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ESTIMATED CONTRIBUTION FROM ALASKA AND CANADA STOCKS TO THE CATCHES OF SOCKEYE SALMON (Oncorhynchus nerka) IN SOUTHERN SOUTHEASTERN ALASKA, 1982 AND 1983 BASED ON SCALE PATTERN ANALYSIS

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January 1985

ALASKA DEPARTMENT OF FISH AND GAME
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Don W. Collinsworth
Commissioner

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ABSTRACT

Mixed stocks of sockeye salmon *(Oncorhynchus nerka)* harvested in southern Southeastern Alaska in 1982 and 1983 were allocated to nation and/or system of origin using linear discriminant function analysis of scale patterns and age composition data. Of the approximately 766 thousand sockeye salmon harvested in 1982, an estimated 435 thousand or 57% were bound for streams in Canada. In 1983, an estimated 633 thousand or 70% of the catch of 909 thousand were bound for streams in Canada. The coefficients of variation on the estimated contributions for the two seasons ranged from 2.8% to 4.4%.

KEY WORDS: sockeye salmon, *Oncorhynchus nerka*, linear discriminant function analysis, scale patterns, Southeastern Alaska, Canada, and stock allocation.

INTRODUCTION

Net fisheries in southern Southeastern Alaska (Figure 1) harvest mixed stocks of sockeye salmon *(Oncorhynchus nerka)* native to the Stikine River, to many small streams in southern Southeastern Alaska, and to the Nass, Skeena, and Fraser Rivers in Canada (Rich and Morton 1930; Verhoeven 1952; Noerenberg 1959; Logan 1967; Simpson 1968; Hoffman 1984, in press). The Stikine River is a transboundary river that arises in British Columbia, Canada and flows into Frederick Sound near Wrangell, Alaska. The Nass and Skeena Rivers lie entirely within British Columbia and flow into Chatham Sound just south of the Alaska border (Figure 2). In some years significant numbers of south migrating stocks of sockeye salmon, thought to be predominately bound for the Fraser River in southern British Columbia, have been caught in some Alaska fisheries. Small numbers of sockeye salmon returning to northern Southeastern Alaska and to systems as distant as Prince William Sound, Alaska, and Washington State may also be taken in some years.

The contribution of several groups of these stocks was estimated to the 1982 and 1983 net fisheries of southern Southeastern Alaska Districts 101 through 108 using linear discriminant function analysis of scale patterns for different age classes of sockeye salmon. Significant and persistent differences were found in the patterns of growth during freshwater and early marine life history between stocks originating in Alaska and Canada (Marshall et al. 1984; Oliver et al. 1983). Sockeye salmon from Alaska stocks grew less and slower during their lacustrine residence than did fish from Canada stocks. Also, Alaska fish rarely exhibited spring plus growth, while fish from Canada almost always did. These differences in growth, reflected in scale patterns, allow easy and accurate separation of Canada and Alaska stocks. Oliver et al. (1983) and Marshall et al. (1983) contain detailed descriptions of linear discriminant analysis of scale patterns as a technique to estimate the destinations of catches in mixed stock, sockeye salmon fisheries.

METHODS

Stock Groupings

Stocks of sockeye salmon were grouped on the basis of national origin except in those cases where identifying the contribution of a specific system was desired (Table 1). Stocks from the Nass, Skeena, and Stikine Rivers in 1982 and 1983 and south migrating stocks, throught to be predominately Fraser River stocks, in the latter year were combined into a Canada group. Stocks from 28 rivers in southern Southeastern Alaska were combined to form an Alaska group (Figure 2). In 1983 where specific south migrating stock contributions were desired the Canada group was split into Nass/Skeena and south migrating stock components.

Where specific Stikine River contributions were desired in 1982 the Canada group was split into Nass/Skeena and Stikine components. In 1983 this grouping was further refined to include south migrating, predominately Fraser River, stocks in the Nass/Skeena group and the Stikine group was split into river spawning stocks and Tahltan Lake stocks.

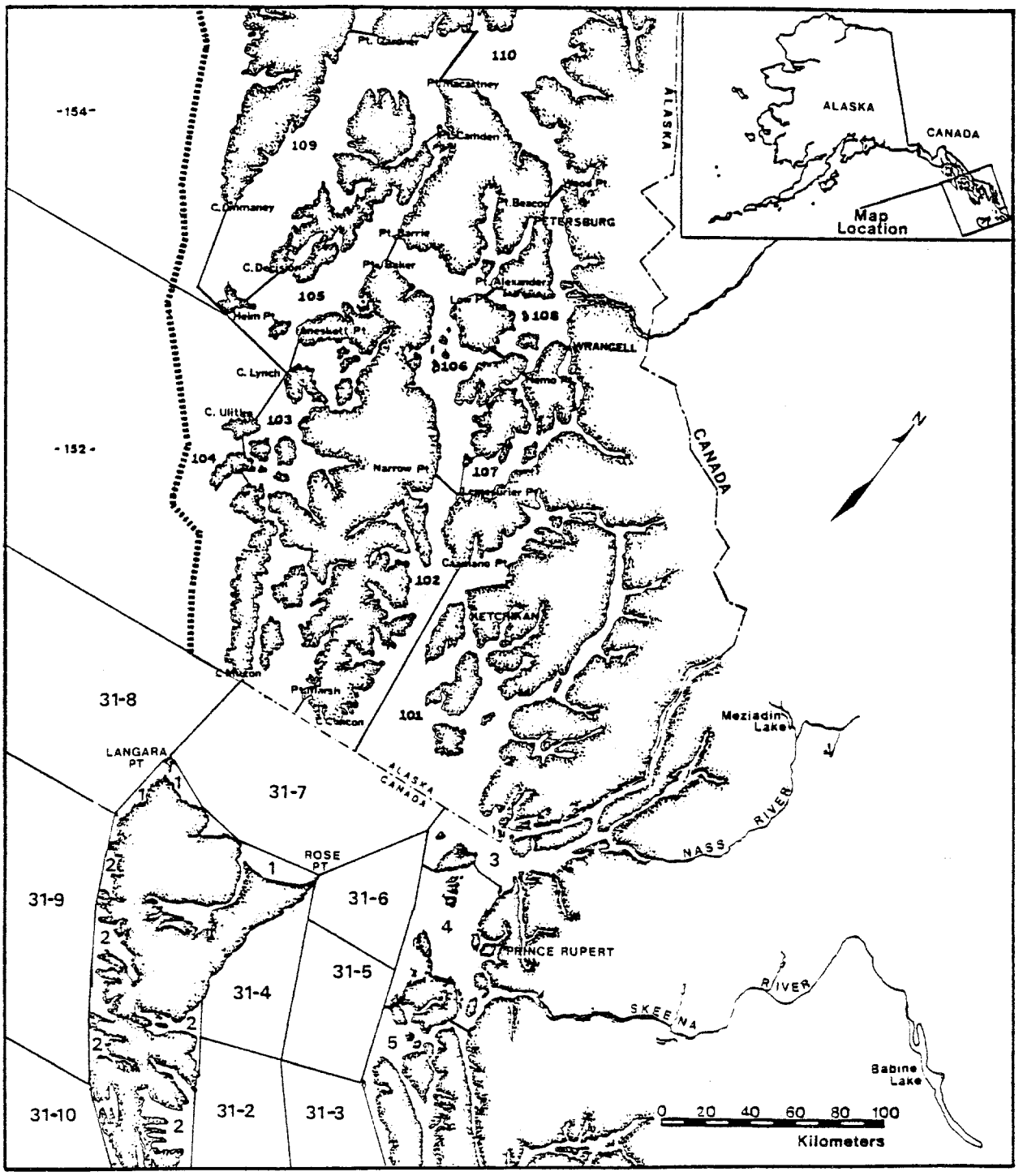

Figure 1. Fishery management districts in southern Southeastern Alaska and northern British Columbia.

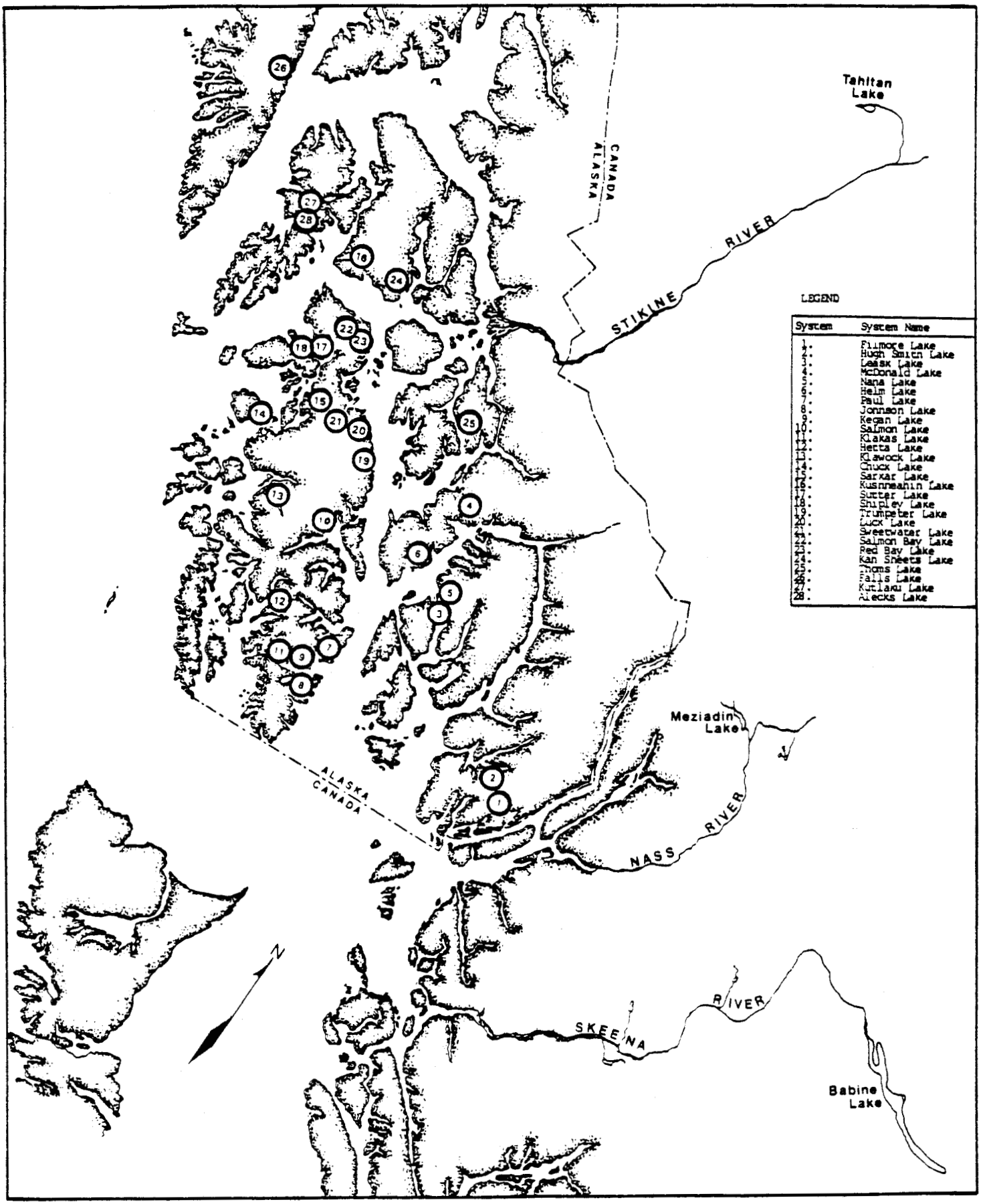

Figure 2. Rivers in southern Southeastern Alaska and northern British Columbia that have major populations of sockeye salmon.

Table 1. Stock groupings used in 1982 and 1983 to estimate the contribution of Alaska and Canada stocks to fisheries in Alaska Districts 101-108. Scale samples from escapements were divided into the groupings below to build linear discriminant functions, then the functions were used to divide scale samples from catches into the groupings below.

District	1982	1983
101 Gillnet	Alaska vs. Canada[1]	Alaska vs. Canada[2]
101 Seine	Alaska vs. Canada	Alaska vs. Canada
102 Seine	Alaska vs. Canada	Alaska vs. Canada
103 Seine	[3]	Alaska vs. Canada
104 Seine	Alaska vs. Canada	Alaska vs. Nass/Skeena vs. south migrating stocks
105 Seine	[3]	[3]
106 Gillnet	Alaska vs. Nass/Skeena vs. Stikine	Alaska vs. Nass/Skeena/south migrating stocks vs. mainstem Stikine vs Tahltan
106 Seine	[3]	Alaska vs. Canada
107 Seine	Alaska vs. Nass/Skeena vs. Stikine	Alaska vs. Canada
108 Gillnet	[3]	[3]

[1] Canada group in 1982 represents Nass, Skeena, and Stikine Rivers.

[2] Canada group in 1983 represents Nass, Skeena, and Stikine Rivers and the south migrating stock group.

[3] Small catches of sockeye salmon with no analysis or closed fishery.

Results of tagging studies conducted in northern British Columbia and southern Southeastern Alaska (Hoffman 1984, in press) and previous tagging studies indicate that catches from Alaska Districts 101-103, 105, and 107 contain few or no fish bound for the Stikine or Fraser Rivers, therefore, catches from these districts were separated into Alaska and Canada groups. In 1982 tagging studies indicated few or no Fraser River sockeye salmon in District 104 so catches were separated into Alaska and Canada groups. In 1983 when significant numbers of Fraser River sockeye salmon were present, District 104 catches were separated into Alaska, Nass/Skeena, and south migrating stock groups. Tagging studies indicated that Stikine River sockeye salmon were most common in Districts 106 and 108. In 1982 catches from these districts were separated into Alaska, Nass/Skeena, and Stikine groups. In 1983 District 106 catches were separated into Alaska, Nass/Skeena, south migrating stocks, Stikine and Tahltan groups. The Tahltan Lake group represents a large stock that returns to the Stikine River but spawns in the Tahltan tributary.

Discriminant Models

Linear discriminant functions (Fisher 1936, Dixon and Brown 1979) were built on scale measurements from sockeye salmon of known origin (escapements) and then were applied to scale measurements from fish of unknown origin (catches). Measurements from scales collected from escapements that correspond to the different stock groupings were used to both build and simultaneously measure the accuracy of each function with the jackknife procedures of Lachenbruch (1967). To obtain models with the best accuracy possible, variables that describe different scale characteristics were added to the models through stepwise comparisons of the ratios of their variances of among-group differences to that of the variance not represented by the function at the time of addition. The completed models (Appendix A) were used to estimate the origins of fish sampled from the catch through measurements of scales taken from these fish. The accuracy of the models was enhanced beyond that obtained with the jackknife procedures by using a correction matrix based on the error rate from that procedure (see Cook and Lord 1978). Variances for estimates were computed with procedures from Pella and Robertson (1979). Marshall et al. (1984) gives a detailed description of the procedures of model construction with escapement scales and how to use these functions to estimate contributions with measurements of catch scales.

Contributions from each group to commercial catches from Alaska Districts 101 through 108 were estimated by period and by age class (Appendix B), then combined for a season total by group. Estimates were stratified by age group to remove the effect on scale patterns of the different growing conditions that each brood year experienced during its freshwater existence. The 1.2, 1.3, 2.2, and 2.3 age classes[1] were used as strata because they represent 95-99% of the catch in all Alaska Districts (McGregor 1983, 1984). Functions were built for each age class on scales from all those stock groups with these age groups[2]. Catches of sockeye

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[1] European Formula Age Designation - Number of freshwater annuli - decimal - number of saltwater of saltwater annuli. Total age is the sum of these two numbers plus 1.

[2] No functions for age 2.2 sockeye salmon included scales from the Stikine River nor from Johnstone Strait because these age classes were poorly represented in these stocks. For the same reason, no function for age 2.3 fish included scales from Johnstone Strait.

salmon belonging to the reamining age classes were too few to provide samples adequate for separation with linear discriminant analysis and were separated according to the relative estimated contributions that the combined major age classes made to the different groups. Also, contributions were estimated for each week to observe changes through time, unless small catches and subsequently small sample sizes forced pooling data over two or more weeks. Appendix C is a detailed description of how the estimates for age groups and time period were combined to produce seasonal estimates. Estimates of age composition of catches were taken from McGregor (1983, 1984).

Scale Collection and Measurement

Scales were taken from catches in Alaska Districts 101-108, from escapements to 28 Alaska streams (Figure 2), from the main Stikine River, from the Tahltan River, from the escapements to the Nass and Skeena Rivers, and from sockeye salmon fisheries in Johnstone Strait which are believed to be mostly of Fraser River origin. Because Marshall et al. (1984) shows stocks can be combined within national groups without significant bias in estimated contributions (between-nation differences in scale patterns are far stronger than differences among rivers and streams within nations), scales from each stream or river within a stock group were combined according to their availability to form the set of scale measurements upon which discriminant functions were built.

Scales were measured according to zones that parallel the age of the fish at right angles to the sculptured field of each scale (Figure 3). Measurements consist of incremental distances of zones, distances between circuli and between circuli and the edge of the zone, and the number of circuli in a zone.

McGregor (1983, 1984) describes the location, times, and methods of collection for the scales measured in this study.

RESULTS

Contribution to Catch

Of 766 thousand sockeye salmon caught in 1982[1], an estimated 435 thousand or 56.8% were headed for streams in Canada (Table 2); a year later (1983), an estimated 633 thousand or 69.6% of a catch of 909 thousand[2] were intercepted (Table 3). The coefficients of variation on the estimated contributions for the two seasons ranged from 2.8% to 4.4%.

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[1] Some 817 thousand sockeye salmon were caught in 1982, 6% of which were not included in this analysis because catches were small or no scale samples were available from some districts.

[2] Some 937 thousand sockeye salmon were caught in 1983, 3% of which were not included in this analysis because catches were small or no scale samples were available in some districts.

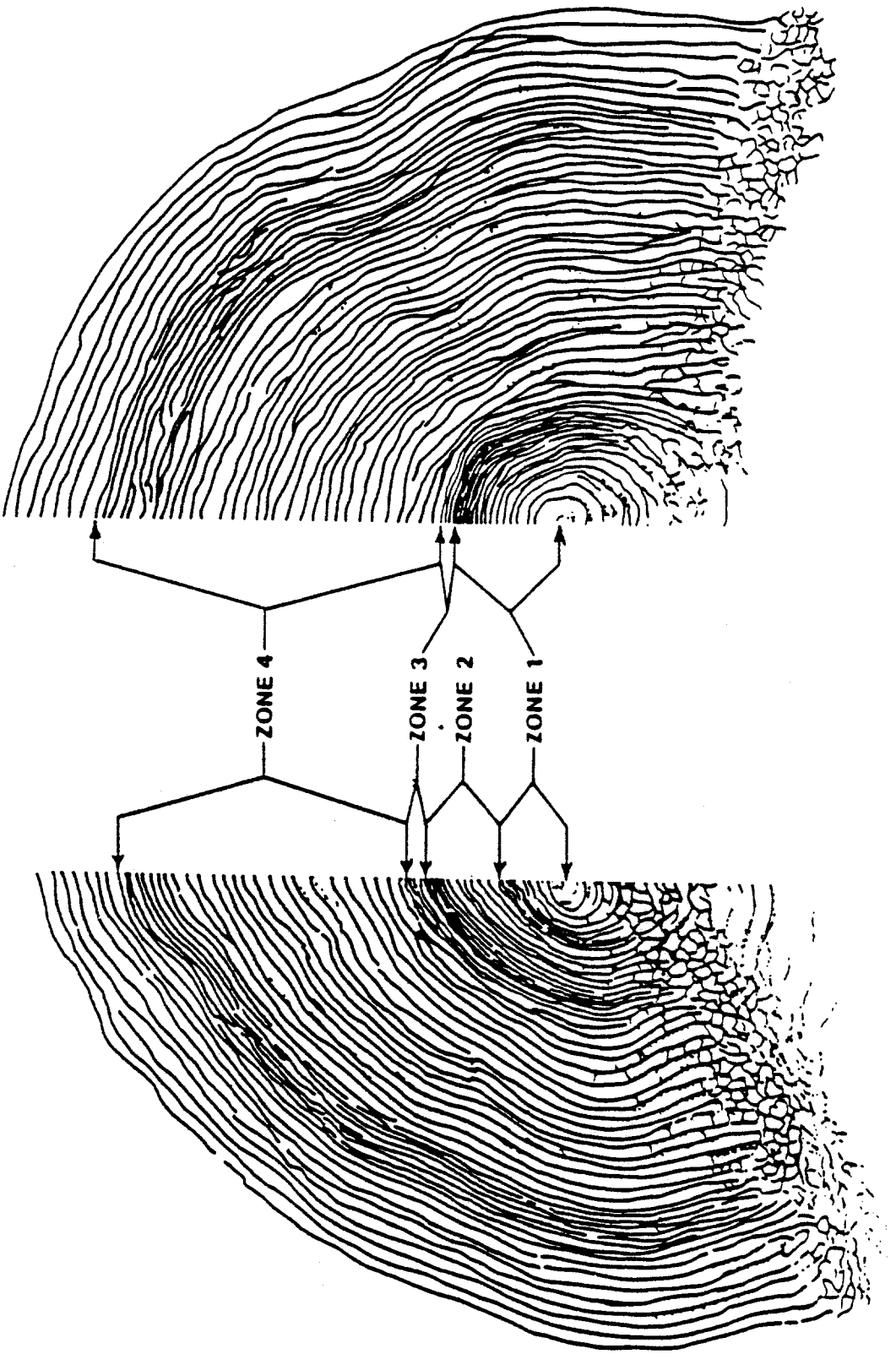

Figure 3. Typical scales for age 1.3 and 2.3 sockeye salmon showing the zones used to measure scale patterns.

Table 2. Estimated contribution by nation of origin of sockeye salmon harvested in Alaska Districts 101-108, 1982.

District	Type	Group	Estimated Number	%	Standard Error	Coef. Var.
101	Gillnet	Alaska	69,510	36.4	3,682	5.3
		Canada	121,373	63.6	3,680	3.0
		Total	190,883			
101	Seine	Alaska	41,401	56.1	1,737	4.2
		Canada	32,416	43.9	1,737	5.4
		Total	73,817			
102	Seine	Alaska	18,296	80.4	617	3.4
		Canada	4,451	19.6	617	13.9
		Total	22,747			
103	Seine	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates were made for this district.				
104	Seine	Alaska	107,492	37.7	7,640	7.1
		Canada	177,739	62.3	7,641	4.3
		Total	285,231			
105	Seine	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates were made for this district.				
106	Gillnet	Alaska	94,187	48.7	6295	6.7
		Nss/Skna	61,976	32.0	6515	10.5
		Stikine	37,365	19.3	7,631	20.4
		Total	193,528			
106	Seine	Closed for the season.				
107	Seine	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates were made for this district.				
108	Gillnet	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates were made for this district.				
All Districts		Alaska	330,886	43.2	10,722	3.2
		Canada	435,320	56.8	12,203	2.8
		Total	766,206			

Table 3. Estimated contribution by nation of origin of sockeye salmon harvested in Alaska Districts 101-108, 1983.

District	Type	Group	Estimated Number	%	Standard Error	Coef. Var.
101	Gillnet	Alaska	48,942	36.0	1,566	3.2
		Canada	87,064	64.0	1,568	1.8
		Total	136,006			
101	Seine	Alaska	20,493	42.8	817	4.0
		Canada	27,419	57.2	818	3.0
		Total	47,912			
102	Seine	Alaska	6,620	59.0	365	5.6
		Canada	4,593	41.0	364	8.0
		Total	11,213			
103	Seine	Alaska	7,053	67.9	410	5.9
		Canada	3,336	32.1	411	12.4
		Total	10,389			
104	Seine	Alaska	157,795	24.2	10,176	6.5
		Naas/Skna	286,337	44.0	19,322	6.8
		s. migrating	206,675	31.8	20,138	9.9
		Total	650,807			
105	Seine	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates for this district were made.				
106	Gillnet	Alaska	32,670	66.7	775	2.4
		Naas/Skna/s. mig.	10,610	21.7	815	7.7
		Stikine	663	1.3	166	36.5
		Tahltan	5,030	10.3	861	17.3
		Total	48,943			
106	Seine	Alaska	1,026	45.6	77	8.7
		Canada	1,222	54.4	76	8.0
		Total	2,248			
107	Seine	Alaska	1,213	97.9	48	4.4
		Canada	26	2.1	36	154.0
		Total	1,239			
108	Gillnet	Because of catches of a few hundred incidentally caught sockeye salmon and an insufficient number of samples from this catch, no estimates for this district were made.				
All Districts		Alaska	275,812	30.4	10,372	3.8
		Canada	632,945	69.6	27,908	4.4
		Total	908,757			

Fewer sockeye salmon were harvested in most districts during 1983 except in District 104 where an increase of 365 thousand fish more than compensated for the decline in other districts. In 1982, 62.3% of the sockeye salmon harvested in District 104 were intercepted Canada stocks; in 1983 the proportion of Canada stocks in District 104 rose to 75.8% of the catch. South migrating, predominately Fraser River stocks which were not harvested in significant numbers in District 104 in 1982 accounted for 31.8% of the catch or 206 thousand fish in 1983. Although the District 104 catch fluctuated, the ratio of Alaska to Canada sockeye salmon remained relatively constant throughout the 1982 season (Figure 4). In 1983 the ratio of Alaska to Canada sockeye salmon also remained constant and was similar to the ratio in 1982 until the period 7/24-7/30 (statistical week 31) when the catch increased from 65 thousand in the previous week to 180 thousand. After week 31, catches remained high in District 104 while the proportion of Alaska fish dropped significantly. Peak catch in 1982 was during the period 7/11-7/17 (statistical week 29) while in 1983 peak catches took place between 7/24-8/13 (statistical weeks 31 and 33). While late season catches increased in 1982, they declined in 1983.

In the District 101-11 gillnet fishery, catch of sockeye salmon dropped from 193 thousand in 1982 to 136 thousand in 1983 with little change in the relative contribution from stocks bound for Canada (Figure 5). In 1982 the catch from Alaska stocks was relatively constant throughout the season while the catch from Canada stocks fluctuated. In 1983 the catch fluctuated throughout the season while the ratio of Alaska to Canada stocks remained constant. Peak of the catch was quite distinct in 1982 during the period 7/11-7/17 (statistical week 29) while in 1983 the peak of the catch was spread out from 7/17-8/13 (statistical weeks 30-33).

In the District 101 seine fishery, catch of sockeye salmon dropped from 74 thousand in 1982 to 48 thousand in 1983 while the estimated contribution from Canada stocks rose from 43.9% to 57.2% (Tables 2 and 3). In 1982 the ratio of Alaska and Canada stocks in the catch were relatively constant except for the period 8/1-8/7 (statistical week 32) when large numbers from Alaska stocks were harvested (Figure 6). In 1983 the estimated contribution from Alaska stocks increased significantly during the period 7/17-7/30 (statistical week 30-31). Peak of the catch in 1982 was bimodal during the periods 7/11-7/17 and 8/1-8/7 (statistical weeks 29 and 32. In 1983 catches peaked in during the period 7/24-7/30 (statistical week 31).

In the District 106 gillnet fishery, the catch of sockeye salmon dropped from 194 thousand in 1982 to 49 thousand in 1983 while the estimated contribution from all Canada stocks fell from 51.3% in 1982 to 33.3% in 1983 (Tables 2 and 3). The proportion of Stikine River sockeye harvested in District 106 fell from 19.3% in 1982 to 11.6% in 1983. In 1982 the ratio of Alaska to Canada stocks remained relatively constant while catches fluctuated (Figure 7). In 1983 the estimated catch from Canada stocks changed somewhat but most of the change in the overall catch was the result of fluctuating contributions from Alaska stocks. The pattern of weekly catches is similar in both years with bimodal peaks around the first and third weeks in July (statistical weeks 27 and 30) and with catches falling off rapidly in early August (statistical week 31).

In smaller fisheries in other districts, catches declined while the estimated contribution from Canada stocks rose from 1982 to 1983.

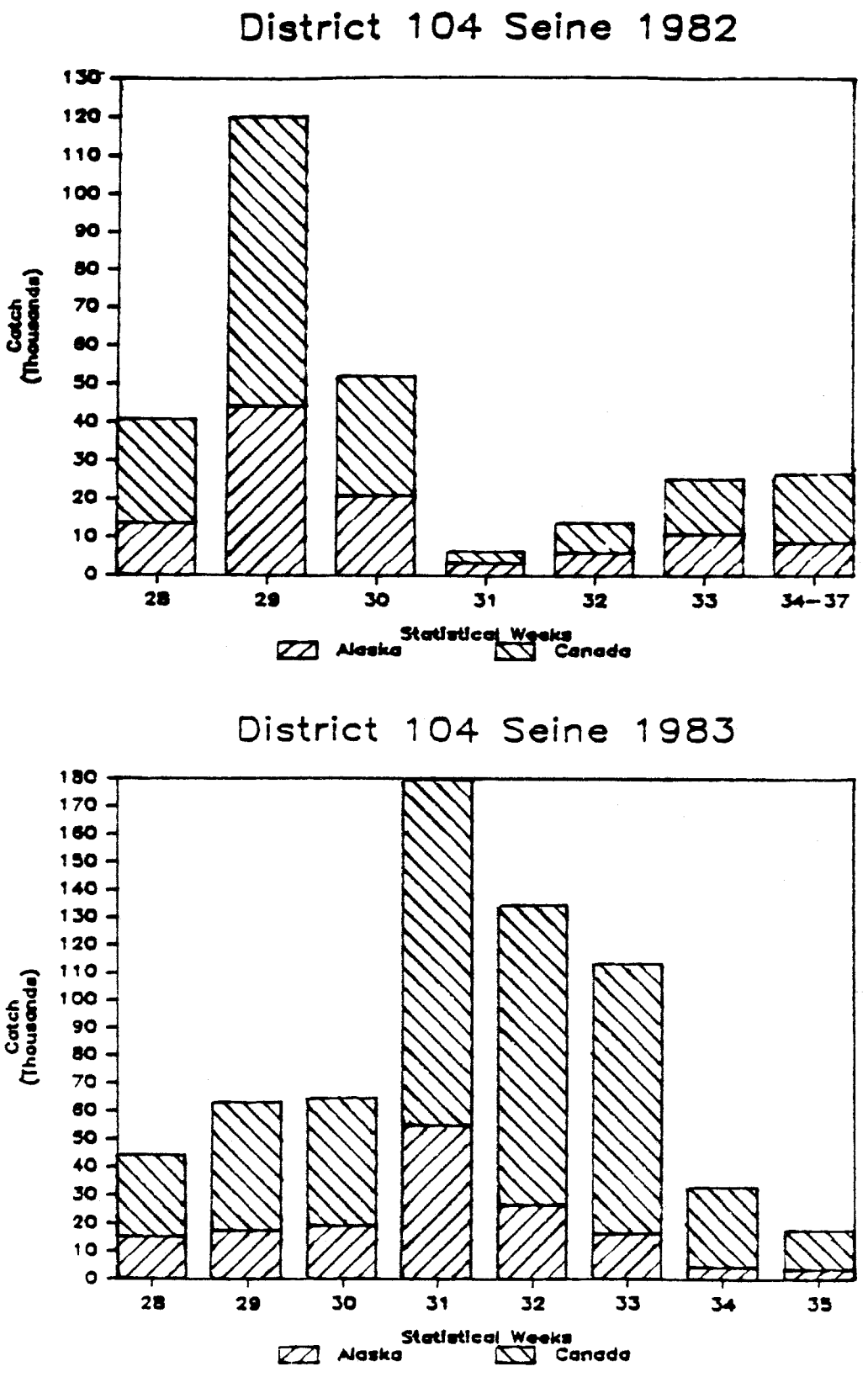

Figure 4. Estimated contributions from Canada and Alaska stocks to the purse seine fishery in Alaska District 104 thoughout the seasons in 1982 and 1983.

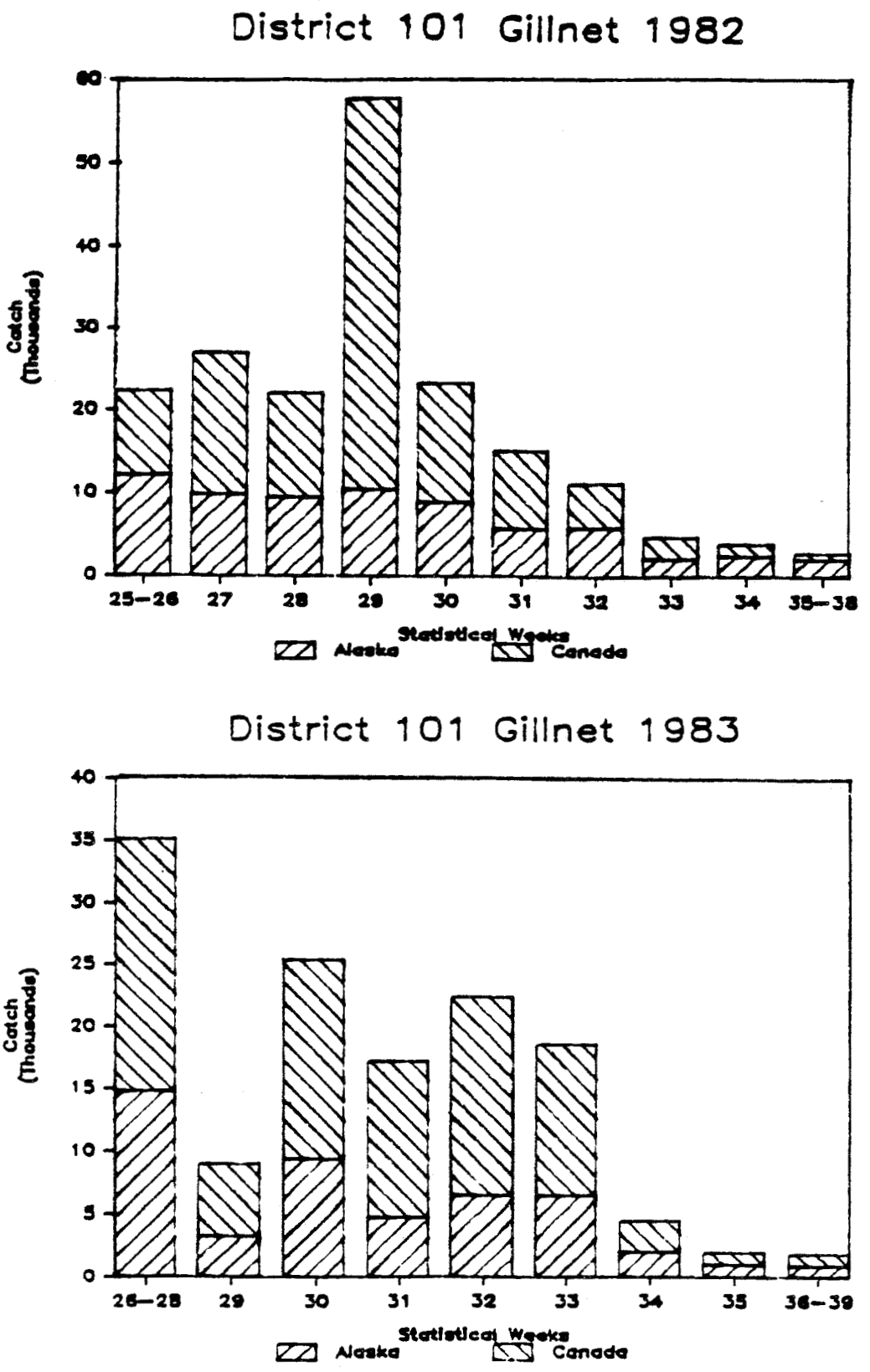

Figure 5. Estimated contributions from Canada and Alaska stocks to the drift gillnet fishery in Alaska District 101-11 throughout the seasons in 1982 and in 1983.

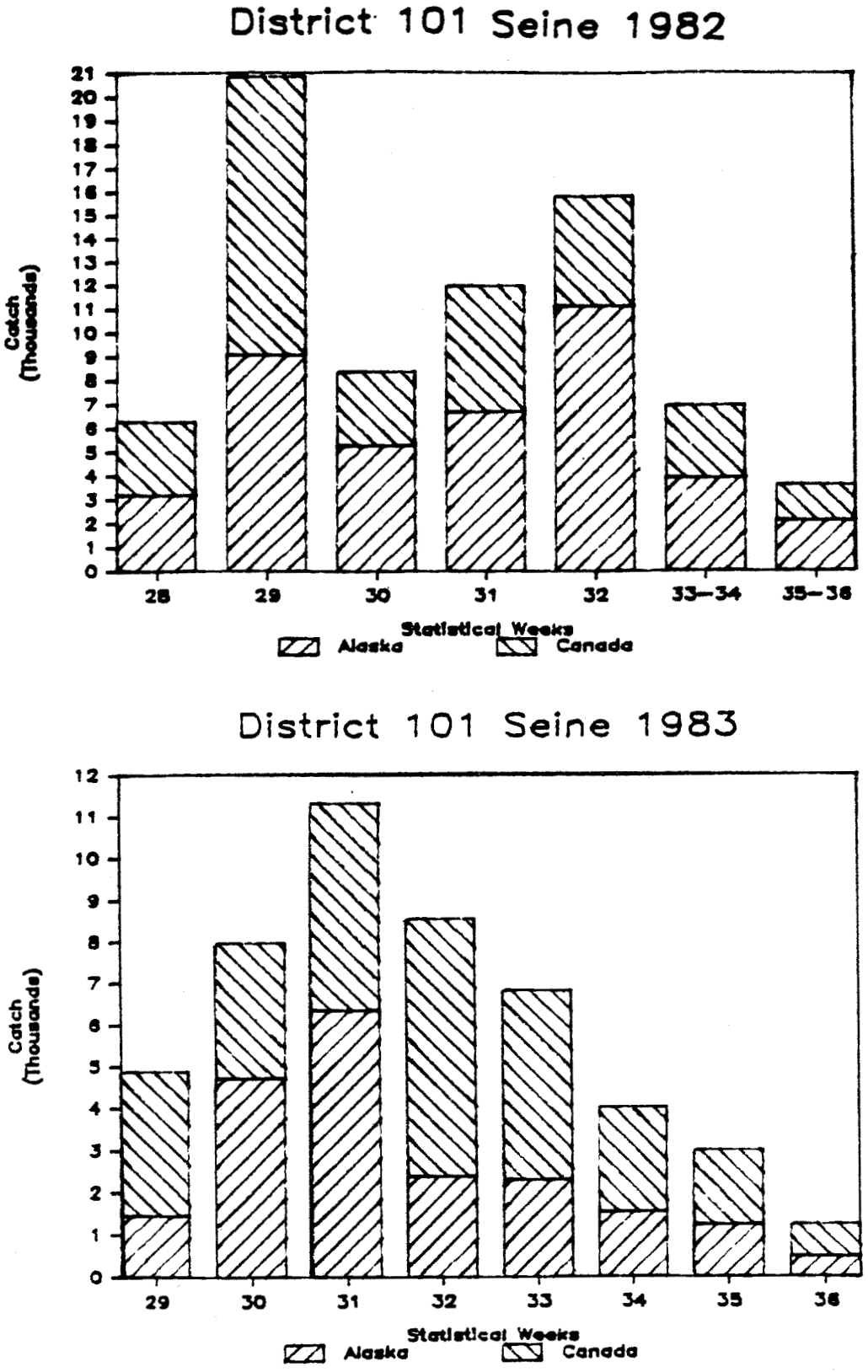

Figure 6. Estimated contribution from Canada and Alaska stocks to the seine fishery in Alaska District 101 throughout the seasons in 1982 and 1983.

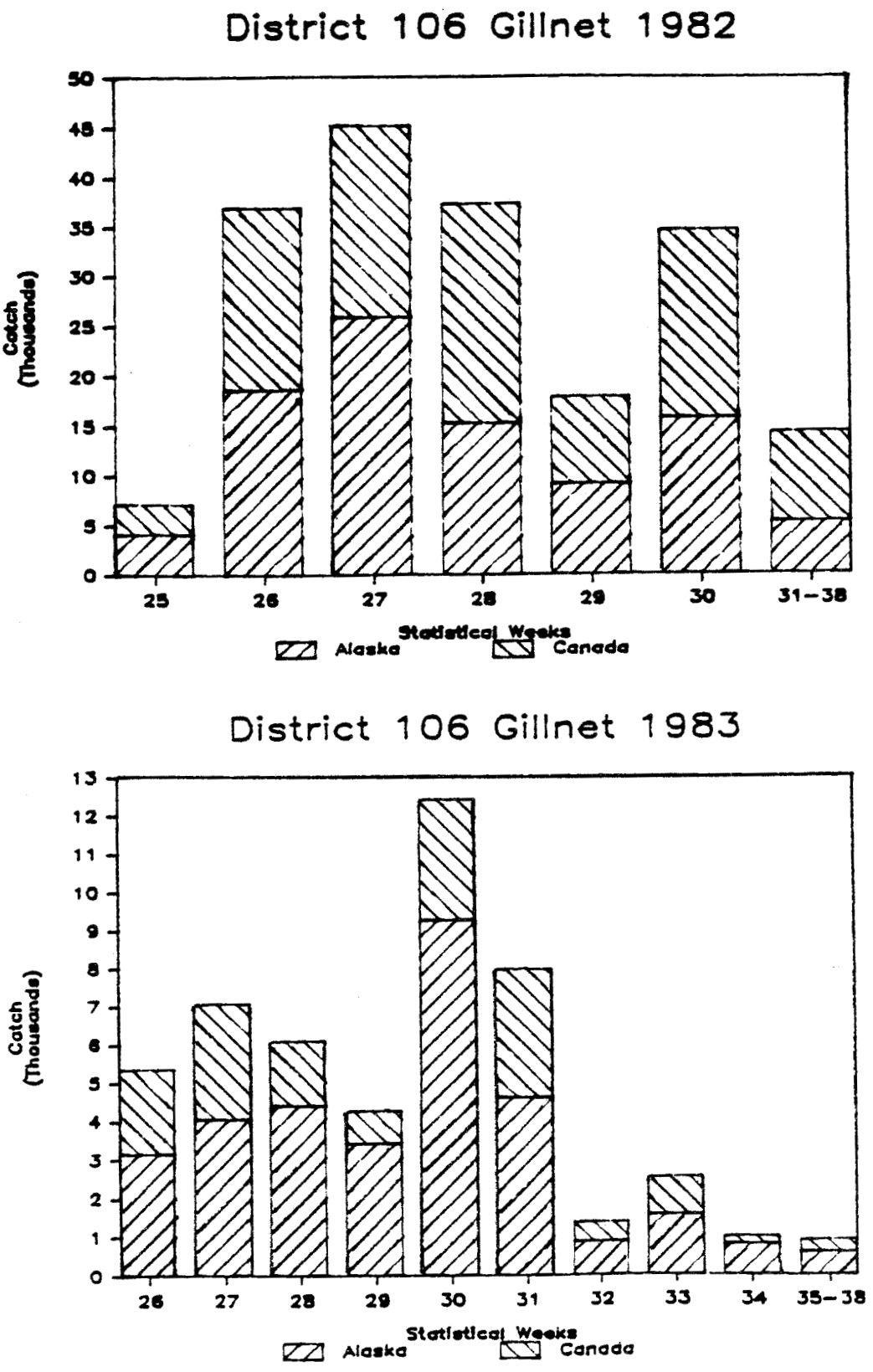

Figure 7. Estimated contributions from Canada and Alaska stocks to the drift gillnet fishery in Alaska District 106 throughout the seasons in 1982 and 1983.

Model Accuracy

For 1982, the uncorrected mean classification accuracy of linear discriminant functions ranged from 87.8% to 92.8% for Alaska vs. Canada groups and from 77.3% to 85.6% for Alaska vs. Nass/Skeena vs. Stikine (Table 4). For 1983, the uncorrected mean classification accuracies ranged from 87.4% to 95.1% for Alaska vs. Canada, from 70.6% to 81.8% for Alaska vs. Nass/Skeena/s. migrating vs. Stikine vs. Tahltan groups, and from 78.8% to 79.5% for Alaska vs. Nass/Skeena vs. south migrating groups (Table 4).

DISCUSSION

High catches in the 1983 District 104 seine fishery may have been responsible for low catches elsewhere, both by drawing off seine effort from other fisheries, and by intercepting sockeye salmon that would have passed through other districts. Tagging studies (Hoffman 1984, in press) show that District 104 is a major migratory pathway for sockeye salmon headed towards Dixon Entrance, Sumner Strait, and the inside waters of Southeastern Alaska and British Columbia. The Southeastern Alaska seine fleet moves freely between districts and is highly mobile. In 1983 both fishing time and number of boats fishing in District 104 increased significantly during the peak of the catch (ADF&G 1984).

Management policies in the District 106 gillnet fishery probably resulted in the lower contribution from Canada stocks in 1983. Fishing time was reduced from previous years in a successful attempt to decrease interceptions of Stikine River stocks (Paul Larson, Regional Management Coordinator, Commercial Fisheries Division, ADF&G, personal communication).

Model accuracy remained high in 1983 with the addition of south migrating stocks because these scale patterns are very similar to those of the other Canada stocks. South migrating stocks have the largest growth related lacustrine scale pattern measurements of all other groups of stocks. Like the other stocks from Canada, the Fraser stock rears in lakes far inland on the eastern slopes of the coastal mountains where climate is more continental.

Splitting the Stikine River run of sockeye salmon into Tahltan Lake stocks and stocks spawning in the Stikine River improved the accuracy of functions with these groups in 1983. While the scale patterns of the Tahltan Lake stock closely resembles that of other Canadian stocks, the mainstem Stikine stock spawns and rears in sloughs adjacent to the mainstem of the Stikine. This unique environment results in scale patterns different from all the other stocks in this analysis which rear in the lakes.

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We are grateful to personnel of the Port Sampling Project of the Division of Commercial Fisheries, Southeast Region, Alaska Department of Fish and Game; to personnel of the Fisheries Rehabilitation, Enhancement, and Development Division of the Alaska Department of Fish and Game; to employees of the Southern Southeast

Table 4. Mean classification accuracy of linear discriminant functions used to estimate the contributions of stock groups to the catches of sockeye salmon in Alaska District 101-108 in 1982 and 1983.

Stock Groups	Year	Mean Classification Accuracy			
		1.2	1.3	2.2	2.3
Alaska vs. Canada	1982	.925	.905	.928	.878
	1983	.874	.935	.951	.919
Alaska vs. Nass/Skeena vs. Stikine	1982	.840	.773	N/A	.856
Alaska vs. Nass/Skeena vs. s. sig. stocks	1983	.795	.788	N/A	N/A
Alaska vs. Nass/Skeena s. sig. stocks vs. Stikine vs. Tahltan	1983	.706	.784	N/A	N/A
Alaska vs. Nass/Skeena vs. Stikine vs. Tahltan	1983	N/A	N/A	N/A	.818

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APPENDIX A

Model Accuracy

Appendix Table A1. Classification matrices for linear discriminant function analysis models of age 1.2 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1982.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Classified Group of Origin: Canada
Alaska	160	.944	.056
Canada	160	.094	.906
Average classification accuracy = .925			

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Classified Group of Origin: Nass-Skeena	Classified Group of Origin: Stikine
Alaska	160	.906	.019	.075
Nass-Skeena	160	.012	.850	.138
Stikine	160	.075	.162	.763
Average classification accuracy = .840				

Appendix Table A2. Classification matrices for linear discriminant function analysis models of age 1.3 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1982.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Classified Group of Origin: Canada
Alaska	200	.885	.115
Canada	200	.075	.925

Average classification accuracy = .905

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Classified Group of Origin: Nass-Skeena	Classified Group of Origin: Stikine
Alaska	200	.830	.035	.135
Nass-Skeena	200	.035	.780	.185
Stikine	200	.120	.170	.710

Average classification accuracy = .773

Appendix Table A3. Classification matrices for linear discriminant function analysis models of age 2.2 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1982.

Actual Group of Origin	Sample Size	Classified Group of Origin	
		Alaska	Canada
Alaska	200	.915	.085
Canada	200	.060	.940
		Average classification accuracy = .928	

Appendix Table A4. Classification matrices for linear discriminant function analysis models of age 2.3 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1982.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Canada
Alaska	111	.847	.153
Canada	111	.090	.910

Average classification accuracy = .878

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Nass-Skeena	Stikine
Alaska	101	.842	.099	.059
Nass-Skeena	101	.054	.861	.079
Stikine	101	.079	.069	.851

Average classification accuracy = .851

Appendix Table A5. Classification matrices for linear discriminant function analysis models of age 1.2 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1983.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Canada
Alaska	208	.894	.106
Canada	585	.147	.853

Average classification accuracy = .874

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Nass-Skeena	s. migrating
Alaska	197	.868	.030	.102
Nass-Skeena	198	.000	.808	.192
s. migrating	188	.085	.207	.707

Average classification accuracy = .795

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Nass-Skeena-s. mig.	Mainstem Stikine	Tahltan
Alaska	208	.740	.043	.096	.120
Nass-Skeena-s. migrating	387	.036	.700	.016	.248
Mainstem Stikine	74	.135	.000	.851	.014
Tahltan	124	.226	.242	.000	.532

Average classification accuracy = .706

Appendix Table A6. Classification matrices for linear discriminant function analysis models of age 1.3 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1983.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Canada
Alaska	210	.895	.105
Canada	503	.026	.974

Average classification accuracy = .935

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Nass-Skeena	s. migrating
Alaska	199	.910	.070	.020
Nass-Skeena	174	.023	.805	.172
s. migrating	128	.039	.313	.648

Average classification accuracy = .788

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Nass-Skeena-s.mig.	Mainstem Stikine	Tahltan
Alaska	210	.848	.062	.038	.052
Nass-Skeena-s. migrating	302	.010	.613	.017	.361
Mainstem Stikine	90	.033	.011	.933	.022
Tahltan	111	.000	.216	.000	.784

Average classification accuracy = .794

Appendix Table A7. Classification matrices for linear discriminant function analysis models of age 2.2 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1983.

Actual Group of Origin	Sample Size	Classified Group of Origin	
		Alaska	Canada
Alaska	182	.918	.082
Canada	200	.015	.985
		Average classification accuracy = .951	

Appendix Table A8. Classification matrices for linear discriminant function analysis models of age 2.3 sockeye salmon stocks contributing to the southern Southeastern Alaska net fisheries, 1983.

Actual Group of Origin	Sample Size	Classified Group of Origin: Alaska	Classified Group of Origin: Canada
Alaska	199	.894	.106
Canada	267	.056	.944

Average classification accuracy = .919

Actual Group of Origin	Sample Size	Alaska	Nass-Skeena	Mainstem Stikine	Tahltan
Alaska	192	.859	.083	.047	.010
Nass-Skeena	144	.056	.764	.069	.111
Mainstem Stikine	30	.067	.067	.867	.000
Tahltan	92	.011	.152	.054	.783

Average classification accuracy = .818

APPENDIX B

Contributions by Age Class and by Week

Appendix Table B1. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to the drift gillnet fishery in Alaska District 101, 1982.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
06/13-06/26	Alaska	60	11,664	370	69	39	12,202	54.4
(wks 25-26)	Canada	449	2,772	6,740	221	33	10,214	45.6
	Total	509	14,435	7,110	289	72	22,416	
06/27-7/03	Alaska	224	8,985	522	144	0	9,875	36.6
(week 27)	Canada	1,689	8,130	6,828	460	0	17,107	63.4
	Total	1,913	17,115	7,350	604	0	26,982	
07/04-07/10	Alaska	181	8,784	322	265	0	9,552	43.1
(week 28)	Canada	1,362	6,207	4,217	849	0	12,634	56.9
	Total	1,542	14,991	4,539	1,114	0	22,186	
07/11-07/17	Alaska	457	9,343	233	426	0	10,459	18.1
(week 29)	Canada	3,448	39,319	3,188	1,365	0	47,321	81.9
	Total	3,906	48,662	3,420	1,792	0	57,780	
07/18-07/24	Alaska	110	7,893	186	702	26	8,917	38.2
(week 30)	Canada	828	5,858	5,449	2,248	42	14,425	61.8
	Total	938	13,751	5,635	2,950	68	23,342	
07/25-07/31	Alaska	124	5,167	214	242	0	5,748	37.9
(week 31)	Canada	936	4,245	3,477	773	0	9,431	62.1
	Total	1,061	9,412	3,691	1,014	0	15,179	
08/01-08/07	Alaska	91	4,964	627	231	0	5,912	52.5
(week 32)	Canada	684	1,911	2,020	737	0	5,352	47.5
	Total	775	6,874	2,647	968	0	11,264	
08/08-08/14	Alaska	178	1,731	195	385	0	2,196	45.4
(week 33)	Canada	371	1,350	630	0	0	2,645	54.6
	Total	550	3,081	825	385	0	4,841	
08/15-08/21	Alaska	160	1,569	122	680	6	2,537	63.7
(week 34)	Canada	333	721	391	0	3	1,449	36.3
	Total	494	2,291	512	680	9	3,986	
08/22-09/18	Alaska	124	466	74	1,436	12	2,112	72.6
(wks 35-38)	Canada	258	294	239	0	4	795	27.4
	Total	382	760	313	1,436	17	2,907	
Fishery	Alaska	1,709	60,567	2,866	4,579	84	69,510	37.1
Total	Canada	10,359	70,806	33,178	6,654	82	121,373	62.9
	Total	12,068	131,373	36,044	11,233	166	190,883	

Appendix Table B2. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 101 gillnet fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
06/19-07/09	Alaska	752	7,555	1,663	4,571	236	14,777	42.1
(wks 26-28)	Canada	4,616	4,514	8,477	2,376	325	20,308	57.9
	Total	5,368	12,069	10,140	6,947	561	35,085	
07/10-07/16	Alaska	218	2,025	252	717	23	3,235	36.1
(week 29)	Canada	1,001	2,796	1,486	403	40	5,726	63.9
	Total	1,219	4,821	1,738	1,120	63	8,961	
07/17-07/23	Alaska	536	5,062	903	2,773	56	9,331	36.7
(week 30)	Canada	2,460	6,237	4,886	2,381	96	16,061	63.3
	Total	2,996	11,299	5,789	5,155	152	25,392	
07/24-07/30	Alaska	0	1,790	1,012	1,977	5	4,783	27.8
(week 31)	Canada	1,893	3,667	4,840	2,017	12	12,429	72.2
	Total	1,893	5,456	5,852	3,993	17	17,212	
07/31-08/06	Alaska	245	3,521	872	1,852	26	6,517	29.1
(week 32)	Canada	2,042	6,074	5,495	2,228	64	15,902	70.9
	Total	2,287	9,595	6,367	4,080	90	22,419	
08/07-08/13	Alaska	174	3,475	502	2,339	20	6,509	34.9
(week 33)	Canada	2,585	5,212	3,544	755	36	12,132	65.1
	Total	2,759	8,687	4,045	3,094	56	18,641	
08/14-08/20	Alaska	269	1,034	236	431	14	1,984	44.1
(week 34)	Canada	416	1,290	481	316	18	2,520	55.9
	Total	685	2,324	716	748	32	4,504	
08/21-08/27	Alaska	118	553	103	188	7	969	49.2
(week 35)	Canada	181	462	210	138	7	998	50.8
	Total	299	1,015	313	327	14	1,967	
08/28-09/24	Alaska	109	452	95	175	6	837	45.9
(wks 36-39)	Canada	168	490	195	128	7	988	54.1
	Total	277	942	290	303	13	1,825	
Fishery	Alaska	2,420	25,468	5,638	15,024	392	48,942	36.0
Total	Canada	15,363	30,741	29,612	10,742	605	87,064	64.0
	Total	17,783	56,209	35,251	25,767	997	136,006	

Appendix Table B3. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to the purse seine fishery in Alaska District 101, 1982.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/04-7/10	Alaska	105	2,725	155	219	0	3,204	51.0
(week 28)	Canada	269	1,926	728	155	0	3,078	49.0
	Total	374	4,651	883	374	0	6,282	
07/11-07/17	Alaska	471	8,306	169	152	0	9,098	43.7
(week 29)	Canada	1,198	9,634	795	108	0	11,735	56.3
	Total	1,669	17,940	964	260	0	20,833	
07/18-07/24	Alaska	417	4,558	59	251	0	5,285	62.9
(week 30)	Canada	1,063	1,602	276	178	0	3,119	37.1
	Total	1,480	6,160	335	429	0	8,404	
07/25-07/31	Alaska	284	5,296	411	720	0	6,711	56.0
(week 31)	Canada	723	2,090	1,940	511	0	5,264	44.0
	Total	1,007	7,386	2,351	1,231	0	11,975	
08/01-08/07	Alaska	664	9,627	432	393	0	11,116	70.5
(week 32)	Canada	1,125	2,668	574	278	0	4,645	29.5
	Total	1,789	12,295	1,006	671	0	15,761	
08/08-08/21	Alaska	456	3,040	264	112	21	3,893	56.0
(week 33)	Canada	773	1,839	351	80	17	3,060	44.0
	Total	1,229	4,879	615	192	38	6,953	
08/22-9/11	Alaska	370	1,567	133	24	0	2,094	58.0
(week 34)	Canada	626	694	178	17	0	1,515	42.0
	Total	996	2,261	311	41	0	3,609	
Fishery	Alaska	2,767	35,119	1,623	1,871	21	41,401	56.1
Total	Canada	5,777	20,453	4,842	1,327	17	32,416	43.9
	Total	8,544	55,572	6,465	3,198	38	73,817	

Appendix Table B4. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 101 purse seine fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/10-07/16	Alaska	177	946	136	181	22	1,462	30.0
(week 29)	Canada	1,242	1,757	249	117	51	3,417	70.0
	Total	1,420	2,703	385	298	73	4,879	
07/17-07/23	Alaska	1,107	3,023	222	296	71	4,719	59.2
(week 30)	Canada	1,214	1,396	408	191	49	3,258	40.8
	Total	2,321	4,419	630	487	120	7,977	
07/24-07/30	Alaska	1,838	3,280	626	531	70	6,344	55.9
(week 31)	Canada	1,905	1,960	735	342	55	4,997	44.1
	Total	3,743	5,240	1,361	873	125	11,341	
07/31-08/06	Alaska	48	1,306	473	531	26	2,384	27.8
(week 32)	Canada	2,778	2,651	555	128	68	6,179	72.2
	Total	2,826	3,956	1,028	659	94	8,563	
08/07-08/13	Alaska	218	1,251	261	540	39	2,310	33.8
(week 33)	Canada	2,854	1,164	307	130	77	4,532	66.2
	Total	3,072	2,415	568	671	116	6,842	
08/14-08/20	Alaska	299	738	171	319	26	1,553	38.5
(week 34)	Canada	1,513	687	164	77	42	2,483	61.5
	Total	1,812	1,425	335	396	69	4,036	
08/21-08/27	Alaska	74	783	127	238	21	1,244	41.3
(week 35)	Canada	1,278	280	122	57	30	1,767	58.7
	Total	1,352	1,063	250	295	51	3,011	
08/28-09/03	Alaska	75	239	53	100	8	476	37.7
(week 36)	Canada	492	206	51	24	13	787	62.3
	Total	567	446	105	124	21	1,263	
Fishery	Alaska	3,837	11,566	2,070	2,736	284	20,493	42.8
Total	Canada	13,275	10,100	2,592	1,066	386	27,419	57.2
	Total	17,113	21,667	4,662	3,802	669	47,912	

Appendix Table B5. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to the purse seine fishery in Alaska District 102, 1982.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/11-07/31	Alaska	1,539	7,722	1,179	277	0	10,717	90.6
(wks 29-31)	Canada	862	39	207	0	0	1,108	9.4
	Total	2,401	7,761	1,386	277	0	11,825	
08/01-08/07	Alaska	552	1,205	610	334	20	2,721	62.8
(week 32)	Canada	309	1,186	107	0	12	1,614	37.2
	Total	861	2,391	717	334	32	4,335	
08/08-08/14	Alaska	365	933	266	403	34	2,001	62.7
(week 33)	Canada	204	919	46	0	21	1,190	37.3
	Total	569	1,852	312	403	55	3,191	
08/15-09/11	Alaska	495	935	774	566	87	2,857	84.1
(wks 34-38)	Canada	277	111	135	0	16	539	15.9
	Total	772	1,046	909	566	103	3,396	
Fishery	Alaska	2,591	10,795	2,829	1,580	141	18,296	80.4
Total	Canada	1,652	2,255	495	0	49	4,451	19.6
	Total	4,243	13,050	3,324	1,580	190	22,747	

Appendix Table B6. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 102 purse seine fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/31-08/20	Alaska	1,506	2,170	573	607	79	4,936	59.3
(wks 32-34)	Canada	2,046	1,050	126	108	54	3,384	40.7
	Total	3,553	3,220	699	716	133	8,320	
08/21-08/27	Alaska	282	621	137	145	19	1,205	60.6
(week 35)	Canada	567	149	30	26	13	784	39.4
	Total	849	770	167	171	32	1,989	
08/28-09/03	Alaska	88	255	62	66	8	480	53.1
(week 36)	Canada	298	94	14	12	7	424	46.9
	Total	386	350	76	78	14	904	
Fishery	Alaska	1,877	3,047	772	819	106	6,620	59.0
Total	Canada	2,911	1,293	170	146	73	4,593	41.0
	Total	4,788	4,339	942	964	179	11,213	

Appendix Table B7. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 103 purse seine fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/31-08/20	Alaska	1,719	3,412	679	217	55	6,081	70.5
(wks 32-34)	Canada	1,884	191	330	111	23	2,538	29.5
	Total	3,603	3,603	1,008	328	78	8,619	
08/21-09/03	Alaska	242	538	139	45	9	972	54.9
(wks 35-36)	Canada	498	202	68	23	7	798	45.1
	Total	740	740	207	67	16	1,770	
Fishery	Alaska	1,960	3,950	818	261	63	7,053	67.9
Total	Canada	2,382	393	397	133	30	3,336	32.1
	Total	4,343	4,343	1,216	395	94	10,389	

Appendix Table B8. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to the purse seine fishery in Alaska District 104, 1982.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/04-7/10	Alaska	937	10,997	855	737	54	13,580	33.3
(week 28)	Canada	1,702	22,634	2,114	582	108	27,140	66.7
	Total	2,639	33,631	2,969	1,319	162	40,720	
07/11-07/17	Alaska	2,753	37,550	1,340	2,600	0	44,243	36.8
(week 29)	Canada	5,001	65,608	3,313	2,052	0	75,974	63.2
	Total	7,754	103,158	4,653	4,652	0	120,217	
07/18-07/24	Alaska	1,347	17,777	1,052	730	0	20,906	40.2
(week 30)	Canada	3,997	23,953	2,601	576	0	31,127	59.8
	Total	5,344	41,730	3,653	1,306	0	52,033	
07/25-07/31	Alaska	214	2,819	112	76	9	3,230	51.2
(week 31)	Canada	636	2,092	278	60	8	3,074	48.8
	Total	850	4,911	390	136	17	6,304	
08/01-08/07	Alaska	565	4,233	722	495	0	6,015	43.7
(week 32)	Canada	2,779	3,829	752	390	0	7,750	56.3
	Total	3,344	8,062	1,474	885	0	13,765	
08/08-08/14	Alaska	2,837	6,048	1,397	565	119	10,966	43.1
(week 33)	Canada	7,830	4,619	1,453	446	157	14,505	56.9
	Total	10,667	10,667	2,850	1,011	276	25,471	
08/15-09/11	Alaska	2,135	4,188	1,473	684	72	8,552	32.0
(wks 34-37)	Canada	13,452	2,492	1,533	540	152	18,169	68.0
	Total	15,587	6,680	3,006	1,224	224	26,721	
Fishery	Alaska	10,788	83,612	6,951	5,887	254	107,492	37.7
Total	Canada	35,397	125,227	12,044	4,646	425	177,739	62.3
	Total	46,185	208,839	18,995	10,533	679	285,231	

Appendix Table B9. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 104 purse seine fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
07/03-07/09	Alaska	3,035	8,789	1,400	1,961	30	15,215	34.4
(week 28)	Naa/Skna	7,755	5,096	5,237	2,730	42	20,860	47.1
	s. nig.	450	7,709	0	0	16	8,175	18.5
	Total	11,239	21,594	6,637	4,690	88	44,249	
07/10-07/16	Alaska	2,782	11,256	1,420	1,742	139	17,339	27.5
(week 29)	Naa/Skna	8,796	9,731	2,684	2,425	191	23,827	37.7
	s. nig.	8,878	12,918	0	0	176	21,971	34.8
	Total	20,456	33,905	4,104	4,167	505	63,137	
07/17-07/23	Alaska	4,225	12,858	1,019	953	192	19,248	29.7
(week 30)	Naa/Skna	10,045	17,107	3,317	1,247	320	32,037	49.5
	s. nig.	5,660	7,632	0	0	134	13,427	20.7
	Total	19,931	37,597	4,336	2,200	647	64,711	
07/24-07/30	Alaska	6,233	36,155	6,777	5,524	220	54,909	30.6
(week 31)	Naa/Skna	24,688	40,661	8,317	7,234	325	81,225	45.2
	s. nig.	17,774	25,605	0	0	174	43,553	24.2
	Total	48,695	102,422	15,094	12,758	719	179,687	
07/31-08/06	Alaska	8,048	12,690	2,908	2,720	213	26,579	19.7
(week 32)	Naa/Skna	31,880	20,326	7,863	2,262	503	62,833	46.7
	s. nig.	22,951	21,919	0	0	362	45,232	33.6
	Total	62,879	54,935	10,772	4,982	1,077	134,644	
08/07-08/13	Alaska	3,706	6,015	3,468	2,853	361	16,403	14.4
(week 33)	Naa/Skna	29,144	3,404	6,527	2,372	932	42,380	37.3
	s. nig.	29,961	23,632	0	0	1,206	54,798	48.2
	Total	62,810	33,052	9,995	5,225	2,499	113,581	
08/14-08/20	Alaska	494	3,245	284	307	129	4,459	13.5
(week 34)	Naa/Skna	12,878	502	808	255	431	14,874	45.0
	s. nig.	8,127	5,217	0	0	399	13,742	41.5
	Total	21,499	8,963	1,091	562	959	33,075	
08/21-08/27	Alaska	941	2,066	327	281	29	3,644	20.6
(week 35)	Naa/Skna	6,776	295	931	233	66	8,303	46.8
	s. nig.	2,189	3,541	0	0	46	5,777	32.6
	Total	9,907	5,902	1,258	514	142	17,723	
Fishery	Alaska	29,465	93,074	17,604	16,340	1,313	157,795	24.2
Total	Naa/Skna	131,963	97,122	35,683	18,759	2,810	286,337	44.0
	s. nig.	95,989	108,173	0	0	2,513	206,675	31.8
	Total	257,417	298,369	53,287	35,098	6,636	650,807	

Appendix Table B10. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to the drift gillnet fishery in Alaska District 106, 1982.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
06/13-06/19	Alaska	66	3,876	82	102	0	4,126	57.7
(week 25)	Nass/Skna	70	2,639	186	2	0	2,897	40.5
	Stikine	28	0	0	101	0	129	1.8
	Total	164	6,515	268	205	0	7,152	
06/20-06/26	Alaska	627	16,018	416	1,461	103	18,625	50.3
(week 26)	Nass/Skna	662	10,112	948	26	58	11,806	32.0
	Stikine	271	4,973	0	1,441	35	6,540	17.1
	Total	1,560	30,923	1,364	2,928	196	36,971	
06/27-07/03	Alaska	621	23,385	431	1,541	0	25,978	57.6
(week 27)	Nass/Skna	655	11,575	982	28	0	13,240	29.3
	Stikine	268	4,145	0	1,519	0	5,932	13.1
	Total	1,544	39,105	1,413	3,088	0	45,150	
07/04-07/10	Alaska	340	13,260	355	1,318	45	15,318	40.9
(week 28)	Nass/Skna	358	10,974	809	24	32	12,197	32.6
	Stikine	147	8,426	0	1,299	28	9,900	26.5
	Total	845	32,660	1,164	2,641	105	37,415	
07/11-07/17	Alaska	163	7,995	170	782	0	9,110	50.9
(week 29)	Nass/Skna	172	3,536	386	14	0	4,108	22.9
	Stikine	70	3,844	0	772	0	4,686	26.2
	Total	405	15,375	556	1,568	0	17,904	
07/18-07/24	Alaska	286	10,205	558	4,586	146	15,781	45.4
(week 30)	Nass/Skna	302	9,316	1,270	0	87	10,975	31.6
	Stikine	124	7,404	0	393	69	7,990	23.0
	Total	712	26,925	1,828	4,979	302	34,746	
07/25-09/18	Alaska	280	2,572	248	2,103	46	5,249	36.8
(wks 31-38)	Nass/Skna	296	5,663	565	0	49	6,573	46.0
	Stikine	121	2,137	0	180	20	2,458	17.2
	Total	697	10,372	813	2,283	115	14,280	
	Alaska	2383	77,311	2,258	11,893	340	94,187	48.6
Fishery	Nass/Skna	2515	53,815	5,146	94	226	61,976	32.0
Total	Stikine	1029	30,749	0	5,705	152	37,635	19.4
	Total	5927	161,875	7,406	17,692	718	193,618	

Appendix Table B11. Estimated contribution of sockeye salmon stocks originating in Alaska and Canada to Alaska's District 106 drift gillnet fishery, 1983.

Dates	Group	Catch 1.2	1.3	2.2	2.3	Other	Total	Percent
06/19-06/25	Alaska	206	2,165	321	451	13	3,155	58.9
(week 26)	Na/Sk/ama	185	820	226	350	6	1,587	29.7
	Stikine	0	0	0	103	0	104	1.9
	Tahltan	0	377	0	128	2	507	9.5
	Total	391	3,362	546	1,033	21	5,353	
06/26-07/02	Alaska	480	2,855	394	280	28	4,037	57.2
(week 27)	Na/Sk/ama	431	578	277	350	12	1,647	23.3
	Stikine	0	0	0	51	0	51	0.7
	Tahltan	0	1,263	0	54	9	1,327	18.8
	Total	911	4,696	671	734	49	7,061	
07/03-07/09	Alaska	566	3,211	339	241	31	4,389	72.2
(week 28)	Na/Sk/ama	76	291	239	301	6	913	15.0
	Stikine	0	0	0	44	0	44	0.7
	Tahltan	142	542	0	47	5	736	12.1
	Total	785	4,045	578	633	43	6,082	
07/10-07/16	Alaska	634	1,811	414	515	38	3,411	80.1
(week 29)	Na/Sk/ama	65	0	93	90	3	250	5.9
	Stikine	0	183	0	55	3	240	5.6
	Tahltan	4	322	0	26	4	355	8.3
	Total	702	2,316	507	685	47	4,257	
07/17-07/23	Alaska	1,074	6,968	465	605	139	9,251	74.6
(week 30)	Na/Sk/ama	834	0	490	106	22	1,451	11.7
	Stikine	0	0	0	64	1	65	0.5
	Tahltan	0	1,571	0	31	24	1,626	13.1
	Total	1,909	8,539	954	806	186	12,393	
07/24-07/30	Alaska	680	2,808	454	624	32	4,599	57.8
(week 31)	Na/Sk/ama	1,374	1,404	350	76	23	3,227	40.5
	Stikine	0	0	0	0	0	0	0.0
	Tahltan	0	135	0	0	1	136	1.7
	Total	2,054	4,347	804	701	56	7,962	
07/31-08/06	Alaska	64	496	66	253	4	883	62.9
(week 32)	Na/Sk/ama	85	160	79	31	2	357	25.4
	Stikine	0	36	0	0	0	36	2.6
	Tahltan	0	128	(0)	0	1	129	9.2
	Total	149	821	145	284	7	1,405	
08/07-08/13	Alaska	217	1,093	86	143	22	1,561	61.7
(week 33)	Na/Sk/ama	288	322	96	44	11	762	30.1
	Stikine	0	73	0	0	1	74	2.9
	Tahltan	0	131	0	0	2	133	5.3
	Total	506	1,619	182	187	35	2,529	
08/14-08/20	Alaska	112	548	56	65	9	790	80.1
(week 34)	Na/Sk/ama	105	0	32	4	2	143	14.5
	Stikine	0	0	0	2	0	2	0.2
	Tahltan	0	51	0	0	1	51	5.2
	Total	217	599	88	72	11	986	
08/21-09/17	Alaska	104	372	52	61	7	595	65.1
(week 35)	Na/Sk/ama	97	140	30	4	3	274	29.9
	Stikine	0	13	0	2	0	16	1.7
	Tahltan	0	30	0	0	0	30	3.3
	Total	201	555	81	67	10	914	
Fishery Total	Alaska	4,139	22,326	2,645	3,238	322	32,670	66.8
	Na/Sk/ama	3,539	3,715	1,911	1,356	88	10,610	21.7
	Stikine	0	305	0	321	6	633	1.3
	Tahltan	146	4,549	0	286	49	5,030	10.3
	Total	7,824	30,896	4,556	5,201	465	48,942	

APPENDIX C

Variance of Seasonal Contributions

The seasonal allocation of the catch to stock groups bound for Alaska and Canada began as a product of catch, age composition and stock composition

$$C_{ijt} = C_t P_{it} S_{ijt}$$

Where C_{ijt} is the number of group j of age i that were caught in period t[1] is the catch in period t, P_{it} is the proportion of the catch made in period t of age i, and S_{ijt} is the fraction of the catch of age i made in period t that were members of group j. The seasonal allocation of the catch to group j is the sum of the C_{ijt} over all ages and periods:

$$C_j = \sum_{t}^{T} \sum_{i}^{n} C_t P_{it} S_{ijt}$$

Where C_j is the seasonal catch of group j, T is the number of periods in the season, and n is the number of age classes in the catch.

The approximate variance of the seasonal allocation to a group was derived using the method described in Seber (1973, p. 8):

$$V[G(X)] = \sum_{i} V[X_i] \left[\frac{dG}{dC_i}\right]^2 + 2 \sum_{i>j} \sum Cov[X_i X_j] \left[\frac{dG}{dX_i} \quad \frac{dG}{dX_j}\right]$$

Where G is a function of the vector X. If the seasonal allocation is G[X] and X = [C P, S]:

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[1] These periods can be fishing periods or statistical weeks, but cannot be several fishing periods or week pooled into a larger unit of time.

$$V[C_j] = \sum_{t}^{T} \sum_{i}^{n} [V[CPit] \ (CtSijt)^2 + V[Sijt] \ (CtPit)^2] +$$

$$+ 2 \sum_{t}^{T} \sum_{i>}^{n} \sum_{K}^{n} Cov[PitPkt]SijtSkjtCt^2$$

Because values for **P** and **S** are unknown, their estimates **p** and **s** were used where:

$$V[Pit] = \frac{Pit \ (1-pit)}{Nt - 1} \qquad Cov[pit. pkt] = - \frac{PitPik}{Nt - 2}$$

with N_t the sample size for the estimate of age composition in period t. Because age compositions and all group compositions were estimated with different discriminant analyses, there are no covariances between **P** and **S** or among the **S**.

APPENDIX D

Comparison of Stock Proportions within Alaska District 101-11

Linear discriminant analysis of scale patterns was used to see if the proportion of the catch of sockeye salmon bound for Canada was the same north and south of Cape Fox in District 101[1]. Scale samples obtained in 1983 were divided by week of collection, by major age classes, and by location of capture, and the proportion of Canada-bound fish from each age-time-location group was estimated with linear discriminant functions. The statistical significance of differences between north and south proportions were tested with independent t tests for each age-time combination of samples (Snedecor and Cochran 1967). For these tests, the variance of the difference of two proportions was calculated as the sum of their individual variances.

The 23[2] possible comparisons indicate: 1) the proportion of Canada-bound fish in the catch south of Cape Fox was usually the same as the proportion in the catch north of this point (Appendix Table D1) when differences did occur, the proportions of Canada-bound sockeye salmon were higher in catches north of Cape Fox. Eighteen of the two-tailed t tests show no statistically significant difference (probability of a Type I error is 5%) in the proportions of Canada-bound sockeye salmon in northern and southern catches for the same age classes at the same time. For the 5 comparisons where a significant difference did occur, only 1 shows a higher proportion to the south while 4 show a higher proportion to the north. The one case where the proportion in the south is greater is the expected number of significant tests out of 23 due to random chance when no difference exists and the probability of a Type I error is 5%.

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[1] Because catches could not be divided in the same way as the scale samples, the proportion and not the contribution of Canada-bound fish was compared with the proportion from the south for each age-time combination.

[2] Division of catch samples representing 4 age classes during each of 6 weeks into Canada and Alaska groups would have produced 24 independent estimated proportions of Canada fish (or 24 independent proportions of Alaska fish). Because only one catch sample of 2.2 aged sockeye salmon is available for statistical weeks 29 and 30, only one independent proportion was produced for this two-week period, thereby reducing the proportions from 24 to 23.

Appendix Table D1. Parametric analysis of differences in the proportions of Canada-bound fish between catches from the drift gillnet fishery north and south of Cape Fox in Alaska District 101, 1983.

Week	1.2	1.3	2.2	2.3	
Differences in Proportions					
29	-1	17	0	1	
30	23	-5		-7	Negative values
31	7	13	2	-8	mean south
32	-2	-7	4	-2	proportions are
33	6	-3	5	29	greater.
34	-33	11	-4	-3	
t Values					
29	-0.07	2.64 *	-0.10	0.08	
30	3.07 *	-0.93		-1.00	Negative values
31	0.96	2.12 *	0.46	-1.32	mean south
32	-0.22	-1.29	1.15	-0.28	proportions are
33	0.78	-0.55	1.14	4.37 *	greater.
34	-3.56 *	1.86	-0.63	-0.33	
Combined Sample Sizes					
29	109	170	243	155	
30	131	207	243	176	
31	120	178	187	198	
32	152	200	168	168	
33	154	200	197	168	
34	97	192	165	116	

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