

ORIGINS OF SOCKEYE SALMON IN 1994 EASTSIDE BRISTOL BAY FISHERIES  
BASED ON LINEAR DISCRIMINANT FUNCTION ANALYSIS  
OF SCALE PATTERNS

By

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Regional Information Report<sup>1</sup> No. 2A95-25

Alaska Department of Fish and Game  
Division of Commercial Fisheries Management and Development  
Central Region  
333 Raspberry Road  
Anchorage, Alaska 99518-1599

May 1995

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## **ACKNOWLEDGMENTS**

The entire Eastside Bristol Bay full-time and seasonal staff of the Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development assisted in collecting data used to generate the 1994 stock composition estimates. Bev Cross, Bristol Bay Research Project Leader, provided technical and editorial assistance.

## TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES .....	v
LIST OF FIGURES .....	vi
LIST OF APPENDICES .....	vii
ABSTRACT .....	viii
INTRODUCTION .....	1
METHODS .....	2
Catch and Escapement Estimation .....	2
Age Composition Estimation .....	2
Catch Composition Estimation .....	2
Scale Measurements .....	2
Linear Discriminant Analysis .....	3
Construction of Age-2.2 Models .....	3
Classification of Age-2.2 Sockeye Salmon .....	3
Separation of Kvichak/Naknek Age-2.2 Catch .....	4
Other Age Group Stock Composition Estimation .....	5
Run Size Estimation .....	6
RESULTS .....	6
Catch and Escapement .....	6
Age Composition .....	6
Classification Models .....	7
Age 2.2 .....	7

TABLE OF CONTENTS (Continued)

	<u>Page</u>
Estimates of Catch Composition .....	7
Age 2.2 .....	7
All Ages .....	8
Harvest Distribution .....	8
Run By River System .....	9
Run Distribution .....	9
Exploitation Rates .....	9
Comparison of Run Estimates .....	9
LITERATURE CITED .....	10
TABLES .....	13
FIGURES .....	37
APPENDIX .....	52

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Sockeye salmon commercial catch by district and date for the Eastside of Bristol Bay, 1994 . . . . .	13
2. Sockeye salmon escapement by river and date for the Eastside of Bristol Bay, 1994 . . . . .	14
3. Sockeye salmon age composition by brood year in the commercial catch for the Eastside of Bristol Bay, 1994 . . . . .	15
4. Sockeye salmon age composition by brood year in the escapement for the Eastside of Bristol Bay, 1994 . . . . .	16
5. Mean and standard error of age-2.2 scale variables used to construct linear discriminant functions for the Eastside of Bristol Bay, 1994 . . . . .	17
6. Classification matrices from discriminant analyses of age-2.2 sockeye salmon sampled from Kvichak, Naknek, Egegik, and Ugashik Rivers, 1994 . . . . .	18
7. Run composition estimates and 90% confidence intervals (C.I.) calculated from scale pattern analyses of age-2.2 sockeye salmon by fishery and date for the Eastside of Bristol Bay, 1994 . . . . .	21
8. Estimated harvest of age-2.2 sockeye salmon and 90% confidence intervals (C.I.), Eastside of Bristol Bay, 1994 . . . . .	22
9. Run composition estimates of sockeye salmon catch by age group and date, Naknek-Kvichak District, 1994 . . . . .	23
10. Run composition estimates of sockeye salmon catch by age group and date, Egegik District, 1994 . . . . .	27
11. Run composition estimates of sockeye salmon catch by age group and date, Ugashik District, 1994 . . . . .	31
12. Catch of sockeye salmon by run and district for the Eastside of Bristol Bay, 1994 . . . . .	33
13. Numbers of sockeye salmon by run and age group for the Eastside of Bristol Bay, 1994 . . . . .	34

## LIST OF TABLES (Continued)

<u>Table</u>	<u>Page</u>
14. Percentages of sockeye salmon by run and age group for the Eastside of Bristol Bay, 1994 .....	35
15. Comparison of sockeye salmon run estimates for the Eastside of Bristol Bay, 1994 .....	36

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Map of Bristol Bay showing major rivers and fishing districts .....	37
2. Commercial catch of sockeye salmon in Naknek-Kvichak, Egegik, and Ugashik Districts from 1978 through 1994 .....	38
3. Age-2.2 sockeye salmon scale showing the growth zones measured to generate variables to build linear discriminant functions .....	39
4. Total size of first freshwater growth zone (S1FW) for age-2.2 sockeye salmon escapement scales, Kvichak and Naknek Rivers, 1994 .....	40
5. Total size of first freshwater growth zone (S1FW) for age-2.2 sockeye salmon escapement scales, Egegik, Ugashik, and Kvichak/Naknek (Other) Rivers combined, 1994 .....	41
6. Stock composition estimates for 1994 Naknek-Kvichak District age-2.2 sockeye salmon catch in percent and numbers through time .....	42
7. Stock composition estimates for 1994 Egegik District age-2.2 sockeye salmon catch in percent and numbers through time .....	43
8. Stock composition estimates for 1994 Ugashik District age-2.2 sockeye salmon catch in percent and numbers through time .....	44
9. Stock composition estimates for 1994 Naknek-Kvichak District total sockeye salmon catch in percent and numbers through time .....	45

**LIST OF FIGURES (Continued)**

<u>Figure</u>	<u>Page</u>
10. Stock composition estimates for 1994 Egegik District total sockeye salmon catch in percent and numbers through time . . . . .	46
11. Stock composition estimates for 1994 Ugashik District total sockeye salmon catch in percent and numbers through time . . . . .	47
12. Estimated 1994 Kvichak River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined . . . . .	48
13. Estimated 1994 Naknek River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined . . . . .	49
14. Estimated 1994 Egegik River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined . . . . .	50
15. Estimated 1994 Ugashik River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined . . . . .	51

**LIST OF APPENDICES**

<u>Appendix</u>	<u>Page</u>
A.1. Scale variables screened for linear discriminant function analysis of age-2.2 sockeye salmon for the Eastside of Bristol Bay, 1994 . . . . .	52

## ABSTRACT

Stock composition of the 1994 commercial sockeye salmon *Oncorhynchus nerka* harvests in Naknek-Kvichak, Egegik, and Ugashik Districts, Bristol Bay, Alaska, were estimated with scale pattern analyses and age composition. Scale measurements from age-2.2 sockeye salmon escapement samples were used to build discriminant functions which allowed the stock composition of this age group in the commercial catch to be estimated. Stock origins for other age groups were estimated by combining age-2.2 scale pattern analyses with escapement age compositions. Most sockeye salmon harvested had originated from rivers within the fishing district; however, harvest of outside stocks occurred in every district. Of the estimated 16,262,625 sockeye salmon caught in Naknek-Kvichak District, 76.1% were from Kvichak River, 18.3% from Naknek River, and 5.6% from Ugashik River. The estimated 10,798,450 sockeye salmon caught in Egegik District were composed of the following stocks: 91.6% Egegik, 5.2% Ugashik, 2.7% Kvichak, and 0.5% Naknek Rivers. The estimated Ugashik District harvest of 4,369,432 sockeye salmon was 84.6% Ugashik River, 8.2% Egegik River, 5.7% Kvichak River, and 1.5% Naknek River origin. Estimated exploitation rates were 84.4% for Egegik River, 82.7% for Ugashik River, 75.8% for Naknek River, and 60.8% for Kvichak River stocks.

**KEY WORDS:** Sockeye salmon *Oncorhynchus nerka*, Bristol Bay, scale pattern analysis, linear discriminant analysis, stock composition, exploitation rate

## INTRODUCTION

To facilitate discrete stock management, the Bristol Bay sockeye salmon *Oncorhynchus nerka* fishery is restricted to districts located near the mouths of major spawning streams (Figure 1). However, the close proximity of these spawning streams and annual variation in migratory routes causes stock mixing in the fisheries.

The Bristol Bay Management Area is divided into two general fisheries, the East and West Side. The Eastside fishery is composed of Naknek-Kvichak, Egegik, and Ugashik Districts (Figure 1); the Westside fishery includes Nushagak and Togiak Districts. Naknek-Kvichak District is subdivided into Naknek and Kvichak Sections.

From 1956 to present, stock composition estimates from Naknek-Kvichak District harvests have been based on escapement age composition estimates from Kvichak, Alagnak (Branch), and Naknek Rivers. Total runs of sockeye salmon to Egegik and Ugashik Rivers were estimated by adding the district catch to the district escapement. This standard method assumes (1) that all fish harvested in a district were returning to rivers within that district, and (2) equal exploitation among stocks. Complete results of the standard method have been summarized and published in separate reports (Stratton 1991; Stratton and Crawford 1992; Stratton and Crawford 1994). Bernard (1983) evaluated the biases inherent with this procedure.

More recently a second method based on linear discriminant function analysis of scale patterns has been used as well as the standard method. Use of this method began when decreased catches of sockeye salmon in Naknek-Kvichak District in 1985 and 1986 prompted concerns that these fish were being intercepted in Egegik and Ugashik Districts where catches were large (Figure 2). Straty (1975), after conducting a tagging study from 1955 to 1957, concluded that Eastside sockeye salmon stocks mixed in all Eastside districts and that Westside stocks were not present in appreciable numbers in Eastside districts. Examining the 1985 Eastside commercial catches, Fried and Yuen (1985) found that scale pattern analysis could accurately identify major Eastside sockeye salmon stocks. Scale pattern studies were expanded and stock compositions of Eastside district catches were recently estimated by Burns (1991) for the 1983 and 1984 runs; estimates for 1986 to 1993 have also been completed (Bue et al. 1986; Cross and Stratton 1989; Cross and Stratton 1991; Cross et al. 1992; Stratton et al. 1992; Stratton and Miller 1993; Stratton and Miller 1994; Miller 1995).

Objectives of this ongoing investigation of Eastside sockeye salmon runs include (1) estimation of stock composition in Eastside commercial sockeye salmon harvests; (2) estimation of total run by river; and (3) comparison of run estimates by river as obtained from scale pattern analyses versus the standard method. For this report, the objectives were specific to the 1994 run.

## METHODS

### *Catch and Escapement Estimation*

Commercial catch statistics used in this report were computed from final operation reports prepared by fish processors (ADF&G 1995). The final ADF&G catch numbers may differ slightly from the numbers used in this report as minor errors are discovered and corrected. Sockeye salmon escapement estimates were based on visual counts made from towers on the banks of Kvichak, Naknek, Egegik, and Ugashik Rivers (ADF&G 1995).

### *Age Composition Estimation*

European notation (Koo 1962) was used to record ages; numerals preceding the decimal refer to number of freshwater annuli, numerals following the decimal refer to number of marine annuli. Total age from time of egg deposition (brood year) is the sum of these numbers plus one. Complete methods and results of sampling Bristol Bay sockeye salmon catches and escapements have been summarized and published in separate reports (Stratton 1991; Stratton and Crawford 1992; Stratton and Crawford 1994). The 1994 sampling efforts will be similarly reported.

### *Catch Composition Estimation*

Linear discriminant function analysis (Fisher 1936) of scale patterns combined with age composition data were used to determine sockeye salmon stock origins in 1994 Eastside harvests.

### **Scale Measurements**

Scale impressions were projected at 100X magnification onto a digitizing tablet using equipment similar to that described by Ryan and Christie (1976). Measurements were taken along the anterior-posterior axis to standardize each scale. This axis is approximately 20° ventral of the long axis and perpendicular to the anterior sculptured field (Figure 3). Distances between growth rings, or circuli, were measured to the nearest 0.01 in, and

number of circuli were counted from (1) center of scale focus to outside edge of first freshwater annulus (first freshwater annular zone), (2) outside edge of first freshwater annulus to outside edge of second freshwater annulus (second freshwater annular zone), (3) outside edge of last freshwater annulus to end of freshwater growth (freshwater plus growth zone), if present, and (4) outside edge of last freshwater circulus to outer edge of first ocean annulus (first marine annular zone). A total of 108 variables were computed from distance measurements and circuli counts (Appendix A.1).

## **Linear Discriminant Analysis**

Escapement samples from Kvichak, Naknek, Egegik, and Ugashik Rivers provided known-origin scales to build linear discriminant functions (LDF). Commercial catch samples provided scales of unknown origin. Escapement samples collected in 1994 were used to classify 1994 commercial catches in age-specific LDF models.

Frequency distribution plots for principal scale variables for each growth zone were examined. Scale variable selection for each discriminant model was made using a forward stepping procedure with partial  $F$ -statistics as criteria for entry or removal of variables (Enslein et al. 1977). This process was continued until model accuracy ceased improving. The equality of variance-covariance matrices were tested using an  $F$ -statistic described by Box (1949). A nearly unbiased estimate of overall classification accuracy for each LDF was determined with a "leaving-one-out procedure" (Lachenbruch 1967).

***Construction of Age-2.2 Models.*** A four-way linear discriminant model was built from scale measurements of age-2.2 sockeye salmon entering Kvichak, Naknek, Egegik, and Ugashik Rivers. Scale samples weighted by run strength through time were used to build the discriminant models. Frequency distribution plots of the size of the first freshwater growth zone for Kvichak and Naknek River stocks were similar (Figure 4). Therefore, Kvichak and Naknek River samples were pooled. A three-way linear discriminant model was built using scales from Egegik, Ugashik, and Kvichak/Naknek Rivers pooled.

***Classification of Age-2.2 Sockeye Salmon.*** The three-way linear discriminant model was used to assign unknown age-2.2 samples to river of origin. Stock proportions in the catches estimated from the model were adjusted for misclassification error with the procedure of Cook and Lord (1978). The adjusted proportions were assumed to reflect true stock composition. A catch sample was reclassified with a model containing fewer stocks if the adjusted proportion  $\leq 0$  for one or more stocks in the three-way model. Variance and 90% confidence intervals around adjusted estimates were computed using the procedure of Pella and Robertson (1979).

The number of age-2.2 sockeye salmon for stock  $i$  in a specific catch stratum, ( $\hat{C}_{i2.2}$ ) was calculated as

$$\hat{C}_{i2.2} = \hat{C} \hat{P}_{2.2} \hat{S}_{i2.2}, \quad (1)$$

where:

$\hat{C}$  = estimated catch of sockeye salmon in a fishery at a given time,

$\hat{P}_{2.2}$  = estimated proportion of age-2.2 sockeye salmon in the catch, and

$\hat{S}_{i2.2}$  = estimated proportion of age-2.2 sockeye salmon of stock  $i$  in the catch.

In this procedure, the variance about catch ( $\hat{C}$ ) is not evaluated. Consequently, a conditional variance of the estimated age-2.2 sockeye salmon catch ( $V[\hat{C}_{i2.2}]$ ) for each stock in a specific fishery at a given time was calculated as described by Goodman (1960). This provided an exact variance of a product conditional on catch:

$$V[\hat{C}_{i2.2}] = C^2 V[\hat{P}_{2.2} \hat{S}_{i2.2}], \quad (2)$$

$$V[\hat{P}_{2.2} \hat{S}_{i2.2}] = V[\hat{P}_{2.2}] \hat{S}_{i2.2}^2 + V[\hat{S}_{i2.2}] \hat{P}_{2.2}^2 - V[\hat{S}_{i2.2}] V[\hat{P}_{2.2}]. \quad (3)$$

Contributions for each stock through time for a specific fishery were added to estimate total contribution to that fishery. The variance of the total contribution was calculated by summing the variances for each period. The contributions by stock to each fishery were added to produce the total contribution by stock to the Eastside age-2.2 sockeye salmon harvest. The variance of the total contribution by stock was calculated as the sum of the variances for each fishery.

### Separation of Kvichak/Naknek Age-2.2 Catch

The age-2.2 sockeye salmon catch proportion classified to the Kvichak/Naknek group was separated to each river based on age composition of the escapements:

where:

$\hat{S}_{p2.2}$  = estimated proportion of age-2.2 sockeye salmon of Kvichak/Naknek pooled stocks in the catch, and

$$\hat{S}_{i2.2} = \hat{S}_{p2.2} \frac{\hat{E}_{i2.2}}{\hat{E}_{p2.2}}, \quad (4)$$

$\hat{E}_{p2.2}$  = estimated number of age-2.2 sockeye salmon in Kvichak and Naknek River pooled escapement.

### Other Age Group Stock Composition Estimation

Estimates of stock composition for sockeye salmon of other ages harvested in Eastside districts were based on scale pattern estimates for age-2.2 sockeye salmon, and the ratio of age-2.2 sockeye salmon to sockeye salmon of other age groups within the respective escapements:

$$\hat{S}_{ij} = \frac{\hat{S}_{i2.2} \frac{\hat{T}_{ij}}{\hat{T}_{i2.2}}}{\sum_{i=1}^n \left( \hat{S}_{i2.2} \frac{\hat{T}_{ij}}{\hat{T}_{i2.2}} \right)}, \quad (5)$$

$$\hat{S}_{i2.2} = \frac{\hat{C}_{i2.2}}{\hat{C}_{2.2}}, \quad (6)$$

$$\hat{T}_{i2.2} = \frac{\hat{E}_{i2.2}}{\hat{E}_i}. \quad (7)$$

where:

$\hat{T}_{ij}$  = estimated proportion of age  $j$  sockeye salmon in stock  $i$  escapement,

$\hat{T}_{i2.2}$  = estimated proportion of age-2.2 sockeye salmon of stock  $i$  in the escapement,

$\hat{S}_{i2.2}$  = estimated proportion of sockeye salmon of stock  $i$  in the catch,

$\hat{C}_{i2.2}$  = estimated number of age-2.2 sockeye salmon of stock  $i$  in the catch,

$\hat{C}_{2.2}$  = estimated number of age-2.2 sockeye salmon in the catch,

$\hat{E}_{i2.2}$  = estimated number of age-2.2 sockeye salmon in stock  $i$  escapement, and

$\hat{E}_i$  = estimated number of stock  $i$  escapement.

### *Run Size Estimation*

Sockeye salmon run size to each river was estimated by adding estimates of catch by stock to escapement estimates. For each river, we computed the percentage (1) harvested within the natal district, (2) harvested outside the natal district, and (3) that escaped. Finally, run size estimates from scale pattern analysis were compared with estimates from the standard method.

## **RESULTS**

### *Catch and Escapement*

Eastside commercial fishermen harvested an estimated 31,430,507 sockeye salmon in 1994 (Table 1). This was 70% greater than the 1984-93 average catch of 22.0 million. The 16,262,625 sockeye salmon caught in Naknek-Kvichak District accounted for 51.7% of the Eastside harvest; commercial harvests in Egegik were 10,798,450 or 34.4% of the Eastside harvest and in Ugashik were 4,369,432 or 13.9%.

Sockeye salmon escapements in 1994 were estimated to be 8,337,840 in Kvichak River, 990,810 in Naknek River, 1,897,932 in Egegik District, and 1,080,858 in Ugashik District (Table 2).

### *Age Composition*

Four age groups made up 98.5% of the Eastside sockeye salmon catch: age-1.2 was 4.7%, age-1.3 was 9.3%, age-2.2 was 59.7%, and age-2.3 was 24.8% (Table 3). Naknek-Kvichak District catch was 75.4% age-2.2. Egegik District catch was 46.5% age-2.3 and 44.4% age-2.2. Ugashik District catch was 46.1% age-2.3, and 39.2% age-2.2.

Age-2.2 was the prominent age class in each of the East Side escapements (Table 4). Kvichak River had the highest percentage of age-2.2 sockeye salmon in its escapement

(84.5%), Ugashik and Egegik Rivers had similar percentages of age-2.2 sockeye salmon in their escapements (66.1% and 62.6%), and Naknek River had the lowest age-2.2 percentage in its escapement (43.5%).

### *Classification Models*

#### **Age 2.2**

Scale characteristics were similar between Kvichak and Naknek samples; the four-way model could not accurately differentiate between these stocks (Tables 5,6; Figure 4). Egegik and Ugashik stocks were more distinct (Figure 5). Therefore, Kvichak and Naknek samples were pooled and compared to Egegik and Ugashik river samples in a three-way model. Scale measurements which provided the most discrimination among age-2.2 sockeye salmon stocks were variables 2, 69, and 51 (Tables 5, 6).

Estimated overall classification accuracy for the three-way model was 75.7% (Table 6). Individual classification accuracy was highest for Ugashik (81.1%) and equal for Egegik and Kvichak/Naknek combined (73.0%). The range of overall classification accuracies was 78.9% to 90.5% for two-way models.

### *Estimates of Catch Composition*

#### **Age 2.2**

Of the estimated 12,237,115 age-2.2 sockeye salmon caught in Naknek-Kvichak District, 83.8% originated within the district and 16.2% from outside the district (Figure 6). Of the estimated 4,794,379 age-2.2 sockeye salmon caught in Egegik District, 88.7% originated from Egegik River and 11.3% were produced outside the district (Figure 7). The estimated catch of age-2.2 sockeye salmon in Ugashik District was 1,713,247; 84.2% originated in Ugashik River and 15.8% from outside the district (Figure 8). The 90% confidence intervals by group are presented in Tables 7 and 8.

## A Ages

The Naknek-Kvichak District harvest was composed of an estimated 12,383,813 sockeye salmon from Kvichak River, 2,973,946 from Naknek River, and 904,866 from Ugashik River (Table 9). No Egegik River stocks were detected in the 1994 Naknek/Kvichak District catch. Estimated stock contributions to the Naknek-Kvichak District total catch were 76.1% for Kvichak, 18.3% for Naknek, 5.6% for Ugashik, and 0.0% for Egegik Rivers (Figure 9).

Of the sockeye salmon caught in Egegik District, an estimated 9,885,494 were from Egegik River, 563,681 from Ugashik River, 296,178 from Kvichak River, and 53,097 from Naknek River (Table 10). Estimated stock contributions to the Egegik District total catch were 91.6% Egegik, 5.2% Ugashik, 2.7% Kvichak, and 0.5% Naknek Rivers (Figure 10).

The Ugashik District catch was composed of an estimated 3,693,941 sockeye salmon from Ugashik River, 357,730 from Egegik River, 250,373 from Kvichak River, and 67,387 from Naknek River (Table 11). Estimated stock contributions to the total Ugashik District sockeye salmon catch were 84.6% from Ugashik River, 8.2% from Egegik River, 5.7% from Kvichak River, and 1.5% from Naknek River (Figure 11).

### *Harvest Distribution*

Of the estimated 12,930,364 Kvichak River sockeye salmon harvested in 1994, 95.8% were taken in Naknek-Kvichak, 2.3% in Egegik, and 1.9% in Ugashik Districts (Table 12). Of the estimated 3,094,430 Naknek River sockeye salmon harvested, 96.1% were taken in Naknek-Kvichak, 2.2% in Ugashik, and 1.7% in Egegik Districts. Of the estimated 10,243,224 Egegik River sockeye salmon harvested, 96.5% were taken in Egegik District and 3.5% in Ugashik Districts. Of the estimated 5,162,489 Ugashik River sockeye salmon harvested, 71.5% were taken in Ugashik, 17.5% in Naknek-Kvichak, and 10.9% in Egegik Districts.

An estimated 667,035 sockeye salmon destined for Kvichak and Naknek Rivers were harvested outside their natal district, whereas Naknek-Kvichak District fishermen caught 904,866 sockeye salmon bound for other districts. Therefore, Naknek-Kvichak District fishermen realized a net gain of 237,831 sockeye salmon. The number of Egegik River sockeye salmon harvested in other districts was 357,730, whereas fishermen in Egegik District caught 912,681 sockeye salmon bound for other districts. Therefore, Egegik District fishermen realized a net gain of 554,951 sockeye salmon. An estimated 1,468,547 Ugashik River sockeye salmon were harvested outside Ugashik District, whereas 675,490 sockeye salmon from other rivers were caught in Ugashik District. Therefore, Ugashik District fishermen had a net loss of 793,057 sockeye salmon.

## *Run By River System*

### **Run Distribution**

The 1994 Kvichak River run was estimated to be 21,268,205 sockeye salmon: 39.2% escaped, 58.2% were harvested in Naknek-Kvichak District, and 2.6% were harvested in other districts (Tables 13, 14; Figure 12). The 1994 Naknek River run was estimated to be 4,085,240 sockeye salmon: 24.3% escaped, 72.8% were harvested in Naknek-Kvichak District, and 2.9% were harvested in other districts (Figure 13). The 1994 Egegik River run was estimated to be 12,141,156 sockeye salmon: 15.6% escaped, 81.4% were harvested in Egegik District, and 3.0% were harvested in other districts (Figure 14). The 1994 Ugashik River run was estimated to be 6,243,346: 17.3% escaped, 59.2% were harvested in Ugashik District, and 23.5% were harvested in other districts (Figure 15).

### **Exploitation Rates**

The Ugashik River run was exploited outside the natal district at a 23.5% rate. Egegik (3.0%), Naknek (2.9%), and Kvichak (2.6%) River runs were exploited outside their natal district at much lower rates. Total exploitation rates based on harvests inside and outside the natal district were 60.8% for Kvichak River, 75.7% for Naknek River, 82.7% for Ugashik River, and 84.4% for Egegik River (Tables 13, 14; Figures 12-15).

### **Comparison of Run Estimates**

Run estimates based on the standard method cannot be directly compared to those based on scale pattern analysis because Branch River stock was not included in linear discriminant models. Therefore, standard run estimates were adjusted so that Naknek-Kvichak District catch was only divided between Kvichak and Naknek Rivers. Kvichak River had the greatest difference in estimated run size between the two methods (Table 15). The standard method estimate for the Kvichak River run was 1,206,693 sockeye salmon more than that obtained from scale pattern analysis. Estimates for Naknek River differed by 968,863, the standard method estimate being lower. Estimates for Ugashik River differed by 793,056, the standard method estimate again being lower. The standard method estimate of run size for Egegik River was 555,226 higher than that obtained from scale pattern analysis. Harvests of stocks outside their natal districts in 1994 resulted in the standard method over-estimating runs to Kvichak (5.4%) and Egegik Rivers (4.4%) and under-estimating runs to Naknek (-31.1%) and Ugashik (-14.6%) Rivers.

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Table 1. Sockeye salmon commercial catch by district and date for the Eastside of Bristol Bay, 1994.

Date	Catch by District			Total
	Naknek-Kvichak	Egegik	Ugashik	
6/06-6/09		15		15
6/13-6/17	1,477	1,658 <sup>b</sup>	1,361	4,496
6/18		340 <sup>b</sup>		340
6/19		343 <sup>b</sup>		343
6/20	4,657	150 <sup>b</sup>	1,652	6,459
6/21	13,268	116 <sup>b</sup>	7,221	20,605
6/22	14,446	170 <sup>b</sup>	5,257	19,873
6/23	3,566	51,501	1,301	56,368
6/24	77	68 <sup>b</sup>	74 <sup>b</sup>	219
6/25	104	123,227		123,331
6/26	288	1,780 <sup>b</sup>	18 <sup>b</sup>	2,086
6/27	402	187,616	3,746	191,764
6/28	620		13,172	13,792
6/29	1,439	153,493	149 <sup>b</sup>	155,081
6/30	2,201	75,968	11,459	89,628
7/01	3,854	417,991	66,759	488,604
7/02	688,791	1,455,265	603 <sup>b</sup>	2,144,659
7/03	673,067	66,049	63,675	802,791
7/04	336,436	372,142	495 <sup>b</sup>	709,073
7/05	778,938	931,942	540 <sup>b</sup>	1,711,420
7/06	1,173,054	881,909	342,018	2,396,981
7/07	1,515,810	1,015,213		2,531,023
7/08	1,891,826	488,088	58,014	2,437,928
7/09	1,303,411	1,048,892	568,607	2,920,910
7/10	1,394,297	538,925	180,064	2,113,286
7/11	956,784	288,773	144,690	1,390,247
7/12	639,084	450,806	158,675	1,248,565
7/13	417,869	162,566	468,165	1,048,600
7/14	686,679	194,574	559,387	1,440,640
7/15	858,190	451,280	251,835	1,561,305
7/16	567,358	241,347	262,929	1,071,634
7/17	907,345	311,538	138,561	1,357,444
7/18	441,660	208,442	142,232	792,334
7/19	156,712	114,887	219,866	491,465
7/20	192,154	166,465	158,481	517,100
7/21	230,980	140,936	50,166	422,082
7/22	194,036	86,806	41,974	322,816
7/23	103,120	34,127	57,074	194,321
7/24-7/30	101,744	122,036	375,606	599,386
8/01-8/05	6,084	9,414	13,015	28,513
8/08-8/12	793	1,212	301	2,306
8/15-8/19	4	321	284	609
8/22-9/08		59	6	65
Total	16,262,625	10,798,450	4,369,432	31,430,507
Percent	51.7	34.4	13.9	100.0

<sup>a</sup> Blanks indicate a district was closed.

<sup>b</sup> ADF&G test-fish catch.

Table 2. Sockeye salmon escapement by river and date for the Eastside of Bristol Bay, 1994.

Date	Kvichak River		Naknek River		Egegik River		Ugashik River	
	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative	Daily	Cumulative
6/20					0	0		
6/21			54	54	0	0		
6/22			1,110	1,164	816	816		
6/23	42	42	132	1,296	264	1,080		
6/24	24	66	600	1,896	4,938	6,018		
6/25	78	144	3,246	5,142	32,052	38,070		
6/26	738	882	1,698	6,840	71,178	109,248		
6/27	6,744	7,626	1,596	8,436	17,364	126,612		
6/28	16,254	23,880	660	9,096	10,890	137,502		
6/29	762	24,642	1,644	10,740	5,712	143,214		
6/30	306	24,948	7,338	18,078	35,088	178,302		
7/01	504	25,452	15,558	33,636	31,410	209,712		
7/02	3,630	29,082	89,922	123,558	4,578	214,290		
7/03	224,208	253,290	188,568	312,126	29,520	243,810	228	228
7/04	1,295,892	1,549,182	61,512	373,638	221,826	465,636	480	708
7/05	1,176,840	2,726,022	37,368	411,006	184,764	650,400	252	960
7/06	790,896	3,516,918	58,176	469,182	178,818	829,218	480	1,440
7/07	754,686	4,271,604	40,092	509,274	180,138	1,009,356	258	1,698
7/08	859,236	5,130,840	113,640	622,914	151,176	1,160,532	120	1,818
7/09	689,646	5,820,486	53,082	675,996	176,892	1,337,424	4,830	6,648
7/10	652,626	6,473,112	43,278	719,274	79,404	1,416,828	101,970	108,618
7/11	584,610	7,057,722	30,180	749,454	106,392	1,523,220	204,678	313,296
7/12	209,814	7,267,536	44,736	794,190	100,008	1,623,228	207,204	520,500
7/13	62,394	7,329,930	17,670	811,860	42,348	1,665,576	50,076	570,576
7/14	52,074	7,382,004	17,880	829,740	43,422	1,708,998	24,162	594,738
7/15	113,484	7,495,488	23,196	852,936	50,148	1,759,146	31,284	626,022
7/16	44,664	7,540,152	30,714	883,650	23,088	1,782,234	63,144	689,166
7/17	90,924	7,631,076	39,672	923,322	21,774	1,804,008	38,490	727,656
7/18	220,458	7,851,534	44,376	967,698	45,642	1,849,650	38,982	766,638
7/19	247,620	8,099,154	11,790	979,488	21,366	1,871,016	56,484	823,122
7/20	69,474	8,168,628	2,868	982,356	11,622	1,882,638	88,884	912,006
7/21	24,558	8,193,186	8,454	990,810	15,294	1,897,932	100,134	1,012,140
7/22	72,264	8,265,450					19,836	1,031,976
7/23	72,390	8,337,840					12,942	1,044,918
7/24							8,454	1,053,372
7/25							6,330	1,059,702
7/26							3,216	1,062,918
7/27							4,668	1,067,586
7/28							13,272	1,080,858
Total	8,337,840		990,810		1,897,932 <sup>a</sup>		1,080,858 <sup>b</sup>	

<sup>a</sup> The USFWS took over counting duties beginning at 0001 hours July 22 and counted through 2400 hours September 11 enumerating 69,798 sockeye salmon. An additional 15 and 30 sockeye salmon were counted in Shosky Creek and King Salmon River, bringing the Egegik District sockeye salmon escapement total to 1,967,730.

<sup>b</sup> An additional 8,885 and 5,325 sockeye salmon were counted in King and Dog Salmon River, bringing the Ugashik District sockeye salmon escapement total to 1,095,068.

Table 3. Sockeye salmon age composition by brood year in the commercial catch for the Eastside of Bristol Bay, 1994.

District	Sample Size		1991		1990		1989			1988			1987		Total	
			0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4		3.3
Naknek-Kvichak	7,445	Numbers	5,171	7,745	988,123	4,944	1,834	2,169,651	12,237,115	35,002	788,870	12,754	9,007	2,409	16,262,625	
		Percent	0.0 <sup>a</sup>	0.1	6.1	0.0	0.0	13.3	75.4	0.0	4.9	0.1	0.1	0.0	100.0	
Egegik	7,702	Numbers	3,494	1,642	288,864	2,384		414,537	4,794,338	2,410	5,007,949	205,321	25,785	51,726	10,798,450	
		Percent	0.0	0.0	2.7	0.0		3.8	44.4	0.0	46.5	1.9	0.2	0.5	100.0	
Ugashik	3,563	Numbers	1,136	12,294	201,811	1,665		336,619	1,713,247	35,281	2,007,124	18,987	18,318	22,950	4,369,432	
		Percent	0.0	0.3	4.6	0.0		7.7	39.2	0.8	46.1	0.4	0.4	0.5	100.0	
Total	18,710	Numbers	4,630	5,171	21,681	1,478,798	8,993	1,834	2,920,807	18,744,700	72,693	7,803,943	237,062	53,110	77,085	31,430,507
		Percent	0.0	0.0	0.1	4.7	0.0	0.0	9.3	59.7	0.2	24.8	0.8	0.2	0.2	100.0

<sup>a</sup> Represented <0.1%

Table 4. Sockeye salmon age composition by brood year in the escapement for the Eastside of Bristol Bay, 1994.

River	Sample Size	1991		1990			1989				1988			1987		Total
		0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	
Kvichak	2,831	Numbers	874	2,622	811,523	79,663	874	252,996	7,037,285		874	151,129				8,337,840
		Percent	0.0 <sup>a</sup>	0.0	9.7	1.0	0.0	3.0	84.5		0.0	1.8				100.0
Naknek	1,414	Numbers	584	7,367	213,077	43,710		140,665	432,677		3,684	146,328		2,718		990,810
		Percent	0.1	0.7	21.5	4.4		14.2	43.5		0.4	14.8		0.3		100.0
Egegik	3,759	Numbers	795	1,038	106,219	62,837		15,059	1,186,797	1,038	1,116	471,801	43,843	4,059	3,330	1,897,932
		Percent	0.0	0.1	5.6	3.3		0.8	62.6	0.1	0.1	24.9	2.3	0.2	0.2	100.0
Ugashik	1,859	Numbers	6,303		136,502	13,071		33,656	714,175			173,655	2,273	1,223		1,080,858
		Percent	0.6		12.6	1.2		3.1	66.1			16.1	0.2	0.1		100.0

<sup>a</sup> Represented <0.1%

Table 5. Mean and standard error of age-2.2 scale variables used to construct linear discriminant functions for the Eastside of Bristol Bay, 1994.

Variable		Kvichak		Naknek		Egegik		Ugashik	
Number	Name	Mean <sup>a</sup>	SE	Mean	SE	Mean	SE	Mean	SE
<u>First Freshwater Annular Zone</u>									
2	S1FW	123.60	1.446	124.36	1.751	153.49	2.677	104.10	1.916
5	C0-C6	94.75	0.777	90.75	0.808	98.96	0.754	83.92	0.841
18	C0-C6/S1FW	0.77	0.008	0.74	0.008	0.66	0.010	0.81	0.010
23	C4-C6/S1FW	0.18	0.002	0.17	0.003	0.15	0.002	0.17	0.003
25	(C(NC-4)-E1FW)/S1FW	0.30	0.006	0.28	0.006	0.24	0.005	0.33	0.008
27	S1FW/NC1FW	13.40	0.117	12.56	0.108	13.10	0.100	12.35	0.128
<u>Second Freshwater Annular Zone</u>									
35	E1FW-C6	66.52	0.715	67.34	0.688	66.35	0.732	70.64	0.651
44	C2-E2FW	67.03	1.211	80.29	1.382	80.50	1.493	86.66	1.384
46	(E1FW-C2)/S2FW	0.27	0.005	0.23	0.005	0.23	0.004	0.22	0.004
51	C2-C6/S2FW	0.47	0.006	0.43	0.006	0.43	0.007	0.43	0.006
59	MAX DIST	14.39	0.229	14.19	0.200	14.09	0.174	14.88	0.189
60	MAX DIST/S2FW	0.16	0.003	0.14	0.002	0.14	0.002	0.14	0.002
<u>Freshwater and Plus Growth Zones</u>									
64	S1FW+S2FW	214.53	1.648	228.26	1.848	257.11	2.880	214.53	2.076
65	NC1FW+NC2FW+NCPG	18.82	0.160	20.89	0.168	22.58	0.226	19.32	0.184
66	S1FW+S2FW+SPGZ	223.11	1.678	238.13	1.853	266.26	2.844	222.19	2.070
67	S1FW/S1FW+S2FW+SPGZ	0.55	0.005	0.52	0.006	0.57	0.006	0.47	0.006
69	S2FW/S1FW+S2FW+SPGZ	0.41	0.005	0.44	0.005	0.39	0.006	0.50	0.006
<u>First Marine Annular Zone</u>									
71	S10Z	394.17	3.312	385.96	3.394	371.99	3.244	399.55	3.398
76	EFW-C15	294.10	2.256	297.25	2.389	286.75	2.049	291.89	2.169
85	C(NC-6)-E10Z	78.02	0.964	82.35	1.241	77.21	1.021	81.57	0.968

<sup>a</sup> Scale images projected at 100x magnification and measured at 0.01 in; therefore, variable means are in 0.0001 in.

Table 6. Classification matrices from discriminant analyses of age-2.2 sockeye salmon sampled from Kvichak, Naknek, Egegik, and Ugashik Rivers, 1994.

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)			
		<u>Kvichak</u>	<u>Naknek</u>	<u>Egegik</u>	<u>Ugashik</u>
Kvichak	100	<u>69.0</u>	20.0	4.0	7.0
Naknek	100	17.0	<u>56.0</u>	11.0	16.0
Egegik	200	13.0	16.0	<u>67.0</u>	4.0
Ugashik	200	12.5	11.0	3.0	<u>73.5</u>

Mean classification accuracy = 66.4%  
 Variables used: 2, 69, 27, 58, 105  
 Box's Test of Variance-Covariance Equality<sup>a</sup>  
 F-statistic = 3.48  
 df = 45, 448, 114  
 P = 0.000

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)		
		<u>Kvichak/Naknek<sup>b</sup></u>	<u>Egegik</u>	<u>Ugashik</u>
Kvichak/Naknek	200	<u>73.0</u>	11.5	15.5
Egegik	200	21.5	<u>73.0</u>	5.5
Ugashik	196	14.3	4.6	<u>81.1</u>

Mean classification accuracy = 75.7%  
 Variables used: 2, 69, 51, 27, 76, 44, 60, 18, 25, 23  
 Box's Test of Variance-Covariance Equality  
 F-statistic = 6.50  
 df = 110, 951, 172  
 P = 0.000

-Continued-

Table 6. (p 2 of 3).

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)	
		<u>Kvichak/Naknek</u>	<u>Egegik</u>
Kvichak/Naknek	200	<u>84.5</u>	15.5
Egegik	200	23.5	<u>76.5</u>

Mean classification accuracy = 80.5%  
 Variables used: 64, 76  
 Box's Test of Variance-Covariance Equality  
 F-statistic = 13.67  
 df = 3, 9,999,999  
 P = 0.000

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)	
		<u>Kvichak/Naknek</u>	<u>Uqashik</u>
Kvichak/Naknek	200	<u>82.5</u>	17.5
Uqashik	200	17.5	<u>82.5</u>

Mean classification accuracy = 82.5%  
 Variables used: 69, 51, 27, 46  
 Box's Test of Variance-Covariance Equality  
 F-statistic = 1.90  
 df = 10, 757,309  
 P = 0.030

-Continued-

Table 6. (p 3 of 3).

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)	
		<u>Kvichak</u>	<u>Naknek</u>
Kvichak	200	<u>79.5</u>	20.5
Naknek	198	21.7	<u>78.3</u>

Mean classification accuracy = 78.9%  
 Variables used: 65, 5, 85  
 Box's Test of Variance-Covariance Equality  
 F-statistic = 1.29  
 df = 15, 631,253  
 P = 0.200

Actual Group Of Origin	Sample Size	Classified Group of Origin (%)	
		<u>Egeqik</u>	<u>Ugashik</u>
Egegik	200	<u>91.5</u>	8.5
Ugashik	200	9.7	<u>90.3</u>

Mean classification accuracy = 90.5%  
 Variables used: 2, 35, 5, 66, 18, 27, 59, 71  
 Box's Test of Variance-Covariance Equality  
 F-statistic = 13.59  
 df = 36, 521,907  
 P = 0.010

<sup>a</sup> The equality of the variance-covariance matrices tested with a procedure described by Box (1949).

<sup>b</sup> Kvichak and Naknek Rivers combined.

Table 7. Run composition estimates and 90% confidence intervals (C.I.) calculated from scale pattern analyses of age-2.2 sockeye salmon by fishery and date for the Eastside of Bristol Bay, 1994.

District	Date	Kvichak/Naknek		Egegik		Ugashik	
		Percent	90% C.I.	Percent	90% C.I.	Percent	90% C.I.
Naknek-Kvichak	6/13-6/30	100.0	(87.5,100)	0.0	Trace <sup>a</sup>	0.0	Trace
	7/01-7/02	94.6	(82.5,100)	0.0	Trace	5.4	(0.0,17.5)
	7/03	94.6	(82.5,100)	0.0	Trace	5.4	(0.0,17.5)
	7/04	100.0	(91.3,100)	0.0	Trace	0.0	Trace
	7/05	100.0	(85.8,100)	0.0	Trace	0.0	Trace
	7/06-7/07	96.2	(84.1,100)	0.0	Trace	3.8	(0.0,15.9)
	7/08	91.5	(79.2,100)	0.0	Trace	8.5	(0.0,20.8)
	7/09	97.7	(85.7,100)	0.0	Trace	2.3	(0.0,14.3)
	7/10	97.7	(85.7,100)	0.0	Trace	2.3	(0.0,14.3)
	7/11	100.0	(97.6,100)	0.0	Trace	0.0	Trace
	7/12-7/14	88.5	(75.9,100)	0.0	Trace	11.5	(0.0,24.1)
	7/15	100.0	(99.0,100)	0.0	Trace	0.0	Trace
	7/16-7/17	92.1	(81.4,100)	0.0	Trace	7.9	(0.0,18.6)
	7/18-7/19	92.1	(81.4,100)	0.0	Trace	7.9	(0.0,18.6)
7/20-8/05	92.1	(81.4,100)	0.0	Trace	7.9	(0.0,18.6)	
Egegik	6/06-6/23	32.1	(10.6,53.6)	67.5	(48.5,86.6)	0.4	(0.0,10.3)
	6/24-6/25	32.1	(10.6,53.6)	67.5	(48.5,86.6)	0.4	(0.0,10.3)
	6/26-6/27	0.0	Trace	100.0	(82.7,100)	0.0	Trace
	6/28-6/29	0.0	Trace	100.0	(82.7,100)	0.0	Trace
	6/30-7/01	7.7	(0.0,28.0)	86.1	(67.0,100)	6.3	(0.0,16.7)
	7/02	12.3	(0.0,26.7)	87.7	(73.3,100)	0.0	Trace
	7/03-7/04	12.3	(0.0,26.7)	87.7	(73.3,100)	0.0	Trace
	7/05	17.4	(0.0,38.1)	76.3	(57.3,95.3)	6.3	(0.0,17.1)
	7/06-7/07	0.0	Trace	88.4	(79.9,96.9)	11.6	(3.1,20.1)
	7/08-7/09	0.0	Trace	88.4	(79.9,96.9)	11.6	(3.1,20.1)
	7/10-7/11	0.0	Trace	100.0	(84.2,100)	0.0	Trace
	7/12	0.0	Trace	100.0	(84.2,100)	0.0	Trace
	7/13-7/14	0.0	Trace	87.2	(78.5,95.8)	12.8	(4.2,21.5)
	7/15-7/17	0.0	Trace	87.2	(78.5,95.8)	12.8	(4.2,21.5)
7/18-8/26	7.4	(0.0,21.6)	92.6	(78.4,100)	0.0	Trace	
Ugashik	6/13-7/01	21.7	(3.1,40.2)	27.6	(12.6,42.7)	50.7	(34.4,67.0)
	7/02-7/03	12.4	(0.0,29.9)	19.8	(6.2,33.4)	67.8	(51.3,84.3)
	7/04-7/06	12.4	(0.0,29.9)	19.8	(6.2,33.4)	67.8	(51.3,84.3)
	7/07-7/09	14.6	(1.9,27.3)	0.0	Trace	85.4	(72.7,98.1)
	7/10-7/12	17.5	(4.1,30.9)	0.0	Trace	82.5	(69.1,95.9)
	7/13	10.4	(0.0,27.6)	8.3	(0.0,19.4)	81.3	(64.8,97.8)
	7/14	9.7	(0.0,27.0)	5.7	(0.0,16.3)	84.6	(68.1,100)
	7/15-9/01	7.1	(0.0,25.1)	4.6	(0.0,15.4)	88.3	(71.0,100)

<sup>a</sup> Trace was recorded for systems that were originally included in the model used to classify the catch, the point estimates were zero, and the upper bounds of the 90% C.I. were greater than zero.

Table 8. Estimated harvest of age-2.2 sockeye salmon and 90% confidence intervals (C.I.), Eastside Bristol Bay, 1994.

District	River	Percent	Number	Standard Error	90% C.I.	
					Lower	Upper
Naknek-Kvichak	Kvi/Nak <sup>a</sup>	94.8	11,605,608	295,660	10,970,799	12,240,416
	Egegik	0.0	0	0	0	0
	Ugashik	5.2	631,507	259,455	74,434	1,188,581
	Total	100.0	12,237,115			
Egegik	Kvi/Nak	4.9	236,149	542,377	0	1,400,683
	Egegik	88.7	4,254,228	924,009	2,270,297	6,238,159
	Ugashik	6.4	304,002	643,931	0	1,686,581
	Total	100.0	4,794,379			
Ugashik	Kvi/Nak	10.4	178,865	71,341	25,689	332,041
	Egegik	5.4	93,244	41,122	4,951	181,536
	Ugashik	84.2	1,441,138	84,484	1,259,743	1,622,533
	Total	100.0	1,713,247			
Total Eastside	Nak/Kvi	64.1	12,020,622	587,667	10,758,848	13,282,396
	Egegik	23.2	4,347,471	812,422	2,603,127	6,091,815
	Ugashik	12.7	2,376,648	635,192	1,012,832	3,740,463
	Total	100.0	18,744,741			

Table 9. Run composition estimates of sockeye salmon catch by age group and date, Naknek-Kvichak District, 1994.

Date	System	1.2		1.3		2.2		1.4		2.3		3.2		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
6/13 <sup>b</sup>	Kvichak	93.1	3,170	86.5	9,714	98.3	22,083	0.0	0	78.6	4,013	0.0	0	100.0	340	92.4	39,320
thru	Naknek	6.9	234	13.5	1,517	1.7	382	0.0	0	21.4	1,092	0.0	0	0.0	0	7.6	3,225
6/30	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	3,404	100.0	11,231	100.0	22,465	0.0	0	100.0	5,105	0.0	0	100.0	340	100.0	42,545
7/01 <sup>a</sup>	Kvichak	62.3	25,434	46.8	46,517	84.7	395,433	9.1	117	28.1	21,858	0.0	0	36.6	1,870	70.9	491,228
thru	Naknek	31.1	12,698	49.3	49,099	9.9	46,219	90.9	1,159	51.6	40,189	0.0	0	55.7	2,845	22.0	152,210
7/02	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	6.6	2,687	3.9	3,880	5.4	25,211	0.0	0	20.3	15,764	100.0	1,276	7.6	389	7.1	49,207
	Total	100.0	40,819	100.0	99,496	100.0	466,863	100.0	1,276	100.0	77,811	100.0	1,276	100.0	5,104	100.0	692,645
7/03 <sup>a</sup>	Kvichak	62.3	27,642	46.8	42,075	84.7	376,838	9.1	464	28.1	24,925	0.0	0	0.0	0	70.1	471,944
	Naknek	31.1	13,801	49.3	44,411	9.9	44,046	90.9	4,606	51.6	45,828	0.0	0	0.0	0	22.7	152,692
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	6.6	2,921	3.9	3,510	5.4	24,025	0.0	0	20.3	17,975	100.0	0	0.0	0	7.2	48,431
	Total	100.0	44,364	100.0	89,996	100.0	444,909	100.0	5,070	100.0	88,728	100.0	0	0.0	0	100.0	673,067
7/04	Kvichak	100.0	30,866	100.0	37,656	100.0	253,716	100.0	1,235	100.0	12,346	0.0	0	100.0	617	100.0	336,436
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	30,866	100.0	37,656	100.0	253,716	100.0	1,235	100.0	12,346	0.0	0	100.0	617	100.0	336,436
7/05 <sup>a</sup>	Kvichak	100.0	47,719	100.0	115,086	100.0	538,942	100.0	2,806	100.0	74,385	0.0	0	0.0	0	100.0	778,938
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	47,719	100.0	115,086	100.0	538,942	100.0	2,806	100.0	74,385	0.0	0	0.0	0	100.0	778,938

23

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Table 9. (p 2 of 4).

Date	System	1.2		1.3		2.2		1.4		2.3		3.2		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
7/06 thru 7/07	Kvichak	93.9	145,594	95.1	422,844	96.2	1,930,066	0.0	0	69.1	53,610	0.0	0	22.3	1,155	95.0	2,553,270
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	6.1	9,532	4.9	21,853	3.8	76,240	0.0	0	30.9	23,954	0.0	0	77.7	4,016	5.0	135,594
	Total	100.0	155,126	100.0	444,697	100.0	2,006,306	0.0	0	100.0	77,564	0.0	0	100.0	5,171	100.0	2,688,864
7/08	Kvichak	53.4	39,033	38.3	61,647	78.7	1,262,468	6.7	658	20.9	9,180	0.0	0	0.0	0	72.6	1,372,985
	Naknek	37.1	27,117	56.3	90,545	12.8	205,331	93.3	9,094	53.5	23,486	0.0	0	0.0	0	18.8	355,574
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	9.6	6,987	5.4	8,711	8.5	136,353	0.0	0	25.6	11,215	0.0	0	0.0	0	8.6	163,267
		Total	100.0	73,137	100.0	160,903	100.0	1,604,152	100.0	9,752	100.0	43,882	0.0	0	0.0	0	100.0
7/09	Kvichak	55.5	46,783	37.9	76,785	83.0	793,877	6.2	450	24.4	11,166	0.0	0	41.5	1,999	71.4	931,061
	Naknek	42.0	35,392	60.7	122,809	14.7	140,602	93.8	6,778	68.0	31,109	0.0	0	55.3	2,666	26.0	339,356
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	2.5	2,149	1.4	2,784	2.3	21,999	0.0	0	7.6	3,500	100.0	2,409	3.2	153	2.5	32,994
		Total	100.0	84,324	100.0	202,378	100.0	956,478	100.0	7,228	100.0	45,776	100.0	2,409	100.0	4,818	100.0
7/10	Kvichak	55.5	57,200	37.9	65,196	83.0	874,062	6.2	153	24.4	15,569	0.0	0	0.0	0	72.6	1,012,179
	Naknek	42.0	43,272	60.7	104,273	14.7	154,804	93.8	2,302	68.0	43,374	0.0	0	0.0	0	25.0	348,026
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	2.5	2,627	1.4	2,364	2.3	24,221	0.0	0	7.6	4,880	100.0	0	0.0	0	2.4	34,092
		Total	100.0	103,099	100.0	171,833	100.0	1,053,087	100.0	2,455	100.0	63,823	100.0	0	0.0	0	100.0
7/11 <sup>d</sup>	Kvichak	62.8	46,017	44.3	40,265	87.8	686,761	0.0	0	31.4	3,288	0.0	0	0.0	0	81.1	776,332
	Naknek	37.2	27,313	55.7	50,525	12.2	95,427	0.0	0	68.6	7,188	0.0	0	0.0	0	18.9	180,452
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
		Total	100.0	73,330	100.0	90,790	100.0	782,188	0.0	0	100.0	10,476	0.0	0	0.0	0	100.0

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Table 9. (p 4 of 4).

Date	System	1.2		1.3		2.2		1.4		2.3		3.2		Other		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
Total	Kvichak	63.6	628,155	53.8	1,166,610	83.8	10,254,398	23.4	8,179	39.1	308,832	20.5	2,616	48.2	15,022	76.1	12,383,813
	Naknek	30.8	304,279	42.7	926,434	11.0	1,351,209	76.6	26,822	44.8	353,474	4.5	574	35.9	11,153	18.3	2,973,946
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	5.6	55,689	3.5	76,607	5.2	631,507	0.0	0	16.0	126,564	75.0	9,564	15.9	4,935	5.6	904,866
	Total	100.0	988,123	100.0	2,169,651	100.0	12,237,115	100.0	35,002	100.0	788,870	100.0	12,754	100.0	31,110	100.0	16,262,625

<sup>a</sup> Other includes ages-1.1, -0.3, -2.1, -0.4, -2.4, and -3.3.

<sup>b</sup> Scale samples were collected on 22 June. Stock composition estimates calculated for this date were applied to 13 through 30 June catches.

<sup>c</sup> Naknek Section only openings.

<sup>d</sup> Kvichak Section only openings.

<sup>e</sup> Scale samples were collected on 20 July. Stock composition estimates calculated for these dates were applied to 20 July through 15 August catches.

Table 10. Run composition estimates of sockeye salmon catch by age group and date, Egegik District, 1994.

Date	System	1.2		1.3		2.2		2.3		3.2		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
6/06'	Kvichak	33.1	1,329	42.1	1,029	30.2	6,073	2.3	625	0.0	0	0.0	0	50.0	287	17.2	9,342
thru	Naknek	8.9	357	23.9	584	1.9	382	2.3	618	0.0	0	0.0	0	2.5	14	3.6	1,956
6/23	Egegik	57.3	2,306	33.2	811	67.5	13,573	95.1	25,811	0.0	0	0.0	0	47.4	272	78.8	42,773
	Ugashik	0.7	29	0.7	18	0.4	80	0.3	94	0.0	0	0.0	0	0.1	1	0.4	222
	Total	100.0	4,022	100.0	2,442	100.0	20,108	100.0	27,147	0.0	0	0.0	0	100.0	574	100.0	54,293
6/24	Kvichak	33.1	1,795	42.1	2,422	30.2	14,952	2.3	1,418	0.0	0	0.0	0	66.7	638	17.2	21,225
thru	Naknek	8.9	482	23.9	1,376	1.9	941	2.3	1,404	0.0	0	0.0	0	1.6	16	3.4	4,218
6/25	Egegik	57.3	3,114	33.2	1,909	67.5	33,420	95.1	58,613	0.0	0	0.0	0	31.6	302	79.0	97,359
	Ugashik	0.7	39	0.7	42	0.4	198	0.3	213	0.0	0	0.0	0	0.1	1	0.4	493
	Total	100.0	5,430	100.0	5,749	100.0	49,511	100.0	61,648	0.0	0	0.0	0	100.0	957	100.0	123,295
6/26	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
thru	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
6/27	Egegik	100.0	9,426	100.0	5,998	100.0	67,704	100.0	99,842	100.0	2,571	100.0	428	100.0	4,283	100.0	189,396
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	9,426	100.0	5,998	100.0	67,704	100.0	99,842	100.0	2,571	100.0	428	100.0	4,283	100.0	189,396
6/28	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
thru	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
6/29	Egegik	100.0	9,294	100.0	4,224	100.0	62,242	100.0	75,197	100.0	845	100.0	1,127	100.0	1,973	100.0	153,493
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	9,294	100.0	4,224	100.0	62,242	100.0	75,197	100.0	845	100.0	1,127	100.0	1,973	100.0	153,493
6/30	Kvichak	8.5	1,794	14.7	2,414	7.3	15,112	0.4	1,062	0.0	0	0.0	0	0.0	0	4.1	20,382
thru	Naknek	2.0	420	7.3	1,195	0.4	828	0.4	915	0.0	0	0.0	0	0.0	0	0.7	3,358
7/01	Egegik	77.4	16,404	61.3	10,034	86.0	178,036	94.9	231,269	99.4	5,741	0.0	0	0.0	0	89.4	441,483
	Ugashik	12.1	2,566	16.7	2,726	6.3	13,042	4.3	10,365	0.6	36	0.0	0	0.0	0	5.8	28,736
	Total	100.0	21,183	100.0	16,369	100.0	207,019	100.0	243,611	100.0	5,777	0.0	0	0.0	0	100.0	493,959

27

-Continued-

Table 10. (p 2 of 4).

Date	System	1.2		1.3		2.2		2.3		3.2		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
7/02	Kvichak	14.0	7,252	23.7	13,562	11.6	68,471	0.7	5,124	0.0	0	0.0	0	0.0	0	6.5	94,409
	Naknek	3.6	1,869	12.9	7,390	0.7	4,132	0.7	4,864	0.0	0	0.0	0	0.7	79	1.3	18,335
	Egegik	82.4	42,560	63.3	36,170	87.7	517,664	98.6	716,284	100.0	19,041	100.0	5,440	99.3	10,801	92.3	1,342,521
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	51,682	100.0	57,122	100.0	590,267	100.0	726,273	100.0	19,041	100.0	5,440	100.0	10,880	100.0	1,455,265
7/03 thru	Kvichak	14.0	1,456	23.7	1,326	11.6	21,295	0.7	1,566	0.0	0	0.0	0	0.9	43	5.9	25,676
	Naknek	3.6	375	12.9	723	0.7	1,285	0.7	1,486	0.0	0	0.0	0	3.3	157	0.9	3,971
7/04	Egegik	82.4	8,545	63.3	3,538	87.7	160,999	98.6	218,837	100.0	12,770	0.0	0	95.8	4,588	93.2	408,544
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	10,376	100.0	5,587	100.0	183,579	100.0	221,889	100.0	12,770	0.0	0	100.0	4,788	100.0	438,191
7/05	Kvichak	18.2	6,555	27.1	8,377	16.4	68,806	1.1	4,675	0.0	0	0.0	0	0.0	0	9.5	88,413
	Naknek	4.7	1,707	14.9	4,613	1.0	4,195	1.0	4,484	0.0	0	0.0	0	1.1	39	1.6	15,039
	Egegik	65.6	23,672	44.4	13,749	76.3	320,115	93.2	402,110	99.3	10,243	100.0	1,719	96.9	3,332	83.0	773,221
	Ugashik	11.6	4,173	13.6	4,210	6.3	26,432	4.7	20,314	0.7	73	0.0	0	1.9	67	5.9	55,269
	Total	100.0	36,108	100.0	30,950	100.0	19,548	100.0	431,582	100.0	10,316	100.0	1,719	100.0	3,438	100.0	931,942
7/06 thru	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
7/07	Egegik	78.1	49,124	67.3	63,452	88.4	713,443	92.6	831,171	98.9	20,727	100.0	3,494	96.9	13,546	89.2	1,691,463
	Ugashik	21.9	13,764	32.7	30,880	11.6	93,619	7.4	66,730	1.1	236	0.0	0	3.1	430	10.8	205,659
	Total	100.0	62,888	100.0	94,332	100.0	807,062	100.0	897,901	100.0	20,963	100.0	3,494	100.0	13,976	100.0	1,897,122
7/08 thru	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
7/09	Egegik	78.1	26,484	67.3	26,607	88.4	736,790	92.6	528,302	98.9	44,696	100.0	14,126	100.0	14,126	89.6	1,377,005
	Ugashik	21.9	7,420	32.7	12,948	11.6	96,683	7.4	42,415	1.1	509	0.0	0	0.0	0	10.4	159,975
	Total	100.0	33,904	100.0	39,555	100.0	833,473	100.0	570,717	100.0	45,205	100.0	14,126	100.0	14,126	100.0	1,536,980

28

-Continued-

Table 10. (p 3 of 4).

Date	System	1.2		1.3		2.2		2.3		3.2		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
7/10	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
thru	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
7/11	Egegik	100.0	20,838	100.0	32,413	100.0	362,333	100.0	386,645	100.0	20,837	100.0	2,316	100.0	4,632	100.0	827,698
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	20,838	100.0	32,413	100.0	362,333	100.0	386,645	100.0	20,837	100.0	2,316	100.0	4,632	100.0	827,698
7/12	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Egegik	100.0	5,409	100.0	18,032	100.0	212,779	100.0	202,862	100.0	8,114	100.0	1,803	100.0	4,509	100.0	450,803
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	5,409	100.0	18,032	100.0	212,779	100.0	202,862	100.0	8,114	100.0	1,803	100.0	4,509	100.0	450,803
7/13	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	50.0	717	0.2	717
thru	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
7/14	Egegik	76.1	9,829	64.8	17,646	87.2	135,701	91.8	144,113	98.7	2,833	100.0	717	50.0	717	87.0	310,838
	Ugashik	23.9	3,080	35.2	9,606	12.8	19,919	8.2	12,943	1.3	36	0.0	0	0.0	0	12.8	45,585
	Total	100.0	12,909	100.0	27,252	100.0	155,620	100.0	157,056	100.0	2,869	100.0	717	100.0	1,434	100.0	357,140
7/15	Kvichak	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
thru	Naknek	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
7/17	Egegik	76.1	0	64.8	24,960	87.2	368,068	100.0	499,065	100.0	30,837	100.0	11,565	100.0	13,492	93.3	936,421
	Ugashik	23.9	0	35.2	13,588	12.8	54,028	0.0	126	0.0	1	0.0	0	0.0	0	6.7	67,744
	Total	100.0	0	100.0	38,548	100.0	422,096	100.0	499,191	100.0	30,838	100.0	11,565	100.0	13,492	100.0	1,004,165
7/18 <sup>b</sup>	Kvichak	8.7	469	16.2	5,824	7.0	28,073	0.4	1,648	0.0	0	0.0	0	0.0	0	4.1	36,014
thru	Naknek	2.1	114	8.3	3,005	0.4	1,604	0.4	1,482	0.0	0	0.0	0	0.1	14	0.7	6,220
8/26	Egegik	89.2	4,814	75.5	27,179	92.6	371,361	99.2	403,128	100.0	25,214	100.0	9,024	99.9	10,779	95.2	842,475
	Ugashik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Total	100.0	5,397	100.0	36,008	100.0	401,038	100.0	406,258	100.0	25,214	100.0	9,024	100.0	10,793	100.0	884,708

29

-Continued-

Table 10. (p 4 of 4).

Date	System	1.2		1.3		2.2		2.3		3.2		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
Total	Kvichak	7.1	20,650	8.4	34,954	4.7	222,782	0.3	16,118	0.0	0	0.0	0	1.9	1,685	2.7	296,178
	Naknek	1.8	5,326	4.6	18,886	0.3	13,367	0.3	15,253	0.0	0	0.0	0	0.4	319	0.5	53,097
	Egegik	80.3	231,818	69.2	286,723	88.7	4,254,228	96.3	4,823,249	99.6	204,468	100.0	51,759	97.1	87,352	91.6	9,885,494
	Ugashik	10.8	31,072	17.9	74,018	6.3	304,002	3.1	153,199	0.4	892	0.0	0	0.6	499	5.2	563,681
	Total	100.0	288,866	100.0	414,581	100.0	4,794,379	100.0	5,007,819	100.0	205,360	100.0	51,759	100.0	89,855	100.0	10,798,450

<sup>a</sup> Other includes age-0.2, -0.3, -2.1, -1.4, and -2.4.

<sup>b</sup> Scale samples were collected 23 June. Stock composition estimates calculated for that date were applied to 6 through 23 June catches.

<sup>c</sup> Scale samples were collected on 18 and 20 July. Stock composition estimates calculated for these dates were applied to 18 July through 26 August catches.

Table 11. Run composition estimates of sockeye salmon catch by age group and date, Ugashik District, 1994.

Date	System	1.2		1.3		2.2		1.4		2.3		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
6/13 <sup>b</sup> thru 7/01	Kvichak	15.5	2,248	18.9	2,422	20.4	6,157	5.4	22	1.8	910	0.0	0	77.7	2,857	13.0	14,615
	Naknek	4.2	612	10.8	1,394	1.3	392	29.1	119	1.8	912	0.0	0	0.7	25	3.1	3,455
	Egegik	16.3	2,361	9.0	1,156	27.6	8,331	65.5	267	45.4	22,764	100.0	408	17.5	641	32.0	35,927
	Ugashik	63.9	9,259	61.3	7,876	50.7	15,303	0.0	0	51.0	25,584	0.0	0	4.1	149	51.9	58,172
	Total	100.0	14,480	100.0	12,848	100.0	30,183	100.0	408	100.0	50,170	100.0	408	100.0	3,672	100.0	112,169
7/02 thru 7/03	Kvichak	8.2	802	10.3	804	11.7	2,181	4.7	0	1.0	261	0.0	0	61.9	1,430	8.5	5,479
	Naknek	2.1	205	5.6	434	0.7	131	23.9	0	1.0	245	0.0	0	0.8	18	1.6	1,033
	Egegik	10.8	1,054	6.1	480	19.8	3,692	71.5	0	31.7	8,155	100.0	0	17.5	404	21.4	13,784
	Ugashik	78.9	7,705	78.0	6,095	67.8	12,641	0.0	0	66.4	17,084	0.0	0	19.8	458	68.4	43,983
	Total	100.0	9,766	100.0	7,813	100.0	18,644	100.0	0	100.0	25,745	100.0	0	100.0	2,310	100.0	64,278
7/04 thru 7/06	Kvichak	8.2	3,063	10.3	3,357	11.7	10,143	4.7	87	1.0	1,755	0.0	0	36.4	3,729	6.5	22,134
	Naknek	2.1	783	5.6	1,814	0.7	607	23.9	445	1.0	1,652	0.0	0	1.6	167	1.6	5,468
	Egegik	10.8	4,024	6.1	2,004	19.8	17,166	71.5	1,332	31.7	54,922	100.0	932	31.9	3,271	24.4	83,651
	Ugashik	78.9	29,419	78.0	25,452	67.8	58,779	0.0	0	66.4	115,064	0.0	0	30.1	3,086	67.6	231,800
	Total	100.0	37,288	100.0	32,627	100.0	86,695	100.0	1,864	100.0	173,394	100.0	932	100.0	10,253	100.0	343,053
7/07 thru 7/09	Kvichak	8.7	3,910	10.4	6,530	13.8	31,036	16.9	654	1.4	3,936	13.8	214	28.6	1,551	7.6	47,831
	Naknek	2.2	968	5.4	3,418	0.8	1,799	83.1	3,224	1.3	3,589	0.8	12	1.9	104	2.1	13,115
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	89.2	40,102	84.2	52,870	85.4	192,065	0.0	0	97.3	275,538	85.4	1,326	85.5	3,774	90.3	565,675
	Total	100.0	44,980	100.0	62,818	100.0	224,900	100.0	3,878	100.0	283,064	100.0	1,552	100.0	5,429	100.0	626,621
7/10 thru 7/12	Kvichak	10.5	1,870	12.4	6,436	16.5	28,225	16.3	484	1.7	3,991	0.0	0	27.6	1,641	8.8	42,647
	Naknek	2.7	484	6.8	3,522	1.0	1,711	83.7	2,491	1.6	3,805	0.0	0	3.6	211	2.5	12,225
	Egegik	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
	Ugashik	86.8	15,495	80.9	42,102	82.5	141,125	0.0	0	96.7	225,739	0.0	0	68.9	4,096	88.6	428,557
	Total	100.0	17,849	100.0	52,061	100.0	171,060	100.0	2,975	100.0	233,535	0.0	0	100.0	5,949	100.0	483,429

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Table 11. (p 2 of 2).

Date	System	1.2		1.3		2.2		1.4		2.3		3.3		Other <sup>a</sup>		Total	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
7/13	Kvichak	6.4	935	7.9	3,367	9.8	18,605	7.2	254	0.9	1,898	0.0	0	0.0	0	5.4	25,058
	Naknek	1.7	244	4.4	1,861	0.6	1,139	37.6	1,323	0.9	1,828	0.0	0	0.3	13	1.4	6,409
	Egegik	4.2	615	2.4	1,006	8.3	15,757	55.1	1,938	14.0	29,715	100.0	1,172	49.4	2,315	11.2	52,518
	Ugashik	87.8	12,854	85.4	36,540	81.3	154,343	0.0	0	84.2	178,082	0.0	0	50.2	2,360	82.1	384,180
	Total	100.0	14,648	100.0	42,774	100.0	189,844	100.0	3,516	100.0	211,523	100.0	1,172	100.0	4,688	100.0	468,165
7/14	Kvichak	5.8	1,457	7.2	2,686	9.1	22,093	8.2	307	0.8	2,044	0.0	0	16.7	1,251	5.3	29,837
	Naknek	1.6	410	4.3	1,599	0.6	1,457	45.8	1,719	0.9	2,120	0.0	0	1.9	142	1.3	7,446
	Egegik	2.8	708	1.6	593	5.7	13,838	46.1	1,729	9.7	23,670	100.0	0	9.7	726	7.4	41,265
	Ugashik	89.7	22,452	87.0	32,665	84.6	205,389	0.0	0	88.5	214,943	0.0	0	71.7	5,389	86.0	480,838
	Total	100.0	25,028	100.0	37,543	100.0	242,777	100.0	3,754	100.0	242,777	100.0	0	100.0	7,508	100.0	559,387
7/15 <sup>c</sup> thru 9/01	Kvichak	4.2	1,598	5.3	4,633	6.7	50,193	8.2	1,541	0.6	4,807	0.0	0	0.0	0	3.7	62,772
	Naknek	1.1	408	2.8	2,498	0.4	2,997	41.4	7,821	0.6	4,514	0.0	0	0.0	0	1.1	18,237
	Egegik	2.3	852	1.3	1,122	4.6	34,461	50.4	9,524	7.8	61,015	100.0	18,886	37.5	4,725	7.6	130,584
	Ugashik	92.4	34,914	90.6	79,882	88.3	661,494	0.0	0	91.1	716,580	0.0	0	62.5	7,866	87.6	1,500,737
	Total	100.0	37,772	100.0	88,135	100.0	749,144	100.0	18,886	100.0	786,916	100.0	18,886	100.0	12,591	100.0	1,712,330
Total	Kvichak	7.9	15,883	9.0	30,234	9.8	168,633	9.5	3,349	1.0	19,602	0.9	214	23.8	12,458	5.7	250,373
	Naknek	2.0	4,114	4.9	16,541	0.6	10,232	48.6	17,142	0.9	18,666	0.1	12	1.3	680	1.5	67,387
	Egegik	4.8	9,613	1.9	6,362	5.4	93,244	41.9	14,790	10.0	200,241	93.2	21,398	23.1	12,083	8.2	357,730
	Ugashik	85.3	172,200	84.2	283,482	84.2	1,441,138	0.0	0	88.1	1,768,615	5.8	1,326	51.8	27,179	84.6	3,693,941
	Total	100.0	201,811	100.0	336,619	100.0	1,713,247	100.0	35,281	100.0	2,007,124	100.0	22,950	100.0	52,400	100.0	4,369,432

32

<sup>a</sup> Other includes ages-0.2, -0.3, -2.1, -3.2, and -2.4.

<sup>b</sup> Scale samples were collected on 27 and 30 June. Stock composition estimates calculated for these dates were applied to 13 June through 1 July catches.

<sup>c</sup> Scale samples were collected on 15 July. Stock composition estimates calculated for that date were applied to 15 July through 1 September catches.

Table 12. Catch of sockeye salmon by run and district for the Eastside of Bristol Bay, 1994.

Run		District			Total
		Naknek-Kvichak	Egegik	Ugashik	
Kvichak	Numbers	12,383,813	296,178	250,373	12,930,364
	Percent	95.8	2.3	1.9	100.0
Naknek	Numbers	2,973,946	53,097	67,387	3,094,430
	Percent	96.1	1.7	2.2	100.0
Egegik	Numbers	0	9,885,494	357,730	10,243,224
	Percent	0.0	96.5	3.5	100.0
Ugashik	Numbers	904,866	563,681	3,693,941	5,162,489
	Percent	17.5	10.9	71.5	100.0
Total	Numbers	16,262,625	10,798,450	4,369,432	31,430,507
	Percent	51.7	34.4	13.9	100.0

Table 13. Numbers of sockeye salmon by run and age group for the Eastside of Bristol Bay, 1994.

		0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	Total
Kvichak	Escapement		874	2,622	811,523	79,663	874	252,996	7,037,285		874	151,129				8,337,840
	In District Catch		1,155	7,745	628,155	1,671	1,834	1,166,610	10,254,398		8,179	308,832	2,616	617	1,999	12,383,813
	Other Dist. Catch			13,936	36,533	186		65,188	391,415		3,360	35,720			214	546,552
	Total Run		2,029	24,303	1,476,211	81,520	2,708	1,484,794	17,683,098		12,413	495,681	2,616	617	2,213	21,268,205
Naknek	Escapement	584	7,367		213,077	43,710		140,665	432,677		3,684	146,328		2,718		990,810
	In District Catch				304,279	3,024		926,434	1,351,209		26,822	353,474	574	7,775	354	2,973,946
	Other Dist. Catch	74			9,440	101		35,427	23,599		17,197	33,919		715	12	120,484
	Total Run	658	7,367		526,796	46,835		1,102,526	1,807,485		47,703	533,721	574	11,208	366	4,085,240
Egegik	Escapement	795	1,038		106,219	62,837		15,059	1,186,797	1,038	1,116	471,801	43,843	4,059	3,330	1,897,932
	In District Catch	3,494			231,818	2,351		286,723	4,254,228		2,344	4,823,249	204,468	25,060	51,759	9,885,494
	Other Dist. Catch	1,062			9,613	75		6,362	93,244		14,790	200,241	8,151	2,795	21,398	357,730
	Total Run	5,351	1,038		347,650	65,263		308,144	5,534,269	1,038	18,250	5,495,291	256,462	31,914	76,487	12,141,156
Ugashik	Escapement		6,303		136,502	13,071		33,656	714,175			173,655	2,273	1,223		1,080,858
	In District Catch				172,200	1,338		283,482	1,441,138			1,768,615	10,836	15,005	1,326	3,693,941
	Other Dist. Catch		4,016		86,761	248		150,625	935,509			279,763	10,456	1,114	55	1,468,547
	Total Run		10,319		395,463	14,657		467,763	3,090,822			2,222,033	23,565	17,342	1,381	6,243,346

Table 14. Percentages of sockeye salmon by run and age group for the Eastside of Bristol Bay, 1994.

		0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	3.1	1.4	2.3	3.2	2.4	3.3	Total
Kvichak	Escapement		0.0 <sup>a</sup>	0.0	3.8	0.4	0.0	1.2	33.1		0.0	0.7				39.2
	In District Catch		0.0	0.0	3.0	0.0	0.0	5.5	48.2		0.0	1.5	0.0	0.0	0.0	58.2
	Other Dist. Catch			0.1	0.2	0.0		0.3	1.8		0.0	0.2			0.0	2.6
	Total Run		0.0	0.1	6.9	0.4	0.0	7.0	83.1		0.1	2.3	0.0	0.0	0.0	100.0
Naknek	Escapement	0.0	0.2		5.2	1.1		3.4	10.6		0.1	3.6		0.1		24.3
	In District Catch				7.4	0.1		22.7	33.1		0.7	8.7	0.0	0.2	0.0	72.8
	Other Dist. Catch	0.0			0.2	0.0		0.9	0.6		0.4	0.8		0.0	0.0	2.9
	Total Run	0.0	0.2		12.9	1.1		27.0	44.2		1.2	13.1	0.0	0.3	0.0	100.0
Egegik	Escapement	0.0	0.0		0.9	0.5		0.1	9.8	0.0	0.0	3.9	0.4	0.0	0.0	15.6
	In District Catch	0.0			1.9	0.0		2.4	35.0		0.0	39.7	1.7	0.2	0.4	81.4
	Other Dist. Catch	0.0			0.1	0.0		0.1	0.8		0.1	1.6	0.1	0.0	0.2	3.0
	Total Run	0.0	0.0		2.9	0.5		2.5	45.6	0.0	0.2	45.3	2.1	0.3	0.6	100.0
Ugashik	Escapement		0.1		2.2	0.2		0.5	11.4			2.8	0.0	0.0		17.3
	In District Catch				2.8	0.0		4.5	23.1			28.3	0.2	0.2	0.0	59.2
	Other Dist. Catch		0.1		1.4	0.0		2.4	15.0			4.5	0.2	0.0	0.0	23.5
	Total Run		0.2		6.3	0.2		7.5	49.5			35.6	0.4	0.3	0.0	100.0

<sup>a</sup> Represented <0.1%

Table 15. Comparison of sockeye salmon run estimates for the Eastside of Bristol Bay, 1994.

Stock	Estimated Run		Difference	
	Standard Method <sup>a</sup>	Scale Pattern Analysis	Number	Percent
Kvichak	22,474,898	21,268,205	1,206,693	5.4
Naknek	3,116,377	4,085,240	- 968,863	-31.1
Egegik	12,696,382	12,141,156	555,226	4.4
Ugashik	5,450,290	6,243,346	- 793,056	-14.6
Total	43,737,947	43,737,947		

<sup>a</sup> Standard method assumes fish harvested in a district originated within that district and divides Naknek-Kvichak District catch to Naknek and Kvichak Rivers based on escapement age composition. These numbers have been adjusted to include Branch River.

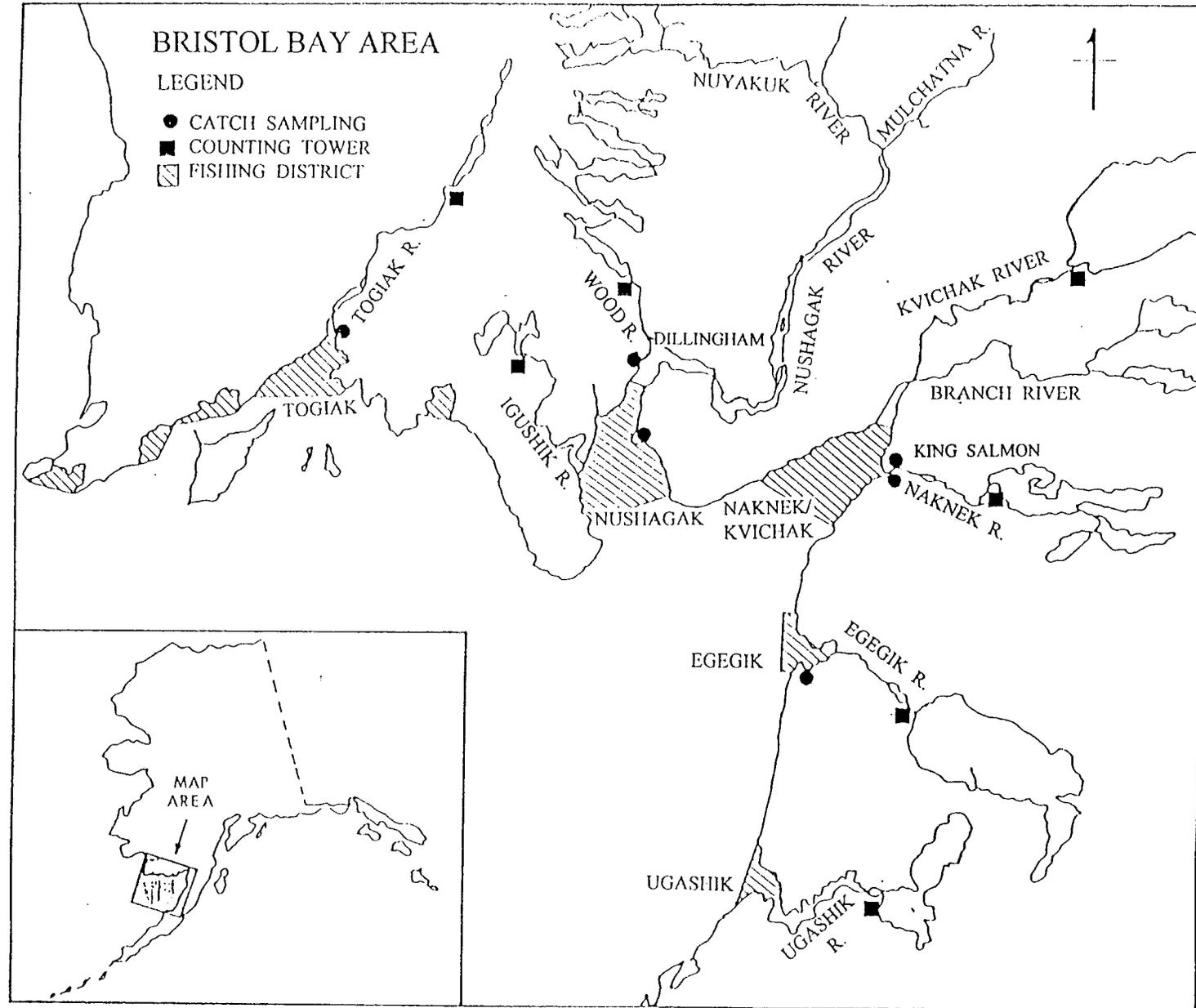


Figure 1. Map of Bristol Bay showing major rivers and fishing districts.

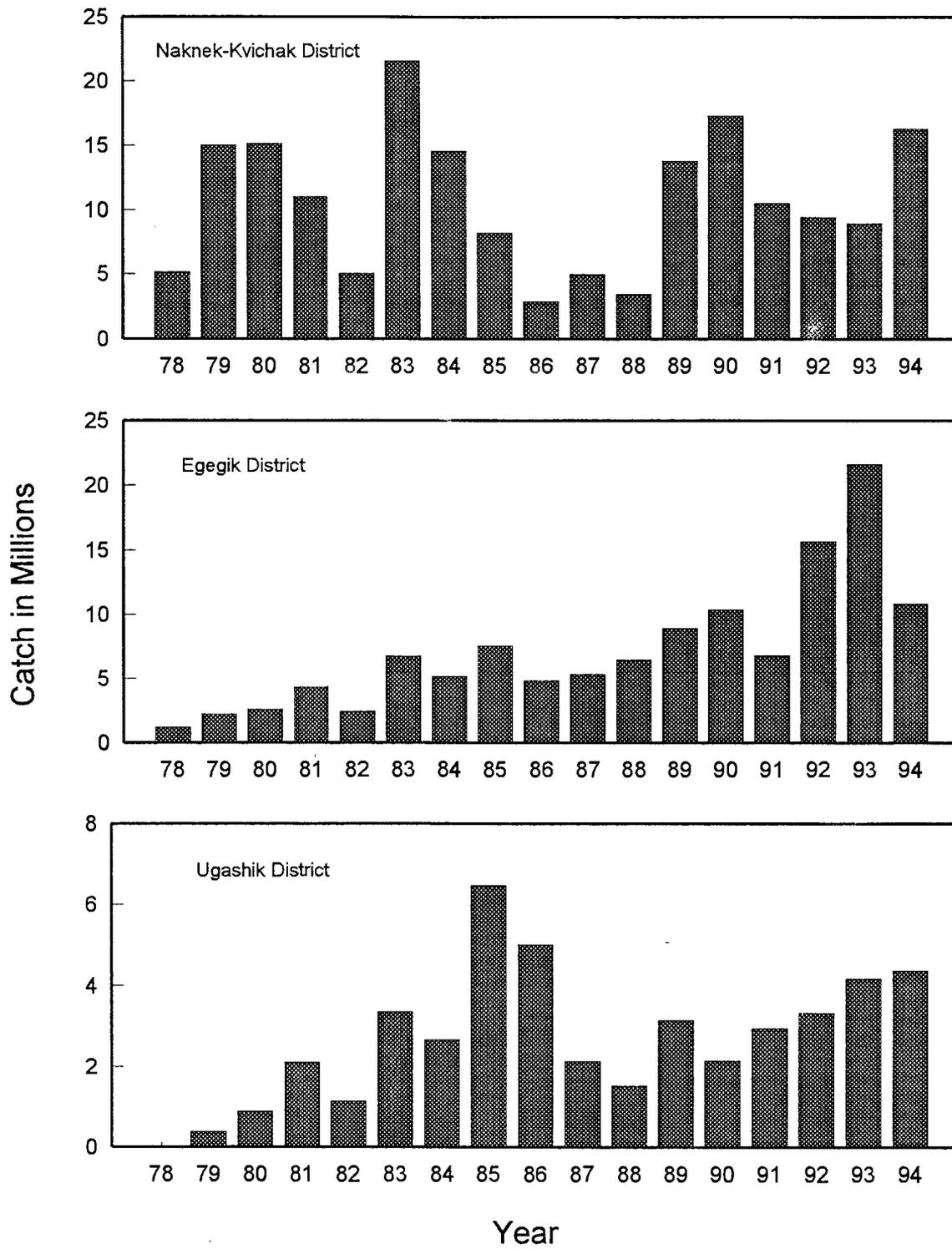


Figure 2. Commercial catch of sockeye salmon in Naknek-Kvichak, Egegik, and Ugashik Districts from 1978 through 1994.

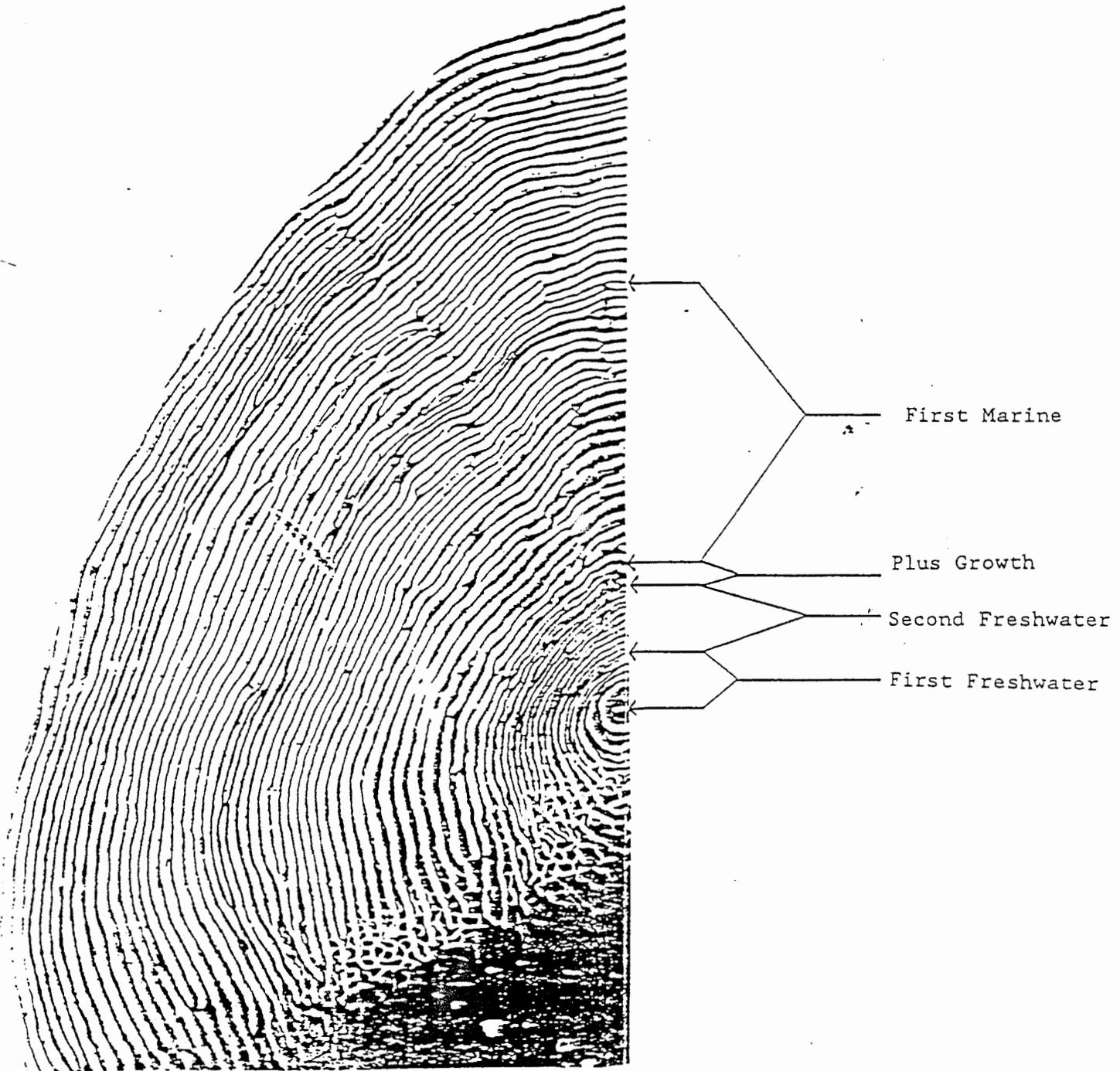


Figure 3. Age-2.2 sockeye salmon scale showing the growth zones measured to generate variables to build linear discriminant functions.

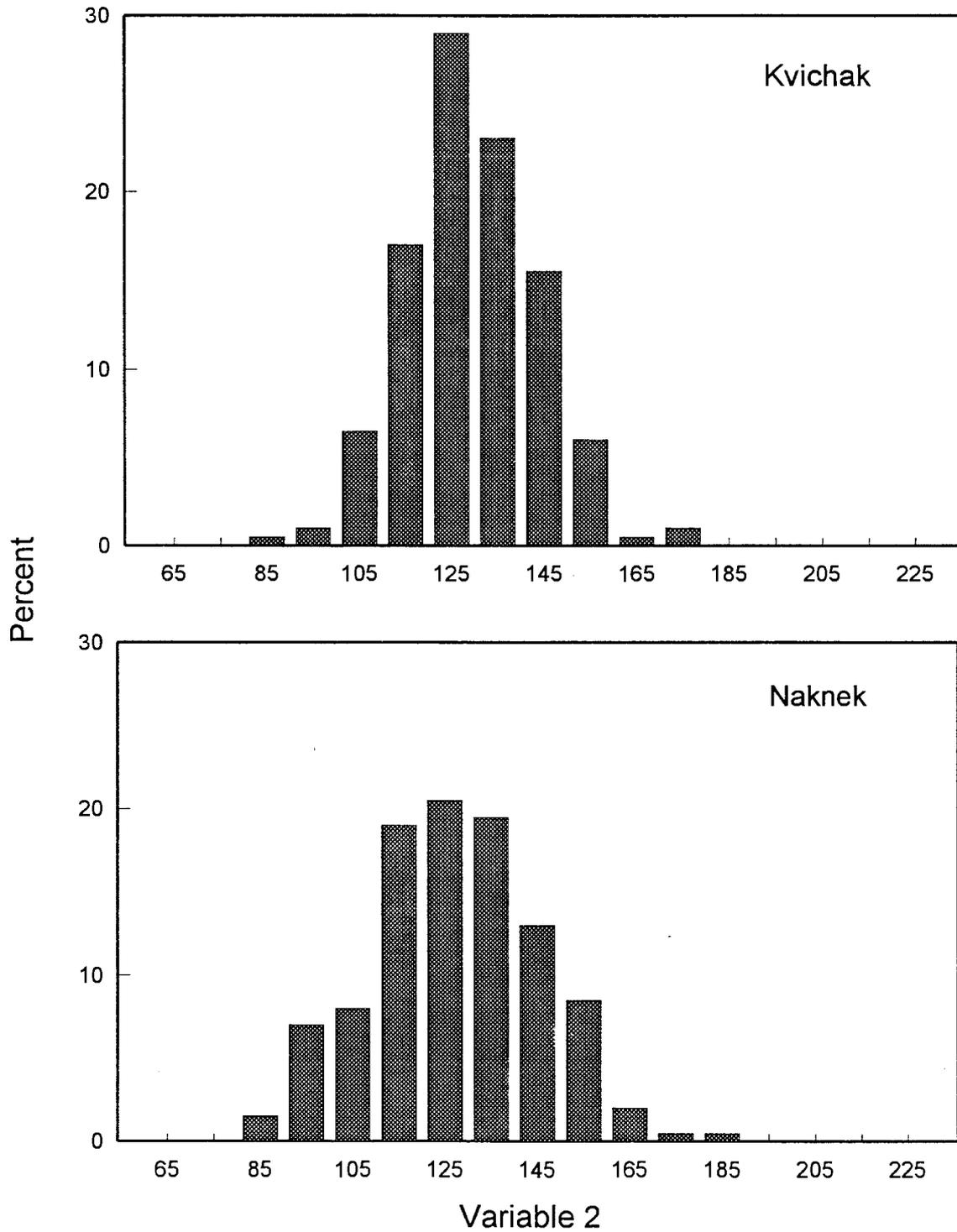


Figure 4. Total size of first freshwater growth zone (S1FW) for age-2.2 sockeye salmon escapement scales, Kvichak and Naknek Rivers, 1994.

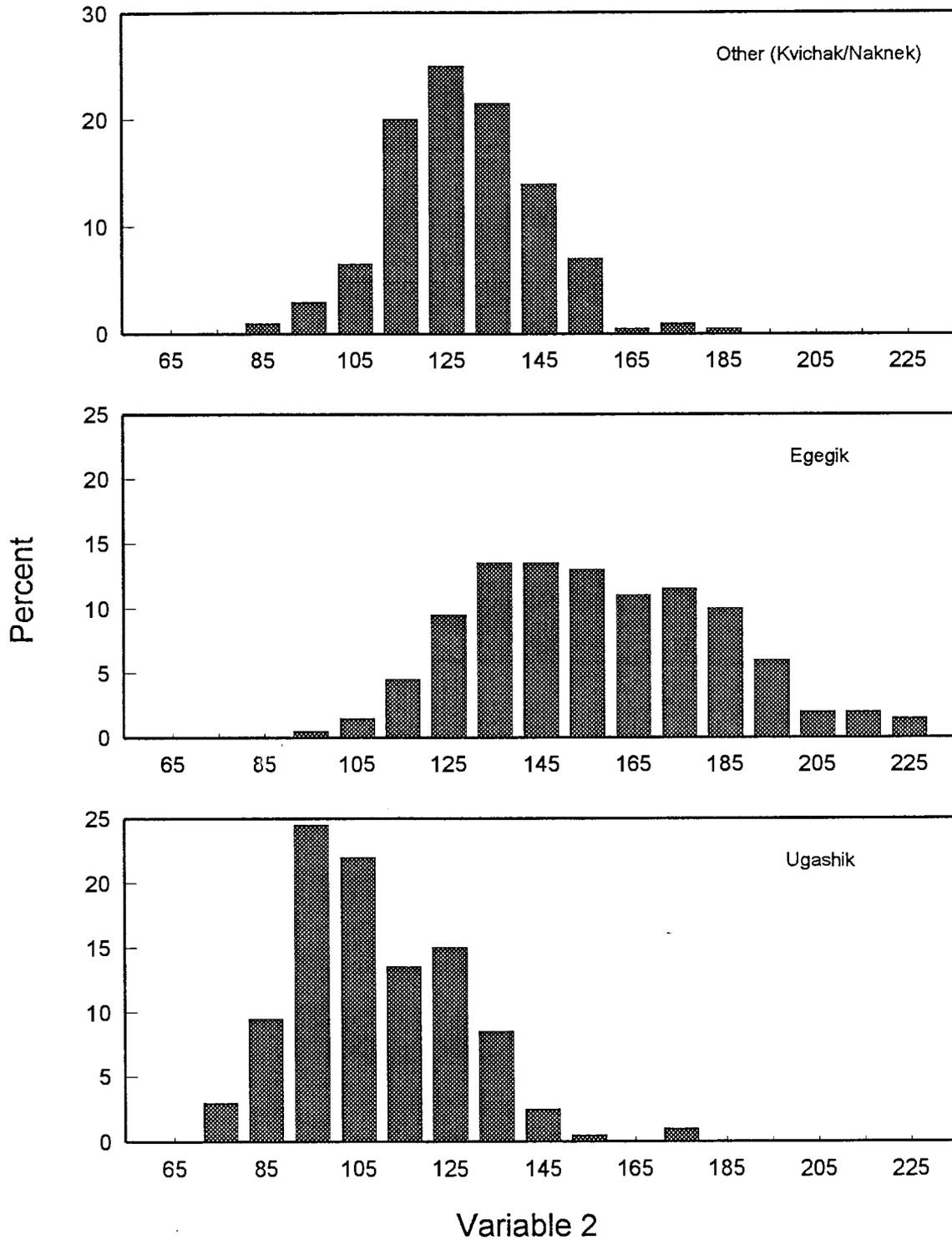


Figure 5. Total size of first freshwater growth zone (SIFW) for age-2.2 sockeye salmon escapement scales, Egegik, Ugashik, and Kvichak/Naknek (Other) Rivers combined, 1994.

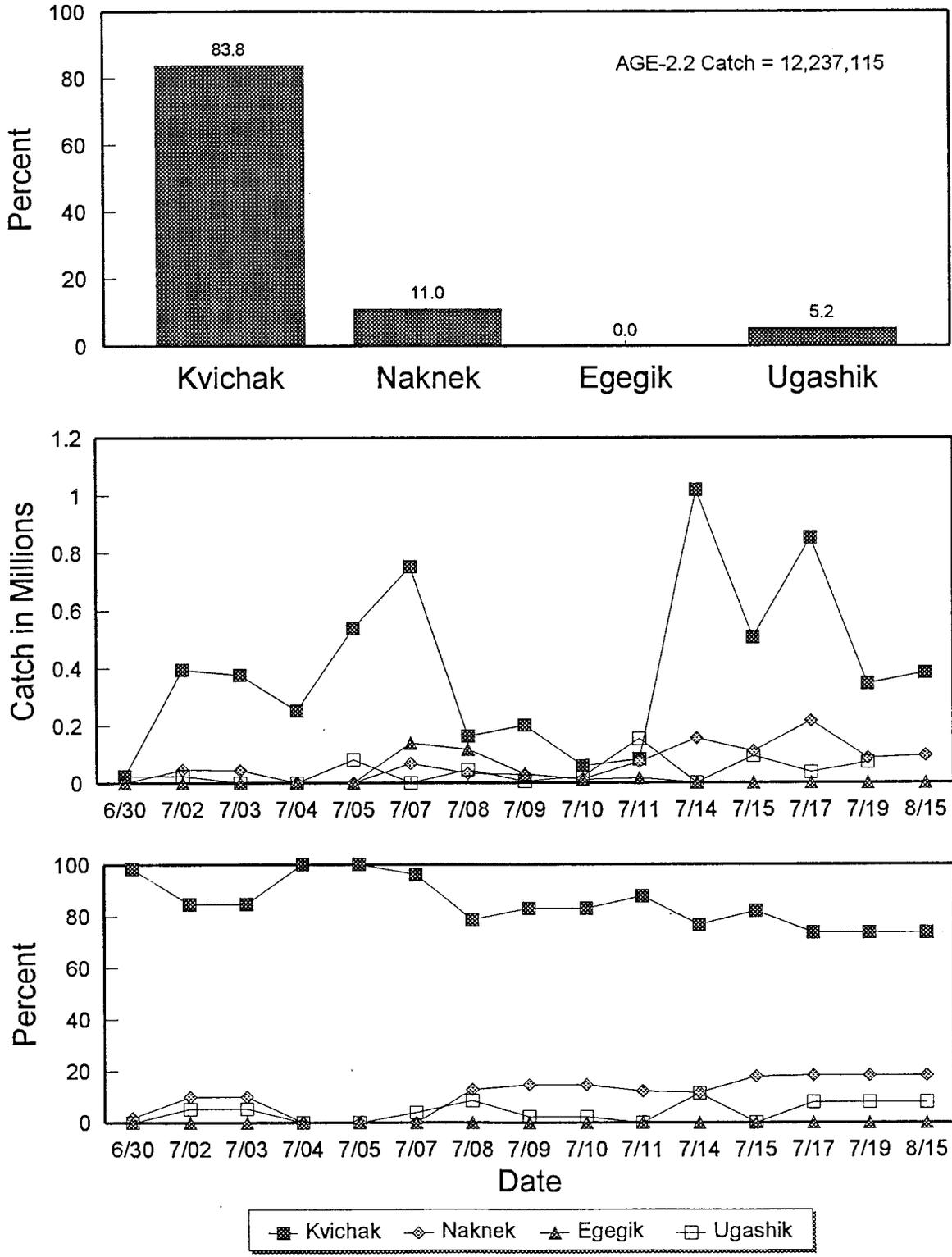


Figure 6. Stock composition estimates for 1994 Naknek-Kvichak District age-2.2 sockeye salmon catch in percent and numbers through time.

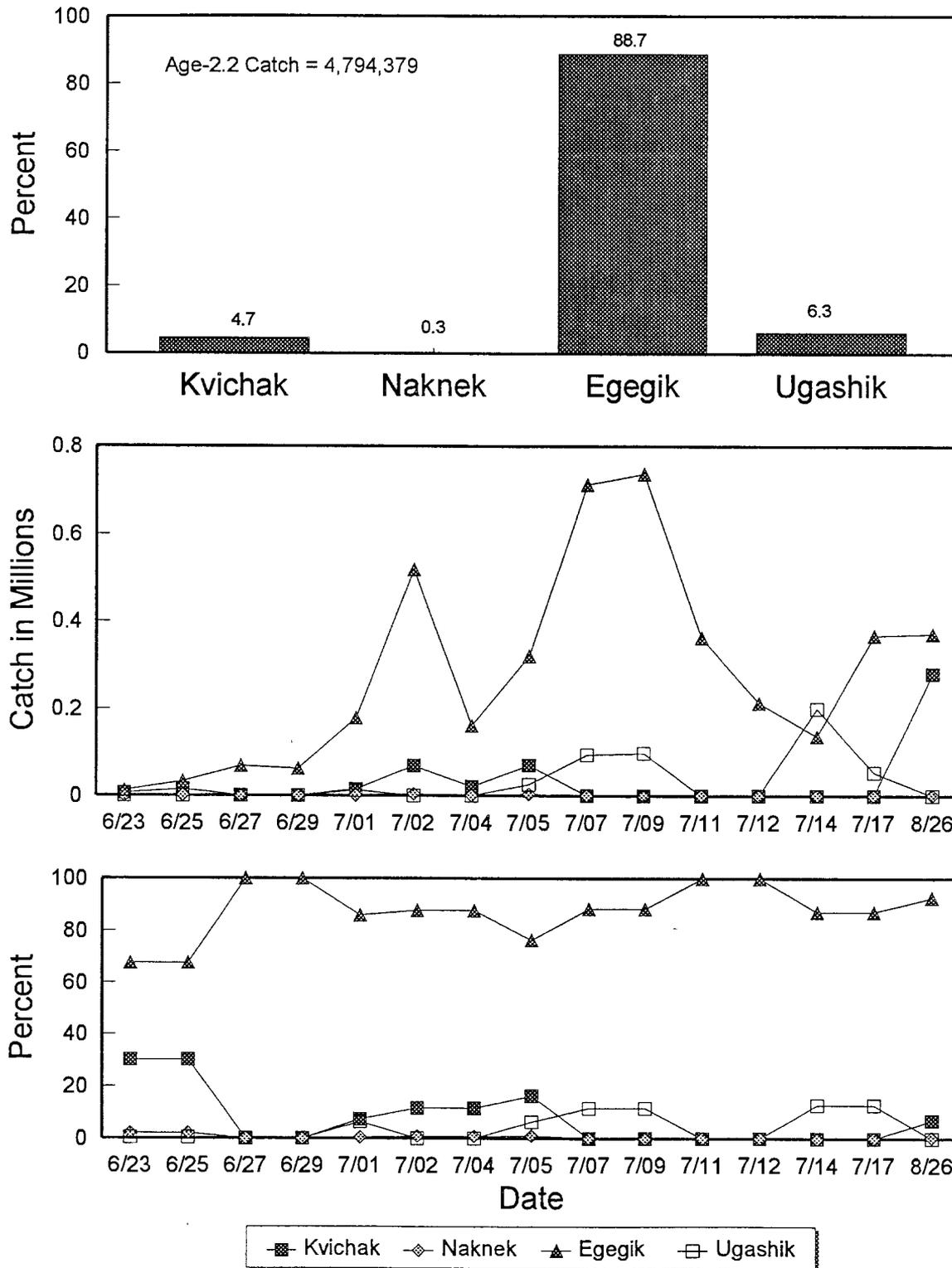


Figure 7. Stock composition estimates for 1994 Egegik District age-2.2 sockeye salmon catch in percent and numbers through time.

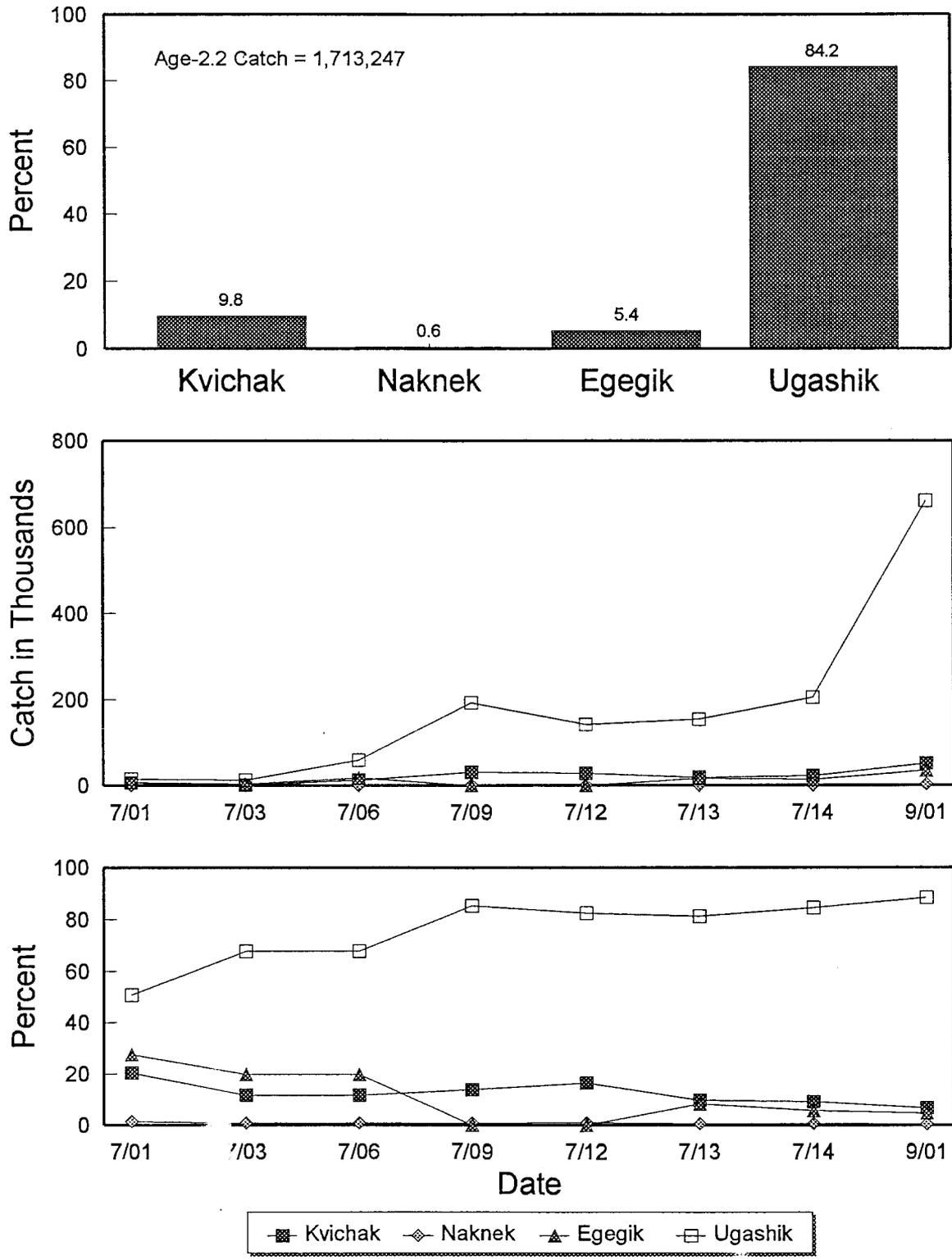


Figure 8. Stock composition estimates for 1994 Ugashik District age-2.2 sockeye salmon catch in percent and numbers through time.

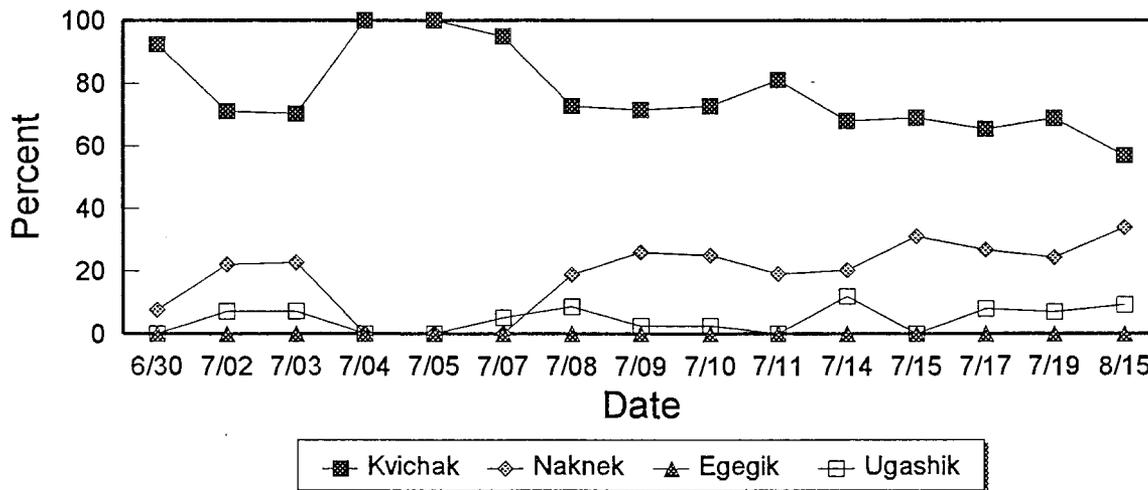
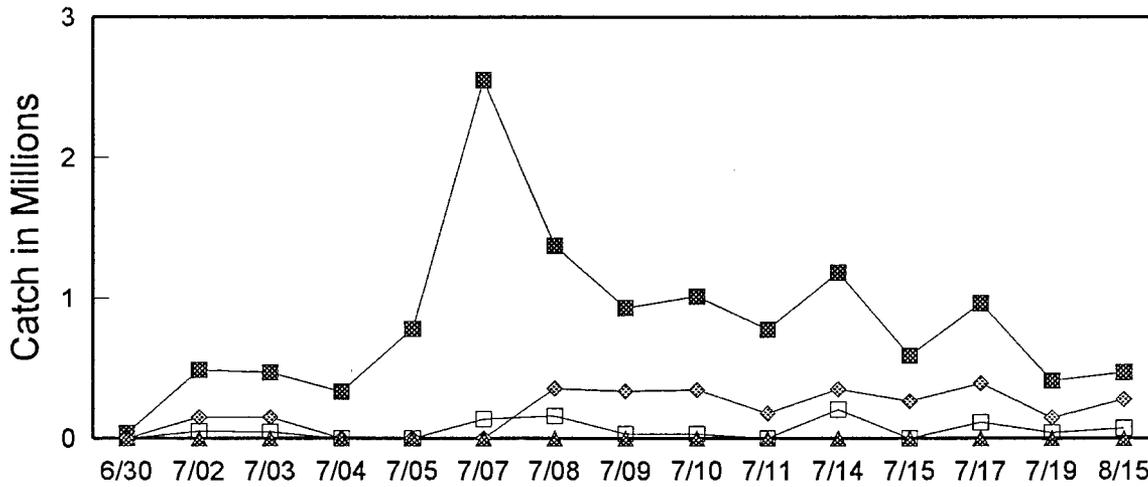
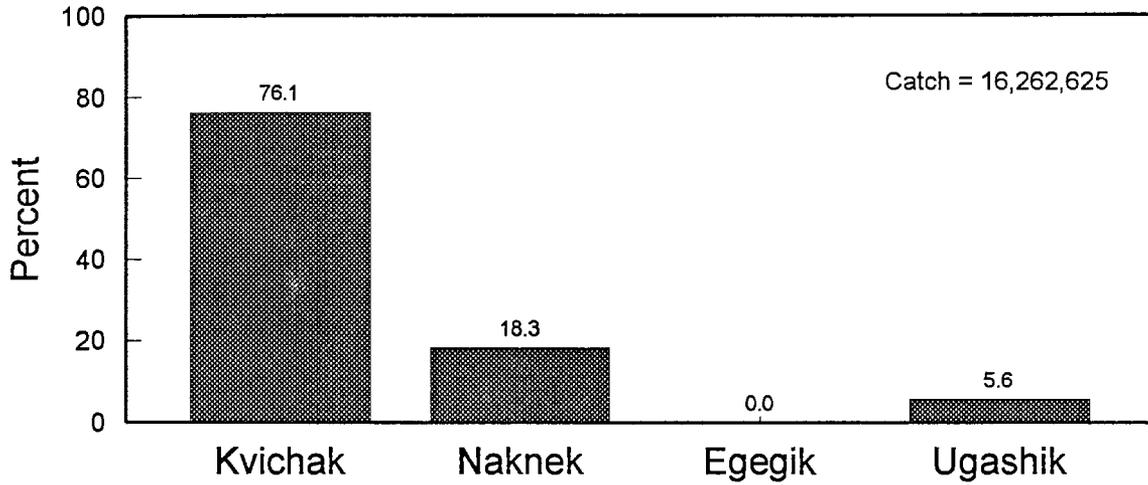


Figure 9. Stock composition estimates for 1994 Naknek-Kvichak District total sockeye salmon catch in percent and numbers through time.

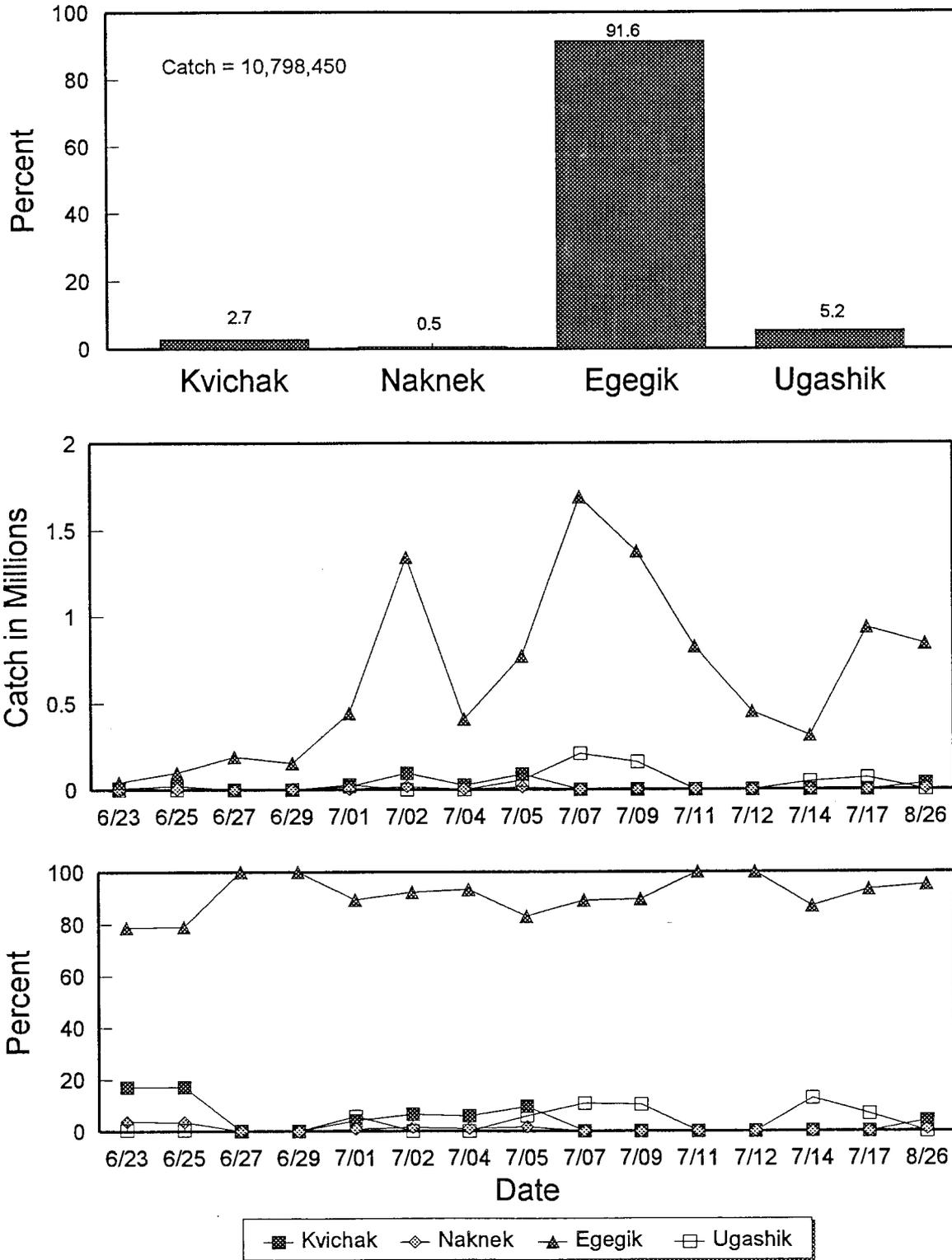


Figure 10. Stock composition estimates for 1994 Egegik District total sockeye salmon catch in percent and numbers through time.

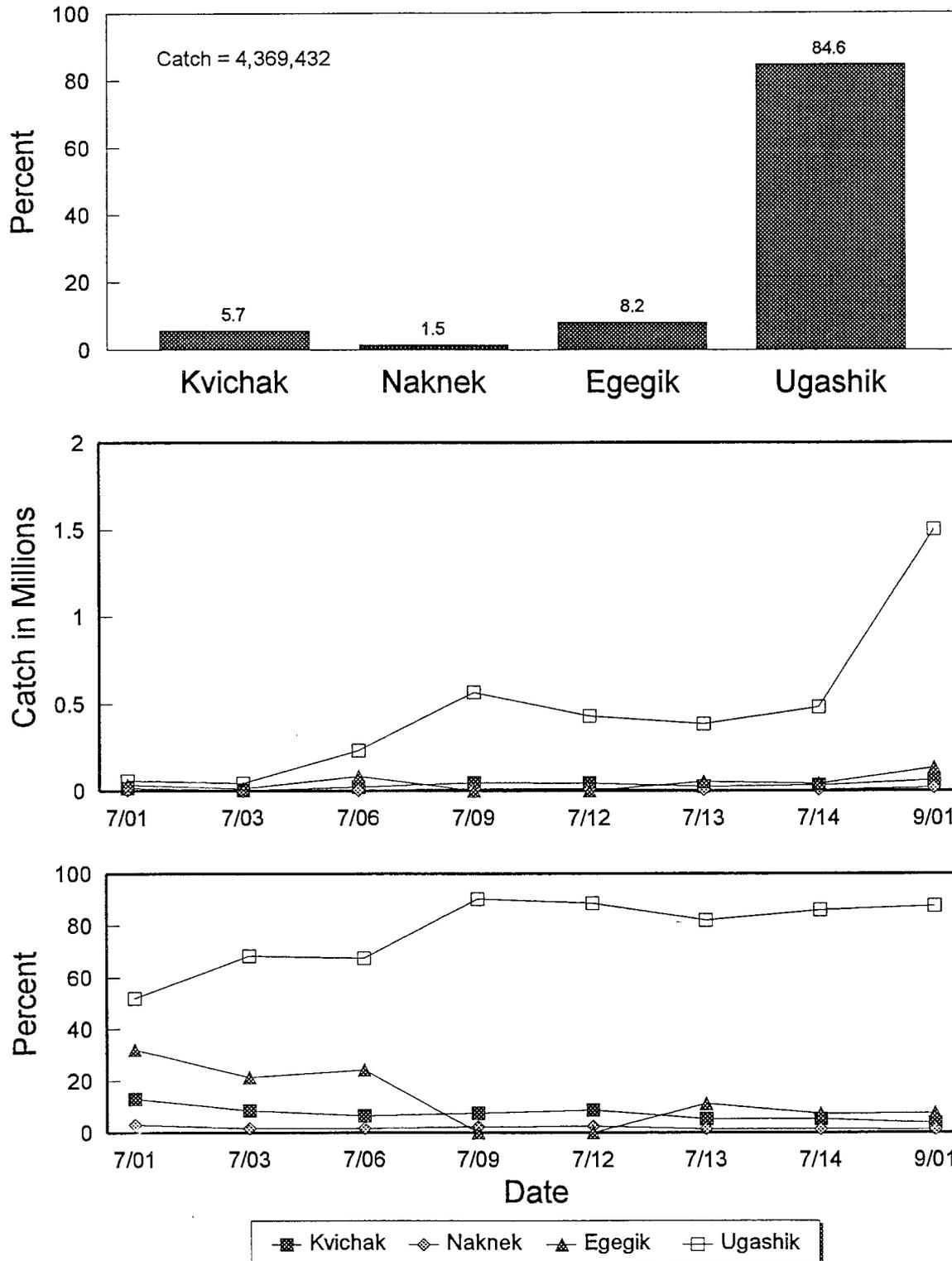


Figure 11. Stock composition estimates for 1994 Ugashik District total sockeye salmon catch in percent and numbers through time.

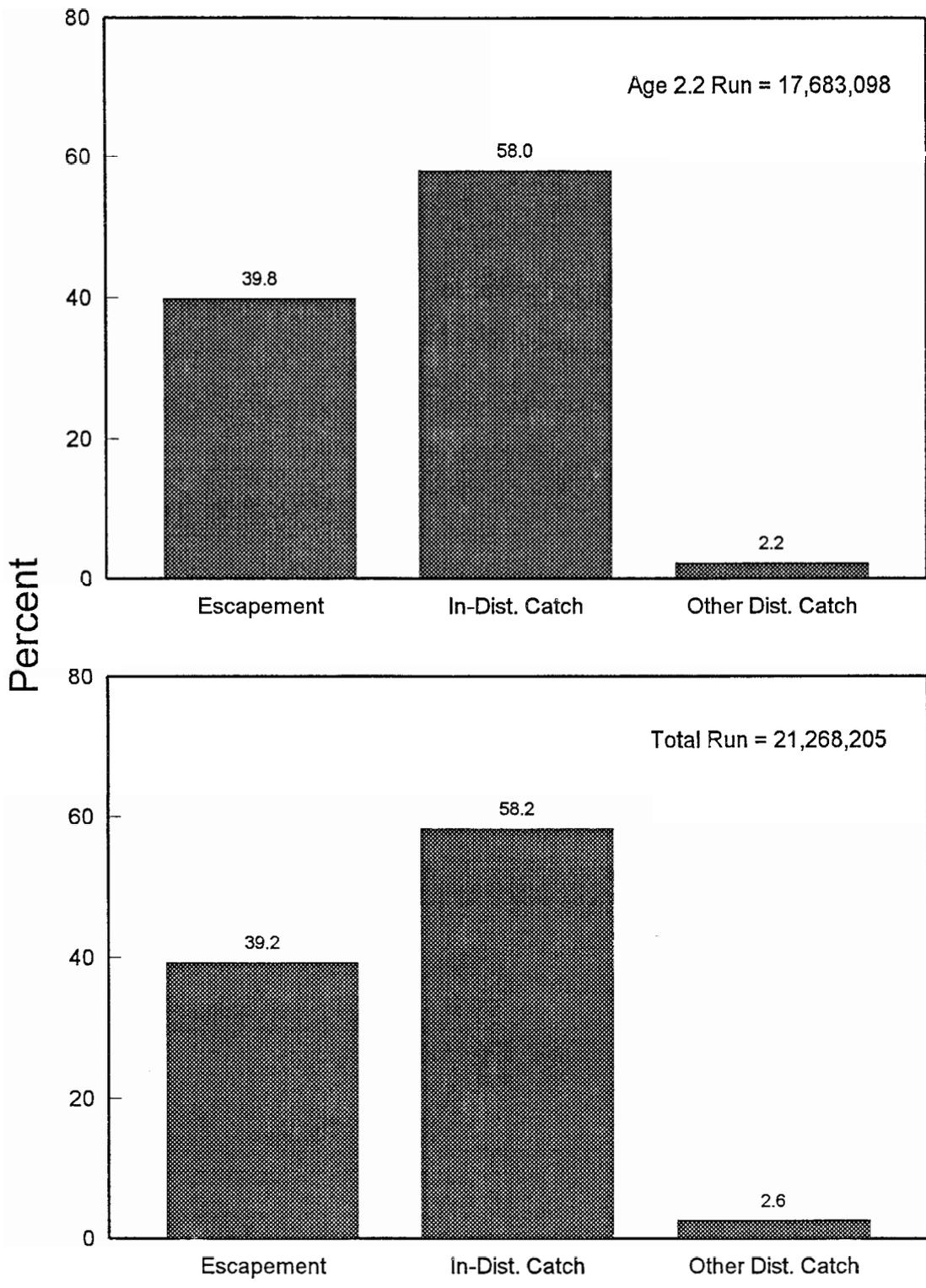


Figure 12. Estimated 1994 Kvichak River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined.

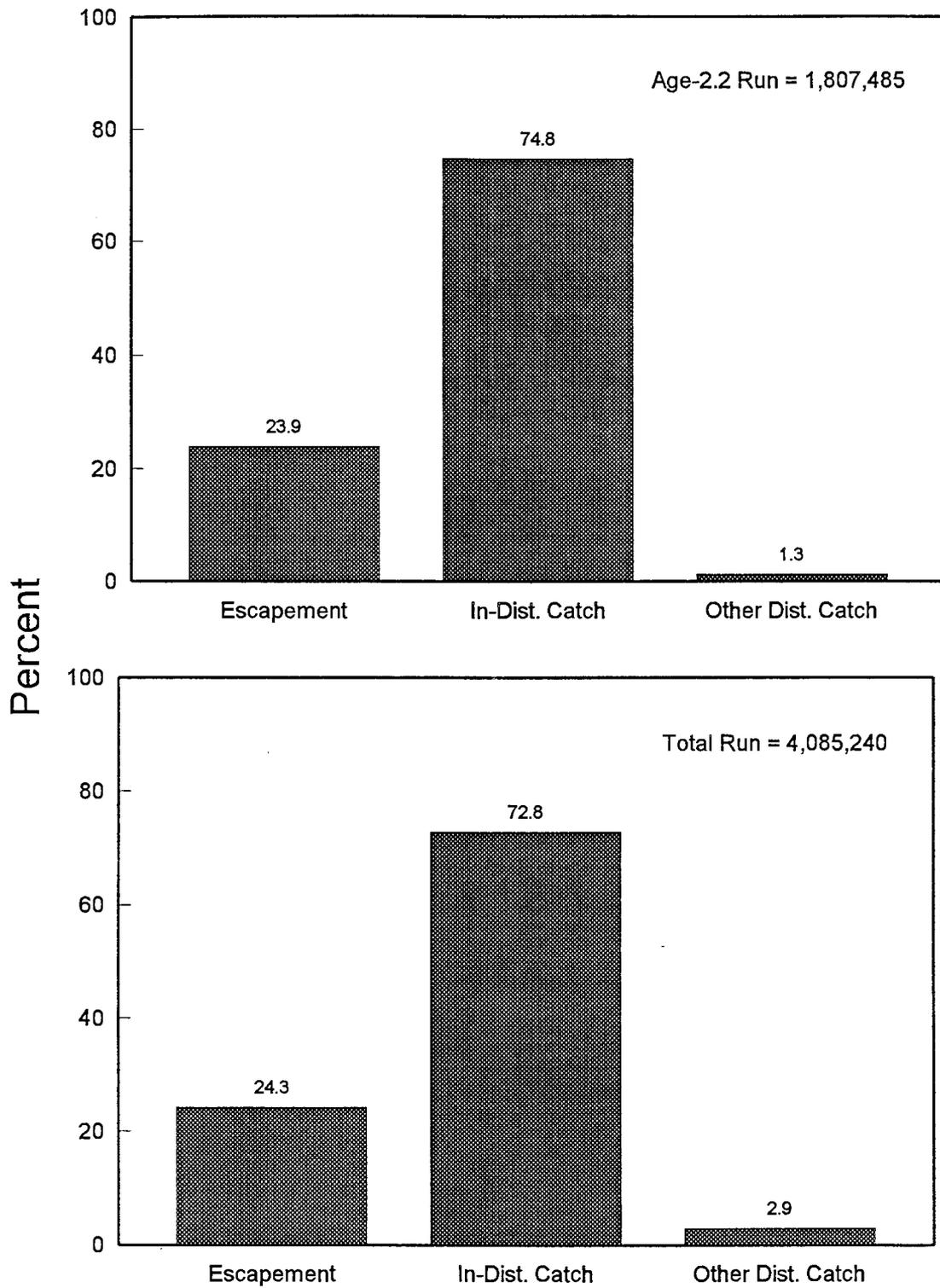


Figure 13. Estimated 1994 Naknek River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined.

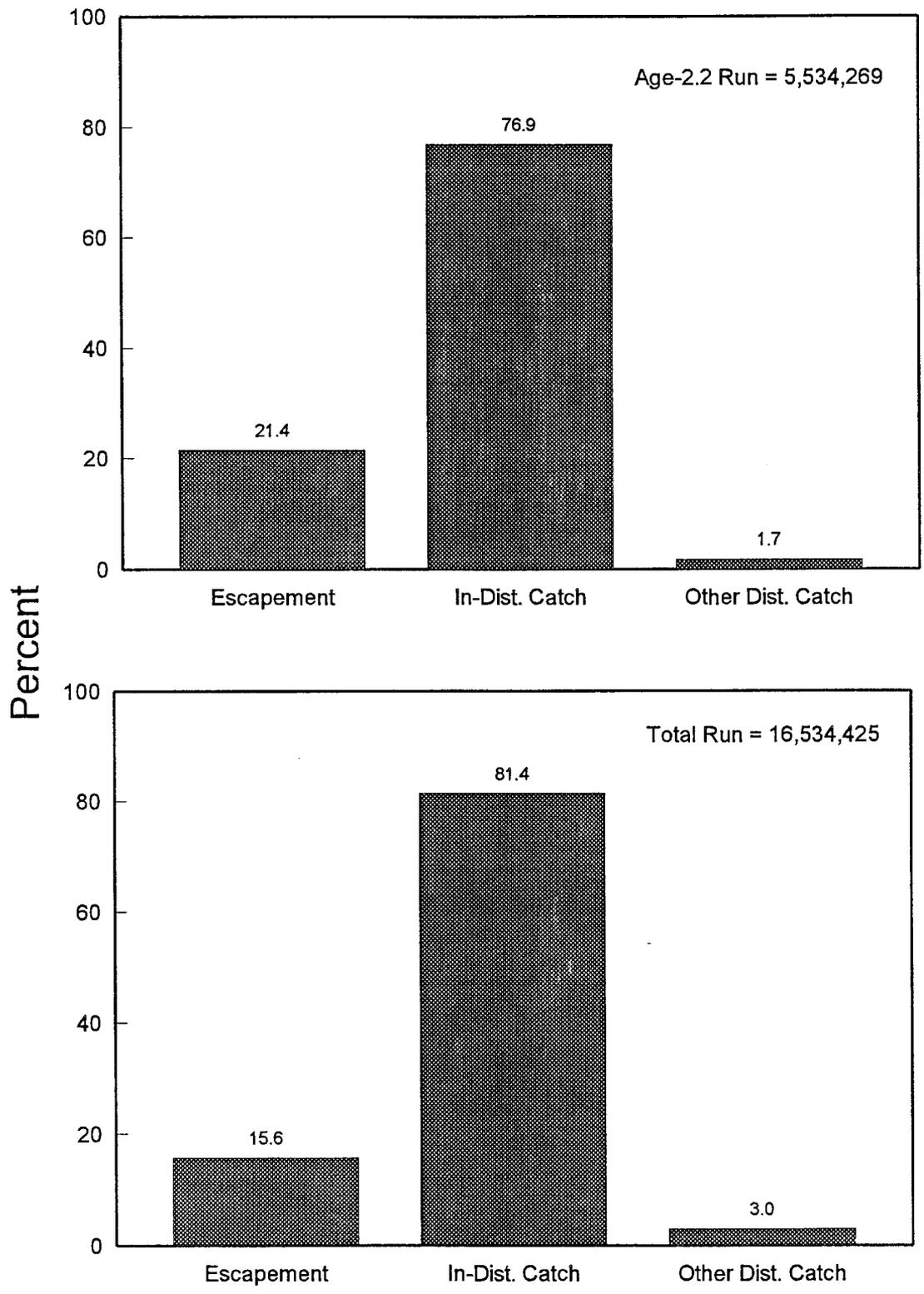


Figure 14. Estimated 1994 Egegik River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined.

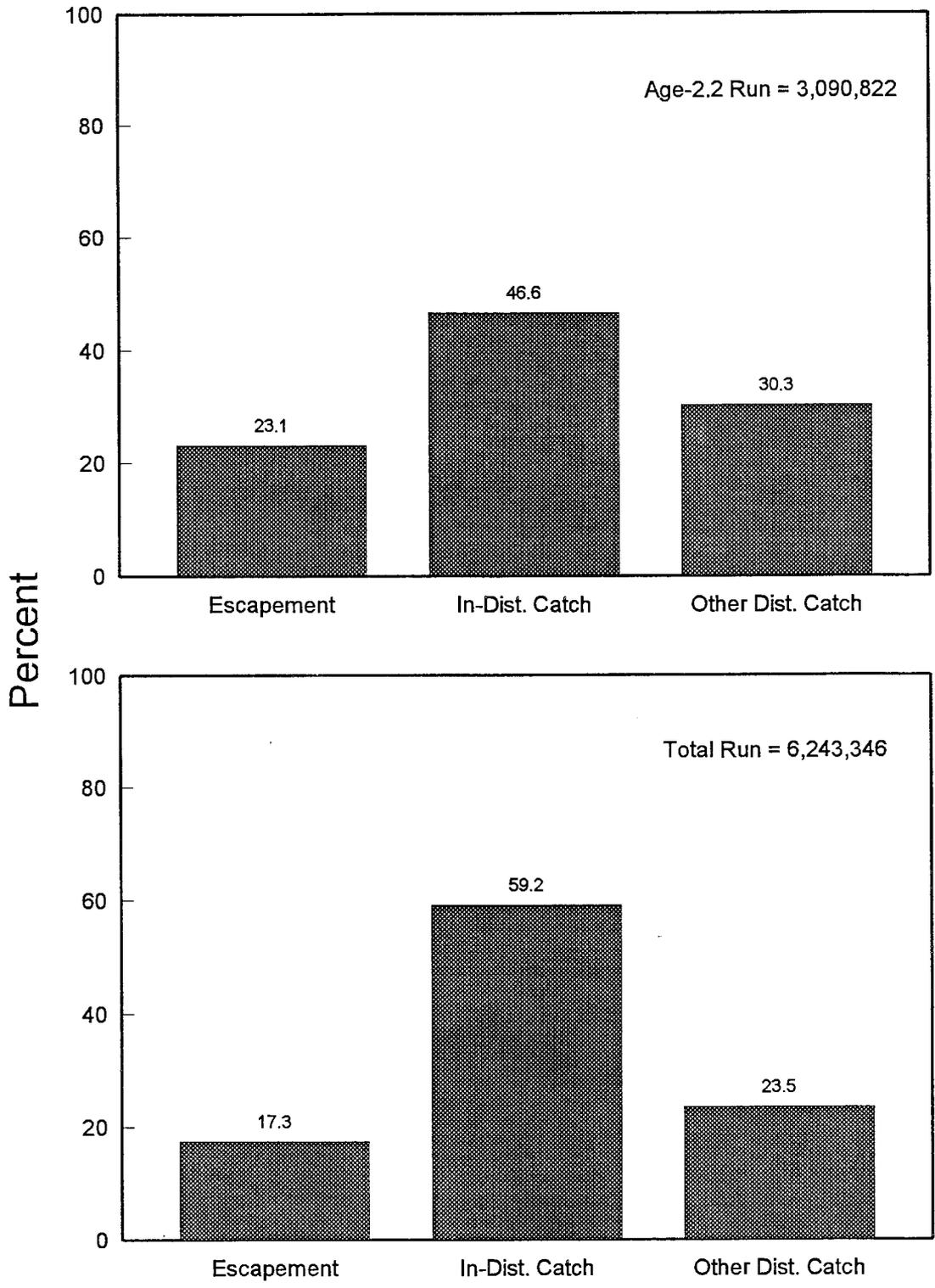


Figure 15. Estimated 1994 Ugashik River sockeye salmon run, escapement, in-district catch, and other district catch for age-2.2 and all ages combined.

Appendix A.1. Scale variables screened for linear discriminant function analysis of age-2.2 sockeye salmon for the Eastside of Bristol Bay, 1994.

Variable Number	Variable Name	Zone
<u>First Freshwater Annular Zone</u>		
1	NC1FW	Number of circuli first freshwater
2	S1FW	Size (width) of first freshwater
3 (16)	C0-C2	Distance, scale focus (C0) to circulus 2 (C2)
4 (17)	C0-C4	Distance, scale focus to circulus 4
5 (18)	C0-C6	Distance, scale focus to circulus 6
6 (19)	C0-C8	Distance, scale focus to circulus 8
7 (20)	C2-C4	Distance, circulus 2 to circulus 4
8 (21)	C2-C6	Distance, circulus 2 to circulus 6
9 (22)	C2-C8	Distance, circulus 2 to circulus 8
10 (23)	C4-C6	Distance, circulus 4 to circulus 6
11 (24)	C4-C8	Distance, circulus 4 to circulus 8
12 (25)	C(NC-4)-E1FW	Distance, circulus (number circuli first freshwater minus 2) to end first freshwater
13 (26)	C(NC-2)-E1FW	Distance, circulus (number circuli first freshwater minus 4) to end first freshwater
14	C2-E1FW	Distance, circulus 2 to end first freshwater
15	C4-E1FW	Distance, circulus 4 to end first freshwater
16 thru 26	C0-C2/S1FW ... C(NC-2)-E1FW/S1FW	Relative widths, (variables 3-13)/S1FW
27	S1FW/NC1FW	Average interval between circuli in first freshwater
28	NC 1ST 3/4	Number of circuli in first 3/4 of first freshwater
29	MAX DIST	Maximum distance between 2 consecutive circuli in first freshwater
30	MAX DIST/S1FW	Relative width, (variable 29)/S1FW
<u>Second Freshwater Annular Zone</u>		
31	NC2FW	Number of circuli second freshwater
32	S2FW	Size (width) of second freshwater
33 (46)	E1FW-C2	Distance, end of first freshwater to circulus 2 (C2) in second freshwater
34 (47)	E1FW-C4	Distance, end of first freshwater to circulus 4
35 (48)	E1FW-C6	Distance, end of first freshwater to circulus 6
36 (49)	E1FW-C8	Distance, end of first freshwater to circulus 8
37 (50)	C2-C4	Distance, circulus 2 to circulus 4
38 (51)	C2-C6	Distance, circulus 2 to circulus 6
39 (52)	C2-C8	Distance, circulus 2 to circulus 8
40 (53)	C4-C6	Distance, circulus 4 to circulus 6
41 (54)	C4-C8	Distance, circulus 4 to circulus 8
42 (55)	C(NC-4)-E2FW	Distance, circulus (number circuli second freshwater minus 4) to end second freshwater
43 (56)	C(NC-2)-E2FW	Distance, circulus (number circuli second freshwater minus 2) to end second freshwater
44	C2-E2FW	Distance, circulus 2 to end second freshwater
45	C4-E2FW	Distance, circulus 4 to end second freshwater
46 thru 56	E1FW-C2/S2FW ... C(NC-2)-E2FW/S2FW	Relative widths, (variables 33-43)/S2FW
57	S2FW/NC2FW	Average interval between circuli in second freshwater
58	NC 1ST 3/4	Number of circuli in first 3/4 of second freshwater
59	MAX DIST	Maximum distance between 2 consecutive circuli in second freshwater
60	MAX DIST/S2FW	Relative width, (variable 59)/S2FW

-Continued-

Appendix A.1. (p 2 of 2).

Variable Number	Variable Name	Zone
<u>Plus Growth Zone</u>		
61	NCPG	Number of circuli in plus growth
62	SPGZ	Size (width) plus growth zone
<u>Freshwater and Plus Growth Zones</u>		
63	NC1FW + NC2FW	Total number of circuli first and second freshwater
64	S1FW + S2FW	Total size (width) of first and second freshwater
65	NC1FW+NC2FW+NCPG	Total number of circuli first and second freshwater and plus growth
66	S1FW+S2FW+SPGZ	Total size (width) first and second freshwater and plus growth
67	S1FW/S1FW+S2FW+SPGZ	Relative width, (variable 2)/S1FW+S2FW+SPGZ
68	SPGZ/S1FW+S2FW+SPGZ	Relative width, (variable 62)/S1FW+S2FW+SPGZ
69	S2FW/S1FW+S2FW+SPGZ	Relative width, (variable 32)/S1FW+S2FW+SPGZ
<u>First Marine Annular Zone</u>		
70	NC10Z	Number of circuli in first ocean zone
71	S10Z	Size (width) first ocean zone
72 (90)	EFW-C3	Distance, end of freshwater growth to circulus 3
73 (91)	EFW-C6	Distance, end of freshwater growth to circulus 6
74 (92)	EFW-C9	Distance, end of freshwater growth to circulus 9
75 (93)	EFW-C12	Distance, end of freshwater growth to circulus 12
76 (94)	EFW-C15	Distance, end of freshwater growth to circulus 15
77 (95)	C3-C6	Distance, circulus 3 to circulus 6
78 (96)	C3-C9	Distance, circulus 3 to circulus 9
79 (97)	C3-C12	Distance, circulus 3 to circulus 12
80 (98)	C3-C15	Distance, circulus 3 to circulus 15
81 (99)	C6-C9	Distance, circulus 6 to circulus 9
82 (100)	C6-C12	Distance, circulus 6 to circulus 12
83 (101)	C6-C15	Distance, circulus 6 to circulus 15
84 (102)	C9-C15	Distance, circulus 9 to circulus 15
85 (103)	C(NC-6)-E10Z	Distance, circulus (number circuli first ocean minus 6) to end first ocean
86 (104)	C(NC-3)-E130Z	Distance, circulus (number circuli first ocean minus 3) to end first ocean
87	C3-E10Z	Distance, circulus 3 to end of first ocean
88	C9-E10Z	Distance, circulus 9 to end of first ocean
89	C15-E10Z	Distance, circulus 15 to end of first ocean
90 thru	EFW-C3/S10Z ...	Relative widths, (variables 72-86)/S10Z
104	C(NC-3)-E130Z/S10Z	
105	S10Z/NC10Z	Average interval between circuli in first ocean
106	NC 1ST 1/2	Number of circuli in first 1/2 of first ocean
107	MAX DIST	Maximum distance between 2 consecutive circuli in first ocean
108	MAX DIST/S10Z	Relative width, (variable 107)/S10Z
<u>Second Marine Annular Zone</u>		
109	S20Z	Size (width) of second ocean zone

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