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February 1989

PACIFIC SALMON COMMISSION  
JOINT CHUM TECHNICAL COMMITTEE REPORT

REPORT TCCHUM (89)-1

1989 PROGRESS REPORT ON  
GENETIC STOCK IDENTIFICATION OF CHUM SALMON  
IN SOUTHERN BRITISH COLUMBIA AND WASHINGTON

February 1989

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1989 PROGRESS REPORT ON GENETIC STOCK IDENTIFICATION OF CHUM SALMON  
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Introduction

In November of 1986, the Pacific Salmon Commission requested that the Joint Chum Technical Committee (CTC) provide estimates of stock composition in intercepting fisheries in southern British Columbia and Washington. The Commission identified the following components of that task:

- 1) Attempt to develop agreed-upon criteria and methods for the application of currently available genetic stock identification (GSI) data to catch data;
- 2) Evaluate and develop recommendations for standardization of GSI sampling, processing, and analysis methods;
- 3) Apply the above methodology to catch data for the fisheries for which adequate GSI data are available.

This report provides a synopsis of the current progress on these tasks. Earlier progress on these tasks has been reported by the CTC in TCCHUM 8702 and TCCHUM (88)-2. Current work has focused on the development of a baseline which provides accurate estimates of stock composition for each fishery. A subcommittee of the CTC has conducted analyses which compare several 7-loci baselines and their accuracy and precision. Based on this work, we make the following recommendations for the use of GSI for chum salmon stock composition estimates.

Recommendations

The first recommendation is in the form of a general cautionary note regarding interpretation of GSI stock composition estimates.

1. Estimates of a particular stock contribution that comprise a small portion of a fishery (e.g. 10%) may be subject to a greater relative bias than estimates comprising a large portion of a fishery (e.g. 80%). However, estimates for stocks which comprise a small portion of the fishery generally have lower absolute biases than for stocks which comprise a larger portion of the fishery. The impact of this finding is illustrated in the following example:

Table 1. Relation between stock composition and relative and absolute bias in the estimate of the catch composition.

	Observed Catch	Stock True	Composition Estimated	True Catch	Estimated Catch	Rel. Bias	Abs. Bias
case 1	500,000	0.1%	5%	500	25,000	4900%	24,500
case 2	500,000	70.0%	80%	350,000	400,000	14%	50,000

The following recommendation concerns estimating stock compositions of intercepting fisheries sampled at the 7-loci level.

2. Use the baseline samples that produce the least biased estimates of stock composition, provided that acceptable levels of precision are maintained. A single baseline is not applicable to all fisheries. If a 7-loci baseline is used to estimate stock compositions in chum fisheries, a baseline with relatively few U.S. stocks is preferred for use in fisheries where the U.S. portion is expected to comprise 15% or less of the annual catch. These fisheries are Johnstone Strait, Georgia Strait, and Nitinat. In fisheries where the U.S. portion is expected to comprise 60% or more of the annual catch, a baseline with relatively equal numbers of U.S. and Canadian stocks provides the most accurate estimates. An example would be the Juan de Fuca net fishery. It is unclear what sort of baseline is suitable when estimating stock compositions in fisheries when U.S. stocks are expected to comprise between 15 and 60% of the annual catch.

Recommendations for estimating stock compositions from fisheries which are sampled at the 21-loci level are not yet provided.

3. The analyses comparing accuracy and precision of a 7-loci and 21-loci baselines need further refinement before conclusions can be made. At the end of 1988, baseline stocks analyzed for 21-loci were available for all U.S. stocks and a subset of southern Canadian stocks. The issue of whether a 21-loci data set will result in improved stock composition estimates will be investigated further during 1989, using the available baseline data.

Stock composition estimates can be provided at several different levels of detail, depending on management requirements, desired accuracy, and precision. As a minimum, a two way (e.g. U.S./Canada) split in stock composition estimates is required.

4. After the simulations in the third recommendation have been completed, the CTC will require further guidance on the desired level of stock grouping and the acceptable levels of bias and precision.

## Stock Composition Estimates

Stock composition estimates for Johnstone Strait, Georgia Strait, and Nitinat fisheries are presented for the years 1985 through 1987. Preliminary estimates for 1988 from these three fisheries will be available in Canadian agency reports. These estimates appear in Tables 1 through 13 in the Appendix. Final 1988 estimates will await further work on the comparison of 7-loci and 21-loci baselines. Catch composition estimates derived from these stock contribution estimates have yet to be developed by the CTC.

The stock composition estimates of the U.S. fisheries will not be presented until the outstanding issues regarding the use of 21-loci baselines are resolved. At that point, the CTC expects to present stock composition estimates from the Strait of Juan de Fuca fisheries from 1986-1988, and from the San Juan Island/Point Roberts fisheries from 1987 and 1988.

## Future Work

The Committee will be working on resolving the following outstanding GSI issues in 1989.

- Determining intra- and interannual variation in genetic characteristics of a stock, using baseline samples collected in 1987 and 1988 from the Nitinat hatchery as an example.
- Comparing the consistency of the laboratory procedures used in Washington and Canada by analyzing in each laboratory a set of identical samples from the Nitinat hatchery.
- Conducting simulations to determine the bias in the Nitinat baseline.
- Evaluating the changes in accuracy and precision of estimated stock compositions by using a 21-loci baselines instead of a 7-loci baseline as well as the implications in regards to sample size.
- Reaching agreement on methods for application of stock composition estimates to catch.
- Examining alternative methods of correcting for bias introduced by the selection of stocks in a baseline.
- Evaluating the effects that the utilization of genotypic versus allelic frequencies have upon the stock compositions.

- Evaluating the effects that the alternative estimation procedures used by Canada and Washington have upon the stock composition estimates.
  
- Investigating techniques other than electrophoretic analysis for stock identification and determining their utility for providing highly accurate and precise estimates of chum salmon stock composition.

## APPENDIX TABLES

1. 1985 Johnstone Strait (Area 12) GSI sampling results
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12. 1985-1986 Nitinat (Area 21) GSI sampling results
13. 1987 Nitinat (Area 21) GSI sampling results

TABLE 1. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1985.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S=WASHINGTON STATE)  
 POOLED NEW ESTIMATES  
 1985 STOCK COMPOSITION - AREA 12

WEEK ENDING DATE	SAMP. SIZE	% FR	% JS,GS	% US
9/1 07-Sep-85	108	80.72 (17.8)	17.98 (17.4)	1.34 (8.4)
9/2 14-Sep-85	146	81.01 (18.1)	16.30 (16.0)	2.78 (8.0)
9/3 21-Sep-85	153	41.62 (14.0)	51.67 (13.3)	6.68 (5.2)
9/4 28-Sep-85	153	44.16 (14.6)	51.65 (13.6)	4.20 (5.7)
10/1 05-Oct-85	152	37.81 (15.8)	49.93 (17.8)	12.41 (8.2)
10/2 12-Oct-85	148	25.67 (15.7)	60.11 (14.6)	14.19 (7.4)
10/3 19-Oct-85	151	25.74 (15.9)	68.46 (14.9)	5.91 (6.2)
10/4 26-Oct-85	150	0.83 (9.8)	88.46 (11.1)	10.79 (6.8)
10/5 02-Nov-85	154	25.10 (15.4)	68.19 (15.5)	6.78 (7.2)
11/1				

( ) = STANDARD DEVIATION

TABLE 2. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1985.  
 (CAN=CANADIAN; U.S.=WASHINGTON STATE)  
 POOLED NEW ESTIMATES  
 1985 STOCK COMPOSITION - AREA 12

WEEK ENDING DATE	SAMP. SIZE	% CAN	% US
9/1 07-Sep-85	108	98.66 (8.4)	1.34 (8.4)
9/2 14-Sep-85	146	97.22 (8.0)	2.78 (8.0)
9/3 21-Sep-85	153	93.32 (5.2)	6.68 (5.2)
9/4 28-Sep-85	153	95.80 (5.7)	4.20 (5.7)
10/1 05-Oct-85	152	87.59 (8.2)	12.41 (8.2)
10/2 12-Oct-85	148	85.81 (7.4)	14.19 (7.4)
10/3 19-Oct-85	151	94.09 (6.2)	5.91 (6.2)
10/4 26-Oct-85	150	89.21 (6.8)	10.79 (6.8)
10/5 02-Nov-85	154	93.22 (7.2)	6.78 (7.2)
11/1			

FILE..12EL8586.WK1 DISK...ELECT CHUM(G)

( ) = STANDARD DEVIATION



TABLE 3. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1986.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S.=WASHINGTON STATE)  
 POOLED NEW ESTIMATES  
 1986 STOCK COMPOSITION - AREA 12

WEEK ENDING DATE	SAMP. SIZE	% FR	% JS,GS	% US
9/1 06-Sep-86	141	55.58 (17.1)	42.41 (16.2)	1.97 (6.4)
9/2 13-Sep-86	153	66.54 (17.3)	33.10 (15.6)	0.35 (5.9)
9/3 20-Sep-86	150	34.33 (13.6)	65.62 (13.9)	0.04 (1.6)
9/4 27-Sep-86	300	73.65 (13.1)	26.27 (13.4)	0.03 (2.5)
10/1 04-Oct-86	300	23.19 (13.3)	75.09 (13.8)	1.78 (3.4)
10/2 11-Oct-86	300	30.03 (12.8)	69.87 (12.7)	0.02 (1.1)
10/3 18-Oct-86	300	28.83 (12.1)	69.38 (12.1)	1.90 (2.3)
10/4 25-Oct-86	300	43.37 (13.0)	54.77 (12.9)	1.82 (3.9)
10/5 01-Nov-86	299	22.38 (13.9)	76.34 (13.3)	1.24 (4.6)
11/1 08-Nov-86	298	30.44 (12.8)	63.66 (13.0)	6.04 (7.6)

() = Standard Deviation  
 File '12EL8586.wk1'; DISK "ELECT (CHUM)".

TABLE 4. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1986.  
 (CAN=CANADIAN; U.S.=WASHINGTON STATE)  
 POOLED NEW ESTIMATES  
 1986 STOCK COMPOSITION - AREA 12

WEEK ENDING DATE	SAMP. SIZE	% CAN	% US
9/1 06-Sep-86	141	98.03 (6.4)	1.97 (6.4)
9/2 13-Sep-86	153	99.65 (5.9)	0.35 (5.9)
9/3 20-Sep-86	150	99.96 (1.6)	0.04 (1.6)
9/4 27-Sep-86	300	99.97 (2.5)	0.03 (2.5)
10/1 04-Oct-86	300	98.22 (3.4)	1.78 (3.4)
10/2 11-Oct-86	300	99.98 (1.1)	0.02 (1.1)
10/3 18-Oct-86	300	98.10 (2.3)	1.90 (2.3)
10/4 25-Oct-86	300	98.18 (3.9)	1.82 (3.9)
10/5 01-Nov-86	299	98.76 (4.6)	1.24 (4.6)
11/1 08-Nov-86	298	93.96 (7.6)	6.04 (7.6)

() = Standard Deviation  
 File '12EL8586.wk1'; DISK "ELECT (CHUM)".

TABLE 5. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1987.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S.=WASHINGTON STATE) NEW POINT ESTIMATES  
 PRELIMINARY 1987 STOCK COMPOSITION - AREA 12 (test seine)  
 26-Jan-89

SAMPLE DATE	SAMP. SIZE	AREA 12 (POOLED)		
		% FR	% JS,GS	% US
9/1		NO SAMPLE		
9/2		NO SAMPLE		
9/3	19-Sep-87	271	25.43 (10.5)	70.31 (10.2) 4.19 (4.8)
9/4	26-Sep-87	300	69.15 (11.4)	28.18 (11.4) 2.64 (5.3)
10/1	03-Oct-87	283	15.09 (14.2)	79.18 (13.6) 5.69 (6.1)
10/2	10-Oct-87	332	20.96 (10.7)	76.52 (10.6) 2.59 (4.4)
10/3	17-Oct-87	300	34.15 (13.4)	62.41 (12.3) 3.43 (4.0)
10/4	24-Oct-87	300	13.93 (9.9)	83.64 (9.9) 2.37 (4.4)
10/5	31-Oct-87	299	25.06 (11.8)	74.83 (11.2) 0.09 (2.5)
11/1	07-Nov-87	300	20.66 (10.5)	72.53 (10.2) 6.84 (4.8)
11/2	14-Nov-87	160	4.49 (14.7)	88.62 (15.8) 6.99 (6.3)

TABLE 6. ELECTROPHORETIC RESULTS FROM AREA 12 TEST FISHING, 1987.  
 CAN= CANADIAN; U.S.=WASHINGTON STATE) NEW POINT ESTIMATES  
 PRELIMINARY 1987 STOCK COMPOSITION - AREA 12 (test seine)  
 26-Jan-89

SAMPLE DATE	SAMP. SIZE	AREA 12 (POOLED)	
		% CAN	% US
9/3	19-Sep-87	271	95.81 (4.8) 4.19 (4.8)
9/4	26-Sep-87	300	97.36 (5.3) 2.64 (5.3)
10/1	03-Oct-87	283	94.31 (6.1) 5.69 (6.1)
10/2	10-Oct-87	332	97.41 (4.4) 2.59 (4.4)
10/3	17-Oct-87	300	96.57 (4.0) 3.43 (4.0)
10/4	24-Oct-87	300	97.63 (4.4) 2.37 (4.4)
10/5	31-Oct-87	299	99.91 (2.5) 0.09 (2.5)
11/1	07-Nov-87	300	93.16 (4.8) 6.84 (4.8)
11/2	14-Nov-87	160	93.01 (6.3) 6.99 (6.3)

File..12jsel87.wk1 Disk..ELECT CHUM(G)  
 () = Standard Deviation

TABLE 7. ELECTROPHORETIC RESULTS FROM AREA 14, 1985.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S.=WASHINGTON STATE)

PRELIMINARY 1985 STOCK COMPOSITION - AREA 14 (commercial & test)  
 26-Jan-89

SAMPLE DATE	LOCATION	SAMP. SIZE	AREA 14 (TEST)		
			FR	JS,GS	US
10/4 Oct 23,25	14-5	S 147	1.44 (8.4)	81.98 (10.9)	16.61 (7.5)
10/2 Oct 11,12	14-9	S 83	7.03 (17.2)	92.77 (19.0)	0.22 (8.1)
10/3 Oct 17	14-9	S 128	1.35 (9.1)	91.39 (10.6)	7.25 (5.5)
10/4 Oct 26	14-9	G 100	15.76 (15.3)	65.68 (18.2)	18.57 (11.2)
10/5 Oct 30	14-9	S 149	4.05 (12.8)	88.72 (14.1)	7.32 (5.4)
10/2 Oct 10	14-10	G 95	23.27 (18.0)	71.19 (21.6)	5.56 (7.0)
10/3 Oct 18	14-10	G 47	26.88 (22.5)	73.08 (22.5)	0.04 (2.2)
10/4 Oct 23	14-10	S 150	1.76 (13.9)	94.65 (15.0)	3.57 (4.6)
10/5 Nov 3	14-10	S 150	13.73 (9.9)	79.84 (10.9)	6.44 (5.3)
AREA 14 (COMMERCIAL)					
10/2 Oct 12	14-5	G 150	34.01 (17.4)	65.86 (17.0)	0.06 (6.4)
10/3 Oct 15	14-4	G 104	3.80 (10.6)	96.16 (10.6)	0.06 (2.4)
10/4 Oct 22	14-4,5	G 146	10.22 (12.4)	78.15 (12.2)	11.58 (6.6)
10/5 Oct 29	14-4,5	G 149	22.06 (15.0)	77.83 (14.3)	0.05 (5.0)
10/3 Oct 16	14-11	G 150	0.27 (7.7)	99.75 (8.0)	0.00 (2.4)
10/4 Oct 22	14-11	G 157	11.91 (11.2)	84.90 (10.9)	3.20 (3.6)

File..A14SUM85.wk1 Disk..ELECT CHUM(G)

( ) = Standard Deviation, S = Seine net, G = Gillnet

TABLE 8. ELECTROPHORETIC RESULTS FROM THE MID VANCOUVER ISLAND  
COMMERCIAL FISHERY (AREA 14), 1986  
(FR=FRASER RIVER; JS,GS=JOHNSTONE/GEORGIA STRAIT  
U.S.=WASHINGTON STATE)

NEW POINT ESTIMATE  
1986 STOCK COMPOSITION - MID VANCOUVER ISLAND (AREA 14)

SAMPLE DATE	AREA	SAMP. SIZE	% FR	% JS,GS	% US	
10/2	OCT 5	14-5,7	GN 109	2.15 (13.7)	70.38 (15.3)	27.48 (11.3)
10/3	OCT 13	14-5	GN 150	19.18 (15.4)	75.57 (16.1)	5.26 (6.5)
10/4	OCT 20	14-5,7	GN 144	35.97 (15.5)	55.43 (13.9)	8.69 (6.8)
10/4	OCT 20	14-9	GN 150	8.89 (9.1)	91.01 (10.0)	0.11 (3.1)
10/5	OCT 26	14-5,7	GN 142	25.95 (16.2)	73.90 (16.3)	0.17 (4.5)
10/5	OCT 26	14-9	GN 140	18.30 (11.5)	71.50 (14.1)	10.16 (7.2)
11/1	NOV 2	14-5	GN 150	13.83 (13.3)	80.25 (14.0)	5.92 (4.2)
11/1	NOV 2	14-9	GN 149	22.82 (13.9)	77.22 (13.7)	0.04 (2.9)

FILE..14TF86.WK1 DISK...ELECT CHUM(G)  
( ) = STANDARD DEVIATION

TABLE 9. ELECTROPHORETIC RESULTS FROM THE MID VANCOUVER ISLAND  
COMMERCIAL FISHERY (AREA 14), 1986  
(CAN=CANADIAN; U.S.=WASHINGTON STATE)

1986 STOCK COMPOSITION - MID VANCOUVER ISLAND (AREA 14)

POINT ESTIMATE AREA 14					
SAMPLE DATE	AREA	SAMP. SIZE	% CAN	% US	
10/2	OCT 5	14-5,7	GN 109	72.52 (11.3)	27.48 (11.3)
10/3	OCT 13	14-5	GN 150	94.74 (6.5)	5.26 (6.5)
10/4	OCT 20	14-5,7	GN 144	91.31 (6.8)	8.69 (6.8)
10/4	OCT 20	14-9	GN 150	99.89 (3.1)	0.11 (3.1)
10/5	OCT 26	14-5,7	GN 142	99.83 (4.5)	0.17 (4.5)
10/5	OCT 26	14-9	GN 140	89.84 (7.2)	10.16 (7.2)
11/1	NOV 2	14-5	GN 150	94.08 (4.2)	5.92 (4.2)
11/1	NOV 2	14-9	GN 149	99.96 (2.9)	0.04 (2.9)

FILE..14TF86.WK1 DISK...ELECT CHUM(G)  
( ) = STANDARD DEVIATION

TABLE 10. ELECTROPHORETIC RESULTS FROM AREA 14 COMMERCIAL, 1987.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S.=WASHINGTON STATE)

PRELIMINARY 1987 STOCK COMP. - AREA 14 (commercial)  
 26-Jan-89 NEW ESTIMATES

Comox area 14-9 (outside bar)									
WEEK ENDING	SAMP.		%		%		%		
DATE	SIZE		FR		JS,GS		US		
10/3	17-Oct-87	G 150	5.50	(12.1)	90.64	(12.7)	3.83	(5.1)	
10/4	24-Oct-87	S 132	0.20	(11.9)	99.72	(12.1)	0.06	(1.0)	
10/5	31-Oct-87	G 150	0.71	(7.9)	99.36	(8.1)	0.11	(3.5)	
11/1	07-Nov-87	S 150	10.44	(12.0)	82.42	(11.3)	7.10	(6.7)	
11/2	14-Nov-87		NO SAMPLE						
11/3	21-Nov-87	S 118	0.57	(9.3)	97.03	(9.2)	2.55	(2.3)	

Qualicum River areas 14-4,5									
WEEK ENDING	SAMP.		%		%		%		
DATE	SIZE		FR		JS,GS		US		
10/3	17-Oct-87	G 139	20.81	(13.9)	79.07	(14.9)	0.09	(4.8)	
10/4	24-Oct-87	S 150	0.90	(8.3)	97.61	(8.5)	1.47	(5.2)	
10/5	31-Oct-87	G 165	1.16	(12.2)	95.21	(12.6)	3.56	(3.2)	
11/1	07-Nov-87	S 150	2.53	(14.1)	92.38	(14.8)	5.09	(4.5)	
11/2	14-Nov-87	G 151	34.66	(16.5)	65.24	(16.4)	0.05	(2.9)	

Note : Comox sample week ending 11/3 from DFO seine charter

1987 STOCK COMP. - AREA 17

WEEK ENDING	SAMP.		%		%		%		
DATE	SIZE		FR		JS,GS		US		
11/2	14-Nov-87	G 135	0.32	(13.6)	82.73	(14.9)	16.99	(8.4)	

G=gillnet S=seine  
 File..14GSEL87.wkl Disk..ELECT (M)  
 () = Standard Deviation

TABLE 11.

CHUM ELECTROPHORETIC POST SEASON ANALYSIS OF 1985 SAMPLING.  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 U.S.=WASHINGTON STATE)

PRELIMINARY 1985 STOCK COMP. NEW POINT ESTIMATE  
 26-Jan-89

SAMPLE DATE		AREA	SAMP. SIZE	%	FR	%	JS,GS	%	US
DATE									
10/5	Oct 29	16	142 T	34.75	(17.6)	57.40	(17.8)	7.78	(6.4)
10/5	Oct 30-31	16	110 T	57.78	(20.8)	42.04	(21.0)	0.21	(4.5)
10/4	Oct 25	17	88 T	11.17	(15.9)	81.51	(15.8)	7.41	(8.3)
10/5	Oct 31	17-12	50 T	6.62	(20.5)	64.76	(23.4)	28.63	(18.1)
11/2	Nov 11,13,14	17-12	134 T	38.33	(19.8)	61.52	(19.6)	0.12	(3.8)
10/4	Oct 19-21	17-12	150 T	22.75	(16.4)	67.22	(16.4)	10.02	(7.1)
10/4	Oct 19-21	17-13	118 T	12.57	(12.4)	86.45	(12.5)	0.96	(5.4)
10/5	Oct 30- Nov 1	17-13	162 T	0.52	(11.5)	90.81	(12.5)	8.74	(7.1)
11/2	Nov 12-14	17-13	150 T	12.18	(12.7)	87.60	(13.2)	0.22	(3.1)
11/1	Nov 5,6,7	18-6	150 T	15.52	(10.3)	77.68	(9.6)	6.80	(7.4)

( )=STANDARD DEVIATION

FILE...POST85-3.WK1

DISK...ELECT CHUM(G0

(NEW WCVI BASELINE)

TABLE 12. G.S.I. RESULTS FROM NITNAT (AREA 21) SAMPLING, 1985 TO 1986.  
(FR=FRASER, JS,GS=JOHNSTONE/GEORGIA STRAIT, US=WASHINGTON STATE, WCVI=W.C. VAN. I5.

STOCK COMPOSITION - AREA 21

SAMPLE DATE	SAMPL SIZE	% FR	% GS	% WCVI	% US	
1985 STOCK COMPOSITION - AREA 21						
10/2	Oct 12	137	5.06 (6.9)	24.36 (12.0)	70.28 (10.4)	0.31 (3.9)
10/3	Oct 17-18	150	3.20 (3.0)	7.97 (10.9)	77.48 (10.8)	11.34 (4.9)
10/4	Oct 24	144	12.12 (8.9)	25.62 (12.5)	58.71 (12.3)	3.49 (4.3)
1986 STOCK COMPOSITION - AREA 21						
10/1	Sep 29	151	6.01 (10.2)	16.80 (12.3)	77.20 (11.1)	0.07 (0.5)
10/2	Oct 7-8	150	31.13 (13.4)	1.10 (9.0)	67.77 (12.0)	0.04 (0.0)
10/3	Oct 15-16	150	0.36 (6.4)	21.61 (11.6)	77.88 (11.0)	0.12 (1.9)
10/4	Oct 20	140	6.19 (6.5)	10.05 (9.8)	79.13 (10.8)	4.72 (6.3)
10/5	Oct 31	149	0.11 (5.4)	0.17 (6.1)	94.06 (8.0)	5.66 (4.1)

( ) = STANDARD DEVIATION

FILE...21TF8586.wk1 DISK...Elect Chum (G)

WCVI BASELINE

TABLE 13 . ELECTROPHORETIC RESULTS FROM NITINAT, 1987  
PRELIMINARY 1987 STOCK COMPOSITION - AREA 21

AREA	SAMPLE DATE	SAMPLE SIZE	% FR	% GS	% WCVI	% US	
10/1	Sep 30 - Oct 2	G 91	5.74 (10.4)	7.84 (10.0)	81.91 (11.9)	4.57 (5.8)	
10/2	Oct 9	G 150	0.17 (6.8)	23.06 (10.3)	69.70 (9.5)	7.13 (6.4)	
10/3	Oct 15-16	G 150	5.70 (7.9)	10.22 (10.9)	83.93 (11.4)	0.21 (2.7)	
10/3	Oct 13	S 149	0.26 (5.1)	18.66 (13.3)	81.02 (14.2)	0.03 (0.0)	
10/4	Oct 21-22	G 125	7.19 (6.0)	0.09 (8.6)	92.64 (9.2)	0.00 (0.0)	
10/4	Oct 22-23	S 150	4.22 (4.1)	6.31 (4.8)	89.51 (5.7)	0.03 (0.9)	
10/5	Oct 29	S 149	2.18 (8.6)	2.80 (7.5)	93.20 (10.5)	1.81 (1.7)	
11/1	Nov 4	S 150	16.26 (12.4)	25.70 (14.7)	44.12 (13.1)	13.86 (7.0)	
11/1	Nov 3	H 126	16.60 (8.8)	1.46 (7.8)	79.85 (8.8)	2.09 (3.6)	
11/1	Nov 4	G 20	SAMPLE TOO SMALL TO PROCESS				

G=gillnet S=seine H=hatchery  
 ( ) = STANDARD DEVIATION  
 (FR=FRASER; JS,GS=JOHNSTONE/GEORGIA STRAIT;  
 US=WASHINGTON STATE; WCVI=WEST COAST VANCOUVER ISLAND)  
 DATA SOURCE : JOHNSTONE STRAIT MANAGEMENT GROUP  
 File..2021e187.wk1 disk..ELECT (G)