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An Assessment of Canadian Enhanced Salmon Production,  
1977 - 1995

prepared by

SEP - Program Coordination and Assessment Division

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submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by

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## ABSTRACT

Dept. of Fisheries and Oceans, 1996. An assessment of Canadian enhanced salmon production, 1977 - 1994. Prepared by Program Coordination and Assessment Division. Document submitted to the Annual Meeting of the North Pacific Anadromous Fish Commission. Tokyo, Japan, September, 1996. 20 pages.

The Salmonid Enhancement Program (SEP) in British Columbia, Canada 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 salmon (*O. nerka*), as well as small numbers of steelhead salmon (*O. mykiss*) and cutthroat trout (*Salmo clarki*). Projects include hatcheries, fishways, spawning and rearing channels, habitat improvements, flow control works, lake fertilization, and small classroom incubators, and range in size from spawning channels releasing nearly 100 million juveniles annually, to schools with classroom incubators releasing fewer than one thousand.

This report tabulates release data for the program by species and stage, program contribution to commercial fisheries and recoveries by catch component, and average post-release survival rates by brood year, species, stock and release stage for selected projects. Egg and release production targets for 1996 by facility are appended. Steelhead and cutthroat data are not included in this report as their assessment is a provincial responsibility.

## **Introduction**

The Salmonid Enhancement Program (SEP) in British Columbia, Canada was undertaken in 1977 to rebuild stocks and increase catch through the expanded use of enhancement technology. It incorporated three existing spawning channels built in the 1960's and five production hatcheries which had began operation in the early 1970's. 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 salmon (*O. nerka*), as well as small numbers of steelhead salmon (*O. mykiss*) and cutthroat trout (*Salmo clarki*). Projects include hatcheries, fishways, spawning and rearing channels, habitat improvements, flow control works, lake fertilization, and small classroom incubators, ranging in size from spawning channels releasing nearly 100 million juveniles annually to school classroom incubators releasing fewer than one thousand juveniles. Projects are operated by SEP staff or contracted community and native groups, as well as by volunteers with some SEP support. As many as 10,000 volunteers may participate in the program in any given year.

Regardless of project size, all production is assessed, with the assessment method dependent on the species and enhancement technology employed. Individual project production is aggregated to assess total program production. Assessment includes analysis of total production and contribution of enhanced fish to the fisheries and escapement. Egg to release survival trends by species are also analyzed within the hatchery and from release to recovery for selected projects. 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 required.

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, stock, species and release stage for selected projects. Steelhead and cutthroat data are not included in this report as their assessment is a provincial responsibility.

## **Methods**

The current method of choice for estimating production and survival rates of chinook, coho, chum and pink salmon enhancement projects are juvenile marking with 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; Kuhn 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 are assumed to represent the unmarked fish. Smaller experimental groups to assess various strategies

within a project may have a greater proportion of the release marked 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 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 is infrequently or never done. 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, usually using data from marked sites to estimate parameters. Data quality depends on the assessment method used.

There are fewer projects enhancing sockeye and pink salmon 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 is estimated using similar methods to chinook and coho. Sockeye are not marked, with production estimated using run reconstruction. Survival data for sockeye are not included in this report because direct estimates are not available.

Release data are used for both production and survival rate analyses. Juveniles are reared to various release stages depending on the species and enhancement technology employed. Chum and pinks are released either unfed after emergence or as fed fry after one month of feeding. 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.

Annual egg and release targets are set pre-season for each stock, in consultation with project managers, stock assessment biologists and harvest management biologists. Factors such as potential adult production (based on previous average survival rates), species interactions, effect on existing stocks, harvest concerns, habitat capacity and project capacity are taken into account. Production targets for 1996 for facilities operated by SEP staff or under contract to native or community groups are shown in Appendix 1.

## **Assessment Results**

Table 1 shows SEP program releases for 1977 - 1994 brood years. Total releases approximately doubled between 1977 and 1988 brood years, with the largest numerical increase for chum fry. Fed chum fry releases averaged 95.2 million for brood years 1990

to 1994, while unfed chum releases averaged 119.1 million. Full production for chinook, coho smolt and sockeye releases was reached in the early to mid 1980s and releases have been relatively stable since that time, averaging 57 million, 11.3 million and 245.1 million respectively for the last five complete brood years. Unfed pink releases fluctuate 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 million but have since declined because of reduced emphasis on this strategy.

For 1993, the most recent brood year for which releases are complete for all species, the percentage of juveniles released by species is shown in Figure 2. Sockeye accounted for 35% of the releases and chum 40%. Pink and chinook releases amounted to 12% and 9% respectively, and coho 4%.

Marine survival is analysed using release and recovery data. At individual projects, survival rates are analyzed by mark group. Survival rates are then averaged over mark groups to obtain averages by release stage for stocks, projects, geographical regions and the program as a whole.

Tables 2 to 5 show survival rates by species for individual projects where marking occurs consistently; projects are organized by the geographical regions shown in Figure 3. There is considerable variation in trends and average survival rate between different geographical regions and even for stocks within the same region. For example, coho smolts (Table 2) on the west coast of Vancouver Island (Conuma and Robertson) show distinct differences in trend and magnitude of survival rate from those on the east coast of Vancouver Island (Big Qualicum and Puntledge) and, within the region, from each other. Conuma survival rates are frequently four times those of Robertson. This is also evident in chum stocks (Table 3) that are geographically close and enhanced from the same facility. For example, Stave and Inch chum stocks at Inch Creek hatchery show differing trends and ranges in survival rates.

Survival rate data also reflect varying marine conditions. For example, survival rates of 1983 brood chinook salmon (Table 4) from Robertson Creek declined to near zero. Subsequent studies implicated heavy predation on juveniles by mackerel, which had moved into the area because of an El Niño event.

Contribution by recovery component for the program is indicated in Table 6. Contribution by SEP projects has increased substantially since the program began. Analytical methods for sockeye are being reviewed, and were unable to be updated from the last report. The largest individual contribution to catch was for chum, averaging 32% of the total commercial catch for the last five years. The commercial catch of coho has remained stable at 12%, largely due to catch ceilings in targeted fisheries. The sport catch of coho varies, dependent on whether coho remain inside Georgia Strait or migrate off the west coast of Vancouver Island. The commercial catch of chinook averages 22%. Recent declines in survival, in part due to El Niño events in 1992 to 1994 have contributed to the declining chinook catch.

## Summary

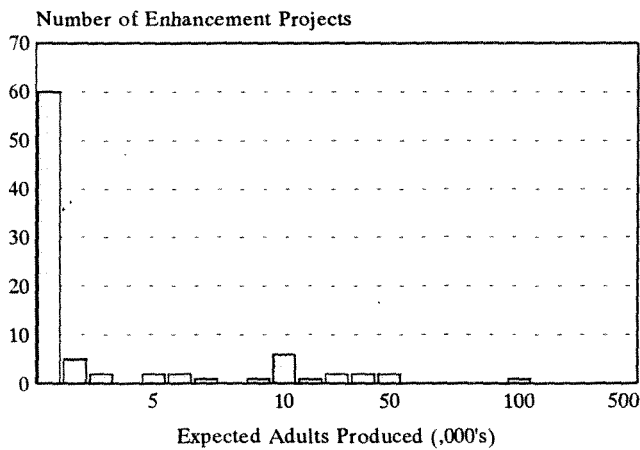
Production and survival rate assessment methods are described for each species. Data are presented for releases by brood year, species and release stage for the program, for average survivals by brood year and species for selected projects, and for contribution by catch year and species for the program.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

## LITERATURE CITED

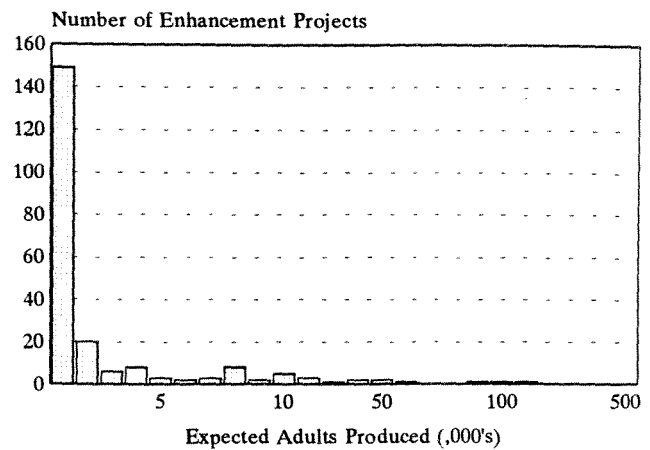
- Kuhn, B. R. 1988. THE MRP-REPORTER PROGRAM: A data extraction and reporting tool for the Mark Recovery Program database. Can. Tech. Rep. Fish. Aquat. Sci. 1625: 145 p.
- Kuhn, B. R., L. Lapi, And J. M. Hamer. 1988. An introduction to the Canadian database on marked Pacific salmonids. Can. Tech. Rep. Fish. Aquat. Sci. 1649: viii + 56 p.

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

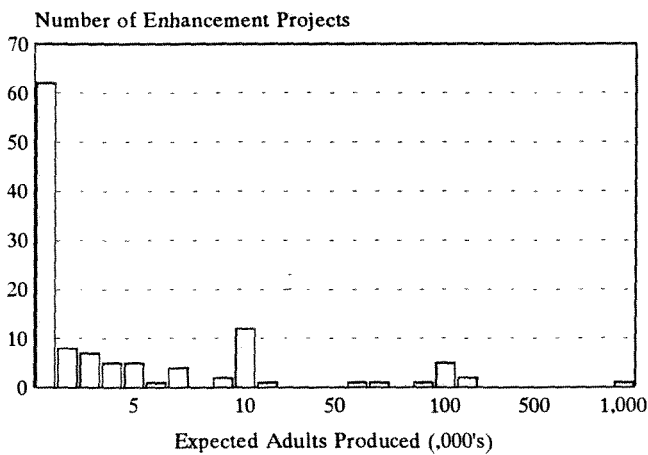
### Chinook



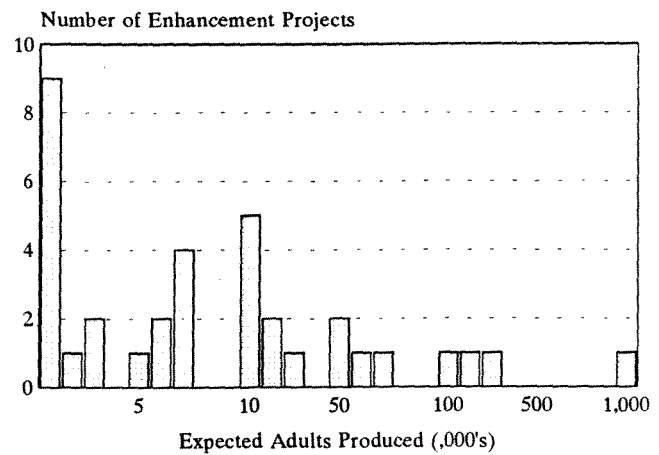
### Coho



### Chum



### Pink



### Sockeye

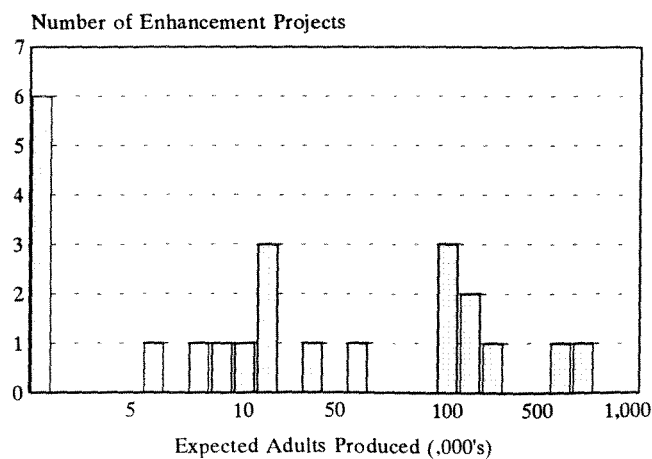
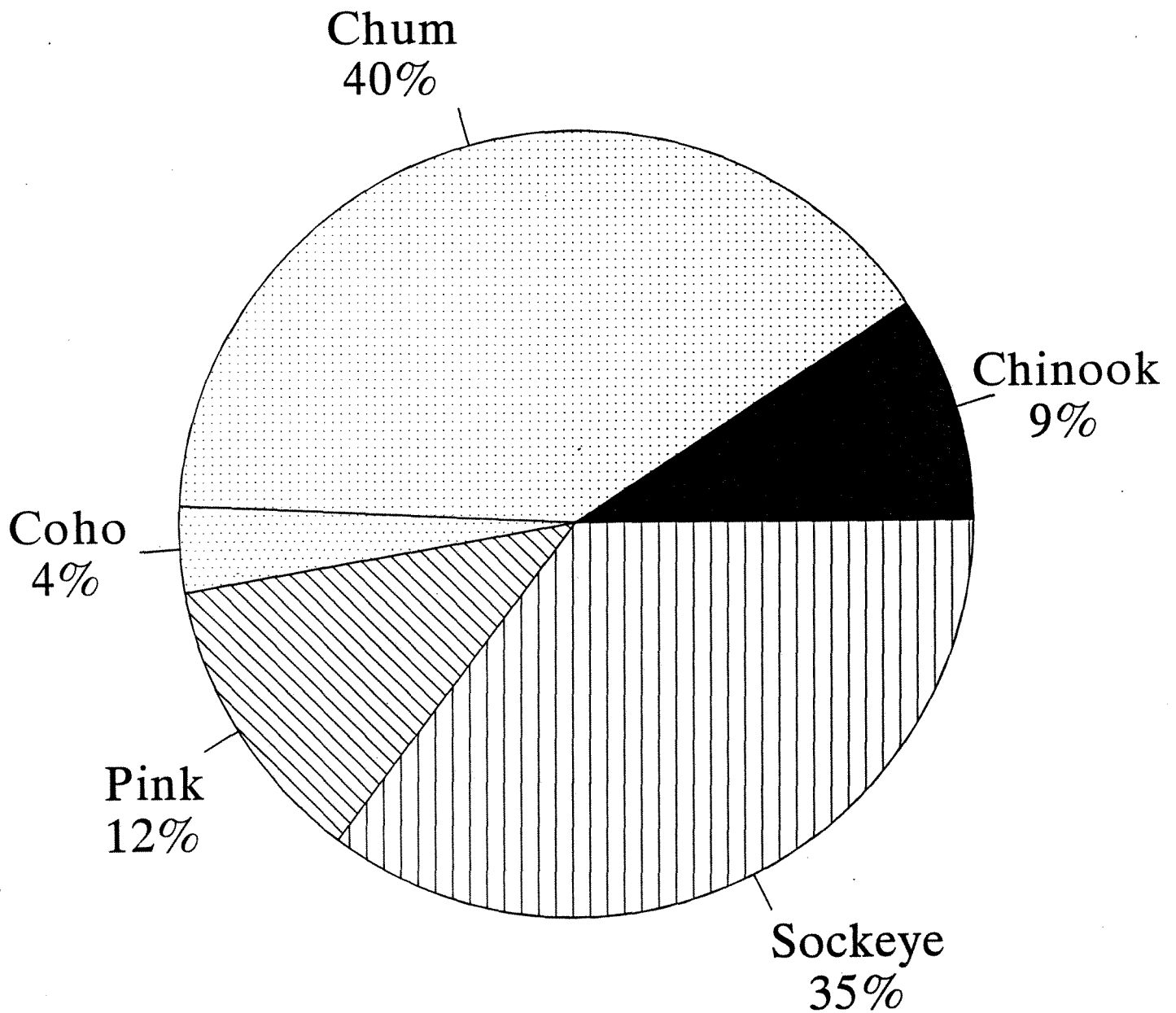
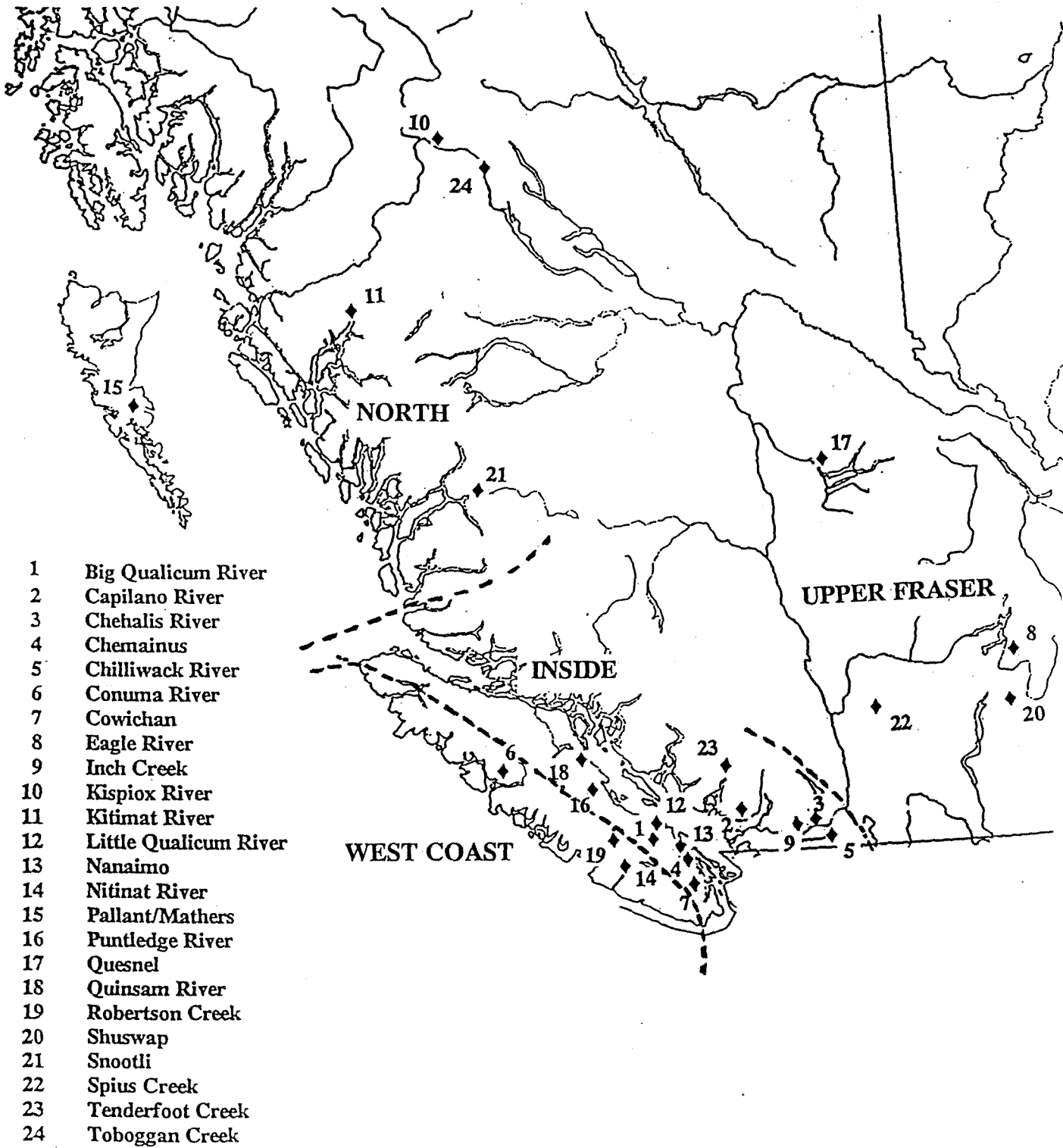


Figure 2: Releases by species (percent) for the 1993 brood for SEP, British Columbia, Canada





**Figure 3: Geographical regions and locations of selected projects for SEP, British Columbia, Canada**



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

Brood Year	Chinook	Chum		Coho		Pink		Sockeye <sup>1</sup>	Total
		Unfed	Fed	Fry	Smolt	Unfed	Fed		
1977	13,620,370	52,127,027	1,904,625	2,073,819	2,984,462	31,029,220	0	201,309,000	305,048,523
1978	14,253,404	48,988,753	5,535,566	1,110,471	3,747,251	1,268,250	0	141,574,350	216,478,045
1979	16,379,080	73,460,748	9,191,947	3,776,769	4,980,154	35,895,904	358,639	220,701,122	364,744,363
1980	19,795,232	76,533,396	29,684,300	2,449,038	5,270,862	36,993,334	1,859,631	199,054,901	371,640,694
1981	17,337,392	60,912,404	68,980,710	7,344,947	4,932,174	91,616,988	492,034	211,604,372	463,221,021
1982	24,820,129	97,024,858	69,365,130	10,816,159	6,944,312	10,505,301	423,038	218,317,433	438,216,360
1983	29,307,086	92,812,179	85,579,589	8,990,546	13,635,453	105,341,916	1,521,896	144,301,195	481,489,860
1984	34,736,308	63,995,445	103,779,630	13,207,972	12,059,350	14,215,868	2,296,285	254,991,214	499,282,072
1985	42,652,923	56,069,711	102,464,677	9,324,796	9,801,246	75,349,972	5,057,021	175,808,962	476,529,308
1986	53,840,001	112,975,482	85,842,800	12,392,340	10,201,914	51,427,812	4,509,098	200,924,044	532,113,491
1987	63,693,726	123,074,563	75,979,591	8,259,191	9,554,873	56,331,230	4,807,689	158,654,299	500,355,162
1988	64,528,141	140,125,152	87,928,664	10,687,510	11,333,223	103,695,812	2,827,349	231,737,734	652,863,585
1989	63,636,836	110,638,299	92,855,759	11,315,083	11,871,268	67,770,180	2,884,163	223,568,392	584,539,980
1990	66,220,850	123,391,279	94,759,699	10,098,979	12,330,585	76,389,273	1,023,076	258,861,158	643,074,899
1991	59,139,749	103,313,315	96,839,355	11,205,396	10,922,374	61,200,540	1,584,525	277,228,098	621,433,352
1992	57,518,170	139,476,171	88,780,879	8,104,763	10,602,361	44,159,561	1,781,339	274,930,119	625,353,363
1993	50,709,598	124,716,463	91,597,661	8,202,945	10,937,536	63,495,354	1,576,168	191,159,518 <sup>2</sup>	542,395,243 <sup>2</sup>
1994	51,655,379	104,733,266	103,949,558	11,575,243	5,024,006 <sup>2</sup>	65,164,240	1,981,042	160,056,183 <sup>2</sup>	504,138,919 <sup>2</sup>

<sup>1</sup> includes lake enrichment projects

<sup>2</sup> releases not yet complete

**Table 2: Coho post-release smolt survival (%) by facility, stock, and brood year in British Columbia, Canada. \***

	Brood Year														
	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
<b>NORTH</b>															
Kispiox River									3.7	0.4	3.1	2.9		5.4	
Kitimat River								5.8	2.1	1.0	1.3	3.4	2.8	3.8	1.2
Toboggan Cr.										0.5	2.9	4.0	6.2	1.6	3.6
<b>INSIDE</b>															
Big Qualicum River	21.9	28.0	13.3	11.6	11.7	9.2	5.4	1.4	0.8	2.2	1.6	5.6	6.9	6.4	7.6
Capilano River	13.1	14.9	17.9	11.8	10.4	11.4	14.7	5.3	13.0	18.9	10.7	12.2	7.6	10.5	9.8
Chehalis River								13.7	14.8	15.3	11.5	10.5	8.7	11.0	8.8
Chilliwack River						15.9	18.0	12.1	17.3	19.5	12.8	11.3	9.7	6.1	6.3
Inch Creek							7.0	6.2	8.7	21.3	11.2	8.5	6.9	9.9	8.6
Puntledge River			13.8	9.3	9.2	7.3	15.7	9.8	3.6	4.1	2.8	3.1	4.1	2.1	3.0
Quinsam River	8.1	11.0	8.0	6.3	7.0	5.8	8.9	7.0	9.3	10.2	11.2	10.0	4.9	6.4	4.0
Tenderfoot Creek							10.2	8.5	10.9	11.2	10.1	6.3	6.5	6.8	6.9
<b>WEST COAST</b>															
Conuma River								18.5	13.5	9.5	6.7	10.6	12.8	13.0	2.9
Robertson Creek	9.6	5.5	2.8	2.2	5.7	6.9	2.1	4.1	3.0	2.0	5.7	10.0	5.9	4.7	2.7
<b>UPPER FRASER</b>															
Eagle River									3.4	4.6	7.6	2.8	0.4	1.9	0.3
Spius Creek - Coldwater stock										6.3	3.6	3.9	2.7	4.1	4.3

\* Stock name same as hatchery name unless otherwise indicated.

**Table 3: 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	89	90	91
<b>NORTH</b>														
Pallant/Mathers	0.4	0.5	1.4	1.9	1.6	0.7	1.2	0.5	1.0	0.8	1.5	0.6	0.8	0.1
Kitimat River							4.5	1.3	2.3	1.1	2.4	1.6	3.7	0.5
Snootli	0.5	1.7	1.5	1.6	4.9	2.8	3.6	1.5	3.0	0.6	1.0	1.9	1.2	0.4
<b>INSIDE</b>														
Big Qualicum River			0.1	1.9	3.2									
Big Qualicum Channel - unfed fry	0.7	0.5	0.2	1.0	1.1	0.5	0.8	0.4	0.8	0.3	1.9	1.1	0.8	0.1
Chehalis River					2.7	0.3	1.0	1.1	1.9	0.6	0.9	0.9	0.8	0.1
Chilliwack River			0.2	1.3	2.6	1.3	2.2	0.8	1.3	0.9	2.3	3.8	1.9	0.1
Inch Creek - Inch stock	0.5	0.5	0.6	1.4	0.4	0.7	0.8	0.3	0.7	0.5	1.6	1.0	1.9	0.6
Inch Creek - Stave stock					5.0	0.1	1.4	2.2	2.9	0.8	2.3	3.3	1.6	0.2
Little Qualicum River			0.3	2.3	3.3	1.3	0.9	0.8	0.7					
Little Qualicum Channel - unfed fry		0.7	0.2	0.5	1.3	0.3	0.3	0.4	0.4	0.2	0.8	0.8	0.5	0.1
Puntledge River		1.6	0.2	3.2	2.2	1.9	0.2	0.5	1.8	1.1	1.9	1.9	1.3	0.1
<b>WEST COAST</b>														
Conuma River	1.4	2.5	0.6	1.1	1.1	0.1	0.2	0.2	0.3	0.3	0.9	1.1	1.6	0.1
Nitinat River			0.6	7.1	2.4	0.8	6.1	1.8	1.4	2.3	3.0	2.9	1.3	0.5

NOTE - 90/91 BROODS COMPLETE ONLY TO 1994 RETURN YEAR

**Table 4: Chinook post release survivals (%) by hatchery, stock, and brood year in British Columbia, Canada.\***

	Brood Year														
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
<b>NORTH</b>															
Kitimat - Lower Kit. stock			1.5	1.2	2.5	1.7	1.8	1.1	0.5	3.6	0.8	0.9	0.9	0.6	0.5
Snootli - Atnarko stock	1.9	0.4	0.6	1.2			1.0	0.1	0.2	0.4	0.2	0.1	0.5	0.5	0.3
<b>INSIDE</b>															
Big Qualicum	3.4	7.9	1.7	0.7	0.3	0.2	0.8	1.1	0.9	0.1	0.1	0.4	0.2	0.3	0.2
Capilano	1.8	4.1	1.7	1.0	0.8	1.7	1.7	0.2	0.3	0.1	0.0	0.6	0.1	0.6	0.2
Chehalis								1.2	0.3	0.3	0.5	2.1	1.0	3.5	2.0
Chemainus					8.5	3.2		4.9	1.7	6.3	2.1	4.0	2.3	2.3	3.8
Chilliwack - fall whites							9.0	1.7	3.0	4.2	1.2	8.6	1.9	9.2	7.0
Cowichan					4.5	2.0	1.8	2.4	2.8		0.9		1.6	1.0	1.2
Little Qualicum					1.2	0.5	1.3	2.3	1.0	0.3	0.2	0.6	0.2	0.4	0.4
Nanaimo					3.6	5.6		0.3					0.2	0.9	1.3
Puntledge Fall	1.4		1.3	0.9	0.5	0.8	1.0	0.6	0.5	0.3	0.1	0.4			
Puntledge Summer	1.9	4.8	0.7	0.9	0.4	0.8	0.3	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.3
Quinsam	0.7	3.0	0.9	1.5	0.8	1.0	2.2	1.2	1.1	1.4	0.4	0.8	0.4	0.4	0.1
Tenderfoot - Cheakamus stock								0.3	0.8	0.3	0.2	0.4	0.4	0.3	0.2
<b>WEST COAST</b>															
Conuma					1.9	0.7	1.4	0.6	0.1	0.5	1.7	1.0	1.9	2.9	2.4
Nitinat						1.0	0.8	0.9	0.7	1.0	1.4	0.7	0.7	1.0	0.3
Robertson	3.2	4.7	1.3	2.5	2.2	1.5	1.1	0.7	0.0	1.9	1.4	3.9	3.6	4.4	2.5
<b>UPPER FRASER</b>															
Eagle : subyearling									0.4	0.3	0.1	0.1	0.2	0.3	0.2
: yearling										0.3	0.5	0.5	0.1	0.0	0.0
Quesnel							0.1	0.0	0.2	0.0	0.0	0.2	0.0	0.0	
Shuswap - Lower										1.7	1.2	1.3	0.9	0.4	0.2
Shuswap - Middle											0.8	0.7	0.6	0.4	0.3
Spius : subyearling - Nicola stock										0.4	0.1		0.3	0.3	0.1
: yearling - Nicola stock											2.3		1.1	0.5	0.9

\* Stock name same as hatchery name unless otherwise indicated. 1989 data incomplete.

**Table 5: Pink post-release survival (%) by facility and brood year in British Columbia, Canada.**

		Brood Year															
		77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
<b>INSIDE</b>																	
<b>Quinsam River</b>	- fed fry			3.4	1.6	2.0	3.5	1.6	13.9	6.6	12.1	19.7	30.0	5.0	3.4	2.2	
	- unfed fry			3.0	0.7	0.9	1.2	1.0	6.1	3.4	1.4	7.8	18.8	2.7	4.9	1.7	1.8
<b>Puntledge River</b>	- fed fry				1.9	0.4				4.8	1.9	5.3		3.4	0.8		
	- unfed fry			0.7	0.7	0.4	1.2	0.6		5.9	1.1	14.6	1.4	1.7	1.1	0.2	0.3

**Table 6. SEP production recovery components and percent contribution to commercial fisheries in British Columbia, Canada.**

Catch Year	COHO					CHINOOK				
	Commercial		Sport	Escapement	U.S.	Commercial		Sport	Escapement	U.S.
	Number	% of Catch				Number	% of Catch			
82	171,230	5.4	91,507	123,784	17,409	109,125	8.9	26,100	30,679	54,645
83	239,622	5.8	97,750	148,845	10,088	102,511	10.8	30,294	30,814	59,981
84	208,990	5.8	91,613	162,863	11,296	97,583	9.7	64,211	37,491	47,279
85	277,213	9.4	239,456	221,834	36,573	61,536	7.1	42,484	55,809	34,489
86	388,827	7.9	206,865	273,086	57,881	64,714	8.0	46,869	57,182	26,265
87	379,199	11.3	309,779	328,376	49,791	47,145	6.1	42,125	88,038	29,839
88	312,649	11.4	408,592	295,984	36,117	57,531	8.0	46,881	130,450	41,096
89	352,702	10.3	215,343	293,071	60,418	101,727	15.7	82,656	156,045	64,176
90	334,706	8.7	213,773	247,213	46,652	139,448	21.0	68,054	223,940	104,054
91	398,226	11.4	59,264	294,876	80,860	175,094	27.4	96,238	224,915	120,373
92	369,934	12.5	218,572	285,385	44,173	196,181	28.9	86,362	262,743	111,128
93	230,989	12.2	267,334	248,986	34,625	169,836	27.4	108,978	245,309	87,099
94	287,588	11.3	100,145	38,909	27,851	53,829	12.6	46,687	57,105	43,197
95	190,154	10.3	26,043	0		23,516	12.4	39,362	0	31,197

Catch Year	CHUM					PINKS				
	Commercial		Sport	Escapement	U.S.	Commercial		Sport	Escapement	U.S.
	Number	% of Catch				Number	% of Catch			
82	255,354	8.6	0	313,933	0	45,931	1.7	339	31,141	0
83	135,357	13.5	0	407,723	0	438,811	1.8	2,199	236,172	78,913
84	415,771	22.6	0	476,991	0	50,304	0.7	1,511	20,957	0
85	1,892,829	34.6	0	1,384,648	0	378,113	1.9	3,637	262,114	138,365
86	1,328,907	23.8	316	893,761	0	292,780	1.6	1,612	236,606	0
87	839,894	37.0	1,375	600,108	0	616,560	4.6	10,983	382,565	92,757
88	2,385,804	38.7	419	830,038	0	345,313	1.5	3,055	332,018	0
89	655,584	36.1	2,224	915,541	0	1,735,978	10.2	12,894	662,945	165,117
90	1,028,577	32.9	887	997,858	0	1,697,837	9.8	6,283	911,547	0
91	734,160	31.2	1,575	844,792	NC	1,566,090	6.5	24,565	844,792	278,838
92	1,524,739	38.0	2,997	923,420	NC	1,791,329	17.4	14,563	923,420	0
93	1,549,672	36.7	1,023	1,528,094	NC	1,455,459	14.3	19,198	1,163,381	81,100
94	1,485,279	34.4	NC	1,279,818	NC	199,147	8.9	6,755	405,157	0
95	426,809	19.3	NC	588,784	NC	1,181,700	10.2	NC	858,526	118,825

Catch Year	SOCKEYE					TOTAL				
	Commercial		Sport	Escapement	U.S.	Commercial		Sport	Escapement	U.S.
	Number	% of Catch				Number	% of Catch			
82	827,688	8.2	0	685,119	128,459	1,409,328	7.0	117,946	1,184,656	200,512
83	826,928	15.0	0	694,166	133,554	1,743,230	4.9	130,243	1,517,720	282,536
84	948,507	18.7	0	602,823	159,673	1,721,156	9.0	157,335	1,301,125	218,248
85	819,148	6.7	0	661,376	130,501	3,428,839	8.2	285,577	2,585,781	339,928
86	902,255	8.5	0	710,352	145,799	2,977,483	7.5	255,662	2,170,986	229,945
87	825,983	15.3	0	747,646	133,586	2,708,781	10.8	364,262	2,146,734	305,973
88	899,527	20.1	0	760,879	130,363	4,000,824	10.7	458,947	2,349,369	207,577
89	508,628	3.7	0	681,871	99,471	3,354,619	9.1	313,118	2,709,474	389,182
90	452,213	3.2	0	514,061	90,423	3,652,782	9.4	288,996	2,894,619	241,129
91	NC		0	NC	NC	2,873,571	9.4	181,642	2,209,375	480,071
92	NC		0	NC	NC	3,882,183	21.7	322,494	2,394,968	155,301
93	NC		0	NC	NC	3,405,956	20.1	396,533	3,185,770	202,825
94	NC		0	NC	NC	2,025,843	21.3	153,587	1,780,990	71,048
95	NC		0	NC	NC	1,822,179	11.5	65,406	1,447,310	150,022

NC - Not complete

**Appendix 1. 1996 BROOD PRODUCTION TARGETS**

12-Sep-96

Project	Species	Stock	Run	Stage	Eggs	Release	ExpAdults
<b>Community Economic Development</b>							
Bella Bella CDP	Chum	Kadjusdis Cr	Fall	Fed Fry	250,000	180,000	4,248
		Kwakusdis Cr	Fall	Fed Fry	250,000	180,000	4,248
		McLaughlin Bay	Fall	Fed Fry	1,000,000	720,000	16,992
	Coho	McLaughlin Bay	Fall	Smolts	100,000	67,500	2,342
Clayoquot CDP	Chinook	Kennedy R Low	Fall	Smolts	450,000	324,000	4,763
Cowichan River CDP	Chinook	Cowichan R	Fall	Smolts	3,500,000	2,100,000	42,800
				Spr Fry		475,000	9,975
	Chum	Cowichan R	Fall	Fed Fry	1,000,000	720,000	10,584
	Coho	Cowichan R	Fall	Spr Fry	200,000	165,000	2,393
		Koksilah R	Fall	Spr Fry	100,000	81,000	1,175
Deadman River CDP	Chinook	Deadman R	Summer	Yearling Smolts	60,000	40,000	372
	Coho	Deadman R	Fall	Smolts	50,000	30,000	1,518
Fort Babine CDP	Chinook	Babine R	Summer	Yearling Smolts	100,000	76,000	1,984
	Coho	Babine R	Fall	Smolts	210,000	60,000	1,740
Hartley Bay CDP	Coho	Hartley Bay Cr		Spr Fry		100,000	1,000
			Fall	Fall Fry	500,000	320,000	5,792
				Smolts		40,000	1,492
Kincolith CDP	Chinook	Kincolith R	Summer	Yearling Smolts	275,000	185,000	3,053
	Chum	Stagoo Cr	Fall	Fed Fry	250,000	180,000	3,060
	Coho	Kincolith R	Fall	Smolts	70,000	47,000	2,139
Klemtu CDP	Chum	Kitasoo Cr	Fall	Fed Fry	620,000	446,000	10,526
	Coho	Kitasoo Cr	Fall	Smolts	90,000	60,750	2,266
Lang Channel SPU	Chum	Lang Cr	Fall	Unfed Fry	1,120,000	224,000	1,568
Masset CDP	Chinook	Yakoun R	Summer	Smolts	300,000	216,000	2,052
	Coho	Yakoun R	Fall	Smolts	40,000	27,000	859
Nanaimo River CDP	Chinook	Nanaimo R	Spring	Smolts	250,000	180,000	3,276
			Fall	Smolts	450,000	324,000	5,897
	Chum	Nanaimo R	Fall	Fed Fry	1,000,000	720,000	10,584
	Coho	Millstone R	Fall	Spr Fry	50,000	40,500	587
		Nanaimo R	Fall	Smolts	650,000	150,000	8,535
					Spr Fry		350,000
Nimpkish CDP	Chinook	Woss R	Fall	Smolts	500,000	360,000	2,664
	Chum	Nimpkish R Low	Fall	Fed Fry	2,200,000	1,584,000	26,928
	Coho	Nimpkish R	Fall	Smolts	140,000	50,000	3,815
Oweekeno CDP	Chinook	Neechanz R		Spr Fry		50,000	725
			Summer	Spr Fry	60,000	50,000	125
			Fall	Smolts	400,000	288,000	864
		Wannock R	Fall	Smolts	400,000	288,000	864



**Appendix 1. 1996 BROOD PRODUCTION TARGETS**

12-Sep-96

Project	Species	Stock	Run	Stage	Eggs	Release	ExpAdults
P.Hardy/Quatse CDP	Chinook	Woss R	Fall	Smolts	0	125,000	925
	Chum	Quatse R	Fall	Fed Fry	275,000	200,000	3,400
	Coho	Airport Cr	Fall	Spr Fry	68,000	55,000	798
		Cluxewe R	Fall	Fall Fry	140,000	20,000	622
				Smolts		25,000	1,908
				Spr Fry		60,000	870
		Glenlion R	Fall	Spr Fry	30,000	25,000	363
		Nahwitti R	Fall	Fall Fry	65,000	20,000	622
				Spr Fry		30,000	435
		Quatse R	Fall	Fall Fry	195,000	20,000	622
				Smolts		25,000	1,908
				Spr Fry		105,000	1,523
		Quatsese R	Fall	Spr Fry	75,000	60,000	870
		Storey Cr	Fall	Spr Fry	75,000	60,000	870
	Cutthroat	Quatse R	Fall	Smolts	5,000	3,300	330
	Pink	Cluxewe R	Fall	Fed Fry	3,125,000	2,500,000	98,250
		Quatse R	Fall	Fed Fry	3,125,000	2,500,000	98,250
	Steelhead	Cluxewe R	Winter	Smolts	10,000	7,000	280
		Quatse R	Winter	Smolts	22,000	15,000	600
		Tsitika R	Summer	Smolts	67,000	45,000	1,350
	P.Hardy/Stephens CDP	Chinook	Marble R	Fall	Smolts	725,000	520,000
Chum		Stephens Cr	Fall	Unfed Fry	67,000	60,000	198
Coho		Coetkwaus Cr	Fall	Spr Fry	19,000	15,000	339
		Marble R	Fall	Spr Fry	0	180,000	4,068
		Stephens Cr	Fall	Spr Fry	250,000	200,000	4,520
		Wanokana Cr	Fall	Spr Fry	25,000	20,000	452
		Washlawlis R	Fall	Spr Fry	125,000	100,000	2,260
		Waukwaas Cr	Fall	Spr Fry	185,000	150,000	3,390
Penny CDP	Chinook	Dome Cr	Summer	Spr Fry	200,000	100,000	310
				Yearling Smolts		55,000	215
Powell River CDP	Chinook	Lang Cr	Fall	Smolts	625,000	450,000	2,250
	Chum	Lang Cr	Fall	Fed Fry	1,200,000	500,000	8,500
				Unfed Fry		500,000	3,500
	Coho	Kelly Cr	Fall	Smolts	15,000	10,100	745
		Lang Cr	Summer	Smolts	75,000	55,000	4,059
Pink	Lang Cr	Fall	Unfed Fry	0	0	0	
San Juan River CDP	Chinook	San Juan R	Fall	Smolts	1,000,000	720,000	5,760
	Chum	San Juan R	Fall	Fed Fry	50,000	36,000	612
	Coho	San Juan R	Fall	Smolts	755,000	30,375	1,698
				Spr Fry		575,000	7,475
Sechelt CDP	Chinook	Lang Cr	Fall	Smolts	0	108,000	281
		Maclean Bay	Fall	Smolts	0	0	0
	Chum	Maclean Bay	Fall	Fed Fry	900,000	650,000	11,050
	Coho	Maclean Bay	Fall	Smolts	150,000	100,000	5,570
	Pink	Jitco Cr	Fall	Unfed Fry	0	0	0
		Maclean Bay	Summer	Unfed Fry	0	0	0

**Appendix 1. 1996 BROOD PRODUCTION TARGETS**

12-Sep-96

Project	Species	Stock	Run	Stage	Eggs	Release	ExpAdults		
Seymour River CDP	Chinook	Chilliwack R	Fall	Smolts	125,000	90,000	450		
	Chum	Indian R	Fall	Fed Fry	500,000	200,000	3,400		
				Unfed Fry		200,000	1,400		
	Coho	Seymour R	Fall	Fed Fry	175,000	126,000	2,142		
		Seymour R	Fall	Smolts	70,000	50,000	5,700		
	Cutthroat	Seymour R	Fall	Smolts	6,000	2,000	200		
	Steelhead	Seymour R		Summer	Smolts	30,000	15,000	450	
				Winter	Smolts	20,000	10,000	400	
Sliammon River CDP	Chinook	Lang Cr	Fall	Smolts	0	130,000	650		
	Chum	Sliammon R	Fall	Fed Fry	1,250,000	500,000	8,500		
				Unfed Fry		500,000	3,500		
	Coho	Sliammon R	Fall	Fall Fry	100,000	35,000	2,062		
				Smolts		25,000	1,240		
	Pink	Sliammon R	Summer	Unfed Fry	0	0	0		
Terrace CDP	Chinook	Cedar R	Summer	Yearling Smolts	110,000	75,000	458		
				Kitsumkalum R	Summer	Spr Fry	250,000	202,500	385
Thompson R N CDP	Coho	Dunn Cr	Fall	Smolts	50,000	20,000	1,712		
				Spr Fry		10,000	85		
	Lemieux Cr	Fall	Smolts	50,000	20,000	1,712			
			Spr Fry		15,000	128			
	Louis Cr	Fall	Smolts	50,000	20,000	1,712			
Thornton Cr CDP	Chinook	Nitinat R	Fall	Smolts	0	360,000	5,292		
				Thornton Cr	Fall	Smolts	300,000	216,000	3,175
				Toquart R	Fall	Smolts	80,000	57,600	847
	Chum	Salmon Cr	Fall	Unfed Fry	500,000	400,000	2,800		
	Coho	Kennedy R Upp	Fall	Spr Fry	100,000	81,000	1,725		
				Maggie R	Fall	Spr Fry	100,000	81,000	1,725
				Thornton Cr	Fall	Smolts	60,000	40,500	2,264
	Toboggan Cr CDP	Chinook	Bulkley R Upp	Summer	Yearling Smolts	100,000	80,000	1,320	
Coho		Bulkley R Upp	Summer	Smolts	40,000	34,000	891		
				Toboggan Cr	Summer	Smolts	60,000	40,500	1,061
<b>Enhancement Operations</b>									
Big Qualicum River	Chinook	B.Qualicum R	Fall	Smolts	4,500,000	3,750,000	17,250		
	Chum	B.Qualicum R	Fall	Unfed Fry	125,000,000	54,000,000	405,000		
				Fall Fry	2,500,000	200,000	3,840		
	Coho	B.Qualicum R	Fall	Smolts		1,250,000	59,125		
				Cutthroat	L.Qualicum R	Fall	Smolts	0	15,000
	Steelhead	B.Qualicum R	Winter	Fed Fry	45,000	10,000	100		
Capilano River	Chinook	Capilano R	Fall	Smolts	600,000	456,000	3,055		
				Chum	Brother Cr	Fall	Fed Fry	50,000	42,500
	Coho	Capilano R	Fall	Smolts	810,000	525,000	62,475		
				Spr Fry		40,000	796		
	Steelhead	Capilano R	Summer	Fed Fry	15,000	5,000	50		
				Smolts		5,000	150		
				Winter	Fed Fry	25,000	8,000	80	
			Smolts		10,000	400			

**Appendix 1. 1996 BROOD PRODUCTION TARGETS**

12-Sep-96

Project	Species	Stock	Run	Stage	Eggs	Release	ExpAdults		
Chehalis River/BC	Chinook	Chehalis R	Summer	Smolts	400,000	225,000	450		
				Yearling Smolts		40,000	556		
			Harrison R	Fall	Smolts	3,800,000	2,600,000	52,520	
	Chum	Chehalis R	Fall	Fed Fry	9,000,000	7,800,000	100,620		
	Coho	Chehalis R	Fall	Smolts	1,300,000	1,007,000	116,510		
				Trout Cr		43,000	3,980		
	Cutthroat	Fraser R Low	Fall	Smolts	42,000	24,000	2,400		
	Steelhead	Chehalis R		Summer	Smolts	43,000	25,000	750	
					Winter	Smolts	76,000	40,000	1,600
				Summer	Coquihalla R	Smolts	43,000	24,000	720
					Harrison R	Winter	Fed Fry	20,000	12,500
	Chemainus River	Chinook	Chemainus R	Fall	Smolts	250,000	200,000	7,820	
Coho		Chemainus R	Fall	Spr Fry	75,000	50,000	725		
Chilliwack River	Chinook	Chilliwack R	Summer	Smolts	500,000	410,000	820		
				Fall	Smolts	2,200,000	1,800,000	74,160	
	Chum	Chilliwack R	Fall	Fed Fry	5,200,000	3,000,000	46,500		
				Unfed Fry		1,900,000	13,300		
	Coho	Chilliwack R	Fall	Smolts	2,400,000	1,950,000	236,145		
	Pink	Chilliwack R	Fall	Unfed Fry	3,000,000	2,400,000	90,480		
	Steelhead	Chilliwack R	Winter	Smolts	200,000	120,000	4,800		
Conuma River	Chinook	Conuma R	Fall	Smolts	3,200,000	2,400,000	81,400		
				Tlupana R	Fall	Smolts	50,000	40,000	460
	Chum	Canton Cr	Fall	Fed Fry	1,500,000	1,290,000	9,546		
				Conuma R	Fall	Fed Fry	5,000,000	4,600,000	34,040
				Deserted R	Fall	Fed Fry	2,000,000	1,700,000	12,580
	Coho	Conuma R	Fall	Sucwoa R	Fed Fry	4,000,000	3,440,000	25,456	
				Tlupana R	Fed Fry	1,500,000	1,290,000	9,546	
				Smolts	200,000	100,000	10,700		
				Spr Fry		52,000	1,175		
				Fed Fry	30,000	22,500	225		
Fulton River	Sockeye	Fulton Ch.#1	Summer	Spr Fry	66,000,000	33,000,000	422,400		
			Summer	Spr Fry	180,000,000	90,000,000	1,152,000		
			Summer	Spr Fry	250,000,000	40,000,000	512,000		
Gates R Spawn Chan	Sockeye	Gates R	Summer	Spr Fry	29,800,000	15,800,000	126,400		
Glendale Channel	Pink	Glendale Chan	Fall	Unfed Fry	24,000,000	12,000,000	471,600		
Horsefly Creek	Sockeye	Horsefly Chan	Summer	Spr Fry	35,000,000	25,500,000	170,850		
Inch Creek	Chinook	Maria Slough	Fall	Smolts	10,000	7,200	62		
	Chum	Inch Cr	Fall	Fed Fry	1,200,000	1,000,000	8,200		
				Fed Fry	4,000,000	3,000,000	68,100		
	Coho	Inch Cr	Fall	Smolts	225,000	200,000	18,800		
				Smolts	67,000	60,000	5,640		
				Smolts	67,000	60,000	5,640		
				Smolts	500,000	430,000	40,420		
Cutthroat	Fraser R Low	Fall	Smolts	0	20,000	2,000			
Kakweiken River	Pink	Kakweiken R	Fall	Unfed Fry	32,000,000	16,000,000	628,800		

Appendix 1. 1996 BROOD PRODUCTION TARGETS

12-Sep-96

Project	Species	Stock	Run	Stage	Eggs	Release	ExpAdults
Kitimat River	Chinook	Dala R	Summer	Smolts	100,000	85,000	1,224
		Hirsch Cr	Summer	Smolts	200,000	170,000	2,448
		Kildala R	Summer	Smolts	225,000	191,000	2,750
		Kitimat R Low	Summer	Smolts	1,100,000	935,000	13,464
		Kitimat R Upp	Summer	Smolts	600,000	510,000	7,344
	Chum	Hirsch Cr	Summer	Fed Fry	1,500,000	1,245,000	28,884
		Kildala R	Summer	Fed Fry	750,000	623,000	14,454
		Kitimat R	Summer	Fed Fry	4,000,000	3,320,000	77,024
	Coho	Kitimat R	Fall	Smolts	500,000	430,000	11,051
	Cutthroat	Kitimat R	Fall	Smolts	10,000	6,800	680
Steelhead	Kitimat R	Winter	Smolts	65,000	44,000	1,760	
Little Qualicum R	Chinook	L.Qualicum R	Fall	Smolts	3,500,000	2,500,000	19,750
	Chum	L.Qualicum R	Fall	Unfed Fry	62,000,000	38,000,000	190,000
	Steelhead	L.Qualicum R	Winter	Smolts	0	25,000	1,000
Nadina R Spawn Chan	Sockeye	Nadina R	Summer	Spr Fry	16,000,000	6,560,000	39,360
Nitinat River	Chinook	Nitinat R	Fall	Smolts	6,823,200	6,000,000	54,600
		Sarita	Fall	Smolts	136,800	120,000	1,092
	Chum	Nitinat R	Fall	Fed Fry	33,700,000	30,000,000	825,000
	Coho	Nitinat R	Fall	Smolts	250,000	100,000	7,210
				Spr Fry		100,000	2,130
	Steelhead	Nitinat R	Winter	Fed Fry	12,000	9,720	58
Pallant Creek	Chum	Mathers Cr	Fall	Fed Fry	5,000,000	4,400,000	47,520
		Pallant Cr	Fall	Fed Fry	10,000,000	8,800,000	95,040
	Coho	Braverman Cr	Fall	Spr Fry	200,000	174,000	5,533
		Pallant Cr	Fall	Spr Fry	200,000	174,000	5,533
Pinkut Creek	Sockeye	Pinkut Ab.Fall	Summer	Spr Fry	75,000,000	37,500,000	480,000
		Pinkut Chan.	Summer	Spr Fry	80,000,000	40,000,000	512,000
		Pinkut Cr	Summer	Spr Fry	37,500,000	5,600,000	71,680
Pitt River Upper	Sockeye	Pitt R Upp	Summer	Fall Fry	5,000,000	3,000,000	27,000
				Spr Fry		1,500,000	10,050
Puntledge River	Chinook	Puntledge R	Summer	Smolts	2,400,000	1,900,000	6,270
				Spr Fry		100,000	250
			Fall	Smolts	2,200,000	1,800,000	5,940
				Fed Fry	4,000,000	3,750,000	54,750
	Chum	Puntledge R	Fall	Fed Fry	4,000,000	3,750,000	54,750
	Coho	Puntledge R	Fall	Fall Fry	2,200,000	400,000	2,320
				Smolts		800,000	44,560
				Spr Fry		600,000	3,480
	Cutthroat	Puntledge R	Fall	Smolts	20,000	13,500	1,350
	Pink	Puntledge R	Fall	Unfed Fry	3,750,000	3,000,000	105,000
Steelhead	Puntledge R	Summer	Fed Fry	35,000	25,000	250	
		Winter	Smolts	50,000	33,750	1,350	
Quinsam River	Chinook	Quinsam R	Fall	Smolts	3,765,000	3,500,000	33,600
				Fall Fry	1,955,000	300,000	9,330
	Coho	Quinsam R		Smolts		1,200,000	93,480
				Fed Fry			
	Cutthroat	Quinsam R	Fall	Smolts	10,000	6,750	675
	Pink	Quinsam R	Fall	Unfed Fry	8,200,000	7,000,000	301,700
Steelhead	Quinsam R	Winter	Fed Fry	60,000	20,000	200	
			Smolts		25,000	1,000	

**Appendix 1. 1996 BROOD PRODUCTION TARGETS**

*12-Sep-96*

<b>Project</b>	<b>Species</b>	<b>Stock</b>	<b>Run</b>	<b>Stage</b>	<b>Eggs</b>	<b>Release</b>	<b>ExpAdults</b>	
Robertson Creek	Chinook	Nahmint R	Fall	Smolts	500,000	450,000	9,270	
		Robertson Cr	Fall	Smolts	8,300,000	8,000,000	164,800	
	Coho	Robertson Cr	Fall	Smolts	1,000,000	800,000	37,680	
		Steelhead	Robertson Cr	Summer	Smolts	75,000	50,000	1,500
			Somass R	Winter	Smolts	75,000	50,000	2,000
			Stamp R	Summer	Smolts	25,000	17,000	510
Seton River	Pink	Seton Chan Low	Fall	Unfed Fry	0	0	0	
		Seton Chan Upp	Fall	Unfed Fry	0	0	0	
Shuswap River	Chinook	Shuswap R Low	Summer	Smolts	925,000	850,000	7,310	
		Shuswap R Mid	Summer	Smolts	300,000	250,000	2,150	
Snettisham	Sockeye	Tahltan Lk	Fall	Spr Fry	6,000,000	4,800,000	32,160	
		Tatsamenie Lk	Fall	Spr Fry	2,500,000	2,000,000	13,400	
Snootli Creek	Chinook	Atnarko R Low	Summer	Smolts	1,550,000	990,000	2,970	
		Atnarko R Upp	Summer	Smolts	1,150,000	990,000	2,970	
		Nusatsum	Summer	Smolts	100,000	86,000	258	
		Salloomt R	Summer	Smolts	100,000	86,000	258	
	Chum	Fish C+Airport	Summer	Fed Fry	1,800,000	1,656,000	42,725	
		Salloomt R	Summer	Fed Fry	1,800,000	1,656,000	42,725	
		Snootli Cr	Summer	Fed Fry	1,800,000	1,656,000	42,725	
		Thorsen Cr	Summer	Fed Fry	1,800,000	1,656,000	42,725	
	Cutthroat	B.Coola R Low	Fall	Fed Fry	15,000	12,000	192	
	Pink	Atnarko R Low	Fall	Unfed Fry	37,500,000	18,750,000	281,250	
	Steelhead	Hotnarko Lk	Landlock	Fed Fry	5,000	4,000	24	
	Spius Creek	Chinook	Coldwater R	Summer	Yearling Smolts	100,000	70,000	707
Nicola R			Summer	Yearling Smolts	280,000	210,000	2,121	
Salmon R			Summer	Yearling Smolts	100,000	70,000	707	
Spius Cr			Summer	Yearling Smolts	100,000	70,000	707	
Coho		Coldwater R	Fall	Spr Fry	225,000	175,000	1,470	
		Salmon R	Fall	Spr Fry	170,000	150,000	1,260	
		Spius Cr	Fall	Smolts	250,000	140,000	5,782	
				Spr Fry		80,000	672	
Tenderfoot Creek		Chinook	Porteau Cove	Summer	Smolts	1,800,000	1,500,000	28,200
	Chum		Tenderfoot C	Fall	Fed Fry	120,000	100,000	1,700
	Coho	Ashlu Cr	Fall	Smolts	40,000	35,000	3,276	
		Mamquam R	Fall	Smolts	40,000	35,000	3,276	
		Squamish R	Fall	Smolts	40,000	35,000	3,276	
		Tenderfoot C	Fall	Smolts	125,000	110,000	10,296	
Weaver Cr Channel	Chum	Weaver Cr	Fall	Unfed Fry	4,125,000	2,700,000	18,900	
	Sockeye	Weaver Cr	Fall	Spr Fry	65,000,000	46,800,000	514,800	