344	10,858 e	295 e	11,181
1974	1978	37	0.082	0.084	1,193 e	799 e	0 e	799
1975	1979	1,246	2.137	2.261	3,927 e	18,486 e	0 e	18,486
1976	1980	8,820	17.524	18.278	3,192 e	67,835 e	1,908 e	69,835
1977	1981	1,174	1.898	2.140	690 e	20,786 e	3,906 e	24,828
1978	1982	129	0.200	0.225	333 e	1,024 e	193 e	1,217
1979	1983	1,649	2.896	3.000	1,587 e	15,926 e	0 p	16,256
1980	1984	11,033	11.469	12.171	1,397 e	78,176 p		
1981	1985	1,907	4.028	4.112	521 p			

TABLE 8 (cont'd).

1985 PREDICTIONS

GATES CREEK SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	4(2)/3(2) Ratio	Survival Fry to 4(2) (%)	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87%)
BRYR	RTNYR	4232	FT42		32SL		32WOSG	32WSG		32MG
1948	1952	NA	NA	0	-	0	-	-	0	-
1949	1953	NA	NA	0	-	0	-	-	0	-
1950	1954	NA	NA	0	-	0	-	-	0	-
1951	1955	NA	NA	0	-	0	-	-	0	-
1952	1956	NA	NA	0	-	0	-	-	0	-
1953	1957	106	NA	6	37.30	5	20.00	22.20	0	-
1954	1958	NA	NA	0	-	0	-	-	0	-
1955	1959	65	NA	0	-	0	-	-	0	-
1956	1960	26	NA	7	38.14	7	18.43	18.43	0	-
1957	1961	13	NA	5	37.00	6	19.86	20.33	0	-
1958	1962	31	NA	0	-	0	-	-	0	-
1959	1963	7	NA	127	39.89	108	24.72	24.86	0	-
1960	1964	68	NA	26	40.15	38	20.84	21.11	0	-
1961	1965	13	NA	100	38.51	80	23.33	25.41	37	84.29
1962	1966	2	NA	13	39.77	8	21.88	22.13	0	-
1963	1967	8	NA	5	38.20	107	21.16	21.50	0	-
1964	1968	21	NA	117	38.54	97	20.51	20.96	76	93.84
1965	1969	8	NA	88	38.23	69	20.75	22.80	0	-
1966	1970	1	NA	81	38.67	0	-	-	0	-
1967	1971	3	NA	230	39.06	201	23.39	23.85	49	87.65
1968	1972	20	1.03%	204	41.61	204	22.59	22.77	131	90.69
1969	1973	3	0.95%	107	37.90	102	21.41	23.10	49	88.89
1970	1974	1	4.31%	69	38.41	59	21.78	21.81	0	-
1971	1975	2	3.24%	115	39.76	100	17.99	19.83	47	88.30
1972	1976	31	1.88%	194	40.76	187	21.44	21.74	51	96.96
1973	1977	8	1.17%	228	37.45	195	18.18	18.41	47	87.08
1974	1978	1	0.95%	145	40.54	145	19.54	20.21	0	-
1975	1979	5	0.82%	229	37.55	204	20.94	24.03	51	84.64
1976	1980	21	0.37%	217	37.98	173	16.01	16.63	50	94.07
1977	1981	30	0.97%	163	36.08	139	20.28	20.65	101	82.14
1978	1982	3	0.46%	91	37.10	69	15.75	17.71	69	90.06
1979	1983	10	0.53%	209	35.90	175	18.43	20.95	99	85.14
1980	1984	56	0.64%	209	36.47	168	19.26	20.40	125	89.78
1981	1985			112	37.80	93	19.24	23.09	55	92.57

TABLE 9.

1985 PREDICTIONS

LATE NADINA RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Total Effective Females Year i	Fry In Channel Only (millions) Year i	Total Fry Production (millions) Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	Adult 5(2) Return Year i+5	Total Adult Return
BRYR	RTNYR	TEF	FRYCO	FRY	32	42	52	TADULT
1948	1952	-	-	-	N.D.	43	0	43
1949	1953	-	-	-	49	105,898	0	105,898
1950	1954	362	-	-	0	5,090	7	5,097
1951	1955	85	-	-	0	981	0	981
1952	1956	4	-	-	3	88	227	315
1953	1957	7,261	-	-	115	162,058	138	162,356
1954	1958	478	-	-	46	4,541	0	4,541
1955	1959	76	-	-	0	3,953	3,952	7,905
1956	1960	9	-	-	0	156	58	214
1957	1961	12,854	-	-	296	116,452	129	116,581
1958	1962	357	-	-	7	4,947	77	5,024
1959	1963	456	-	-	0	16,923	478	17,401
1960	1964	16	-	-	0	700	523	1,223
1961	1965	8,287	-	-	57	93,840	352	94,192
1962	1966	923	-	-	0	11,693	7,799	19,492
1963	1967	3,027	-	-	185	51,669	2,797	54,466
1964	1968	116	-	-	0	4,938	569	5,507
1965	1969	5,572	-	-	487	93,961	419	94,380
1966	1970	951	-	-	11	33,580	23,141	56,721
1967	1971	3,903	-	-	54	129,871	3,841	133,712
1968	1972	625	-	-	117	40,005	494	40,499
1969	1973	15,498	-	-	1,086	104,679	0	104,679
1970	1974	2,133	-	-	48	29,836	0	29,836
1971	1975	7,894	-	-	416	69,314	5,724	75,038
1972	1976	1,326	-	-	14	10,052	662 e	10,714
1973	1977	9,638	9.906	12.123	146	79,101 e	481 e	79,582
1974	1978	2,072	1.001	2.054	131 e	12,351 e	0 e	12,351
1975	1979	8,358	12.113	13.856	383 e	301,236 e	5,729 e	306,965
1976	1980	846	1.830 *	1.962	10 e	7,247 e	45 e	7,292
1977	1981	9,260	14.213	14.502	172 e	151,455 e	3,730 e	155,185
1978	1982	1,527	2.818	2.923	28 e	14,834 e	2,915 e	17,749
1979	1983	20,415	19.162	22.065	1 e	82,529 e	9,740 p	92,269
1980	1984	1,518	1.968	1.991	3 e	13,433 p		13,433
1981	1985	10,924	16.504	17.003	6 p			

*: Doe not include 490,089 fry from Stellako egg plant.

TABLE 9 (cont'd).

1985 PREDICTIONS

LATE NADINA RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	Survival Fry to 4(2) (%)	Survival Fry to Adult (%)	3(2) Standard Length (n)	3(2) Standard Length (cm)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count wo/sg	3(2) Circuli Count w/sg	3(2) Marine Growth (n)	3(2) Marine Growth (cm @87%)
BRYR	RTNYR	4232	42/EF	FT42	FTADULT		32SL		32WOSG	32WSG		32MG
1948	1952	NA	NA	NA	NA	-	-	-	-	-	-	-
1949	1953	2,161.18	NA	NA	NA	-	-	-	-	-	-	-
1950	1954	NA	14.07	NA	NA	-	-	-	-	-	-	-
1951	1955	NA	11.54	NA	NA	-	-	-	-	-	-	-
1952	1956	29.33	22.00	NA	NA	-	-	-	-	-	-	-
1953	1957	1,409.20	22.32	NA	NA	3	37.30	11	20.09	21.27	-	-
1954	1958	98.72	9.50	NA	NA	-	-	-	-	-	-	-
1955	1959	NA	52.01	NA	NA	-	-	-	-	-	-	-
1956	1960	NA	17.33	NA	NA	2	35.50	2	20.00	20.00	-	-
1957	1961	393.42	9.06	NA	NA	22	38.05	17	19.00	21.12	-	-
1958	1962	706.71	13.86	NA	NA	-	-	-	-	-	-	-
1959	1963	NA	37.09	NA	NA	-	-	-	-	-	-	-
1960	1964	NA	43.75	NA	NA	-	-	-	-	-	-	-
1961	1965	1,646.32	11.32	NA	NA	3	36.67	3	19.33	21.67	-	-
1962	1966	NA	12.67	NA	NA	-	-	-	-	-	-	-
1963	1967	279.29	17.07	NA	NA	5	39.00	4	19.25	20.75	-	-
1964	1968	NA	42.57	NA	NA	-	-	-	-	-	-	-
1965	1969	192.94	16.86	NA	NA	27	41.00	21	19.29	21.00	-	-
1966	1970	3,052.73	35.31	NA	NA	-	-	3	17.67	20.33	-	-
1967	1971	2,405.02	33.28	NA	NA	2	37.50	4	19.00	19.00	-	-
1968	1972	341.92	64.00	NA	NA	8	39.13	7	22.43	23.14	-	-
1969	1973	96.39	6.75	NA	NA	31	40.06	26	18.73	21.19	-	-
1970	1974	621.58	13.99	NA	NA	5	38.58	5	18.40	18.80	-	-
1971	1975	166.62	8.78	NA	NA	22	38.36	15	17.67	18.27	-	-
1972	1976	718.00	7.58	NA	NA	9	37.89	9	19.44	20.78	-	-
1973	1977	541.79	8.21	0.65%	0.66%	36	37.17	36	19.53	20.11	-	-
1974	1978	94.28	5.96	0.60%	0.60%	37	37.84	29	19.52	21.10	-	-
1975	1979	786.52	36.04	2.17%	2.22%	151	36.28	151	19.44	19.44	-	-
1976	1980	724.70	8.57	0.37%	0.37%	5	40.00	3	18.67	18.67	-	-
1977	1981	880.55	16.36	1.04%	1.07%	61	35.73	55	19.40	21.25	-	-
1978	1982	529.79	9.71	0.51%	0.61%	3	38.67	2	23.50	25.00	-	-
1979	1983	82,529.00	4.04	0.37%	0.42%	1	38.00	1	20.00	20.00	-	-
1980	1984	4,477.67	8.85	0.67%		2	34.60	2	20.50	22.50	1	66.99
1981	1985					2	35.00	2	18.50	18.50	2	80.48

Francois Lake was not sampled in 1982, however, smolts were trapped at Glennanon Bridge on the Stellako River on April 18, 1983. The length and weight of preserved fish were 95.0 mm and 7.8 g and the smolts had 17.78 circuli (w/and wo/sg). Only 2 jacks returned to the area in 1984. These fish had 18.5 circuli wo/sg which was a low count for 3/2's. Recent odd year cycle juvenile growth is summarized below:

Brood Year	Age 0 juvenile Length	(Date)	3/2 wo/sg c.c.	(n)	4/2 wo/sg c.c.
1975	61.3	(9/8/76)	19.44	(151)	18.83
1977	58.4	(8/23/78)	19.40	(55)	20.72
1979	63.3	(8/26/80)	20.00	(1)	20.37
1981	-	-	18.50	(2)	-

The lack of jacks precludes analysis of length except to say that the mean of 35.0 cm was the lowest on record. The near absence of jacks would normally suggest a poor return, however, based on the 1982 return of 1 jack and the 1983 return of 83,000 4/2 adults, the return of 2 smaller jacks in 1984 which had lower freshwater growth may indicate a reasonably decent return.

I am forecasting a return of 150,000 Late Nadina sockeye in 1985.

HORSEFLY

Slightly over 50% of the 1981 effective females were located in the Quesnel Lake watershed. The Upper Horsefly River, Lower Horsefly and McKinley Creek populations (plus miscellaneous streams) accounted for 296,000 effective females (Table 10) while Mitchell River contained 36,000 effective female spawners. The basic data exists for Horsefly but little specific information

TABLE 10.

1985 PREDICTIONS

HORSEFLY RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Revised Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	TOTAL Return Per Eff. Female Ratio	3(2) Standard Length (n)	3(2) Standard Length (cm)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count wo/sg	3(2) Circuli Count w/sg	3(2) Circuli Count w/sg (n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	TRPEF		32SL		32WOSG	32WSG		32MG
1948	1952	48	ND	1,132	NA	23.83	-	-	-	-	-	-	-
1949	1953	18,839	22,451	453,619	20.20	25.27	325	44.62	118	17.25	18.54	91	93.26
1950	1954	264	34	1,893	55.68	7.30	-	-	-	-	-	-	-
1951	1955	9	0	413	NA	46.93	-	-	-	-	-	-	-
1952	1956	51	0	562	NA	10.94	-	-	-	-	-	-	-
1953	1957	46,530	5,880	596,893	101.51	12.96	230	42.77	209	17.96	18.19	96	94.69
1954	1958	137	0	10,312	NA	75.27	-	-	-	-	-	-	-
1955	1959	30	0	180	NA	5.92	-	-	-	-	-	-	-
1956	1960	39	18	2,535	140.83	65.46	-	-	-	-	-	-	-
1957	1961	132,960	8,350	967,991	115.93	7.34	273	42.51	233	17.74	20.47	80	92.81
1958	1962	1,236	27	3,346	123.93	2.75	-	-	2	16.50	18.00	-	-
1959	1963	29	0	165	NA	5.69	-	-	-	-	-	-	-
1960	1964	123	6	1,469	244.83	11.99	-	-	-	-	-	-	-
1961	1965	68,096	44,164	1,178,314	26.68	17.96	245	43.50	e216	16.85	18.75	115	95.82
1962	1966	564	30	6,670	222.33	11.88	-	-	-	-	-	-	-
1963	1967	40	0	956	NA	23.99	-	-	-	-	-	-	-
1964	1968	77	0	2,797	NA	36.50	-	-	-	-	-	-	-
1965	1969	103,712	14,161	1,599,167	112.93	15.56	115	42.10	e111	15.19	18.07	103	95.32
1966	1970	975	28	6,918	247.07	7.53	-	-	-	-	-	-	-
1967	1971	24	11	1,750	159.09	73.38	-	-	-	-	-	-	-
1968	1972	331	0	484	NA	1.46	-	-	-	-	-	-	-
1969	1973	75,975	6,257	1,482,295	236.90	19.69	54	42.85	243	16.26	18.92	139	100.80
1970	1974	373	0	20,339	NA	54.54	-	-	-	-	-	-	-
1971	1975	16	0	747	NA	45.76	-	-	-	-	-	-	-
1972	1976	44	9	1,383	153.67	31.64	-	-	-	-	-	-	-
1973	1977	101,233	5,114	1,976,638 e	386.52	19.60	9	40.85	104	16.97	19.31	80	99.75
1974	1978	2,587	79 e	17,000 e	215.19	7.09	2	44.00	2	17.00	20.00	-	-
1975	1979	105	0 e	1,713 e	NA	16.31	-	-	-	-	-	-	-
1976	1980	205	0 e	1,184	NA	5.78	-	-	-	-	-	-	-
1977	1981	147,631	8,446	3,777,700 e	447.28	25.98	58	39.34	53	17.68	18.94	46	93.21
1978	1982	3,721	0 e	162,967 e	NA	46.30	4	40.75	4	17.50	18.75	-	-
1979	1983	238	0 e	1,904 e	NA	20.32	0	-	0	-	-	0	-
1980	1984	98	0 e	886 p	NA	9.04	0	-	0	-	-	0	-
1981	1985	296,136	20,342 p				149	40.29	149	15.83	18.26	56	105.79

- All streams to the Quesnel system excluding Mitchell.

is available for Mitchell River. Thus, the Horsefly/McKinley stock will be treated extensively and the Mitchell River stock will be related to the Horsefly.

The spawner-recruit relationship for Horsefly sockeye (Figure 3) does not provide for a good forecast due to the large deviation on a few data points. The S-R curve does now suggest that larger than previously estimated maximum returns can be expected, in part, because of the increased use of the Lower Horsefly River spawning grounds (119,000 spawners in 1981). It would appear that, as this segment of the population expands relative to the upper area, the potential production limit will increase. That is, the maximum height of the S-R curve will rise. For 1985, the S-R curve fit to prior year data predicts a return of 3.1×10^6 fish (Table 11). This estimate should be low considering the large Lower Horsefly population as discussed above.

Horsefly sockeye rate of reproduction may be related to spawning and incubation conditions. While the relationship of discharge during spawning to minimum winter flow could influence survival in an unstable stream with extensive gravel bars, etc., this does not seem to be involved on the Horsefly. Rather, a negative relationship between minimum winter discharge and R/Effective female ($r = -0.859$*) has been observed (Figure 4). I speculate that low flows may result in less frazzle ice build-up in the Horsefly River upper area spawning grounds. Frazzle ice build-up below Horsefly Falls may increase on higher discharges or may carry down farther downstream into the main spawning area. The minimum discharge in the winter of 1981-82 was 102 cfs, a below average minimum flow. The prediction is for a return of 23.3 4/2's per effective female or 6.9×10^6 total 4/2's in 1985 (Table 11). A second environmental variable, i.e. Blue River winter (December-February) air temperature is also related to Horsefly return per effective female. The mechanism

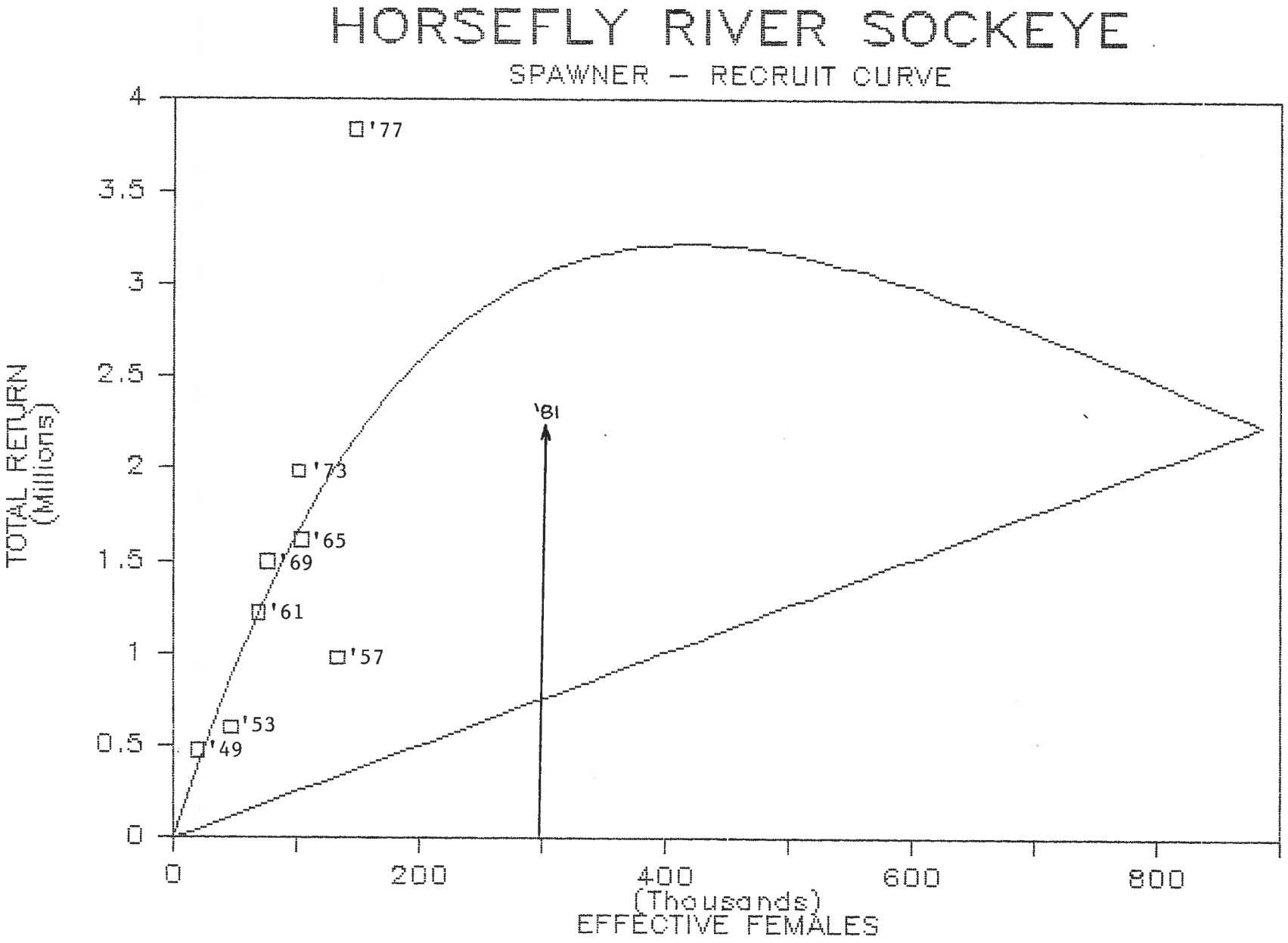

FIGURE 3. Horsefly River sockeye spawner-recruit curve - 1985 cycle - BY 1949-1977.

TABLE 11. Forecasts of 1985 Horsefly River sockeye age 4/2 returns.

Y Variable	X_1 Variable	Years	Equation	r	Prediction	Forecast
Recruits	Eff.fem.spawn.	CY	S-R curve		3.1×10^6	3.1×10^6
4_2/eff.fem.	HF River min. winter disch.	CY	$Y = 57.610-0.3368X$	-0.859*	23.26	6.9×10^6
4_2/eff.fem.	Blue R. (D-F) air temp.	CY	$Y = 35.41-0.9019X$	-0.840*	21.0	6.2×10^6
4_2/eff.fem.	Smolt yr. Blue R. D-F air temp.	CY	$Y = 34.239-0.858X$	-0.637	13.65	4.0×10^6
4_2 return	Juv. Pop. Est.	1973 -77	-	-	-	3.2×10^6
4_2:3_2	3_2 length	CY	$\hat{Y} = -90.266X+4000.8$	-0.907**	364	6.9×10^6
4_2:3_2	3_2 2nd yr.growth	CY	$\hat{Y} = 1,579.2-79.33X$	-0.948**	480	9.8×10^6
	3_2 log 2nd yr. growth	CY	$\hat{Y}= -3,214.9 \log X +4,180$	-0.960**	509	10.4×10^6

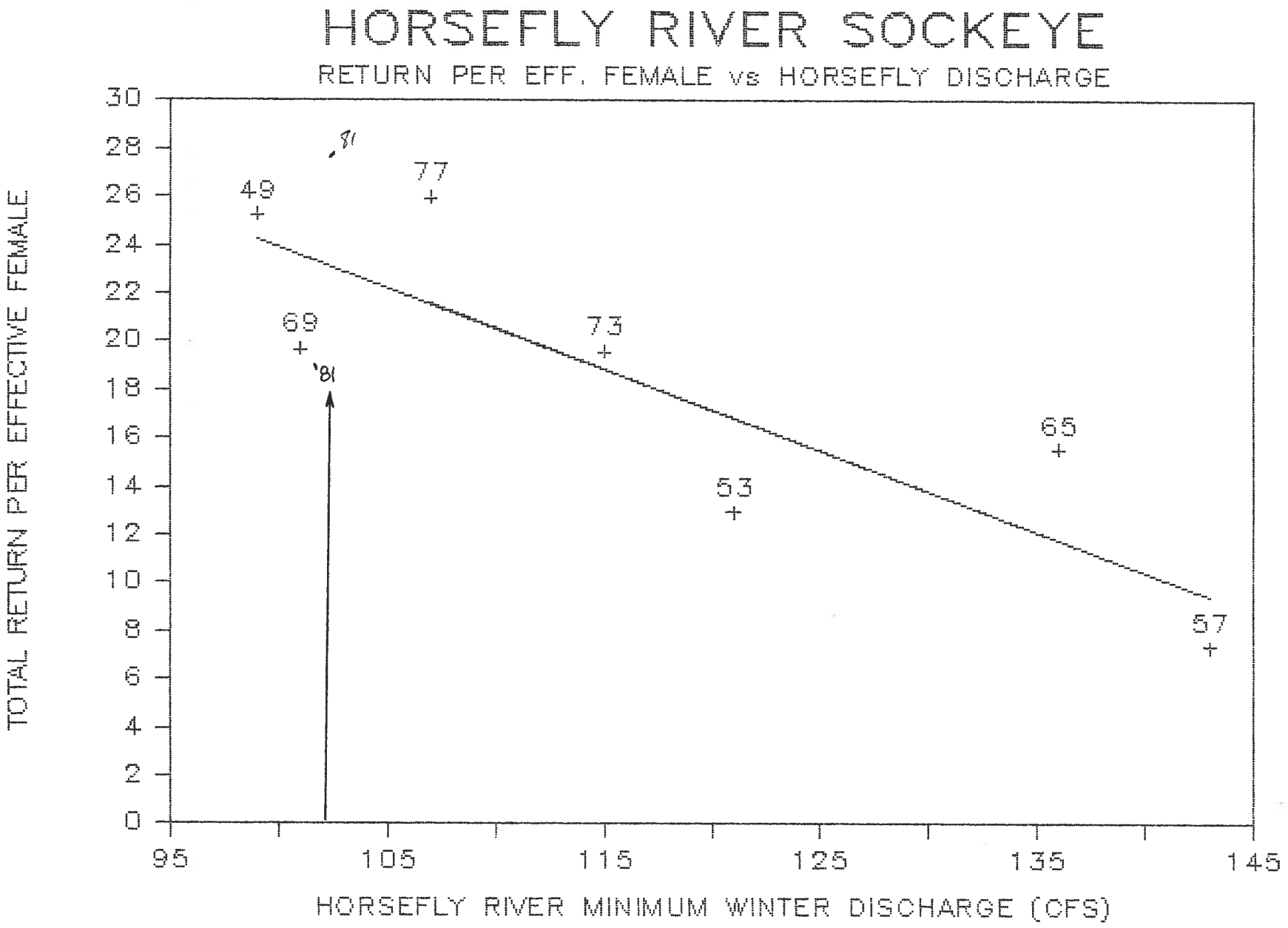

FIGURE 4. Horsefly River sockeye return per effective female vs Horsefly River winter minimum discharges - 1985 cycle - BY 1949-1977.

here may be in control of minimum flows. The correlation coefficient is slightly lower (r = -0.840*) and would for 1985 predict 21.0 returnees/effective female or 6.2 x 10^6 total 4/2's.

No fry enumeration was attempted, however, Quesnel Lake acoustical surveys of juvenile abundance were carried out in August and October 1982. The October survey yielded a higher population estimate than the August survey but was considered to be adversely affected by electrical noise problems. Bob Johnson recommends use of the August, 1982 estimate. The following data for BY 1973, 1977 and 1981 (Table 12) have been produced by various techniques and may not be strictly comparable.

TABLE 12. Quesnel Lake juvenile sockeye population estimates (all stocks).

Brood Year	Survey Date	Juvenile Sockeye (x 10^6)	Mean Length (mm)	4/2 (x 10^6) Return	Juvenile to 4/2 Surv.(%)
1973	8/21-24/74	21.0		2.15	10.2
1977	8/27-29/78	61.90	64.77	3.8	6.1
	10/4-5/78	49.58	73.84		8.5 7.7
1981	8/10-12/82	50.57	56.04		
	10/26-29/82	60.31	70.08		

Relating the August data for BY 1973 and 1977 data on juvenile abundance and adult return produces a 2-point line and gives a forecast of 3.6 x 10^6 adults in 1985 for Quesnel sockeye. Considering the lower mean length of juveniles which is supported by lower jack wo/sg circuli counts, a slightly lower total might be forecast using these data. On the basis of effective females, Horsefly River would contribute about 89% of the total or 3.2 x 10^6 sockeye and Mitchell River would contribute 400,000 fish.

In order to examine production of cycle years, the 4/2 R/effective

female data were used in regressions with discharge and temperature measurements in the smolt year. No significant relationships appeared in the use of May Hope discharge, Hope discharge weighted by Chilko smolts (+15 days) and Quesnel River discharge in late April and May. Winter air temperatures at Blue River (December-February) gave the best correlation between smolt year variables and return per effective female ($r = -0.637^{ns}$). Warm winter temperatures in 1982-83 yielded an estimate of 13.65 returnees per effective female and a forecast of 4.0×10^6 adults in 1985.

Juvenile growth is available from lake samples, smolts and from 3/2 and 4/2 circuli counts (Table 13).

TABLE 13. Horsefly River and Quesnel Lake freshwater growth.

Brood Year	Juveniles Length/Weight	Smolt Length/Weight	3/2 circ. ct. w/sg	4/2 circ. ct. w/sg
1949		-	-	18.08
53		-	18.19	17.35
57		94.2/8.31	20.47	18.98
61		98.2/6.21	18.75	18.93
65		91.1/7.77	18.07	18.14
69		90.4/7.54	18.92	18.55
73	?	90.0/8.18	19.31	18.99
77	73.84/4.33 (10/4-5)	- -	18.94	17.65
81	70.08/3.80 (10/26-29)	87.7/6.24	18.26	

No strong density dependent relationships are apparent between growth and returns. The BY 1981 smolts were the smallest yet observed; however, continued good growth suggests that Quesnel Lake could support a much larger

population of juvenile sockeye, as it apparently did in pre-1913 years.

Returns of 3/2 Horsefly jacks may provide the more promising indications of 4/2 return. The 1984 jacks were relatively abundant (20,342) and their length was the second smallest for the cycle (40.29 cm). Examination of fishery fork lengths for 1964 and 1968 Horsefly jacks has led to an upward adjustment of the mean length in those years. Regression of the 4/2:3/2 ratio on jack length is improved (Figure 5) ($r = -0.907^{**}$; $n = 8$) which predicts a ratio of 364:1 or a forecast of 7.4×10^6 4/2's in 1985. First year marine growth regressed on 4/2:3/2 ratio is poor ($r = +0.329^{ns}$), however, the 1984 jack marine growth was the highest, by far, yet observed at 105.79. Since the regression is positive, the high marine growth predicts a high (358) 4/2:3/2 ratio, as well. This relationship must be discounted since it operates opposite to most stocks.

In order to estimate the 2nd year growth of jacks, an index was calculated by subtracting the estimated length at the end of the 1st year marine annulus from the jack fork length converted from spawning ground standard length. The 4/2:3/2 ratio was regressed on the resulting index of incremental 2nd year growth. The linear regression ($r = -0.948^{**}$, 6 d.f.) and the log index regression ($r = -0.962^{**}$) appear to be the highest significance level estimators available (Figure 6). These regressions predict 4/2:3/2 ratios of 480 and 509:1, respectively, for the 1985 return and give forecasts of 9.8 and 10.4 x 10 4/2's in 1985. Attempts to extend this technique to other stocks has not yielded comparable results and may, therefore, be invalid.

The use of 4/2:3/2 ratio predictors may have the higher significance levels but may be faulty for prediction of the 1985 ratio owing to possible non-normal maturation rate associated with the very high 1st year marine

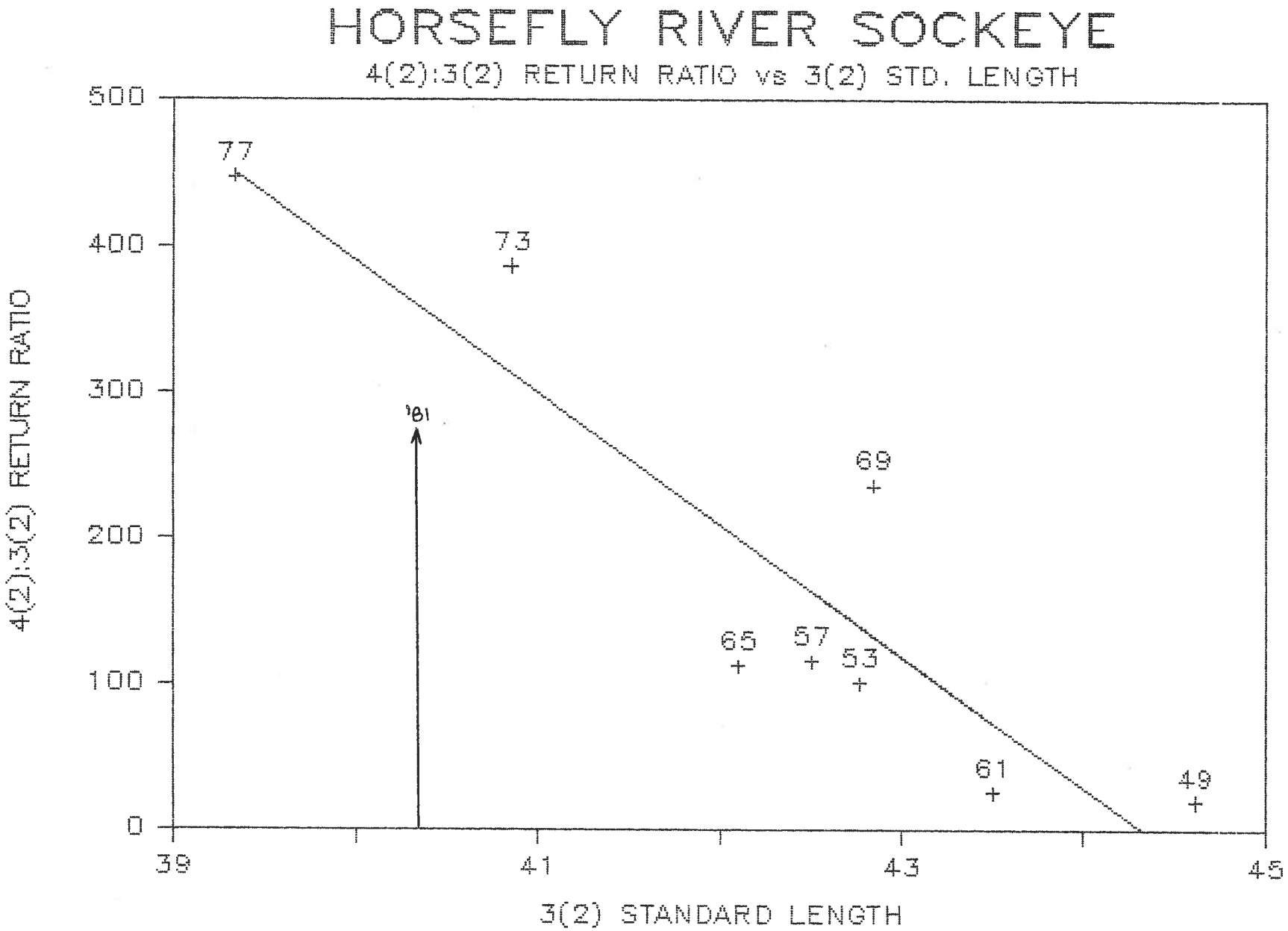

FIGURE 5. Horsefly River sockeye 4/2:3/2 return ratio vs 3/2 jack length - 1985 cycle - BY 1949-1977.

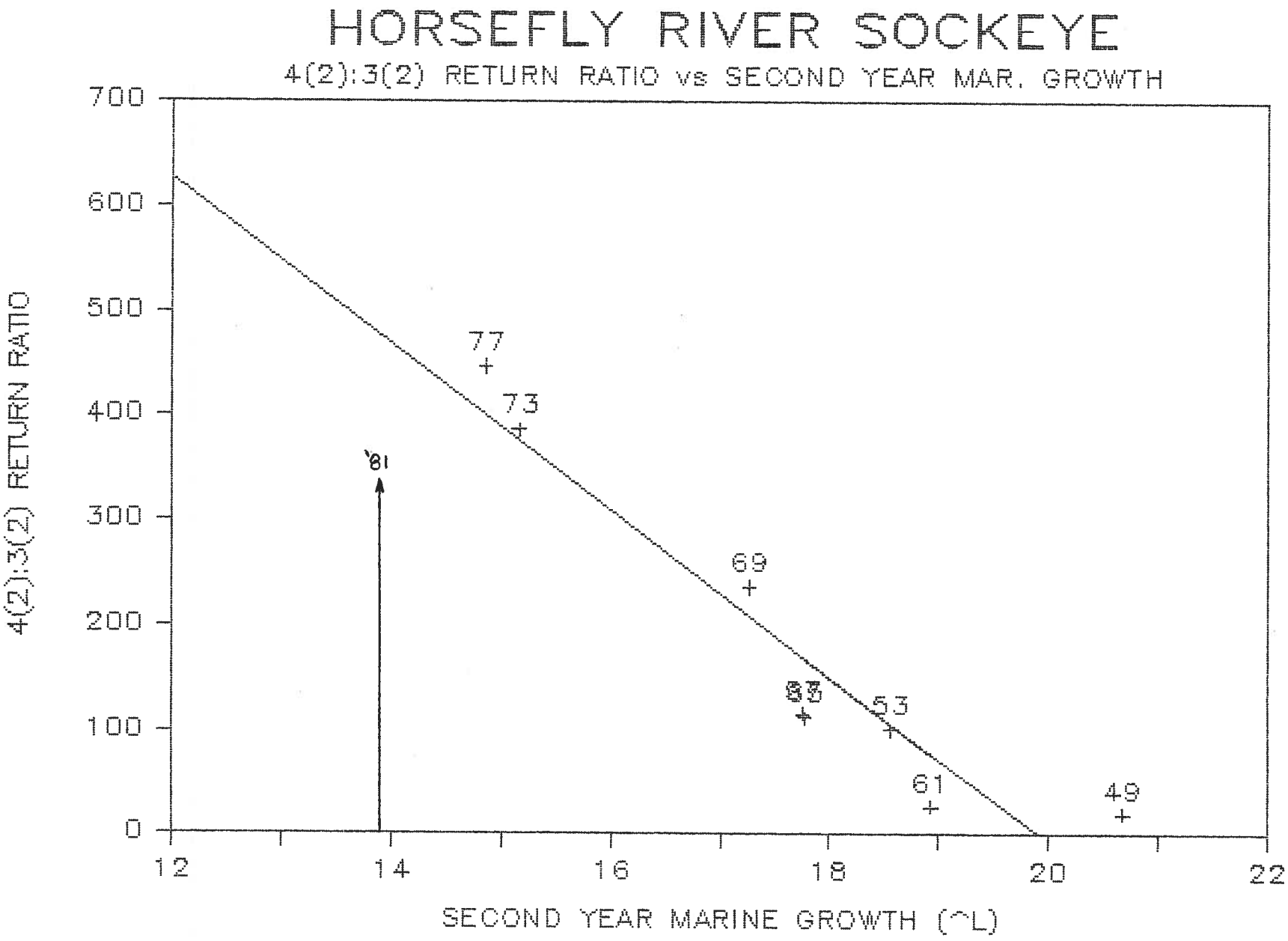

FIGURE 6. Horsefly River sockeye 4/2:3/2 return ratio vs second year marine growth - 1985 cycle - BY 1949-1977.

growth. Also, the 1982 lake population had been similar to, if not lower than, the previous cycle year juvenile abundance, making forecasts of returns which are double the 1981 level somewhat doubtful. My best estimate of Horsefly-Mitchell return in 1985 would be 6.0×10^6 fish of which approximately 350,000 (5.8%) would be Mitchell River fish. It would appear that no adverse survival resulted from the 1983 El Nino event but rather, the Horsefly population may have survived better than normal as did the BY 1980 Chilko sockeye.

SEYMOUR

Prediction of Seymour River sockeye in 1985 rests on the spawner-recruit relationship as no jacks were recovered in the spawning ground sampling (Table 14). The 1985 return year cycle is one of the two "off" cycles. The combined off-cycle S-R data predicts a return of 25,000 4/2's in 1985 from an escapement of 5,400 effective females.

SCOTCH

Prediction of Scotch Creek sockeye returns in 1985 is difficult owing to the lack of long-term data. Brood year escapement and jack returns are basically the same as for the 1981 return, which was about 91,000 4/2's (Table 15). I would, however, estimate that only 50,000 adults will return in 1985.

LATE STUART

Forecast of Late Stuart sockeye returns has relied upon the relationship of spawners and resulting production, due to the lack of dependability of jack related predictors. The return/effective female vs log number of effective females relationship in the previous cycle year return (1981) predicted 16.5/eff. female, while the actual return was 18.6/eff. female (Table

TABLE 14.

1985 PREDICTIONS

SEYMOUR RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	3(2) Standard Length (cm) (n)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count w/sg (n)	3(2) Marine Growth (cm @87X) (n)
BRYR	RTNYR	EF	32	42	4232	42/EF	32SL	32WOSG	32WSG	32MG
1948	1952	1,280	N.D.	29,658	-	23.17	0 -	10 13.10	14.00	0 -
1949	1953	3,476	733	25,617	35	7.37	0 -	0 -	-	0 -
1950	1954	4,697	909	161,081	177	34.29	0 -	17 13.18	13.71	0 -
1951	1955	11,504	125	67,964	544	5.91	0 -	4 13.25	13.25	0 -
1952	1956	2,780	93	11,156	120	4.01	0 -	14 15.50	15.79	0 -
1953	1957	2,907	150	44,870	299	15.44	10 41.50	9 15.33	15.69	0 -
1954	1958	12,463	23,882	428,958	18	34.42	57 44.28	48 12.29	12.67	0 -
1955	1959	5,178	372	308,775	830	59.63	0 -	0 -	-	0 -
1956	1960	1,102	26	10,971	422	9.96	0 -	0 -	-	0 -
1957	1961	7,106	262	11,959	46	1.68	4 41.25	3 17.00	17.00	0 -
1958	1962	44,285	6,184	188,824	31	4.26	0 -	102 10.79	13.57	0 -
1959	1963	25,473	409	175,192	428	6.88	16 41.50	14 12.36	13.86	11 92.64
1960	1964	1,862	51	8,697	171	4.67	6 41.67	5 14.40	15.40	0 -
1961	1965	1,957	55	25,649	466	13.11	0 -	7 15.43	15.43	0 -
1962	1966	27,411	2,939	169,778	58	6.19	0 -	67 11.51	14.82	28 95.30
1963	1967	26,742	147	112,265	764	4.20	0 -	15 13.27	14.07	0 -
1964	1968	1,321	0	17,994	-	13.62	0 -	0 -	-	0 -
1965	1969	2,550	183	34,707	190	13.61	0 -	0 -	-	0 -
1966	1970	12,943	658	139,745	212	10.80	17 43.41	14 10.86	15.14	0 -
1967	1971	7,264	66	216,733	3,284	29.84	0 -	0 -	-	0 -
1968	1972	2,064	0	21,963	-	10.64	0 -	0 -	-	0 -
1969	1973	3,276	258	14,617	57	4.46	9 42.10	8 16.50	19.75	0 -
1970	1974	3,603	470	223,705	476	62.09	21 42.95	15 11.87	13.40	0 -
1971	1975	9,463	1,341	132,035	98	13.95	87 42.70	64 12.59	15.55	0 -
1972	1976	1,418	320	56,465	176	39.82	8 42.00	8 14.75	19.63	0 -
1973	1977	1,150	419	23,962 e	57	20.84	10 41.30	0 -	-	0 -
1974	1978	25,096	688 e	181,163 e	263	7.22	11 43.09	10 13.20	14.70	0 -
1975	1979	15,756	303 e	217,627 e	718	13.81	11 41.64	11 13.64	15.82	0 -
1976	1980	4,898	50 e	18,677 e	374	3.81	3 44.00	2 10.00	12.00	0 -
1977	1981	2,883	135 e	77,274 e	572	26.80	4 40.25	4 15.75	16.75	4 77.33
1978	1982	30,757	100 e	220,865 e	2,209	7.18	0 -	0 -	-	0 -
1979	1983	24,866	82 e	90,764 e	1,107	3.65	3 39.67	4 11.50	16.00	5 85.24
1980	1984	4,616	9 e	38,048 p	4,228	8.24	1 41.00	1 18.00	23.00	0 -
1981	1985	5,354	0 p				0 -	0 -	-	0 -

TABLE 15.

1985 PREDICTIONS

SCOTCH CREEK SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	3(2) Standard Length (cm) (n)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count w/sg (n)	3(2) Marine Growth (cm @87X) (n)
BRYR	RTNYR	EF	32	42	42/32	42/EF	32SL	32WOSG	32WSG	32MG
1948	1952	5	ND	51	NA	10.20	- 0	- 0	- 0	- 0
1949	1953	1,003	496	6,023	12.14	6.00	- 0	- 0	- 0	- 0
1950	1954	19	0	0	NA	0.00	- 0	- 0	- 0	- 0
1951	1955	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1952	1956	10	0	35	NA	3.50	- 0	- 0	- 0	- 0
1953	1957	780	294	9,205	31.31	11.80	- 0	- 0	- 0	- 0
1954	1958	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1955	1959	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1956	1960	8	0	0	NA	0.00	- 0	- 0	- 0	- 0
1957	1961	1,214	24	1,196	49.83	0.99	- 0	- 0	- 0	- 0
1958	1962	NA	0	23	NA	NA	- 0	- 0	- 0	- 0
1959	1963	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1960	1964	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1961	1965	295	0	8,073	NA	27.40	- 0	- 0	- 0	- 0
1962	1966	1	0	2,717	NA	2717.00	- 0	- 0	- 0	- 0
1963	1967	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1964	1968	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1965	1969	777	200	16,437	82.19	21.14	- 0	- 0	- 0	- 0
1966	1970	236	0	2,956	NA	12.54	- 0	- 0	- 0	- 0
1967	1971	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1968	1972	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1969	1973	1,317	120	33,883	282.36	25.72	- 0	- 0	- 0	- 0
1970	1974	142	0	2,236	NA	15.70	- 0	- 0	- 0	- 0
1971	1975	NA	39	0	0.00	NA	- 0	- 0	- 0	- 0
1972	1976	NA	0	0	NA	NA	- 0	- 0	- 0	- 0
1973	1977	2,966	0	55,081 e	NA	18.57	- 0	- 0	- 0	- 0
1974	1978	275	0 e	9,824 e	NA	35.75	- 0	- 0	- 0	- 0
1975	1979	NA	0 e	0 e	NA	NA	- 0	- 0	- 0	- 0
1976	1980	20	0 e	286	NA	14.36	39.38 8	18.50 8	22.38 8	94.58 8
1977	1981	6,702	163	91,100 e	558.90	13.59	- 0	- 0	- 0	- 0
1978	1982	1,091	0 e	41,506 e	NA	38.04	- 0	- 0	- 0	- 0
1979	1983	NA	0 e	0 e	NA	NA	- 0	- 0	- 0	- 0
1980	1984	62	0 e	1,283 p	NA	20.69	- 0	- 0	- 0	- 0
1981	1985	6,887	126 p				36.40 1	21.00 1	27.00 1	80.40 1

16) or 13% higher (Figure 7). The relationship ($r = -0.900^{**}$) predicts a R/eff. female of 12.8 in 1985. This would result in a return of 1.54×10^6 4/2's in 1985. Regressions of R/eff. female for Middle River and Tachie River separately can be used in place of the combined data. These two regressions predict 13.6 and 11.9 4/2's/eff. female for Middle River and Tachie River, respectively, and give forecasts totaling 1.54×10^6 4'2's as well. Spawner-recruit curves use the same information as do the empirical relationships above; however, S/R curves require the assumption of a descending right hand limb of the curve. The S/R fit for Late Stuart sockeye stocks combined forecasts a 1985 return of 1.4×10^6 4/2's (Figure 8). Individual stock S/R curves forecast a summed return of 1.4×10^6 4/2's as well.

The use of environmental variables in the prediction of Late Stuart sockeye was examined. Winter air temperature during incubation and prior to smolt migration and discharge of the Stuart and Fraser Rivers during smolt migration were examined in relation to R/S and the deviations (%) from the S-R curve. No relationship accounted for over 35% of the variability and with only 8 data points was not predictive.

Examination of juvenile abundance in Trembleur and Stuart Lakes in fall, 1982, presents a mixed picture (see Table 6). The Trembleur Lake population should include both Middle River-Late Stuart juveniles and Middle River tributary-Early Stuart fish. Analysis of lacustrine growth confirms that these fish do normally rear together. The Trembleur Lake juvenile sockeye/kokanee population in 1982 was estimated to be 6.2×10^6 fish (Table 6) or about 58% of that present in 1978. This suggests that both the Early and Late Stuart populations utilizing this lake will be depressed in 1985. The juvenile sockeye/kokanee population present in Stuart Lake in 1982 was, however, substantially larger (at 30.8×10^6 fish) than in 1978 (19.5×10^6

TABLE 16.

1985 PREDICTIONS

LATE STUART SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF		32SL		32WOSG	32WSG		32MG
1948	1952	0	ND	327	NA	-	0	-	0	-	-	0	-
1949	1953	39,085	3,433	1,526,554	444.67	39.06	0	-	2	18.50	18.50	10	89.40
1950	1954	1,834	591	36,671	62.05	19.99	0	-	0	-	-	0	-
1951	1955	1,246	0	56,085	NA	45.01	0	-	0	-	-	0	-
1952	1956	16	86	3,858	44.86	241.12	0	-	0	-	-	0	-
1953	1957	78,686	830	1,548,072	1,865.15	19.67	20	41.35	19	17.53	17.68	11	96.46
1954	1958	2,687	150	135,111	900.74	50.28	0	-	1	16.00	16.00	0	-
1955	1959	3,274	29	50,196	1,730.90	15.33	0	-	1	11.00	14.00	0	-
1956	1960	466	0	13,472	NA	28.89	0	-	0	-	-	0	-
1957	1961	300,038	874	1,327,094	1,518.41	4.42	35	39.00	33	18.18	18.61	10	82.50
1958	1962	13,152	672	53,044	78.93	4.03	0	-	0	-	-	0	-
1959	1963	4,090	67	6,092	90.93	1.49	3	36.00	0	-	-	0	-
1960	1964	1,307	27	6,658	246.59	5.09	2	44.50	0	-	-	0	-
1961	1965	194,461	143	770,385	5,387.31	3.96	0	-	0	-	-	0	-
1962	1966	9,073	45	43,107	957.93	4.75	0	-	0	-	-	0	-
1963	1967	1,092	25	11,911	476.44	10.91	2	41.00	0	-	-	0	-
1964	1968	824	60	1,806	30.10	2.19	0	-	0	-	-	0	-
1965	1969	122,786	228	1,102,448	4,835.30	8.98	1	36.00	1	19.00	19.00	1	78.00
1966	1970	4,164	274	71,954	262.61	17.28	1	37.00	1	16.00	18.00	0	-
1967	1971	897	224	6,294	28.10	7.02	4	39.25	4	19.25	20.25	0	-
1968	1972	179	0	27,393	NA	153.03	0	-	0	-	-	0	-
1969	1973	114,300	2,756	1,602,892	581.60	14.02	24	40.58	19	17.21	20.32	0	-
1970	1974	8,027	318	70,520	221.76	8.79	5	40.00	13	15.85	17.69	0	-
1971	1975	725	1,243	65,527	52.72	90.38	0	-	0	-	-	0	-
1972	1976	3,411	0	16,180	NA	4.74	0	-	0	-	-	0	-
1973	1977	116,702	290	602,292 e	2,076.87	5.16	0	-	1	17.00	20.00	1	98.42
1974	1978	7,371	572 e	41,888 e	73.23	5.68	24	40.25	18	17.50	19.83	0	-
1975	1979	5,679	0 e	196,371 e	NA	34.58	0	-	0	-	-	0	-
1976	1980	1,674	0 e	3,209	NA	1.92	0	-	0	-	-	0	-
1977	1981	75,962	104	1,410,100 e	13,558.65	18.56	1	39.00	1	18.00	23.00	0	-
1978	1982	7,115	923 e	56,953 e	61.70	8.00	24	37.83	19	18.16	20.58	18	88.51
1979	1983	16,711	0 e	9,750 e	NA	0.58	0	-	0	-	-	0	-
1980	1984	287	0 e	9,811 p	NA	34.18	0	-	0	-	-	0	-
1981	1985	120,124	0 p				0	-	0	-	-	0	-

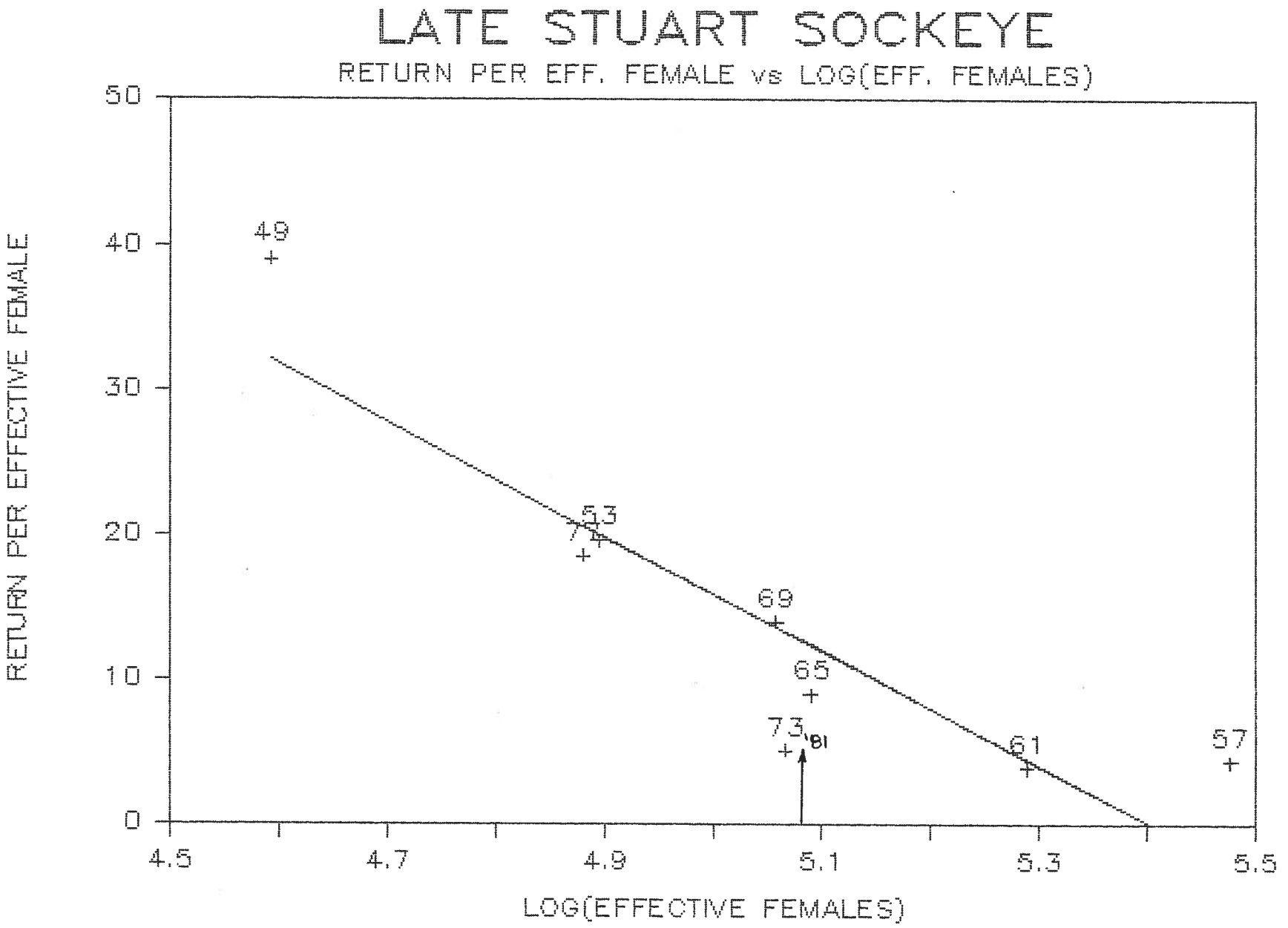

FIGURE 7. Late Stuart sockeye return per effective female vs effective females - 1985 cycle - BY 1949-1977.

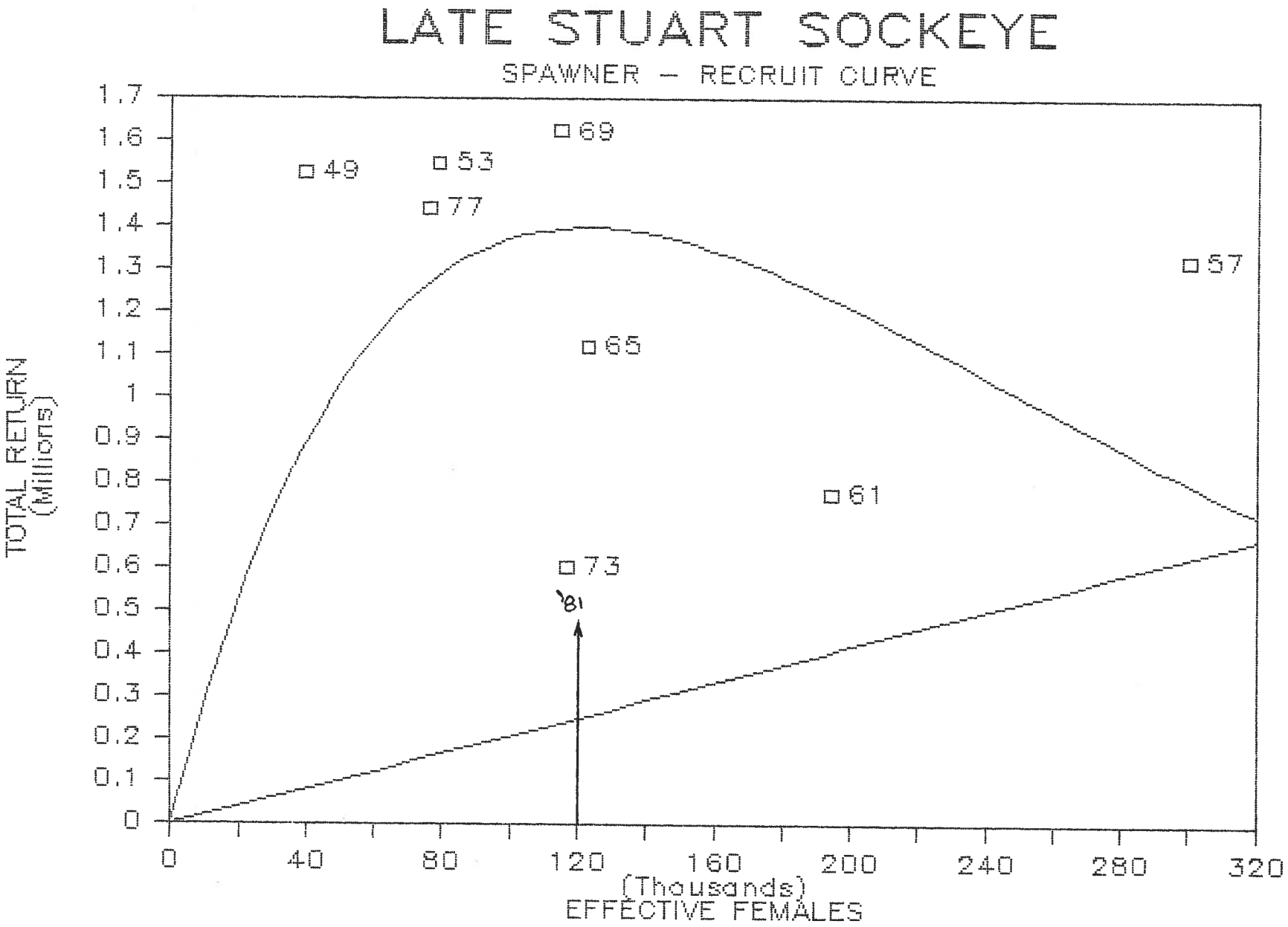

FIGURE 8. Late Stuart sockeye spawner-recruit curve - 1985 cycle - BY 1949-1977.

juveniles). These data may indicate a very successful Tachie River production or that Middle River fish may have also reared in Stuart Lake. Alternately, the difference in populations may be solely the influence of juvenile kokanee and may not be indicative of the size of the sockeye population. Differentiation of the juvenile sockeye and kokanee components on the basis of length frequencies, etc. may help sort out this problem but the analyses are currently not available. Juvenile fish were small in both lakes which may indicate a larger proportion of kokanee in the lakes.

Smolts captured at the outlet of Stuart Lake on April 27, 1983 are believed to be Tachie River fish based on data from early samples taken in past years. These smolts averaged 90.3 mm in length, weighed 7.77 g and had 18.55 circuli (wo/sg). The circuli count appears to be above average for Tachie River fish. Age 4/2 adult circuli counts have averaged 17.0 (wo/sg) for the 5 previous returns (range: 16.3-17.3). Regression of circuli count on density of effective females predicts an average count of 17.1 circuli for 1985 4/2's. It is likely that the smolts do not adequately represent the circuli count of 1985 returnees owing to the early date of sampling.

No jacks were observed or sampled in 1984; however, no real effort was made to locate and sample jacks. We assume that some did return but we cannot identify them in either catch or escapement. It would appear that the jack population was small; however, as stated earlier, 3/2 abundance does not appear to be well related to the 4/2 return.

The lack of predictive data other than for recruits per spawner and S/R relationships require use of these in the 1985 forecast. However, the lack of juveniles in Trembleur Lake suggests a reduced Middle River production in 1985. My best estimate is for a return of 1.2×10^6 adults in 1985.

CHILKO

The forecast of "off" cycle Chilko River sockeye returns can be based on S/R curves for the cycle or on smolt to adult survival related to environmental variables. The S/R curve for the 1985 cycle predicts a total return of 190,000 adults or about 180,000 4/2's in 1985 (Figure 9).

The smolt migration in 1983 was estimated at 1.704×10^6 yearlings. Of this total approximately 1.698×10^6 (Table 17) would be Chilko River origin while 6,000 would be attributable to Chilko Lake sockeye. Using relationships of survival for smolt populations less than 5×10^6 individuals, Chilko River discharge predicts 12.6% survival or 214,000 4/2's while Chilko River water temperature was the highest on record and suggests a very low survival (i.e. 0). Big Creek log December-March air temperatures for all non-dominant cycle years is negatively related to survival ($r = -0.754$). The relatively mild winter air temperature (24.7°F) suggests a 4.5% survival or 76,000 4/2's in 1985. Weighted Hope discharge (137,000 cfs) for all years ($r = 0.560^{**}$) predicts a survival rate of 5.9% or 100,000 4/2's.

Jack returns for Chilko stocks were estimated at 1,678 fish with 1,211 attributable to Chilko River. The jack mean length was small suggesting that a relatively high 4/2:3/2 ratio might be expected. However, the BY 1977 jacks were the smallest Chilko jacks on record at 37.08 cm and had a low 4/2:3/2 ratio of 70:1. This ratio would give a 4/2 return forecast of 85,000 fish in 1985.

My best estimate is for a 1985 return of 100,000 4/2's and, in addition, 100,000 5/2's and 5/3's should return.

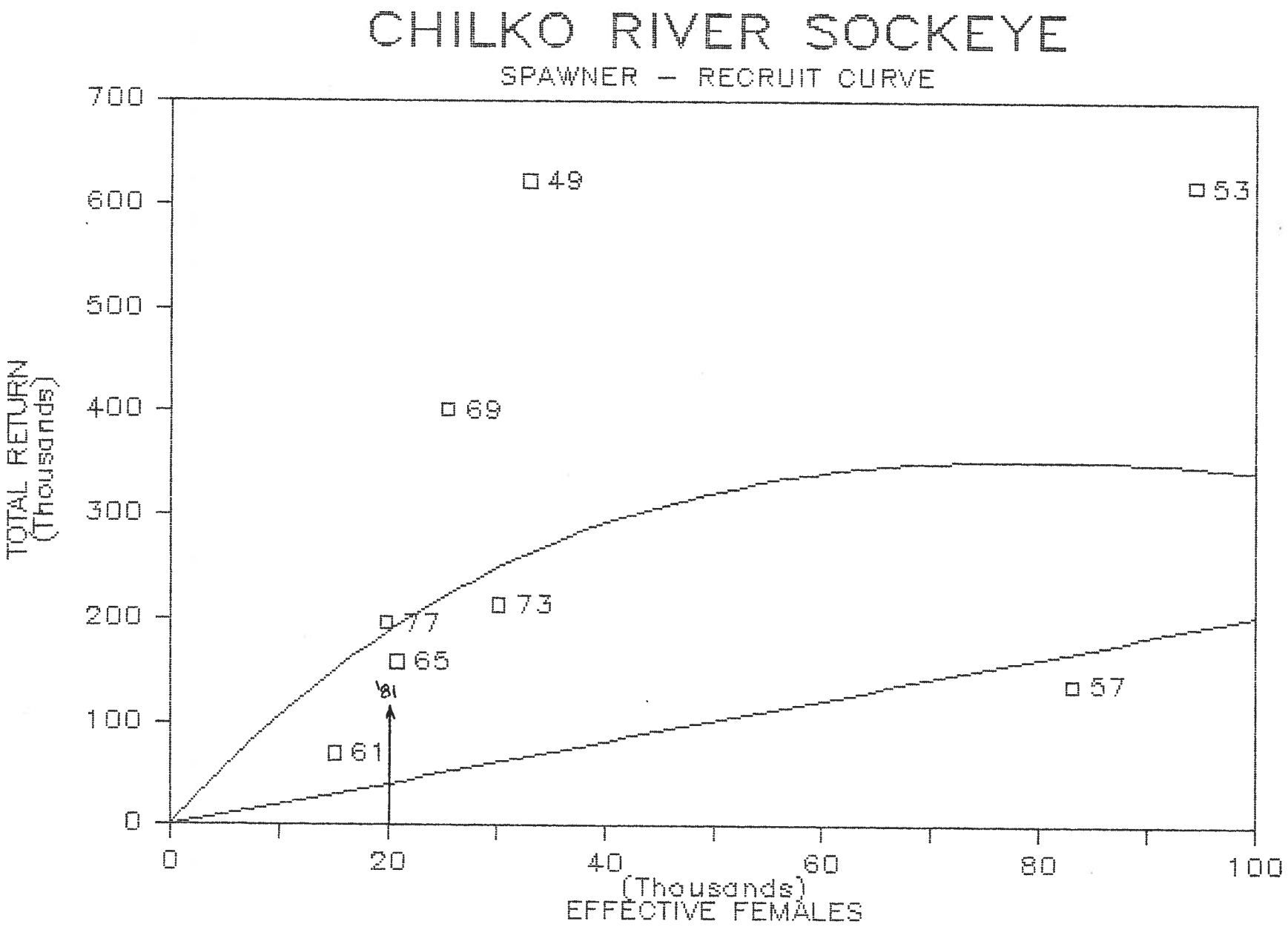

FIGURE 9. Chilko River sockeye spawner-recruit curve - 1985 cycle - BY 1949-1977.

TABLE 17.

1985 PREDICTIONS

CHILKO RIVER AND NORTH END LAKE SOCKEYE BASIC DATA

Brood Year Year i	Effective Females Above Canoe Cross Year i	Number ChilkoRNE Age I Smolts (millions)	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	Survival Age I Smolts to 4(2)	4(2)/ 3(2) Ratio	4(2) Return Per Effect. Female Ratio	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87X)
BRYR	EFACC	RNESMOLT1	32	42	S42SURV	4232	42/EF		32SL		32WOSG	32WSG		32MG
1948	364,597	NA	32,000 e	1,643,062	NA	51	4.51	257	42.98	53	10.15	13.28	118	93.69
1949	33,029	3.147	3,732	560,635	17.82%	150	16.97	88	42.84	64	12.14	12.22	32	99.13
1950	6,555	1.170	1,489	183,278	15.66%	123	27.96	18	42.52	93	14.04	14.08	55	86.07
1951	57,563	11.505	3,925	644,911	5.61%	164	11.20	153	38.64	129	12.68	12.68	106	86.92
1952	233,628	24.491	18,732	1,763,929	7.20%	94	7.55	180	40.11	180	13.15	13.41	132	91.05
1953	94,471	7.690	1,172	514,554	6.69%	439	5.45	37	38.65	88	11.60	11.98	63	94.81
1954	21,247	2.853	12,234	632,132	22.15%	52	29.75	116	40.29	205	12.16	12.88	139	88.68
1955	75,834	9.159	32,418	1,407,963	15.37%	43	18.57	193	42.95	193	14.80	14.81	123	96.00
1956	325,872	28.242	13,905	2,379,854	8.43%	171	7.30	108	40.80	108	14.26	15.34	51	84.00
1957	83,007	9.458	76	117,362	1.24%	1544	1.41	7	42.43	11	12.91	14.18	11	86.73
1958	70,433	6.895	4,055	278,320	4.04%	69	3.95	265	42.21	216	12.28	12.83	118	100.74
1959	246,420	32.165	23,792	2,080,497	6.47%	87	8.44	179	38.99	464	11.54	13.32	409	91.52
1960	244,002	33.780	5,472	958,877	2.84%	175	3.93	227	40.87	204	11.96	12.36	140	98.84
1961	15,038	1.592	256	52,713	3.31%	206	3.51	52	41.04	48	14.35	14.42	45	86.33
1962	42,125	8.813	10,657	960,609	10.90%	90	22.80	299	42.90	499	17.64	19.23	102	93.54
1963	56,710	9.270	37,579	1,112,861	12.01%	30	19.62	132	40.73	132	11.14	12.41	94	97.60
1964	127,724	23.665	7,252	1,818,921	7.69%	251	14.24	80	40.74	81	12.09	12.51	63	95.56
1965	19,930	2.346	1,787	138,555	5.91%	78	6.95	38	37.34	40	11.20	13.73	38	84.63
1966	102,410	17.355	26,456	744,469	4.29%	28	7.27	340	40.71	340	14.93	15.87	103	101.57
1967	90,006	9.148	28,734	1,933,329	21.13%	67	21.48	197	39.38	197	10.97	14.31	291	96.95
1968	181,912	31.542	46,952	2,335,183	7.40%	50	12.84	176	41.88	176	13.18	15.59	163	100.65
1969	25,519	3.586	4,126	369,954	10.32%	90	14.50	61	39.80	61	15.00	15.36	41	91.12
1970	50,926	3.833	16,775	627,337	16.37%	37	12.32	225	40.84	224	11.34	13.05	113	94.69
1971	90,643	5.672	24,353	571,260	10.07%	23	6.30	297	41.37	297	11.48	13.99	187	92.48
1972	327,616	20.006	37,001	1,861,092	9.30%	50	5.68	158	40.85	162	10.52	12.89	91	89.35
1973	30,231	4.169	7,640	180,432 e	4.33%	24	5.97	122	40.70	123	12.50	14.62	86	98.50
1974	70,526	7.057	18,667 e	547,007 e	7.75%	29	7.76	190	41.90	190	14.20	14.57	100	88.02
1975	102,022	13.013	8,131 e	1,406,022 e	10.80%	173	13.78	267	37.21	268	11.25	13.74	99	75.90
1976	211,581	25.411	7,798 e	1,571,493	6.18%	202	7.43	101	41.50	101	12.23	15.63	75	88.44
1977	19,832	2.607	2,707	190,813 e	7.32%	70	9.62	59	37.08	39	15.74	17.18	35	89.89
1978	82,726	18.140	8,327 e	1,083,536 e	5.97%	130	13.10	155	39.89	124	13.64	13.80	84	92.50
1979	134,853	21.160	4,119 e	1,455,136 e	6.88%	353	10.79	177	38.00	130	11.86	14.38	85	87.65
1980	276,086	31.642	5,800 e	3,772,379 p	11.92%	650	13.66	110	39.53	125	13.74	13.08	69	91.35
1981	20,083	1.698	1,211 p					8	37.69	8	14.13	14.13	7	80.79

1971 - River only, total return = 43,201
1975 - River only, total return = 17,376
1979 - River only, total return = 6,680
1983 - River only, total return = 9,228

STELLAKO

The 1981 spawning of 12,000 effective females (Table 18) was the 3rd lowest on record for all "off" cycle years (i.e. 1984 + 1985 cycles). Spawner-recruit data for these cycles predicts a 1985 return of 150,000 total adults or about 130,000 4/2's in 1985 (Figure 10). The relationships of R/eff. female vs number of effective females is enhanced by the inclusion of log Big Creek air temperature (December-March) in a multiple regression (R = 0.736**). This relationship predicts 8.1/eff. female or 97,000 adults which would give about 85,000 4/2's in 1985.

The 1982 fall acoustic survey of Fraser Lake yielded a population of 6.84×10^6 juvenile sockeye and kokanee. The population estimate was quite large considering the low spawner abundance. Juvenile size was very low (58.5 mm) compared to other years. I feel the juvenile population includes large numbers of kokanee and is not a true indicator of the sockeye population.

Growth in Fraser Lake as indicated by age 3/2 jack wo/sg circuli count was quite good at 19.33 circuli. While this generally indicates small populations, the relationship with adult return is not good.

Jack returns in 1984 were estimated to be 106 fish. The length of 6 jacks measured on the spawning grounds was 38.00 cm, equal to the smallest on record, i.e. 1982. The 4/2:3/2 ratio does not seem to be well related to length or first year marine growth of jacks. The recent off cycle years have had small jacks but normal 4/2:3/2 ratios. Ratios have been 1,270 to 1,764:1 for the past 3 off cycle years and within this period some relationship with length can be seen. The jack length and jack production for the 1985 return are similar to that for the 1981 brood year return. A 4/2:3/2 ratio of 1,764:1 was observed in the latter year. This would give a 1985 return of 187,000 4/2's.

TABLE 18.

1985 PREDICTIONS

STELLAKO RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF		326L		32WOSG	32WSG		32MG
1948	1952	9,242	ND	185,175	-	20.04	0	-	0	-	-	0	-
1949	1953	40,231	133	173,402	1,304	4.31	0	-	0	-	-	0	-
1950	1954	77,410	4,630	903,768	195	11.68	0	-	182	19.14	19.14	16	103.30
1951	1955	51,413	26	354,049	13,617	6.89	2	39.50	2	19.50	20.50	0	-
1952	1956	19,920	23	93,984	4,086	4.72	0	-	0	-	-	0	-
1953	1957	20,388	30	156,192	5,206	7.66	0	-	0	-	-	0	-
1954	1958	72,273	3,311	1,140,205	344	15.78	7	40.71	7	14.86	14.86	3	98.05
1955	1959	29,937	28	602,677	21,524	20.13	0	-	0	-	-	0	-
1956	1960	21,686	92	220,400	2,396	10.16	6	39.83	4	18.00	18.00	0	-
1957	1961	18,044	8	143,835	17,979	7.97	0	-	0	-	-	0	-
1958	1962	61,581	1,156	323,089	279	5.25	2	40.50	1	17.00	17.00	0	-
1959	1963	41,872	17	514,918	30,289	12.30	3	39.33	3	15.67	15.67	1	83.03
1960	1964	22,718	19	143,340	7,544	6.31	29	40.03	0	-	-	0	-
1961	1965	18,136	288	137,046	476	7.56	0	-	25	19.48	19.80	11	99.49
1962	1966	44,532	100	572,029	5,720	12.85	0	-	0	-	-	0	-
1963	1967	41,535	977	713,487	730	17.18	14	40.43	11	18.09	18.55	1	87.44
1964	1968	16,161	194	170,674	880	10.56	0	-	1	15.00	15.00	0	-
1965	1969	20,479	179	231,100	1,291	11.28	0	-	13	17.46	19.31	0	-
1966	1970	51,509	833	336,316	404	6.53	0	-	30	13.83	16.83	7	96.15
1967	1971	32,467	288	531,886	1,847	16.38	10	41.00	17	16.00	17.24	5	95.39
1968	1972	13,680	85	125,900	1,481	9.20	12	43.75	8	17.63	17.88	0	-
1969	1973	25,629	131	235,729	1,799	9.20	13	42.54	10	19.40	20.30	4	94.73
1970	1974	26,727	1,170	228,808	196	8.56	4	42.75	2	18.00	18.00	0	-
1971	1975	20,147	496	508,759	1,026	25.25	8	41.00	2	15.50	18.00	2	97.60
1972	1976	19,938	204	711,226	3,486	35.67	17	40.00	18	18.72	19.00	7	98.67
1973	1977	15,424	11	73,561 e	6,687	4.77	0	-	0	-	-	0	-
1974	1978	23,718	1,804 e	246,806 e	137	10.41	58	42.36	58	18.66	18.71	23	97.35
1975	1979	68,451	3,608 e	1,682,571 e	466	24.58	130	39.48	226	18.58	19.34	50	98.82
1976	1980	63,865	170 e	215,832 e	1,270	3.38	15	40.67	9	16.89	18.44	4	92.05
1977	1981	10,894	74 e	130,554 e	1,764	11.98	11	38.18	8	19.00	21.25	8	80.63
1978	1982	32,528	878 e	370,226 e	422	11.38	26	40.69	20	19.25	19.75	6	93.00
1979	1983	152,583	19 e	463,046 e	24,371	3.03	5	38.00	3	18.67	18.67	3	91.39
1980	1984	28,477	150 e	204,761 p	1,365	7.19	16	38.49	14	19.57	19.57	10	90.57
1981	1985	12,030	106 p				6	38.00	6	19.33	21.17	6	81.95

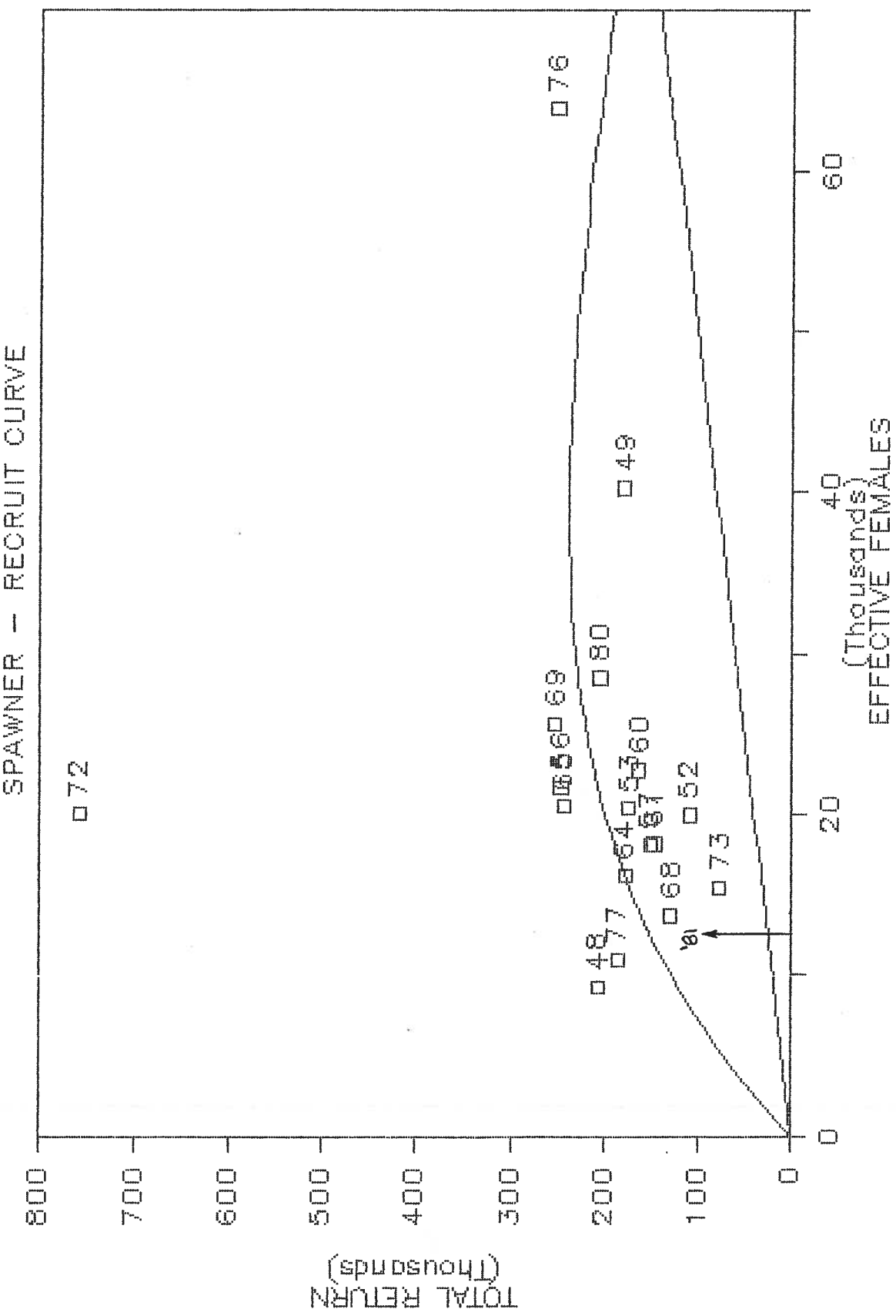

FIGURE 10. Stellako River sockeye spawner-recruit curve - 1984 & 1985 cycles - BY 1949-1980.

The best estimate is for a return of 125,000 4/2's. In addition, approximately 25,000 5/2's from BY 1980 should contribute to the 1985 return.

BIRKENHEAD

A good escapement and success of spawning in 1981 provided 27,200 effective female spawners (Table 19). The S/R curve for recent years (BY 1967-80) predicts a 4/2 return of 311,000 fish. However, moderately high discharges in fall, 1981 probably reduced the egg-to-fry survival. The relationship of the deviation from R/eff. female vs number of females curve to maximum discharge (Nahatlatch River) indicates a below average rate of return of 6.5 per effective female, or 177,000 4/2's in 1985.

No usable juvenile population information was obtained in the 1982 fall acoustic survey of Harrison Lake. Jacks in 1984 had 18.00 circuli wo/sg and 22.52 circuli w/sg which are relatively high, probably the result of low abundance following a modest Weaver fry output and low Birkenhead survival. Only 3 of the previous 23 brood years have had higher 3/2 circuli counts, including BY 1975 and BY 1980 jacks, both of which had very poor adult returns. The relationship between wo/sg circuli count of 3/2's and 4/2 return for BY 1965 to 1980 ($r = 0.728^{**}$, 14 d.f.) predicts a return of 204,000 4/2's in 1985.

Jack returns in 1984 totaled 4,244 3/2's. This was the second lowest jack total on record, but the jack length at 33.19 cm was the smallest on record. The long term relationship of 4/2:3/2 ratio to jack length ($r = -0.498^{**}$) predicts a ratio of 15:1 for BY 1981. The forecast return would be 64,000 4/2's. The previous small jacks (BY 1979) were 33.54 cm and gave a 20:1 ratio. Thus, given the recent history of jack production, a 4/2:3/2 of 20:1 or greater could occur.

While some indicators give forecasts of 175,000 to 200,000 4/2's in

TABLE 19.

1985 PREDICTIONS

BIRKENHEAD RIVER SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF		32SL		32WOSG	32WSG		32MG
1948	1952	54,755	N.D.	179,637	-	3.28	143	37.47	170	14.33	15.99	0	-
1949	1953	43,328	44,548	228,462	5	5.27	276	37.33	0	-	-	0	-
1950	1954	41,370	13,166	183,919	14	4.45	132	37.08	131	16.79	17.65	0	-
1951	1955	13,589	31,161	107,397	3	7.90	195	35.69	197	16.71	18.08	0	-
1952	1956	24,744	14,902	180,787	12	7.31	91	35.84	69	15.71	17.10	0	-
1953	1957	16,287	8,205	102,206	12	6.28	65	35.98	50	17.10	18.70	0	-
1954	1958	8,635	12,671	128,222	10	14.85	115	35.92	85	13.62	16.14	0	-
1955	1959	8,185	35,100	221,160	6	27.02	167	38.66	53	13.15	15.32	0	-
1956	1960	27,156	20,500	209,127	10	7.70	139	36.38	82	14.43	16.63	42	88.34
1957	1961	7,068	3,587	37,495	10	5.30	123	36.51	26	16.31	18.69	0	-
1958	1962	5,510	21,115	74,626	4	13.54	52	38.65	59	16.22	17.88	29	93.36
1959	1963	11,388	26,205	188,393	7	16.54	81	36.47	359	13.40	15.87	50	80.56
1960	1964	19,198	28,566	119,526	4	6.23	359	36.29	66	14.48	16.53	41	86.85
1961	1965	10,550	21,891	67,104	3	6.36	142	36.33	140	16.35	18.99	87	86.47
1962	1966	14,311	21,342	66,117	3	4.62	256	38.00	249	17.07	20.30	108	89.60
1963	1967	20,769	95,525	281,641	3	13.56	358	37.76	498	15.77	19.11	103	93.93
1964	1968	27,978	39,236	225,898	6	8.07	158	38.56	157	16.76	19.17	50	95.68
1965	1969	9,769	30,602	109,033	4	11.16	245	35.93	382	17.91	20.33	50	89.27
1966	1970	13,462	56,603	155,016	3	11.52	289	36.93	290	16.91	19.87	100	97.31
1967	1971	17,580	54,257	365,358	7	20.78	265	36.68	265	18.75	21.65	50	95.00
1968	1972	31,042	21,213	218,223	10	7.03	195	36.19	167	17.44	20.79	50	82.73
1969	1973	14,324	73,972	451,184	6	31.50	238	35.76	190	15.65	19.41	50	88.05
1970	1974	19,252	119,108	531,214	4	27.59	158	36.16	133	14.51	16.65	50	90.57
1971	1975	16,143	62,316	245,897	4	15.23	104	37.28	88	17.69	20.66	48	93.06
1972	1976	26,202	42,841	424,942	10	16.22	261	37.79	227	15.57	18.03	50	90.85
1973	1977	28,374	44,117	229,267 e	5	8.08	106	37.12	91	16.22	18.91	50	91.76
1974	1978	85,495	50,561 e	623,744 e	12	7.30	331	37.28	254	13.88	15.67	50	96.82
1975	1979	19,653	7,588 e	86,517 e	11	4.40	21	36.24	20	19.45	22.70	18	87.00
1976	1980	50,023	41,164 e	479,356 e	12	9.58	154	36.06	103	14.44	18.08	59	87.67
1977	1981	12,799	15,580 e	162,714 e	10	12.71	209	35.00	122	15.46	18.85	77	81.81
1978	1982	48,158	37,626 e	598,443 e	16	12.43	271	36.33	116	16.15	18.08	95	94.56
1979	1983	35,168	12,450 e	243,812 e	20	6.93	165	33.54	62	17.29	19.92	84	80.73
1980	1984	32,786	10,228 e	122,310 p	12	3.73	73	36.15	42	18.45	21.81	41	87.26
1981	1985	27,175	4,244 p				27	33.19	27	18.00	22.52	26	82.04

1985, I feel that the 4/2:3/2 ratio would not likely be in excess of 25:1. The best guess at this time is for a return of 100,000 4/2's in 1985.

ADAMS

The 1981 escapement of 4,200 effective females was the largest off-cycle escapement for many years (Table 20). Off-cycle Adams sockeye produce irratically with some disastrously low rates of return mixed with a few extremely high rates of return (R/eff. female: range 1.65-144.47). A geometric mean of 8.0/eff. female is obtained after excluding BY 1973 data. This would give a return of 33,000 4/2's in 1985. No jacks were recovered on the spawning grounds, suggesting a poor rate of return in 1985.

My best estimate would be for a return of 30,000 4/2's.

WEAVER

Fry production from Weaver channel in 1982 was estimated at 27.2 x 10^6 fish (Table 21) with 21.6 x 10^6 fry from the channel. Log survival from fry to adult related to log fry abundance (r = 0.641**) predicts a survival of 0.98% (Figure 11) or 267,000 adults of which approximately 235,000 would be 4/2's. Weaver fry were smaller than normal in 1982, particularly in wet weight, averaging 0.163 g compared to a 10-year average of 0.183 g, and thus, may have lower survival than expected. Growth in Harrison Lake as estimated by jack scale circuli count (wo/sg) is related to adult returns (r = -0.585**). The BY 1981 jack circuli count of 19.82 was the 3rd highest since BY 1965. The forecast based on the existing relationship forecasts a return of 155,000 adults or about 135,000 4/2's.

Jack abundance was estimated to be 2,848 age 3/2 fish. The relationships of 3/2's to 4/2's (r = 0.534**) forecasts a return of 180,000 4/2's in 1985. The 4/2:3/2 ratio is not well related to jack length, however,

TABLE 20.

1985 PREDICTIONS

ADAMS SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/ 3(2) Ratio	4(2) Return Per Eff. Female Ratio	3(2) Standard Length (n)	3(2) Standard Length (cm)	3(2) Circuli Count (n)	3(2) Circuli Count wo/sg	3(2) Circuli Count w/sg	3(2) Marine Growth (n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF		32SL		32WOSG	32WSG		32MG
1948	1952	8,502	ND	22,876	-	2.69	0	-	185	16.08	16.17	0	-
1949	1953	2,004	5,415	29,456	5	14.70	106	45.28	99	16.36	16.56	23	92.09
1950	1954	575,292	593,959	9,177,229	15	15.95	220	43.36	211	11.00	11.47	83	89.46
1951	1955	82,094	7,290	519,576	71	6.33	0	-	191	12.14	12.58	236	79.59
1952	1956	4,211	1,481	14,320	10	3.40	0	-	0	-	-	0	-
1953	1957	1,623	1,450	29,548	20	18.21	67	43.70	65	19.57	20.08	19	93.47
1954	1958	1,056,654	713,573	15,017,122	21	14.21	224	41.81	189	10.77	12.62	81	89.20
1955	1959	44,622	11,091	851,321	77	19.08	0	-	119	13.01	13.92	49	97.43
1956	1960	2,103	555	6,961	13	3.31	0	-	0	-	-	0	-
1957	1961	1,650	16	2,724	170	1.65	0	-	2	19.00	22.50	1	101.00
1958	1962	1,638,695	118,539	2,002,680	17	1.22	441	44.23	365	11.15	13.10	117	97.18
1959	1963	89,083	7,457	370,773	50	4.16	210	42.62	140	12.81	13.74	69	92.09
1960	1964	1,322	194	2,333	12	1.76	15	43.27	11	15.36	15.91	6	85.50
1961	1965	839	204	6,215	30	7.41	10	43.60	9	15.44	18.33	0	-
1962	1966	634,084	89,785	2,684,675	30	4.23	230	41.40	95	11.01	13.04	50	93.42
1963	1967	79,228	78,569	3,028,444	39	38.22	446	45.11	367	11.84	13.82	46	98.43
1964	1968	345	2,346	17,103	7	49.57	0	-	0	-	-	0	-
1965	1969	1,160	496	24,417	49	21.05	18	41.89	14	17.50	21.64	0	-
1966	1970	645,401	94,825	3,816,991	40	5.91	230	42.37	198	11.05	15.02	17	98.18
1967	1971	399,486	65,401	3,045,035	47	7.62	124	42.37	104	10.44	13.07	45	97.53
1968	1972	2,713	222	20,511	92	7.56	8	45.11	8	14.25	17.50	0	-
1969	1973	2,648	818	7,722	9	2.92	19	41.11	17	15.12	18.59	0	-
1970	1974	770,674	155,256	4,965,705	32	6.44	124	42.68	105	11.76	14.57	37	90.11
1971	1975	155,276	20,347	634,813	31	4.09	165	43.88	170	13.16	16.32	48	89.10
1972	1976	2,135	4,003	38,141	10	17.86	47	43.09	49	14.82	18.43	0	-
1973	1977	501	2,069	72,378 e	35	144.47	21	42.10	37	16.97	19.54	0	-
1974	1978	567,891	130,162 e	6,256,038 e	48	11.02	111	43.03	190	10.99	14.35	55	91.44
1975	1979	79,416	9,142 e	984,836 e	108	12.40	99	40.71	100	13.39	15.86	30	91.80
1976	1980	3,053	500 e	12,650 e	25	4.14	14	45.21	21	13.86	17.81	0	-
1977	1981	2,472	399 e	25,314 e	63	10.24	5	39.60	6	16.33	19.00	5	89.99
1978	1982	918,972	81,669 e	7,991,071 e	98	8.70	459	41.70	246	9.97	13.98	76	89.31
1979	1983	156,431	6,165 e	1,444,745 e	234	9.24	123	39.49	100	11.28	14.11	19	81.86
1980	1984	1,811	501 e	34,014 p	68	18.78	5	39.94	6	14.50	17.33	6	77.60
1981	1985	4,161	0 p				0	-	0	-	-	0	-

Includes all Late South Thompson areas except Lower and Middle Shuswap Rivers.

TABLE 21.

1985 PREDICTIONS

WEAVER CREEK SOCKEYE PRODUCTION DATA

Brood Year Year i	4(2) Return Year Year i+4	Total Effective Females Year i	Total Fry Production (millions) Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	Adult 5(2) Return Year i+5	Total Adult Return
BRYR	RTNYR	TEF	FRY	32	42	52	TADULT
1948	1952	12,663	-	ND	125,758	5,877	131,635
1949	1953	7,930	-	74	45,223	9,705	54,928
1950	1954	15,630	-	1,321	171,876	10,960	182,836
1951	1955	7,696	-	576	97,547	19,388	116,935
1952	1956	13,175	-	73	6,576	4,357	10,933
1953	1957	5,142	-	337	194,973	22,897	217,870
1954	1958	13,754	-	2,805	231,060	1,432	232,492
1955	1959	13,037	-	470	71,145	1,233	72,378
1956	1960	5,893	-	36	20,717	546	21,572
1957	1961	11,111	-	15	7,070	1,731	8,801
1958	1962	21,770	-	357	30,406	309	30,715
1959	1963	5,023	-	51	38,308	900	39,208
1960	1964	4,059	-	0	2,856	1,049	4,623
1961	1965	2,336	-	337	47,946	9,526	57,472
1962	1966	9,403	-	84	44,483	3,371	47,854
1963	1967	8,848	-	4,564	161,295	509	161,915
1964	1968	663	-	78	21,556	3,406	24,962
1965	1969	7,326	10.471	1,129	184,488	19,915	204,530
1966	1970	9,860	14.493	660	73,515	1,939	75,454
1967	1971	10,618	7.002	1,764	77,288	8,421	86,641
1968	1972	2,202	3.584	2,976	141,825	10,577	152,402
1969	1973	30,604	37.132	3,031	371,636	38,246	409,882
1970	1974	5,003	9.843	7,393	371,993	4,652	376,645
1971	1975	2,656	5.233	10,694	139,569	2,345	144,561
1972	1976	15,026	19.400	7,439	331,589	3,346 e	334,935
1973	1977	24,885	38.817	4,227	331,296 e	20,089 e	351,385
1974	1978	28,099	43.627	6,714 e	253,970 e	15,653 e	269,623
1975	1979	16,033	25.961	2,813 e	141,661 e	1,479 e	143,140
1976	1980	28,243	57.578	9,489 e	271,322 e	15,044 e	286,366
1977	1981	28,510	19.859	2,995 e	145,856 e	14,598 e	160,454
1978	1982	42,315	43.047	5,119 e	939,551 e	173,691 e	1,113,612
1979	1983	25,702	27.036	1,157 e	158,168 e	16,416 p	174,584
1980	1984	43,286	52.603	2,958 e	368,927 p		368,927
1981	1985	22,627	27.213	2,848 p			

TABLE 21 (cont'd).

1985 PREDICTIONS

WEAVER CREEK SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	Survival Fry to 4(2) (%)	Survival Fry to Adult (%)	3(2) Standard Length (n)	3(2) Standard Length (cm)	3(2) Circuli Count wo/sg (n)	3(2) Circuli Count wo/sg	3(2) Circuli Count w/sg	3(2) Marine Growth (n)	3(2) Marine Growth (cm @87%)
BRYR	RTNYR	4232	42/EF	FT42	FTADULT		32SL		32WOSG	32WSG		32MG
1948	1952	-	9.93	-	NA	0	-	6	20.17	22.16	0	-
1949	1953	611	5.70	-	NA	0	-	5	21.00	24.20	0	-
1950	1954	130	11.00	-	NA	21	46.19	140	21.97	22.38	0	-
1951	1955	169	12.68	-	NA	6	44.83	6	23.33	23.33	0	-
1952	1956	90	0.50	-	NA	3	45.17	2	22.00	22.00	0	-
1953	1957	579	37.92	-	NA	15	44.93	13	20.62	22.00	0	-
1954	1958	82	16.80	-	NA	228	45.05	196	18.78	19.46	37	117.73
1955	1959	151	5.46	-	NA	40	46.20	40	18.28	18.80	22	113.50
1956	1960	575	3.52	-	NA	2	40.00	2	24.00	24.00	0	-
1957	1961	471	0.64	-	NA	2	41.00	2	21.50	21.50	22	113.59
1958	1962	85	1.40	-	NA	29	45.21	25	19.40	21.52	7	98.43
1959	1963	751	7.63	-	NA	10	45.20	9	18.22	19.33	5	104.00
1960	1964	NA	0.70	-	NA	0	-	0	-	-	0	-
1961	1965	142	20.52	-	NA	39	45.97	36	23.31	25.22	7	109.14
1962	1966	530	4.73	-	NA	3	44.67	2	17.00	20.00	0	-
1963	1967	35	18.23	-	NA	271	47.47	231	20.45	22.39	20	106.00
1964	1968	276	32.51	-	NA	8	45.13	9	19.44	20.44	0	-
1965	1969	163	25.18	1.76%	1.95%	80	43.44	77	18.86	20.58	101	102.74
1966	1970	111	NA	0.51%	0.52%	459	42.84	59	19.00	19.69	16	111.94
1967	1971	44	NA	1.10%	1.24%	26	46.05	104	21.47	22.53	38	108.20
1968	1972	48	NA	3.96%	4.25%	115	43.29	15	19.60	23.00	31	101.21
1969	1973	123	NA	1.00%	1.10%	178	44.45	45	15.71	18.24	67	106.03
1970	1974	50	NA	3.78%	3.83%	115	43.85	92	17.41	18.89	13	107.92
1971	1975	13	NA	2.67%	2.76%	223	42.27	184	18.77	20.67	10	112.26
1972	1976	45	NA	1.71%	1.73%	230	44.10	202	16.43	18.27	11	112.75
1973	1977	78	NA	0.85%	0.91%	268	43.12	50	17.34	19.18	7	97.80
1974	1978	38	NA	0.58%	0.62%	115	43.49	104	14.94	16.04	30	107.76
1975	1979	50	NA	0.55%	0.55%	75	43.64	183	21.30	21.98	49	102.49
1976	1980	29	NA	0.47%	0.50%	114	43.08	86	16.43	17.28	16	115.02
1977	1981	49	NA	0.73%	0.81%	223	40.39	161	15.93	18.31	55	104.73
1978	1982	184	NA	2.18%	2.59%	240	42.50	138	14.90	16.03	59	113.42
1979	1983	137	NA	0.59%	0.65%	125	41.27	86	18.65	19.87	42	95.97
1980	1984	125	NA	0.70%	0.70%	230	40.58	179	19.71	22.03	76	104.05
1981	1985					166	41.07	132	19.82	22.72	77	101.01

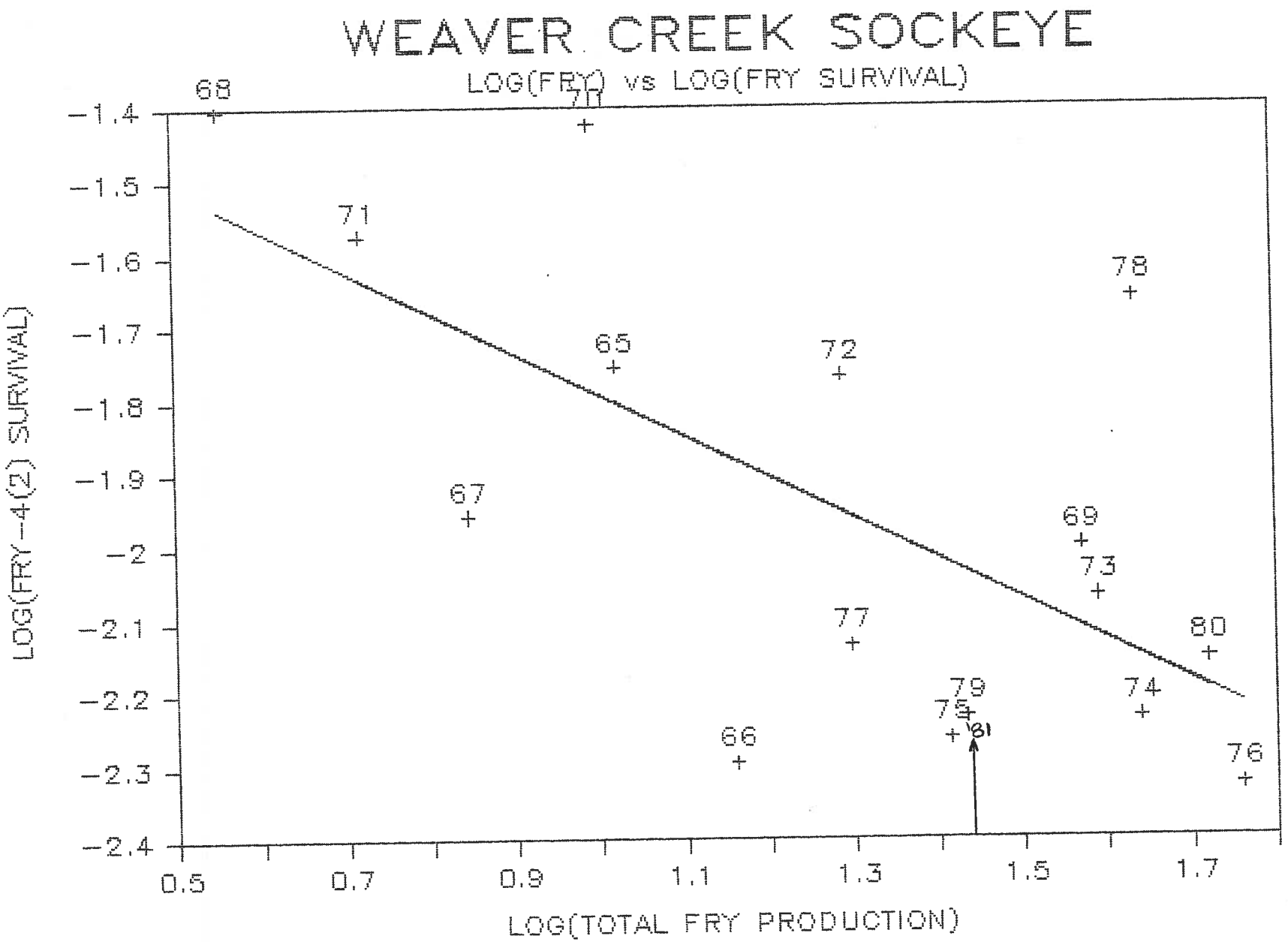

FIGURE 11. Weaver Creek sockeye fry survival vs fry production - channel years - BY 1965-1980.

continued small jack lengths indicate a continuation of high 4/2:3/2 ratios seen in the past few years. The average ratio for BY 1978-1980 was 149:1. This appears to be somewhat higher than would be expected and is weighted by the high ratio in 1978. A ratio similar to BY 1980 (125:1) would be possible and would forecast a return of 356,000 4/2's in 1985.

My best guess is for a return of 220,000 4/2's in 1985. An additional 30,000 5/2's should return as well.

PORTAGE

The 1985 return of Portage sockeye will be the production of 2,950 effective females in 1981 (Table 22). Return per spawner has fluctuated considerably in recent years but appears to be at a reasonably high level presently. The average rate of return for escapements of 2,000 to 4,000 effective females in the past 4 years has been 18.6 4/2's/effective female. This rate of return would give 55,000 4/2's in 1985.

The jack return in 1984 was estimated at 248 3/2's. This total was low in relation to the escapement but jack length (40.00 cm) was low as well. The 4/2:3/2 ratio has fluctuated from 12.5 to 263.5:1 in the past 6 returns. The geometric mean of these values is 35.5:1 which would give a 1985 return forecast of 9,000 fish.

The best estimate at this point would be for a return of 30,000 4/2's in 1985.

SUMMARY

The forecasts of individual stocks, including minor stocks not discussed, total 8.857×10^6 4/2's for 1985 (Table 23). These production forecasts can be compared with estimated production in past cycle years as presented in Table 24. The large age 4/2 forecast for 1985 stems from the

TABLE 22.

1985 PREDICTIONS

PORTAGE CREEK SOCKEYE BASIC DATA

Brood Year Year i	4(2) Return Year Year i+4	Effective Females Year i	Jack 3(2) Return Year i+3	Adult 4(2) Return Year i+4	4(2)/3(2) Ratio	4(2) Return Per Eff. Female Ratio	(n)	3(2) Standard Length (cm)	(n)	3(2) Circuli Count wo/sg	w/sg	(n)	3(2) Marine Growth (cm @87X)
BRYR	RTNYR	EF	32	42	4232	42/EF		32SL		32WOSG	32WSG		32MG
1948	1952	N.O.	ND	0	-	-	0	-	0	-	-	0	-
1949	1953	N.O.	0	296	-	-	0	-	0	-	-	0	-
1950	1954	N.O.	426	28,087	65.93	-	5	41.20	0	-	-	0	-
1951	1955	15	18	226	12.56	15.53	0	-	0	-	-	0	-
1952	1956	N.O.	2	0	0.00	-	1	37.00	0	-	-	0	-
1953	1957	24	0	394	-	16.24	0	-	0	-	-	0	-
1954	1958	1,729	1,898	35,946	18.94	20.79	16	47.94	16	22.00	22.13	0	-
1955	1959	20	16	4,376	273.50	214.74	0	-	0	-	-	0	-
1956	1960	0	0	0	-	-	0	-	0	-	-	0	-
1957	1961	20	0	47	-	2.35	0	-	0	-	-	0	-
1958	1962	2,749	895	24,738	27.64	9.00	11	45.36	11	21.55	21.73	0	-
1959	1963	286	134	5,431	40.53	18.99	37	44.35	36	23.03	24.03	0	-
1960	1964	0	0	21	-	-	0	-	0	-	-	0	-
1961	1965	12	2	2,721	1,360.50	226.75	0	-	0	-	-	0	-
1962	1966	6,326	1,878	70,118	37.34	11.08	0	-	0	-	-	0	-
1963	1967	1,116	2,207	56,214	25.47	50.37	18	46.83	12	19.92	21.17	0	-
1964	1968	5	42	571	13.60	117.68	0	-	0	-	-	0	-
1965	1969	589	155	3,308	21.34	5.62	0	-	0	-	-	0	-
1966	1970	15,201	332	30,704 *	92.48	2.02	8	44.25	8	22.00	24.75	0	-
1967	1971	1,983	167 *	4,005	23.98	2.02	1	39.30	2	27.00	27.00	0	-
1968	1972	50	0	1,046	-	20.73	0	-	0	-	-	0	-
1969	1973	491	3,839	30,773	8.02	62.68	62	43.74	0	-	-	0	-
1970	1974	2,139	1,317	56,751	43.09	26.53	4	43.50	4	21.25	21.25	0	-
1971	1975	155	2,050	15,812	7.71	102.01	6	45.67	7	19.71	19.71	0	-
1972	1976	98	2,127	13,156	6.19	134.24	0	-	3	21.00	23.00	0	-
1973	1977	1,688	10,591	58,101 p	5.49	34.42	133	43.71	0	-	-	0	-
1974	1978	4,843	1,430 e	39,941 e	27.93	8.25	10	43.40	8	17.88	17.88	0	-
1975	1979	1,631	722 e	12,592 e	17.44	7.72	4	40.75	4	21.75	23.75	0	-
1976	1980	753	570 e	7,097	12.45	9.43	4	38.75	10	14.40	17.00	0	-
1977	1981	3,923	768	24,098 e	31.38	6.14	3	37.80	0	-	-	0	-
1978	1982	3,963	1,321 e	69,322 e	52.48	17.49	5	41.60	4	15.00	17.75	0	-
1979	1983	2,023	246 e	64,827 e	263.52	32.04	11	39.27	6	16.50	18.83	4	102.50
1980	1984	996	633 e	13,523 p	21.36	13.57	5	37.58	2	20.00	22.00	2	80.48
1981	1985	2,951	248 p				7	40.00	7	17.14	20.14	3	93.70

TABLE 23. Summary of 1985 Fraser River sockeye stock return forecasts and escapement goals.

Stock	4_2 Forecast	5_2+ 5_3 Forecast	Total	Net Escapement Goal
E. Stuart	700,000	-	700,000	230,000
Bowron	5,000	5,000	10,000	2,000
Fennell	10,000	2,000	12,000	2,000
Upper Pitt	10,000	30,000	40,000	10,000
Gates	20,000	5,000	25,000	5,000
L. Nadina	150,000	-	150,000	25,000
Horsefly	5,650,000	-	5,650,000	1,000,000
Mitchell	350,000	-	350,000	60,000
L. Stuart	1,200,000	-	1,200,000	225,000
Scotch	50,000	-	50,000	9,000
Seymour	25,000	-	25,000	5,000
Chilko	100,000	100,000	200,000	30,000
Stellako	125,000	25,000	150,000	27,000
Birkenhead	100,000	35,000	135,000	25,000
Adams	30,000	-	30,000	7,000
L. Shuswap	20,000	-	20,000	5,000
Weaver	220,000	30,000	250,000	70,000
Portage	30,000	-	30,000	7,000
Harrison	20,000	10,000	30,000	8,000
Cultus	2,000	1,000	3,000	1,000
Miscellaneous	40,000	-	40,000	7,000
Total Adults	8,857,000	243,000	9,100,000	1,760,000
Jacks			257,000	100,000
TOTAL			9,357,000	1,860,000

TABLE 24.

1985 CYCLE YEAR FRASER RIVER SOCKEYE

4(2) RETURNS FROM MAJOR RACES

RACE	1953	1957	1961	1965	1969	1973	1977	1981	CYCLE YEAR MEANS
EARLY STUART	1,029,437	537,711	1,215,763	252,123	415,253	1,366,181	1,332,552	737,851	860,859
LATE STUART	1,526,554	1,548,072	1,327,094	770,385	1,102,448	1,602,892	602,292	1,410,100	1,236,230
CHILKO	560,635	514,554	117,362	52,713	138,555	369,954	180,432	190,813	265,627
HORSEFLY	463,229	604,123	989,580	1,195,807	1,652,107	1,626,582	1,976,638	4,175,100	1,585,396
STELLAKO	173,402	156,192	143,835	137,046	231,100	235,729	73,561	130,554	160,177
BIRKENHEAD	228,462	102,206	37,492	67,104	109,033	451,184	229,267	162,714	173,433
WEAVER	45,223	194,973	7,070	47,946	184,488	371,636	331,296	145,856	166,061
TOTALS:	4,026,942	3,657,831	3,838,196	2,523,124	3,832,984	6,024,158	4,726,038	6,952,988	4,447,783

4(2) RETURNS FROM MINOR RACES

EARLY NADINA	176,960	166,784	122,946	32,276	28,878	13,124	6,874	6,398	69,280
ENDAKO	21,000	9,709	959	301	483	261	-	-	4,089
BOWRON	62,746	70,599	41,008	26,835	16,770	16,003	7,729	8,300	31,249
GATES	590	7,811	1,051	13,460	2,198	3,556	10,858	19,800	7,416
LATE NADINA	105,898	162,058	116,452	93,840	93,961	104,679	79,101	151,455	113,431
PITT	6,085	12,688	3,474	26,282	14,943	9,262	16,231	19,014	13,497
RAFT	36,748	30,285	18,932	22,139	18,867	10,279	3,257	3,258	17,971
SEYMOUR	25,617	44,870	11,959	25,649	34,707	14,617	23,962	77,274	32,332
BARRIERE	-	170	870	347	197	122	-	-	213
FENNELL	-	-	584	-	255	881	2,805	9,300	1,728
EARLY SCOTCH	6,023	9,795	1,196	8,073	16,526	33,944	55,081	91,100	27,717
CHILLIWACK LAKE	-	-	-	-	-	-	-	-	0
NAHATLACH	-	-	-	-	-	-	-	3,016	377
NOMICH	-	-	-	-	-	-	-	-	0
UPPER ADAMS	-	1,201	-	-	-	-	-	-	150
E. CHILKO	-	-	-	-	-	-	4,847	1,029	735
TASEKO	16,836	12,309	246	-	-	-	-	-	3,674
BIG SILVER	1,232	3,986	705	1,594	271	2,213	-	-	1,250
HARR.LK. TRIBS.	333	-	38	139	172	-	-	-	85
ADAMS	29,456	29,548	2,724	6,215	24,417	7,722	88,234	25,314	26,704
LOWER SHUSWAP	-	23	99	1,009	4,892	20,352	-	16,544	5,365
PORTAGE	296	394	47	2,721	3,308	30,773	58,101	24,098	14,967
HARRISON	89,875	9,642	62,075	49,772	52,677	20,662	13,393	5,428	37,941
WIDGEON SLOUGH	8,689	9,212	1,354	691	1,822	3,072	-	1,320	3,270
CULTUS LAKE	96,197	112,193	27,018	12,889	31,186	6,517	516	600	35,890
TOTALS:	684,581	693,277	413,737	324,232	346,530	298,039	370,989	463,248	449,329

NOTE: HORSEFLY INCLUDES MITCHELL RIVER AND MCKINLEY CREEK STOCKS.
NOTE: WHERE RETURNS ARE NOT PRESENT, THEY HAVE BEEN INCLUDED WITH OTHER STOCKS.

good production of small Horsefly jacks. The 6.0×10^6 fish forecast for the Quesnel system stocks is crucial to the overall forecast. Further examination of the Horsefly jack length and marine growth relationships are needed. These may provide better insight for the forecast for that stock. The total non-Quesnel forecast of 2.867×10^6 4/2's in 1985 is 13% below the average of 3.301×10^6 4/2's for the past 8 cycles.

The total 1985 forecast includes 500,000 fish of other age groups, including 3/2's, for a total return of 9.367×10^6 sockeye.

ESCAPEMENT

Net escapement goals for the 1985 sockeye returns have been developed on the basis of the above forecasts of abundance and the optimum escapement estimates for major stocks. The Early Stuart goal of 230,000 adults (Table 23) will require an escapement of approximately 450,000 adults past Mission. This high figure would appear to be needed if upstream removals continue to increase. The Horsefly sockeye net escapement goal of 1.0×10^6 is based on the need to stimulate the growth of the Lower Horsefly River population which had 120,000 spawners in 1981 (17.7% of Horsefly River total). In addition, higher harvest rates on the Horsefly run would negatively impact escapements of several other important stocks sharing similar migration timing.

The Late Stuart goal of 225,000 is near optimum. This level can be achieved with a reduction of harvest rate for fish entering the lower Fraser River after August 5. It would appear difficult, however, to obtain an optimum escapement at Chilko and Stellako owing to the small forecast and high exploitation required on the major stocks.

Reduced fishing pressure after mid-August will be required in order

to obtain an adequate escapement to Birkenhead River. Reduction of the exploitation rate at this time would result in excess escapement of Weaver sockeye to Georgia Strait. However, other minor late run stocks should benefit from these moves.

The total net escapement of 1,760,000 adult spawners will be augmented by approximately 100,000 jacks, primarily to Adams River. The net escapement goal of 1,860,000 sockeye will require a gross escapement of, roughly, 2,400,000 fish in 1985. The adult escapement goal of 1,760,000 fish is 31% higher than the previous largest escapement of 1,340,000 adult spawners in 1957. The escapement level will continue to increase in future cycle years if growth of the Quesnel population continues.

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