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Doc.	93
Rev.	_____

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NPAFC DOCUMENT NUMBER**

**A Preliminary Assessment of Canadian Enhanced Salmon Production,
1977 - 1992**

by

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submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by

CANADA

October 1994

This paper may be cited in the following manner:

C. L. Cross, A. E. Kling, and S. J. Lehmann. A preliminary assessment of Canadian enhanced salmon production, 1977 - 1992. Document submitted to the Annual Meeting of the North Pacific Anadromous Fish Commission, Vladivostok, Russia, October, 1994. 17 pages.

Introduction

The existing salmon enhancement projects in British Columbia began with spawning channels in the 1960s and the first routine hatchery operation in 1971. The Salmonid Enhancement Program (SEP) was undertaken in 1977 to rebuild stocks and increase catch through the expanded use of enhancement technology. The program is now comprised of nearly 300 projects and produces chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), chum (*O. keta*), pink (*O. gorbuscha*), and sockeye (*O. nerka*), as well as small numbers of steelhead salmon (*O. mykiss*) and cutthroat trout (*Salmo clarki*). The projects include hatcheries, fishways, spawning and rearing channels, flow control works, lake fertilization, and small classroom incubators, and range in size from spawning channels releasing nearly 100,000,000 juveniles annually to schools with classroom incubators releasing fewer than 1,000. The method of production assessment from projects depends on the species and enhancement technology employed.

Individual project production is aggregated for the assessment of program production. Such assessment includes analysis of total production and contribution of enhanced fish to the fisheries and to the escapement. Survival trends by species are also analyzed within the hatchery from egg to release and, after release, from release to recovery. Assessment data are available for each species and release stage at a number of resolution levels (project, area, program) depending on the detail of analysis desired.

This report tabulates release data for the program by species and stage, program contribution to fisheries and recoveries by catch component, and average post-release survival rates by brood year, species and release stage for the program and for selected projects. Steelhead and cutthroat data are not included in this report as their assessment is a provincial responsibility. Data prior to 1977, the first year of SEP production, are also not included because the analytical methods for pre-SEP data are being reworked.

Methods

The current method of choice for estimating production and survival rates of chinook, coho, chum and pink salmon enhancement projects are juvenile mark/adult recovery programs. Marking occurs at the project prior to release, while recovery takes place through coastwide sampling programs in the sport and commercial fisheries (Kuhn, 1988; Khun et al., 1988) and through dead recovery programs in the escapement or at the project.

Mark type is dependent on the species with coded wire tags (CWT's) used for chinook, coho and some chum stocks, and finclips for pinks and other chum stocks. For large production groups, a proportion of the release group is marked and marked fish are

assumed to represent the unmarked fish. Smaller experimental groups may have a greater proportion of the release marked to assess various strategies within a project but are not considered to represent production.

Attempts are made to assess all stocks routinely using the method of choice but some enhancement projects and species are rarely or never assessed directly because of their small size or because of other logistical constraints. For chinook, coho, and chum, only a few projects produce more than 10,000 adults, while most produce fewer than 2,000 (Figure 1). The former are consistently assessed directly through marking, the latter rarely. For chinook, most juveniles released are represented by a marked group while for coho, marking for some release stages or at some of the smaller hatcheries or channels has never been done or done only infrequently. For chum, most stocks released from major facilities are represented by marked fish but smaller projects are often not marked. For chinook, chum, and coho sites without consistent marking, indirect methods are used to estimate contribution. This usually involves using data from marked sites to estimate parameters for sites with little or infrequent marking. Data quality depends on the assessment method.

For sockeye and pink salmon there are fewer projects but a greater percentage of them produce more than 10,000 adults (58% and 44% respectively). For pinks, releases are marked only for selected stocks. Contribution for marked stocks is estimated using similar methods to chinook and coho; indirect methods are used for unmarked stocks.

Sockeye are not marked on a production basis. Production is currently estimated using run reconstruction. Survival data for sockeye are not included in this report because direct estimates of survival are not available.

More detailed discussion of the data quality and assessment methodology by species can be found in Perry and Cross (1993).

Release data are used for production and survival rate analysis or can be utilized on their own to analyze trends. Juveniles are reared to various release stages depending on the species and enhancement technology employed. Chum are released either unfed after emergence or as fed fry after one month of feeding; a similar strategy is employed for pinks. Coho are released as fed fry after 3 to 5 months of rearing or as smolts after one year of rearing. Sockeye are released as unfed fry after emergence from channels. For chinook, coastal stocks are released after 3 to 4 months of rearing, while interior stocks are frequently reared for one year to the yearling stage. The latter are a very small part of the chinook program and releases are not tabulated separately in this report. For the other species, releases are tabulated by release stage.

Assessment Results

Table 1 shows SEP program releases for the brood years 1977 - 1992. Total releases have approximately doubled from the 1977 brood year to the 1990 and subsequent brood years. The largest numerical increase was for chum fry. Fed chum fry releases averaged 92.2 million for brood years 1988 to 1992, while unfed chum releases averaged 121 million. Full production for chinook, coho smolt and sockeye releases was reached in the early and mid 1980s and releases have been relatively stable since that period, averaging 62 million, 9.6 million and 224 million respectively for the last 5 complete brood years. Unfed pink releases have fluctuated from year to year because of the natural cycles in the Fraser River and the phasing in and out of pink projects since the 1988 brood year. Pink fed fry releases peaked in 1985 at more than 5,000,000 but have since declined because of a de-emphasis on this strategy.

For 1991, the most recent brood year for which releases are complete for all species, the percentage of juveniles released by species is shown in Figure 2a. Sockeye accounted for 43% of the releases and chum 33%. Pink and chinook releases amounted to 10% each, and coho 4%.

Releases, together with recovery data, are used as a component of survival assessment. At individual projects, survival rates are analyzed by mark group; Table 2 gives an example of the data tabulation format for such data for chinook salmon at Quinsam hatchery. Survival rates are then averaged over mark groups to obtain averages by release stage for projects, geographical regions and the program as a whole.

Weighted average survival rates for the program are summarized in Table 3 and Figure 3. For coho smolts, smolt survivals have been relatively stable since the 1979 brood year, ranging from 6.5% to 9.8% and averaging 8.2%, while fed fry survival rates have been close to 1% since the 1981 brood. For chum, survival rates for fed fry are consistently greater than unfed fry but show a similar although more extreme trend, with both stages peaking in 1982 at 2.4% and 1.2% respectively. Similarly, pink salmon fed and unfed fry follow a common trend; unfed fry survival rates, however, are more moderate than the fed fry peak survivals which exceed 14% for the 1984 and 1987 broods. Survival rates for chinook declined to a low of 0.5% in 1983 but have increased somewhat since then.

Tables 4 to 7 show survival rates by species for individual projects where marking occurs consistently; projects are organized by the geographical regions shown in Figure 4. There is considerable individual variation in trend and average survival rate between projects in different geographical regions and even for projects within the same geographical region. For example, for coho smolts in the Inside area, some projects such as Chehalis, Chilliwack, and Capilano have almost without exception maintained survival rates that are greater than 10% (Table 4), and in some instances, 20% (Capilano 1985 brood, and

Chilliwack 1984 and 85 broods) while other projects on the Inside have shown different trends, with Puntledge and Big Qualicum declining in the mid 1980s to a low of 2.8% and 0.7% respectively. Other species show similar variation.

Contribution by recovery component for the program is indicated in Table 8. Over time, commercial contribution more than tripled from 1.4 million fish in the 1982 catch year to 4.9 million in the 1992 catch year, while escapement went from 1.2 million in 1982 to 3.0 million in 1990. Catch contribution was numerically greatest for chum for the 1985 to 1988 catch years and for pinks for the 1989 to 1992 period.

For 1992, the most recent year complete for catch analysis, the commercial contribution of 4.9 million comprised 18.7% of the total commercial catch; sport contribution was some 237,000 pieces or 33% of the total sport catch. By species, the largest individual contribution to catch was for chum at 38% of the total commercial catch, followed by chinook at 27%. Figure 2b shows the percentage of each species constituting the total enhanced catch in 1992. Pinks, chum and sockeye accounted for more than 85% of the total at 35%, 30%, and 20% respectively.

Summary

Production and survival rate assessment methods are described for each species. Data are presented for releases by brood year, species and release stage for the program, for average survivals by brood year and species for selected projects and the program, and for contribution by catch year and species for the program. Other levels of detail, although not included, are available.

Table 1 . Releases of juveniles from SEP facilities in British Columbia, Canada.

Brood Year	Chinook	Chum		Coho		Pink		Sockeye*	Total
		Fed	Unfed	Fry	Smolt	Fed	Unfed		
1977	13,620,370	1,904,625	52,127,027	2,073,819	2,984,462	0	31,029,220	201,309,000	305,048,523
1978	14,253,404	5,535,566	48,958,030	1,016,721	3,747,251	0	750	141,574,350	215,086,072
1979	16,379,080	9,191,947	73,460,748	3,720,519	4,980,154	358,639	26,145,904	220,701,122	354,938,113
1980	19,850,845	29,684,300	76,533,396	2,449,038	5,270,862	1,859,631	4,705,834	199,054,901	339,408,807
1981	17,428,192	68,980,710	60,912,404	7,299,322	4,949,674	492,034	33,113,088	211,604,372	404,779,796
1982	24,854,529	69,365,130	97,024,858	10,806,784	6,944,312	423,038	2,510,301	218,317,433	430,246,385
1983	29,374,066	85,579,589	92,812,179	8,973,671	13,635,453	1,521,896	27,341,916	144,301,195	403,539,965
1984	34,864,768	103,779,630	63,995,445	13,207,972	12,059,350	2,296,285	3,783,368	254,991,214	488,978,032
1985	42,736,623	102,554,994	55,769,394	9,292,296	9,801,246	5,057,021	26,182,597	175,808,962	427,203,133
1986	53,815,001	85,842,800	107,035,482	11,904,340	10,201,914	4,509,098	14,190,312	200,924,044	488,422,991
1987	63,693,726	75,979,591	120,697,363	8,174,816	9,554,873	4,807,689	44,781,230	158,654,299	486,343,587
1988	64,465,641	87,928,664	137,567,352	8,442,247	11,319,111	2,827,349	34,245,812	226,841,734	573,637,910
1989	63,543,086	92,855,759	105,888,519	10,752,633	11,871,268	2,797,031	49,796,430	221,932,392	559,437,118
1990	66,220,850	94,759,699	120,031,279	10,098,979	12,330,585	927,396	91,522,634	248,861,158	644,752,580
1991	59,139,749	96,839,355	103,513,315	11,191,153	10,882,388	1,496,458	61,200,540	263,081,598	607,344,556
1992	56,721,330	88,758,879	137,736,171	7,765,863	NC**	1,781,339	21,059,561	NC**	NC**

* includes lake enrichment projects

** NC - releases not yet complete

Table 2 . Mean brood year survival weighted by number tagged for Quinsam hatchery chinook.
 (Abbreviations: IFF = Indian Food Fish, FW = Fresh Water, Hatch = Hatchery, Nat = Natural)

QUINSAM RIVER		CHINOOK			STOCK: ALL				WASH ORG	ALASKA	TOTAL MARINE CATCH	FRESH SPORT	IFF	TOTAL FW			ESCAPEMENT			TOTAL	% SURV
RELEASE INFORMATION	RECOV AGE	WEST VAN COMM	COAST ISLAND SPT	NORTH CENTRAL COMM	SPT	INSIDE COMM	SPT	CATCH						HATCH	NAT	TOTAL	HATCH	NAT	TOTAL		
Brood Year 1974																					
	2	0	0	156	0	23	158	0	0	337	0	0	0	0	0	0	0	337	0.2		
Tagged:	65683	3	0	1022	0	135	103	0	64	1324	0	0	0	32	0	32	1356	0.8			
Total:	162516	4	12	281	0	112	51	0	324	781	0	0	0	45	237	281	1062	0.7			
	5	0	0	328	30	78	76	0	194	706	0	0	0	140	916	1056	1762	1.1			
	6	0	0	21	0	17	0	0	39	76	0	0	0	8	6	14	91	0.1			
	Tot	12	0	1807	30	365	388	0	622	3225	0	0	0	224	1160	1383	4608	2.8			
Brood Year 1975																					
	2	0	0	191	0	15	17	0	0	223	0	0	0	0	0	0	223	0.1			
Tagged:	99167	3	0	552	0	122	35	0	0	708	0	0	0	0	0	0	708	0.2			
Total:	424567	4	0	288	17	9	19	0	34	367	0	0	0	35	835	870	1237	0.3			
	5	0	0	220	0	121	69	0	40	451	0	0	0	61	162	223	674	0.2			
	6	0	0	7	17	0	0	0	0	24	0	0	0	0	0	0	24	0.0			
	Tot	0	0	1258	34	267	140	0	74	1773	0	0	0	96	997	1094	2867	0.7			
Brood Year 1976																					
	2	31	0	640	16	349	113	0	0	1148	0	0	0	0	0	0	1148	0.3			
Tagged:	97123	3	0	1486	155	291	100	0	432	2465	0	0	0	48	12	59	2524	0.7			
Total:	376480	4	0	1537	211	346	260	0	918	3271	0	0	0	320	487	807	4079	1.1			
	5	34	19	716	31	311	455	0	394	1960	0	0	0	255	1017	1272	3232	0.9			
	6	0	0	13	0	9	0	0	30	52	0	0	0	7	23	30	82	0.0			
	Tot	65	19	4392	412	1306	928	0	1774	8896	0	0	0	630	1539	2169	11065	2.9			
Brood Year 1977																					
	2	0	0	482	19	166	111	0	0	778	0	0	0	0	0	0	778	0.1			
Tagged:	152518	3	13	851	32	154	72	0	1364	2485	0	0	0	37	0	37	2522	0.3			
Total:	776387	4	0	842	40	214	194	0	509	1799	0	0	0	39	156	195	1994	0.3			
	5	23	0	446	116	229	248	0	271	1332	0	0	0	121	569	690	2022	0.3			
	6	0	0	13	0	0	0	0	0	13	0	0	0	0	0	0	13	0.0			
	Tot	36	0	2634	207	762	625	0	2144	6407	0	0	0	197	725	922	7329	0.9			
Brood Year 1978																					
	2	0	0	1016	117	119	37	0	0	1289	0	0	0	10	0	10	1298	0.2			
Tagged:	97316	3	0	2556	175	159	50	0	67	3006	0	0	0	27	0	27	3033	0.4			
Total:	849226	4	37	1203	35	210	237	0	1285	3006	0	0	0	331	542	874	3880	0.5			
	5	69	0	1206	140	321	384	0	807	2927	0	0	0	285	891	1176	4102	0.5			
	6	0	0	55	0	12	0	0	71	137	0	0	0	25	104	130	267	0.0			
	Tot	106	0	6036	466	820	707	0	2230	10365	0	0	0	677	1538	2215	12580	1.5			
Brood Year 1979																					
	2	52	0	153	0	0	0	0	8	213	0	0	0	11	0	11	224	0.0			
Tagged:	102844	3	0	1175	45	81	0	0	596	1897	0	0	0	30	60	90	1987	0.2			
Total:	1081433	4	0	1254	126	218	120	0	1417	3136	0	0	0	198	198	396	3532	0.3			
	5	36	0	429	40	142	99	0	482	1229	0	0	0	295	506	801	2030	0.2			
	6	0	0	0	0	35	61	0	0	96	0	0	0	31	106	136	233	0.0			
	Tot	88	0	3011	212	476	280	0	2502	6571	0	0	0	565	869	1434	8005	0.7			
Brood Year 1980																					
	2	0	0	991	30	90	148	0	154	1413	0	0	0	41	0	41	1454	0.1			
Tagged:	156121	3	0	1372	211	292	208	0	322	2404	0	0	0	59	33	92	2496	0.2			
Total:	1136778	4	14	827	200	253	448	0	1343	3104	0	0	0	809	643	1453	4556	0.4			
	5	0	0	268	61	264	141	0	285	1019	0	0	0	520	891	1410	2429	0.2			
	6	0	0	0	0	0	0	0	0	0	0	0	0	16	11	27	27	0.0			
	Tot	14	19	3458	502	898	945	0	2103	7939	0	0	0	1445	1578	3023	10962	1.0			

Table 3. Weighted average survival (%) by release stage and species for SEP, British Columbia, Canada.

Brood Year	Survival (%)						
	Chinook	Coho		Chum		Pink	
		Fed Fry	Smolts	Unfed Fry	Fed Fry	Unfed Fry	Fed Fry
1977	1.0	4.2	14.2	.4	4.4		
1978	1.5	2.2	10.4	.7	.8	1.5	
1979	1.3	3.0	8.2	.5	1.7	1.9	3.4
1980	1.0	1.9	8.6	.2	.7	.7	2.0
1981	1.2	1.2	8.0	1.0	3.9	.9	1.3
1982	.8	1.0	9.3	1.2	2.3	2.2	3.9
1983	.5	1.0	6.5	.4	.9	.9	2.4
1984	1.0	.9	8.0	.6	2.6	6.1	14.9
1985	.7	1.2	9.8	.4	1.0	4.6	5.7
1986	.9	1.0	7.6	.5	1.1	1.6	6.9
1987	NC	1.2	8.0	NC	NC	9.9	14.4

NC = DATA NOT AVAILABLE

Table 4 . Coho post-release smolt survival (%) by facility and brood year in British Columbia, Canada.

	BROOD YEAR												
	76	77	78	79	80	81	82	83	84	85	86	87	88
NORTH													
Kispiox River									3.2	.4	3.1	2.4	NC
Kitimat River							6.9	2.4	1.2	1.4	4.2	NC	
Toboggan Cr										.5	3.0	3.1	NC
INSIDE													
Big Qualicum River	21.2	26.0	12.4	11.6	11.7	9.2	5.4	1.4	.7	2.2	1.6	5.3	6.6
Capilano River	12.7	15.0	17.7	13.2	10.2	10.8	15.0	5.2	12.0	21.1	11.8	11.4	6.9
Chehalis River							12.0	11.5	13.1	14.7	10.8	10.0	8.4
Chilliwack River					13.1	11.9	16.0	12.2	20.5	19.3	12.6	11.7	9.5
Inch Creek							7.2	6.2	7.9	15.7	10.7	6.7	7.2
Puntledge River	29.1	13.3	13.7	9.3	9.2	7.3	15.7	9.8	3.5	4.1	2.8	3.1	4.0
Quinsam River	8.1	11.5	8.0	6.3	7.0	5.8	8.9	7.0	9.1	9.9	11.2	10.0	4.8
Tenderfoot Creek							11.1	9.2	10.8	13.9	7.7	5.4	NC
WEST COAST													
Conuma River								19.4	12.1	7.6	7.0	11.3	13.4
Robertson Creek	9.6	5.5	2.8	2.2	5.6	6.9	2.1	4.1	2.9	1.7	5.5	9.5	5.3
UPPER FRASER													
Eagle River									3.4	4.3	7.5	2.7	.3
Spius Creek										5.9	3.5	3.8	2.5

NC = DATA NOT AVAILABLE

Table 5 . Chinook post-release survivals (%) by hatchery and brood year in British Columbia, Canada.

	BROOD YEAR													
	75	76	77	78	79	80	81	82	83	84	85	86	87	88
NORTH														
Kitimat			2.9	2.1	4.6	3.4	3.8	2.0	1.1	2.4	.8	.9	.8	.8
Snootli	.7	.2	.3	.6			2.0	.1	.3	.4	.2	.1	.3	.2
INSIDE														
Big Qualicum	3.4	7.9	1.7	.7	.3	.2	.8	1.1	.9	.1	.1	.4	.2	.3
Capilano	1.9	4.0	1.2	1.5	.8	1.7	1.7	.2	.3	.1	.0	.5	NC	NC
Chehalis								1.2	.3	.4	.5	2.0	NC	NC
Chemainus					9.9	3.6		6.2	1.5	8.2	2.7	4.7	2.4	2.4
Chilliwack - fall whites							10.5	1.5	2.8	3.6	1.2	7.8	NC	NC
Cowichan					5.2	2.2	2.0	3.1	2.5		1.1		1.5	1.2
Little Qualicum					1.1	.5	1.3	2.3	1.0	.3	.2	.6	.2	.4
Nanaimo					4.1	6.1		.4					.3	1.0
Puntledge Fall	1.4	4.4	1.1	2.5	.5	.8	1.0	.6	.5	.2	.1	.4	.1	.3
Puntledge Summer	1.9	4.8	.7	.9	.4	.8	.3	.2	.2	.2	.1	.2	.1	.2
Quinsam	.7	2.9	.9	1.5	.8	1.0	2.1	1.2	1.1	1.4	.4	.8	.4	.3
Tenderfoot							.6	.4	.8	.3	.1	.4	NC	NC
WEST COAST														
Conuma					1.9	.5	1.4	.6	.1	.4	3.4	1.5	2.6	2.2
Nitinat						.6	.6	.8	.7	1.2	1.5	.8	.7	.6
Robertson	3.0	4.4	1.3	2.4	2.1	1.4	1.2	.8	.0	1.7	1.4	3.9	3.3	4.0
UPPER FRASER														
Eagle - subyearling									.3	.2	.2	.2	.2	.2
- yearling										.3	.5	.5	.1	.0
Quesnel							.1	.0	.3	.1	.3	.3	.0	.0
Shuswap Lwr										1.6	1.1	1.2	.9	.3
Shuswap Mid											.8	.7	.6	.4
Spius - subyearling										.3	.2	.2	.4	.3
- yearling											2.3	.1	1.1	.5

NC = DATA NOT AVAILABLE

Table 6 . Chum post-release survival (%) by facility and brood year (fed fry unless noted) in British Columbia, Canada

	BROOD YEAR										
	78	79	80	81	82	83	84	85	86	87	88
NORTH											
Pallant/Mathers ,	.4	.5	1.4	1.9	1.6	.7	1.2	.5	1.0	.7	1.4
Kitimat River							4.5	1.3	2.3	1.1	2.1
Snootli	.5	1.7	1.5	1.8	5.1	3.6	5.5	1.9	3.1	.6	1.0
INSIDE											
Big Qualicum River			.1	1.9	3.2						
Big Qualicum Channel - unfed fry	.7	.5	.2	1.0	1.1	.5	.8	.4	.8	.3	1.4
Chehalis River					2.7	.3	1.0	1.1	1.9	.6	.7
Chilliwack River			.2	1.3	2.6	1.3	2.2	.8	1.3	.9	1.9
Inch Creek	.5	.5	.6	.7	2.7	.3	1.1	1.7	2.3	.7	1.9
Little Qualicum River			.3	2.3	3.3	1.3	.9	.8	.7		
Little Qualicum Channel - unfed fry		.7	.2	.5	1.3	.3	.3	.4	.4	.2	.6
Puntledge River		1.6	.2	3.2	2.2	1.9	.2	.5	1.8	1.1	1.4
WEST COAST											
Conuma River	1.4	2.5	.6	1.1	1.1	.1	.2	.2	.3	.3	.8
Nitinat River			.6	7.1	2.4	.8	6.1	1.8	1.4	2.3	2.2

NC = DATA NOT AVAILABLE

Table 7 . Pink post-release survival (%) by facility and brood year in British Columbia, Canada.

		BROOD YEAR												
		76	77	78	79	80	81	82	83	84	85	86	87	88
INSIDE														
Quinsam River	- fed fry				3.4	2.0	2.1	3.9	2.4	14.9	6.6	11.8	18.9	15.2
	- unfed fry				3.0	.8	1.3	2.2	1.0	6.1	3.4	2.0	7.5	9.5
Puntledge River	- fed fry					1.9	.4				4.8	1.9	5.3	
	- unfed fry				.7	.7	.6	2.2	.7		5.9	1.1	14.6	1.4

Table 8. SEP production recovery components and percent contribution to fisheries of in British Columbia, Canada.

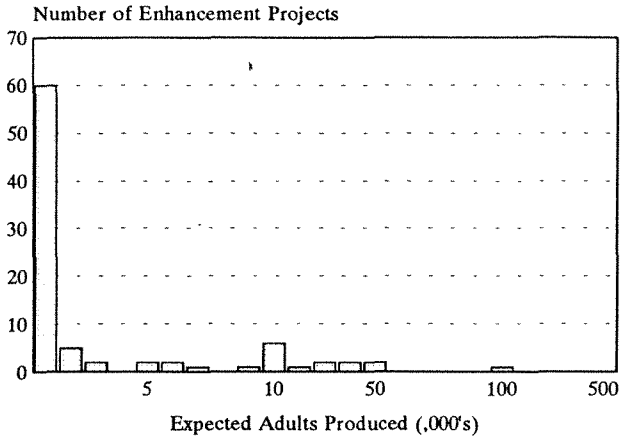
Catch Year	Coho					Chinook					Chum						
	Commercial		Sport		Escapement	U.S.	Commercial		Sport		Escapement	U.S.	Commercial		Sport	Escapement	U.S.
Number	%	Number	%	Number			%	Number	%	Number			%	Number			
82	170,531	5.4	110,284	25.3	123,731	16,404	103,916	8.4	28,492	17.4	25,918	53,478	255,354	8.6	0	313,933	0
83	241,175	5.8	104,204	25.8	152,058	9,396	93,544	9.8	32,175	16.3	24,611	57,421	135,357	13.5	0	407,723	0
84	207,752	5.8	91,029	20.5	173,970	10,156	90,581	9.0	40,532	11.0	38,899	46,214	415,771	22.5	0	476,991	0
85	280,176	9.5	246,390	33.8	218,977	34,899	56,169	6.4	29,658	12.6	74,763	35,243	1,892,829	34.5	0	1,384,648	0
86	572,930	11.7	216,702	37.9	297,604	60,081	49,625	6.0	37,091	20.4	56,367	23,197	1,328,907	23.8	0	893,761	0
87	397,380	11.8	319,639	49.8	436,956	56,708	46,595	6.0	31,164	25.7	82,286	29,992	839,894	36.5	0	600,108	0
88	324,950	11.8	400,958	37.0	303,088	34,404	56,153	7.6	32,674	27.4	128,201	46,818	2,385,804	38.5	0	830,038	0
89	363,991	10.6	226,414	45.5	301,006	65,725	102,580	15.6	57,372	43.2	163,483	64,539	655,584	36.0	0	915,541	0
90	533,838	13.8	245,382	38.9	399,359	48,822	135,163	19.9	57,008	50.9	211,982	100,237	1,028,577	31.9	0	997,858	0
91	420,198	12.0	44,134	28.1	NC	NC	178,866	27.5	38,374	33.2	NC	NC	734,160	31.1	0	NC	NC
92	377,285	12.7	194,636	32.7	NC	NC	190,142	27.5	42,366	36.3	NC	NC	1,524,739	38.0	0	NC	NC

Catch Year	Pink				Sockeye				All Species							
	Commercial		Sport	Escapement	U.S.	Commercial		Sport	Escapement	U.S.	Commercial		Sport		Escapement	U.S.
Number	%	Number				%	Number				%	Number	%			
82	45,931	1.7	0	31,141	0	827,688	8.2	0	685,119	128,459	1,403,420	7.0	138,776	15.2	1,179,842	198,341
83	438,811	1.8	0	236,172	78,913	826,928	15.0	0	694,166	133,554	1,735,815	4.9	136,379	13.5	1,514,730	279,284
84	50,304	.7	0	20,957	0	948,507	18.7	0	602,823	159,673	1,712,915	9.0	131,561	10.2	1,313,640	216,043
85	378,113	1.9	0	262,114	138,365	819,148	6.7	0	661,376	130,501	3,426,435	8.2	276,048	11.8	2,601,878	339,008
86	292,780	1.6	0	236,606	0	902,255	8.5	0	710,352	145,799	3,146,497	7.9	253,793	15.4	2,194,690	229,077
87	616,560	4.6	0	382,565	92,757	825,983	15.3	0	747,646	133,586	2,726,412	10.8	350,803	25.7	2,249,561	313,043
88	345,313	1.5	0	332,018	0	899,527	20.1	0	760,879	130,363	4,011,747	10.8	433,632	21.3	2,354,224	211,585
89	1,735,978	10.2	0	662,945	165,117	508,628	3.7	0	681,871	99,471	3,366,761	9.2	283,786	18.4	2,724,846	394,852
90	1,697,837	9.8	0	911,547	0	452,213	3.2	0	514,061	90,423	3,847,628	9.8	302,390	17.4	3,034,807	239,482
91	1,566,090	6.5	0	NC	NC	1,242,148	12.0	0	NC	NC	4,141,462	10.1	82,508	30.3	NC	NC
92	1,791,329	17.5	0	NC	NC	1,002,209	12.2	0	NC	NC	4,885,704	18.7	237,002	33.3	NC	NC

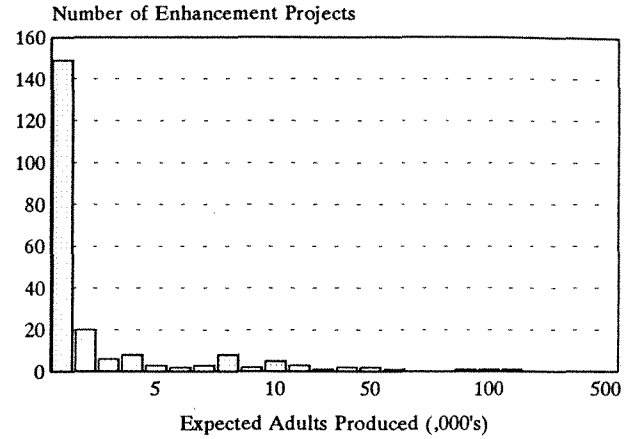
NC = Analysis is not yet complete

Figure 1 : Enhancement projects vs expected adult production for SEP, British Columbia, Canada

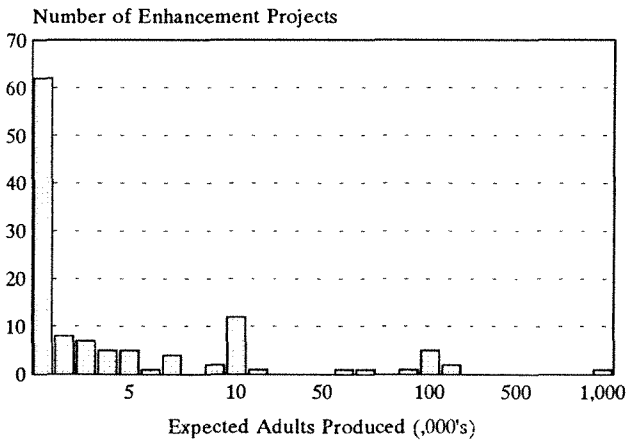
Chinook



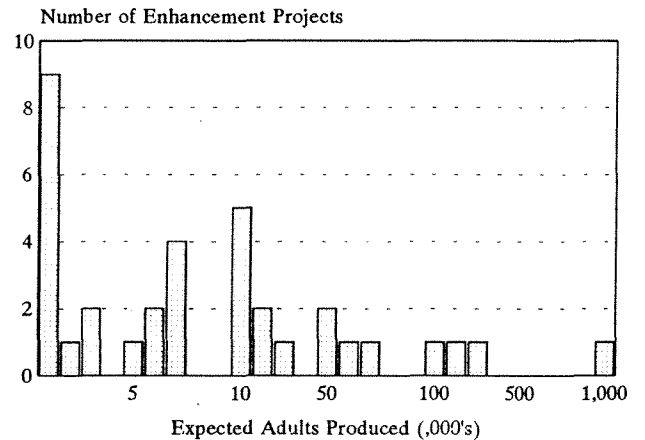
Coho



Chum



Pink



Sockeye

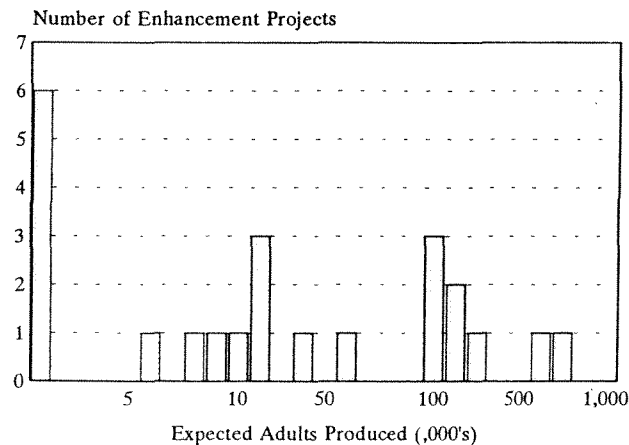


Figure 2a : Releases by species (percent) for the 1991 brood for SEP, British Columbia, Canada

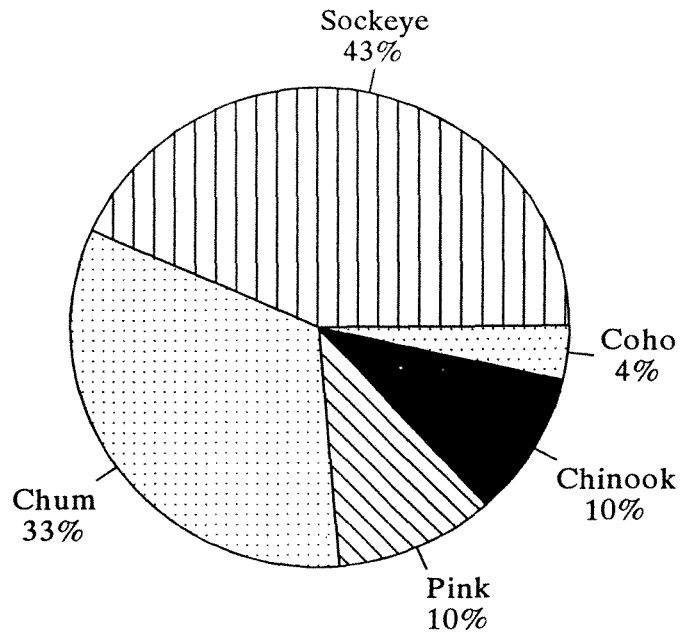


Figure 2b : Species composition (percent) of the 1992 catch of SEP production, British Columbia, Canada

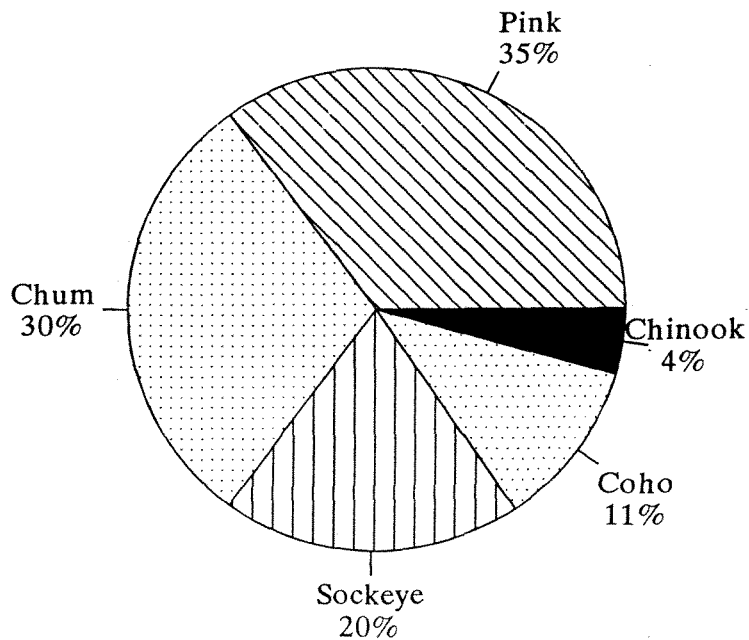
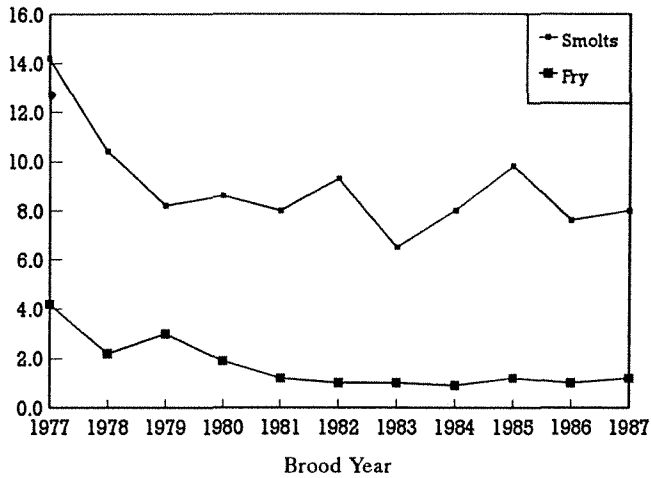


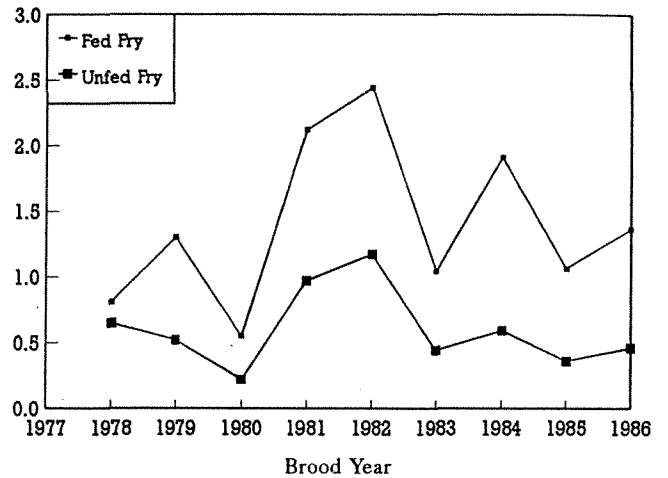
Figure 3 : Weighted average survival (%) by release stage and species for SEP, British Columbia, Canada

Coho



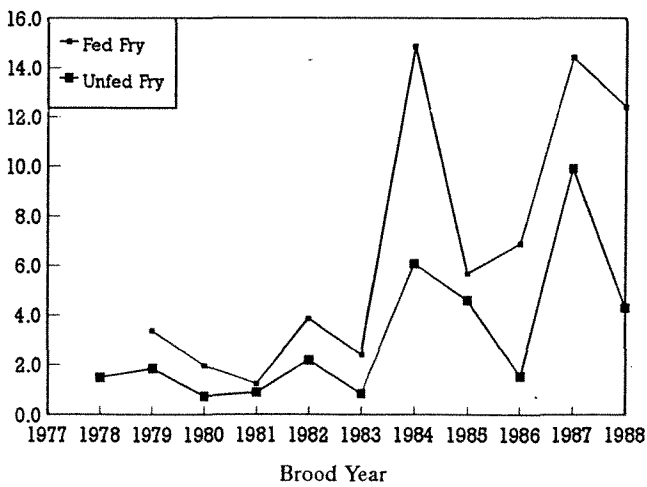
- weighted by total releases

Chum



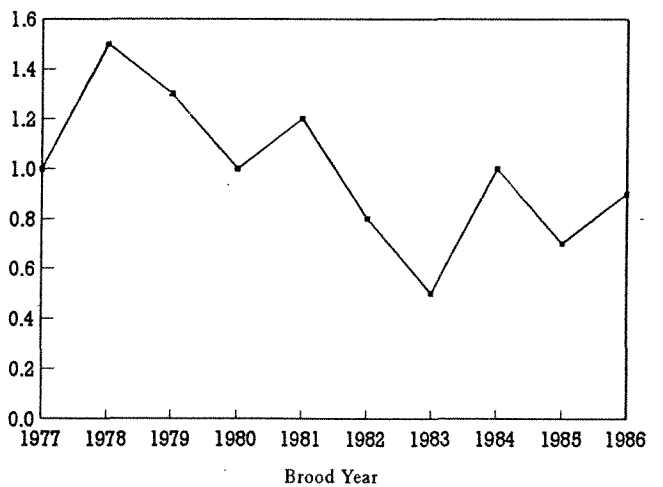
- weighted by total releases

Pink



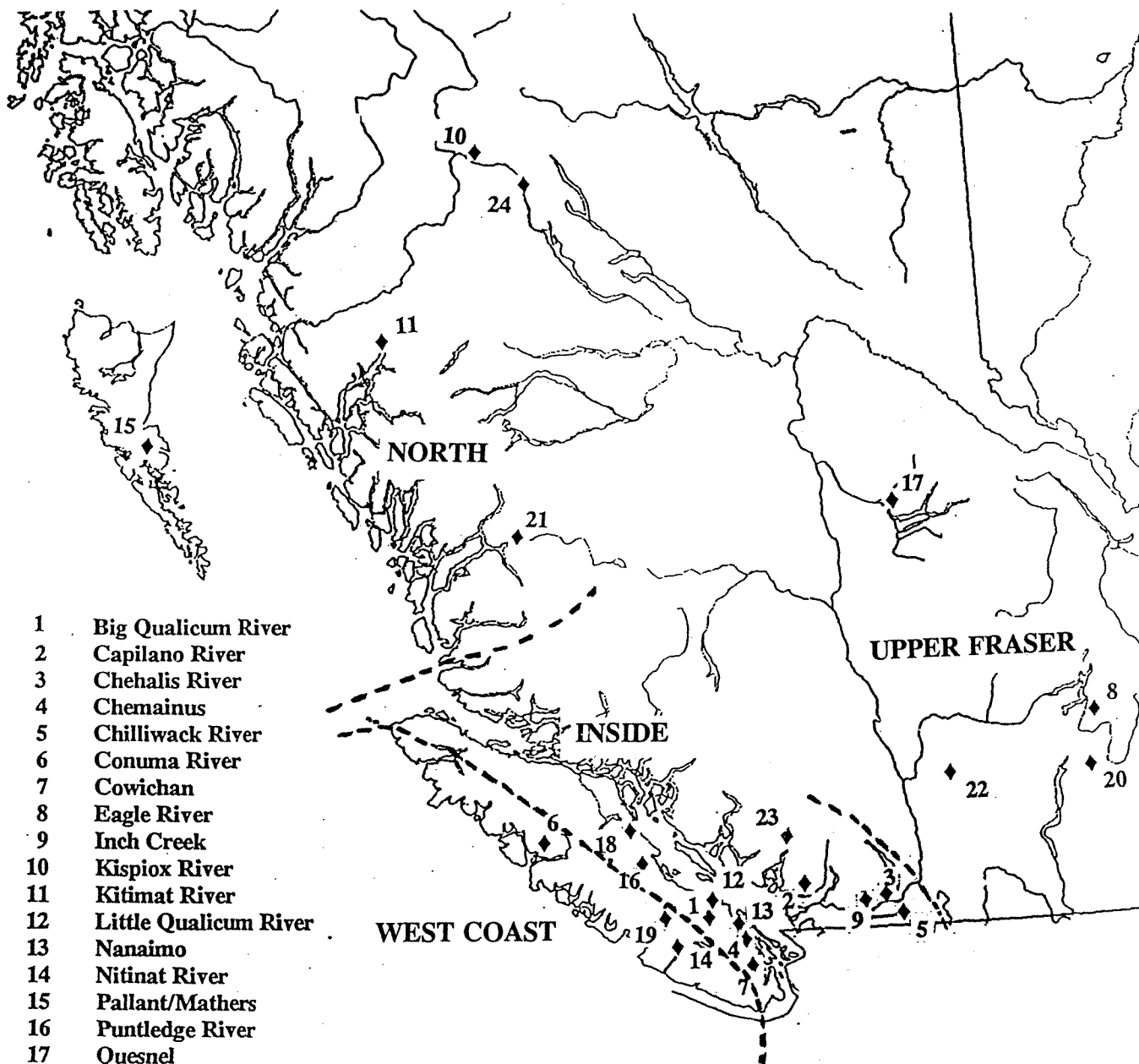
- weighted by total releases

Chinook



- weighted by total releases

Figure 4. Geographical regions and locations of selected projects for SEP, British Columbia, Canada.



- 1 Big Qualicum River
- 2 Capilano River
- 3 Chehalis River
- 4 Chemainus
- 5 Chilliwack River
- 6 Conuma River
- 7 Cowichan
- 8 Eagle River
- 9 Inch Creek
- 10 Kispiox River
- 11 Kitimat River
- 12 Little Qualicum River
- 13 Nanaimo
- 14 Nitinat River
- 15 Pallant/Mathers
- 16 Puntledge River
- 17 Quesnel
- 18 Quinsam River
- 19 Robertson Creek
- 20 Shuswap
- 21 Snootli
- 22 Spius Creek
- 23 Tenderfoot Creek
- 24 Toboggan Creek

Literature Cited

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- Kuhn, B. R. 1988. THE MRP-REPORTER PROGRAM: A data extraction and reporting tool for the Mark Recovery Program database. Can. Tech. Rep. Fish. Aquat. Sci. 1625: 145 p.
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