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Evaluation of the Sampling of the Skeena River 1968 Sockeye Catch

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EVALUATION OF THE SAMPLING OF THE SKEENA RIVER 1968 SOCKEYE CATCH

The sampling of sockeye and chum salmon was reduced in 1968 after a statistical evaluation was made to determine the effort required to provide reliable estimates of the age, size and sex composition of the catches.

On the basis of this evaluation, the following weekly sample requirements for both species were designated as follows:

Estimate of:	At precision	At reliability	Number of samples
Weekly age composition	±10%	95%	100/week
Annual " "	±5%	99%	676
Annual mean size	±5 mm	95%	768

The above sample sizes are based on the ideal situation of complete randomness, which is extremely difficult to realize in the practical situation. In 1968, the absolute need for randomness of sampling was emphatically pointed out to the samplers. Samplers were instructed to sample each species of fish in catches from each statistical area on an hourly basis throughout the period of unloading each day. If only small boats were unloading, every effort was to be made to obtain hourly samples from a different boat each time. Sampling of fish from each area was to continue over one or more days each week until all catches had been unloaded at the cannery. It was hoped that this distribution of sampling effort would be sufficiently random to provide estimates of age and size composition at the above theoretical levels of precision and reliability. At the time, it was not possible to test the reliability of the sampling. Subsequent to this, Mr. I. Todd, of the Department of Fisheries, made available to us a large number of measurements of sockeye salmon sampled from the Skeena catch in 1968. These data have been used here to make a comparison between the estimates of the FRB samples with the estimate by the Department, based on a much larger sample.

Methods

The Fisheries Research Board sampled, on the average, 97 sockeye from the Skeena catch each week (sample sizes ranged from 64 to 156) for age, hypural length (taken from the posterior margin of the eye to the end

of the hypural plate) and sex. For the 7-week period, a total of 677 samples were obtained. Samples of catches from the outside and inside regions of statistical fishing Area 4 were obtained on a random basis. Ages of these samples were determined by FRB personnel from examination of the scales.

The Department of Fisheries sampled on the average 994 sockeye from the Skeena catch each week (sample sizes ranged from 509 to 1,979) for age, hypural length and sex. For the 7-week period, a total of 6,960 samples were obtained. Ages of these samples were determined by Department of Fisheries personnel from examination of the scales. Weekly samples of sockeye catches were obtained from each of the following arbitrarily chosen sub-areas within Area 4:

(a) Fish caught in the outside regions of Area 4; i.e., the North Boundary region which lies between Tugwell Island in the south and the Area 3 boundary in the north; and the Edye Passage - outside Stephens Island area.

(b) Fish caught in the Skeena River and Gap regions; i.e., from the upriver fishing boundary to an imaginary line drawn from Hazel Point on Smith Island to the northwestern tip of Kennedy Island.

(c) Fish caught in the Chatham Sound area.

RESULTS

Estimates of weekly age and sex composition

Age composition of samples collected by the Department of Fisheries from each of three sub-areas (Table I) were quite similar, so the data were combined to provide weekly estimates of age and sex composition of the catch (Table II).

Comparison of the Department of Fisheries estimates of weekly age and sex composition with those of FRB indicates quite close agreement (Table II). Differences in estimates of a particular age and sex category in the weekly catches varied from a low 0.11% to a high of 10.90%. The overall average of the differences was 2.15%. Some of the differences in age estimates by the two agencies were likely due to differences in their interpretations of age from the scales (Godfrey et al., 1968). Differences in the estimates of the proportions of males and females in the weekly catches ranged from 2.5% to 10.2%, averaging approximately 6.2%.

Estimates of annual age and sex composition

Comparison of the Department of Fisheries estimates of annual age and sex composition with those of FRB indicates close agreement (Table II). Differences in estimates of the percentage representation of a particular age and sex category in the total catch varied from 0.06% to 5.62%. Differences in estimates of age composition, sexes combined, varied from 0.11% to 3.46%. The estimates of proportions of males and females in the total catch differed by approximately 4.0%.

Estimates of annual mean size of sockeye of each age and sex category

Comparison of the Department of Fisheries estimate of the annual mean size of sockeye of each age and sex category with that of the FRB sample indicates quite close agreement (Table I). Differences in the estimates of mean sizes of sockeye in each age and sex category ranged from 0.8 mm for age 2.2 females to 11.3 mm for age 2.3 females. The difference in estimates of mean sizes of the two major age groups (1.2 and 1.3 fish) ranged from 5.5 mm to 5.9 mm. In 7 out of the 8 age-sex categories, estimates of mean length by FRB were higher than those of the Department of Fisheries (Table I), suggesting differences in either the methods or in the equipment used by the two agencies. It is most unlikely the bias originated from the kind of equipment used, but it is possible it was a result of a difference in the calibration of the measuring sticks. In general, the methods used to obtain the posterior eye-hypural plate length measurement were the same, but it is possible the consistent difference in length was the result of a difference in estimating the location of the hypural plate.

SUMMARY

The sampling of 6,960 sockeye out of the Skeena catch of 781,000 fish by the Department of Fisheries was approximately 10 times the samples (677) collected by FRB in 1968. If it is assumed that the estimates of age, size and sex composition of the sockeye catch (based on the large number of samples obtained) by the Department are representative of the catch, then the following conclusions can be made regarding the FRB sampling:

(a) Weekly estimates of age and sex composition - FRB sampled at a theoretical precision of $\pm$10% at 95% reliability. Comparison of FRB's weekly estimates of age with the Department's indicated that the differences in estimates exceeded 10% in 1 of 64 cases. Differences in estimates of weekly sex composition exceeded 10% in 2 of 8 cases.

(b) Annual estimates of age and sex composition - FRB sampled at a theoretical precision of $\pm$5% at 99% reliability. Comparison of FRB's annual estimate of age composition with the Department's indicated that the differences in estimates by age and sex category exceeded 5% in 1 of 12 cases.

When only age was considered and sexes were combined within each age category, in no case did the differences in the estimates exceed 5%.

(c) Annual estimates of mean size of sockeye in each age and sex category - FRB sampled at a theoretical precision of ±5 mm at 95% reliability. Comparison of FRB's annual estimates of mean size of each age and sex with the Department's estimates indicated that the differences in all but two cases exceeded 5 mm, ranging from 5.5 to 6.2 mm. In general, the differences were very close to the theoretical level of precision.

In conclusion, the relatively small size of the FRB sample provided estimates which were very similar to those of the Department. It is probably safe to conclude that despite the relatively small size of the FRB sample, estimates of the age, size and sex composition of sockeye in the catch were reasonably reliable.

ACKNOWLEDGEMENT

The author would like to thank Dr. R. R. Parker for his helpful criticism of this report.

REFERENCES

Godfrey, H., D. D. Worlund and H. T. Bilton. 1968. Tests on the accuracy of ageing chinook salmon (Oncorhynchus tshawytscha) from their scales. J. Fish. Res. Bd. Canada, 25(9): 1971-1982.

Table I. Per cent age composition and mean sizes of sockeye of each age and sex category in catches from three sub-areas of Area 4. Estimates of age composition and mean size from Department of Fisheries samples compared with the estimate of each from the Fisheries Research Board samples.

		1.2		1.3		2.2		2.3		Total
		♂	♀	♂	♀	♂	♀	♂	♀	
Outside Skeena (A)	Number	167	154	621	1,073	60	52	30	35	2,192
	%	7.62	7.03	28.33	48.95	2.73	2.37	1.36	1.59	
	Mean length	479.7	473.7	537.1	519.9	486.6	497.6	536.0	516.6	
Inside Skeena (B)	Number	168	140	809	1,263	37	36	31	34	2,518
	%	6.67	5.56	32.13	50.16	1.46	1.42	1.23	1.35	
	Mean length	465.3	466.3	536.5	518.3	483.3	491.2	525.5	507.6	
Chatham Sound	Number	145	124	709	1,152	28	40	13	19	2,230
	%	6.50	5.56	31.79	51.66	1.25	1.79	0.58	0.85	
	Mean length	470.2	471.1	534.0	518.2	494.6	483.5	517.4	531.9	
Combined areas	Number	480	418	2,139	3,488	125	128	74	88	6,960
	Mean length	471.7	470.4	535.8	518.7	487.4	491.4	528.3	516.4	
F.R.B.	Number	53	45	170	354	16	17	9	12	677
	Mean length	477.4	476.3	541.3	524.5	481.2	492.2	531.1	527.7	
Difference (mm)		+ 5.7	+ 5.9	+ 5.5	+ 5.8	- 6.2	+ 0.8	+ 2.8	+ 11.3	

Table II. Weekly and annual per cent age and sex composition of sockeye in Skeena River catch in 1968. Estimates by the Department of Fisheries are compared with estimates by the Fisheries Research Board.

Agency	Week ending		Age groups 1.2 ♂	1.2 ♀	1.3 ♂	1.3 ♀	2.2 ♂	2.2 ♀	2.3 ♂	2.3 ♀	Other ♂	Other ♀	Total ♂	Total ♀	Total ♂+♀
D.F.	June 30	Number	46	36	151	196	24	11	20	23	1	1	242	267	509
		%	9.04	7.07	29.67	38.50	4.72	2.16	3.93	4.52	-	-	47.5	52.5	
F.R.B.		Number	12	7	30	37	4	3	6	3	-	-	52	50	102
		%	11.76	6.86	29.41	36.27	3.92	2.94	5.88	2.94	-	-	50.9	49.1	
		Difference %	2.28	0.21	0.25	2.23	0.80	0.78	1.95	1.58	-	-	3.4	3.4	
D.F.	July 7	Number	90	48	347	523	21	26	15	15	1	3	474	615	1,089
		%	8.26	4.41	31.86	48.03	1.93	2.39	1.38	1.38	-	-	43.5	56.5	
F.R.B.		Number	6	4	19	45	1	3	-	-	-	-	26	52	78
		%	7.69	5.12	24.35	57.69	1.28	3.84	-	-	-	-	33.3	66.7	
		Difference %	0.57	0.71	7.51	9.66	0.65	1.45	1.38	1.38	-	-	10.2	10.2	
D.F.	July 14	Number	57	31	274	331	15	7	14	10	1	-	361	379	740
		%	7.70	4.19	37.03	44.73	2.03	0.95	1.89	1.35	-	-	48.8	51.2	
F.R.B.		Number	6	5	23	46	1	4	2	1	-	-	32	56	88
		%	6.81	5.68	26.13	52.27	1.13	4.54	2.27	1.13	-	-	36.4	63.6	
		Difference %	0.89	1.49	10.90	7.54	0.90	3.59	0.38	0.22	-	-	12.4	12.4	
D.F.	July 21	Number	110	121	642	1,013	26	34	17	12	2	2	797	1,182	1,979
		%	5.56	6.11	31.44	51.19	1.31	1.72	0.86	0.61	-	-	40.3	59.7	
F.R.B.		Number	3	3	27	58	-	1	-	3	-	-	30	65	95
		%	3.15	3.15	28.42	61.05	-	1.05	-	3.15	-	-	31.6	68.4	
		Difference %	2.41	2.96	3.02	9.86	1.31	0.72	0.86	2.54	-	-	8.7	8.7	
D.F.	July 28	Number	103	89	450	860	28	34	5	20	2	-	588	1,003	1,591
		%	6.47	5.59	28.28	54.05	1.76	2.14	0.31	1.26	-	-	36.9	63.1	
F.R.B.		Number	12	9	40	84	4	3	-	4	-	-	56	100	156
		%	7.69	5.76	25.64	53.84	2.56	1.92	-	2.56	-	-	35.9	64.1	
		Difference %	1.22	0.17	2.64	0.21	0.80	0.22	0.31	1.30	-	-	1.0	1.0	
D.F.	Aug. 4	Number	27	34	152	300	3	5	1	3	1	-	184	342	526
		%	5.13	6.46	28.90	57.03	0.57	0.95	0.19	0.57	-	-	35.0	65.0	
F.R.B.		Number	6	4	15	36	3	-	-	-	-	-	24	40	64
		%	9.37	6.25	23.43	56.25	4.68	-	-	-	-	-	37.5	62.5	
		Difference %	4.24	0.21	5.47	0.78	4.11	0.95	0.19	0.57	-	-	2.5	2.5	
D.F.	Aug. 11	Number	47	59	123	266	8	11	3	5	4	-	185	341	526
		%	8.94	11.22	23.38	50.57	1.52	2.09	0.57	0.95	-	-	35.2	64.8	
F.R.B.		Number	8	13	16	48	3	3	1	1	-	1	28	66	94
		%	8.51	13.82	17.02	51.06	3.19	3.19	1.06	1.06	-	-	29.8	70.2	
		Difference %	0.43	2.60	6.36	0.49	1.67	1.10	0.49	0.11	-	-	5.4	5.4	
D.F.	Total	Number	480	418	2,139	3,489	125	128	75	88	12	6	2,831	4,129	6,960
		%	6.89	6.00	30.73	50.12	1.79	1.83	1.07	1.26	0.17	0.08	40.67	59.33	
F.R.B.		Number	53	45	170	354	16	17	9	12	-	1	248	429	677
		%	7.82	6.64	25.11	52.28	2.36	2.51	1.32	1.77	-	0.14	36.63	63.37	
		Difference %	0.93	0.64	5.62	2.16	0.57	0.68	0.25	0.51	0.17	0.06	4.04	4.04	
D.F.		%	12.90		80.86		3.63		2.34		0.25				
F.R.B.		%	14.47		77.40		4.87		3.10		0.14				
		Difference %	1.57		3.46		1.24		0.76		0.11				