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RACIAL TRENDS IN CHINOOK SALMON  
(Oncorhynchus tshawytscha) SCALE PATTERNS

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INTRODUCTION

Myers et al. (1984) recently completed a study that employed scale pattern analysis techniques to determine the regional stock origins of chinook salmon in the area of directed high seas salmon fisheries. Their stock composition estimates for the Bering Sea fishery area were similar to estimates from a previous scale pattern analysis (Major et al. 1975, 1977a,b), but estimates for the North Pacific from the two studies were disparate. Major's et al. scale pattern analysis included samples from only two regions, Asia and western Alaska, and their results indicated that Asian (USSR) chinook were often the predominant regional stock in North Pacific catches. Myers et al. used samples from two additional regions, central Alaska and southeast Alaska/British Columbia, and their results indicated that a large proportion of the chinook catch south of the Aleutian Islands and between 160°E and 175°W is of central Alaskan origin.

Myers' et al. estimates of large catches of central Alaskan chinook by North Pacific high seas salmon fisheries have been the cause of considerable concern in Alaska and formed the basis for much discussion at the 1984 INPFC annual meeting. The Japanese scientists at the meeting suggested that the standard samples established by Myers et al. for the various regional categories may not be representative, especially the Asian group since scales from only two rivers (Kamchatka and Bolshaya) were used to represent the entire Asian chinook salmon production.

There are numerous streams along the Pacific coast of Asia and North America that produce chinook salmon, but spawning tends to be concentrated in a few of the larger river systems, and scale samples are routinely collected by fisheries management agencies only from the most commercially important (abundant) of these stocks. Myers' et al. approach was to use samples collected by agencies from the most abundant stocks to represent the scale patterns of all chinook from a particular region. From these samples, brood-year standards were constructed for each region to represent the various ages at which fish in the high seas samples mature, in proportion to their relative abundance in successive inshore runs.

Myers et al. were able to obtain from the Soviet and Japanese fisheries agencies scale samples from only two Asian stocks, the Kamchatka and Bolshaya. Because there was no available information on the run sizes or age composition of these stocks, the relative proportions of Kamchatka and Bolshaya scales in the Asian standards were based on commercial chinook catches reported for East and West Kamchatka Peninsula, respectively, and age compositions were calculated from age determinations made by Fisheries Research Institute (FRI) biologists from the same set of scale samples. In the 14 brood-year standards, the percentage of Kamchatka River scales ranged from 75% to 95% of

the total sample, reflecting the larger commercial catch in East Kamchatka. The proportion of Bolshaya scales was greatest in standards used to classify age 1.3 immature chinook, because the proportion of .4 and .5 age fish was greater in the Bolshaya scale samples than in the Kamchatka scale samples.

Vronskii (1972) reported that chinook salmon is a relatively scarce species along the Asiatic coast of the Pacific Ocean and "is of commercial importance only in Kamchatkan waters where it is caught mainly in the basins of the largest rivers - the Bolshaya and the Kamchatka." He ascribed 90% of the chinook catch to stocks of the Kamchatka River. In addition, the only Asian coastal tag recovery of a chinook salmon tagged in the Bering Sea or North Pacific Ocean (west of 155°W, east of 160°E) from 1956 to 1984 was a North Pacific Ocean release recovered in the Kamchatka River (Myers et al. 1984). Therefore, in terms of the information presently available, there is no reason to believe that the Asian standards used by Myers et al. were not representative of Asian chinook stocks, or, at least, that they were any less representative than the other regional standards.

In terms of scale patterns, a direct assessment of the representativeness of the Asian standards used by Myers et al. is not possible because inshore scale samples from rivers other than the Kamchatka and Bolshaya rivers are not available. An indirect method of assessing the representativeness of the standards is to examine further the classification error rates in discriminant analyses. The stock proportion estimates presented by Myers et al. were corrected by Cook and Lord's (1978) technique, which takes into consideration classification errors of the standard samples. However, classification error of the individual stocks within the regional standards were not determined.

In this paper, racial trends in scale patterns and the misclassification and clustering tendencies of individual stocks or stock-groups included in Myers' et al. regional standards are examined. The results are discussed in terms of the representativeness of the original regional categories and the possible effects of high seas stock composition on Myers' et al. results.

#### METHODS

The four regional groups (standards) established by Myers et al. were composed of up to 17 individual stocks or stock-groups: (1) Asia (Kamchatka and Bolshaya), (2) western Alaska (Yukon, Kuskokwim, Kanektok, Goodnews, Nushagak, and Togiak), (3) central Alaska (Cook Inlet and Copper River), and (4) southeast Alaska/British Columbia (Alsek, Taku, Stikine, Fraser, Nass, Skeena, and Bella Coola). Trends in scale patterns and the misclassification and clustering tendencies of individual stocks or stock-groups included in Myers' et al. standards were examined by four different methods: (1) multiple comparisons tests, (2) tabulation of linear discriminant function (LDF) group classifications by stock, (3) K-means cluster analysis, and (4) graphical interpretation of LDF models. The same data sets, sample sizes, and variables that were used by Myers et al. in their 14 four-region LDF models were used for all of the analyses in this report.

### (1) Multiple Comparisons Tests

The statistical differences between all possible pairs of means of the scale characters of the individual stocks used in Myers' et al. 14 four-region LDF models were examined by the Tukey test (Tukey 1953; Zar 1984). The Tukey test was selected because sample sizes of the various stocks included in the models were unequal and the test is known to be robust to departures from equality of group sizes (Keselman et al. 1976). The Statistical Packages for the Social Sciences (SPSS) version 8.3 of SPSS-6000 procedure ONEWAY (RANGES=TUKEY) with a significance level of .05 was used to perform the computations (Hull and Nie 1981).

### (2) LDF Group Classifications by Stock

The group classifications of individual stocks within the regional categories were tabulated from the results of Myers' et al. 14 four-region LDF analyses. The BMDP statistical program for stepwise discriminant analysis (P7M) writes an index that indicates group membership for each case, as determined by the classification functions at the final step, to an output (BMDP) file, and the BMDP program for frequency tables (P4F) was used to cross-tabulate these results by region and stock (Dixon et al. 1983). The BMDP program does not save an index for the group into which each case is classified for the jackknifed classification matrices that were presented by Myers et al., but the jackknifed classification results differ only slightly from the classification results presented herein.

### (3) K-means Cluster Analysis

K-means cluster analysis (Hartigan 1975) was used to examine how the individual stocks might group without the imposition of a priori regional categories. The K-means procedure was selected because it can handle data sets with a large number of cases and it partitions the data into homogeneous subsets. The BMDP statistical program for K-means clustering (PKM) was used for the computations (Dixon et al. 1983). The same variables used in the LDF analyses by Myers et al. (Table 1) were used in the cluster analyses. The data were pooled over all regions and standardized by dividing each variable by its standard deviation. The Euclidean distance was used to measure the distance between each case and the center of each cluster (mean of the cases in the cluster). The procedure was begun with all of the cases in one cluster, and the data were partitioned by the K-means algorithm into four clusters. An indicator variable that identified the final clusters was saved with the data in a BMDP file, and the results were cross-tabulated by region and stock.

### (4) Graphical Interpretation of LDF Models

The effect of changes in grouping of the component stocks on the LDF analysis was interpreted graphically from plots of the group centroids of the first two discriminant functions (canonical variables). The centroids are the means of the standardized (mean = 0.0, standard deviation = 1.0) discriminant scores for each group on each dimension; i.e., the distance of the group in standard deviation units from the zero mean of the discriminant function. The

first discriminant function is the linear combination of scale characters that maximizes group separation; and the second discriminant function is the linear combination of scale characters in a dimension at right angle (orthogonal) to the first, that best separates the groups on the basis of information not accounted for by the first discriminant function (Tabachnick and Fidell 1983). Plots of the group centroids with respect to the first (x-axis) and second (y-axis) discriminant functions provide a good visual representation of group separation. Output from the BMDP (P7M) program presents plots of this type and a table of the values of the x- and y-coordinates (Dixon et al. 1983). Plots of the group centroids of the original (four-region) discriminant functions were compared to plots of new (six-region) discriminant functions in which the two component stocks for Asia and central Alaska were placed into separate groups. The group centroids of the high seas unknowns were also plotted. The same data sets, sample sizes, and predictor variables (scale characters) that were used in Myers' et al. four-region analyses were used in the new six-region analyses.

## RESULTS

### (1) Multiple Comparisons Test

A total of 146 different Tukey tests were performed to compare the statistical differences between individual stocks for all of the scale characters used in Myers' et al. 14 four-region analyses. Because of the magnitude of this analysis, the results for selected scale characters only are presented herein.

The variables selected were those that were among the first three entered into at least one of the 4-region analyses (Table 1). The BMDP statistical software for forward stepping linear discriminant function analysis at each step enters the 'best' variable; i.e., the variable with the largest F-to-enter value. This value is computed for all variables at each step from a one-way analysis of covariance where the covariates are the previously entered variables (Dixon et al. 1983). Descriptions of the variables (scale characters) are listed by number in Table 2. For ease of presentation, the selected variables will be referred to in this paper by the following scale character names: (1) 'zone sizes' = char. Nos. 5 and 6, (2) 'circulus counts' = char. Nos. 7, 12, and 16, (3) 'circulus spacing' = char. Nos. 9 and 21, (4) 'ratios' = char. Nos. 26 and 27, (5) 'inner bands' = char. Nos. 34 and 49, and (6) 'outer band' = char. No. 36.

The results of the Tukey tests for the selected variables are presented in Table 3. Subsets of groups of stocks that were statistically similar are underlined. The results of the analysis were often difficult to interpret, having as many as five overlapping sets of similarities. Repeating the analysis with larger sample sizes for some of the groups would increase the power of this test and, probably, provide less obscure results (Zar 1984). However, some useful observations can still be made about trends in scale patterns for the individual stocks and the statistical relationships between component stocks of the four regional categories used by Myers et al.

The Asian stocks, Kamchatka and Bolshaya, usually had the smallest mean zone sizes and circulus counts, and the means were consistently smaller for Bolshaya than Kamchatka (Table 3). For these characters, significant differences between Kamchatka and Bolshaya occurred in several of the analyses. The western Alaskan stocks, and occasionally the Copper River, usually had the largest mean zone sizes, and the British Columbia stocks (Fraser, Nass, Skeena, Bella Coola) often had the largest mean circulus counts. There were rarely significant differences for these characters among the western Alaskan stocks, but there were often significant differences between one or more of the transboundary stocks (Alsek, Taku, and Stikine) and the British Columbia stocks for the circulus count characters. Typically, the transboundary stocks had fewer circuli than the British Columbia stocks, even though zone sizes were similar. There were also statistically significant differences in mean zone sizes and circulus counts between the central Alaskan stocks, Cook Inlet and Copper River, in several of the analyses. Cook Inlet almost always had smaller mean zone sizes and circulus counts than Copper River, although there is a considerable amount of variability in the mean zone sizes and circulus counts of the Copper River samples in the various brood year models.

The British Columbia stocks (Fraser, Nass, Skeena, and Bella Coola) usually had the smallest circulus spacing, and the western Alaskan stocks had the largest circulus spacing (Table 3). In several of the analyses, the Taku had significantly wider circulus spacing than other southeast Alaska/British Columbia stocks, and the circulus spacing of Nushagak samples was significantly less than that of some of the other western Alaskan stocks in a few cases. The circulus spacing of the Bolshaya samples was usually less than that of the Kamchatka samples, but the differences were not statistically significant. There were no consistent trends or significant differences in circulus spacing for the central Alaska stocks.

Although the two ratio characters involved adjacent groups of three circuli (C13-C15 and C16-C18), the trends in scale patterns for the two characters were somewhat different (Table 3). The Asian stocks usually had the largest mean ratios and Kamchatka and Bolshaya were not statistically different, but the means for Kamchatka were consistently less than Bolshaya for the C13-C15 ratios and greater than Bolshaya for the C16-C18 ratios. The Bristol Bay stocks, Nushagak and Togiak, tended to have smaller mean ratios than the other western Alaska stocks, and mean ratios for Nushagak were significantly less than some of the other western Alaska stocks in a few analyses. The mean ratios for the Copper River sample were always consistently less than those for the Cook Inlet samples, and Copper River and Cook Inlet were significantly different in two of the four C16 to C18 ratio analyses. The southeast Alaska/British Columbia stocks have the smallest mean C16-C18 ratios, and the British Columbia stocks tended to have smaller mean ratios than the transboundary stocks.

Kamchatka almost always had the smallest mean inner bands, and was significantly smaller than Bolshaya in several of the analyses (Table 3). This difference reflects the fact that Bolshaya scales typically have few, if any, freshwater circuli in the early portion of the second year of growth, while Kamchatka scales often have a large number of freshwater circuli in this portion of the scale. The southeast Alaska/British Columbia stocks tended to

have the largest inner bands, and Bella Coola generally had the smaller and Taku the larger mean inner bands within this regional standard. Copper River usually had larger mean inner bands than Cook Inlet, and the differences were statistically significant in a few cases. There were no significant differences among the western Alaska stocks for these characters.

Bolshaya had the smallest mean outer band, and was significantly different than Kamchatka in three of the four analyses (Table 3). This, again, relates to the fact that zone sizes of Bolshaya scales are smaller than zone sizes of Kamchatka scales. Similarly, the regional category with the largest zone sizes, western Alaska, tended to have the largest mean outer band. There were no statistically significant differences for this character among component stocks of the western Alaskan, central Alaskan, or southeast Alaskan/British Columbian regional categories.

Although the results for the other characters used in the models (Table 1) are not presented in this report, the same general trends were apparent. Within the regional categories, statistically significant differences in scale character means were most frequent between the two Asian stocks: Kamchatka and Bolshaya, the two central Alaskan stocks: Cook Inlet and Copper River, and the two southeast Alaska/ British Columbia groups, i.e., the transboundary stocks (Alsek, Taku, and Stikine) and the British Columbia stocks (Fraser, Nass, Skeena, and Bella Coola).

## (2) Linear Discriminant Function (LDF) Group Classifications by Stock

The predicted regional categories for individual stocks in 14 LDF scale pattern models used by Myers et al. are presented by region in Tables 4-7. In this report, 'classification accuracy' is the percentage of scales correctly predicted by the LDF model. A 'low' classification accuracy refers to an accuracy below 62.5% [half-way between random chance (25%) and 100% for a 4-way model].

Except for the brood year '73 models, overall classification accuracies for the Asian standards were relatively high (Table 4). Classification accuracies for Kamchatka averaged 75.1% and ranged from 63.6% to 88.6% in the 14 LDF models. Kamchatka scales most often misclassified to western Alaska, but misclassifications were higher to central Alaska in the '75 and '76 models (Table 4). Classification accuracies for Bolshaya were usually lower than for Kamchatka, averaging 62.2% and ranging from 40.0% to 87.5%. In contrast to Kamchatka, Bolshaya almost never misclassified to western Alaska. Low classification accuracies for Bolshaya occurred in the '71, '72, and '73 models, where Bolshaya usually misclassified to central Alaska, and in the '74B model, where almost half of the scales classified to southeast Alaska/British Columbia.

Except for an occasional low accuracy, classification accuracies for the western Alaska stocks were relatively high (Table 5). Accuracies for Yukon River samples averaged 76.2% and ranged from 51.9% to 85.7%. The highest misclassifications of Yukon scales were usually to central Alaska, and in the '77 model an unusually high proportion (36.5%) of the Yukon scales misclassified to the central Alaska region. Accuracies for the Kuskokwim averaged

somewhat lower than the Yukon (73.3%) and ranged from 60.7% to 82.6%. In the earlier brood year models ('70-'74) the Kuskokwim usually misclassified most frequently to Asia, and in the later models ('75-'77) misclassifications were greatest to central Alaska. Classification accuracies for the Kanektok and Goodnews averaged 84.5% and 100%, respectively, for the models in which they were included. Classification accuracies for the two Bristol Bay stocks, Nushagak and Togiak, averaged 84.1% and 77.5%, respectively. The Bristol Bay stocks also tended to misclassify to Asia in the earlier brood year models ('70-'71) and to central Alaska or southeast Alaska/British Columbia in the later brood year models ('74-'77).

Classification accuracies for the two central Alaskan stocks, particularly Cook Inlet, were often low (Table 6). The accuracies for Cook Inlet averaged 57.7% and ranged from 49.0% to 69.5%. Except for the '74B model, Cook Inlet tended to misclassify most heavily to Asia or western Alaska. Except for the brood year '71 models, Copper River classification accuracies were higher than Cook Inlet. The accuracies for Copper River averaged 68.8% and ranged from 54.8% to 83.6%. In contrast to Cook Inlet, the Copper River scales misclassified most heavily to the southeast Alaska/British Columbia region.

Overall classification accuracies for the southeast Alaska/ British Columbia standards were usually high (Table 7). However, within these standards classification accuracies for the three transboundary stocks, Alek, Taku, and Stikine, were usually very low and averaged 30.5%, 42.2%, and 49.4%, respectively. The transboundary stocks usually misclassified heavily to the central Alaska region. Classification accuracies for the four British Columbia stocks, Fraser, Nass, Skeena, and Bella Coola, were usually much higher and averaged 91.8%, 80.7%, 81.5%, and 74.7%, respectively. Similar to the transboundary stocks, the British Columbia stocks most often misclassified to the central Alaska region. The classification accuracies were low for the Bella Coola in the '72, '75A, and '76A models and for the Nass in the '71A model.

### (3) K-Means Cluster Analysis

The results of the K-means cluster analysis of the scale data used by Myers et al. are summarized by region and stock in Table 8. In most of the analyses, each of the four clusters contained scales from each of the individual stock and regional categories (Table 8). This suggests a broad overlap in scale patterns and indicates that both the regional and individual stock categorizations are somewhat artificial in terms of categorizing fish with similar scale patterns. However, the proportion of the total sample of the individual stock and regional categories in each cluster was varied. Usually, for individual stocks or regional groups, a large proportion of the sample was grouped into one or two of the clusters. This indicates that there is a predominant pattern or set of patterns that characterize individual stocks or regional groups. By determining which clusters have the highest and lowest proportions of the various stock and regional categories, some trends in the clustering tendencies of these groups can be observed and the scale patterns which the clusters represent can be more easily interpreted.



For ease of interpretation, the results in Table 8 were organized so that the cluster with the highest proportion of scales in the Asian regional category always appears on the left hand side of the table and is labeled 'Cluster 1'. The remaining clusters in each brood year analysis were ordered by decreasing proportion of Asian scales from left to right in the table.

Except for brood year '70 and '74B, the highest proportions of the two Asian stocks, Kamchatka and Bolshaya, always occurred within the same cluster (Cluster 1, Table 8). Although Cluster 1 occasionally contained the highest proportions of some of the western Alaskan and southeast Alaskan/British Columbian stocks, the total proportion of scales from these regions were often the lowest in this cluster. Cluster 1 contained the highest proportion of central Alaskan scales for several of the earlier brood year groups ('71A, '71B, and '73A) and the lowest proportion of central Alaskan scales for several of the later brood year groups ('75B, '76A, and '76B). In terms of the scale pattern variables examined in this report, the clusters with the highest proportions of Asian scales might best be characterized as groups of scales with small zone sizes and circulus counts, average circulus spacing, and large ratios. The clusters with the lowest proportion of Asian scales (Cluster 4, Table 8) often contained the highest proportions of western Alaskan or southeast Alaskan/British Columbian scales.

Although there were a few analyses in which the highest proportions of the individual western Alaska stocks all occurred within the same cluster ('71A, '71B, and '75A), the western Alaska stocks tended to split into two clusters (Table 8). However, there was no readily discernible pattern in the stock composition of the clusters, and this variability is probably related to differences in the scale characters used in the various analyses. The clusters which contained the highest proportions of western Alaskan scales almost never included the highest proportion of any of the other regional stocks. The only exceptions to this were the '76B and '77 analyses in which these clusters also included the highest proportions of central Alaskan scales. In general, clusters with the highest proportions of western Alaskan scales might best be characterized as groups of scales with average circulus counts and large circulus spacing and zone sizes.

The highest proportions of the two central Alaskan stocks often occurred in separate clusters (Table 8). This indicates that the scale patterns of Cook Inlet and Copper River chinook are fairly distinct. In these cases, Cook Inlet had a tendency to cluster with the groups that had high proportions of Asian scales, while Copper River had more of a tendency to cluster with the groups that had high proportions of western Alaska or southeast Alaska/British Columbia stocks. When the highest proportions of the two central Alaska stocks occurred within the same cluster, they tended to group with western Alaska or southeast Alaska/British Columbia stocks.

The highest proportions of the southeast Alaska/British Columbia stocks all occurred in the same cluster in two of the brood year analyses ('72B and '75A, Table 8), but more frequently they occurred in two or more clusters. In over half of the analyses, the highest proportions of all the British Columbia stocks occurred within the same cluster. These clusters might best be characterized as groups of scales with small circulus spacing and ratios,

average zone sizes, and large circulus counts. The highest proportions of the three transboundary stocks (Alsek, Taku, and Stikine) often occurred in three different clusters. This indicates that the scale patterns of these three stocks are divergent and difficult to categorize.

#### (4) Graphical Interpretation of LDF Models

Plots of the group centroids for the original 4-region (Asia vs. western Alaska vs. central Alaska vs. southeast Alaska/ British Columbia) LDF models used by Myers et al. and new 6-region models (Kamchatka vs. Bolshaya vs. western Alaska vs. Cook Inlet vs. Copper River vs. southeast Alaska/British Columbia) for the 14 brood year analyses are shown in Figure 1. In general, the plots show that the centroids of all the regional groups are relatively close to each other (usually within two standard deviation units from the zero mean of the discriminant function) and demonstrate the utility of both dimensions in discriminating among the groups. Although the discriminant functions in the four- and six-region analyses represent different linear combinations of the same scale characters, the general spatial relationships between the groups can be compared.

The Asian centroid in the four-region analyses usually occupies a region of space more similar to the Kamchatka centroid than to the Bolshaya centroid in the six-region analyses (Fig. 1). This is not surprising since the Asian standard was usually heavily weighted toward Kamchatka. The Kamchatka and Bolshaya centroids were often widely separated, and were sometimes closer to the Cook Inlet centroid than they were to each other. The Bolshaya and Cook Inlet centroids were particularly close to each other in the brood year 1973 analyses.

In the six-region analyses, the Cook Inlet and Copper River centroids were often widely separated in multivariate space (Fig. 1). The Copper River centroid was sometimes closer to the southeast Alaska/British Columbia centroid than to the Cook Inlet centroid. The Cook Inlet centroid was often located centrally (close to the zero mean of the discriminant functions) and sometimes equidistant from the Kamchatka, Bolshaya, western Alaska, and Copper River centroids. The group centroids for the high seas unknowns were often located very close to the Cook Inlet centroids.

Because the variables used in the six-region analyses were the same as those used in the original four-region analyses (Table 1), the six-region classification models depicted in Figure 1 are probably not optimal. Therefore, the proportions of the various stocks in the high seas samples were not estimated. However, the total number of scales in the high seas unknowns that were classified to each regional stock was summarized in Table 9 to provide some indication of the results that might be obtained with a six-region model.

In the six-region analyses, scales in the high seas unknowns classified to both of the component stocks in the original Asian and central Alaskan categories (Table 9). The total number of scales that classified to Asian and central Alaskan stocks was larger in the six-region analyses than in the four-region analyses. However, the difference in the number of scales that classi-

fied to a particular region in the four- and six-way models was sometimes slight.

#### DISCUSSION

The racial trends in chinook salmon scale patterns (Table 3) and linear discriminant function (LDF) classification errors (Tables 4-7) were similar to the regional trends described by Myers et al. (1984). The Asian stocks had the smallest zone sizes and circulus counts, western Alaskan stocks had the largest zone sizes and circulus spacing, British Columbia stocks had the smallest circulus spacing and the largest circulus counts, and the scale patterns of the transboundary stocks (Alsek, Taku, and Stikine) and the central Alaska stocks were often intermediate to these extremes. However, there is no way to be certain that these trends in scale patterns are due strictly to racial differences.

Myers et al. discussed problems in their methodology related to the presence of suspected non-preferred body area scales in the Asian and high seas samples and the difficulties involved in making accurate freshwater age determinations without samples of known age fish for age verification. The Asian (Kamchatka and Bolshaya) scale samples often had the smallest zone sizes and circulus counts (Table 3), and small zone sizes and circulus counts can be indicative of scales collected from body areas outside of the INPFC preferred area (Knudsen 1985) or of scales collected from freshwater age 0. chinook (Myers and Rogers 1985). Karpenko (1982) reported that downstream migration of chinook salmon juveniles from the rivers of East Kamchatka occurs later (late July-August) than in North American stocks, and that they do not migrate to the open part of the Bering Sea until October. This life history strategy might also account for smaller zone sizes and circulus counts on the scales of Asian chinook salmon. However, until Kamchatka and Bolshaya scale samples known to have been collected from the INPFC preferred body area and samples of known age fish can be obtained, these problems will not be resolved.

The results indicate that there is a considerable amount of sample variability in the scale patterns of the individual stocks (Table 3). Although much of this variability is probably related to differences in growth due to year-to-year fluctuations in environmental conditions, some of this variability may be related to annual differences in the quality of the scale samples or in the sub-stocks that were sampled. For example, the Asian scale samples (1977, 1980, 1982, and 1983) that were processed by FRI biologists contained many fewer regenerated and grossly non-preferred body area scales and were much cleaner and easier to digitize precisely than samples from other years. Due to sample availability, the Cook Inlet scales for the earlier brood-years (1970-74) were composed largely of samples collected from Kenai Peninsula stocks (Deep Creek, Ninilchik R., Kasilof R., Crooked Creek, and Kenai R.), while later brood-years (1975-77) were predominantly Susitna River chinook. These differences in the stock composition of the Cook Inlet sample probably account for some of the observed differences in the results for earlier and later brood-year analyses (Tables 3, 6, and 8). However, these same early/late trends were not observed in Myers' et al. stock proportion estimates for central Alaska. Samples for many of the other stocks were also variable as to quality and sub-stock sampled, and sample gear types and

periods also often varied from year-to-year. The effect of these types of sample variability on the stock proportion estimates presented by Myers et al. is not known.

The scale patterns of the component stocks within a region were statistically different for some characters and similar for others (Table 3). Statistically significant differences in scale character means were most frequent between the two Asian stocks (Kamchatka and Bolshaya), the two central Alaska stocks (Cook Inlet and Copper River), and the transboundary stocks (Alsek, Taku, and Stikine) and the British Columbia stocks (Fraser, Nass, Skeena, and Bella Coola). The LDF method was used to determine the linear combinations of scale characters that maximized between group differences and minimized within group differences, but because of overlapping similarities in scale patterns between groups and significant differences in scale patterns within groups some high classification errors for individual stocks occurred. High classification errors occurred most frequently in the Bolshaya, Cook Inlet, Taku, Alsek, and Stikine samples, and there were occasional high classification errors in some of the other samples (Table 4-7).

The cluster analysis of the scale pattern data indicated that both regional and individual stock categorizations are somewhat artificial in terms of grouping fish with similar scale patterns (Table 8). Clearly, a classification scheme based on life history patterns would have more biological meaning and would result in higher classification accuracies. However, when the results of scale pattern analysis are to be used for fisheries management, categorization of the samples into geographical or political regions is often the only acceptable technique.

The division of regional standards containing stocks with high classification error rates into separate groups might be one method of improving their representativeness. However, one characteristic of multi-group discriminant analysis is that an increase in the number of groups also increases the probability of misclassification because there are more opportunities for erroneous assignment (Lachenbruch 1975). The plots of the group centroids in the six-region LDF models showed that the component stocks of the Asian (Kamchatka and Bolshaya) and central Alaskan (Cook Inlet and Copper River) regions are sometimes widely separated in multivariate space (Fig. 1). A comparison of the total number of scales in the high seas unknowns that classified to each regional group in the original four- and new six-region analysis showed some differences in the classification results (Table 9), but it is likely that confidence intervals around stock composition estimates calculated from the six-region classification results would be inclusive of the original estimates.

The results of the present analyses indicate that the regional samples used by Myers et al. were not always homogeneous. The procedure used by Myers et al. to correct for errors in the classification scheme was based on the assumption that the stock proportions in the high seas population are similar to stock proportions in the inshore runs. However, when classification accuracies are low and unknown sample sizes are small, spurious estimates are likely to be obtained if the stock proportions in the high seas population are

different than the proportions in the classification models (Cook 1982). In Myers' et al. analyses, there were often low classification accuracies for the central Alaska standards and unknown sample sizes, particularly for the Japanese landbased driftnet fishery area, were often small.

Myers et al. discussed many of the potential sources of bias in their estimates and the need for improvements in methodology and the information base required for interpretation and application of results. The discussion presented herein iterates many of their conclusions. Regardless of these problems, Myers' et al. estimates represent an improvement over estimates from the single previous scale pattern analysis and are the best estimates presently available.

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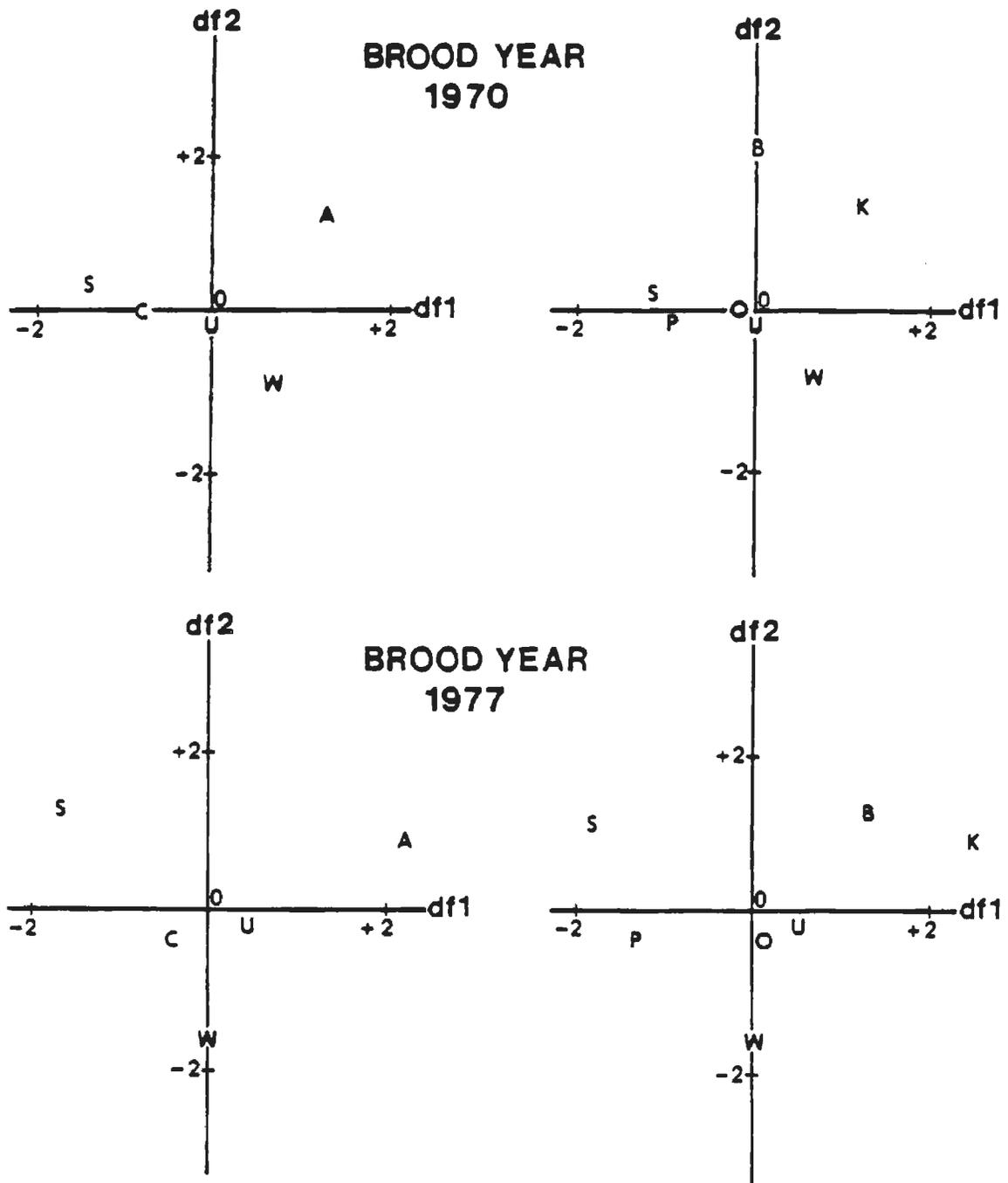


Figure 1. The group centroids of the first two discriminant functions for four-region (left-hand side of figure) and six-region (right-hand side of figure) linear discriminant function models for 14 different brood-year analyses. The centroids are the means of the standardized (mean = 0.0; standard deviation = 1.0) discriminant scores for each group on each dimension; i.e., the distance of the group in standard deviation units from the zero mean of the discriminant function. df1 = the first discriminant function; df2 = the second discriminant function; group centroids: A = Asia, B = Bolshaya, C = central Alaska, K = Kamchatka, O = Cook Inlet, P = Copper River, S = southeast Alaska/British Columbia, U = chinook salmon of unknown origin in the high seas samples, W = western Alaska.

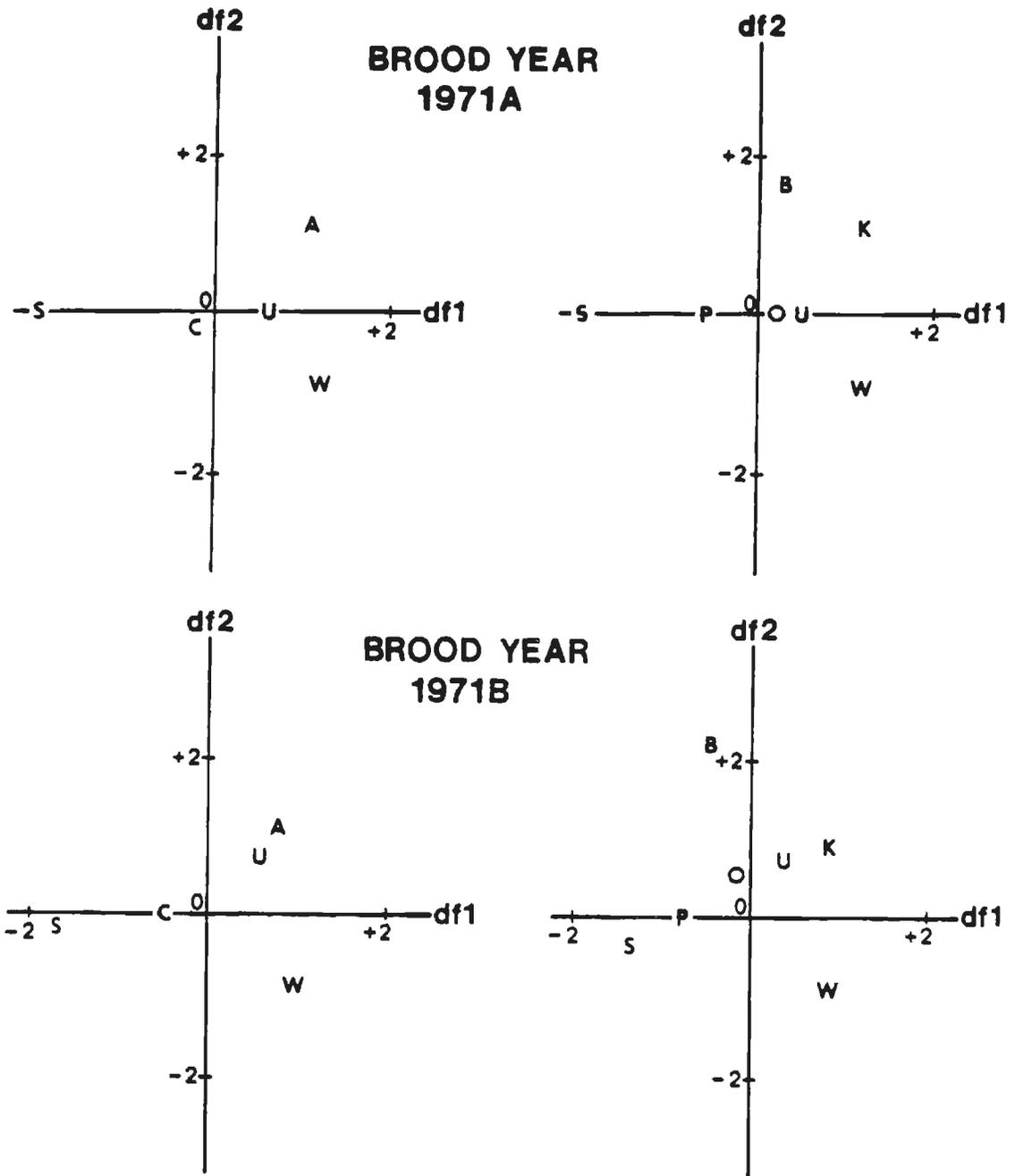


Figure 1. Continued.

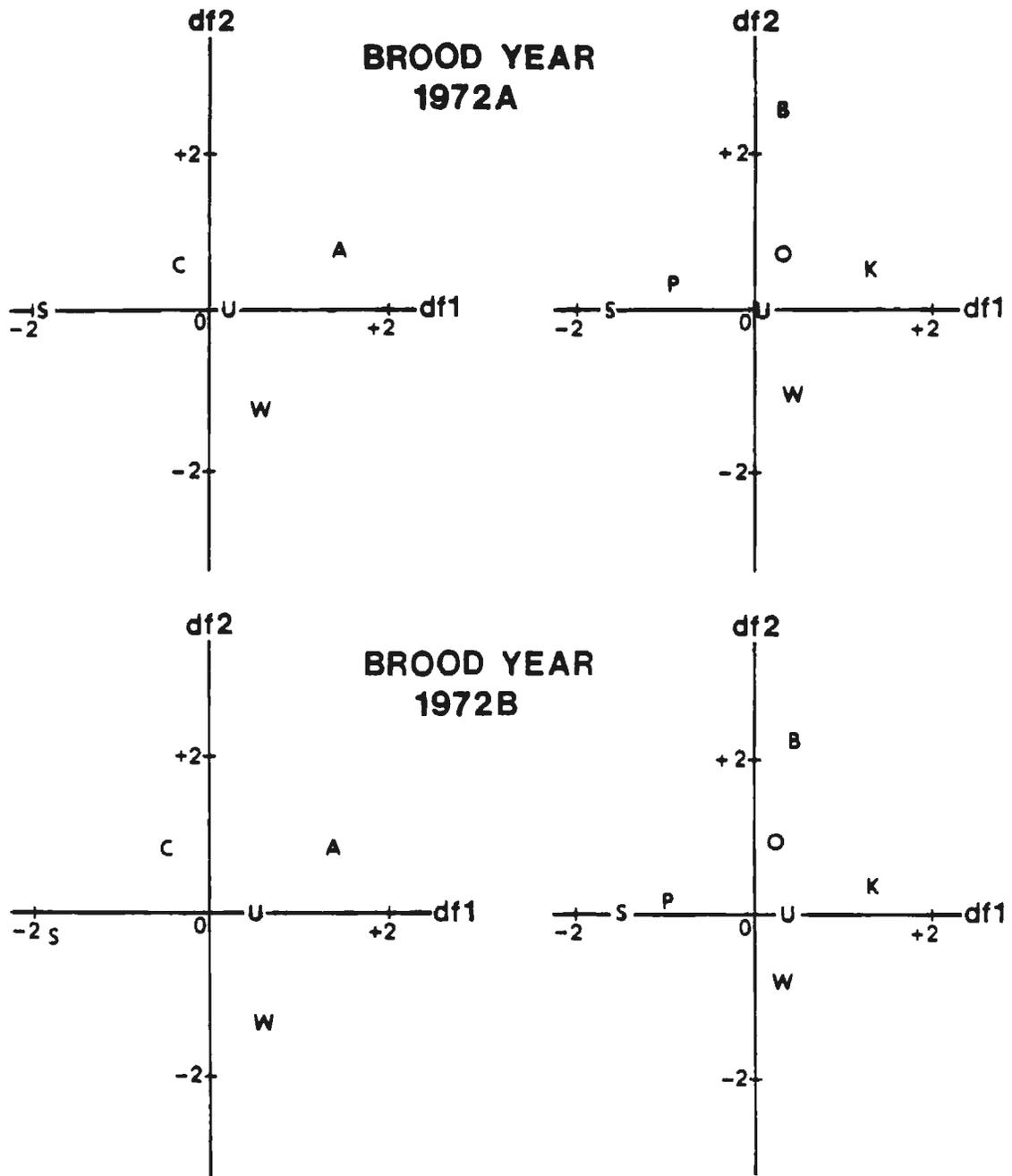


Figure 1. Continued.

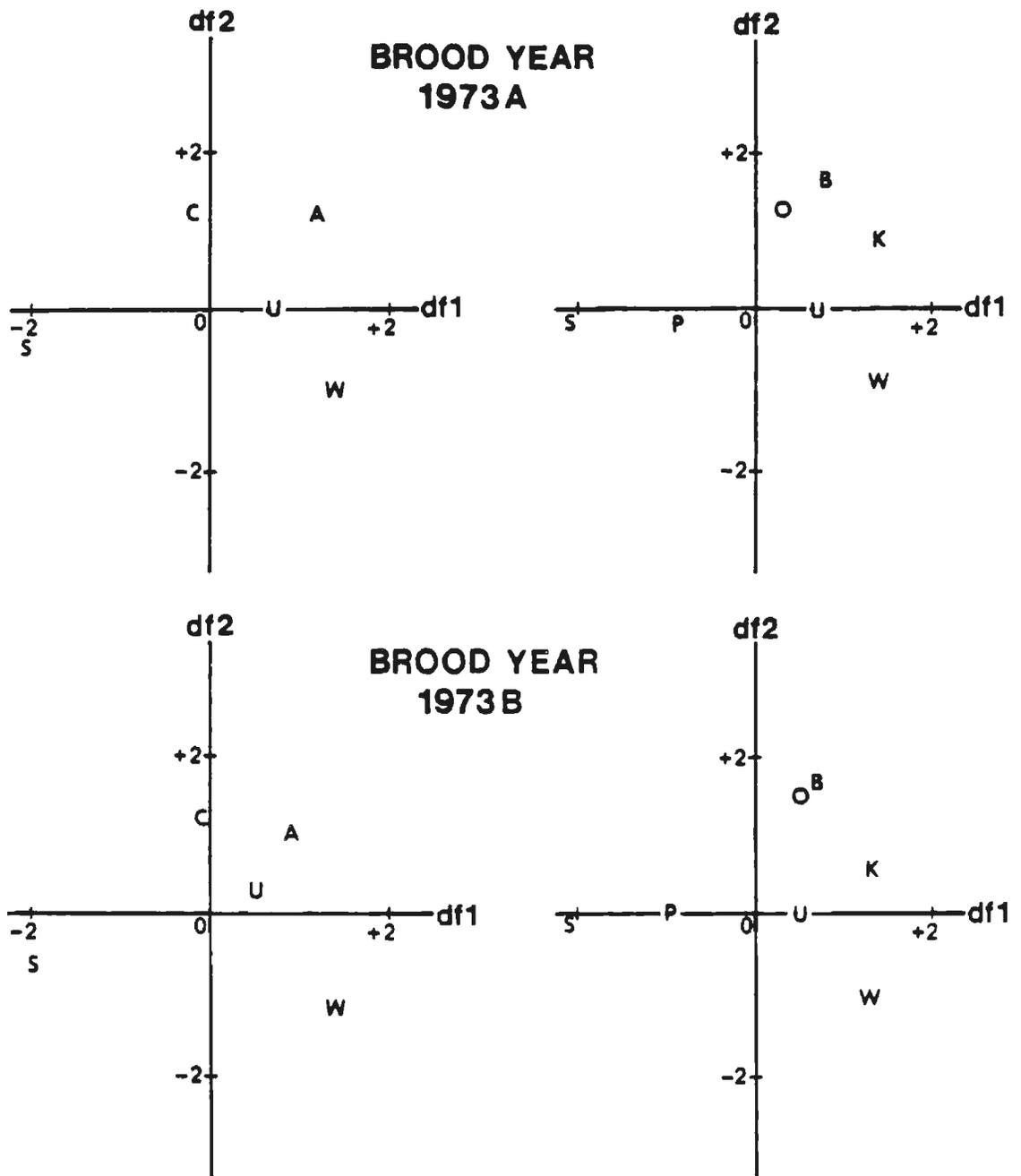


Figure 1. Continued.

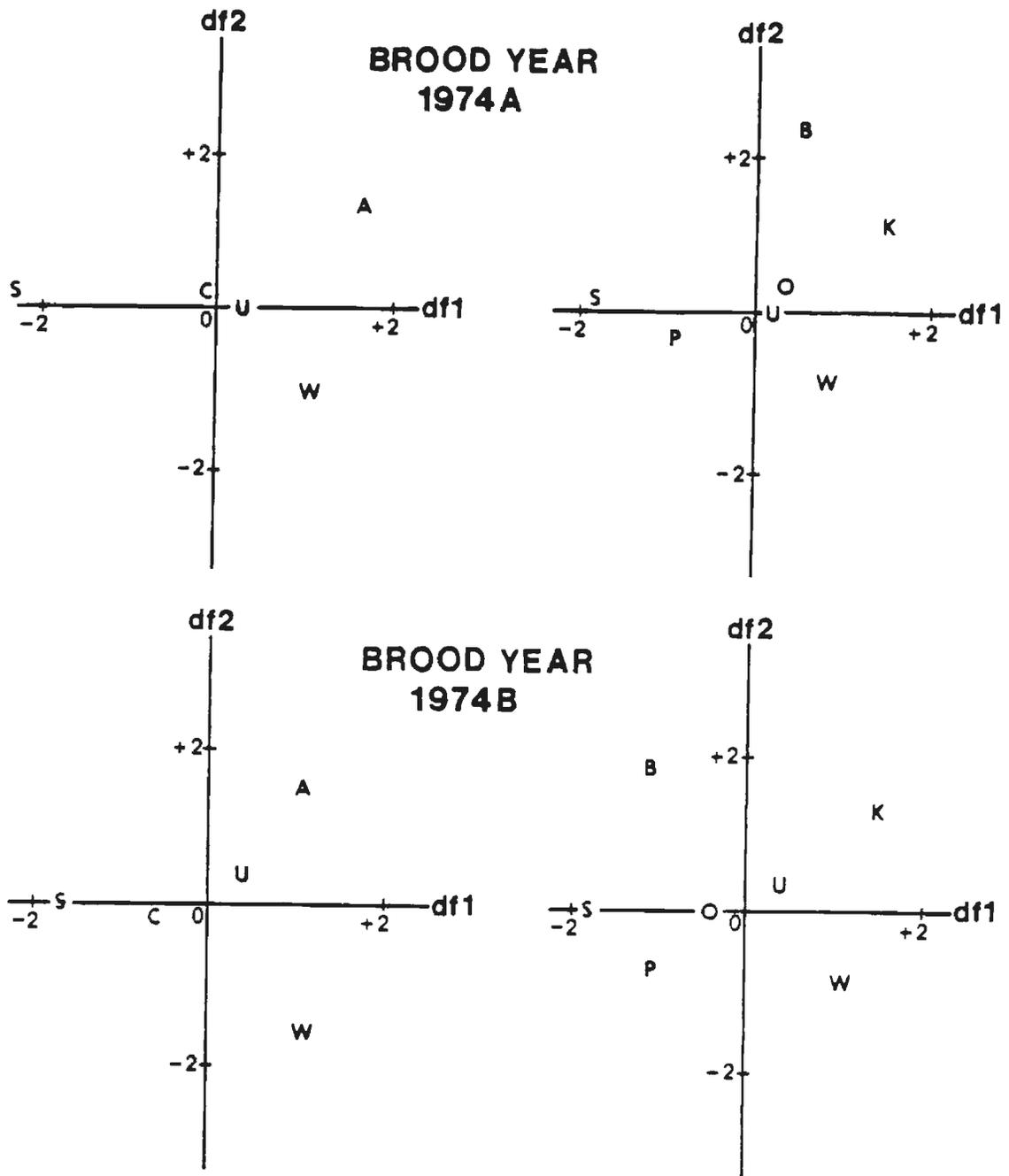


Figure 1. Continued.

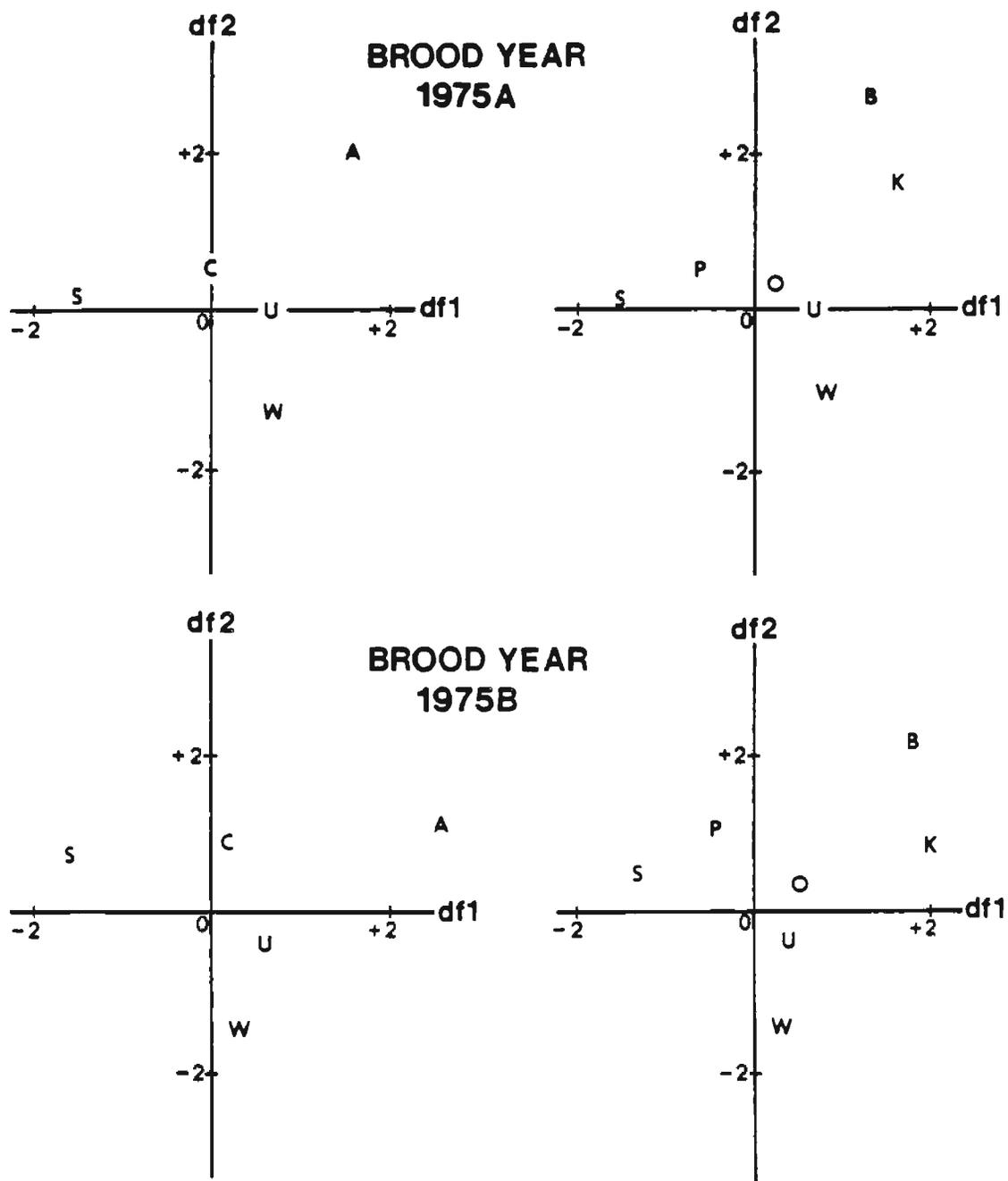


Figure 1. Continued.

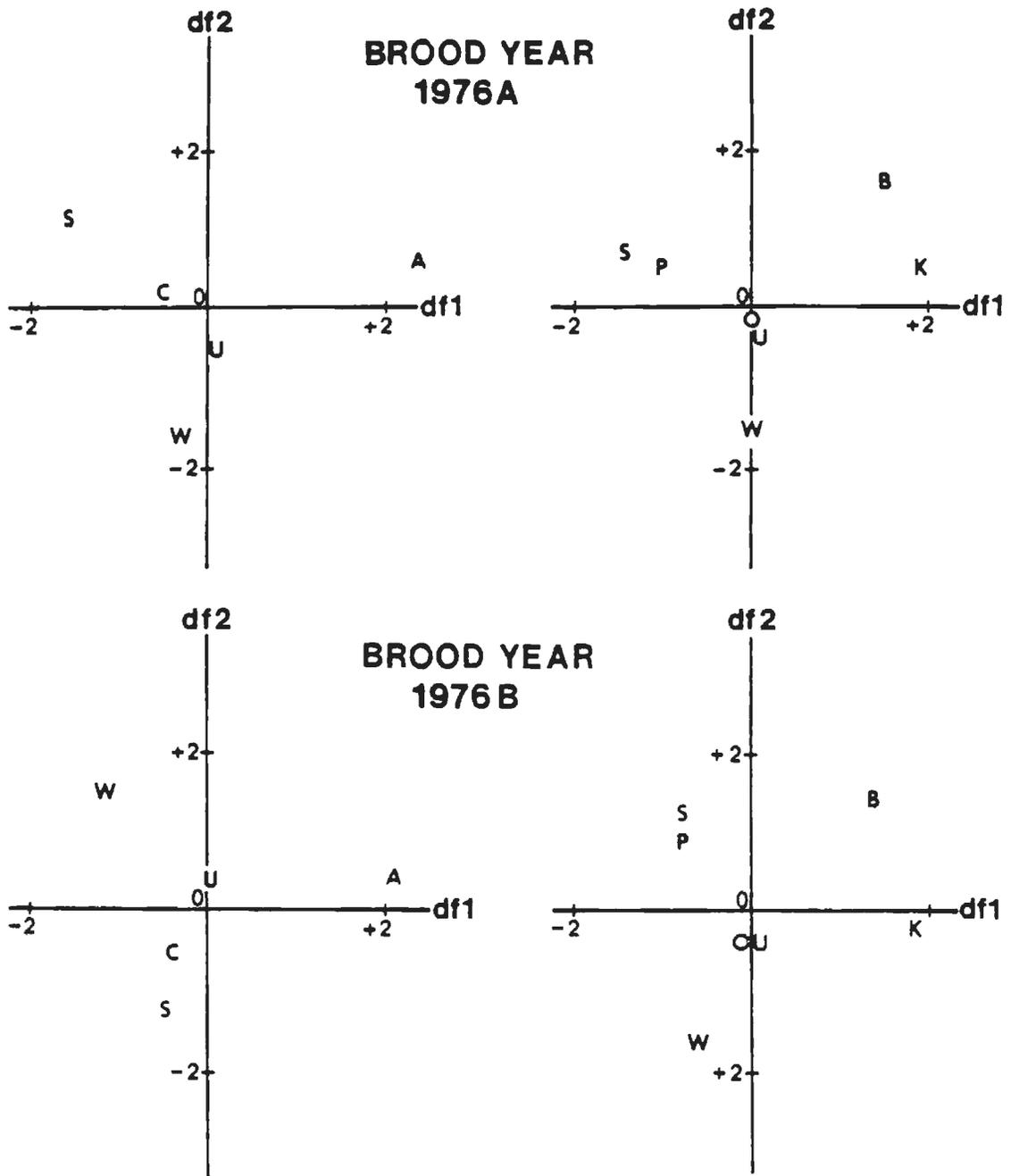


Figure 1. Continued.



Table 1. The percent of scales correctly classified at each step and the variables selected for 14 four-region jackknifed linear discriminant function (LDF) chinook salmon scale pattern models used by Myers et al. (1984). Variables that were both entered and removed from a particular model are not included. Descriptions of the variables are listed by number in Table 2.

Brood year Model	Step no.																Variables in the order that they were added to LDF
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
'70	37.2	48.4	53.1	57.2	59.8	67.2	69.5	70.4	69.1	71.9	-	-	-	-	-	-	27,9,34,21,44,11,45, 35,49,16
'71A	55.9	58.4	59.7	63.6	67.0	69.2	71.1	70.9	71.5	-	-	-	-	-	-	-	9,34,16,17,44,35,11, 6,40
'71B	50.1	53.7	55.6	58.5	63.0	66.3	66.3	67.2	67.1	66.9	-	-	-	-	-	-	7,34,21,35,9,44,5,40, 42,1
'72A	45.8	61.0	62.6	66.3	70.6	70.3	70.6	70.2	70.7	-	-	-	-	-	-	-	7,5,34,21,35,11,17, 42,44
'72B	41.0	59.4	62.5	64.7	67.1	68.3	-	-	-	-	-	-	-	-	-	-	12,26,49,21,34,53
'73A	60.1	64.9	69.3	70.8	71.9	72.0	71.7	72.0	73.3	73.3	73.9	-	-	-	-	-	34,7,21,35,44,36,11, 5,23,52,58
'73B	49.0	57.7	62.1	66.5	70.1	70.5	71.2	-	-	-	-	-	-	-	-	-	9,7,34,21,25,44,53
'74A	59.0	71.5	71.5	75.1	75.9	75.3	75.6	76.3	77.9	-	-	-	-	-	-	-	7,36,21,6,34,28,55, 35,11
'74B	50.1	59.2	62.1	66.0	67.7	68.7	68.9	69.2	69.9	68.9	70.7	71.0	72.0	-	-	-	9,27,34,16,36,5,53, 54,6,28,22,39,50
'75A	55.9	70.3	74.0	76.4	76.2	75.7	76.6	76.4	76.7	77.3	76.2	76.9	-	-	-	-	7,5,34,12,31,35,26, 48,53,22,55,9
'75B	52.6	64.3	73.3	74.2	74.0	75.2	75.6	75.6	75.8	-	-	-	-	-	-	-	6,7,34,17,31,44,35, 30,57
'76A	53.1	68.9	69.9	71.8	72.3	71.7	71.9	71.4	71.6	71.6	72.2	-	-	-	-	-	7,16,34,5,35,31,9,58, 54,27,32
'76B	48.4	60.3	67.2	67.8	71.5	71.5	71.5	71.1	71.6	71.8	72.3	72.8	72.8	72.8	-	-	6,21,34,35,12,60,25, 52,44,11,1,32,49,22
'77	51.0	62.6	69.8	76.0	79.3	78.6	79.4	79.1	79.0	78.0	78.6	78.8	79.0	79.0	79.4	79.5	27,9,34,17,58,16,31, 35,28,44,42,21,36, 47,25,26

Table 2. Descriptions of scale characters used by Myers et al. (1984).

Character No.	Description <sup>a</sup>
1	Size Zone 1
2	Size Zone 2
3	Size Zone 3
4	Size Zone 1 + size Zone 2
5	Size Zone 2 + size Zone 3
6	Size Zone 1 + size Zone 2 + size Zone 3
7	No. circuli Zone 1 + no. circuli Zone 2 + no. circuli Zone 3
8	Size zone 2/(size Zone 1 + size Zone 2 + size Zone 3)
9	(Size Zone 1 + size Zone 2 + size Zone 3)/(no. circuli Zone 1 + no. circuli Zone 2 + no. circuli Zone 3)
10	(Size Zone 1 + size Zone 2)/(size Zone 1 + size Zone 2 + size Zone 3)
11	(Size Zone 2 + size Zone 3)/(size Zone 1 + size Zone 2 + size Zone 3)
12	No. circuli Zone 1
13	No. circuli Zone 2
14	No. circuli Zone 3
15	No. circuli Zone 1 + no. circuli Zone 2
16	No. circuli Zone 2 + no. circuli Zone 3
17	Size Zone 1/no. circuli Zone 1
18	Size Zone 2/no. circuli Zone 2
19	Size Zone 3/no. circuli Zone 3
20	(Size Zone 1 + size Zone 2)/(no. circuli Zone 1 + no. circuli Zone 2)
21	(Size Zone 2 + size Zone 3)/(no. circuli Zone 2 + no. circuli Zone 3)
22	Distance C1 to C3 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
23	Distance C4 to C6 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
24	Distance C7 to C9 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
25	Distance C10 to C12 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
26	Distance C13 to C15 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
27	Distance C16 to C18 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
28	Distance C19 to C21 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
29	Distance C22 to C24 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
30	Distance C25 to C27 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
31	Distance C28 to C30 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
32	Distance C31 to C33 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
33	Distance C34 to C36 in Zones 2+3/(size Zone 1 + size Zone 2 + size Zone 3)
34	Distance C1 to C9 in Zones 2+3 (= character Nos. 49 + 50 + 51)
35	Distance C10 to C18 in Zones 2+3 (= character Nos. 52 + 53 + 54)
36	Distance C19 to C27 in Zones 2+3 (= character Nos. 55 + 56 + 57)
37	Distance C28 to C36 in Zones 2+3 (= character Nos. 58 + 59 + 60)
38	Radius of focus
39	Distance C2 - C4 in Zone 1
40	Distance C5 - C7 in Zone 1

Table 2. Continued.

Character No.	Description <sup>a</sup>
41	Distance C8 - C10 in Zone 1
42	Distance C11 - C13 in Zone 1
43	Distance C14 - C16 in Zone 1
44	Distance C2 - C4 in Zone 1/(size Zone 1 + size Zone 2 + size Zone 3)
45	Distance C5 - C7 in Zone 1/(size Zone 1 + size Zone 2 + size Zone 3)
46	Distance C8 - C10 in Zone 1/(size Zone 1 + size Zone 2 + size Zone 3)
47	Distance C11 - C13 in Zone 1/(size Zone 1 + size Zone 2 + size Zone 3)
48	Distance C14 - C16 in Zone 1/(size Zone 1 + size Zone 2 + size Zone 3)
49	Distance C1 to C3 in Zones 2+3
50	Distance C4 to C6 in Zones 2+3
51	Distance C7 to C9 in Zones 2+3
52	Distance C10 to C12 in Zones 2+3
53	Distance C13 to C15 in Zones 2+3
54	Distance C16 to C18 in Zones 2+3
55	Distance C19 to C21 in Zones 2+3
56	Distance C22 to C24 in Zones 2+3
57	Distance C25 to C27 in Zones 2+3
58	Distance C28 to C30 in Zones 2+3
59	Distance C31 to C33 in Zones 2+3
60	Distance C34 to C36 in Zones 2+3

<sup>a</sup>Zone 1: The area of the scale from the center of the focus to the outer edge of the last circulus in the freshwater annulus.

Zone 2: The area of the scale from the outer edge of the last circulus in the freshwater annulus to the outer edge of the last freshwater circulus.

Zone 3: The area of the scale from the outer edge of the last freshwater circulus to the outer edge of the last circulus in the first ocean annulus.

Cn: The n<sup>th</sup> circulus from the beginning of the indicated zone.

Table 3. Results of multiple comparison tests (Tukey, 1953) of the means of selected scale characters of 17 chinook salmon stocks included in 14 four-region linear discriminant function (LDF) scale pattern models used by Myer et al. (1984). Sample means are arranged in order of increasing magnitude and homogeneous subsets [subsets of stocks whose highest and lowest means do not differ by more than the shortest significant ( $\alpha = .05$ ) range for subset of that size] are underlined. Sample sizes are the same as those shown in Tables 4 to 7. Measurement are inches  $\times 10^3$  at 104X. KAMC = Kamchatka, BOL.S = Bolshaya, YUKO = Yukon, KUSK = Kuskokwim, KANE = Kanektok GOOD = Goodnews, NUSH = Nushagak, TOGI = Togiak, COOK = Cook Inlet, COPP = Copper R., ALSE = Alsek, STIK = Stikine, FRAS = Fraser, SKEE = Skeena, BELL = Bella Coola.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																
Character No. 5: Size Zone 2 + Size Zone 3																			
'71B	7	1	BOLS	STIK	COOK	BELL	ALSE	KAMC	COPP	SKEE	TAKU	NASS	FRAS	KUSK	YUKO	GOOD	KANE	NUSH	TOGI
		2	<u>4075</u>	<u>4597</u>	<u>4619</u>	<u>4674</u>	<u>4679</u>	<u>4683</u>	<u>4799</u>	<u>4863</u>	<u>4888</u>	<u>4941</u>	<u>5071</u>	<u>5219</u>	<u>5271</u>	<u>5382</u>	<u>5450</u>	<u>5545</u>	<u>5556</u>
		3																	
'72A	2	1	BOLS	KAMC	NASS	COOK	TAKU	GOOD	STIK	SKEE	BELL	FRAS	ALSE	KUSK	COPP	YUKO	KANE	NUSH	TOGI
		2	<u>4004</u>	<u>4585</u>	<u>4692</u>	<u>4701</u>	<u>4755</u>	<u>4826</u>	<u>4841</u>	<u>4912</u>	<u>5087</u>	<u>5089</u>	<u>5098</u>	<u>5151</u>	<u>5189</u>	<u>5349</u>	<u>5367</u>	<u>5592</u>	<u>5671</u>
		3																	
		4																	
		5																	
'73A	8	1	BOLS	COOK	KAMC	FRAS	ALSE	SKEE	STIK	TOGI	NASS	KUSK	YUKO	COPP	KANE	BELL	NUSH		
		2	<u>4101</u>	<u>4231</u>	<u>4560</u>	<u>4675</u>	<u>4773</u>	<u>4875</u>	<u>5021</u>	<u>5124</u>	<u>5134</u>	<u>5211</u>	<u>5288</u>	<u>5322</u>	<u>5336</u>	<u>5400</u>	<u>5434</u>		
'74B	6	1	BOLS	KAMC	NASS	STIK	TAKU	BELL	ALSE	COOK	FRAS	KUSK	YUKO	SKEE	TOGI	NUSH	COPP		
		2	<u>3761</u>	<u>4418</u>	<u>4460</u>	<u>4603</u>	<u>4622</u>	<u>4927</u>	<u>4945</u>	<u>4950</u>	<u>4968</u>	<u>5290</u>	<u>5464</u>	<u>5467</u>	<u>5635</u>	<u>5772</u>	<u>5821</u>		
		3																	
		4																	
'75A	2	1	BOLS	KAMC	COPP	COOK	ALSE	STIK	TAKU	FRAS	NASS	BELL	SKEE	KUSK	NUSH	YUKO	TOGI	KANE	GOOD
		2	<u>3684</u>	<u>4367</u>	<u>4912</u>	<u>5000</u>	<u>5052</u>	<u>5056</u>	<u>5270</u>	<u>5424</u>	<u>5547</u>	<u>5609</u>	<u>5672</u>	<u>5740</u>	<u>6159</u>	<u>6191</u>	<u>6370</u>	<u>6684</u>	<u>6746</u>
		3																	
		4																	

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																
<b>Character No. 5: Size Zone 2 + Size Zone 3</b>																			
'76A	4		BOLS	KAMC	STIK	COOK	NASS	SKEE	BELL	FRAS	COPP	KUSK	ALSE	TAKU	YUKO	KANE	NUSH	TOGI	
		1	<u>3749</u>	<u>4377</u>	4811	5250	5330	5341	5358	5461	5489	5634	5682	5757	5821	5981	6124	6166	
		2																	
		3																	
		4																	
		5																	
<b>Character No. 6: Size Zone 1 + Size Zone 2 + Size Zone 3</b>																			
'71A	8		BOLS	COOK	KAMC	ALSE	BELL	TAKU	COPP	SKEE	STIK	NASS	FRAS	YUKO	KANE	KUSK	NUSH	GOOD	TOGI
		1	<u>5174</u>	<u>5785</u>	<u>5801</u>	<u>5801</u>	<u>5942</u>	<u>5986</u>	<u>5988</u>	<u>6027</u>	<u>6088</u>	<u>6244</u>	<u>6351</u>	<u>6385</u>	<u>6468</u>	<u>6510</u>	<u>6590</u>	<u>6594</u>	<u>6650</u>
		2																	
'74A	4		BOLS	KAMC	TAKU	COOK	STIK	TOGI	ALSE	NASS	BELL	FRAS	SKEE	NUSH	KUSK	YUKO	COPP		
		1	<u>4621</u>	<u>5458</u>	<u>5535</u>	<u>5833</u>	<u>6011</u>	<u>6216</u>	<u>6331</u>	<u>6513</u>	<u>6563</u>	<u>6651</u>	<u>6687</u>	<u>6727</u>	<u>6781</u>	<u>6797</u>	<u>7111</u>		
		2																	
		3																	
		4																	
		5																	
'74B	9		BOLS	KAMC	NASS	STIK	TAKU	ALSE	COOK	BELL	FRAS	KUSK	YUKO	SKEE	TOGI	NUSH	COPP		
		1	<u>4710</u>	<u>5458</u>	<u>5551</u>	<u>5624</u>	<u>5679</u>	<u>5919</u>	<u>5960</u>	<u>6047</u>	<u>6260</u>	<u>6625</u>	<u>6638</u>	<u>6677</u>	<u>6777</u>	<u>6878</u>	<u>7111</u>		
		2																	
		3																	
		4																	
		5																	
'75B	1		BOLS	KAMC	COPP	COOK	FRAS	ALSE	STIK	NASS	TAKU	SKEE	KUSK	BELL	YUKO	NUSH	KANE	TOGI	GOOD
		1	<u>4663</u>	<u>5410</u>	<u>6031</u>	<u>6072</u>	<u>6194</u>	<u>6415</u>	<u>6606</u>	<u>6919</u>	<u>6993</u>	<u>7078</u>	<u>7176</u>	<u>7367</u>	<u>7428</u>	<u>7459</u>	<u>7746</u>	<u>7981</u>	<u>8064</u>
		2																	
		3																	
		4																	
'76B	1		BOLS	KAMC	STIK	NASS	COOK	FRAS	ALSE	BELL	SKEE	COPP	TAKU	KANE	KUSK	YUKO	NUSH	TOGI	
		1	<u>4863</u>	<u>5350</u>	<u>5863</u>	<u>6175</u>	<u>6193</u>	<u>6239</u>	<u>6475</u>	<u>6582</u>	<u>6641</u>	<u>6679</u>	<u>6684</u>	<u>6796</u>	<u>6982</u>	<u>7072</u>	<u>7197</u>	<u>7560</u>	
		2																	
		3																	
		4																	

Table 3 - cont'd.

Brood Year	LDL Rank	Subset No.	Stock and sample mean																	
Character No. 7:			No. Circuli Zone 1 +			No. Circuli Zone 2 +			No. Circuli Zone 3											
'71B	1	1	BOLS	COOK	TAKU	YUKO	KAMC	ALSE	KANE	COPP	KUSK	STIK	TOGI	GOOD	NUSH	NASS	SKEE	BELL	FRAS	
			34.3	38.2	38.6	39.3	39.3	39.6	39.6	39.9	39.9	40.1	41.2	41.5	41.8	42.8	43.7	44.8	47.0	
			2																	
			3																	
			4																	
'72A	1	1	BOLS	KAMC	TAKU	COOK	GOOD	YUKO	KANE	STIK	KUSK	NASS	ALSE	COPP	TOGI	NUSH	SKEE	BELL	FRAS	
			33.9	37.1	38.7	38.9	39.0	41.0	41.1	41.2	41.8	42.0	42.1	42.9	43.6	44.0	44.8	45.5	46.9	
			2																	
			3																	
			4																	
'73A	2	1	BOLS	COOK	KAMC	KUSK	ALSE	YUKO	KANE	TOGI	STIK	NUSH	COPP	FRAS	SKEE	NASS	BELL			
			31.9	35.5	36.7	38.6	39.0	39.4	39.5	39.9	40.5	40.7	42.1	43.0	44.8	46.7	47.4			
			2																	
			3																	
			4																	
'73B	2	1	BOLS	COOK	KAMC	KUSK	YUKO	ALSE	TOGI	NUSH	TAKU	COPP	FRAS	STIK	SKEE	NASS	BELL			
			32.5	35.3	36.7	38.3	38.4	38.6	38.8	39.6	40.0	42.1	43.9	44.0	45.2	46.7	47.2			
			2																	
			3																	
			4																	
'74A	1	1	BOLS	KAMC	TOGI	TAKU	COOK	KUSK	YUKO	NUSH	STIK	ALSE	COPP	NASS	FRAS	SKEE	BELL			
			31.0	35.5	38.2	38.6	39.2	40.3	40.6	41.3	41.7	42.4	46.0	48.2	48.8	48.9	50.3			
			2																	
			3																	
			4																	
'75A	1	1	BOLS	KAMC	ALSE	COOK	TAKU	KUSK	STIK	COPP	NUSH	TOGI	YUKO	KANE	GOOD	NASS	BELL	SKEE	FRAS	
			30.9	36.8	40.2	40.9	42.5	42.5	42.8	43.0	43.9	44.7	44.7	47.5	47.5	48.3	48.8	48.9	49.9	
			2																	
			3																	
			4																	

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																	
<b>Character No. 7: No. Circuli Zone 1 + No. Circuli Zone 2 + No. Circuli Zone 3 - cont'd.</b>																				
'75B	2		BOLS	KAMC	COOK	STIK	COPP	KUSK	ALSE	TAKU	NUSH	TOGI	YUKO	FRAS	KANE	NASS	GOOD	SKEE	BELL	
		1	<u>31.9</u>	<u>36.8</u>	40.4	42.9	43.0	43.0	43.2	44.0	44.4	44.7	44.8	45.2	45.5	47.1	47.5	48.6	49.7	
		2																		
		3																		
'76A	1		BOLS	KAMC	STIK	YUKO	COOK	TAKU	KUSK	ALSE	KANE	COPP	NUSH	TOGI	NASS	BELL	SKEE	FRAS		
		1	<u>33.2</u>	<u>36.0</u>	41.2	42.3	42.5	42.9	43.1	43.5	44.8	45.0	45.2	46.8	47.5	48.8	48.8	50.1		
		2																		
		3																		
		4																		
		5																		
<b>Character No 9: (Size Zone 1 + Size Zone 2 + Size Zone 3)/(No. circuli Zone 1 + no. circuli Zone 2 + no. circuli Zone 3)</b>																				
'70	2		FRAS	SKEE	BELL	KAMC	COPP	STIK	ALSE	BOLS	COOK	NUSH	TAKU	KUSK	YUKO	KANE	TOGI			
		1	<u>133.9</u>	<u>136.5</u>	<u>137.2</u>	<u>141.8</u>	<u>144.9</u>	<u>146.9</u>	<u>148.6</u>	151.2	151.3	153.4	156.1	157.8	160.3	161.9	169.6			
		2																		
'71A	1		BELL	FRAS	SKEE	NASS	BOLS	STIK	KAMC	ALSE	COPP	TAKU	COOK	TOGI	NUSH	GOOD	KANE	YUKO	KUSK	
		1	<u>133.1</u>	<u>135.6</u>	<u>138.7</u>	<u>146.2</u>	<u>146.2</u>	<u>147.1</u>	<u>147.6</u>	<u>148.5</u>	<u>149.7</u>	<u>150.9</u>	<u>151.5</u>	<u>156.6</u>	<u>157.9</u>	<u>159.4</u>	<u>159.4</u>	<u>162.3</u>	<u>163.2</u>	
'71B	5		BELL	FRAS	SKEE	BOLS	STIK	NASS	ALSE	KAMC	COOK	COPP	GOOD	TAKU	NUSH	KUSK	YUKO	TOGI	KANE	
		1	<u>133.2</u>	<u>137.8</u>	<u>140.8</u>	<u>143.1</u>	<u>145.4</u>	<u>146.2</u>	<u>146.3</u>	<u>147.6</u>	<u>148.9</u>	<u>149.9</u>	<u>159.4</u>	<u>160.3</u>	<u>161.2</u>	<u>161.9</u>	<u>163.7</u>	<u>166.4</u>	<u>167.8</u>	
		2																		
'73B	1		FRAS	NASS	BELL	SKEE	ALSE	COOK	STIK	BOLS	TAKU	KAMC	COPP	NUSH	TOGI	YUKO	KUSK			
		1	<u>137.2</u>	<u>138.9</u>	<u>139.5</u>	<u>139.5</u>	<u>146.9</u>	<u>147.6</u>	<u>151.2</u>	<u>151.9</u>	<u>151.9</u>	<u>152.4</u>	<u>156.8</u>	<u>164.2</u>	<u>166.3</u>	<u>169.0</u>	<u>170.9</u>			
		2																		
'74B	1		NASS	BELL	FRAS	SKEE	STIK	BOLS	TAKU	ALSE	COOK	KAMC	COPP	TOGI	YUKO	NUSH	KUSK			
		1	<u>131.2</u>	<u>131.8</u>	<u>135.1</u>	<u>137.9</u>	<u>139.5</u>	<u>141.8</u>	<u>145.9</u>	<u>147.3</u>	<u>148.9</u>	<u>153.9</u>	<u>154.6</u>	<u>155.7</u>	<u>164.2</u>	<u>164.8</u>	<u>167.4</u>			
		2																		

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																	
Character No 9: (Size Zone 1 + Size Zone 2 + Size Zone 3)/(No. circuli Zone 1 + no. circuli Zone 2 + no. circuli Zone 3)			- cont'd.																	
'75A	12		FRAS	NASS	COPP	BELL	SKEE	KAMC	BOLS	COOK	TAKU	STIK	ALSE	YUKO	KUSK	NUSH	GOOD	KANE	TOGI	
		1	135.5	139.8	140.2	141.6	142.5	146.7	147.3	150.2	150.6	150.8	151.4	164.8	166.5	168.5	169.8	172.1	174.7	
		2																		
		3																		
'76A	7		BELL	FRAS	BOLS	SKEE	NASS	STIK	GOPP	KAMC	COOK	KANE	KUSK	ALSE	TOGI	NUSH	TAKU	YUKO		
		1	137.4	139.2	140.4	141.3	141.8	146.2	148.5	149.1	149.7	157.9	158.7	159.5	160.9	163.6	164.3	167.9		
		2																		
		3																		
'77	2		BELL	FRAS	NASS	SKEE	STIK	ALSE	COOK	COPP	KAMC	KUSK	NUSH	BOLS	TAKU	TOGI	YUKO	KANE	GOOD	
		1	129.1	132.6	138.8	139.7	140.9	141.2	149.5	150.2	150.6	154.9	156.7	158.1	159.5	161.4	161.9	162.9	166.2	
		2																		
		3																		
Character No. 12: No. circuli Zone 1																				
'72B	1		BOLS	KAMC	COOK	KANE	ALSE	NUSH	GOOD	TOGI	COPP	YUKO	TAKU	KUSK	BELL	NASS	SKEE	FRAS		
		1	7.0	8.7	9.1	9.9	9.9	10.2	10.5	10.5	10.6	10.6	10.9	11.1	11.2	12.1	12.8	13.4		
		2																		
		3																		
'75A	4		BOLS	ALSE	GOOD	KAMC	NUSH	COOK	TAKU	YUKO	COPP	KUSK	TOGI	KANE	NASS	STIK	SKEE	FRAS	BELL	
		1	6.8	7.8	9.0	9.4	9.8	9.9	9.9	10.3	10.4	10.4	10.7	11.0	11.2	11.5	11.9	12.8	12.8	
		2																		
		3																		
'76B	5		ALSE	BOLS	KAMC	COOK	TAKU	COPP	KUSK	YUKO	KANE	STIK	NUSH	NASS	TOGI	BELL	FRAS	SKEE		
		1	8.6	8.8	9.1	9.2	10.0	10.1	10.2	10.4	10.5	10.6	11.0	11.8	11.9	12.1	14.0	14.4		
		2																		
		3																		

Table 3 - cont'd.

Brood Year	IDF Rank	Subset No.	Stock and sample mean																
<u>Character No. 16: No. circuli Zone 2 + no. circuli Zone 3</u>																			
'70	10		BOLS	KANE	KUSK	KAMC	TAKU	TOGI	NUSH	COOK	STIK	YUKO	ALSE	FRAS	COPP	SKEE	BELL		
		1	25.8	26.5	26.5	26.9	27.5	28.1	28.7	28.7	29.6	29.9	31.4	31.5	31.7	32.8	33.2		
'71A	3		BOLS	KAMC	COOK	YUKO	ALSE	TAKU	KUSK	STIK	COPP	NASS	KANE	GOOD	NUSH	TOGI	SKEE	BELL	FRAS
		1	27.6	28.8	29.1	29.3	29.5	29.8	30.1	30.2	30.3	31.3	31.5	31.5	31.6	31.6	31.6	32.9	33.6
'74B	4		BOLS	KAMC	TAKU	KUSK	YUKO	COOK	STIK	NASS	ALSE	NUSH	FRAS	TOGI	BELL	SKEE	COPP		
		1	24.9	26.8	29.2	29.3	30.5	31.1	31.2	31.7	32.2	33.2	33.3	34.0	34.8	36.0	36.8		
		2																	
		3																	
		4																	
'76A	2		BOLS	KAMC	STIK	YUKO	COOK	TAKU	KUSK	SKEE	NUSH	ALSE	TOGI	COPP	NASS	BELL	KANE	FRAS	
		1	25.0	26.9	30.9	31.8	32.6	32.9	32.9	34.2	34.4	34.7	34.8	34.9	35.1	35.5	35.8	36.1	
		2																	
'77	6		BOLS	KAMC	COOK	YUKO	TAKU	KANE	STIK	GOOD	KUSK	SKEE	TOGI	COPP	NASS	ALSE	FRAS	NUSH	BELL
		1	25.1	26.9	30.3	31.7	32.0	32.5	32.5	33.5	33.6	34.7	34.8	34.9	35.5	36.0	36.6	37.0	37.6
		2																	
<u>Character No. 21: (Size Zone 2 + size Zone 3)/(No. circuli Zone 2 + no. circuli zone 3)</u>																			
'70	4		FRAS	BELL	SKEE	COPP	KAMC	STIK	ALSE	COOK	BOLS	NUSH	TAKU	KUSK	YUKO	KANE	TOGI		
		1	145.3	145.4	147.7	152.2	154.6	156.1	157.0	160.5	162.3	164.6	168.3	170.4	174.1	175.1	184.0		
		2																	
'71B	3		BELL	BOLS	FRAS	SKEE	STIK	NASS	COPP	ALSE	COOK	KAMC	GOOD	TAKU	NUSH	KUSK	YUKO	KANE	TOGI
		1	142.3	150.4	151.6	152.6	156.3	158.0	158.8	158.9	158.9	162.9	171.9	175.3	175.8	177.1	177.5	181.0	182.4
		2																	

Table 3 - cont'd.

Brood Year	LD <sup>1</sup>	Subset Rank <sup>2</sup>	Subset No.	Stock and sample mean																
Character No. 21: (Size Zone 2 + size Zone 3)/(No. circuli Zone 2 + no. circuli zone 3) - cont'd.																				
'72A	4			BOLS	FRAS	BELL	SKEE	NASS	COOK	COPP	KAMC	STIK	ALSE	NUSH	KUSK	TAKU	TOGI	GOOD	KANE	YUKO
		1		149.5	151.4	151.6	154.4	157.9	159.0	160.6	161.9	164.4	165.3	166.5	169.5	170.0	170.9	172.4	174.2	178.4
		2																		
		3																		
'72B	4			BOLS	BELL	FRAS	SKEE	COOK	NASS	COPP	KAMC	ALSE	NUSH	KUSK	TAKU	KANE	TOGI	GOOD	YUKO	
		1		149.5	152.2	152.3	154.4	157.4	157.9	160.6	161.9	162.4	163.4	165.3	167.9	169.7	172.0	176.1	178.1	
		2																		
'73A	3			NASS	FRAS	BELL	SKEE	COOK	ALSE	STIK	KAMC	COPP	BOLS	NUSH	TOGI	YUKO	KANE	KUSK		
		1		150.2	151.1	152.2	155.5	158.2	158.4	161.9	163.2	164.6	165.9	176.3	178.4	182.9	184.0	184.6		
		2																		
'73B	4			FRAS	NASS	BELL	SKEE	ALSE	COOK	BOLS	KAMC	COPP	STIK	TAKU	NUSH	KUSK	YUKO	TOGI		
		1		149.8	150.2	152.0	154.1	154.9	155.9	158.5	163.2	164.6	164.8	170.8	177.1	184.1	185.2	185.2		
		2																		
'74A	3			BELL	NASS	SKEE	FRAS	TAKU	STIK	ALSE	COOK	COPP	BOLS	KAMC	NUSH	TOGI	KUSK	YUKO		
		1		140.0	146.8	150.7	151.7	153.7	154.6	156.4	157.6	158.7	159.8	165.1	173.9	174.6	181.2	182.5		
		2																		
		3																		
'76B	2			FRAS	NASS	BELL	BOLS	SKEE	STIK	COOK	COPP	ALSE	KAMC	TAKU	NUSH	KUSK	KANE	TOGI	YUKO	
		1		144.0	145.3	145.8	151.9	152.7	153.6	157.8	158.7	159.5	161.8	173.2	173.5	173.9	176.1	178.2	180.1	
		2																		
		3																		
		4																		
'77	12			BELL	ALSE	FRAS	NASS	STIK	SKEE	COPP	COOK	KAMC	KUSK	BOLS	NUSH	TAKU	YUKO	TOGI	KANE	GOOD
		1		140.0	146.3	147.1	147.2	152.1	154.3	156.6	160.3	164.5	167.8	168.0	169.9	170.2	176.9	177.4	185.3	187.7
		2																		
Character No. 26: Distance C13 to C15 In Zones 2 + 3/(Size Zone 1 + size Zone 2 + size Zone 3)																				
'72B	2			NUSH	TOGI	SKEE	FRAS	NASS	BELL	KUSK	GOOD	COPP	TAKU	YUKO	ALSE	KANE	COOK	KAMC	BOLS	
		1		.0748	.0752	.0780	.0793	.0799	.0808	.0823	.0837	.0848	.0862	.0883	.0883	.0937	.0975	.1015	.1070	
		2																		
		3																		

Table 3 - cont'd.

Brood	LDF Subset	Stock and sample mean																	
Year <sup>1</sup>	Rank <sup>2</sup>	No.																	
Character No. 26: Distance C13 to C15 in Zones 2 + 3/(Size Zone 1 + size Zone 2 + size Zone 3) - cont'd.																			
'75A	7		KANE	NASS	GOOD	SKEE	BELL	NUSH	TOGI	KUSK	FRAS	YUKO	STIK	COPP	TAKU	COOK	ALSE	KAMC	BOLS
		1	.0637	.0660	.0663	.0700	.0717	.0735	.0773	.0775	.0783	.0786	.0797	.0829	.0830	.0845	.0946	.1072	.1171
		2																	
'77	16		NUSH	NASS	BELL	SKEE	TOGI	TAKU	KUSK	FRAS	COPP	ALSE	STIK	YUKO	KANE	COOK	GOOD	KAMC	BOLS
		1	.0669	.0731	.0738	.0744	.0769	.0774	.0778	.0779	.0788	.0789	.0828	.0834	.0845	.0893	.0937	.1061	.1102
		2																	
Character No. 49: Distance C1 to C3 in Zones 2 + 3																			
'70	9		KAMC	NUSH	TOGI	BELL	SKEE	COOK	KUSK	ALSE	YUKO	FRAS	TAKU	BOLS	KANE	STIK	COPP		
		1	296	315	328	331	339	340	345	346	355	356	357	361	361	369	370		
		2																	
		3																	
'72B	3		KANE	NUSH	KAMC	KUSK	TOGI	BOLS	GOOD	YUKO	COOK	FRAS	BELL	COPP	NASS	ALSE	SKEE	TAKU	
		1	268	310	312	324	331	340	344	347	357	364	379	384	386	398	398	406	
		2																	
'76B	13		KAMC	KUSK	COOK	NUSH	BELL	YUKO	FRAS	TAKU	BOLS	STIK	NASS	KANE	ALSE	TOGI	COPP	SKEE	
		1	312	312	319	341	342	347	351	352	353	354	359	361	368	378	380	390	
		2																	
Character No. 27: Distance C16 to C18 in Zones 2 + 3/(Size Zone 1 + size Zone 2 + size Zone 3)																			
'70	1		BELL	SKEE	FRAS	ALSE	STIK	COPP	YUKO	TAKU	NUSH	TOGI	COOK	BOLS	KANE	KUSK	KAMC		
		1	.0759	.0814	.0818	.0857	.0860	.0921	.0935	.0990	.1028	.1029	.1032	.1081	.1084	.1112	.1142		
		2																	
		3																	
'74B	2		SKEE	BELL	COPP	NUSH	FRAS	NASS	TOGI	ALSE	STIK	TAKU	COOK	YUKO	KUSK	BOLS	KAMC		
		1	.0741	.0751	.0764	.0779	.0793	.0799	.0853	.0854	.0879	.0940	.0951	.0953	.1002	.1076	.1143		
		2																	
		3																	
		4																	
		5																	

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																
<b>Character No. 27: Distance C16 to C18 in Zones 2 + 3/(Size Zone 1 + size Zone 2 + size Zone 3) - cont'd.</b>																			
'76A	10		FRAS	SKEE	NASS	BELL	TAKU	ALSE	COPP	STIK	TOG1	NUSH	KANE	KUSK	COOK	YUKO	BOLS	KAMC	
		1	.0734	.0740	.0746	.0767	.0787	.0808	.0816	.0830	.0833	.0834	.0851	.0897	.0912	.0916	.1103	.1129	
		2																	
		3																	
		4																	
'77	1		ALSE	NASS	FRAS	BELL	NUSH	SKEE	COPP	TOG1	KUSK	TAKU	STIK	GOOD	COOK	YUKO	BOLS	KAMC	
		1	.0693	.0701	.0718	.0749	.0764	.0768	.0791	.0794	.0840	.0843	.0857	.0880	.0893	.0907	.1050	.1161	
		2																	
		3																	
<b>Character No. 34: Distance C1 to C9 in Zones 2 + 3</b>																			
'70	3		KAMC	NUSH	COPP	SKEE	COOK	BELL	YUKO	KUSK	ALSE	FRAS	STIK	TOG1	TAKU	BOLS	KANE		
		1	1008	1072	1147	1154	1155	1173	1173	1187	1189	1221	1237	1239	1318	1332	1334		
		2																	
'71A	2		KAMC	GOOD	KANE	TOG1	BELL	KUSK	NUSH	COOK	ALSE	SKEE	COPP	YUKO	BOLS	FRAS	STIK	NASS	TAKU
		1	1035	1045	1068	1104	1110	1127	1138	1163	1186	1198	1208	1208	1219	1262	1277	1282	1292
		2																	
'71B	2		KAMC	GOOD	BELL	KANE	COOK	KUSK	NUSH	SKEE	TOG1	BOLS	YUKO	COPP	ALSE	STIK	NASS	FRAS	TAKU
		1	1035	1045	1108	1112	1138	1150	1160	1180	1186	1194	1199	1207	1235	1240	1282	1295	1398
		2																	
'72A	3		KAMC	NUSH	TOG1	KUSK	COOK	KANE	BELL	BOLS	YUKO	STIK	GOOD	SKEE	COPP	FRAS	NASS	TAKU	ALSE
		1	1044	1065	1100	1114	1158	1166	1195	1207	1235	1268	1288	1291	1292	1304	1343	1351	1356
		2																	
		3																	
'72B	5		KAMC	KANE	NUSH	TOG1	KUSK	COOK	BELL	BOLS	YUKO	ALSE	GOOD	SKEE	COPP	FRAS	NASS	TAKU	
		1	1044	1047	1054	1115	1142	1173	1188	1207	1260	1270	1286	1288	1292	1306	1343	1427	
		2																	
'73A	1		KAMC	BELL	COOK	KUSK	TOG1	NUSH	YUKO	BOLS	STIK	NASS	COPP	KANE	SKEE	FRAS	ALSE		
		1	1043	1170	1179	1203	1213	1220	1242	1269	1286	1286	1289	1294	1294	1333	1372		
		2																	

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																
<b>Character No. 34: Distance C1 to C9 in Zones 2 + 3 cont'd.</b>																			
'73B	3		KAMC	COOK	BELL	KUSK	ALSE	BOLS	NUSH	TOGI	YUKO	NASS	SKEE	COPP	FRAS	STIK	TAKU		
		1	1043	1122	1154	1192	1195	1215	1228	1262	1275	1286	1288	1289	1319	1365	1538		
		2																	
'74A	5		KAMC	COOK	BELL	ALSE	NUSH	SKEE	STIK	KUSK	TAKU	COPP	YUKO	TOGI	NASS	BOLS	FRAS		
		1	1063	1079	1079	1100	1148	1156	1184	1186	1195	1202	1240	1250	1265	1287	1329		
		2																	
		3																	
'74B	3		TOGI	KAMC	NUSH	STIK	COOK	BELL	SKEE	YUKO	KUSK	COPP	ALSE	TAKU	BOLS	NASS	FRAS		
		1	996	1063	1115	1131	1132	1137	1162	1182	1196	1202	1208	1238	1265	1272	1280		
'75A	3		GOOD	KAMC	KANE	KUSK	COOK	ALSE	NUSH	COPP	FRAS	BOLS	BELL	YUKO	SKEE	TOGI	NASS	TAKU	STIK
		1	924	994	1127	1137	1140	1147	1164	1166	1170	1181	1200	1217	1232	1238	1248	1276	1316
'75B	3		GOOD	KAMC	KUSK	COOK	COPP	NUSH	ALSE	KANE	YUKO	BOLS	FRAS	TOGI	SKEE	NASS	STIK	BELL	TAKU
		1	924	994	1123	1129	1166	1183	1199	1213	1214	1231	1246	1265	1270	1331	1350	1356	1393
		2																	
'76A	3		KANE	KAMC	KUSK	COOK	NUSH	BELL	BOLS	COPP	TOGI	YUKO	STIK	NASS	SKEE	FRAS	ALSE	TAKU	
		1	1049	1061	1085	1108	1172	1176	1210	1214	1215	1215	1236	1258	1263	1275	1316	1391	
		2																	
'76B	3		KAMC	COOK	KUSK	BELL	NUSH	KANE	TOGI	YUKO	STIK	NASS	COPP	BOLS	ALSE	FRAS	SKEE	TAKU	
		1	1064	1066	1101	1142	1158	1192	1197	1198	1211	1217	1232	1232	1254	1256	1260	1389	
		2																	
		3																	
		4																	
'77	1		BELL	KAMC	ALSE	KUSK	COOK	STIK	NUSH	YUKO	TOGI	KANE	COPP	GOOD	FRAS	NASS	SKEE	BOLS	TAKU
		1	1044	1054	1074	1094	1153	1158	1163	1176	1192	1203	1205	1222	1268	1317	1344	1388	1540
		2																	
<b>Character No. 36: Distance C19 to C27 in Zones 2 + 3</b>																			
'73A	6		BOLS	COOK	FRAS	SKEE	NASS	STIK	COPP	KAMC	BELL	ALSE	KUSK	YUKO	TOGI	NUSH	KANE		
		1	1014	1158	1226	1270	1361	1366	1462	1464	1471	1491	1711	1756	1759	1894	1994		
		2																	

Table 3 - cont'd.

Brood Year	LDF Rank	Subset No.	Stock and sample mean																
Character No. 36: Distance C19 to C27 in Zones 2 + 3 - cont'd.																			
'74A	2		BOLS	TAKU	FRAS	STIK	NASS	KAMC	BELL	TOGI	SKEE	COOK	ALSE	COPP	KUSK	YUKO	NUSH		
		1	536	1270	1299	1334	1348	1360	1384	1393	1446	1489	1536	1539	1809	1855	1898		
		2																	
		3																	
		4																	
'74B	5		BOLS	NASS	FRAS	STIK	TAKU	KAMC	BELL	ALSE	SKEE	COOK	COPP	KUSK	TOGI	YUKO	NUSH		
		1	783	1174	1288	1330	1358	1360	1361	1393	1456	1511	1539	1734	1816	1856	1980		
		2																	
		3																	
		4																	
'77	13		BOLS	TAKU	FRAS	NASS	BELL	ALSE	SKEE	KAMC	COPP	STIK	COOK	NUSH	KUSK	TOGI	YUKO	KANE	GOOD
		1	988	1146	1290	1297	1344	1346	1360	1392	1413	1422	1461	1744	1755	1820	1874	1933	2001
		2																	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as 'A' were used to classify age 1.2 chinook and models designated as 'B' were used to classify age 1.3 chinook of the same brood year.

<sup>2</sup>LDF rank indicates the step at which the variable was entered into the discriminant analysis.

Table 4. Predicted regional category (number and percent) of Asian chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984).

Asian Stock	LDF Model <sup>1</sup>	Predicted regional category - number (%)				Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia	
Bolshaya	'70	19 (76.0)	0 (0.0)	3 (12.0)	3 (12.0)	25 (100.0)
Kamchatka	'70	68 (85.0)	9 (11.3)	1 (1.3)	2 (2.5)	80 (100.0)
Total	'70	87 (82.9)	9 (8.6)	4 (3.8)	5 (4.8)	105 (100.0)
Bolshaya	'71A	6 (46.2)	0 (0.0)	6 (46.2)	1 (7.7)	13 (100.0)
Kamchatka	'71A	108 (73.0)	26 (17.6)	12 (8.1)	2 (1.4)	148 (100.0)
Total	'71A	114 (70.8)	26 (16.1)	18 (11.2)	3 (1.9)	161 (100.0)
Bolshaya	'71B	8 (40.0)	0 (0.0)	11 (55.0)	1 (5.0)	20 (100.0)
Kamchatka	'71B	106 (71.6)	25 (16.9)	14 (9.5)	3 (2.0)	148 (100.0)
Total	'71B	114 (67.9)	25 (14.9)	25 (14.9)	4 (2.4)	168 (100.0)
Bolshaya	'72A	5 (55.6)	0 (0.0)	3 (33.3)	1 (11.1)	9 (100.0)
Kamchatka	'72A	130 (73.4)	32 (18.1)	13 (7.3)	2 (1.1)	177 (100.0)
Total	'72A	135 (72.6)	32 (17.2)	16 (8.6)	3 (1.6)	186 (100.0)
Bolshaya	'72B	4 (44.4)	0 (0.0)	5 (55.6)	0 (0.0)	9 (100.0)
Kamchatka	'72B	127 (71.8)	36 (20.3)	12 (6.8)	2 (1.1)	177 (100.0)
Total	'72B	131 (70.4)	36 (19.4)	17 (9.1)	2 (1.1)	186 (100.0)
Bolshaya	'73A	5 (45.5)	1 (9.1)	5 (45.5)	0 (0.0)	11 (100.0)
Kamchatka	'73A	68 (63.6)	28 (26.2)	10 (9.3)	1 (0.9)	107 (100.0)
Total	'73A	73 (61.9)	29 (24.6)	15 (12.7)	1 (0.8)	118 (100.0)
Bolshaya	'73B	10 (41.7)	1 (4.2)	13 (54.2)	0 (0.0)	24 (100.0)
Kamchatka	'73B	68 (63.6)	27 (25.2)	11 (10.3)	1 (0.9)	107 (100.0)
Total	'73B	78 (59.5)	28 (21.4)	24 (18.3)	1 (0.8)	131 (100.0)
Bolshaya	'74A	11 (78.6)	0 (0.0)	3 (21.4)	0 (0.0)	14 (100.0)
Kamchatka	'74A	94 (73.4)	24 (18.8)	10 (7.8)	0 (0.0)	128 (100.0)
Total	'74A	105 (73.9)	24 (16.9)	13 (9.2)	0 (0.0)	142 (100.0)
Bolshaya	'74B	10 (47.6)	0 (0.0)	1 (4.8)	10 (47.6)	21 (100.0)
Kamchatka	'74B	99 (77.3)	24 (18.8)	5 (3.9)	0 (0.0)	128 (100.0)
Total	'74B	109 (73.2)	24 (16.1)	6 (4.0)	10 (6.7)	149 (100.0)
Bolshaya	'75A	8 (72.7)	0 (0.0)	3 (27.3)	0 (0.0)	11 (100.0)
Kamchatka	'75A	54 (73.0)	6 (8.1)	14 (18.9)	0 (0.0)	74 (100.0)
Total	'75A	62 (72.9)	6 (7.1)	17 (20.0)	0 (0.0)	85 (100.0)
Bolshaya	'75B	20 (83.3)	0 (0.0)	4 (16.7)	0 (0.0)	24 (100.0)
Kamchatka	'75B	51 (68.9)	6 (8.1)	16 (21.6)	1 (1.4)	74 (100.0)
Total	'75B	71 (72.4)	6 (6.1)	20 (20.4)	1 (1.0)	98 (100.0)

Table 4. Predicted regional category (number and percent) of Asian chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Asian Stock	LDF Model <sup>1</sup>	Predicted regional category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Boshaya	'76A	21 (87.5)	0 (0.0)	3 (12.5)	0 (0.0)	24 (100.0)	
Kamchatka	'76A	145 (82.9)	10 (5.7)	20 (11.4)	0 (0.0)	175 (100.0)	
Total	'76A	166 (83.4)	10 (5.0)	23 (11.6)	0 (0.0)	199 (100.0)	
Bolshaya	'76B	38 (76.0)	0 (0.0)	5 (10.0)	7 (14.0)	50 (100.0)	
Kamchatka	'76B	128 (85.9)	7 (4.7)	9 (6.0)	5 (3.4)	149 (100.0)	
Total	'76B	166 (83.4)	7 (3.5)	14 (7.0)	12 (6.0)	199 (100.0)	
Bolshaya	'77	12 (75.0)	0 (0.0)	3 (18.8)	1 (6.3)	16 (100.0)	
Kamchatka	'77	163 (88.6)	15 (8.2)	6 (3.3)	0 (0.0)	184 (100.0)	
Total	'77	175 (87.5)	15 (7.5)	9 (4.5)	1 (0.5)	200 (100.0)	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as 'A' were used to classify age 1.2 chinook and models designated as 'B' were used to classify age 1.3 chinook of the same brood year.

Table 5. Predicted regional category (number and percent) of western Alaska chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984).

Western Alaskan Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Yukon	'70	5 (8.6)	42 (72.4)	7 (12.1)	4 (6.9)	58 (100.0)	
Kuskokwim	'70	10 (16.7)	43 (71.7)	5 (8.3)	2 (3.3)	60 (100.0)	
Kanektok	'70	0 (0.0)	2 (50.0)	0 (0.0)	2 (50.0)	4 (100.0)	
Nushagak	'70	11 (15.7)	52 (74.3)	7 (10.0)	0 (0.0)	70 (100.0)	
Togiak	'70	0 (0.0)	8 (100.0)	0 (0.0)	0 (0.0)	8 (100.0)	
Total	'70	26 (13.0)	147 (73.5)	19 (9.5)	8 (4.0)	200 (100.0)	
Yukon	'71A	11 (14.1)	60 (76.9)	7 (9.0)	0 (0.0)	78 (100.0)	
Kuskokwim	'71A	6 (14.3)	31 (73.8)	5 (11.9)	0 (0.0)	42 (100.0)	
Kanektok	'71A	0 (0.0)	6 (100.0)	0 (0.0)	0 (0.0)	6 (100.0)	
Goodnews	'71A	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'71A	7 (11.3)	52 (83.9)	3 (4.8)	0 (0.0)	62 (100.0)	
Togiak	'71A	2 (20.0)	8 (80.0)	0 (0.0)	0 (0.0)	10 (100.0)	
Total	'71A	26 (13.0)	159 (79.5)	15 (7.5)	0 (0.0)	200 (100.0)	
Yukon	'71B	7 (8.5)	62 (75.6)	13 (15.9)	0 (0.0)	82 (100.0)	
Kuskokwim	'71B	9 (21.4)	27 (64.3)	5 (11.9)	1 (2.4)	42 (100.0)	
Kanektok	'71B	0 (0.0)	8 (100.0)	0 (0.0)	0 (0.0)	8 (100.0)	
Goodnews	'71B	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'71B	4 (7.1)	49 (87.5)	2 (3.6)	1 (1.8)	56 (100.0)	
Togiak	'71B	2 (20.0)	8 (80.0)	0 (0.0)	0 (0.0)	10 (100.0)	
Total	'71B	22 (11.0)	156 (78.0)	20 (10.0)	2 (1.0)	200 (100.0)	
Yukon	'72A	9 (14.1)	44 (68.8)	9 (14.1)	2 (3.1)	64 (100.0)	
Kuskokwim	'72A	4 (8.7)	38 (82.6)	1 (2.2)	3 (6.5)	46 (100.0)	
Kanektok	'72A	2 (20.0)	8 (80.0)	0 (0.0)	0 (0.0)	10 (100.0)	
Goodnews	'72A	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'72A	2 (4.3)	37 (80.4)	4 (8.7)	3 (6.5)	46 (100.0)	
Togiak	'72A	3 (9.4)	28 (87.5)	1 (3.1)	0 (0.0)	32 (100.0)	
Total	'72A	20 (10.0)	157 (78.5)	15 (7.5)	8 (4.0)	200 (100.0)	
Yukon	'72B	7 (9.7)	56 (77.8)	9 (12.5)	0 (0.0)	72 (100.0)	
Kuskokwim	'72B	2 (4.8)	31 (73.8)	3 (7.1)	6 (14.3)	42 (100.0)	
Kanektok	'72B	2 (25.0)	6 (75.0)	0 (0.0)	0 (0.0)	8 (100.0)	
Goodnews	'72B	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'72B	4 (9.1)	33 (75.0)	4 (9.1)	3 (6.8)	44 (100.0)	
Togiak	'72B	0 (0.0)	28 (87.5)	3 (9.4)	1 (3.1)	32 (100.0)	
Total	'72B	15 (7.5)	156 (78.0)	19 (9.5)	10 (5.0)	200 (100.0)	

Table 5. Predicted regional category (number and percent) of western Alaska chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Western Alaskan Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Yukon	'73A	8 (14.3)	43 (76.8)	5 (8.9)	0 (0.0)	56 (100.0)	
Kuskokwim	'73A	6 (21.4)	17 (60.7)	4 (14.3)	1 (3.6)	28 (100.0)	
Kanektok	'73A	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'73A	4 (4.0)	94 (94.0)	1 (1.0)	1 (1.0)	100 (100.0)	
Togiak	'73A	2 (16.7)	7 (58.3)	2 (16.7)	1 (8.3)	12 (100.0)	
Total	'73A	20 (10.1)	163 (82.3)	12 (6.1)	3 (1.5)	198 (100.0)	
Yukon	'73B	11 (16.2)	53 (77.9)	4 (5.9)	0 (0.0)	68 (100.0)	
Kuskokwim	'73B	7 (23.3)	21 (70.0)	2 (6.7)	0 (0.0)	30 (100.0)	
Nushagak	'73B	4 (4.6)	79 (90.8)	3 (3.4)	1 (1.1)	87 (100.0)	
Togiak	'73B	3 (23.1)	10 (76.9)	0 (0.0)	0 (0.0)	13 (100.0)	
Total	'73B	25 (12.6)	163 (82.3)	9 (4.5)	1 (0.5)	198 (100.0)	
Yukon	'74A	7 (5.6)	106 (84.1)	12 (9.5)	1 (0.8)	126 (100.0)	
Kuskokwim	'74A	4 (12.5)	26 (81.3)	2 (6.3)	0 (0.0)	32 (100.0)	
Nushagak	'74A	1 (2.6)	32 (84.2)	5 (13.2)	0 (0.0)	38 (100.0)	
Togiak	'74A	1 (25.0)	1 (25.0)	2 (50.0)	0 (0.0)	4 (100.0)	
Total	'74A	13 (6.5)	165 (82.5)	21 (10.5)	1 (0.5)	200 (100.0)	
Yukon	'74B	6 (4.7)	107 (84.3)	9 (7.1)	5 (3.9)	127 (100.0)	
Kuskokwim	'74B	10 (33.3)	20 (66.7)	0 (0.0)	0 (0.0)	30 (100.0)	
Nushagak	'74B	1 (2.7)	29 (78.4)	7 (18.9)	0 (0.0)	37 (100.0)	
Togiak	'74B	0 (0.0)	3 (75.0)	1 (25.0)	0 (0.0)	4 (100.0)	
Total	'74B	17 (8.6)	159 (80.3)	17 (8.6)	5 (2.5)	198 (100.0)	
Yukon	'75A	1 (1.1)	78 (84.8)	11 (12.0)	2 (2.2)	92 (100.0)	
Kuskokwim	'75A	2 (4.7)	35 (81.4)	6 (14.0)	0 (0.0)	43 (100.0)	
Kanektok	'75A	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Goodnews	'75A	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'75A	2 (3.7)	46 (85.2)	5 (9.3)	1 (1.9)	54 (100.0)	
Togiak	'75A	0 (0.0)	5 (83.3)	0 (0.0)	1 (16.7)	6 (100.0)	
Total	'75A	5 (2.5)	168 (84.4)	22 (11.1)	4 (2.0)	199 (100.0)	
Yukon	'75B	1 (1.0)	84 (85.7)	9 (9.2)	4 (4.1)	98 (100.0)	
Kuskokwim	'75B	1 (2.4)	33 (78.6)	6 (14.3)	2 (4.8)	42 (100.0)	
Kanektok	'75B	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Goodnews	'75B	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'75B	1 (2.0)	43 (87.8)	2 (4.1)	3 (6.1)	49 (100.0)	
Togiak	'75B	0 (0.0)	6 (100.0)	0 (0.0)	0 (0.0)	6 (100.0)	
Total	'75B	3 (1.5)	170 (85.4)	17 (8.5)	9 (4.5)	199 (100.0)	

Table 5. Predicted regional category (number and percent) of western Alaska chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Western Alaskan Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Yukon	'76A	3 (5.4)	42 (75.0)	9 (16.1)	2 (3.6)	56 (100.0)	
Kuskokwim	'76A	2 (3.7)	41 (75.9)	11 (20.4)	0 (0.0)	54 (100.0)	
Kanektok	'76A	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4 (100.0)	
Nushagak	'76A	0 (0.0)	69 (89.6)	6 (7.8)	2 (2.6)	77 (100.0)	
Togiak	'76A	0 (0.0)	6 (75.0)	2 (25.0)	0 (0.0)	8 (100.0)	
Total	'76A	6 (3.0)	161 (80.9)	28 (14.1)	4 (2.0)	199 (100.0)	
Yukon	'76B	2 (3.6)	42 (75.0)	10 (17.9)	2 (3.6)	56 (100.0)	
Kuskokwim	'76B	0 (0.0)	43 (76.8)	9 (16.1)	4 (7.1)	56 (100.0)	
Kanektok	'76B	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4 (100.0)	
Nushagak	'76B	0 (0.0)	61 (80.3)	8 (10.5)	7 (9.2)	76 (100.0)	
Togiak	'76B	0 (0.0)	6 (75.0)	1 (12.5)	1 (12.5)	8 (100.0)	
Total	'76B	3 (1.5)	155 (77.5)	28 (14.0)	14 (7.0)	200 (100.0)	
Yukon	'77	6 (11.5)	27 (51.9)	19 (36.5)	0 (0.0)	52 (100.0)	
Kuskokwim	'77	2 (8.0)	17 (68.0)	6 (24.0)	0 (0.0)	25 (100.0)	
Kanektok	'77	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4 (100.0)	
Goodnews	'77	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)	
Nushagak	'77	1 (1.0)	86 (86.0)	7 (7.0)	6 (6.0)	100 (100.0)	
Togiak	'77	0 (0.0)	13 (81.3)	1 (6.3)	2 (12.5)	16 (100.0)	
Total	'77	10 (5.0)	148 (74.4)	33 (16.6)	8 (4.0)	199 (100.0)	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as 'A' were used to classify age 1.2 chinook and models designated as 'B' were used to classify age 1.3 chinook of the same brood year.

Table 6. Predicted regional category (number and percent) of central Alaska chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984).

Central Alaskan Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Cook Inlet	'70	2 (6.5)	8 (25.8)	18 (58.1)	3 (9.7)	31 (100.0)	
Copper River	'70	1 (1.4)	5 (6.8)	53 (72.6)	14 (19.2)	73 (100.0)	
Total	'70	3 (2.9)	13 (12.5)	71 (68.3)	17 (16.3)	104 (100.0)	
Cook Inlet	'71A	8 (12.9)	11 (17.7)	39 (62.9)	4 (6.5)	62 (100.0)	
Copper River	'71A	8 (13.3)	4 (6.7)	36 (60.0)	12 (20.0)	60 (100.0)	
Total	'71A	16 (13.1)	15 (12.3)	75 (61.5)	16 (13.1)	122 (100.0)	
Cook Inlet	'71B	11 (15.1)	11 (15.1)	44 (60.3)	7 (9.6)	73 (100.0)	
Copper River	'71B	8 (13.6)	4 (6.8)	33 (55.9)	14 (23.7)	59 (100.0)	
Total	'71B	19 (14.4)	15 (11.4)	77 (58.3)	21 (15.9)	132 (100.0)	
Cook Inlet	'72A	29 (31.5)	13 (14.1)	47 (51.1)	3 (3.3)	92 (100.0)	
Copper River	'72A	2 (2.2)	5 (5.4)	61 (65.6)	25 (26.9)	93 (100.0)	
Total	'72A	31 (16.8)	18 (9.7)	108 (58.4)	28 (15.1)	185 (100.0)	
Cook Inlet	'72B	30 (29.7)	14 (13.9)	51 (50.5)	6 (5.9)	101 (100.0)	
Copper River	'72B	2 (2.2)	4 (4.3)	51 (54.3)	36 (38.7)	93 (100.0)	
Total	'72B	32 (16.5)	18 (9.3)	102 (52.6)	42 (21.6)	194 (100.0)	
Cook Inlet	'73A	20 (26.0)	7 (9.1)	45 (58.4)	5 (6.5)	77 (100.0)	
Copper River	'73A	1 (1.8)	4 (7.0)	43 (75.4)	9 (15.8)	57 (100.0)	
Total	'73A	21 (15.7)	11 (8.2)	88 (65.7)	14 (10.4)	134 (100.0)	
Cook Inlet	'73B	36 (37.5)	6 (6.3)	52 (54.2)	2 (2.1)	96 (100.0)	
Copper River	'73B	1 (1.8)	3 (5.3)	35 (61.4)	18 (31.6)	57 (100.0)	
Total	'73B	37 (24.2)	9 (5.9)	87 (56.9)	20 (13.1)	153 (100.0)	
Cook Inlet	'74A	8 (19.5)	6 (14.6)	24 (58.5)	3 (7.3)	41 (100.0)	
Copper River	'74A	0 (0.0)	1 (4.2)	20 (83.3)	3 (12.5)	24 (100.0)	
Total	'74A	8 (12.3)	7 (10.8)	44 (67.7)	6 (9.2)	65 (100.0)	
Cook Inlet	'74B	6 (11.8)	6 (11.8)	25 (49.0)	14 (27.5)	51 (100.0)	
Copper River	'74B	0 (0.0)	1 (4.2)	19 (79.2)	4 (16.7)	24 (100.0)	
Total	'74B	6 (8.0)	7 (9.3)	44 (58.7)	18 (24.0)	75 (100.0)	
Cook Inlet	'75A	9 (15.3)	8 (13.6)	41 (69.5)	1 (1.7)	59 (100.0)	
Copper River	'75A	0 (0.0)	0 (0.0)	21 (72.4)	8 (27.6)	29 (100.0)	
Total	'75A	9 (10.2)	8 (9.1)	62 (70.5)	9 (10.2)	88 (100.0)	

Table 6. Predicted regional category (number and percent) of central Alaska chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Central Alaskan Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Cook Inlet	'75B	6 (17.1)	9 (25.7)	19 (54.3)	1 (2.9)	35 (100.0)	
Copper River	'75B	0 (0.0)	0 (0.0)	19 (65.5)	10 (34.5)	29 (100.0)	
Total	'75B	6 (9.4)	9 (14.1)	38 (59.4)	11 (17.2)	64 (100.0)	
Cook Inlet	'76A	18 (15.8)	27 (23.7)	59 (51.8)	10 (8.8)	114 (100.0)	
Copper River	'76A	1 (1.2)	6 (7.0)	56 (65.1)	23 (26.7)	86 (100.0)	
Total	'76A	19 (9.5)	33 (16.5)	115 (57.5)	33 (16.5)	200 (100.0)	
Cook Inlet	'76B	11 (9.5)	24 (20.7)	74 (63.8)	7 (6.0)	116 (100.0)	
Copper River	'76B	1 (1.2)	3 (3.6)	58 (69.0)	22 (26.2)	84 (100.0)	
Total	'76B	12 (6.0)	27 (13.5)	132 (66.0)	29 (14.5)	200 (100.0)	
Cook Inlet	'77	10 (11.2)	19 (21.3)	58 (65.2)	2 (2.2)	89 (100.0)	
Copper River	'77	0 (0.0)	2 (1.8)	92 (83.6)	16 (14.5)	110 (100.0)	
Total	'77	10 (5.0)	21 (10.6)	150 (75.4)	18 (9.0)	199 (100.0)	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as 'A' were used to classify age 1.2 chinook and models designated as 'B' were used to classify age 1.3 chinook of the same brood year.

Table 7. Predicted regional category (number and percent) of Southeast Alaskan/British Columbian chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984).

Southeast Alaska/ British Columbian Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Taku	'70	3 (16.7)	6 (33.3)	4 (22.2)	5 (27.8)	18 (100.0)	
Alsek	'70	1 (12.5)	1 (12.5)	4 (50.0)	2 (25.0)	8 (100.0)	
Stikine	'70	4 (22.2)	1 (5.6)	3 (16.7)	10 (55.6)	18 (100.0)	
Fraser	'70	1 (5.9)	0 (0.0)	1 (5.9)	15 (88.2)	17 (100.0)	
Skeena	'70	1 (1.6)	2 (3.2)	9 (14.3)	51 (81.0)	63 (100.0)	
Bella Coola	'70	0 (0.0)	0 (0.0)	1 (25.0)	3 (75.0)	4 (100.0)	
Total	'70	10 (7.8)	10 (7.8)	22 (17.2)	86 (67.2)	128 (100.0)	
Taku	'71A	0 (0.0)	0 (0.0)	10 (83.3)	2 (16.7)	12 (100.0)	
Alsek	'71A	1 (16.7)	0 (0.0)	5 (83.3)	0 (0.0)	6 (100.0)	
Stikine	'71A	1 (12.5)	1 (12.5)	3 (37.5)	3 (37.5)	8 (100.0)	
Fraser	'71A	1 (1.0)	0 (0.0)	4 (4.1)	92 (94.8)	97 (100.0)	
Nass	'71A	1 (16.7)	0 (0.0)	2 (33.3)	3 (50.0)	6 (100.0)	
Skeena	'71A	5 (15.6)	0 (0.0)	7 (21.9)	20 (62.5)	32 (100.0)	
Bella Coola	'71A	1 (2.9)	1 (2.9)	6 (17.6)	26 (76.5)	34 (100.0)	
Total	'71A	10 (5.1)	2 (1.0)	37 (19.0)	146 (74.9)	195 (100.0)	
Taku	'71B	0 (0.0)	3 (18.8)	10 (62.5)	3 (18.8)	16 (100.0)	
Alsek	'71B	0 (0.0)	0 (0.0)	7 (70.0)	3 (30.0)	10 (100.0)	
Stikine	'71B	3 (21.4)	1 (7.1)	3 (21.4)	7 (50.0)	14 (100.0)	
Fraser	'71B	1 (3.8)	0 (0.0)	0 (0.0)	25 (96.2)	26 (100.0)	
Nass	'71B	0 (0.0)	0 (0.0)	2 (33.3)	4 (66.7)	6 (100.0)	
Skeena	'71B	2 (3.4)	1 (1.7)	15 (25.9)	40 (69.0)	58 (100.0)	
Bella Coola	'71B	1 (2.9)	1 (2.9)	6 (17.1)	27 (77.1)	35 (100.0)	
Total	'71B	7 (4.2)	6 (3.6)	43 (26.1)	109 (66.1)	165 (100.0)	
Taku	'72A	0 (0.0)	2 (33.3)	3 (50.0)	1 (16.7)	6 (100.0)	
Alsek	'72A	0 (0.0)	1 (12.5)	3 (37.5)	4 (50.0)	8 (100.0)	
Stikine	'72A	0 (0.0)	1 (25.0)	1 (25.0)	2 (50.0)	4 (100.0)	
Fraser	'72A	0 (0.0)	1 (1.3)	8 (10.0)	71 (88.8)	80 (100.0)	
Nass	'72A	0 (0.0)	2 (12.5)	3 (18.8)	11 (68.8)	16 (100.0)	
Skeena	'72A	0 (0.0)	2 (4.2)	4 (8.3)	42 (87.5)	48 (100.0)	
Bella Coola	'72A	0 (0.0)	0 (0.0)	9 (50.0)	9 (50.0)	18 (100.0)	
Total	'72A	0 (0.0)	9 (5.0)	31 (17.2)	140 (77.8)	180 (100.0)	
Taku	'72B	0 (0.0)	0 (0.0)	5 (62.5)	3 (37.5)	8 (100.0)	
Alsek	'72B	1 (8.3)	0 (0.0)	9 (75.0)	2 (16.7)	12 (100.0)	
Fraser	'72B	0 (0.0)	1 (2.4)	2 (4.9)	38 (92.7)	41 (100.0)	
Nass	'72B	0 (0.0)	2 (12.5)	3 (18.8)	11 (68.8)	16 (100.0)	
Skeena	'72B	0 (0.0)	0 (0.0)	9 (14.3)	54 (85.7)	63 (100.0)	
Bella Coola	'72B	1 (5.3)	2 (10.5)	5 (26.3)	11 (57.9)	19 (100.0)	
Total	'72B	2 (1.3)	5 (3.1)	33 (20.8)	119 (74.8)	159 (100.0)	

Table 7. Predicted regional category (number and percent) of Southeast Alaskan/British Columbian chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Southeast Alaska/ British Columbian Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Alsek	'73A	2 (16.7)	1 (8.3)	2 (16.7)	7 (58.3)	12 (100.0)	
Stikine	'73A	0 (0.0)	0 (0.0)	1 (50.0)	1 (50.0)	2 (100.0)	
Fraser	'73A	2 (2.4)	0 (0.0)	11 (13.4)	69 (84.1)	82 (100.0)	
Nass	'73A	0 (0.0)	0 (0.0)	2 (6.5)	29 (93.5)	31 (100.0)	
Skeena	'73A	1 (2.7)	1 (2.7)	6 (16.2)	29 (78.4)	37 (100.0)	
Bella Coola	'73A	1 (3.3)	0 (0.0)	4 (13.3)	25 (83.3)	30 (100.0)	
Total	'73A	6 (3.1)	2 (1.0)	26 (13.4)	160 (82.5)	194 (100.0)	
Taku	'73B	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)	
Alsek	'73B	5 (25.0)	2 (10.0)	8 (40.0)	5 (25.0)	20 (100.0)	
Stikine	'73B	0 (0.0)	1 (20.0)	2 (40.0)	2 (40.0)	5 (100.0)	
Fraser	'73B	0 (0.0)	0 (0.0)	5 (10.9)	41 (89.1)	46 (100.0)	
Nass	'73B	0 (0.0)	0 (0.0)	1 (3.2)	30 (96.8)	31 (100.0)	
Skeena	'73B	4 (6.7)	0 (0.0)	5 (8.3)	51 (85.0)	60 (100.0)	
Bella Coola	'73B	0 (0.0)	1 (3.1)	1 (3.1)	30 (93.8)	32 (100.0)	
Total	'73B	9 (4.6)	4 (2.0)	22 (11.2)	161 (82.1)	196 (100.0)	
Taku	'74A	2 (25.0)	1 (12.5)	4 (50.0)	1 (12.5)	8 (100.0)	
Alsek	'74A	1 (10.0)	1 (10.0)	7 (70.0)	1 (10.0)	10 (100.0)	
Stikine	'74A	0 (0.0)	0 (0.0)	13 (81.3)	3 (18.8)	16 (100.0)	
Fraser	'74A	0 (0.0)	0 (0.0)	2 (1.8)	108 (98.2)	110 (100.0)	
Nass	'74A	0 (0.0)	0 (0.0)	1 (5.6)	17 (94.4)	18 (100.0)	
Skeena	'74A	0 (0.0)	1 (3.1)	2 (6.3)	29 (90.6)	32 (100.0)	
Bella Coola	'74A	0 (0.0)	0 (0.0)	1 (16.7)	5 (83.3)	6 (100.0)	
Total	'74A	3 (1.5)	3 (1.5)	30 (15.0)	164 (82.0)	200 (100.0)	
Taku	'74B	2 (7.1)	2 (7.1)	4 (14.3)	20 (71.4)	28 (100.0)	
Alsek	'74B	2 (8.3)	1 (4.2)	8 (33.3)	13 (54.2)	24 (100.0)	
Stikine	'74B	4 (8.0)	2 (4.0)	12 (24.0)	32 (64.0)	50 (100.0)	
Fraser	'74B	0 (0.0)	0 (0.0)	2 (6.3)	30 (93.8)	32 (100.0)	
Nass	'74B	0 (0.0)	0 (0.0)	1 (10.0)	9 (90.0)	10 (100.0)	
Skeena	'74B	0 (0.0)	4 (9.8)	7 (17.1)	30 (73.2)	41 (100.0)	
Bella Coola	'74B	0 (0.0)	0 (0.0)	1 (10.0)	9 (90.0)	10 (100.0)	
Total	'74B	8 (0.0)	9 (4.6)	35 (17.9)	143 (73.3)	195 (100.0)	
Taku	'75A	1 (10.0)	1 (10.0)	4 (40.0)	4 (40.0)	10 (100.0)	
Alsek	'75A	1 (25.0)	0 (0.0)	3 (75.0)	0 (0.0)	4 (100.0)	
Stikine	'75A	0 (0.0)	3 (11.5)	9 (34.6)	14 (53.8)	26 (100.0)	
Fraser	'75A	0 (0.0)	1 (1.6)	2 (3.2)	59 (95.2)	62 (100.0)	
Nass	'75A	0 (0.0)	1 (3.8)	3 (11.5)	22 (84.6)	26 (100.0)	
Skeena	'75A	0 (0.0)	1 (1.6)	7 (11.3)	54 (87.1)	62 (100.0)	
Bella Coola	'75A	0 (0.0)	1 (10.0)	3 (30.0)	6 (60.0)	10 (100.0)	
Total	'75A	2 (1.0)	8 (4.0)	31 (15.5)	159 (79.5)	200 (100.0)	

Table 7. Predicted regional category (number and percent) of Southeast Alaskan/British Columbian chinook salmon stocks in 14 linear discriminant function (LDF) scale pattern models used by Myers et al. (1984) - cont'd.

Southeast Alaska/ British Columbian Stock	LDF Model <sup>1</sup>	Predicted Regional Category - number (%)					Total
		Asia	Western Alaska	Central Alaska	Southeast Alaska/ British Columbia		
Taku	'75B	0 (0.0)	2 (10.0)	2 (10.0)	16 (80.0)	20 (100.0)	
Alsek	'75B	0 (0.0)	0 (0.0)	2 (33.3)	4 (66.7)	6 (100.0)	
Stikine	'75B	2 (3.8)	0 (0.0)	16 (30.8)	34 (65.4)	52 (100.0)	
Fraser	'75B	0 (0.0)	0 (0.0)	3 (30.0)	7 (70.0)	10 (100.0)	
Nass	'75B	0 (0.0)	1 (4.2)	1 (4.2)	22 (91.7)	24 (100.0)	
Skeena	'75B	0 (0.0)	7 (8.5)	9 (11.0)	66 (80.5)	82 (100.0)	
Bella Coola	'75B	0 (0.0)	1 (16.7)	0 (0.0)	5 (83.3)	6 (100.0)	
Total	'75B	2 (1.0)	11 (5.5)	33 (16.5)	154 (77.0)	200 (100.0)	
Taku	'76A	0 (0.0)	1 (7.1)	10 (71.4)	3 (21.4)	14 (100.0)	
Alsek	'76A	1 (16.7)	0 (0.0)	4 (66.7)	1 (16.7)	6 (100.0)	
Stikine	'76A	4 (9.1)	2 (4.5)	19 (43.2)	19 (43.2)	44 (100.0)	
Fraser	'76A	0 (0.0)	0 (0.0)	2 (3.8)	50 (96.2)	52 (100.0)	
Nass	'76A	0 (0.0)	0 (0.0)	3 (16.7)	15 (83.3)	18 (100.0)	
Skeena	'76A	1 (1.9)	1 (1.9)	4 (7.4)	48 (88.9)	54 (100.0)	
Bella Coola	'76A	0 (0.0)	2 (16.7)	3 (25.0)	7 (58.3)	12 (100.0)	
Total	'76A	6 (3.0)	6 (3.0)	45 (22.5)	143 (71.5)	200 (100.0)	
Taku	'76B	1 (6.3)	2 (12.5)	4 (25.0)	9 (56.3)	16 (100.0)	
Alsek	'76B	0 (0.0)	0 (0.0)	6 (75.0)	2 (25.0)	8 (100.0)	
Stikine	'76B	11 (13.4)	1 (1.2)	18 (22.0)	52 (63.4)	82 (100.0)	
Fraser	'76B	0 (0.0)	0 (0.0)	0 (0.0)	16 (100.0)	16 (100.0)	
Nass	'76B	0 (0.0)	0 (0.0)	3 (25.0)	9 (75.0)	12 (100.0)	
Skeena	'76B	0 (0.0)	0 (0.0)	6 (11.5)	46 (88.5)	52 (100.0)	
Bella Coola	'76B	0 (0.0)	1 (7.1)	4 (28.6)	9 (64.3)	14 (100.0)	
Total	'76B	12 (6.0)	4 (2.0)	41 (20.5)	143 (71.5)	200 (100.0)	
Taku	'77	0 (0.0)	0 (0.0)	1 (50.0)	1 (50.0)	2 (100.0)	
Alsek	'77	0 (0.0)	0 (0.0)	3 (50.0)	3 (50.0)	6 (100.0)	
Stikine	'77	1 (10.0)	1 (10.0)	3 (30.0)	5 (50.0)	10 (100.0)	
Fraser	'77	0 (0.0)	2 (2.3)	0 (0.0)	34 (97.7)	36 (100.0)	
Nass	'77	0 (0.0)	1 (3.7)	3 (11.1)	23 (85.2)	27 (100.0)	
Skeena	'77	0 (0.0)	1 (1.9)	8 (15.1)	44 (83.0)	53 (100.0)	
Bella Coola	'77	0 (0.0)	1 (7.1)	0 (0.0)	13 (92.9)	14 (100.0)	
Total	'77	1 (0.5)	6 (3.0)	18 (9.1)	173 (87.4)	198 (100.0)	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as 'A' were used to classify age 1.2 chinook and models designated as 'B' were used to classify age 1.3 chinook of the same brood year.

Table 8. The results of k-means clustering (Hartigan 1975) of chinook salmon scale data summarized by the number (%) of scales of each region or stock category in each of four clusters for 14 different brood year models. For ease of interpretation, the table was organized so that the cluster with the highest proportion of Asian scales appears on the left hand side of the table. WEST = Western Alaska, CENT = Central Alaska, SEBC = Southeast Alaska and British Columbia.

Brood year <sup>1</sup>	Region	Stock	Cluster				Total
			1	2	3	4	
'70	ASIA	Kamchatka	42 (52.5)	13 (16.3)	14 (17.5)	11 (13.8)	80 (100.0)
		Bolshaya	8 (32.0)	11 (44.0)	2 (8.5)	4 (16.0)	25 (100.0)
		Total	50 (47.6)	24 (22.9)	16 (15.2)	15 (14.3)	105 (100.0)
	WEST	Yukon	1 (1.7)	13 (22.4)	4 (6.9)	40 (69.0)	58 (100.0)
		Kuskokwim	12 (20.0)	27 (45.0)	2 (3.3)	19 (31.7)	60 (100.0)
		Kanektok	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4 (100.0)
		Nushagak	23 (32.9)	8 (11.4)	7 (10.0)	32 (45.7)	70 (100.0)
		Togiak	0 (0.0)	6 (75.0)	0 (0.0)	2 (25.0)	8 (100.0)
		Total	37 (18.5)	57 (28.5)	13 (6.5)	93 (46.5)	200 (100.0)
	CENT	Cook Inlet	4 (12.9)	6 (19.4)	5 (16.1)	16 (51.6)	31 (100.0)
		Copper R.	7 (9.6)	2 (2.7)	41 (56.2)	23 (31.5)	73 (100.0)
		Total	11 (10.6)	8 (7.7)	46 (44.2)	39 (37.5)	104 (100.0)
	SEBC	Taku	3 (16.7)	10 (55.6)	1 (5.6)	4 (22.2)	18 (100.0)
		Alsek	0 (0.0)	2 (25.0)	3 (37.5)	3 (37.5)	8 (100.0)
Stikine		3 (16.7)	5 (27.8)	6 (33.3)	4 (22.2)	18 (100.0)	
Fraser		2 (11.8)	2 (11.8)	13 (76.5)	0 (0.0)	17 (100.0)	
Skeena		3 (4.8)	5 (7.9)	50 (79.4)	5 (7.9)	63 (100.0)	
Bella Coola		1 (25.0)	0 (0.0)	2 (50.0)	1 (25.0)	4 (100.0)	
Total		12 (9.4)	24 (18.8)	75 (58.6)	17 (13.3)	128 (100.0)	
'71A	ASIA	Kamchatka	73 (49.3)	30 (20.3)	24 (16.2)	21 (14.2)	148 (100.0)
		Bolshaya	8 (61.5)	4 (30.8)	1 (7.7)	0 (0.0)	13 (100.0)
		Total	81 (50.3)	34 (21.1)	25 (15.5)	21 (13.0)	161 (100.0)
	WEST	Yukon	12 (15.4)	31 (39.7)	27 (34.6)	8 (10.3)	78 (100.0)
		Kuskokwim	3 (7.1)	23 (54.8)	11 (26.2)	5 (11.9)	42 (100.0)
		Kanektok	0 (0.0)	3 (50.0)	1 (16.7)	2 (33.3)	6 (100.0)
		Goodnews	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
		Nushagak	6 (9.7)	28 (45.2)	9 (14.5)	19 (30.6)	62 (100.0)
		Togiak	1 (10.0)	8 (80.0)	0 (0.0)	1 (10.0)	10 (100.0)
		Total	22 (11.0)	95 (47.5)	48 (24.0)	35 (17.5)	200 (100.0)
	CENT	Cook Inlet	21 (33.9)	24 (38.7)	9 (14.5)	8 (12.9)	62 (100.0)
		Copper R.	21 (35.0)	12 (20.0)	17 (28.3)	10 (16.7)	60 (100.0)
		Total	42 (34.4)	36 (29.5)	26 (21.3)	18 (14.8)	122 (100.0)

Table 8. Continued.

Brood <sub>1</sub> year	Region	Stock	Cluster				Total
			1	2	3	4	
	SEBC	Taku	1 (8.3)	3 (25.0)	7 (58.3)	1 (8.3)	12 (100.0)
		Alsek	1 (16.7)	3 (50.0)	2 (33.3)	0 (0.0)	6 (100.0)
		Stikine	3 (37.5)	3 (37.5)	1 (12.5)	1 (12.5)	8 (100.0)
		Fraser	23 (23.7)	17 (17.5)	12 (12.4)	45 (46.4)	97 (100.0)
		Nass	2 (33.3)	2 (33.3)	1 (16.7)	1 (16.7)	6 (100.0)
		Skeena	12 (37.5)	4 (12.5)	3 (9.4)	13 (40.6)	32 (100.0)
		Bella Coola	13 (38.2)	3 (8.8)	1 (2.9)	17 (50.0)	34 (100.0)
		Total	55 (28.2)	35 (17.9)	27 (13.8)	78 (40.0)	195 (100.0)
'71B	ASIA	Kamchatka	74 (50.0)	28 (18.9)	27 (18.2)	19 (12.8)	148 (100.0)
		Bolshaya	10 (50.0)	7 (35.0)	0 (0.0)	3 (15.0)	20 (100.0)
		Total	84 (50.0)	35 (20.8)	27 (16.1)	22 (13.1)	168 (100.0)
	WEST	Yukon	23 (28.0)	10 (12.2)	0 (0.0)	49 (59.8)	82 (100.0)
		Kuskokwim	10 (23.8)	8 (19.0)	4 (9.5)	20 (47.6)	42 (100.0)
		Kanektok	1 (12.5)	1 (12.5)	0 (0.0)	6 (75.0)	8 (100.0)
		Goodnews	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)
		Nushagak	14 (25.0)	5 (8.9)	1 (1.8)	36 (64.3)	56 (100.0)
		Togiak	3 (30.0)	1 (10.0)	1 (10.0)	5 (50.0)	10 (100.0)
		Total	51 (25.5)	25 (12.5)	6 (3.0)	118 (59.0)	200 (100.0)
	CENT	Cook Inlet	41 (56.2)	18 (24.7)	1 (1.4)	13 (17.8)	73 (100.0)
		Copper R.	24 (40.7)	19 (32.2)	4 (6.3)	12 (20.3)	59 (100.0)
		Total	65 (49.2)	37 (28.0)	5 (3.3)	25 (18.9)	132 (100.0)
	SEBC	Taku	2 (12.5)	7 (43.8)	2 (12.5)	5 (31.3)	16 (100.0)
		Alsek	4 (40.0)	3 (30.0)	2 (20.0)	1 (10.0)	10 (100.0)
		Stikine	3 (21.4)	8 (57.1)	1 (7.1)	2 (14.3)	14 (100.0)
		Fraser	4 (15.4)	1 (3.8)	19 (73.1)	2 (7.7)	26 (100.0)
		Nass	2 (33.3)	1 (16.7)	1 (16.7)	2 (33.3)	6 (100.0)
		Skeena	19 (32.8)	14 (24.1)	19 (32.8)	6 (10.3)	58 (100.0)
		Bella Coola	16 (45.7)	4 (11.4)	13 (37.1)	2 (5.7)	35 (100.0)
		Total	50 (30.3)	38 (23.0)	57 (34.5)	20 (12.1)	165 (100.0)
'72A	ASIA	Kamchatka	72 (40.7)	53 (29.9)	48 (27.1)	4 (2.3)	177 (100.0)
		Bolshaya	6 (66.7)	1 (11.1)	2 (22.2)	0 (0.0)	9 (100.0)
		Total	78 (41.9)	54 (29.0)	50 (26.9)	4 (2.2)	186 (100.0)
	WEST	Yukon	6 (9.4)	41 (64.1)	12 (18.8)	5 (7.8)	64 (100.0)
		Kuskokwim	9 (19.6)	14 (30.4)	16 (34.8)	7 (15.2)	46 (100.0)
		Kanektok	0 (0.0)	4 (40.0)	5 (50.0)	1 (10.0)	10 (100.0)
		Goodnews	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
		Nushagak	3 (6.5)	14 (30.4)	24 (52.2)	5 (10.89)	46 (100.0)
		Togiak	0 (0.0)	9 (28.1)	20 (62.5)	3 (9.4)	32 (100.0)
		Total	18 (9.0)	84 (42.0)	77 (38.5)	21 (10.5)	200 (100.0)

Table 8. Continued.

Brood year	Region	Stock	Cluster				Total
			1	2	3	4	
	CENT	Cook Inlet	31 (33.7)	19 (20.7)	38 (41.3)	4 (4.3)	92 (100.0)
		Copper R.	12 (12.9)	25 (26.9)	43 (46.2)	13 (14.0)	93 (100.0)
		Total	43 (23.2)	44 (23.8)	81 (43.8)	17 (9.2)	185 (100.0)
	SEBC	Taku	2 (33.3)	3 (50.0)	0 (0.0)	1 (16.7)	6 (100.0)
		Alsek	1 (12.5)	3 (37.5)	3 (37.5)	1 (12.5)	8 (100.0)
		Stikine	1 (25.0)	0 (0.0)	1 (25.0)	2 (50.0)	4 (100.0)
		Fraser	8 (10.0)	6 (7.5)	18 (22.5)	48 (60.0)	80 (100.0)
		Nass	4 (25.0)	4 (25.0)	2 (12.5)	6 (37.5)	16 (100.0)
		Skeena	11 (22.9)	3 (6.3)	7 (14.6)	27 (56.3)	48 (100.0)
		Bella Coola	3 (16.7)	1 (5.6)	10 (55.6)	4 (22.2)	18 (100.0)
		Total	30 (16.7)	20 (11.1)	41 (22.8)	89 (49.4)	180 (100.0)
'72B	ASIA	Kamchatka	115 (65.0)	34 (19.2)	22 (12.4)	6 (3.4)	177 (100.0)
		Bolshaya	5 (55.6)	3 (33.3)	1 (11.1)	0 (0.0)	9 (100.0)
		Total	120 (64.5)	37 (19.9)	23 (12.4)	6 (3.2)	186 (100.0)
WEST	Yukon	Kuskokwim	12 (16.7)	15 (20.8)	36 (50.0)	9 (12.5)	72 (100.0)
		Kanektok	5 (11.9)	20 (47.6)	9 (21.4)	8 (19.0)	42 (100.0)
		Goodnews	4 (50.0)	3 (37.5)	1 (12.5)	0 (0.0)	8 (100.0)
		Nushagak	0 (0.0)	0 (0.0)	1 (50.0)	1 (50.0)	2 (100.0)
		Togiak	3 (6.8)	29 (65.9)	6 (13.6)	6 (13.6)	44 (100.0)
		Total	1 (3.1)	18 (56.3)	6 (18.8)	7 (21.9)	32 (100.0)
		Total	25 (12.5)	85 (42.5)	59 (29.5)	31 (15.5)	200 (100.0)
CENT	Cook Inlet	Cook Inlet	38 (37.6)	29 (28.7)	14 (13.9)	20 (19.8)	101 (100.0)
		Copper R.	11 (11.8)	13 (14.0)	20 (21.5)	49 (52.7)	93 (100.0)
		Total	49 (25.3)	42 (21.6)	34 (17.5)	69 (35.6)	194 (100.0)
SEBC	Taku	Taku	0 (0.0)	0 (0.0)	3 (37.5)	5 (62.5)	8 (100.0)
		Alsek	2 (16.7)	1 (8.3)	3 (25.0)	6 (50.0)	12 (100.0)
		Fraser	2 (4.9)	7 (17.1)	5 (12.2)	27 (65.9)	41 (100.0)
		Nass	0 (0.0)	3 (18.8)	5 (31.3)	8 (50.0)	16 (100.0)
		Skeena	1 (1.6)	11 (17.5)	8 (12.7)	43 (68.3)	63 (100.0)
		Bella Coola	2 (10.5)	6 (31.6)	3 (15.8)	8 (42.1)	19 (100.0)
		Total	7 (4.4)	28 (17.6)	27 (17.0)	97 (61.0)	159 (100.0)
'73A	ASIA	Kamchatka	33 (30.8)	29 (27.1)	28 (26.2)	17 (15.9)	107 (100.0)
		Bolshaya	7 (63.6)	4 (36.4)	0 (0.0)	0 (0.0)	11 (100.0)
		Total	40 (33.9)	33 (28.0)	28 (23.7)	17 (14.4)	118 (100.0)

Table 8. Continued.

Brood <sup>1</sup> year	Region	Stock	Cluster				Total
			1	2	3	4	
WEST	Yukon		2 (3.6)	26 (46.4)	4 (7.1)	24 (42.9)	56 (100.0)
	Kuskokwim		1 (3.6)	19 (67.9)	2 (7.1)	6 (21.4)	28 (100.0)
	Kanektok		0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
	Nushagak		2 (2.0)	24 (24.0)	31 (31.0)	43 (43.0)	100 (100.0)
	Togiak		0 (0.0)	9 (75.0)	2 (16.7)	1 (8.3)	12 (100.0)
	Total		5 (2.5)	80 (40.4)	39 (19.7)	74 (37.4)	198 (100.0)
CENT	Cook Inlet		34 (44.2)	23 (29.9)	13 (16.9)	7 (9.1)	77 (100.0)
	Copper R.		6 (10.5)	8 (14.0)	18 (31.6)	25 (43.9)	57 (100.0)
	Total		40 (29.9)	31 (23.1)	31 (23.1)	32 (23.9)	134 (100.0)
SEBC	Alsek		5 (41.7)	1 (8.3)	3 (25.0)	3 (25.0)	12 (100.0)
	Stikine		1 (50.0)	0 (0.0)	0 (0.0)	1 (50.0)	2 (100.0)
	Fraser		29 (35.4)	4 (4.9)	30 (36.6)	19 (23.2)	82 (100.0)
	Nass		4 (12.9)	0 (0.0)	23 (74.2)	4 (12.9)	31 (100.0)
	Skeena		12 (32.4)	1 (2.7)	16 (43.2)	8 (21.6)	37 (100.0)
	Bella Coola		1 (3.3)	1 (3.3)	24 (80.0)	4 (13.3)	30 (100.0)
Total		52 (26.8)	7 (3.6)	96 (49.5)	39 (20.1)	194 (100.0)	
'73B ASIA	Kamchatka		52 (47.7)	29 (27.1)	20 (18.7)	7 (6.5)	107 (100.0)
	Bolshaya		19 (79.2)	0 (0.0)	5 (20.8)	0 (0.0)	24 (100.0)
	Total		70 (53.4)	29 (22.1)	25 (19.1)	7 (5.3)	131 (100.0)
WEST	Yukon		3 (4.4)	24 (35.3)	39 (57.4)	2 (2.9)	68 (100.0)
	Kuskokwim		2 (6.7)	10 (33.3)	17 (56.7)	1 (3.3)	30 (100.0)
	Nushagak		1 (1.1)	57 (65.5)	26 (29.9)	3 (3.4)	87 (100.0)
	Togiak		1 (7.7)	3 (23.1)	8 (61.5)	1 (7.7)	13 (100.0)
	Total		7 (3.5)	94 (47.5)	90 (45.5)	7 (3.5)	198 (100.0)
CENT	Cook Inlet		59 (61.5)	16 (16.7)	14 (14.6)	7 (7.3)	96 (100.0)
	Copper R.		5 (8.8)	32 (56.1)	12 (21.1)	8 (14.0)	57 (100.0)
	Total		64 (41.8)	48 (31.4)	26 (17.0)	15 (9.8)	153 (100.0)
SEBC	Taku		0 (0.0)	1 (50.0)	1 (50.0)	0 (0.0)	2 (100.0)
	Alsek		8 (40.0)	4 (20.0)	3 (15.0)	5 (25.0)	20 (100.0)
	Stikine		0 (0.0)	4 (80.0)	0 (0.0)	1 (20.0)	5 (100.0)
	Fraser		9 (19.6)	3 (6.5)	2 (4.3)	32 (69.6)	46 (100.0)
	Nass		1 (3.2)	2 (6.5)	3 (9.7)	25 (80.6)	31 (100.0)
	Skeena		6 (10.0)	8 (13.3)	2 (3.3)	44 (73.3)	60 (100.0)
	Bella Coola		0 (0.0)	3 (9.4)	1 (3.1)	28 (87.5)	32 (100.0)
	Total		24 (12.2)	25 (12.8)	12 (6.1)	135 (68.9)	196 (100.0)

Table 8. Continued.

Brood <sub>1</sub> year	Region	Stock	Cluster				Total	
			1	2	3	4		
'74A	ASIA	Kamchatka	85 (66.4)	32 (25.0)	10 (7.8)	1 (0.8)	128 (100.0)	
		Bolshaya	12 (85.7)	0 (0.0)	0 (0.0)	2 (14.3)	14 (100.0)	
		Total	97 (68.3)	32 (22.5)	10 (7.0)	3 (2.1)	142 (100.0)	
	WEST	Yukon	4 (3.2)	86 (68.3)	33 (26.2)	3 (2.4)	126 (100.0)	
		Kuskokwim	3 (9.4)	23 (71.9)	6 (18.8)	0 (0.0)	32 (100.0)	
		Nushagak	3 (7.9)	11 (28.9)	24 (63.2)	0 (0.0)	38 (100.0)	
		Togiak	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	4 (100.0)	
	CENT	Cook Inlet	19 (46.3)	6 (14.6)	14 (34.1)	2 (4.9)	41 (100.0)	
		Copper R.	1 (4.2)	0 (0.0)	15 (62.5)	8 (33.3)	24 (100.0)	
		Total	20 (30.8)	6 (9.2)	29 (44.6)	10 (15.4)	65 (100.0)	
	SEBC	Taku	4 (50.0)	1 (12.5)	3 (37.5)	0 (0.0)	8 (100.0)	
		Alsek	2 (20.0)	0 (0.0)	8 (80.0)	0 (0.0)	10 (100.0)	
		Stikine	4 (25.0)	1 (6.3)	6 (37.5)	5 (31.3)	16 (100.0)	
		Fraser	0 (0.0)	2 (1.8)	12 (10.9)	96 (87.3)	110 (100.0)	
		Nass	1 (5.6)	1 (5.6)	3 (16.7)	13 (72.2)	18 (100.0)	
		Skeena	1 (3.1)	0 (0.0)	14 (43.8)	17 (53.1)	32 (100.0)	
		Bella Coola	0 (0.0)	0 (0.0)	2 (33.3)	4 (66.7)	6 (100.0)	
		Total	12 (6.0)	5 (2.5)	48 (24.0)	135 (67.5)	200 (100.0)	
	'74B	ASIA	Kamchatka	70 (54.7)	45 (35.2)	6 (4.7)	7 (5.5)	128 (100.0)
			Bolshaya	0 (0.0)	4 (19.0)	16 (76.2)	1 (4.8)	21 (100.0)
			Total	70 (47.0)	49 (32.9)	22 (14.8)	8 (5.4)	149 (100.0)
WEST		Yukon	64 (50.4)	7 (5.5)	2 (1.6)	54 (42.5)	127 (100.0)	
		Kuskokwim	16 (53.3)	2 (6.7)	2 (6.7)	10 (33.3)	30 (100.0)	
		Nushagak	4 (10.8)	2 (5.4)	0 (0.0)	31 (83.8)	37 (100.0)	
		Togiak	0 (0.0)	1 (25.0)	0 (0.0)	3 (75.0)	4 (100.0)	
		Total	84 (42.4)	12 (6.1)	4 (2.0)	98 (49.5)	198 (100.0)	
CENT		Cook Inlet	12 (23.5)	19 (37.3)	7 (13.7)	13 (25.5)	51 (100.0)	
		Copper R.	1 (4.2)	2 (8.3)	1 (4.2)	20 (83.3)	24 (100.0)	
		Total	13 (17.3)	21 (28.0)	8 (10.7)	33 (44.0)	75 (100.0)	
SEBC		Taku	8 (28.6)	6 (21.4)	12 (42.9)	2 (7.1)	28 (100.0)	
		Alsek	1 (4.2)	5 (20.8)	6 (25.0)	12 (50.0)	24 (100.0)	
		Stikine	5 (10.0)	22 (44.0)	15 (30.0)	8 (16.0)	50 (100.0)	
		Fraser	0 (0.0)	3 (9.4)	17 (53.1)	12 (37.5)	32 (100.0)	
		Nass	1 (10.0)	0 (0.0)	9 (90.0)	0 (0.0)	10 (100.0)	
		Skeena	0 (0.0)	7 (17.1)	8 (19.5)	26 (63.4)	41 (100.0)	
		Bella Coola	0 (0.0)	3 (30.0)	5 (50.0)	2 (20.0)	10 (100.0)	
		Total	15 (7.7)	46 (23.6)	72 (36.9)	62 (31.8)	195 (100.0)	

Table 8. Continued.

Brood year <sup>1</sup>	Region	Stock	Cluster				Total
			1	2	3	4	
'75A	ASIA	Kamchatka	50 (67.6)	14 (18.9)	10 (13.5)	0 (0.0)	74 (100.0)
		Bolshaya	11 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	11 (100.0)
		Total	61 (71.8)	14 (16.5)	10 (11.8)	0 (0.0)	85 (100.0)
	WEST	Yukon	1 (1.1)	77 (83.7)	14 (15.2)	0 (0.0)	92 (100.0)
		Kuskokwim	1 (2.3)	28 (65.1)	14 (32.6)	0 (0.0)	43 (100.0)
		Kanektok	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
		Goodnews	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
		Nushagak	6 (11.1)	33 (61.1)	15 (27.8)	0 (0.0)	54 (100.0)
		Togiak	0 (0.0)	6 (100.0)	0 (0.0)	0 (0.0)	6 (100.0)
		Total	8 (4.0)	148 (74.4)	43 (21.6)	0 (0.0)	199 (100.0)
	CENT	Cook Inlet	17 (28.8)	19 (32.2)	23 (39.0)	0 (0.0)	59 (100.0)
		Copper R.	5 (17.2)	6 (20.7)	18 (62.1)	0 (0.0)	29 (100.0)
		Total	22 (25.0)	25 (28.4)	41 (46.6)	0 (0.0)	88 (100.0)
	SEBC	Taku	2 (20.0)	2 (20.0)	6 (60.0)	0 (0.0)	10 (100.0)
		Alsek	1 (25.0)	1 (25.0)	2 (50.0)	0 (0.0)	4 (100.0)
		Stikine	3 (11.5)	7 (26.9)	10 (38.5)	6 (23.1)	26 (100.0)
		Fraser	1 (1.6)	11 (17.7)	43 (69.4)	7 (11.3)	62 (100.0)
		Nass	0 (0.0)	2 (7.7)	23 (88.5)	1 (3.8)	26 (100.0)
		Skeena	0 (0.0)	15 (24.2)	43 (69.4)	4 (6.5)	62 (100.0)
Bella Coola		0 (0.0)	1 (10.0)	8 (80.0)	1 (10.0)	10 (100.0)	
Total		7 (3.5)	39 (19.5)	135 (67.5)	19 (9.5)	200 (100.0)	
'75B	ASIA	Kamchatka	32 (43.2)	27 (36.5)	13 (17.6)	2 (2.7)	74 (100.0)
		Bolshaya	20 (83.3)	3 (12.5)	1 (4.2)	0 (0.0)	24 (100.0)
		Total	52 (53.1)	30 (30.6)	14 (14.3)	2 (2.0)	98 (100.0)
	WEST	Yukon	1 (1.0)	1 (1.0)	49 (50.0)	47 (48.0)	98 (100.0)
		Kuskokwim	1 (2.4)	4 (9.5)	12 (28.6)	25 (59.5)	42 (100.0)
		Kanektok	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)
		Goodnews	0 (0.0)	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)
		Nushagak	0 (0.0)	1 (2.0)	15 (30.6)	33 (67.3)	49 (100.0)
		Togiak	0 (0.0)	0 (0.0)	0 (0.0)	6 (100.0)	6 (100.0)
		Total	2 (1.0)	6 (3.0)	76 (38.2)	115 (57.8)	199 (100.0)
	CENT	Cook Inlet	5 (14.3)	8 (22.9)	11 (31.4)	11 (31.4)	35 (100.0)
		Copper R.	1 (3.4)	7 (24.1)	19 (65.5)	2 (6.9)	29 (100.0)
		Total	6 (9.4)	15 (23.4)	30 (46.9)	13 (20.3)	64 (100.0)
	SEBC	Taku	0 (0.0)	1 (5.0)	8 (40.0)	11 (55.0)	20 (100.0)
		Alsek	0 (0.0)	1 (16.7)	1 (16.7)	4 (66.7)	6 (100.0)
		Stikine	5 (9.6)	9 (17.3)	12 (23.1)	26 (50.0)	52 (100.0)
		Fraser	0 (0.0)	0 (0.0)	9 (90.0)	1 (10.0)	10 (100.0)
		Nass	0 (0.0)	0 (0.0)	15 (62.5)	9 (37.5)	24 (100.0)
		Skeena	0 (0.0)	1 (1.2)	62 (75.6)	19 (23.2)	82 (100.0)
Bella Coola		0 (0.0)	0 (0.0)	4 (66.7)	2 (33.3)	6 (100.0)	
Total		5 (2.5)	12 (6.0)	111 (55.5)	72 (36.0)	200 (100.0)	

Table 8. Continued.

Brood year <sup>1</sup>	Region	Stock	Cluster				Total
			1	2	3	4	
'76A	ASIA	Kamchatka	75 (42.9)	68 (38.9)	26 (14.9)	6 (3.4)	175 (100.0)
		Bolshaya	17 (70.8)	5 (20.8)	1 (4.2)	1 (4.2)	24 (100.0)
		Total	92 (46.2)	73 (36.7)	27 (13.6)	7 (3.5)	199 (100.0)
	WEST	Yukon	0 (0.0)	9 (16.1)	36 (64.3)	11 (19.6)	56 (100.0)
		Kuskokwim	0 (0.0)	6 (11.1)	22 (40.7)	26 (48.1)	54 (100.0)
		Kanektok	0 (0.0)	1 (25.0)	1 (25.0)	2 (50.0)	4 (100.0)
		Nushagak	0 (0.0)	2 (2.6)	37 (48.1)	38 (49.4)	77 (100.0)
		Togiak	0 (0.0)	0 (0.0)	3 (37.5)	5 (62.5)	8 (100.0)
		Total	0 (0.0)	18 (9.0)	99 (49.7)	82 (41.2)	199 (100.0)
		CENT	Cook Inlet	11 (9.6)	12 (10.5)	27 (32.5)	54 (47.4)
	Copper R.		2 (2.3)	2 (2.3)	23 (26.7)	59 (68.6)	86 (100.0)
	Total		13 (6.5)	14 (7.0)	60 (30.0)	113 (56.5)	200 (100.0)
	SEBC	Taku	0 (0.0)	2 (14.3)	7 (50.0)	5 (35.7)	14 (100.0)
		Alsek	1 (16.7)	0 (0.0)	2 (33.3)	3 (50.0)	6 (100.0)
		Stikine	10 (22.7)	3 (6.8)	12 (27.3)	19 (43.2)	44 (100.0)
		Fraser	1 (1.9)	0 (0.0)	6 (11.5)	45 (86.5)	52 (100.0)
		Nass	1 (5.6)	0 (0.0)	1 (5.6)	16 (88.9)	18 (100.0)
		Skeena	5 (9.3)	1 (1.9)	5 (9.3)	43 (79.6)	54 (100.0)
		Bella Coola	0 (0.0)	0 (0.0)	1 (8.3)	11 (91.7)	12 (100.0)
		Total	18 (9.0)	6 (3.0)	34 (17.0)	142 (71.0)	200 (100.0)
	'76B	ASIA	Kamchatka	99 (66.4)	31 (20.8)	19 (12.8)	0 (0.0)
Bolshaya			42 (84.0)	7 (14.0)	1 (2.0)	0 (0.0)	50 (100.0)
Total			141 (70.9)	38 (19.1)	20 (10.1)	0 (0.0)	199 (100.0)
WEST		Yukon	0 (0.0)	24 (42.9)	28 (50.0)	4 (7.1)	56 (100.0)
		Kuskokwim	0 (0.0)	10 (17.9)	38 (67.9)	8 (14.3)	56 (100.0)
		Kanektok	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	4 (100.0)
		Nushagak	0 (0.0)	22 (28.9)	30 (39.5)	24 (31.6)	76 (100.0)
		Togiak	0 (0.0)	2 (25.0)	2 (25.0)	4 (50.0)	8 (100.0)
		Total	0 (0.0)	60 (30.0)	100 (50.5)	40 (20.0)	200 (100.0)
		CENT	Cook Inlet	18 (15.5)	13 (11.2)	60 (51.7)	25 (21.6)
Copper R.			9 (10.7)	21 (25.0)	23 (27.4)	31 (36.9)	84 (100.0)
Total			27 (13.5)	34 (17.0)	83 (41.5)	56 (28.0)	200 (100.0)
SEBC		Taku	2 (12.5)	12 (75.0)	2 (12.5)	0 (0.0)	16 (100.0)
		Alsek	3 (37.5)	1 (12.5)	2 (25.0)	2 (25.0)	8 (100.0)
		Stikine	33 (40.2)	21 (25.6)	20 (24.4)	8 (9.8)	82 (100.0)
		Fraser	6 (37.5)	5 (31.3)	2 (12.5)	3 (18.8)	16 (100.0)
		Nass	5 (41.7)	3 (25.0)	1 (8.3)	3 (25.0)	12 (100.0)
		Skeena	10 (19.2)	27 (51.9)	4 (7.7)	11 (21.2)	52 (100.0)
		Bella Coola	2 (14.3)	1 (7.1)	3 (21.4)	8 (57.1)	14 (100.0)
		Total	61 (30.5)	70 (35.0)	34 (17.0)	35 (17.5)	200 (100.0)

Table 8. Continued.

Brood <sup>1</sup> year	Region	Stock	Cluster				Total
			1	2	3	4	
'77	ASIA	Kamchatka	155 (84.2)	15 (8.2)	12 (6.5)	2 (1.1)	184 (100.0)
		Bolshaya	15 (93.8)	1 (6.3)	0 (0.0)	0 (0.0)	16 (100.0)
		Total	170 (85.0)	16 (8.0)	12 (6.0)	2 (1.0)	200 (100.0)
	WEST	Yukon	8 (15.4)	35 (67.3)	4 (7.7)	5 (9.6)	52 (100.0)
		Kuskokwim	3 (12.0)	11 (44.0)	7 (28.0)	4 (16.0)	25 (100.0)
		Kanektok	1 (25.0)	1 (25.0)	0 (0.0)	2 (50.0)	4 (100.0)
		Goodnews	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
		Nushagak	2 (2.0)	47 (47.0)	37 (37.0)	14 (14.0)	100 (100.0)
		Togiak	0 (0.0)	11 (68.8)	2 (12.5)	3 (18.8)	16 (100.0)
		Total	14 (7.0)	107 (53.8)	50 (25.1)	28 (14.1)	199 (100.0)
	CENT	Cook Inlet	28 (31.5)	30 (33.7)	19 (21.3)	12 (13.5)	89 (100.0)
		Copper R.	5 (4.5)	46 (41.8)	43 (39.1)	16 (14.5)	110 (100.0)
		Total	33 (16.6)	76 (38.2)	62 (31.2)	28 (14.1)	199 (100.0)
	SEBC	Taku	1 (50.0)	0 (0.0)	0 (0.0)	1 (50.0)	2 (100.0)
		Alsek	0 (0.0)	0 (0.0)	6 (100.0)	0 (0.0)	6 (100.0)
		Stikine	2 (20.0)	2 (20.0)	4 (40.0)	2 (20.0)	10 (100.0)
		Fraser	0 (0.0)	1 (1.2)	21 (24.4)	64 (74.4)	86 (100.0)
		Nass	1 (3.7)	2 (7.4)	21 (77.8)	3 (11.1)	27 (100.0)
		Skeena	1 (1.9)	1 (1.9)	14 (26.4)	37 (69.8)	53 (100.0)
		Bella Coola	0 (0.0)	0 (0.0)	10 (71.4)	4 (28.6)	14 (100.0)
Total		5 (2.5)	6 (3.0)	76 (38.4)	111 (56.1)	198 (100.0)	

<sup>1</sup>The number indicates the brood year of the chinook salmon included in a particular model. Models designated as "A" were used by Myers et al. (1984) to classify age 1.2 chinook and models designated as "B" were used to classify age 1.3 chinook of the same brood year.

Table 9. The number of scales in the high seas unknowns (1975-81) that were classified to each regional stock in 14 four-region linear discriminant function (LDF) models used by Myers et al. (1984) and 14 six-region models. The same variables (listed in Table 1) and data sets were used for both 4- and 6-way analyses. KAMC = Kamchatka, BOLS = Bolshaya, WEST = Western Alaska, COOK = Cook Inlet, COPP = Copper River, CENT = Central Alaska, SEBC = Southeast Alaska and British Columbia.

LDF Model	Analysis	Number of unknowns classified into group								Total
		KAMC	BOLS	ASIA <sup>1</sup>	WEST	COOK	COPP	CENT <sup>1</sup>	SEBC	
'70	4-region	-	-	15	52	-	-	35	27	129
	6-region	7	20	(27)	42	25	12	(37)	23	"
'71A	4-region	-	-	386	486	-	-	383	111	1,366
	6-region	278	142	(420)	427	152	301	(453)	66	"
'71B	4-region	-	-	101	45	-	-	29	20	195
	6-region	65	29	(94)	50	16	26	(42)	9	"
'72A	4-region	-	-	327	459	-	-	692	114	1,592
	6-region	229	128	(357)	420	340	411	(751)	64	"
'72B	4-region	-	-	86	112	-	-	86	21	305
	6-region	52	24	(76)	117	55	41	(96)	16	"
'73A	4-region	-	-	249	480	-	-	370	64	1,163
	6-region	165	158	(323)	469	174	138	(312)	59	"
'73B	4-region	-	-	36	57	-	-	65	8	166
	6-region	33	19	(52)	54	21	30	(51)	9	"
'74A	4-region	-	-	270	507	-	-	371	163	1,311
	6-region	130	209	(339)	453	313	59	(372)	147	"
'74B	4-region	-	-	49	37	-	-	19	13	118
	6-region	34	15	(49)	43	10	4	(14)	12	"
'75A	4-region	-	-	189	403	-	-	293	27	912
	6-region	114	83	(197)	363	245	91	(336)	16	"
'75B	4-region	-	-	34	96	-	-	42	15	187
	6-region	26	10	(36)	93	30	17	(47)	11	"
'76A	4-region	-	-	258	708	-	-	587	236	1,789
	6-region	206	47	(253)	636	441	283	(724)	176	"
'76B	4-region	-	-	70	132	-	-	123	62	387
	6-region	50	31	(81)	111	104	48	(152)	43	"
'77	4-region	-	-	786	704	-	-	732	187	2,409
	6-region	439	352	(791)	625	683	179	(862)	131	"

<sup>1</sup>The numbers indicated in parentheses for the 6-region analyses are the sum of the number of unknowns that classified into the component stocks of a particular region, i.e., Kamchatka and Bolshaya for Asia and Cook Inlet and Copper River for Central Alaska.

