PACIFIC SALMON COMMISSION
COHO TECHNICAL COMMITTEE

INTERIM ESTIMATES OF COHO STOCK COMPOSITION FOR 1984-1991 SOUTHERN AREA FISHERIES AND FOR 1987-1991 NORTHERN PANEL AREA FISHERIES

TCCOHO (94)-1

February 10th, 1994

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of the Pacific Salmon Commission Coho Technical Committee

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Executive Summary

In 1988, the Pacific Salmon Commission instructed the Coho Technical Committee (CoTC) to develop methodologies for estimation of stock compositions of coho harvested by Southern Panel area fisheries. Over the past year, the feasibility of applying these methodologies to estimate stock compositions for Northern Panel area stocks and fisheries has been explored. This report presents interim stock composition estimates based on the progress of research to date.

After investigating a number of approaches, including run reconstruction and production factor estimation, the CoTC determined that analysis of coded-wire-tag recovery data provided the most promising means to generate stock composition estimates for coho salmon. The CoTC provided its first estimates of stock composition for Southern Panel area fisheries for 1984 through 1986 (CoTC, 1989) based on a Linear Programming model. Since that time, bilaterally-sponsored research has led to the development of least squares estimation models.

Interim estimates of coho stock composition are provided for Southern Panel area fisheries for 1984 through 1991 (Tables 1-8) and for Northern Panel area fisheries for 1987 through 1991 (Tables 9-13), based on a Constrained Least Squares estimation model. Interception estimates associated with these stock compositions are summarized below.

Interim Estimates of Coho Salmon Interceptions By Southern Panel Area Fisheries, 1984-1991 and Northern Panel Area Fisheries, 1987-1991 (Thousands of fish). Based on Constrained Least Squares Estimation and Recoveries of Coded-Wire-Tags.

	Southern Panel Area		Northern Panel Area	
Year	Canadian Interceptions of U.S. Coho Stocks	U.S. Interceptions of Canadian Coho Stocks	Canadian Interceptions of U.S. Coho Stocks	U.S. Interceptions of Canadian Coho Stocks
1984	1,244.7	76.0		
1985	1,636.2	105.7		
1986	1,947.5	110.5		
1987	1,305.5	150.7	50.7	267.6
1988	1,087.7	155.8	29.0	127.7
1989	1,857.7	95.3	40.4	399.8
1990	1,079.3	160.2	122.3	559.8
1991	1,114.7	169.6	83.5	815.8

Further investigations into methodologies will be undertaken by the CoTC, including the refinement of estimation models and data. The estimates presented in this report are preliminary and, therefore, likely to be revised as work on development of joint methodologies progresses. Additional work is necessary to determine the sensitivity of the estimates to underlying assumptions. Furthermore, the statistical reliability of the estimates should be investigated and reported.

1.0 INTRODUCTION

In the fall of 1988, the Pacific Salmon Commission (PSC) identified the need for estimates of stock composition of coho catches in Southern Panel area fisheries. The Coho Technical Committee (CoTC) established a Stock Composition Work Group to pursue the development of methodologies for generating the required estimates.

The CoTC has been evaluating alternative methods of utilizing coded-wire-tag (CWT) recovery data to estimate stock composition of fisheries harvesting coho salmon since 1988. In an attempt to overcome limitations in available data, most notably the lack of terminal fisheries on coho and/or stock-specific escapement estimates in British Columbia, innovative estimation techniques had to be developed. The basic framework of the estimation approach was based on the work of Shaul and Clark (1990). After investigating a number of approaches, including run reconstruction and production factor estimation, the CoTC provided its first estimates of stock composition for 1984 through 1986 (CoTC, 1989), based on a Linear Programming model (LP).

Since 1989, the CoTC has continued to investigate alternative methods of estimating stock composition with the assistance of a bilaterally funded research project. Investigations have focused on a generalized statistical model (Fournier and Sibert, 1989; Sibert and Fournier, 1991) and least squares estimation.

Since 1992, the CoTC has included Northern Panel area stock and fishery data in its investigations in response to requirements for coho stock composition estimates for this area. Including Northern Panel area stocks and fisheries also improves the estimates for some Southern Panel area fisheries.

This report presents interim estimates of stock composition for coho catches in Southern Panel area fisheries for 1984 through 1991 and for Northern Panel area fisheries for 1987 through 1991. The estimates are based on a form of least squares model, which appears to hold the most promise at this time. Estimates may be revised as development of joint methodologies continues. Further investigations into refining methodologies are planned by the CoTC.

2.0 METHODS

2.1 Data Types

Two types of data were used to generate interim stock composition estimates: 1) estimated numbers of CWTs recovered by fishery; and 2) estimates of total catch by fishery.

2.1.1 Recovery Data

CWT recovery data for the years 1984 to 1991 were obtained from the Mark Recovery Program (MRP) database on the VAX computer located at the Canadian Department of Fisheries and Oceans Pacific Biological Station. Estimated recoveries (observed recoveries, expanded to account for catch sampling) were grouped by sets of fisheries which were specified by CoTC members representing each jurisdiction (Appendix A). Further modifications to this list of fisheries may occur pending closer examination of tag profiles in some fishing locations.

All tag codes contributing to fisheries from Southeast Alaska to California were included in the raw data sets for each year. The following information was included for each tag code:

- tag code;
- release site name and 19 character code;
- estimated recoveries by fishery;
- release date(s) - when available, a start date and end date;
- total observed recoveries across all fisheries;
- release type - P (production), E (experimental), B (both production and experimental) and M (management information).

Recoveries included all coho CWTs reported by calendar year, regardless of the age of fish. All releases were used, regardless of production type or dates of release, except for situations where release sites were not defined. This occurred in several years when fish were released into unspecified locations off coastal Oregon.

2.1.2 Catch Data

Catch data for the years 1984 to 1991 were obtained from catch sample records in the MRP data base. Catches were verified by the appropriate agency representatives on the CoTC.

2.2 Treatment of CWT Recovery Data

2.2.1 Preliminary Screening

CWT recovery data collected during a calendar year were screened using two general criteria:

1) CWT recoveries were first grouped on the basis of release site. Only release sites having codes accounting for at least 30 observed recoveries in all fisheries were used in the analysis. This screening was applied to eliminate the large random variation that can be due to small numbers of recoveries.

2) Estimated recoveries of all tag codes were summed for each fishery. Fisheries were excluded if fewer than a total of 50 estimated tags were recovered. This screening was applied to exclude small fisheries that might have highly biased samples of the contributing stocks. In addition, portions of fisheries believed to disproportionately harvest some stocks within a production area were excluded from this interim analysis - Puget Sound net fisheries not included in Appendix A, Area 4/4A net fisheries along the Washington coast, the Southwest Vancouver Island, Northwest Vancouver Island, and Queen Charlotte Islands net fisheries in British Columbia and the Southeast Alaska District 107/108 net fishery. This exclusion was necessary because the stock composition estimation models are based on differences between distribution patterns of CWT recoveries. These distribution patterns represent hatchery and wild fish, both tagged and untagged, from a production area. Since all stocks within production areas were not tagged and since the primary focus of interest was centered in estimation of stock compositions in mixed-stock fisheries, CWT recoveries from fisheries targeting on hatchery production were excluded to increase the likelihood that the CWT distribution pattern would be representative of the set of stocks originating in a given production area.

2.2.2 Grouping into Default Production Areas

For each calendar year, CWT recovery data for all release sites passing the first screening criteria were grouped into 38 default production areas that were defined by the work group members. Generally, the production areas aggregate proximate release sites where CWT groups are assumed to have similar fishery distribution patterns. After the screening process described above, the recoveries by fishery were combined for all sites within a default production area to produce a single recovery profile. Appendix B summarizes the release sites included in the analyses, by default production area and the total number of estimated recoveries for all codes in all included fisheries.

2.2.3 Aggregation of Default Production Areas into Stocks

If the distributions of recoveries for two or more of the default production areas are highly similar (i.e. strongly correlated) then the procedures used to estimate stock composition can lead to the assignment of catch to one group at the expense of another. To reduce this problem, the work group used hierarchical clustering to group the default production areas. Estimated recoveries for each default production area were converted to proportions and a matrix of Euclidean distances between default production areas was generated. Default production areas were clustered using an average centroid linkage procedure. Clusters were defined using a distance of 0.3 for all years. If clusters grouped Canadian and U.S. default production areas, then those clusters were manually separated. In most years, mixed nation groupings were generated in the Taku/Transboundary area and in the Strait of Georgia/Puget Sound area. This procedure generally produced 20 to 25 clustered groups; both the number of stock groups and the specific default production areas included varied from year to year because of differences in CWT distribution patterns. CWT recovery data, aggregated for the clustered groups, are termed "stocks" for purposes of estimating stock compositions.

2.2.4 Adequacy of CWT Recovery Data

CWT recovery data are available for virtually all U.S. and Canadian Southern Panel area default production areas for the years 1984 through 1991. The CoTC believes that the available data are sufficient to generate reliable estimates of stock composition for the Southern Panel area for all of these years. The potential impact of the lack of complete data (e.g., Thompson production area in 1985) on stock composition estimates will be investigated by the CoTC in its future work, as well as the feasibility of applying the estimation methodologies to data prior to 1984.

In the Northern Panel area, CWT coverage is very sparse for the Nass/Skeena/North Coastal production areas in 1986 and non-existent in 1984 and 1985. Therefore, the CoTC believes that available data are only sufficient to generate reliable estimates of stock composition for Northern Panel area fisheries for the years 1987 through 1991. Tagging is sparse in the Northern Boundary area relative to the number of stocks present. It is possible that stocks with distinctive characteristics that affect their harvest distributions are not represented by tags. Most default stock groups in Southeast Alaska included at least one or more tagged stocks every year since 1987. An exception is the Yakutat group which was not tagged during 1987-1991.

2.3 Methods For Estimating Stock Composition

2.3.1 Estimation Model

A generalized mathematical optimization model and computer software developed through the bilateral research effort was employed to estimate stock compositions (Sibert and Fournier, 1991). The CWT recoveries in a fishery can be estimated as:

$$T_{ij} = \frac{C_i \, q_{ij} d_{ij} \exp(v_i)}{PEF_j} \qquad (2.1)$$

where,

i : fishery (1...,n);
j : stock (1...,s);
T_{ij} : number of tag recoveries for stock j in fishery i;
PEF_j : production expansion factor for stock j;
d_{ij} : multiplicative deviation in the proportion tagged for stock j in fishery i;
q_{ij} : proportion of the catch in the ith fishery which consists of tag group j fish;
C_i : reported catch in fishery i;
v_i : normally distributed random variable with mean 0, associated with the estimate of catch.

In practice, this theoretical model is often over-parameterized; it is not possible to reliably estimate all of the parameters because the available data do not provide sufficient degrees of freedom.

To simplify the estimation problem, a model was developed in which: 1) all stocks contributing to the fisheries were assumed to be tagged by representative tag groups; and 2) variation in the ratio of tagged to untagged fish for each stock was minimal (i.e., $d_{ij}=1$). The *PEF*s could then be estimated, as suggested by Shaul and Clark (1990), using a least squares model of the form:

$$C_i = \Sigma_j PEF_j T_{ij} + e_i \qquad (2.2)$$

where,

e_i : error in estimate of catch.

The work group has evaluated the performance of several types of mathematical optimization models to generate stock composition estimates. Current efforts are focusing on two general types of models: 1) Linear Programming (LP); and 2) Least Squares (LS).

The LP model was employed by the CoTC to generate its first estimates of coho stock composition for Southern Panel area fisheries (TCCOHO (89)-1). Further investigation by the work group has indicated that the LP model does not perform as well as the LS model. The structure of the LP model, combined with the characteristics of the fishery and stock groups, results in ***PEF***s that are constrained by only a few fisheries, frequently those involving terminal or near-terminal areas. Because the data preparation methods employed in the analysis often combined fisheries where tagged fish within a stock were disproportionately harvested, much of the catch could not be allocated to a particular stock and was hence of "unknown" origin.

The work group has determined that LS models currently provide the most promising avenue for further development. The least squares approach to parameter estimation has been extensively studied and well documented (Titterington, et. al. 1985).

The form of the LS model employed to generate the interim stock composition estimates presented in this report is termed "Constrained Least Squares" (CLS). The objective of the model is to find the ***PEF***s that minimize the sum of squares of the differences between the reported and estimated catches (e_is in equation 2.2) subject to a requirement that all ***PEF***s must at least account for recovered CWTs. In mathematical terms, this model can be expressed as:

$$MINIMIZE \sum_{i=1}^{n} (C_i - \sum_{j=1}^{s} PEF_j T_{ij})^2 \qquad (2.3)$$

subject to:

$PEF_j \geq 1.0$ for all stocks

Several types of LS models are under investigation. An unconstrained LS model provides the best estimates in a mathematical sense, since the sum of the squared deviations from reported catches is minimized. However, this model can produce negative ***PEF***s for some stocks, a biological impossibility. At the present time, we have therefore employed a constrained LS model to generate interim stock composition estimates.

The need to impose a constraint on the ***PEF***s is an indication of a problem with the data used to generate stock composition estimates. The ***PEF*** parameter estimates will be of poor quality (negative, biased, or with large variance) if a stock group has a catch distribution which is a linear combination of one or more of the other groups. This may be referred to as ill-conditioning, or multicollinearity, which results in aliasing of the parameters estimated by the model. Errors in the estimates of catch and problems with the representativeness of tagging could also cause problems when applying this methodology.

The clustering process described in Section 2.2 is one method of addressing the problem of ill-conditioning. The cluster distance is not a direct measure of collinearity within the dataset; consequently, it may be possible to improve stock groupings by applying a direct measure of collinearity, such as the Gauss-Jordan sweep operator (Clarke, 1982). This approach was

investigated but has not been developed to the point where stock groups can be readily replicated by different individuals using mechanistic procedures.

The clustering procedure provides a mechanistic algorithm that can be readily applied by different individuals to generate the same stock groups for analysis and was, therefore, selected for generating the interim estimates of stock composition. Ultimately, the objective should be to find the best-fitting model and insure that the grouping process is well documented.

2.3.2 Reported vs. CLS-Estimates of Catch

The catch of all stocks in a fishery, as estimated by the CLS model, commonly deviates from catches reported by agencies. The work group assumed that agency reported catches were accurate. Since nearly all production areas contributing to Southern Panel area fisheries are represented by tagged releases, the work group assumed that differences were due to factors not included in the model, such as variation in mark/unmarked ratios in fisheries and catch sampling. The validity of these assumptions is under investigation. For purposes of estimating interceptions, agency reported catches were apportioned to U.S. and Canadian stocks according to the proportions estimated by the CLS model. For example, a model estimate of 30% Canadian, 30% U.S., and 40% unknown origin in a fishery would be modified to 50% Canadian, 50% U.S., and 0% unknown origin. Biased estimates of interceptions could result if the proportions of unrepresented stock groups differ from the proportions attributed to each country's tagged stocks included in the model.

3.0 RESULTS

Stock composition estimates are presented for Southern Panel area fisheries in Tables 1 through 8 and for Northern Panel area fisheries in Tables 9 through 13. Stock groupings used to generate these estimates are presented in Appendix C. A variety of models and stock groupings were explored by the work group. Estimates of interceptions resulting from different models are summarized in Tables 14 and 15 (NOTE: These estimates of total interceptions are provided only to illustrate the similarity of results; they have not been adjusted to correct for differences between model estimates of catch and catches reported by management agencies. From the perspective of estimating interception levels, results of LS models (both constrained and unconstrained) using different techniques to produce the stock groupings are quite similar. This stable behavior contrasts markedly with variable results of LP models and increases the confidence of the work group that further investigation would most productively be directed at continued development of the LS class of models.

Table 1. INTERIM Estimates of Coho Catch Composition for 1984 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	226130	92.5	7.5	209209	16921
NWVI	Troll	503757	80.4	19.6	404952	98805
SWVI	Troll	1668409	40.7	59.3	678419	989990
Georgia Strait	Troll	80416	83.6	16.4	67238	13178
Johnstone Strait	Net	118071	92.4	7.6	109139	8932
Georgia Strait	Net	13563	86.1	13.9	11679	1884
Fraser	Net	9194	91.7	8.3	8429	765
Juan de Fuca	Net	74851	33.3	66.7	24905	49946
Juan de Fuca	Sport	41826	57.5	42.5	24040	17786
Northern Georgia Strait	Sport	318302	90.3	9.7	287288	31014
Southern Georgia Strait	Sport	83462	81.5	18.5	68009	15453
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	54833	25.6	74.4	14045	40788
Grays Harbor	Troll/Sport	12379	2.3	97.7	282	12097
Columbia River	Troll/Sport	49167	9.4	90.6	4606	44561
Other Oregon Ocean	Troll/Sport	120678	7.5	92.5	9054	111624
California	Troll	47049	0.0	100.0	0	47049
California	Sport	19005	0.0	100.0	0	19005
PUGET SOUND						
Juan de Fuca	Troll/Sport	59106	28.7	71.3	16992	42114
Juan de Fuca	Net	46895	22.7	77.3	10633	36262
Nooksack/Samish Marine	Net	132796	4.3	95.7	5757	127039
Skagit Freshwater	Net	7154	0.0	100.0	0	7154
Stillaguamish/Snohomish	Net	38496	0.1	99.9	28	38468
Hood Canal Marine	Net	23481	0.2	99.8	51	23430
South Puget Sound Marine	Net	171761	0.2	99.8	330	171431
Area 7/7A	Net	24597	53.4	46.6	13143	11454
Area 8	Sport	6575	0.0	100.0	0	6575
Area 9	Sport	36032	1.0	99.0	371	35661
Area 10 & 11	Sport	24384	0.2	99.8	48	24336
Area 13	Sport	9851	0.0	100.0	0	9851
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	29486	0.0	100.0	0	29486
Grays Harbor Marine	Net	3218	0.0	100.0	0	3218
Grays Harbor Freshwater	Net	9834	0.0	100.0	0	9834
Willapa Bay	Net	50674	0.0	100.0	0	50674
Columbia River	Net/Sport	239612	0.0	100.0	0	239612
Buoy 10	Sport	47708	1.3	98.7	633	47075
INTERCEPTION SUMMARY						
Canada of U.S.	1244674					
U.S. of Canada	75973					

Table 2. INTERIM Estimates of Coho Catch Composition for 1985 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	89266	50.8	49.2	45348	43918
NWVI	Troll	377035	23.4	76.6	88089	288946
SWVI	Troll	1012020	13.5	86.5	137099	874921
Georgia Strait	Troll	191207	67.4	32.6	128897	62310
Johnstone Strait	Net	145694	94.1	5.9	137107	8587
Georgia Strait	Net	31764	78.2	21.8	24836	6928
Fraser	Net	18229	77.2	22.8	14079	4150
Juan de Fuca	Net	224735	18.5	81.5	41486	183249
Juan de Fuca	Sport	25304	34.9	65.1	8833	16471
Northern Georgia Strait	Sport	569722	81.6	18.4	465056	104666
Southern Georgia Strait	Sport	133171	68.4	31.6	91135	42036
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	75817	8.2	91.8	6207	69610
Quillayute	Troll/Sport	66374	11.3	88.7	7510	58864
Grays Harbor	Troll/Sport	159947	5.1	94.9	8216	151731
Columbia River	Troll/Sport	138810	1.9	98.1	2622	136188
Other Oregon Ocean	Troll/Sport	210772	0.5	99.5	1056	209716
California	Troll	12057	0.0	100.0	0	12057
California	Sport	15827	0.0	100.0	0	15827
PUGET SOUND						
Juan de Fuca	Troll/Sport	90317	6.5	93.5	5914	84403
Juan de Fuca	Net	85973	13.5	86.5	11589	74384
Nooksack/Samish Marine	Net	156022	1.0	99.0	1569	154453
Skagit Freshwater	Net	13086	1.1	98.9	138	12948
Stillaguamish/Snohomish	Net	93333	0.2	99.8	155	93178
Hood Canal Marine	Net	27522	0.0	100.0	0	27522
South Puget Sound Marine	Net	285425	0.2	99.8	531	284894
Area 7/7A	Net	141889	41.2	58.8	58483	83406
Area 7	Sport	8612	10.9	89.1	942	7670
Area 8	Sport	8941	0.0	100.0	0	8941
Area 9	Sport	39535	0.9	99.1	371	39164
Area 10 & 11	Sport	31515	0.7	99.3	216	31299
Area 13	Sport	6152	0.0	100.0	0	6152
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	25789	0.8	99.2	197	25592
Willapa Bay	Net	35353	0.0	100.0	0	35353
Columbia River	Net/Sport	209408	0.0	100.0	0	209408
Buoy 10	Sport	16482	0.0	100.0	0	16482

INTERCEPTION SUMMARY	
Canada of U.S.	1636182
U.S. of Canada	105716

Table 3. INTERIM Estimates of Coho Catch Composition for 1986 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	430083	81.4	18.6	350152	79931
NWVI	Troll	610502	57.2	42.8	348942	261560
SWVI	Troll	1546331	19.0	81.0	294009	1252322
Georgia Strait	Troll	181419	76.4	23.6	138533	42886
Johnstone Strait	Net	123059	96.3	3.7	118466	4593
Georgia Strait	Net	16237	99.3	0.7	16117	120
Fraser	Net	32790	95.9	4.1	31439	1351
Juan de Fuca	Net	202501	12.5	87.5	25225	177276
Juan de Fuca	Sport	34706	31.1	68.9	10795	23911
Northern Georgia Strait	Sport	442432	82.4	17.6	364427	78005
Southern Georgia Strait	Sport	94842	73.0	27.0	69276	25566
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	81477	10.1	89.9	8269	73208
Quillayute	Troll/Sport	42814	7.8	92.2	3332	39482
Grays Harbor	Troll/Sport	95730	1.7	98.3	1661	94069
Columbia River	Troll/Sport	165787	0.5	99.5	898	164889
Other Oregon Ocean	Troll/Sport	599037	0.3	99.7	1826	597211
California	Troll	36355	0.3	99.7	117	36238
California	Sport	18728	0.0	100.0	0	18728
PUGET SOUND						
Juan de Fuca	Troll/Sport	146455	8.2	91.8	12048	134407
Juan de Fuca	Net	71700	12.1	87.9	8699	63001
Nooksack/Samish Marine	Net	136777	2.1	97.9	2826	133951
Skagit Freshwater	Net	33215	0.1	99.9	25	33190
Stillaguamish/Snohomish	Net	114268	0.3	99.7	314	113954
Hood Canal Marine	Net	60253	0.0	100.0	0	60253
South Puget Sound Marine	Net	295000	0.3	99.7	1030	293970
Area 7/7A	Net	103754	63.9	36.1	66330	37424
Area 7	Sport	12420	22.6	77.4	2808	9612
Area 8	Sport	11698	0.0	100.0	0	11698
Area 9	Sport	45419	0.0	100.0	0	45419
Area 10 & 11	Sport	38713	0.5	99.5	193	38520
Area 13	Sport	9744	0.0	100.0	0	9744
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	52171	0.0	100.0	0	52171
Grays Harbor Marine	Net	12639	0.0	100.0	0	12639
Grays Harbor Freshwater	Net	38641	0.0	100.0	0	38641
Willapa Bay	Net	117301	0.0	100.0	0	117301
Columbia River	Net/Sport	1052053	0.0	100.0	0	1052053
Buoy 10	Sport	78627	0.2	99.8	118	78509
INTERCEPTION SUMMARY						
Canada of U.S.	1947521					
U.S. of Canada	110494					

Table 4. INTERIM Estimates of Coho Catch Composition for 1987 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	141049	84.7	15.3	119462	21587
NWVI	Troll	525108	72.1	27.9	378614	146494
SWVI	Troll	1295914	43.3	56.7	561692	734222
Georgia Strait	Troll	217538	75.7	24.3	164630	52908
Johnstone Strait	Net	57916	81.3	18.7	47073	10843
Georgia Strait	Net	14045	88.0	12.0	12360	1685
Fraser	Net	6528	96.9	3.1	6323	205
Juan de Fuca	Net	216400	24.5	75.5	52971	163429
Juan de Fuca	Sport	61559	39.5	60.5	24324	37235
Northern Georgia Strait	Sport	472127	78.2	21.8	369161	102966
Southern Georgia Strait	Sport	107886	74.6	25.4	80472	27414
WCVI	Sport	52987	87.7	12.3	46494	6493
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	84817	18.6	81.4	15734	69083
Quillayute	Troll/Sport	25386	22.5	77.5	5704	19682
Grays Harbor	Troll/Sport	86255	19.0	81.0	16372	69883
Columbia River	Troll/Sport	102032	2.9	97.1	2938	99094
Other Oregon Ocean	Troll/Sport	495756	1.9	98.1	9410	486346
California	Troll	43687	0.0	100.0	0	43687
California	Sport	47253	0.0	100.0	0	47253
PUGET SOUND						
Juan de Fuca	Troll/Sport	134613	10.6	89.4	14244	120369
Juan de Fuca	Net	62857	17.2	82.8	10799	52058
Nooksack/Samish Marine	Net	227895	6.0	94.0	13770	214125
Skagit Freshwater	Net	12368	3.5	96.5	435	11933
Stillaguamish/Snohomish	Net	168748	0.0	100.0	0	168748
Hood Canal Marine	Net	56968	0.2	99.8	101	56867
South Puget Sound Marine	Net	361099	0.7	99.3	2485	358614
Area 7/7A	Net	79314	66.6	33.4	52804	26510
Area 7	Sport	8146	51.7	48.3	4213	3933
Area 8	Sport	8824	0.0	100.0	0	8824
Area 9	Sport	43012	0.1	99.9	47	42965
Area 10 & 11	Sport	37621	1.8	98.2	676	36945
Area 12	Sport	1756	0.0	100.0	0	1756
Area 13	Sport	22988	0.0	100.0	0	22988
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	31890	0.0	100.0	0	31890
Grays Harbor Marine	Net	17383	0.0	100.0	0	17383
Grays Harbor Freshwater	Net	34112	0.0	100.0	0	34112
Willapa Bay	Net	63092	0.0	100.0	0	63092
Columbia River	Net/Sport	194727	0.0	100.0	0	194727
Buoy 10	Sport	31665	2.9	97.1	918	30747
INTERCEPTION SUMMARY						
Canada of U.S.	1305481					
U.S. of Canada	150650					

Table 5. INTERIM Estimates of Coho Catch Composition for 1988 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	145363	85.1	14.9	123703	21660
NWVI	Troll	555914	65.8	34.2	365616	190298
SWVI	Troll	1039887	40.2	59.8	417821	622066
Georgia Strait	Troll	256480	89.6	10.4	229839	26641
Johnstone Strait	Net	82660	95.4	4.6	78852	3808
Georgia Strait	Net	3478	99.5	0.5	3459	19
Fraser	Net	26899	99.5	0.5	26768	131
Juan de Fuca	Net	56719	25.4	74.6	14433	42286
Juan de Fuca	Sport	75878	35.0	65.0	26522	49356
Northern Georgia Strait	Sport	824298	88.1	11.9	725887	98411
Southern Georgia Strait	Sport	184614	83.1	16.9	153326	31288
WCVI	Sport	23346	92.7	7.3	21653	1693
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	57276	21.1	78.9	12073	45203
Quillayute	Troll/Sport	16088	19.3	80.7	3100	12988
Grays Harbor	Troll/Sport	65363	9.1	90.9	5977	59386
Columbia River	Troll/Sport	34138	3.4	96.6	1167	32971
Other Oregon Ocean	Troll/Sport	837165	3.4	96.6	28464	808701
California	Troll	50962	0.0	100.0	0	50962
California	Sport	34361	0.0	100.0	0	34361
PUGET SOUND						
Juan de Fuca	Troll/Sport	116935	20.4	79.6	23897	93038
Juan de Fuca	Net	20869	26.3	73.7	5485	15384
Nooksack/Samish Marine	Net	168710	3.4	96.6	5753	162957
Skagit Freshwater	Net	14619	0.3	99.7	42	14577
Stillaguamish/Snohomish	Net	80006	0.5	99.5	390	79616
Hood Canal Marine	Net	5331	0.0	100.0	0	5331
South Puget Sound Marine	Net	474459	1.5	98.5	7074	467385
Area 7/7A	Net	83844	61.3	38.7	51391	32453
Area 7	Sport	12500	68.6	31.4	8571	3929
Area 8	Sport	7413	1.8	98.2	132	7281
Area 9	Sport	26680	1.9	98.1	498	26182
Area 10 & 11	Sport	25758	2.8	97.2	715	25043
Area 13	Sport	6074	0.0	100.0	0	6074
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	23145	0.0	100.0	0	23145
Grays Harbor Marine	Net	3549	0.0	100.0	0	3549
Grays Harbor Freshwater	Net	20862	0.0	100.0	0	20862
Willapa Bay	Net	49236	0.0	100.0	0	49236
Columbia River	Net/Sport	427197	0.0	100.0	0	427197
Buoy 10	Sport	97716	1.1	98.9	1076	96640
INTERCEPTION SUMMARY						
Canada of U.S.	1087657					
U.S. of Canada	155805					

Table 6. INTERIM Estimates of Coho Catch Composition for 1989 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	94927	70.9	29.1	67296	27631
NWVI	Troll	565870	42.2	57.8	238947	326923
SWVI	Troll	1362932	23.7	76.3	323384	1039548
Georgia Strait	Troll	71837	81.9	18.1	58868	12969
Johnstone Strait	Net	108425	89.1	10.9	96583	11842
Georgia Strait	Net	5020	92.9	7.1	4663	357
Fraser	Net	9613	93.3	6.7	8964	649
Juan de Fuca	Net	336233	21.2	78.8	71390	264843
Juan de Fuca	Sport	89427	28.5	71.5	25508	63919
Northern Georgia Strait	Sport	332647	85.2	14.8	283291	49356
Southern Georgia Strait	Sport	75149	81.7	18.3	61394	13755
WCVI	Sport	85815	46.5	53.5	39907	45908
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	135191	6.9	93.1	9289	125902
Quillayute	Troll/Sport	16093	3.7	96.3	598	15495
Grays Harbor	Troll/Sport	104331	0.4	99.6	413	103918
Columbia River	Troll/Sport	210024	0.1	99.9	266	209758
Other Oregon Ocean	Troll/Sport	1342332	0.1	99.9	1368	1340964
California	Troll	42189	0.0	100.0	0	42189
California	Sport	49605	0.0	100.0	0	49605
PUGET SOUND						
Juan de Fuca	Troll/Sport	150390	8.4	91.6	12643	137747
Juan de Fuca	Net	64835	15.7	84.3	10173	54662
Nooksack/Samish Marine	Net	109301	0.7	99.3	808	108493
Skagit Freshwater	Net	10457	0.5	99.5	50	10407
Stillaguamish/Snohomish	Net	43572	0.0	100.0	0	43572
Hood Canal Marine	Net	6973	0.0	100.0	0	6973
South Puget Sound Marine	Net	247003	0.6	99.4	1573	245430
Area 7/7A	Net	114306	48.5	51.5	55437	58869
Area 7	Sport	5375	37.6	62.4	2019	3356
Area 8	Sport	6310	0.4	99.6	28	6282
Area 9	Sport	29151	2.0	98.0	593	28558
Area 10 & 11	Sport	29010	0.0	100.0	0	29010
Area 13	Sport	1932	0.0	100.0	0	1932
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	19661	0.0	100.0	0	19661
Grays Harbor Freshwater	Net	24951	0.0	100.0	0	24951
Columbia River	Net/Sport	433166	0.0	100.0	0	433166
Buoy 10	Sport	55457	0.0	100.0	0	55457

INTERCEPTION SUMMARY	
Canada of U.S.	1857700
U.S. of Canada	95258

Table 7. INTERIM Estimates of Coho Catch Composition for 1990 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	165128	89.9	10.1	148469	16659
NWVI	Troll	729516	66.8	33.2	487305	242211
SWVI	Troll	1134092	45.6	54.4	517046	617046
Georgia Strait	Troll	163202	92.2	7.8	150450	12752
Johnstone Strait	Net	95931	94.6	5.4	90794	5137
Georgia Strait	Net	8014	97.6	2.4	7823	191
Fraser	Net	12556	90.4	9.6	11354	1202
Juan de Fuca	Net	154133	39.8	60.2	61278	92855
Juan de Fuca	Sport	69409	56.8	43.2	39405	30004
Northern Georgia Strait	Sport	493105	90.0	10.0	443794	49311
Southern Georgia Strait	Sport	67519	88.3	11.7	59624	7895
WCVI	Sport	46544	91.3	8.7	42510	4034
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	141694	26.3	73.7	37306	104388
Quillayute	Troll/Sport	33261	9.1	90.9	3033	30228
Grays Harbor	Troll/Sport	112366	4.6	95.4	5133	107233
Columbia River	Troll/Sport	158183	0.5	99.5	830	157353
Other Oregon Ocean	Troll/Sport	275949	0.0	100.0	0	275949
California	Troll	60910	0.0	100.0	0	60910
California	Sport	47727	0.0	100.0	0	47727
PUGET SOUND						
Juan de Fuca	Troll/Sport	229338	24.9	75.1	57100	172238
Juan de Fuca	Net	41602	21.7	78.3	9031	32571
Nooksack/Samish Marine	Net	91538	8.4	91.6	7688	83850
Skagit Freshwater	Net	13492	0.0	100.0	0	13492
Stillaguamish/Snohomish	Net	150051	0.3	99.7	439	149612
South Puget Sound Marine	Net	309161	0.9	99.1	2736	306425
Area 7/7A	Net	59903	55.7	44.3	33372	26531
Area 7	Sport	5166	55.1	44.9	2846	2320
Area 8	Sport	7105	6.3	93.7	449	6656
Area 9	Sport	35264	0.4	99.6	140	35124
Area 10 & 11	Sport	39538	0.3	99.7	114	39424
Area 13	Sport	2497	0.0	100.0	0	2497
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	22623	0.0	100.0	0	22623
Grays Harbor Marine	Net	3827	0.0	100.0	0	3827
Grays Harbor Freshwater	Net	41431	0.0	100.0	0	41431
Columbia River	Net/Sport	98177	0.0	100.0	0	98177
Buoy 10	Sport	13178	0.0	100.0	0	13178

INTERCEPTION SUMMARY	
Canada of U.S.	1079297
U.S. of Canada	160217

Table 8. INTERIM Estimates of Coho Catch Composition for 1991 Southern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
South/Central	Troll	47384	79.5	20.5	37678	9706
NWVI	Troll	664646	65.8	34.2	437145	227501
SWVI	Troll	1225300	42.4	57.6	519675	705625
Georgia Strait	Troll	11583	97.7	2.3	11317	266
Johnstone Strait	Net	63778	94.4	5.6	60222	3556
Georgia Strait	Net	7168	89.9	10.1	6445	723
Fraser	Net	10085	98.9	1.1	9977	108
Juan de Fuca	Net	180362	39.6	60.4	71381	108981
Juan de Fuca	Sport	110590	67.0	33.0	74042	36548
Northern Georgia Strait	Sport	34977	95.5	4.5	33393	1584
Southern Georgia Strait	Sport	11544	97.7	2.3	11284	260
WCVI	Sport	80839	75.4	24.6	60984	19855
UNITED STATES FISHERIES						
OCEAN						
Cape Flattery	Troll/Sport	109495	26.8	73.2	29358	80137
Quillayute	Troll/Sport	27019	8.5	91.5	2296	24723
Grays Harbor	Troll/Sport	106636	7.1	92.9	7551	99085
Columbia River	Troll/Sport	140936	1.5	98.5	2154	138782
Other Oregon Ocean	Troll/Sport	516521	1.7	98.3	8720	507801
California	Troll	83895	0.0	100.0	0	83895
California	Sport	69134	0.1	99.9	60	69074
PUGET SOUND						
Juan de Fuca	Troll/Sport	197590	24.0	76.0	47472	150118
Juan de Fuca	Net	36468	27.8	72.2	10132	26336
Nooksack/Samish Marine	Net	48699	12.1	87.9	5879	42820
Skagit Freshwater	Net	3622	0.0	100.0	0	3622
Stillaguamish/Snohomish	Net	59870	0.1	99.9	65	59805
South Puget Sound Marine	Net	145457	2.7	97.3	3883	141574
Area 7/7A	Net	62001	76.9	23.1	47671	14330
Area 7	Sport	3953	85.0	15.0	3360	593
Area 8	Sport	7659	0.0	100.0	0	7659
Area 9	Sport	20971	1.0	99.0	213	20758
Area 10 & 11	Sport	25696	0.1	99.9	35	25661
WASHINGTON COASTAL						
N Washington Coastal Freshwater	Net	49663	0.2	99.8	83	49580
Grays Harbor Marine	Net	47764	0.0	100.0	0	47764
Grays Harbor Freshwater	Net	77533	0.0	100.0	0	77533
Columbia River	Net/Sport	511293	0.0	100.0	0	511293
Buoy 10	Sport	144366	0.5	99.5	706	143660
INTERCEPTION SUMMARY						
Canada of U.S.	1114713					
U.S. of Canada	169638					

Table 9. INTERIM Estimates of Coho Catch Composition for 1987 Northern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area		Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES							
Northern		Troll	595733	93.2	6.8	555304	40429
North/Central		Troll	73441	94.5	5.5	69375	4066
Northern		Net	82160	98.6	1.4	80975	1185
Central		Net	96090	94.8	5.2	91070	5020
UNITED STATES FISHERIES							
Southwest quadrant		Troll	327484	27.2	72.8	89018	238466
Southeast quadrant		Troll	87385	72.8	27.2	63586	23799
Northwest quadrant		Troll	523140	9.9	90.1	51999	471141
Northeast quadrant		Troll	103166	17.2	82.8	17709	85457
District 115		Net	53630	0.0	100.0	0	53630
District 106		Net	37151	0.0	100.0	0	37151
Districts 101 & 102		Net	95678	32.5	67.5	31100	64578
District 113		Net	7784	0.0	100.0	0	7784
Districts 103 & 104		Net	69241	20.5	79.5	14211	55030
INTERCEPTION SUMMARY							
Canada of U.S.	50700						
U.S. of Canada	267623						

Table 10. INTERIM Estimates of Coho Catch Composition for 1988 Northern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
Northern	Troll	348039	92.6	7.4	322284	25755
North/Central	Troll	38493	95.3	4.7	36698	1795
Northern	Net	50648	97.7	2.3	49506	1142
Central	Net	109448	99.7	0.3	109134	314
UNITED STATES FISHERIES						
Southwest quadrant	Troll	116473	26.5	73.5	30825	85648
Southeast quadrant	Troll	47689	49.3	50.7	23534	24155
Northwest quadrant	Troll	288174	6.9	93.1	19884	268290
Northeast quadrant	Troll	47823	17.1	82.9	8159	39664
District 115	Net	81452	0.0	100.0	0	81452
District 111	Net	45094	0.0	100.0	0	45094
District 106	Net	14419	10.4	89.6	1502	12917
Districts 101 & 102	Net	49380	18.4	81.6	9105	40275
Districts 103 & 104	Net	106729	32.5	67.5	34652	72077
INTERCEPTION SUMMARY						
Canada of U.S.	29006					
U.S. of Canada	127661					

Table 11. INTERIM Estimates of Coho Catch Composition for 1989 Northern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
Northern	Troll	570854	94.4	5.6	538982	31872
North/Central	Troll	28376	94.8	5.2	26905	1471
Northern	Net	143001	95.2	4.8	136182	6819
Central	Net	36882	99.5	0.5	36689	193
UNITED STATES FISHERIES						
Southwest quadrant	Troll	257868	37.0	63.0	95409	162459
Southeast quadrant	Troll	123316	61.1	38.9	75321	47995
Northwest quadrant	Troll	904796	10.8	89.2	97620	807176
Northeast quadrant	Troll	129531	18.7	81.3	24214	105317
District 115	Net	50307	0.0	100.0	0	50307
District 111	Net	51812	0.0	100.0	0	51812
District 106	Net	96827	7.8	92.2	7572	89255
Districts 101 & 102	Net	140091	22.3	77.7	31250	108841
Districts 112 & 114	Net	25887	8.5	91.5	2191	23696
District 113	Net	3710	0.0	100.0	0	3710
Districts 103 & 104	Net	183089	35.5	64.5	64998	118091
Districts 105 109 & 110	Net	26938	4.5	95.5	1221	25717

INTERCEPTION SUMMARY

Canada of U.S.	40355
U.S. of Canada	399796

Table 12. INTERIM Estimates of Coho Catch Composition for 1990 Northern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
Northern	Troll	974804	88.9	11.1	866924	107880
North/Central	Troll	89740	91.6	8.4	82194	7546
Northern	Net	129352	95.2	4.8	123136	6216
Central	Net	98262	99.3	0.7	97596	666
UNITED STATES FISHERIES						
Southwest quadrant	Troll	348587	36.9	63.1	128463	220124
Southeast quadrant	Troll	229697	38.8	61.2	89075	140622
Northwest quadrant	Troll	1085192	13.6	86.4	147586	937606
Northeast quadrant	Troll	168205	12.3	87.7	20689	147516
District 115	Net	63070	0.0	100.0	0	63070
District 111	Net	67530	0.0	100.0	0	67530
District 106	Net	172604	4.8	95.2	8313	164291
Districts 101 & 102	Net	171242	18.6	81.4	31879	139363
Districts 112 & 114	Net	20566	3.3	96.7	684	19882
Districts 103 & 104	Net	223609	58.9	41.1	131795	91814
Districts 105 109 & 110	Net	23037	5.8	94.2	1329	21708
INTERCEPTION SUMMARY						
Canada of U.S.	122308					
U.S. of Canada	559813					

Table 13. INTERIM Estimates of Coho Catch Composition for 1991 Northern Panel Fisheries based on Constrained Least Squares Model.

Fishery/Area	Gear	Reported Catch	<- Composition -> % CAN	% U.S.	<---- Catch ---> CAN Origin	U.S. Origin
CANADIAN FISHERIES						
Northern	Troll	982298	92.2	7.8	905755	76543
North/Central	Troll	58344	97.2	2.8	56732	1612
Northern	Net	179738	97.4	2.6	175002	4736
Central	Net	54137	98.9	1.1	53549	588
UNITED STATES FISHERIES						
Southwest quadrant	Troll	288159	47.4	52.6	136524	151635
Southeast quadrant	Troll	255108	56.2	43.8	143368	111740
Northwest quadrant	Troll	1015355	29.3	70.7	297499	717856
Northeast quadrant	Troll	161143	8.7	91.3	13966	147177
District 115	Net	128365	0.0	100.0	0	128365
District 111	Net	126439	0.0	100.0	0	126439
District 106	Net	200795	2.5	97.5	5014	195781
Districts 101 & 102	Net	184427	40.1	59.9	73887	110540
Districts 112 & 114	Net	42517	2.2	97.8	945	41572
Districts 103 & 104	Net	237337	59.9	40.1	142161	95176
Districts 105 109 & 110	Net	65053	3.7	96.3	2402	62651
INTERCEPTION SUMMARY						
Canada of U.S. 83479						
U.S. of Canada 815766						

Table 14. Comparison of interception estimates for Southern Panel fisheries, 1984-1991, generated by alternative LS and LP models and stock-grouping procedures. (NOTE: These interception estimates have not been adjusted to reported catches; consequently, estimates reported for the CLS Clustered model are not identical to those presented in Tables 1-8.*) All Constrained Least Squares (CLS) models are required to have *PEF*s of at least 1.0. LS is a LS-type model with unconstrained *PEF*s. Unclustered = estimates generated on the basis of default production areas. Clustered = stock groupings based on hierarchical Euclidian clustering algorithms. Sweep = stocks groupings resulting from manual evaluation of sweep statistics and correlations between stock distribution patterns.

Year	Nonlinear Model	Canadian catch of U.S. coho	U.S. Catch of Canadian Coho	Linear Model	Canadian Catch of U.S. Coho	U.S. Catch of Canadian Coho
1984	CLS Unclustered	1,326,126	57,006	LP Unclustered	1,056,525	75,119
	CLS Clustered	1,249,260	78,029	LP Clustered	788,888	52,812
	CLS Sweep	1,426,651	49,720	LP Sweep	785,226	50,253
	LS Sweep	1,419,612	49,874			
1985	CLS Unclustered	1,643,669	87,307	LP Unclustered	1,240,235	94,472
	CLS Clustered	1,611,765	92,372	LP Clustered	1,244,434	80,246
	CLS Sweep	1,668,658	84,447	LP Sweep	1,241,710	83,450
	LS Sweep	1,743,836	83,617			
1986	CLS Unclustered	1,546,209	203,354	LP Unclustered	1,387,300	168,018
	CLS Clustered	1,944,234	86,019	LP Clustered	1,100,614	89,630
	CLS Sweep	2,046,896	60,341	LP Sweep	1,238,126	77,878
	LS Sweep	2,038,623	60,888			
1987	CLS Unclustered	1,349,254	145,044	LP Unclustered	1,274,734	78,243
	CLS Clustered	1,308,754	147,901	LP Clustered	1,275,384	72,099
	CLS Sweep	1,299,746	232,215	LP Sweep	1,275,384	71,044
	LS Sweep	1,322,278	225,433			
1988	CLS Unclustered	1,093,193	174,355	LP Unclustered	1,036,927	108,447
	CLS Clustered	1,074,593	138,567	LP Clustered	1,035,021	130,023
	CLS Sweep	1,299,501	89,530	LP Sweep	475,357	45,814
	LS Sweep	1,378,568	63,890			
1989	CLS Unclustered	1,976,991	96,685	LP Unclustered	1,908,392	77,249
	CLS Clustered	1,867,663	85,660	LP Clustered	701,712	167,977
	CLS Sweep	1,892,968	90,225	LP Sweep	695,373	166,011
	LS Sweep	1,820,367	92,169			
1990	CLS Unclustered	1,136,934	136,749	LP Unclustered	1,284,631	52,970
	CLS Clustered	1,082,249	138,686	LP Clustered	597,792	158,926
	CLS Sweep	1,083,658	138,189	LP Sweep	594,501	158,927
	LS Sweep	1,029,083	136,806			
1991	CLS Unclustered	1,112,031	137,733	LP Unclustered	1,006,573	132,974
	CLS Clustered	1,091,002	175,766	LP Clustered	655,561	55,893
	CLS Sweep	1,069,402	181,504	LP Sweep	696,798	54,481
	LS Sweep	1,072,146	180,630			

** Based on preliminary analyses. Does not reflect some minor modifications to the input data (Southeast Alaska Districts 107 and 108 net fisheries were removed and the WCVI sport catch was updated. The Southeast Alaska Southern Inside production area was split into an early and later timing component).*

Table 15. Comparison of interception estimates for Northern Panel fisheries, 1987-1991, generated by alternative LS and LP models and stock-grouping procedures. (NOTE: These interception estimates have not been adjusted to reported catches; consequently, estimates reported for the CLS Clustered model are not identical to those presented in Tables 9-13.*) All Constrained Least Squares (CLS) models are required to have *PEF*s of at least 1.0. LS is a LS-type model with unconstrained *PEF*s. Unclustered = estimates generated on the basis of default production areas. Clustered = stock groupings based on hierarchical Euclidian clustering algorithms. Sweep = stocks groupings resulting from manual evaluation of sweep statistics and correlations between stock distribution patterns.

Year	Nonlinear Model	Canadian catch of U.S. coho	U.S. Catch of Canadian Coho	Linear Model	Canadian Catch of U.S. Coho	U.S. Catch of Canadian Coho
1987	CLS Unclustered	38,815	408,260	LP Unclustered	46,543	243,479
	CLS Clustered	43,129	278,493	LP Clustered	47,875	199,244
	CLS Sweep	43,357	274,749	LP Sweep	47,868	196,451
	LS Sweep	43,514	278,925			
1988	CLS Unclustered	18,399	209,883	LP Unclustered	12,343	253,205
	CLS Clustered	27,250	126,436	LP Clustered	25,768	122,842
	CLS Sweep	30,648	131,545	LP Sweep	25,343	122,416
	LS Sweep	29,787	126,503			
1989	CLS Unclustered	35,320	487,919	LP Unclustered	42,569	316,763
	CLS Clustered	42,621	399,858	LP Clustered	36,545	289,973
	CLS Sweep	44,789	405,311	LP Sweep	37,023	270,471
	LS Sweep	44,720	402,000			
1990	CLS Unclustered	118,160	654,349	LP Unclustered	116,597	670,173
	CLS Clustered	113,098	565,136	LP Clustered	118,544	565,840
	CLS Sweep	109,048	648,720	LP Sweep	118,935	545,548
	LS Sweep	107,617	651,167			
1991	CLS Unclustered	55,885	935,973	LP Unclustered	63,468	881,716
	CLS Clustered	78,720	813,274	LP Clustered	95,345	832,137
	CLS Sweep	71,481	891,636	LP Sweep	99,167	527,131
	LS Sweep	70,840	890,508			

** Based on preliminary analyses. Does not reflect some minor modifications to the input data (Southeast Alaska Districts 107 and 108 net fisheries were removed and the WCVI sport catch was updated. The Southeast Alaska Southern Inside production area was split into an early and later timing component).*

4.0 DISCUSSION

4.1 Interim Estimates

The interim stock composition estimates presented in this report represent the best available estimates of stock composition for Southern Panel and Northern Panel area fisheries harvesting coho. The CoTC will explore the feasibility of applying stock composition models for years prior to 1984. Additionally, the CoTC intends to continue development and refinement of methodologies and data; consequently, stock composition estimates will likely change as work progresses.

It is currently not possible, using the least squares model, to estimate separate *PEF*s for Canadian Taku River tagged releases and some adjacent Southeast Alaska tagged releases because of similarities in harvest distributions and the lack of tagging in some systems. For the purpose of providing interim estimates of stock composition, we have classified this aggregate stock as being of U.S. origin. In addition, we assume that the model also classifies harvests from other Transboundary River stocks as being of U.S. origin since these stocks are believed to have distributions similar to tagged Southeast Alaska stocks,.

4.2 Improving Quality of Estimates

The CoTC will continue to evaluate alternative methods which may improve the accuracy and precision of the estimates. Refinements to the LS-type models include the following alternatives:

1) Aggregation of Tag Codes - In the current analysis, stock groups were created by aggregating all tag codes within a production region. The similarity of stock groups was then evaluated using cluster analysis. However, when tag codes within a production region are aggregated, it is implicitly assumed that the tag groups within this aggregate have the same catch distribution. Alternatively, two stock groups, one including recoveries by targeting fisheries and one excluding such recoveries, could be incorporated into the model for each area where targeting on hatchery production occurs. Homogeneity of the tag codes within stock groups, and hence model performance, might be improved by conducting the tests of similarity at either the tag group or release site level. In addition, other techniques, such as principal components or ridge regression models (c.f. Montgomery and Peck, 1992), may be explored as a means of overcoming the ill-conditioning problem.

2) Aggregation of Default Production Areas - Cluster analysis was used to identify similarities in the catch distribution of stock groups. An alternative technique, the sweep operator (Clarke, 1982), is more consistent with least squares theory and may provide an improved method for identifying the appropriate aggregation of stock groups. Although the sweep operator was used for two sets of preliminary estimates, the CoTC elected to not use sweep techniques to generate interim estimates since the behavior of the model under alternative grouping procedures has not been fully investigated. It may be possible to overcome this collinearity problem (e.g., removing stocks, combining stocks that are strongly correlated, or adjusting the fisheries included in the model), but additional research is required.

3) Weighting of Tag Codes - When creating stock groups, tag codes are now combined by adding the recoveries. This may introduce bias into the results if the codes have different catch distributions and *PEF*s. Alternative methods of combining the tag codes should be examined, including weighting the codes so that each is equally represented in the aggregate stock group.

4) Constrained and Unconstrained Estimates - Constrained least squares estimates were used in the current analysis since it seems reasonable to assume that the *PEF*s for all stocks should be greater than 1.0. However, these estimates are not mathematically optimal since the deviations from the observed catches can be reduced in some instances by using negative *PEF*s. The necessity of constraining the *PEF*s implies that one or more of the assumptions of the methodology is being violated or that distribution data are ill-conditioned. The CoTC is investigating all potential sources of negative *PEF*s and the effect that they may be having on stock composition estimates.

5) Border Area Confounding - Puget Sound production areas often cluster with adjacent Fraser River or Strait of Georgia production areas. However, these groups are split into Canadian and U.S. components in our analysis. An evaluation of the effects of this procedure on estimates of stock composition is required. Transboundary area stocks could not be resolved into U.S. and Canadian components with the least squares model and the data available. Addressing this problem may require a different approach and collaboration with the Transboundary Technical Committee.

6) *PEF*s for Hatchery Stocks - Independent estimates of the *PEF*s for hatchery stocks may often be made by using either the proportion tagged at release or return. In some cases, these estimates may have a smaller error than estimates obtained from the least squares model. The CoTC is developing criteria which may be used to judge which hatcheries have data of sufficient quality to be used to estimate the *PEF*s. By removing fish of known origin from the model, it may be possible to increase the precision of remaining *PEF*s.

7) Selection of Fisheries to Include in Estimation Model- With the least squares estimator, a deviation of a given proportion from the reported catch is given less weight in small fisheries than in large fisheries. Although small fisheries are given less weight, the CoTC is investigating if these fisheries should be excluded to limit the effect of small sample error.

8) Bootstrap Estimates - A bootstrap approach may provide a method to estimate the variance of the *PEF* estimates and stock composition. Bootstrapping involves generation of many sets of CWT recovery data through re-random sampling of the observed recoveries by computer. The method used to randomly modify the data can be designed to reflect the expected natural variability of CWT data. This variability can be caused by tagging rates, catch sampling procedures, and fishery characteristics (e.g. size, timing, location, etc.). The CoTC is evaluating alternative methods for implementing bootstrap techniques.

9) Representative Tagging and Sampling - The current analysis assumes that representative tagging is present from all production regions and that every fishery is sampled for CWTs. The CoTC will continue to investigate the effect of these assumptions upon the estimated *PEF*s.

10) Fishery Stratification - Further stratification of Southeast Alaska troll fishing areas beyond the quadrant level may improve the ability to identify some stock groups, particularly in northern Southeast Alaska where many stocks are harvested only in the northwest quadrant.

11) Terminal Fisheries - Further review of fisheries in terminal or near-terminal areas is needed, particularly in Southeast Alaska. Alaska hatchery terminal fisheries are not separated from traditional net fisheries in the current Pacific States Marine Fisheries Commission data base, and, therefore, were not separated in the current model estimate. Catches and recoveries from these types of fisheries can be separated using the ADF&G CWT database since 1989, and in some cases, prior to 1989.

4.4 Problems in Generating Stock Composition Estimates

The capacity to generate useful and timely stock composition estimates are affected by a number of factors that are under the control of agencies responsible for fisheries management. These factors include:

a. The timing of availability of CWT recoveries for the Puget Sound sport fishery delays the ability to generate stock composition estimates by at least one year.

b. Uncertain reliability of catch estimates, particularly for certain recreational fisheries, and inconsistencies between official catch statistics and data contained in CWT catch-sample records.

c. Interannual variability in stocks that are tagged within production areas.

d. The inability to maintain adequate catch sampling rates.

e. Low tagging rates in some areas, especially in the Northern Panel area from 1984 to 1986.

f. Tagged stocks in some stock groups may have a different harvest distribution compared with the overall group. For example, tagged central and southern inside stocks in Alaska show different migratory timing and potentially a different fishery distribution than the total aggregate.

The work group is also concerned that the current lack of an independent means of estimating stock composition precludes direct validation tests of models and methodologies. Although Genetic stock identification (GSI) techniques may eventually prove useful as a means of identifying coho stocks, several years of additional research will be required before the utility of GSI as a means to reliably estimate coho stock compositions can be determined.

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Appendix A. Fisheries used to estimate Production Expansion Factors.

Alaskan Fisheries
- Southwest Troll
- Southeast Troll
- Northwest Troll
- Northeast Troll
- District 115 Net (Lynn Canal)
- District 111 Net (Stephens Passage)
- District 106 Net (Central Inside)
- District 101-102 Net (Southern Inside)
- District 112,114 Net (Central Intermediate)
- District 113 Net (Central Outside)
- District 103-104 Net (Southern Outside)
- District 105,109,110 Net (Southern Intermediate)

Canadian Fisheries
- Northern Troll (Areas 1 to 5)
- North Central Troll (Areas 6 to 9, 30)
- South Central Troll (Areas 10 to 12)
- Northwest Vancouver Island Troll (Areas 25 to 27)
- Southwest Vancouver Island Troll (Areas 21 to 24)
- Georgia Strait Troll (Areas 13 to 19)
- Northern Net (Areas 3 to 5)
- Central Net (Areas 6 to 10)
- Johnstone Net (Areas 11 to 13)
- Georgia Strait Net (Areas 14 to 18)
- Fraser Gillnet (Areas 28 and 29)
- Strait of Juan de Fuca Net (Area 20)
- Northern Georgia Strait Sport (Areas 13 to 16)
- Southern Georgia Strait Sport (Areas 17, 18, 19A, 28, 29)
- Strait of Juan de Fuca Sport (Area 19B+)
- West Coast Vancouver Island Sport (Areas 21 to 27)

Appendix A. Fisheries used to estimate *PEF*s (continued).

Southern U.S. Fisheries
- Area 7B/7C Net (Nooksack/Samish)
- Skagit River Net
- Area 8A Net (Stillaguamish/Snohomish)[1]
- Area 12 Net (Hood Canal)
- Area 10-11 Net (South Sound)
- Area 4B,5,6C Net (Strait of Juan de Fuca)
- Area 4B,5,6C Troll and Area 5,6 Sport (Strait of Juan de Fuca)
- Area 7,7A Net (San Juan Islands)
- Area 7 Sport (San Juan Islands)
- Area 8 Sport (Skagit, Stillaguamish/Snohomish)
- Area 9 Sport (Admiralty Inlet)
- Area 10,11 Sport (Mid-South Sound)
- Area 13 Sport (South Sound)
- North Washington Coast Freshwater Net
- Grays Harbor Marine Net
- Grays Harbor Freshwater Net
- Willapa Marine Net
- Area 1 Troll and Sport (Columbia River Mouth)
- Area 2 Troll and Sport (Grays Harbor)
- Area 3 Troll and Sport (Quillayute)
- Area 4 Troll and Sport (Cape Flattery)
- Buoy 10 Sport
- Columbia River Freshwater Net
- Oregon Sport and Troll South of Cape Falcon

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1 Includes Area 8D in 1990.

Appendix B. Release sites within each production area and estimated recoveries by calendar year. (NOTE: A zero value in the table indicates either no releases for that year or insufficient recoveries to meet criteria for incorporation into the analysis.)

>CINT.2.ALASKA.CENTRAL.INTERMEDIATE	84	85	86	87	88	89	90	91
BANNER.LK.109.10	1009.6	0.0	0.0	0.0	0.0	0.0	133.7	0.0
BLANCHARD.LK.109.10	0.0	0.0	0.0	0.0	124.4	0.0	0.0	0.0
CLIFF.LK.109.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.9
DEER.LK.109.10	0.0	0.0	0.0	407.3	0.0	191.9	851.5	1930.7
IRISH.CR.105.32	0.0	0.0	0.0	0.0	0.0	0.0	124.0	187.6
JETTY.CR.109.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3665.0
KADASHAN.R.112.42	0.0	0.0	0.0	0.0	0.0	196.4	0.0	0.0
KASNYKU.BAY.112.11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1588.1
L.PORT.WALTER.109.10	1411.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L.ROSTISLAF.LK109.10	0.0	0.0	173.0	0.0	0.0	0.0	0.0	0.0
SLIPPERY.CR.109.43	0.0	0.0	0.0	0.0	0.0	293.5	477.0	501.9
total est. recoveries	2420.7	0.0	173.0	407.3	124.4	681.8	1586.2	7993.2

>COUT.2.ALASKA.CENTRAL.OUTSIDE								
DEEP.INLET.113.41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	899.2
ELFENDAHL.LK.113.91	0.0	144.7	0.0	0.0	0.0	0.0	0.0	0.0
FORD.ARM.LK.113.73	0.0	225.8	450.8	204.7	398.2	719.5	668.7	691.1
REDOUBT.LK.113.41	0.0	0.0	0.0	0.0	293.1	0.0	0.0	0.0
SALMON.LK.113.41	0.0	262.5	572.3	426.7	353.2	304.4	379.2	545.3
SEALION.CV.LK.113.61	0.0	0.0	0.0	172.3	0.0	0.0	0.0	0.0
SITKA.SOUND.113.41	0.0	1237.1	169.9	82.5	470.0	428.4	398.5	337.7
SURPRISE.LK.113.62	0.0	0.0	0.0	217.3	0.0	0.0	0.0	0.0
total est. recoveries	0.0	1870.1	1193.0	1103.5	1514.5	1452.3	1446.4	2473.3

>CINS.2.ALASKA.CENTRAL.INSIDE								
BURNETT.INLET.106.22	0.0	0.0	0.0	268.8	0.0	183.5	432.3	1687.7
CRYSTAL.CR.106.44	1190.6	886.5	1439.1	0.0	182.5	603.5	440.3	356.0
EARL.WEST.COV.107.40	606.7	0.0	0.0	1874.0	332.4	101.4	1753.5	1726.9
OHMER.CR.108.40	319.8	297.0	225.5	0.0	0.0	0.0	0.0	0.0
PETERSBURG.AREA.106	0.0	0.0	0.0	772.9	0.0	0.0	0.0	0.0
SALMON.BAY.LK.106.41	0.0	0.0	280.3	98.7	0.0	0.0	0.0	0.0
total est. recoveries	2117.1	1183.5	1944.9	3014.4	514.9	888.4	2626.1	3770.6

>LYNN.2.ALASKA.LYNN.CANAL								
BERNERS.R.115.20	0.0	330.6	627.2	222.2	335.8	182.9	2036.7	4176.1
BURRO.CR.115.34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	615.2
CHILKAT.PONDS.115.32	352.0	0.0	352.1	0.0	0.0	0.0	0.0	0.0
CHILKOOT.LK.115.33	0.0	0.0	0.0	234.6	0.0	0.0	0.0	0.0
TAIYA.INLET.115.34	0.0	0.0	0.0	160.9	0.0	0.0	0.0	356.4
total est. recoveries	352.0	330.6	979.3	617.7	335.8	182.9	2036.7	5147.7

>SINN.2.ALASKA.S.INSIDE.NORTH								
CHICKAMIN.R.101.71	0.0	136.1	218.5	0.0	0.0	0.0	0.0	0.0
MCDONALD.LK.101.80	0.0	0.0	0.0	0.0	0.0	237.5	0.0	0.0
NEETS.BAY.101.90	3898.1	3239.8	3115.8	1023.0	106.8	664.1	5118.6	3436.9
UNUK.R.101.75	0.0	331.7	490.3	0.0	0.0	0.0	0.0	0.0
VALLENAR.CR.101.29	0.0	0.0	0.0	0.0	0.0	140.4	0.0	0.0
total est. recoveries	3898.1	3707.6	3824.6	1023.0	106.8	1042.0	5118.6	3436.9

>SINS.2.ALASKA.S.INSIDE.SOUTH	84	85	86	87	88	89	90	91
ANNETTE.BAY.CR	0.0	0.0	1681.3	0.0	0.0	0.0	0.0	0.0
BOLD.IS.LK.101.41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1285.7
HERRING.COVE.101.45	597.0	5962.5	5822.4	722.8	554.8	431.4	1489.5	2054.9
HUGH.SMITH.LK.101.30	464.2	795.5	1107.7	311.9	134.5	333.9	992.1	1298.5
NAKAT.INLET.101.11	0.0	0.0	0.0	1675.5	1073.8	343.1	2662.8	3648.3
RIO.ROBERTS.102.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.3
TAMGAS.CR	1512.3	1629.8	0.0	1415.7	735.9	2666.3	4575.6	9370.3
total est. recoveries	2573.5	8387.8	8611.4	4125.9	2499.0	3774.7	9720.0	17796.0

>SINE.2.S.INSIDE.EARLY								
KETCHIKAN.CR.101.47	0.0	0.0	0.0	0.0	0.0	303.5	1266.2	1875.5
REFLECTION.LK.101.80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.7
WARD.LK.101.47	832.4	792.4	0.0	0.0	0.0	849.9	955.8	1341.1
total est. recoveries	832.4	792.4	0.0	0.0	0.0	1153.4	2222.0	3294.3

>SOUT.2.ALASKA.S.OUTSIDE								
CABLE.CR.103.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	501.7
KLAKAS.LK.103.15	0.0	0.0	0.0	0.0	144.0	0.0	0.0	0.0
KLAWOCK.LK.103.60	662.6	1966.8	1480.8	610.6	531.3	1562.6	2236.8	4365.8
TUNGA.LK.103.90	0.0	0.0	0.0	0.0	443.3	0.0	498.9	745.2
KLAWOCK.R.103.60	0.0	190.5	0.0	0.0	0.0	0.0	0.0	0.0
WARM.CHUCK.LK.103.80	0.0	0.0	321.3	122.9	0.0	0.0	0.0	0.0
total est. recoveries	662.6	2157.3	1802.1	733.5	1118.6	1562.6	2735.7	5612.7

>STEP.2.ALASKA.STEPHENS.PASSAGE								
AUKE.BAY.111.50	0.0	0.0	0.0	0.0	0.0	1426.6	0.0	0.0
AUKE.CR.111.50	556.7	1495.6	579.6	543.7	373.7	550.5	690.7	174.0
DREDGE.LK.111.50	0.0	0.0	1066.5	0.0	0.0	406.9	1341.9	301.4
DREDGE.MOOSE.111.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	388.7
FISH.CR.111.50	0.0	0.0	0.0	0.0	0.0	479.2	1103.7	1678.8
GASTINEAU.CH.111.40	0.0	0.0	0.0	0.0	0.0	1641.2	1231.5	2979.8
INDIAN.LK.111.33	293.9	343.1	0.0	98.1	0.0	0.0	124.2	0.0
SALMON.CR.111.40	3898.1	4356.5	0.0	0.0	0.0	0.0	0.0	0.0
SHEEP.CR.111.40	0.0	0.0	0.0	0.0	500.3	538.2	997.7	3522.1
SPEEL.ARM.111.33	339.9	1475.5	278.2	0.0	0.0	343.0	276.7	0.0
SPEEL.LK.111.33	0.0	497.2	466.5	0.0	0.0	323.8	0.0	0.0
SWEETHEART.LK.111.35	0.0	0.0	0.0	0.0	0.0	195.6	164.2	0.0
total est. recoveries	5088.6	8167.9	2390.8	641.8	874.0	5905.0	5930.6	9044.8

>YAKU.2.ALASKA.YAKUTAT								
LOST.R.182.80	0.0	0.0	143.8	0.0	0.0	0.0	0.0	0.0
SITUK.R.182.70	0.0	121.6	0.0	0.0	0.0	0.0	0.0	0.0
TSIU.TSIVAT.R.192.42	0.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0
total est. recoveries	0.0	121.6	168.3	0.0	0.0	0.0	0.0	0.0

>CALI.2.CALIFORNIA								
FRESHWATER.CREEK	0.0	0.0	0.0	287.8	0.0	0.0	0.0	0.0
IRON.GATE.HATCHERY	396.6	1104.1	471.7	908.5	0.0	0.0	172.5	0.0
SALMON.RIVER.CA	0.0	0.0	0.0	469.4	0.0	0.0	0.0	0.0
TRINITY.RIVER	363.7	3022.1	981.4	1779.6	297.1	0.0	0.0	0.0
SAWMILL.PONDS	0.0	0.0	0.0	0.0	0.0	938.9	0.0	0.0
WARM.SPRINGS.HATCHER	0.0	0.0	0.0	0.0	0.0	152.0	0.0	0.0
YOAKIM.BRIDGE	0.0	0.0	0.0	242.1	0.0	0.0	0.0	0.0
total est. recoveries	760.3	4126.2	1453.1	3687.4	297.1	1090.9	172.5	0.0

>CCST.1.CENTRAL.COAST	84	85	86	87	88	89	90	91
ANGLER.COVE.LAKE	0.0	0.0	0.0	0.0	0.0	0.0	770.4	0.0
ATNARKO.SPAWNING.CH	0.0	0.0	0.0	0.0	0.0	0.0	1232.0	3136.5
BELLA.COOLA.R.LOWER	0.0	0.0	0.0	0.0	0.0	118.2	333.3	0.0
BELLA.COOLA.R.UPPER	0.0	0.0	0.0	0.0	0.0	153.6	0.0	0.0
CECIL.CREEK	0.0	0.0	2152.2	667.3	187.9	241.7	393.2	0.0
HAGENSBORG.SLOUGH	0.0	0.0	0.0	0.0	200.7	0.0	0.0	0.0
HARTLEY.BAY.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	466.4	714.4
KITIMAT.LOWER	0.0	0.0	0.0	0.0	0.0	233.5	1052.5	0.0
KITIMAT.RIVER	0.0	0.0	2212.1	0.0	280.5	162.4	727.8	1986.0
MCLAUGHLIN.BAY	0.0	0.0	0.0	0.0	1065.9	301.9	747.2	831.3
SECOND.LAKE.CCST	0.0	0.0	0.0	0.0	0.0	208.2	155.5	0.0
SNOOTLI.CREEK	0.0	279.2	0.0	0.0	0.0	0.0	0.0	0.0
THORSEN.CREEK	0.0	0.0	0.0	0.0	171.3	0.0	0.0	0.0
TROUT.BAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	137.4
UNION.PASS.LAKE	0.0	0.0	0.0	0.0	0.0	0.0	458.5	0.0
total est. recoveries	0.0	279.2	4364.3	667.3	1906.3	1419.5	6336.8	6805.6

>DESC.2.DESCHUTES.middle.columbia.so								
total est. recoveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

>GSML.1.GEORGIA.STRAIT.MAINLAND								
ASHLU.CREEK	0.0	0.0	0.0	0.0	1469.5	0.0	416.2	464.0
BIG.QUALICUM.MARINE	0.0	0.0	0.0	0.0	0.0	0.0	381.2	0.0
CAPILANO.RIVER	9934.4	8403.9	11248.9	18420.2	7924.2	7610.5	2838.1	1030.1
CAPILANO.WATERSHED	177.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CATES.PARK	0.0	0.0	0.0	0.0	0.0	327.2	0.0	0.0
CHAPMAN.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	501.2
CHASTER.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	449.6
CHEAKAMUS.RIVER	0.0	1134.1	0.0	0.0	236.5	0.0	0.0	0.0
HASLAM.LAKE	0.0	0.0	0.0	1065.8	0.0	347.6	0.0	0.0
HORSESHOE.BAY	0.0	0.0	0.0	0.0	1317.7	915.2	297.2	0.0
INDIAN.RIVER	0.0	0.0	0.0	0.0	1062.1	0.0	0.0	0.0
JITCO.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	592.8	590.2
LANG.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	1761.3	891.3
L.CAMPBELL.RIVER	233.6	0.0	1728.3	0.0	0.0	0.0	0.0	0.0
MACLEAN.BAY	1328.9	811.9	1375.8	1306.0	0.0	0.0	0.0	578.4
MAMQUAM.RIVER	0.0	0.0	2650.0	980.2	1511.0	0.0	0.0	0.0
NOONS.CREEK	599.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SERPENTINE.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	709.3	0.0
SEYMOUR.RIVER	0.0	636.5	0.0	0.0	0.0	0.0	0.0	0.0
SHOVELNOSE.CREEK	0.0	3468.2	0.0	0.0	0.0	0.0	0.0	0.0
SLIAMMON.LAKE	0.0	0.0	973.1	0.0	0.0	0.0	0.0	0.0
SLIAMMON.RIVER	0.0	0.0	926.3	0.0	0.0	0.0	0.0	0.0
SQUAMISH.RIVER	0.0	0.0	0.0	763.8	0.0	0.0	458.5	521.5
TENDERFOOT.CREEK	0.0	0.0	0.0	0.0	0.0	1643.8	492.7	510.0
TENDERFOOT.LAKE	0.0	3543.9	4218.5	2727.7	2493.7	900.1	0.0	0.0
VANCOUVER.R.UPPER	0.0	0.0	0.0	594.3	1154.1	0.0	0.0	0.0
VANCOUVER.RIVER	0.0	0.0	2061.4	0.0	0.0	0.0	0.0	0.0
WEST.VANCOUVER.LAB	1646.2	639.7	0.0	0.0	0.0	0.0	0.0	0.0
total est. recoveries	13920.0	18638.2	25182.3	25858.0	17168.8	11744.4	7947.3	5536.3

>GSVI.1.GEORGIA.STRAIT.VANC.ISL	84	85	86	87	88	89	90	91
BIG.QUALICUM.ESTUARY	0.0	0.0	0.0	0.0	0.0	0.0	662.5	0.0
BIG.QUALICUM.RIVER	2611.1	1775.7	935.9	456.8	1144.9	406.5	1179.2	1830.7
BLUE.GROUSE.LAKE	0.0	0.0	248.7	170.3	0.0	0.0	0.0	0.0
BRANNEN.LAKE	0.0	0.0	0.0	248.8	274.2	0.0	0.0	0.0
CHASE.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	639.5	1536.5
COLLIERY.LAKE	0.0	0.0	0.0	0.0	0.0	0.0	259.1	0.0
COMOX.LAKE	0.0	116.8	0.0	0.0	0.0	0.0	0.0	119.7
COMOX.LAKE.TOMA.CR	168.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRUICKSHANK.PUNTLEDG	0.0	0.0	308.4	352.5	0.0	0.0	0.0	0.0
CRUICKSHANK.RIVER	0.0	182.3	0.0	0.0	299.2	327.3	0.0	197.1
DEADWOOD.CREEK	269.8	383.0	0.0	0.0	0.0	0.0	0.0	0.0
DEEP.BAY.GSVI	0.0	0.0	0.0	0.0	0.0	184.5	401.5	425.8
GRANT.CREEK	0.0	0.0	0.0	0.0	587.6	0.0	0.0	0.0
HEADQUARTERS.CREEK	0.0	0.0	0.0	431.4	0.0	0.0	0.0	253.9
HELLDIVER.LK	0.0	0.0	137.5	0.0	0.0	0.0	0.0	0.0
KOKSILAH.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	161.3
LITTLE.LOST.LAKE	0.0	0.0	0.0	219.8	0.0	0.0	0.0	0.0
LOWER.LOST.LAKE	0.0	0.0	0.0	221.0	0.0	0.0	0.0	0.0
MILLSTONE.RIVER	0.0	511.4	0.0	672.1	802.1	553.8	0.0	0.0
NANAIMO.RIVER	1285.7	257.5	0.0	0.0	0.0	0.0	0.0	0.0
NAPOLEON.CREEK	0.0	445.1	0.0	0.0	0.0	0.0	0.0	0.0
PUNTLEDGE.R.UPPER	2824.2	9954.3	7413.5	1059.7	1859.3	1286.9	953.1	1574.0
BLACK.CREEK	0.0	0.0	2181.8	3086.9	3211.3	5938.2	2652.5	6076.4
CHEMAINUS.RIVER	0.0	0.0	0.0	0.0	0.0	719.4	0.0	118.4
FRENCH.CREEK	0.0	0.0	0.0	348.1	1282.3	1516.2	606.3	1515.4
KELVIN.CREEK	0.0	0.0	0.0	0.0	234.2	0.0	0.0	0.0
LITTLE.QUALICUM.R	0.0	0.0	703.1	972.2	920.9	0.0	0.0	0.0
MESACHIE.CREEK	0.0	0.0	0.0	0.0	243.4	201.5	0.0	104.5
QUAMICHAN.CREEK	0.0	0.0	0.0	0.0	0.0	668.0	0.0	0.0
ROSEWALL.CREEK	0.0	0.0	0.0	3774.0	4125.7	0.0	542.6	0.0
TRENT.RIVER	0.0	0.0	468.5	932.5	1819.9	2166.4	1006.3	465.1
WILLIMAR.FORBUSH.LKS	282.1	0.0	154.0	243.2	188.4	0.0	0.0	134.0
total est. recoveries	7441.8	13626.1	12551.4	13189.3	16993.4	13968.7	8902.6	14512.8

>JNST.1.JOHNSTONE.STRAIT								
CLUXEWE.RIVER	0.0	0.0	0.0	376.9	0.0	0.0	0.0	0.0
DEVEREUX.CREEK	0.0	0.0	0.0	177.0	0.0	0.0	0.0	0.0
KEOGH.RIVER	0.0	0.0	0.0	0.0	0.0	575.1	0.0	1103.8
LOOSE.LAKE	0.0	0.0	0.0	0.0	432.4	0.0	0.0	0.0
QUATSE.LAKE	0.0	0.0	1649.2	433.7	0.0	0.0	0.0	0.0
QUINSAM.RIVER	10004.1	21039.8	12665.4	5441.8	3113.9	11835.3	2481.3	1034.3
QUINSAM.RIVER.LOWER	0.0	0.0	1303.0	1128.5	0.0	0.0	0.0	0.0
QUINSAM.RIVER.UPPER	0.0	1747.4	2015.8	1183.6	0.0	0.0	0.0	0.0
total est. recoveries	10004.1	22787.2	17633.4	8741.5	3546.3	12410.4	2481.3	2138.1

>LOCO.2.LOWER.COLUMBIA	84	85	86	87	88	89	90	91
BIG.CR.L.COL.R	646.9	1135.1	3288.9	3723.2	2390.7	5136.2	1655.8	3206.4
CEDAR.CR.SANDY.R.1	0.0	1948.0	16644.7	10452.8	16681.7	16539.1	2718.7	5593.3
CEDAR.CR.SANDY.R.2	4227.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COLUMBIA.R.1	493.4	4747.9	11209.5	2409.7	982.1	0.0	0.0	0.0
COLUMBIA.R.2	0.0	0.0	4163.8	1419.3	0.0	0.0	0.0	660.6
COWLITZ.R.26.0002	4031.8	3281.5	6677.4	4001.7	5924.2	5475.3	551.1	5887.3
ELOCHOMAN.R.25.0236	0.0	0.0	1675.9	275.2	2160.6	0.0	0.0	3042.6
FALLERT.CR.27.0017	1089.5	0.0	0.0	0.0	0.0	0.0	0.0	1249.9
GRAYS.R.WF.25.0131	753.4	151.6	2708.5	717.8	3470.7	0.0	0.0	843.5
GREEN.R.26.0323	0.0	0.0	0.0	0.0	0.0	2478.1	1311.9	1889.3
KALAMA.R.27.0002	0.0	0.0	11580.1	2075.1	9178.2	0.0	0.0	2497.8
KLASKANINE.R	1130.0	1875.2	2980.5	935.4	0.0	0.0	386.1	0.0
KLASKANINE.R.N.FK	264.2	0.0	0.0	0.0	5437.9	1330.9	765.5	1412.8
KLASKANINE.R.S.FK	0.0	0.0	0.0	0.0	0.0	0.0	1873.6	1362.2
KLICKITAT.R.30.0002	0.0	0.0	1936.5	222.3	1102.2	0.0	0.0	760.0
KLICKITAT.WASHOUGAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	922.8
LEWIS.R.27.0168	0.0	268.8	0.0	167.6	3380.6	9449.0	864.6	5790.5
L.WHITE.SALMON.WILRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	559.7
LTL.WHITE.SALMON.NFH	630.0	960.2	0.0	0.0	0.0	0.0	0.0	0.0
TANNER.CR	874.9	838.9	3472.5	1926.2	3091.8	3628.9	922.1	1616.9
TUCKER.CR	1094.0	1347.1	1459.0	667.2	0.0	685.4	0.0	0.0
WASHOUGAL.R.28.0159	1822.1	5147.9	3367.2	1908.1	0.0	0.0	0.0	1081.7
YOUNGS.R.BAY	0.0	0.0	0.0	0.0	0.0	0.0	919.1	3742.1
CHELATCHIE.CREEK.NF	0.0	0.0	0.0	0.0	219.4	0.0	0.0	0.0
total est. recoveries	17057.9	21702.2	71164.5	30901.6	54020.1	44722.9	11968.5	42119.4

>LWFR.1.LOWER.FRASER								
ALOUETTE.RIVER	0.0	3346.6	0.0	0.0	0.0	0.0	0.0	0.0
ALOUETTE.RIVER.SOUTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	229.2
BLANEY.CREEK	0.0	0.0	646.4	457.7	743.7	0.0	0.0	0.0
BRUNETTE.RIVER	170.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEHALIS.RIVER.BC	0.0	2345.6	4141.2	3381.1	2205.2	2177.4	3359.5	1763.1
CHILLIWACK.RIVER	2485.8	13118.1	5332.4	16505.7	8688.0	6086.9	3072.4	2482.8
COHO.CREEK	0.0	2188.5	2008.8	0.0	0.0	940.1	0.0	0.0
DOLLY.VARDEN.CREEK	1883.1	2033.2	0.0	843.5	0.0	0.0	0.0	0.0
HARRISON.RIVER	0.0	1375.2	0.0	0.0	0.0	0.0	0.0	0.0
HICKS.CREEK	0.0	0.0	0.0	902.2	0.0	0.0	0.0	0.0
HICKS.MARIA.CREEK	0.0	1206.4	0.0	0.0	1491.4	811.4	0.0	0.0
INCH.CREEK	191.9	4765.7	2062.6	2922.6	3509.4	1457.6	1875.6	2137.3
KANAKA.CREEK	0.0	0.0	0.0	2152.3	0.0	0.0	0.0	0.0
NICOMEN.SLOUGH	0.0	0.0	865.0	800.4	1215.5	0.0	0.0	0.0
NORRISH.CREEK	0.0	0.0	527.6	686.7	2033.5	0.0	0.0	0.0
POST.CREEK	2214.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SALMON.R.VANCOUVER	0.0	0.0	0.0	830.6	3237.1	2363.0	2667.1	1185.5
SALWEIN.CREEK	1503.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIDDLE.CREEK	0.0	0.0	660.2	977.5	2868.7	1511.7	582.4	592.1
SIDDLE.CREEK.LOWER	213.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SIDDLE.CREEK.UPPER	315.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SQUAKUM.CREEK	0.0	0.0	0.0	0.0	1240.0	0.0	0.0	0.0
STAVE.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	494.2
WEAVER.CREEK.BC	0.0	1218.5	2238.1	2018.2	1230.9	0.0	0.0	0.0
total est. recoveries	8978.0	31597.8	18482.3	32478.5	28463.4	15348.1	11557.0	8884.2

>LWOR.2.LOWER.OREGON								
ROGUE.R	355.4	327.9	176.6	348.5	1189.2	461.0	134.9	90.0
total est. recoveries	355.4	327.9	176.6	348.5	1189.2	461.0	134.9	90.0

>LWWA.2.LOWER.COASTAL.WASHINGTON	84	85	86	87	88	89	90	91
BEAVER.CR.23.0667	0.0	81.4	413.5	0.0	0.0	0.0	0.0	0.0
BINGHAM.CR.22.0465	1072.5	408.0	1315.0	834.6	613.9	1639.4	1351.0	3043.8
BLACK.RIVER.23.0649	0.0	167.9	668.1	0.0	0.0	0.0	0.0	0.0
BLACK.BEAVER.WADDELL	584.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CHEHALIS.R.22.0190	0.0	0.0	408.4	0.0	0.0	0.0	0.0	0.0
CHEHALIS.RIV.SYSTEM	272.8	103.9	304.6	655.5	0.0	0.0	0.0	0.0
GRAYS.HARBOR.TRIBS	0.0	180.4	0.0	0.0	0.0	0.0	0.0	0.0
NEWAUKUM.R.23.0882	0.0	0.0	164.3	0.0	0.0	0.0	0.0	0.0
SCATTER.CR.23.0716	0.0	0.0	0.0	0.0	279.7	183.7	0.0	811.6
STEVENS.CR.22.0064	503.4	556.2	5772.1	876.0	3367.3	2586.5	1565.5	3572.3
STILLMAN.CR.LOST.CR	0.0	0.0	169.0	0.0	0.0	0.0	0.0	0.0
UPPER.CHEHALIS.TRIBS	0.0	0.0	0.0	0.0	0.0	314.9	303.7	860.3
WESTPORT.BOAT.BASIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4946.1
ABERDEEN.NET.PENS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8427.4
OCEAN.SHORES.NET.PEN	0.0	0.0	0.0	0.0	0.0	0.0	97.4	3747.5
total est. recoveries	2433.5	1497.8	9215.0	2366.1	4260.9	4724.5	3317.6	25409.0

>NASS.1.NASS								
KINCOLITH.RIVER	0.0	0.0	0.0	1140.3	125.8	588.3	0.0	2415.8
total est. recoveries	0.0	0.0	0.0	1140.3	125.8	588.3	0.0	2415.8

>NCST.1.NORTH.COAST.BC								
DIANA.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	954.5	442.9
LACHMACH.RIVER	0.0	0.0	0.0	0.0	0.0	250.9	1701.8	2160.2
total est. recoveries	0.0	0.0	0.0	0.0	0.0	250.9	2656.3	2603.1

>NWVI.1.NW.VANCOUVER.ISLAND								
CONUMA.RIVER	0.0	279.6	4582.6	1253.4	1038.7	893.8	1138.8	1663.6
CONUMA.RIVER.UPPER	0.0	214.5	625.2	395.5	0.0	0.0	0.0	0.0
GOODSPEED.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	637.6
STEPHENS.CREEK	0.0	0.0	556.2	0.0	0.0	0.0	0.0	0.0
SUCWOA.RIVER	0.0	0.0	0.0	749.3	0.0	0.0	0.0	0.0
total est. recoveries	0.0	494.1	5764.0	2398.2	1038.7	893.8	1138.8	2301.2

>QCI.1.QUEEN.CHARLOTTES.HAIDA.GWAII								
BRAVERMAN.CREEK	0.0	0.0	22.7	823.0	1328.4	1123.4	697.7	625.9
COATES.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	756.8	0.0
DEER.BAY	0.0	0.0	0.0	0.0	0.0	0.0	1875.4	0.0
GOLD.CREEK.BC	0.0	0.0	0.0	0.0	0.0	0.0	664.5	168.9
HAANS.CREEK	0.0	0.0	0.0	549.8	0.0	0.0	0.0	0.0
MARIE.LAKE	0.0	0.0	0.0	0.0	0.0	154.4	0.0	0.0
MOSQUITO.CREEK.QCI	0.0	0.0	0.0	76.1	66.7	0.0	0.0	0.0
MOSQUITO.LAKE.BC	235.6	94.3	0.0	0.0	164.1	233.1	359.7	299.2
PALLANT.CREEK	0.0	35.3	173.9	0.0	54.4	0.0	88.3	538.4
PALLANT.CREEK.LOWER	0.0	0.0	0.0	0.0	0.0	95.1	0.0	0.0
PALLANT.CREEK.UPPER	0.0	50.4	0.0	0.0	45.2	161.3	149.2	0.0
TASU.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1147.6
total est. recoveries	235.6	180.0	196.6	1448.9	1658.8	1767.3	4591.6	2780.0

>SKNA.1.SKEENA	84	85	86	87	88	89	90	91
BABINE.RIVER	0.0	0.0	0.0	542.7	236.0	604.3	635.2	876.7
BULKLEY.RIVER.UPPER	0.0	0.0	0.0	0.0	0.0	0.0	836.1	0.0
DRY.CREEK.BC	0.0	0.0	0.0	0.0	0.0	0.0	1278.4	242.7
HODDER.CREEK.CDP	0.0	0.0	0.0	657.5	0.0	0.0	0.0	0.0
KISPIOX.RIVER.TRIBS	0.0	0.0	254.8	0.0	0.0	0.0	0.0	0.0
KITWANGA.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	584.1
MCQUEEN.CREEK	0.0	0.0	0.0	0.0	119.2	0.0	525.7	0.0
MURDER.CREEK	0.0	0.0	0.0	0.0	0.0	458.8	0.0	0.0
THORNHILL.CREEK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.6
TOBOGGAN.CREEK	0.0	0.0	0.0	0.0	127.8	445.9	742.5	964.0
total est. recoveries	0.0	0.0	254.8	1200.2	483.0	1509.0	4017.9	2778.1

>SWVI.1.SW.VANCOUVER.ISL								
CHEEWHAT.LAKE	0.0	0.0	0.0	0.0	0.0	0.0	151.8	0.0
CHEEWHAT.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.9
FLORA.LAKE	0.0	0.0	0.0	0.0	0.0	376.9	0.0	0.0
FRANCIS.DARLINGTON.L	0.0	0.0	0.0	0.0	21.0	486.2	0.0	0.0
FRANCIS.FLORA.DARLIN	0.0	0.0	0.0	0.0	0.0	0.0	281.5	0.0
HARRIS.CREEK.BC	0.0	298.6	0.0	0.0	0.0	0.0	0.0	0.0
KENNEDY.RIVER.UPPER	0.0	176.6	0.0	0.0	0.0	0.0	0.0	0.0
LITTLE.NITINAT.RIVER	0.0	915.1	0.0	0.0	0.0	0.0	0.0	0.0
NITINAT.RIVER	0.0	0.0	0.0	0.0	0.0	394.5	0.0	1007.7
NITINAT.R.UPPER	0.0	0.0	0.0	0.0	42.9	803.5	179.4	0.0
ROBERTSON.CREEK	5951.2	1173.7	1210.0	701.6	418.0	1581.9	3459.4	1357.5
SOOKE.RIVER	329.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
THORNTON.CR.ESTUARY	0.0	1258.6	0.0	0.0	0.0	0.0	0.0	0.0
total est. recoveries	6280.4	3822.6	1210.0	701.6	481.9	3643.0	4072.1	2489.1

>TAKU.2.AK								
TAKU.R.111.32	0.0	0.0	0.0	0.0	0.0	0.0	260.6	140.0
YEHRING.CR.111.32	0.0	0.0	0.0	0.0	269.8	818.1	948.6	0.0
total est. recoveries	0.0	0.0	0.0	0.0	269.8	818.1	1209.2	140.0

>TRAN.1.TAKU.BC								
TATSAMENIE.LAKE	0.0	0.0	0.0	0.0	0.0	127.9	172.0	153.1
LITTLE.TATSAMENIE.LK	0.0	0.0	0.0	0.0	121.4	0.0	0.0	0.0
SHESLAY.RIVER.TAKU	0.0	0.0	0.0	0.0	82.4	0.0	0.0	0.0
TAKU.RIVER.LOWER	0.0	0.0	0.0	0.0	198.8	648.7	733.1	162.9
total est. recoveries	0.0	0.0	0.0	0.0	402.6	776.6	905.1	316.0

>THOM.1.THOMPSON								
CLEARWATER.R.LOW.BC	0.0	0.0	0.0	0.0	140.7	0.0	0.0	0.0
COLDWATER.RIVER	0.0	0.0	0.0	0.0	3173.5	2096.1	2292.4	1087.0
DUNN.LAKE	0.0	0.0	0.0	198.3	1009.4	177.0	1739.6	1143.1
EAGLE.RIVER	0.0	0.0	0.0	2077.9	2667.9	2340.9	2323.6	422.2
FENNELL.CREEK	0.0	0.0	0.0	216.0	323.2	0.0	448.1	0.0
IANSON.CHANNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	554.2
LEMIEUX.CREEK	0.0	0.0	254.9	326.7	879.6	239.7	0.0	127.0
LION.CREEK	203.0	0.0	0.0	877.2	882.9	0.0	0.0	0.0
LOUIS.CREEK	435.0	0.0	0.0	0.0	0.0	0.0	0.0	670.4
MCTAGGART.CREEK	0.0	0.0	199.8	0.0	0.0	0.0	0.0	0.0
PERRY.RIVER	0.0	0.0	0.0	0.0	731.2	576.0	0.0	0.0
RAFT.RIVER.BC	0.0	0.0	0.0	0.0	0.0	541.3	0.0	0.0
SALMON.R.THOMPSON	0.0	0.0	366.9	771.5	1290.7	944.9	405.8	168.8
total est. recoveries	638.0	0.0	821.6	4467.6	11099.1	6915.9	7209.5	4172.7

>BRGT.2.BRIGHT.COLUMBIA	84	85	86	87	88	89	90	91
UMATILLA.R	0.0	0.0	0.0	0.0	918.7	1989.6	602.8	2234.5
total est. recoveries	0.0	0.0	0.0	0.0	918.7	1989.6	602.8	2234.5

>UPFR.1.UPPER.FRASER								
BIRKENHEAD.RIVER	1044.2	0.0	907.4	0.0	0.0	0.0	0.0	0.0
MCKINLEY.CREEK	0.0	0.0	0.0	0.0	145.5	0.0	0.0	0.0
QUESNEL.RIVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	356.9
total est. recoveries	1044.2	0.0	907.4	0.0	145.5	0.0	0.0	356.9

>UPOR.2.UPPER.OREGON								
ALSEA.R	147.0	84.8	0.0	133.9	0.0	0.0	126.5	0.0
ANADROMOUS.COOS.BAY	432.0	1022.8	3011.5	2734.8	1456.1	1547.3	1061.4	0.0
COOS.R.S.FK	0.0	0.0	0.0	0.0	0.0	574.1	0.0	0.0
COW.CR	0.0	0.0	0.0	0.0	0.0	198.4	0.0	0.0
EEL.LK	122.4	0.0	0.0	248.7	890.2	392.2	904.7	290.9
FALL.CR.ALSEA.R	488.7	268.3	1466.4	878.8	1322.2	2045.3	623.8	710.0
FERRY.CR	234.5	113.9	0.0	0.0	441.8	450.2	299.8	152.7
FISHHAWK.CR	0.0	0.0	386.5	0.0	0.0	0.0	0.0	0.0
FIVE.RIVERS	0.0	117.7	332.6	0.0	0.0	0.0	0.0	0.0
MORGAN.CR.COOS.R	0.0	0.0	0.0	129.8	465.7	0.0	1378.7	318.0
NEHALEM.R.N.FK	698.0	630.3	806.8	619.3	2044.6	707.0	491.1	542.0
NOBLE.CR.COOS.R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	299.2
NORTH.SPIT	132.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ROCK.CR.L	811.3	173.8	876.9	605.2	808.8	122.7	131.4	0.0
ROCK.CR.N.UMPQUA.R	432.3	236.2	501.2	1014.2	308.0	339.9	464.7	847.8
ROCK.CR.SILETZ.R	0.0	0.0	545.3	0.0	0.0	0.0	0.0	0.0
SALMON.R.OR.COAST	281.6	0.0	126.1	0.0	0.0	0.0	0.0	0.0
SILETZ.R	229.9	364.4	1397.4	299.8	0.0	0.0	0.0	340.9
SMITH.R	137.3	146.6	340.3	0.0	575.7	223.7	0.0	0.0
SMITH.R.N.FK	0.0	0.0	0.0	673.2	0.0	0.0	0.0	0.0
SOUTH.BEACH.OAF	563.4	1594.9	2704.7	1815.5	4767.2	1371.8	4480.4	1091.0
TRASK.R	937.7	595.4	653.0	205.4	983.8	1246.6	1041.4	701.6
TRASK.R.E.FK.OF.S.FK	0.0	0.0	349.3	0.0	398.9	409.2	408.6	262.3
UMPQUA.R	0.0	0.0	0.0	0.0	0.0	0.0	419.0	0.0
UMPQUA.R.S.FK	0.0	0.0	378.6	121.5	1020.8	0.0	382.6	368.4
OFFSHORE.COOS.BAY	0.0	0.0	1712.3	1947.1	344.8	1307.5	0.0	0.0
total est. recoveries	5649.0	5349.1	15588.9	11427.2	15828.6	10935.9	12214.1	5924.8

>UPWA.2.UPPER.WASHINGTON								
BOGACHIEL.R.20.0162	0.0	0.0	0.0	0.0	167.4	0.0	0.0	0.0
BOGACHIEL.RIV.TRIBS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.8
BRADEN.PINS.CREEKS	0.0	0.0	0.0	136.4	0.0	0.0	0.0	0.0
CANYON.CR.20.0470	0.0	0.0	0.0	0.0	0.0	328.7	217.4	0.0
CANYON.SPRINGS.POND	0.0	0.0	0.0	105.8	0.0	0.0	0.0	0.0
CHALAAT.CR.20.0423	0.0	0.0	0.0	0.0	0.0	0.0	0.0	265.3
CLEARWATER.R.21.0024	467.4	0.0	0.0	0.0	2194.6	0.0	0.0	0.0
CLEARWATER.R.TRIBS	205.0	345.3	0.0	345.6	0.0	0.0	172.6	0.0
COOK.CR.21.0429	0.0	116.1	1141.1	558.7	1664.9	915.3	1103.5	2639.0
DICKEY.R.EF.20.0110	755.4	158.1	821.7	277.3	0.0	213.8	0.0	0.0
EDUCKET.CR.20.0010	0.0	0.0	0.0	0.0	0.0	893.0	0.0	3082.7
ELK.CR.20.0176	0.0	0.0	0.0	0.0	0.0	168.3	0.0	0.0
ELK.WINFIELD.CREEK	0.0	0.0	211.2	0.0	0.0	0.0	0.0	0.0
HOH.RIVER.20.0422	0.0	0.0	0.0	0.0	963.5	0.0	0.0	0.0
HOH.RIVER.TRIBS	400.3	0.0	0.0	0.0	0.0	410.5	133.2	0.0
HURST.CR.21.0025	0.0	0.0	0.0	113.3	0.0	0.0	112.3	143.1
MILLER.CR.21.0048	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.1
PARADISE.POND.21	0.0	0.0	0.0	81.5	0.0	0.0	0.0	0.0
QUILLAYUTE.RIV.TRIBS	0.0	0.0	165.8	0.0	0.0	0.0	0.0	0.0
QUINAULT.R.21.0398	1807.9	761.2	0.0	0.0	0.0	0.0	0.0	2810.1
RAFT.R.21.0337	265.4	0.0	310.4	197.0	0.0	0.0	0.0	0.0
SALMON.R.21.0139	658.9	577.0	1805.0	1237.8	2194.4	1656.1	2218.5	2292.2
SHALE.CR.21.0041	0.0	0.0	0.0	0.0	0.0	638.0	2225.2	0.0
SNAHAPISH.R.21.0077	234.2	189.3	198.8	280.6	0.0	131.2	273.4	204.6
SOLEDUCK.BOGACHIEL	0.0	206.4	0.0	0.0	0.0	0.0	0.0	0.0
SOLEDUCK.R.20.0096	2516.3	217.6	976.6	405.8	1812.1	2387.9	327.9	2020.7
SOOES.R.20.0015	0.0	0.0	0.0	0.0	0.0	1427.9	0.0	4354.6
total est. recoveries	7310.8	2571.0	5630.6	3739.8	8996.9	9170.7	6784.0	18023.2

>WA01.2.WASHINGTON.AREA.1	84	85	86	87	88	89	90	91
FAIRHAVEN.NET.PENS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2967.3
KENDALL.CR.01.0406	3617.5	3808.3	3615.8	16500.7	6765.2	4318.1	4782.5	3239.9
LUMMI.SEA.PONDS	0.0	0.0	0.0	2289.4	4518.7	2826.7	1981.9	0.0
NOOKSACK.R.LUMMI.BAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	833.1
NOOKSACK.RIVER.SF	0.0	0.0	0.0	3750.0	5081.3	4513.7	4712.0	0.0
SQUALICUM.NET.PENS	0.0	0.0	0.0	0.0	0.0	0.0	146.0	486.4
total est. recoveries	3617.5	3808.3	3615.8	22540.1	16365.2	11658.5	11622.4	7526.7

>WA02.2.WASHINGTON.AREA.2								
BAKER.LAKE.03	0.0	0.0	0.0	0.0	0.0	451.1	999.6	0.0
BAKER.R.03.0435	1561.7	0.0	2700.0	0.0	2629.1	2274.6	0.0	0.0
CAREYS.CR.03.0354	0.0	0.0	0.0	0.0	0.0	227.7	0.0	458.1
CLARK.CR.03.1421	4799.4	4567.9	5849.5	15679.1	3260.1	2513.2	3214.3	740.5
ETACH.CR.03.0343	0.0	0.0	0.0	0.0	577.5	715.3	411.8	0.0
MANNSER.CR.03.0339	0.0	0.0	0.0	0.0	735.6	390.4	0.0	312.0
NOOKACHAMPS.CR.WF	0.0	1560.3	696.9	0.0	508.2	180.8	0.0	0.0
ROSS.IS.SL.03.0286	0.0	0.0	0.0	0.0	1106.4	421.8	0.0	0.0
SAUK.RIVER.SLOUGH	0.0	0.0	0.0	0.0	0.0	253.8	351.0	0.0
SAUK.RIVER.TRIBS	0.0	0.0	0.0	0.0	363.3	0.0	0.0	0.0
SKAGIT.R.03.0176	0.0	0.0	0.0	0.0	403.8	0.0	0.0	0.0
SKAGIT.RIVER.TRIBS	0.0	0.0	417.0	2881.0	0.0	0.0	2809.2	272.2
SUIATTLE.RIVER.TRIBS	0.0	0.0	0.0	0.0	1098.3	0.0	0.0	0.0
SWINOMISH.CHANNEL.PD	0.0	0.0	5617.6	0.0	4986.1	4008.8	3351.7	2085.4
total est. recoveries	6361.1	6128.2	15281.0	18560.1	15668.4	11437.5	11137.6	3868.2

>WA03.2.WASHINGTON.AREA.3								
ARMSTRONG.CR.05.0126	0.0	0.0	0.0	0.0	248.3	0.0	189.5	0.0
CANYON.CR.TRIB.5.361	0.0	0.0	0.0	522.5	693.2	242.9	651.8	0.0
CHURCH.CR.TRIB.0022	0.0	0.0	0.0	0.0	163.7	195.4	0.0	0.0
CRANBERRY.CR.05.0390	0.0	0.0	0.0	0.0	139.0	0.0	0.0	0.0
FISH.CREEK.05.0038	0.0	0.0	0.0	0.0	0.0	152.1	327.3	0.0
FORTSON.CR.05.0254	0.0	0.0	0.0	565.7	1182.7	385.0	777.6	0.0
HARRIS.CR.07.0283	0.0	1988.0	1645.1	0.0	0.0	0.0	0.0	0.0
LITTLE.PILCHUCK.CR	0.0	1604.5	1548.8	0.0	0.0	0.0	0.0	0.0
MCGOVERN.CR.05.0168	0.0	0.0	0.0	0.0	369.6	343.6	478.2	0.0
SKYKOMISH.R.SF.07	1276.6	805.8	1279.2	1236.1	0.0	0.0	0.0	0.0
SNOQUALMIE.R.07.0219	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2418.1
STILLAGUAMISH.RIVER	2798.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
STILLAGUAMISH.TRIBS	0.0	0.0	0.0	342.6	0.0	0.0	0.0	0.0
TROUT.CR.05.0396	0.0	0.0	0.0	0.0	210.6	0.0	162.4	0.0
TULALIP.CR.07.0001	0.0	9015.9	3507.8	18061.9	2988.9	3411.6	9036.9	2397.9
WALLACE.R.07.0940	2361.1	3520.6	3121.3	7624.3	4219.1	4280.8	6585.3	4077.8
WHIDBEY.ISL.NET.PENS	0.0	0.0	0.0	0.0	3587.7	0.0	2049.8	0.0
HAZEL.SLOUGH.SIDE.CH	0.0	0.0	0.0	189.2	0.0	0.0	0.0	0.0
total est. recoveries	6436.6	16934.8	11102.2	28542.3	13802.8	9011.4	20258.8	8893.8

>WA04.2.WASHINGTON.AREA.4	84	85	86	87	88	89	90	91
AGATE.PASS.SEA.PENS	2788.9	2890.1	3648.8	73.5	7279.0	6784.5	9545.3	5745.9
AIRPORT.POND.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	205.9
BIG.SOOS.CR.09.0072	2175.3	2332.8	4409.2	4716.9	0.0	0.0	2898.1	1167.2
CARPENTER.CR.03.0179	0.0	0.0	0.0	0.0	0.0	525.1	614.2	0.0
DESCHUTES.R.13.0028	826.3	1442.7	724.6	1285.2	2043.3	494.7	1067.5	530.2
ELLIOTT.BAY.SEAPENS	2120.2	0.0	0.0	0.0	0.0	0.0	4666.6	2339.4
FOX.ISLAND.NET.PENS	0.0	0.0	0.0	3025.5	3418.8	1272.7	0.0	0.0
GREEN.R.09.0001	0.0	0.0	0.0	0.0	1379.5	1485.4	0.0	0.0
KALAMA.CR.11.0017	0.0	0.0	0.0	0.0	2043.0	806.3	827.9	676.5
LAEBUGTEN.WHARF	0.0	0.0	0.0	0.0	0.0	1337.4	0.0	0.0
LAKE.WASHINGTON.08	0.0	828.2	0.0	0.0	0.0	0.0	0.0	0.0
MINTER.CR.15.0048	2558.0	1186.5	4036.5	0.0	0.0	0.0	0.0	0.0
PEALE.PASSAGE	0.0	0.0	0.0	1107.4	0.0	0.0	0.0	0.0
PEALE.PASS.SI.PENS	0.0	0.0	0.0	0.0	0.0	0.0	2904.6	1695.8
PORTAGE.BAY.SHIP.CNL	0.0	2950.5	3249.1	186.1	0.0	0.0	0.0	0.0
SOUTH.SOUND.NET.PENS	3345.5	4264.8	5986.6	5075.4	7440.3	6805.1	7210.2	1178.1
VOIGHT.CR.10.0414	4219.9	3309.6	6568.1	7492.9	4683.4	4671.0	2665.7	2488.1
total est. recoveries	18034.1	19205.2	28622.9	22962.9	28287.3	24182.2	32400.1	16027.1

>WA56.2.WASHINGTON.AREA.5.6								
BIG.BEEF.CR.15.0389	1780.4	4732.7	3637.1	3567.9	425.8	1735.5	1963.3	917.5
BIG.QUILCENE.R.17	1725.3	0.0	0.0	0.0	0.0	0.0	3533.6	3928.7
FINCH.CR.16.0222	1179.2	273.6	1634.9	0.0	0.0	0.0	0.0	0.0
PORT.GAMBLE.BAY.PENS	3923.6	2192.8	2707.5	2032.2	250.7	2016.9	4433.7	423.5
PURDY.CR.16.0005	2372.3	1942.8	3852.2	2776.4	870.9	1637.9	1422.1	1598.9
QUILCENE.BAY.SEAPENS	0.0	0.0	0.0	3840.4	0.0	0.0	0.0	1634.6
SKOKOMISH.R.16.0001	0.0	0.0	0.0	937.9	229.5	289.2	403.7	0.0
DUNGENESS.COOP.P.A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	736.7
DUNGENESS.R.18.0018	0.0	0.0	2416.8	0.0	0.0	4815.3	0.0	0.0
ELWHA.R.18.0272	517.0	1396.0	0.0	0.0	120.1	1659.1	273.9	0.0
HOKO.RIVER.19.0148	0.0	0.0	0.0	285.4	263.0	294.6	1468.8	0.0
total est. recoveries	11497.8	10537.9	14248.5	13440.2	2160.0	12448.5	13499.1	9239.9

>WILL.2.WILLAMETTE								
COLLAWASH.R	0.0	0.0	0.0	0.0	304.4	316.6	0.0	0.0
EAGLE.CR.CLACKAMAS.R	1833.4	0.0	0.0	0.0	0.0	0.0	0.0	1562.6
total est. recoveries	1833.4	0.0	0.0	0.0	304.4	316.6	0.0	1562.6

>WAPA.2.WILLAPA.BAY								
FORK.CREEK.24.0356	1731.6	680.6	6065.6	2263.3	2709.4	3147.0	0.0	0.0
NASELLE.R.24.0543	1179.8	1423.0	6664.7	0.0	0.0	0.0	0.0	0.0
NEMAH.R.24.0460	1226.5	631.3	1988.4	0.0	0.0	0.0	0.0	0.0
total est. recoveries	4137.9	2734.9	14718.7	2263.3	2709.4	3147.0	0.0	0.0

Appendix C. Stock groupings used to generate the stock composition estimates presented in Tables 1 through 13. Stocks combined into a single group appear on a single line, with individual stocks separated by colons. Abbreviations are defined by first four characters of stock groups listed in Appendix B (e.g., "LOCO" in Appendix C = "LOCO.2.LOWER COLUMBIA" in Appendix B).

1984

LOCO:WILL
LWWA:UPWA:WA02:WA03:WA04:WA56
GSVI:JNST
SINN:SINS:SINE
GSML:LWFR
CALI:LWOR
CINT
CINS
LYNN
SOUT
STEP
QCI
SWVI
UPOR
WA01
WAPA
THOM:UPFR

1985

GSML:GSVI:JNST:LWFR
COUT:STEP:YAKU
WA02:WA56
CALI:LWOR
NWVI:SWVI
SINN:SINS:SINE
CINS
LYNN
SOUT
CCST
LOCO
LWWA
QCI
UPOR
UPWA
WA01
WA03
WA04
WAPA

1986

WA02:WA03
QCI:SKNA
WA04:WA56
LWFR:THOM:UPFR
SINN:SINS
COUT:STEP:YAKU
NWVI:SWVI
GSVI:JNST
CALI:LWOR
CINT
CINS
LYNN
SOUT
CCST
GSML
LOCO
LWWA
UPOR
UPWA
WA01
WAPA

1987

THOM
CCST:NASS:SKNA
GSML:GSVI:JNST:LWFR
COUT:STEP
CINS:SINN
CALI:LWOR
CINT
LYNN
SINS
SOUT
LOCO
LWWA
NWVI
QCI
SWVI
UPOR
UPWA
WA01
WA03
WA04
WA56
WAPA
WA02

1988

STEP:TAKU:TRAN
WA04:WA56
NASS:SKNA
GSVI:JNST:LWFR
THOM:UPFR
SINN:SINS
LOCO:BRGT:WILL
CALI:LWOR
CINT
COUT
CINS
LYNN
SOUT
CCST
GSML
LWWA
NWVI
QCI
SWVI
UPOR
UPWA
WA01
WA03
WAPA
WA02

1989

UPWA:WA02:WA03:WA04:WA56:WAPA
CALI:LWOR
CCST:NASS:NCST:SKNA
GSML:GSVI:JNST:LWFR
CINS:SINN:SINS
COUT:LYNN:STEP
LOCO:BRGT:WILL
NWVI:SWVI
TAKU:TRAN
CINT
SINE
SOUT
LWWA
QCI
UPOR
WA01
THOM

1990	1991
SINS:SINE	GSML:LWFR:THOM:UPFR
THOM	SINS:SINE
GSML:GSVI:JNST:LWFR	GSVI:JNST:SWVI
WA04:WA56	CCST:NASS:NCST:SKNA
NWVI:SWVI	TAKU:TRAN
LOCO:BRGT:UPOR	LOCO:BRGT:WILL
COUT:STEP	CINS:SINN
CCST:NCST:SKNA	CINT
CINS:SINN	COUT
CALI:LWOR	LYNN
TAKU:TRAN	SOUT
CINT	STEP
LYNN	LWOR
SOUT	LWWA
LWWA	NWVI
QCI	QCI
UPWA	UPOR
WA01	UPWA
WA03	WA01:WA02:WA03:WA04:WA56
WA02	