

# **INFORMATIONAL LEAFLET NO. 186**

## ORIGINS OF SOCKEYE SALMON IN THE UPPER COOK INLET FISHERY OF 1978 BASED ON SCALE PATTERN ANALYSIS

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## TABLE OF CONTENTS

	<u>Page</u>
LIST OF FIGURES . . . . .	i
LIST OF TABLES . . . . .	ii
LIST OF APPENDIX TABLES . . . . .	iv
ABSTRACT . . . . .	vi
INTRODUCTION . . . . .	1
METHODS AND MATERIALS . . . . .	1
Scale Collection and Processing . . . . .	1
Scale Examination and Data Processing . . . . .	3
Sample Collection . . . . .	3
Statistical Techniques . . . . .	3
In-Season Run Analysis . . . . .	5
Catch Apportionment . . . . .	5
RESULTS AND DISCUSSION . . . . .	5
Catch and Escapement Samples . . . . .	5
Discriminant Analyses . . . . .	7
Three-Way Analyses . . . . .	7
Four-Way Analyses . . . . .	7
Two-Way Analyses . . . . .	11
Age 5 <sub>2</sub> Stock Composition Estimates . . . . .	11
Three-Way Stock Composition Estimates . . . . .	11
Four-Way Classification of Catch Samples . . . . .	15
In-Season Stock Composition Analysis . . . . .	17
Catch Apportionment . . . . .	17
East-side Set Net Fishery . . . . .	23
West-side Set Net Fishery . . . . .	23

TABLE OF CONTENTS (Continued)

	<u>Page</u>
RECOMMENDATIONS . . . . .	27
LITERATURE CITED . . . . .	29
APPENDICES . . . . .	30

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. The Upper Cook Inlet area showing the locations of the Northern and Central Districts and the major sockeye salmon spawning drainages . . . . .	2
2. Age 52 sockeye salmon scale showing characteristics used in discriminant analysis . . . . .	4

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Numbers of sockeye salmon sampled from the Upper Cook Inlet commercial salmon fishery for stock separation studies, 1978 . . . . .	6
2. Learning and test sample classification matrices from a 3-way discriminant analyses of Kenai, Kasilof, and Susitna River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	8
3. Learning and test sample classification matrices from a 3-way discriminant analyses of Kenai, Kasilof, and Susitna River age 5 <sub>2</sub> sockeye salmon, fish length included as a variable, 1978 . . . . .	9
4. Learning and test sample classification matrices from a 4-way discriminant analyses of Kenai, Kasilof, Susitna, and Crescent River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	10
5. Learning and test sample classification matrices from a 4-way discriminant analyses of Kenai, Kasilof, Susitna, and Crescent River age 5 <sub>2</sub> sockeye salmon, fish length included as a variable, 1978 . . . . .	12
6. Estimates of the proportion of age 5 <sub>2</sub> fish by stock from the 3-way classification model of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978 . . . . .	13
7. Estimates of the proportion of age 5 <sub>2</sub> fish by stock of samples collected from the Central District drift harvest, by period, 26 June through 28 July, Upper Cook Inlet, 1978 . . . . .	14
8. Estimates of the proportion of age 5 <sub>2</sub> fish by stock from the 4-way classification model of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978 . . . . .	16
9. In-season and post-season estimates of the proportion of age 5 <sub>2</sub> fish by stock from 3-way classification models of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978 . . . . .	18
10. In-season and post-season estimates of the proportion of age 5 <sub>2</sub> fish by stock and stock allocation estimates from 3-way classification models of commercial drift gill net harvests, by period, Central District, Cook Inlet, 1978 . . . . .	20
11. Catch by stock for each subdistrict of the Central District, 1978 . . . . .	21

LIST OF TABLES (Continued)

<u>Table</u>		<u>Page</u>
12.	Sockeye salmon catch allocation by river system, age class, and major fishery of the Central District, Upper Cook Inlet, 1978 . . . . .	22
13.	Sockeye salmon catch allocation by river system, age class, and date(s) for the drift gill net fishery of the Central District, Upper Cook Inlet, 1978 . . . . .	24
14.	Sockeye salmon catch allocation by river system, age class, and date(s) for the East-side set gill net fishery of the Central District, Upper Cook Inlet, 1978 . . . . .	25
15.	Sockeye salmon catch allocation by river system, age class, and date(s) for the West-side set gill net fishery of the Central District, Upper Cook Inlet, 1978 . . . . .	26

LIST OF APPENDIX TABLES

<u>Appendix Table</u>	<u>Page</u>
1. Numbers of sockeye salmon sampled by date from the Upper Cook Inlet sockeye salmon fishery, 1978 . . . . .	31
2. Numbers of sockeye salmon sampled by date and area from the West-side set gill net fishery of the Central District, Upper Cook Inlet, 1978 . . . . .	32
3. Unweighted age composition of the Kenai River sockeye salmon escapement, 1978 . . . . .	33
4. Weighted cumulative age composition of the Kenai River sockeye salmon escapement, 1978 . . . . .	34
5. Unweighted age composition of the Kasilof River sockeye salmon escapement, 1978 . . . . .	35
6. Weighted cumulative age composition of the Kasilof River sockeye salmon escapement, 1978 . . . . .	36
7. Unweighted age composition of the Susitna River sockeye salmon escapement, 1978 . . . . .	37
8. Weighted cumulative age composition of the Susitna River sockeye salmon escapement, 1978 . . . . .	38
9. Age composition of the Crescent River sockeye salmon escapement, 1978 . . . . .	39
10. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Kasilof River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	40
11. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Susitna River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	41
12. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Crescent River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	42
13. Learning and test sample classification matrices from 2-way discriminant analyses of Kasilof and Susitna River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	43

LIST OF APPENDIX TABLES (Continued)

<u>Appendix Table</u>	<u>Page</u>
14. Learning and test sample classification matrices from 2-way discriminant analyses of Kasilof and Crescent River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	44
15. Learning and test sample classification matrices from 2-way discriminant analyses of Susitna and Crescent River age 5 <sub>2</sub> sockeye salmon, fish length not included as a variable, 1978 . . . . .	45

## ABSTRACT

Discriminant function analysis of scale patterns of age 5<sub>2</sub> sockeye salmon (*Oncorhynchus nerka*) sampled from the commercial harvest of Upper Cook Inlet, Alaska provided the basis for apportioning the catch into component stocks. The four component stocks are Kenai River, Kasilof River, Susitna River, and Crescent River. The drift net fishery of the Central District harvested 72.5% of the total catch of 2.4 million sockeye salmon, followed by the East-side set net fishery with 25.4%, and the West-side set net fishery with 2.1%. Kenai River fish dominated the catches accounting for 74.3% and was followed by Kasilof River with 15.5%, Susitna River at 9.3%, and Crescent River 0.9%. This abundance pattern was seen in the Central District drift net and East-side set net fishery. In the West-side set net fishery, Crescent River fish were most abundant followed by Susitna River, Kasilof River, and Kenai River.

## INTRODUCTION

The Upper Cook Inlet Management Area encompasses the marine waters and drainages north of Anchor Point (Figure 1) which consists of two fishing districts, the Northern and Central. The majority of the salmon are harvested in the Central District which is further subdivided into several subdistricts.

Types of fishing gear have varied. Prior to 1959, regulations permitted the use of drift gill nets, set gill nets, pile traps, and hand traps. After 1959 the use of traps was prohibited. Current regulations permit the use of set gill nets in the Northern and Central Districts. Drift gill nets are permitted only in the Central District.

The principle runs of sockeye salmon in Upper Cook Inlet return to the Kenai, Kaslof, and Susitna River systems. Numerous other systems such as the Crescent River are known to produce smaller runs of sockeye salmon. These stocks exhibit a substantial overlap in their time of entry and distribution which resulted in management strategies that could primarily consider only the most abundant stock.

In 1977 the Statewide Salmon Stock Separation Project initiated studies to develop and apply stock identification techniques based on scale patterns to the Cook Inlet commercial fishery (Bethe and Krasnowski 1979). The objectives of these studies were: (1) develop an in-season stock identification program to aid management biologists in the regulatory decision making process, (2) provide information on the temporal and spatial distribution of each stock within the commercial fishery, and (3) allocate the commercial sockeye salmon harvest by river system.

During 1978 the Statewide Salmon Stock Separation Project continued these studies and also allocated the commercial sockeye salmon harvest to component river systems.

## METHODS AND MATERIALS

### Scale Collection and Processing

Most scales were collected from a preferred area on the left side of the body below the insertion of the dorsal fin and two or three rows above the lateral line (INPFC 1963). Scales were mounted on gummed cards and impressions were made in cellulose acetate cards (Clutter and Whitesel 1956). Initial examination and aging was accomplished with the aid of a microfiche reader. Ages were described in Gilbert-Rich<sup>1</sup> notation.

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<sup>1</sup> Gilbert-Rich formula: Total years of life at maturity (superscript) - year of life at outmigration from freshwater (subscript).

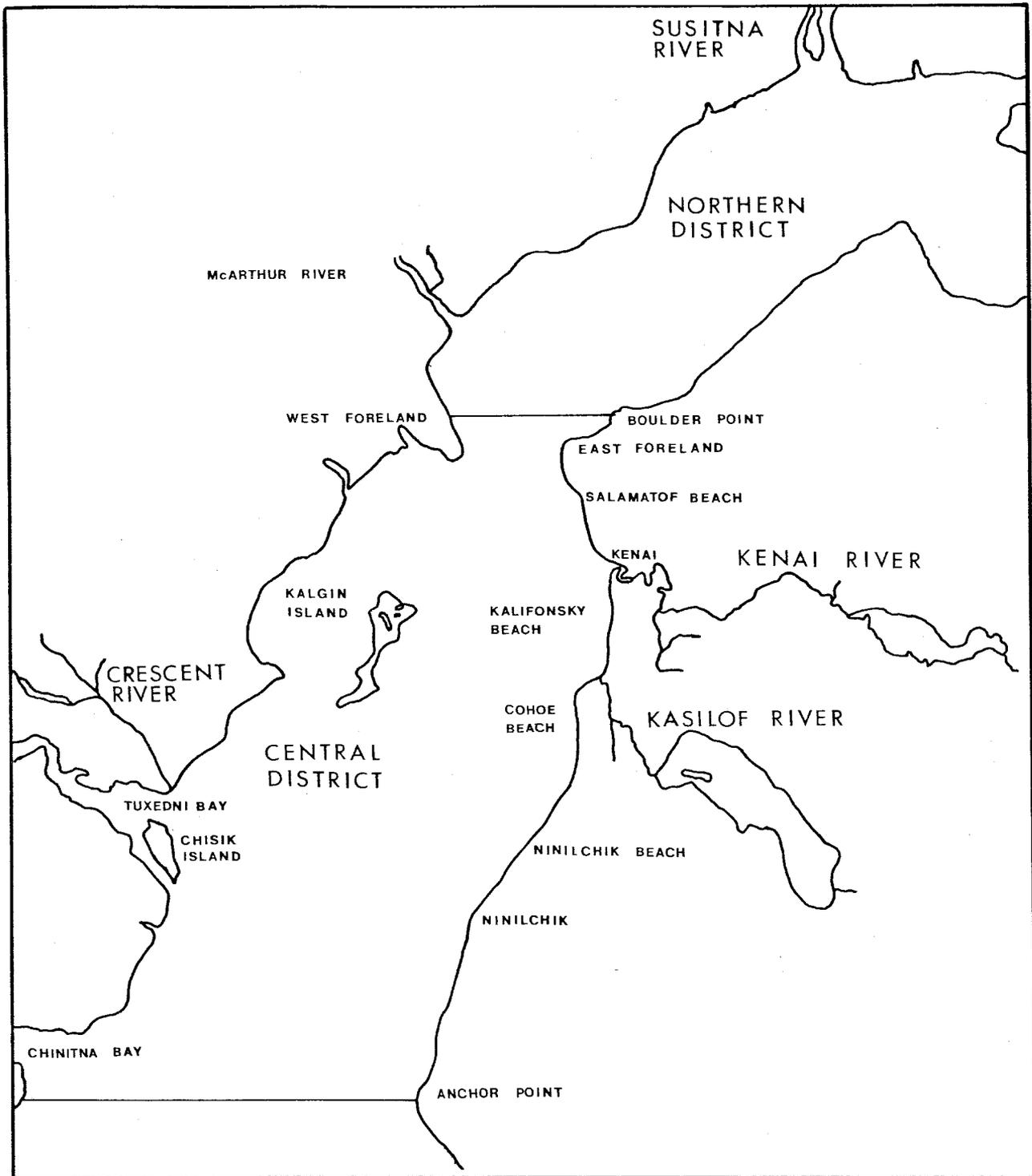


Figure 1. The Upper Cook Inlet area showing the locations of the Northern and Central Districts and the major sockeye salmon spawning drainages.

## Scale Examination and Data Processing

Scale images were projected onto a table surface utilizing equipment similar to that described by Bilton (1970) and later modified by Ryan and Christie (1976). Scales were projected at a magnification of 100X.

The width and number of circuli of summer and winter growth zones were measured (Figure 2). These characteristics were also recorded for the freshwater plus growth zone if present. A detailed description of the scale measurement procedure is given by Krasnowski and Bethe (1978).

## Sample Collection

The escapements into the Kenai, Kasilof, and Susitna Rivers were sampled by means of fishwheels at the sonar counting sites located on each river. Escapements were sampled at each site, except for the Crescent River, throughout the season. Sampling at Crescent River was limited to the period 5 July through 10 July because of logistic problems. Initially, an extensive effort was made to capture 300 fish from each site, then sampling efforts were reduced. This insured adequate samples to begin the analysis and sufficient samples to consider possible temporal variation in scale patterns. Length (mid-eye to fork of tail) was measured, sex was determined, and a scale was collected from each fish.

Commercial catches from the Northern and Central Districts were sampled during or following each fishing period. Catches from the drift gill net fishery in the Central District were sampled at processor plants in the Kenai area. Catches from the set gill net fishery along the east side of the Central District were sampled at specific sites on each beach. Because the harvest from this area normally comprises a significant portion of the total harvest and because it is located adjacent to the Kenai and Kasilof River mouths, critical sections of the beach were further subdivided into independent sampling areas. Catches made in the Northern District, Central District West-side, and Kalgin Island set gill net fisheries were sampled at processor plants in the Kenai area.

## Statistical Techniques

We used linear discriminant function analysis (Fisher 1936; Nie et al. 1975) to identify the origin of sockeye salmon sampled from the various fisheries. The analysis requires measurements from samples of known group membership, in our case, samples from the escapement into each river system. Scale measurements from these samples provide the data required to estimate the discriminant functions. In order to estimate the accuracy of the classification functions a series of test classifications were performed in which a second sample of known origin was classified. Because the true origin of the fish in the test classification samples are known, estimates of the accuracy as well as estimates of misclassification for each group can be made. These estimates are considered unbiased because the samples used to compute the classification functions are not used to estimate classification accuracy.

Final proportional estimates of the stock composition of mixed-stock fishery samples were made using the procedure of Cook and Lord (1978). This procedure

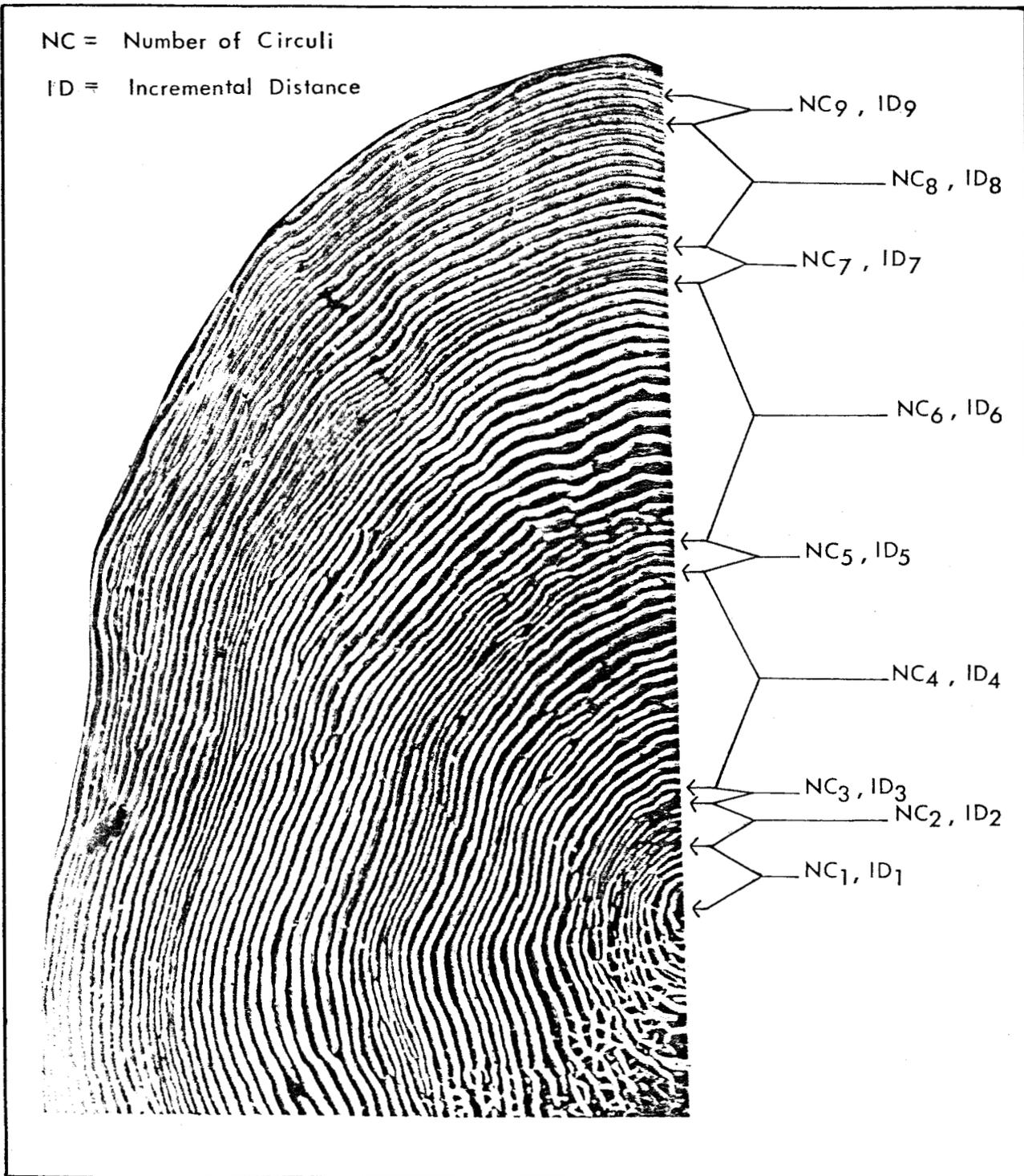


Figure 2. Age 5<sub>2</sub> sockeye salmon scale showing scale characteristics used in discriminant analysis.

uses the classification matrix estimated from the test sample to account for errors in the classification function. The variance and 90% confidence intervals of the estimates were made using the method of Pella and Robertson (1979). Learning and test samples consisted of approximately 50 fish each; whenever possible, classification of mixed stock samples was based on at least 100 fish.

### In-Season Run Analysis

Scales from the early component of the escapements into the Kenai, Kasilof, and Susitna Rivers were used in a preliminary analysis in order to provide estimates of the stock composition of catches occurring in areas and during the time periods critical to the management of the fishery.

During the fishing season, estimates were not corrected for misclassification errors using the procedure of Cook and Lord (1978). The reliability of these preliminary in-season estimates was evaluated by comparing them with final post-season estimates derived using the procedure of Cook and Lord (1978) and from samples collected throughout the duration of the escapement.

### Catch Apportionment

Sockeye salmon catches from the drift gill net and set gill net fisheries along the east and west side of the Central District were apportioned by age class and river system. Allocation of catches from Kalgin Island in the Central District and set net catches from the Northern District were limited because insufficient scale samples were obtained to estimate stock and age composition.

Catch allocation figures are based upon a combination of scale analysis and age composition techniques. Scale analysis was used to estimate the proportion of age 52 fish in each catch by river system. Allocations of the other age classes were based upon age 52 stock composition estimates and the ratios of the proportion of each age class to the 52 age class from the respective escapements.

## RESULTS AND DISCUSSION

### Catch and Escapement Samples

Approximately 2,500 scale samples were collected from the escapement to the Kenai, Kasilof, and Susitna Rivers. Catch sampling was conducted during the period 23 June through 28 July and produced 18,372 sockeye salmon scales. The number of samples obtained from each area is summarized in Table 1; in Appendix Tables 1 and 2 we show the number of samples obtained from each area by date.

Because of low escapements into the Kenai River we were prevented from obtaining adequate sample sizes for making in-season estimates for age apportionment until approximately mid-season (18 July). Age composition

Table 1. Numbers of sockeye salmon sampled from the upper Cook Inlet commercial salmon fishery for stock separation studies, 1978.

Location	Number of Samples		Total
	Cannery	Beach Site	
Salamatof Beach Set Net	745		3,979
Boulder Point to East Foreland		1,139	
North Salamatof Beach		882	
South Salamatof Beach		1,213	
Kalifonsky Beach Set Net	793		3,823
North Kalifonsky Beach		1,508	
South Kalifonsky Beach		1,522	
Cohoe Beach Set Net	1,962		3,837
North Cohoe Beach		1,875	
Ninilchik Beach Set Net	1,478		1,478
Chisik Island Set Net		776	776
Central District Drift	2,461		2,461
Central District West-Side Set Net	1,061		1,061
Northern District West-Side Set Net	351		351
Northern District East-Side Set Net	606		606
Total	9,457	8,915	18,372

for the Kenai, Kasilof, and Susitna River escapements is shown in Appendix Table 3 through 8. Appendix Table 9 shows the age composition of escapement samples obtained from the Crescent River.

### Discriminant Analyses

Discriminant analyses of scale characteristics was conducted to examine the two-way, three-way, and four-way separability of Kenai, Kasilof, Susitna, and Crescent River stocks. The resulting classification models were used to estimate the stock composition of catches from the commercial fishery. In order to evaluate the performance of the in-season classification model, results were compared to final post-season classification results. In addition we examined two, three, and four-way separability with and without the inclusion of fish length as a variable.

#### Three-Way Analyses:

Learning and test sample classification matrices of Kenai, Kasilof, and Susitna samples that exclude fish lengths as a variable are presented in Table 2. The learning sample classification matrix shows an overall accuracy of 74%; Kenai and Kasilof samples correctly classified 77% and 84%, respectively. Susitna samples showed the lowest accuracy (59%) with similar numbers being misclassified as Kenai and Kasilof. The test classification matrix shows a slightly lower overall accuracy of 72%. This was due to a decrease of correctly classified Susitna fish to 46%. Generally, misclassification trends are similar for each matrix.

Learning and test classification matrices in which fish lengths was included as a variable are shown in Table 3. Each matrix is similar to those which excluded fish length as a variable. No increase of classification accuracy was achieved, in fact, a very slight decrease from 74% to 73% is noted in the learning sample classification matrix.

In each of the three-way analyses, Susitna River stocks are misclassified most often and Kasilof fish are correctly classified most often. We believe this is a result of the Susitna sockeye run being composed of multiple sub-populations resulting in a high within group variability. The Kasilof system on the other hand, is probably composed of fewer sub-populations each of which rear in a similar freshwater environment (Tustumena Lake) and this is reflected by less within run variability of scale patterns. The trend of classification accuracies obtained are similar to those observed in 1977 (Bethe and Krasnowski 1979).

#### Four-Way Analyses:

Classification matrices resulting from four-way analyses of Kenai, Kasilof, Susitna, and Crescent River stocks (fish length not included as a variable) are presented in Table 4. Comparison of these matrices with those obtained in the three-way analyses (see Table 2) shows only a slight decrease in overall classification accuracy (67% learning, 68% test samples). The inclusion of Crescent River resulted in a slight decrease in accuracy for the Kenai and Susitna Rivers. Kasilof classification accuracy decreased

Table 2. Learning and test sample classification matrices from a 3-way discriminant analyses of Kenai, Kasilof, and Susitna River age 52 sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>		
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>
Kenai (n=97)	Number	75	4	18
	Percent	0.77	0.04	0.19
Kasilof (n=93)	Number	5	78	10
	Percent	0.05	0.84	0.11
Susitna (n=79)	Number	18	14	47
	Percent	0.23	0.18	0.59

Overall Classification Accuracy = 74%

B. Test sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>		
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>
Kenai (n=97)	Number	75	9	13
	Percent	0.77	0.09	0.14
Kasilof (n=93)	Number	2	83	8
	Percent	0.02	0.89	0.09
Susitna (n=79)	Number	24	19	36
	Percent	0.30	0.24	0.46

Overall Classification Accuracy = 72%

Table 3. Learning and test sample classification matrices from a 3-way discriminant analyses of Kenai, Kasilof, and Susitna River age 5<sub>2</sub> sockeye salmon, fish length included as a variable, 1978.

A. Learning sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>		
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>
Kenai (n=97)	Number	74	4	19
	Percent	0.76	0.04	0.20
Kasilof (n=93)	Number	7	77	9
	Percent	0.07	0.83	0.10
Susitna (n=79)	Number	18	16	45
	Percent	0.23	0.20	0.57

Overall Classification Accuracy = 73%

B. Test sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>		
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>
Kenai (n=97)	Number	72	9	16
	Percent	0.74	0.09	0.17
Kasilof (n=93)	Number	1	86	6
	Percent	0.01	0.93	0.06
Susitna (n=79)	Number	25	18	36
	Percent	0.32	0.23	0.45

Overall Classification Accuracy = 72%

Table 4. Learning and test sample classification matrices from a 4-way discriminant analyses of Kenai, Kasilof, Susitna, and Crescent River age 52 sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>			
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>	<u>Crescent</u>
Kenai (n=97)	Number	66	5	12	14
	Percent	0.68	0.05	0.12	0.15
Kasilof (n=93)	Number	5	72	14	2
	Percent	0.06	0.77	0.15	0.02
Susitna (n=79)	Number	13	18	35	13
	Percent	0.17	0.22	0.44	0.17
Crescent (n=48)	Number	4	1	3	40
	Percent	0.08	0.02	0.06	0.84

Overall Classification Accuracy = 67%

B. Test sample classification matrix.

<u>ACTUAL GROUP MEMBERSHIP</u>		<u>CLASSIFIED GROUP MEMBERSHIP</u>			
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>	<u>Crescent</u>
Kenai (n=97)	Number	59	10	13	15
	Percent	0.61	0.10	0.13	0.16
Kasilof (n=93)	Number	2	83	7	1
	Percent	0.02	0.89	0.08	0.01
Susitna (n=79)	Number	17	18	36	8
	Percent	0.21	0.23	0.46	0.10
Crescent (n=48)	Number	6	0	4	38
	Percent	0.13	0.00	0.08	0.79

Overall Classification Accuracy = 68%

only in the learning sample classification matrix. In summary, Crescent River stocks were readily identified in the test sample (79% accuracy) and inclusion of this group has little effect upon overall accuracy.

Comparable four-way matrices resulting from analyses which include fish length as a variable are shown in Table 5. As in the previous three-way example, the inclusion of fish length resulted in no improvement of classification accuracy (68% learning and test samples).

#### Two-Way Analyses:

Analyses were also conducted to examine all possible two-way comparisons. Classification matrices from these analyses are presented in Appendix Tables 10 through 15. Application of the results from the two-way analyses for stock separation is limited by the multiple mixed-stock nature of the fishery. Only after the presence of two stocks has been eliminated through the use of four and/or three-way classification models can these models be applied to the classification of catch samples.

#### Age 5<sub>2</sub> Stock Composition Estimates

During 1978 the commercial harvest consisted primarily of age 5<sub>2</sub> fish (82%). Because of this and the importance of this age class as an indicator of stock composition within upper Cook Inlet, direct application of scale pattern classification techniques was limited to the 5<sub>2</sub> age class. Stock composition estimates were made using both the three and four-way classification models (fish length not included as a variable).

#### Three-Way Stock Composition Estimates:

Stock composition estimates derived from the three-way Kenai, Kasilof, and Susitna classification model are presented in Table 6. Examination of these results show several trends. Generally, the proportion of Kenai age 5<sub>2</sub> fish tended to be relatively weak during early fishing periods, increased as the fishery progressed, and finally dropped off. Kasilof age 5<sub>2</sub> fish tended to be strongest during early fishing periods and weakened as the fishery progressed. It is more difficult to generalize about Susitna age 5<sub>2</sub> fish. However, catches occurring in the East-side set net fishery, from Boulder Point and Salamatof set net areas, contained the highest proportions of Susitna age 5<sub>2</sub> fish. With the exception of Coho Beach during the latter fishing period (17 July - 28 July) much smaller proportions of Susitna age 5<sub>2</sub> fish were observed in catches south of the Salamatof set net area.

Except for the Central District West-side set net area, the proportion of age 5<sub>2</sub> Kenai fish builds sharply to a peak occurring between 15 and 21 July (Table 6). In late July the proportion of age 5<sub>2</sub> Kenai fish tended to decrease while age 5<sub>2</sub> Susitna fish increased in many areas of the fishery, particularly Boulder Point, Salamatof Beach, and Central District drift.

Sufficient samples were collected from the drift gill net fishery in the Central District to examine the stock composition of harvests from each period between 26 June and 28 July (Table 7). Early in the drift fishery

Table 5. Learning and test sample classification matrices from a 4-way discriminant analyses of Kenai, Kasilof, Susitna, and Crescent River age 52 sockeye salmon, fish length included as a variable, 1978.

A. Learning sample classification matrix.

ACTUAL GROUP MEMBERSHIP		CLASSIFIED GROUP MEMBERSHIP			
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>	<u>Crescent</u>
Kenai (n=97)	Number	67	3	14	13
	Percent	0.69	0.03	0.15	0.13
Kasilof (n=93)	Number	6	72	12	3
	Percent	0.07	0.77	0.13	0.03
Susitna (n=79)	Number	13	18	35	13
	Percent	0.16	0.23	0.45	0.16
Crescent (n=48)	Number	4	1	3	40
	Percent	0.08	0.02	0.06	0.84

Overall Classification Accuracy = 68%

B. Test Sample Classification matrix.

ACTUAL GROUP MEMBERSHIP		CLASSIFIED GROUP MEMBERSHIP			
		<u>Kenai</u>	<u>Kasilof</u>	<u>Susitna</u>	<u>Crescent</u>
Kenai (n=97)	Number	62	8	14	13
	Percent	0.64	0.08	0.15	0.13
Kasilof (n=93)	Number	2	84	6	1
	Percent	0.02	0.90	0.07	0.01
Susitna (n=79)	Number	17	18	32	12
	Percent	0.22	0.23	0.40	0.15
Crescent (n=48)	Number	7	0	3	38
	Percent	0.15	0.00	0.06	0.79

Overall Classification Accuracy = 68%

Table 6. Estimates of the proportion of age 5<sub>2</sub> fish by stock from the 3-way classification model of commercial set and drift gillnet harvests from the Central and Northern Districts of Cook Inlet, 1978.

Proportion of Catch (90% C.I.) by Sample Period								
Sample Location	River	6/19 - 6/26	7/3 - 7/7	7/10	7/15	7/17 - 7/21	7/21 - 7/28	7/24 - 7/28
Boulder Point Set Net	Kenai		.34 ( 0, .69)	.04 ( 0, .49)	.30 (.07, .53)	.72 (.49, .95)		.68 (.44, .92)
	Kasilof		.35 (.07, .63)	.26 ( 0, .67)	.53 (.33, .73)	.22 (.08, .36)		.18 (.04, .32)
	Susitna		.31 ( 0, .75)	.70 (.01, 1.0)	.17 (.12, .46)	.06 ( 0, .32)		.14 ( 0, .42)
North Salamatof Set Net	Kenai		.49 (.16, .82)	0 ( 0, .40)	.79 (.54, 1.0)	.80 (.56, 1.0)		.79 (.53, 1.0)
	Kasilof		.34 (.10, .58)	.11 ( 0, .52)	.21 (.06, .36)	.09 ( 0, .21)		.03 ( 0, .15)
	Susitna		.17 ( 0, .56)	.89 (.20, 1.0)	0 ( 0, .26)	.11 ( 0, .39)		.18 ( 0, .48)
South Salamatof Set Net	Kenai		.43 (.23, .63)	.44 (.10, .78)	.83 (.59, 1.0)	.82 (.56, 1.0)		.76 (.48, 1.0)
	Kasilof		.45 (.29, .61)	.24 (.02, .50)	.11 ( 0, .24)	.02 ( 0, .14)		0 ( 0, .10)
	Susitna		.12 ( 0, .36)	.30 ( 0, .72)	.06 ( 0, .33)	.16 ( 0, .46)		.24 ( 0, .58)
North Kalifornsky Set Net	Kenai		.37 (.16, .58)	.51 (.28, .74)	.92 (.68, 1.0)	.56 (.33, .79)		.60 (.38, .82)
	Kasilof		.63 (.45, .81)	.45 (.27, .63)	.07 ( 0, .19)	.20 (.05, .35)		.25 (.11, .39)
	Susitna		0 ( 0, .23)	.04 ( 0, .30)	.01 ( 0, .29)	.24 ( 0, .52)		.15 ( 0, .43)
South Kalifornsky Set Net	Kenai		.61 (.40, .82)	.58 (.36, .80)	.70 (.47, .93)	.60 (.39, .81)		.67 (.43, .91)
	Kasilof		.39 (.24, .54)	.41 (.25, .57)	.30 (.14, .46)	.40 (.24, .56)		.14 ( 0, .28)
	Susitna		0 ( 0, .23)	.01 ( 0, .25)	0 ( 0, .25)	0 ( 0, .24)		.19 ( 0, .47)
North Cohoe <sup>1]</sup> Set Net	Kenai		.39 (.20, .58)	.46 (.24, .68)	.74 (.51, .97)	.71 (.48, .94)		.82 (.58, 1.0)
	Kasilof		.57 (.41, .73)	.51 (.33, .69)	.23 (.09, .37)	.19 (.05, .33)		.18 (.04, .32)
	Susitna		.04 ( 0, .26)	.03 ( 0, .28)	.03 ( 0, .29)	.10 ( 0, .37)		0 ( 0, .26)
Cohoe Set Net	Kenai		.39 (.20, .58)	.68 (.39, .97)	.90 (.61, 1.0)	.41 (.15, .67)		.50 (.25, .75)
	Kasilof		.56 (.40, .72)	.27 (.08, .46)	.10 ( 0, .27)	.12 ( 0, .30)		.07 ( 0, .21)
	Susitna		.05 ( 0, .27)	.05 ( 0, .37)	0 ( 0, .31)	.47 (.12, .82)		.43 (.11, .75)
Ninilchik Set Net	Kenai		.34 (.15, .53)	.82 ( 0, .83)	.86 (.57, 1.0)	.68 (.45, .91)		
	Kasilof		.56 (.40, .72)	.18 ( 0, .36)	.14 ( 0, .32)	.28 (.14, .42)		
	Susitna		.10 ( 0, .33)	0 ( 0, .33)	0 ( 0, .31)	.04 ( 0, .30)		
Central District West-Side Set Net	Kenai	.47 (.21, .73)	.40 (.03, .77)	.90 (.50, 1.0)	.08 ( 0, .39)			.24 ( 0, .60)
	Kasilof	.02 ( 0, .17)	0 ( 0, .18)	.03 ( 0, .23)	.17 ( 0, .40)			.33 (.03, .63)
	Susitna	.51 (.18, .84)	.60 (.13, 1.0)	.07 ( 0, .51)	.75 (.32, 1.0)			.43 ( 0, .92)
Chisik Island Set Net	Kenai					.03 ( 0, .35)		.19 ( 0, .46)
	Kasilof					0 ( 0, .20)		.08 ( 0, .36)
	Susitna					.97 (.53, 1.0)		.73 (.37, 1.0)
Central District Drift Net	Kenai	.12 ( 0, .36)	.60 (.39, .81)	.90 (.59, 1.0)	.97 (.66, 1.0)	.98 (.72, 1.0)	.80 (.58, 1.0)	.67 (.44, .90)
	Kasilof	.55 (.23, .78)	.16 (.06, .26)	.10 ( 0, .22)	.03 ( 0, .15)	.02 ( 0, .12)	.04 ( 0, .13)	.06 ( 0, .16)
	Susitna	.33 ( 0, .66)	.24 ( 0, .50)	0 ( 0, .15)	0 ( 0, .27)	0 ( 0, .33)	.16 ( 0, .43)	.27 ( 0, .55)
Northern District East-Side Set Net	Kenai					.32 ( 0, .68)		.80 (.51, 1.0)
	Kasilof					.04 ( 0, .25)		.15 ( 0, .32)
	Susitna					.64 (.18, 1.0)		.05 ( 0, .37)
Northern District West-Side Set Net	Kenai						.11 ( 0, .41)	
	Kasilof						.13 ( 0, .37)	
	Susitna						.76 (.34, 1.0)	

<sup>1]</sup> Northern section of beach only, within three miles south of the Kasilof River mouth.

Table 7. Estimates of the proportion of age 5<sub>2</sub> fish by stock of samples collected from the Central District drift harvest, by period, 26 June through 28 July, Upper Cook Inlet, 1978.

Date	River	Proportion of Catch	
		Point Estimate	90% Confidence Interval
June 26	Kenai	.12	(0, .36)
	Kasilof	.55	(.23, .78)
	Susitna	.33	(0, .66)
June 30	Kenai	0	(0, .15)
	Kasilof	.05	(0, .31)
	Susitna	.95	(.49, 1.0)
July 3	Kenai	.45	(.21, .70)
	Kasilof	.22	(.07, .37)
	Susitna	.33	(.03, .63)
July 5	Kenai	.75	(.47, .83)
	Kasilof	.08	(0, .22)
	Susitna	.17	(0, .51)
July 10	Kenai	.90	(.59, 1.0)
	Kasilof	.10	(0, .22)
	Susitna	0	(0, .15)
July 15	Kenai	.97	(.66, 1.0)
	Kasilof	.03	(0, .15)
	Susitna	0	(0, .28)
July 17	Kenai	.92	(.61, 1.0)
	Kasilof	.08	(0, .20)
	Susitna	0	(0, .20)
July 19-20	Kenai	.99	(.68, 1.0)
	Kasilof	.01	(0, .12)
	Susitna	0	(0, .16)
July 21	Kenai	.99	(.70, 1.0)
	Kasilof	.01	(0, .10)
	Susitna	0	(0, .34)
July 26	Kenai	.95	(.66, 1.0)
	Kasilof	.05	(0, .17)
	Susitna	0	(0, .35)
July 28	Kenai	.27	(0, .56)
	Kasilof	.09	(0, .29)
	Susitna	.64	(.26, 1.0)

the proportion of Kenai age 52 fish was low; however, from 10 July through 26 July nearly all of the age 52 catch was of Kenai origin. On 28 July the majority of the age 52 harvest was composed of Susitna fish. This is similar to results shown in Table 6, i.e., a resurgence in the proportion of Susitna age 52 fish during later fishing periods.

A closer examination of Kasilof River age 52 fish shows that this group was very strong in East-side set net catches from 3 July through 7 July. The proportion of Kasilof age 52 fish decreased somewhat during the fishing period on 10 July and with the exception of the Boulder Point set net area continued to do so until 15 July. During the peak of the fishery when the proportion of Kenai age 52 fish predominated in most areas, Kasilof age 52 fish were most abundant in the set net areas adjacent to the Kasilof River mouth (South Kalifonsky Beach and North Cohoe Beach) and in the Boulder Point set net areas. In the drift fishery Kasilof age 52 fish were present in significant proportions on 26 June, the first fishing period of the season.

#### Four-Way Classification of Catch Samples:

Estimates of the proportion of age 52 fish by stock derived from the four-way Kenai, Kasilof, Susitna, and Crescent River classification model are shown in Table 8. Samples from the Central District East-side and Northern District set net fisheries were classified by the four-way model in order to examine the eastern and northern distributions of Crescent River stocks. Results show that few, if any, age 52 Crescent fish were present in catches occurring in the East-side set net fisheries from Boulder Point south through North Cohoe Beach. However, a small proportion of the catches occurring on Cohoe and Ninilchik beaches appeared to have been of Crescent origin. These results seem reasonable in view of the closer proximity of these beaches to Crescent River. However, it must be noted that in all but one sample (Cohoe Beach set net, 3 July through 7 July) the lower end of the 90% confidence range is zero.

Significant proportions of the harvest occurring in the Central District West-side set net fishery were composed of Crescent River age 52 fish. Only in the sample from the period of 24 July through 28 July does the lower range of the confidence interval for Crescent River fall to zero. In fact, we see that it is practically the only stock represented whose lower confidence limit does not fall to zero. Point estimates show that age 52 Crescent fish were predominant in three of the five samples.

Point estimates for age 52 fish of two samples collected from the Northern District East-side set net area (Table 8) show that no Crescent stocks were harvested. However, point estimates from the one sample obtained from the Northern District West-side set net area show that approximately 17% of the age 52 harvest during that time period was composed of Crescent River fish. Again, it must be noted that in each case the lower limit of the Crescent River stocks the 90% confidence interval falls to zero.

Within the drift fishery, few if any Crescent stock were intercepted prior to the period from 21 July through 28 July. Results from this time period show that approximately 24% of the harvest of age 52 fish was of Crescent

Table 8. Estimates of the proportion of age 5<sub>2</sub> fish by stock from the 4-way classification model of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978.

Sampling Location	River	Proportion of Catch (90% C.I.) by Sample Period						
		6/19 - 6/26	7/3 - 7/7	7/10	7/15	7/17 - 7/21	7/21 - 7/28	7/24 - 7/28
Boulder Point Set Net	Kenai	.40 (.0, .86)	.16 (.0, .68)	.31 (.01, .61)	.74 (.43, 1.0)			.67 (.34, 1.0)
	Kasilof	.27 (.0, .66)	.31 (.19, .81)	.42 (.16, .68)	.16 (.0, .34)			.16 (.0, .36)
	Susitna	.33 (.0, .94)	.46 (.0, 1.0)	.23 (.0, .62)	.10 (.0, .45)			.17 (.0, .55)
	Crescent	0 (.0, .18)	.07 (.0, .39)	.04 (.0, .20)	0 (.0, .15)			0 (.0, .15)
North Salamatof Set Net	Kenai	.52 (.10, .94)	.02 (.0, .50)	.85 (.49, 1.0)	.78 (.45, 1.0)			.84 (.47, 1.0)
	Kasilof	.34 (.03, .65)	.18 (.0, .70)	.15 (.0, .35)	.08 (.0, .26)			0 (.0, .17)
	Susitna	.10 (.0, .58)	.71 (.0, 1.0)	0 (.0, .35)	.14 (.0, .55)			.16 (.0, .58)
	Crescent	.04 (.0, .26)	.09 (.0, .40)	0 (.0, .18)	0 (.0, .16)			0 (.0, .16)
South Salamatof Set Net	Kenai	.42 (.16, .68)	.46 (.02, .90)	.82 (.48, 1.0)	.83 (.47, 1.0)			.73 (.38, 1.0)
	Kasilof	.43 (.22, .64)	.26 (.0, .58)	.08 (.0, .26)	0 (.0, .16)			0 (.0, .13)
	Susitna	.12 (.0, .44)	.28 (.0, .83)	.10 (.0, .46)	.17 (.0, .57)			.25 (.0, .65)
	Crescent	.03 (.0, .17)	0 (.0, .16)	0 (.0, .17)	0 (.0, .17)			.02 (.0, .22)
North Kalifonsky Set Net	Kenai	.40 (.12, .68)	.51 (.20, .82)	.96 (.60, 1.0)	.56 (.26, .86)			.62 (.31, .93)
	Kasilof	.60 (.35, .85)	.45 (.21, .69)	.02 (.0, .19)	.15 (.0, .35)			.17 (.0, .37)
	Susitna	0 (.0, .32)	0 (.0, .24)	.02 (.0, .38)	.29 (.0, .67)			.21 (.0, .58)
	Crescent	0 (.0, .12)	.04 (.0, .20)	0 (.0, .18)	0 (.0, .14)			0 (.0, .13)
South Kalifonsky Set Net	Kenai	.65 (.35, .95)	.58 (.28, .88)	.60 (.36, 1.0)	.64 (.34, .94)			.68 (.35, 1.0)
	Kasilof	.35 (.15, .55)	.38 (.16, .60)	.27 (.07, .47)	.36 (.15, .57)			.07 (.0, .25)
	Susitna	0 (.0, .31)	.04 (.0, .36)	0 (.0, .32)	0 (.0, .32)			.25 (.0, .63)
	Crescent	0 (.0, .14)	0 (.0, .13)	0 (.0, .23)	0 (.0, .12)			0 (.0, .16)
North Coho <sup>1]</sup> Set Net	Kenai	.41 (.17, .65)	.42 (.14, .70)	.78 (.46, 1.0)	.78 (.44, 1.0)			.85 (.51, 1.0)
	Kasilof	.58 (.36, .80)	.54 (.30, .78)	.22 (.02, .42)	.11 (.0, .30)			.14 (.0, .32)
	Susitna	.01 (.0, .31)	.03 (.0, .37)	.03 (.0, .34)	.11 (.0, .49)			.01 (.0, .37)
	Crescent	0 (.0, .12)	.01 (.0, .14)	0 (.0, .16)	0 (.0, .14)			0 (.0, .16)
Coho Set Net	Kenai	.18 (.0, .38)	.47 (.11, .83)	.73 (.33, 1.0)	.41 (.09, .73)			.54 (.20, .88)
	Kasilof	.51 (.31, .71)	.26 (.02, .50)	.15 (.0, .37)	.08 (.0, .30)			.02 (.0, .24)
	Susitna	.02 (.0, .30)	.02 (.0, .38)	0 (.0, .36)	.51 (.07, .95)			.44 (.0, .88)
	Crescent	.29 (.12, .46)	.25 (.0, .50)	.12 (.0, .36)	0 (.0, .14)			0 (.0, .15)
Ninlichik Set Net	Kenai	.29 (.05, .53)	.68 (.28, 1.0)	.76 (.36, 1.0)	.75 (.42, 1.0)			
	Kasilof	.56 (.34, .78)	.12 (.0, .33)	.12 (.0, .33)	.20 (.0, .40)			
	Susitna	.09 (.0, .39)	.01 (.0, .39)	0 (.0, .35)	.05 (.0, .41)			
	Crescent	.06 (.0, .20)	.19 (.0, .45)	.12 (.0, .38)	0 (.0, .13)			
Central District West-Side Set Net	Kenai	.06 (.0, .32)	.12 (.0, .50)	.37 (.0, .85)	0 (.0, .24)			.34 (.0, .79)
	Kasilof	.01 (.0, .13)	0 (.0, .22)	.01 (.0, .19)	.13 (.0, .33)			.26 (.0, .62)
	Susitna	.16 (.0, .50)	.57 (.01, 1.0)	0 (.0, .45)	.09 (.0, .48)			.30 (.0, .90)
	Crescent	.77 (.52, 1.0)	.31 (.02, .60)	.62 (.22, 1.0)	.78 (.50, 1.0)			.10 (.0, .38)
Chisik Island Set Net	Kenai					.02 (.0, .31)		.12 (.0, .42)
	Kasilof					0 (.0, .21)		.07 (.0, .31)
	Susitna					.65 (.17, 1.0)		.68 (.21, 1.0)
	Crescent					.33 (.0, .67)		.13 (.0, .33)
Central District Drift Net	Kenai	.21 (.0, .51)	.70 (.40, 1.0)	.89 (.47, 1.0)	.98 (.55, 1.0)	1.0 (.63, 1.0)	.64 (.36, .92)	.50 (.20, .80)
	Kasilof	.60 (.34, .86)	.12 (.0, .25)	.04 (.0, .18)	0 (.0, .12)	0 (.0, .11)	.08 (.0, .17)	.11 (.0, .22)
	Susitna	.19 (.0, .58)	.18 (.0, .50)	0 (.0, .40)	.02 (.0, .46)	0 (.0, .38)	.04 (.0, .31)	.06 (.0, .29)
	Crescent	0 (.0, .22)	0 (.0, .23)	.06 (.0, .40)	0 (.0, .32)	0 (.0, .28)	.24 (.0, .48)	.33 (.05, .61)
Northern District East-Side Set Net	Kenai					.43 (.0, .87)		.79 (.39, 1.0)
	Kasilof					.01 (.0, .28)		.12 (.0, .34)
	Susitna					.66 (.07, 1.0)		.08 (.0, .50)
	Crescent					0 (.0, .20)		0 (.0, .20)
Northern District West-Side Set Net	Kenai						.10 (.0, .40)	
	Kasilof						.14 (.0, .40)	
	Susitna						.59 (.10, 1.0)	
	Crescent						.17 (.0, .39)	

1] Northern section of beach only, within three miles south of the Kasilof River mouth.

origin with the bulk of the remaining age 5<sub>2</sub> fish of Kenai origin.

A comparison of the four-way and three-way classification models for Kenai, Kasilof, and Susitna for the East-side set net area south through North Cohoe Beach and the Central District drift fishery shows similar results. However, comparison of three and four-way results from the Cohoe and Ninilchik set net areas on the East-side and for the West-side Central District set net area indicates a somewhat different picture. For the Cohoe and Ninilchik set net areas when Crescent River age 5<sub>2</sub> fish were indicated in the four-way analysis, these proportions resulted largely from a decreased allocation to the Kenai River. For the Central District West-side set net area, the large proportions of age 5<sub>2</sub> Crescent fish resulted from a decreased allocation of both Kenai and Susitna fish.

### In-Season Stock Composition Analysis

A three-way classification model of Kenai, Kasilof, and Susitna River age 5<sub>2</sub> fish was developed in-season using only the early components of each escapement. The first stock composition estimates were provided to fishery managers on 18 July. In order to evaluate the performance of the in-season classification model, all samples collected from the commercial harvest were classified by both the in-season model and the post-season classification model.

In-season and post-season age 5<sub>2</sub> stock composition estimates for catches occurring in both the set and drift gill net fisheries is presented in Table 9. Comparison of the respective estimates show little difference for the East-side set net fisheries and for the Central District drift gill net fishery. This is particularly important because the majority of the total harvest occurred in these areas. Significant differences between in-season and post-season stock composition estimates are evident for samples collected from the set net fisheries north of the east foreland and on the West-side, however relatively few fish were harvested in these areas.

Sufficient samples were collected from the drift fishery to examine the stock composition of catches from each fishing period. In-season and post-season age 5<sub>2</sub> stock composition estimates with catch allocations are shown in Table 10. Again, the in-season and post-season classification models reflect similar estimates of stock composition.

### Catch Apportionment

Apportionment estimates were computed for the East-side and West-side set gill net and drift gill net fisheries in the Central District.

#### Drift Gill Net Fishery:

The drift gill net fishery took 1.75 million fish or 72.5% of the combined Central District harvest (Table 11). The drift harvest was composed primarily of age 5<sub>2</sub> fish (84.2%), followed by age 4<sub>2</sub> (5.8%), age 5<sub>3</sub> (4.4%), and age 6<sub>3</sub> (5.6%), Table 12. Allocation of the catch by stock shows that Kenai fish comprised the largest proportion (82.1%) followed by Kasilof (10.2%) and Susitna fish (7.7%).

Table 9. In-season and post-season estimates of the proportion of age 5<sub>2</sub> fish by stock from 3-way classification models of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978.

Sampling Location	River	Proportion of Catch (90% C.I.) by Sample Period							
		6/19-6/26		7/3-7/7		7/10		7/15	
		In-season Estimate	Post-season Estimate	In-season Estimate	Post-season Estimate	In-season Estimate	Post-season Estimate	In-season Estimate	Post-season Estimate
Boulder Point Set Net	Kenai			.30 ( 0,.61)	.34 ( 0,.69)	.19 ( 0,.52)	.04 ( 0,.49)	.29 (.10,.48)	.30 (.07,.53)
	Kasilof			.15 ( 0,.39)	.35 (.07,.63)	.49 (.12,.06)	.26 ( 0,.67)	.49 (.29,.69)	.53 (.33,.73)
	Susitna			.55 (.16,.94)	.31 ( 0,.75)	.32 ( 0,.78)	.70 (.01,1.0)	.22 ( 0,.46)	.17 (.12,.46)
North Salamatof Set Net	Kenai			.57 (.30,.84)	.49 (.16,.82)	0 ( 0,.21)	0 ( 0,.40)	.82 (.63,1.0)	.79 (.54,1.0)
	Kasilof			.30 (.07,.53)	.34 (.10,.58)	.43 (.06,.80)	.11 ( 0,.52)	.18 (.04,.32)	.21 (.06,.36)
	Susitna			.13 ( 0,.41)	.17 ( 0,.56)	.57 (.11,1.0)	.89 (.20,1.0)	0 ( 0,.26)	0 ( 0,.26)
South Salamatof Set Net	Kenai			.45 (.28,.62)	.43 (.23,.63)	.53 (.26,.80)	.44 (.10,.70)	.79 (.61,.97)	.83 (.59,1.0)
	Kasilof			.41 (.26,.56)	.45 (.29,.61)	.27 (.05,.49)	.24 (.02,.50)	.14 (.02,.26)	.11 ( 0,.24)
	Susitna			.14 ( 0,.33)	.12 ( 0,.36)	.20 ( 0,.49)	.30 ( 0,.72)	.07 ( 0,.26)	.06 ( 0,.33)
North Kalifonsky Set Net	Kenai			.38 (.20,.56)	.37 (.16,.58)	.45 (.26,.64)	.51 (.28,.74)	.83 (.74,1.0)	.92 (.68,1.0)
	Kasilof			.62 (.44,.80)	.63 (.45,.81)	.48 (.30,.66)	.45 (.27,.63)	.09 ( 0,.20)	.07 ( 0,.19)
	Susitna			0 ( 0,.18)	0 ( 0,.22)	.07 ( 0,.27)	.04 ( 0,.30)	.08 ( 0,.27)	.01 ( 0,.29)
South Kalifonsky Set Net	Kenai			.53 (.36,.70)	.61 (.40,.82)	.56 (.38,.74)	.58 (.36,.80)	.66 (.47,.85)	.70 (.47,.93)
	Kasilof			.38 (.23,.53)	.39 (.24,.54)	.37 (.21,.53)	.41 (.25,.57)	.34 (.18,.50)	.30 (.14,.46)
	Susitna			.09 ( 0,.27)	0 ( 0,.23)	.07 ( 0,.25)	.01 ( 0,.25)	0 ( 0,.17)	0 ( 0,.25)
North Cohoe <sup>1</sup> Set Net	Kenai			.42 (.26,.58)	.39 (.20,.58)	.43 (.25,.61)	.46 (.24,.68)	.74 (.56,.92)	.74 (.51,.97)
	Kasilof			.58 (.42,.74)	.57 (.41,.73)	.57 (.39,.75)	.51 (.33,.69)	.26 (.12,.40)	.23 (.09,.37)
	Susitna			0 ( 0,.16)	.04 ( 0,.27)	0 ( 0,.18)	.03 ( 0,.37)	0 ( 0,.16)	.03 ( 0,.31)
Cohoe Set Net	Kenai			.37 (.22,.49)	.39 (.20,.58)	.66 (.43,.89)	.68 (.39,.97)	.88 (.66,1.0)	.90 (.61,1.0)
	Kasilof			.61 (.45,.77)	.56 (.40,.77)	.34 (.15,.53)	.27 (.08,.46)	.12 ( 0,.28)	.10 ( 0,.27)
	Susitna			.02 ( 0,.19)	.05 ( 0,.27)	0 ( 0,.21)	.05 ( 0,.33)	0 ( 0,.19)	0 ( 0,.31)
Ninilchik Set Net	Kenai			.36 (.20,.52)	.34 (.15,.53)	.72 (.49,.95)	.82 ( 0,.83)	.76 (.52,1.0)	.86 (.57,1.0)
	Kasilof			.64 (.48,.80)	.56 (.40,.72)	.28 (.09,.47)	.18 ( 0,.36)	.21 (.04,.38)	.14 ( 0,.32)
	Susitna			0 ( 0,.15)	.10 ( 0,.33)	0 ( 0,.19)	0 ( 0,.33)	.03 ( 0,.26)	0 ( 0,.31)
Central District West-side Set Net	Kenai	.43 (.23,.63)	.47 (.21,.73)	.63 (.37,.99)	.40 (.03,.77)	.75 (.42,1.0)	.90 (.50,1.0)	.22 (.02,.42)	.08 ( 0,.39)
	Kasilof	.09 ( 0,.23)	.02 ( 0,.17)	.08 ( 0,.24)	0 ( 0,.18)	.12 ( 0,.34)	.03 ( 0,.23)	.37 (.16,.58)	.17 ( 0,.40)
	Susitna	.48 (.24,.72)	.51 (.18,.84)	.29 ( 0,.58)	.60 (.13,1.0)	.13 ( 0,.47)	.07 ( 0,.51)	.41 (.14,.68)	.75 (.32,1.0)
Chisik Island Set Net	Kenai								
	Kasilof								
	Susitna								
Central District Drift Net	Kenai	.15 ( 0,.32)	.12 ( 0,.36)	.60 (.45,.75)	.60 (.39,.81)	.95 (.77,1.0)	.90 (.59,1.0)	1.0 (.82,1.0)	.97 (.66,1.0)
	Kasilof	.63 (.42,.84)	.55 (.23,.78)	.09 ( 0,.20)	.16 (.06,.26)	.05 ( 0,.16)	.10 ( 0,.22)	0 ( 0,.08)	.03 ( 0,.15)
	Susitna	.22 ( 0,.46)	.33 ( 0,.66)	.31 (.11,.51)	.24 ( 0,.50)	0 ( 0,.20)	0 ( 0,.15)	0 ( 0,.22)	0 ( 0,.27)
Northern District East-side Set Net	Kenai								
	Kasilof								
	Susitna								
Northern District West-side Set Net	Kenai								
	Kasilof								
	Susitna								

Table 9. In-season and post-season estimates of the proportion of age 5<sub>2</sub> fish by stock from 3-way classification models of commercial set and drift gill net harvests from the Central and Northern Districts of Cook Inlet, 1978 (continued).

Sampling Location	River	Proportion of Catch (90% C.I.) by Sample Period					
		7/17-7/21		7/21-7/28		7/24-7/28	
		In-season Estimate	Post-season Estimate	In-season Estimate	Post-season Estimate	In-season Estimate	Post-season Estimate
Boulder Point Set Net	Kenai	.70 (.51,.89)	.72 (.49,.95)			.66 (.47,.85)	.68 (.44,.92)
	Kasilof	.07 ( 0,.10)	.22 (.08,.36)			.15 (.02,.28)	.18 (.04,.32)
	Susitna	.23 (.02,.44)	.06 ( 0,.32)			.19 ( 0,.40)	.14 ( 0,.42)
North Salamatof Set Net	Kenai	.79 (.60,.98)	.80 (.56,1.0)			.76 (.57,.95)	.79 (.53,1.0)
	Kasilof	.02 ( 0,.12)	.09 ( 0,.21)			.08 ( 0,.19)	.03 ( 0,.15)
	Susitna	.19 ( 0,.40)	.11 ( 0,.39)			.16 ( 0,.36)	.18 ( 0,.48)
South Salamatof Set Net	Kenai	.80 (.61,.99)	.82 (.56,1.0)			.93 (.74,1.0)	.76 (.48,1.0)
	Kasilof	0 ( 0,.10)	.02 ( 0,.14)			0 ( 0,.08)	0 ( 0,.10)
	Susitna	.20 ( 0,.41)	.16 ( 0,.46)			.07 ( 0,.28)	.24 ( 0,.58)
North Kalifonsky Set Net	Kenai	.56 (.37,.85)	.56 (.33,.79)			.56 (.37,.75)	.60 (.38,.82)
	Kasilof	.17 (.04,.30)	.20 (.05,.35)			.15 (.02,.27)	.25 (.11,.39)
	Susitna	.27 (.06,.48)	.24 ( 0,.52)			.29 (.08,.50)	.15 ( 0,.43)
South Kalifonsky Set Net	Kenai	.65 (.47,.93)	.60 (.39,.91)			.68 (.49,.87)	.67 (.43,.91)
	Kasilof	.35 (.70,.50)	.40 (.24,.56)			.11 ( 0,.23)	.14 ( 0,.28)
	Susitna	0 ( 0,.17)	0 ( 0,.24)			.21 ( 0,.42)	.19 ( 0,.47)
North Coho <sup>1</sup> Set Net	Kenai	.66 (.48,.84)	.71 (.40,.94)			.78 (.59,.97)	.82 (.58,1.0)
	Kasilof	.24 (.11,.37)	.19 (.05,.33)			.14 (.02,.26)	.18 (.04,.32)
	Susitna	.10 ( 0,.29)	.10 ( 0,.37)			.08 ( 0,.27)	0 ( 0,.26)
Cohoe Set Net	Kenai	.47 (.27,.67)	.41 (.15,.67)			.53 (.34,.72)	.50 (.25,.75)
	Kasilof	.05 ( 0,.18)	.12 ( 0,.30)			.16 (.03,.29)	.07 ( 0,.21)
	Susitna	.48 (.24,.72)	.47 (.12,.82)			.31 (.10,.52)	.43 (.11,.75)
Ninilchik Set Net	Kenai	.50 (.40,.76)	.68 (.45,.91)				
	Kasilof	.21 (.07,.35)	.20 (.14,.42)				
	Susitna	.21 (.01,.41)	.04 ( 0,.30)				
Central District West-side Set Net	Kenai					.09 ( 0,.38)	.24 ( 0,.60)
	Kasilof					.21 ( 0,.50)	.33 (.03,.63)
	Susitna					.70 (.28,1.0)	.43 ( 0,.92)
Chisik Island Set Net	Kenai	.14 ( 0,.33)	.03 ( 0,.35)			.20 ( 0,.40)	.19 ( 0,.46)
	Kasilof	.20 (.03,.37)	0 ( 0,.20)			.10 ( 0,.26)	.08 ( 0,.36)
	Susitna	.66 (.39,.93)	.97 (.53,1.0)			.70 (.43,.97)	.73 (.37,1.0)
Central District Drift Net	Kenai	.98 (.83,1.0)	.98 (.72,1.0)	.77 (.63,.91)	.80 (.58,1.0)	.68 (.53,.83)	.67 (.44,.90)
	Kasilof	.01 ( 0,.08)	.02 ( 0,.12)	.11 (.03,.19)	.04 ( 0,.13)	.16 (.06,.26)	.06 ( 0,.16)
	Susitna	.01 ( 0,.19)	0 ( 0,.33)	.12 ( 0,.29)	.16 ( 0,.43)	.16 ( 0,.34)	.27 ( 0,.55)
Northern District East-side Set Net	Kenai	.37 (.10,.64)	.32 ( 0,.68)			.63 (.40,.86)	.80 (.51,1.0)
	Kasilof	.05 ( 0,.20)	.04 ( 0,.25)			.15 (.01,.31)	.15 ( 0,.32)
	Susitna	.50 (.25,.91)	.64 (.18,1.0)			.22 ( 0,.47)	.05 ( 0,.37)
Northern District West-side Set Net	Kenai			.17 ( 0,.37)	.11 ( 0,.41)		
	Kasilof			.29 (.09,.49)	.13 ( 0,.37)		
	Susitna			.54 (.26,.82)	.76 (.34,1.0)		

<sup>1</sup> Northern section of beach only, within three miles south of the Kasilof River mouth.

Table 10. In-season and post-season estimates of the proportion of age 52 fish by stock and stock allocation estimates from 3-way classification models of commercial drift gill net harvests, by period, Central District, Cook Inlet, 1978.

Date	Drift Harvest (52 Only)	River	IN-SEASON ESTIMATES						POST-SEASON ESTIMATES					
			Proportion of Catch			Numbers of 52 Fish			Proportion of Catch			Numbers of 52 Fish		
			Point Estimate	90% Confidence Interval		Point Estimate	90% Confidence Interval		Point Estimate	90% Confidence Interval		Point Estimate	90% Confidence Interval	
June 26	11,027	Kenai	.15	( 0, .32)		1,654	( 0, 3,529)		.12	( 0, .36)		1,323	( 0, 3,970)	
		Kasilof	.63	(.42, .84)		6,947	( 4,631, 9,263)		.55	(.23, .78)		6,065	( 2,536, 8,601)	
		Susitna	.22	( 0, .46)		2,426	( 0, 5,072)		.33	( 0, .66)		3,639	( 0, 7,278)	
June 30	34,742	Kenai	.19	( 0, .42)		6,601	( 0, 14,592)		0	( 0, .15)		0	( 0, 5,211)	
		Kasilof	.15	( 0, .37)		5,211	( 0, 12,855)		.05	( 0, .31)		1,737	( 0, 10,770)	
		Susitna	.66	(.31,1.00)		22,930	( 10,770, 34,742)		.95	(.49,1.00)		33,005	( 17,024, 34,742)	
July 3	138,351	Kenai	.45	(.26, .64)		62,258	( 35,971, 88,545)		.45	(.21, .70)		62,258	( 29,054, 96,846)	
		Kasilof	.16	( 0, .32)		22,136	( 0, 44,272)		.22	(.07, .37)		30,437	( 9,685, 51,190)	
		Susitna	.39	(.13, .55)		53,957	( 17,986, 76,094)		.33	(.03, .63)		45,656	( 4,151, 87,161)	
July 5	166,121	Kenai	.75	(.56, .94)		124,591	( 93,028, 156,154)		.75	(.47, .83)		124,591	( 78,077, 137,880)	
		Kasilof	.01	( 0, .12)		1,661	( 0, 19,935)		.08	( 0, .22)		13,290	( 0, 36,547)	
		Susitna	.24	( 0, .49)		39,869	( 0, 81,399)		.17	( 0, .51)		28,241	( 0, 84,722)	
July 10	317,889	Kenai	.95	(.77,1.00)		301,994	(244,774, 317,889)		.90	(.59,1.00)		286,100	(187,555, 317,889)	
		Kasilof	.05	( 0, .16)		15,894	( 0, 50,862)		.10	( 0, .22)		31,789	( 0, 69,936)	
		Susitna	0	( 0, .20)		0	( 0, 63,578)		0	( 0, .15)		0	( 0, 47,683)	
July 15	476,963	Kenai	1.0	(.82,1.00)		476,963	(391,110, 476,963)		.97	(.66,1.00)		462,654	(314,796, 476,963)	
		Kasilof	0	( 0, .08)		0	( 0, 38,157)		.03	( 0, .15)		14,309	( 0, 71,544)	
		Susitna	0	( 0, .22)		0	( 0, 104,932)		0	( 0, .28)		0	( 0, 133,550)	
July 17	123,473	Kenai	.91	(.72,1.00)		112,360	( 88,901, 123,473)		.92	(.61,1.00)		113,595	( 75,319, 123,473)	
		Kasilof	.03	( 0, .13)		3,704	( 0, 16,051)		.08	( 0, .20)		9,878	( 0, 24,695)	
		Susitna	.06	( 0, .28)		7,408	( 0, 34,572)		0	( 0, .20)		0	( 0, 24,695)	
July 19-20	172,226	Kenai	1.00	(.83,1.00)		172,226	(142,948, 172,226)		.99	(.68,1.00)		170,504	(117,114, 172,226)	
		Kasilof	0	( 0, .07)		0	( 0, 12,056)		.01	( 0, .12)		1,722	( 0, 20,667)	
		Susitna	0	( 0, .10)		0	( 0, 17,226)		0	( 0, .16)		0	( 0, 27,556)	
July 21	60,002	Kenai	.94	(.75,1.00)		56,402	( 45,002, 60,002)		.99	(.70,1.00)		59,402	( 42,001, 60,002)	
		Kasilof	.01	(1.0, .10)		600	( 0, 6,000)		.01	( 0, .10)		600	( 0, 6,000)	
		Susitna	.05	( 0, .28)		3,000	( 0, 16,801)		0	( 0, .34)		0	( 0, 20,401)	
July 26	11,733	Kenai	.94	(.76,1.00)		11,029	( 8,917, 11,733)		.95	(.66,1.00)		11,146	( 7,744, 11,733)	
		Kasilof	.05	( 0, .15)		587	( 0, 1,760)		.05	( 0, .17)		587	( 0, 1,995)	
		Susitna	.01	( 0, .23)		117	( 0, 2,699)		0	( 0, .35)		0	( 0, 4,107)	
July 28	3,523	Kenai	.32	(.12, .52)		1,127	( 423, 1,832)		.27	( 0, .56)		951	( 0, 1,973)	
		Kasilof	.32	(.13, .51)		1,127	( 458, 1,797)		.09	( 0, .29)		317	( 0, 1,022)	
		Susitna	.36	(.08, .64)		1,268	( 282, 2,255)		.64	(.26,1.00)		2,255	( 916, 3,523)	

Table 11. Catch by stock for each subdistrict of the Central District, 1978<sup>1</sup>.

	KENAI			KASILOF			SUSITNA			CRESCENT			TOTAL		
	No.	%	% of Catch	No.	%	% of Catch	No.	%	% of Catch	No.	%	% of Catch	No.	%	% of Catch
Drift Net Catch	1,440	67.2	80.4	179	36.8	47.7	135	46.1	60.0	0	0	0	1,754	59.5	72.5
East-side Set Net Catch	353	16.4	19.6	186	38.2	49.6	74	25.3	32.9	0	0	0	613	20.8	25.4
West-side Set Net Catch	3	0.1	2.1	10	2.1	2.7	16	5.5	7.1	22		100	51	1.7	2.1
Subtotal	<u>1,796</u>	<u>83.6</u>	<u>100.0</u>	<u>375</u>	<u>77.0</u>	<u>100.0</u>	<u>225</u>	<u>76.8</u>	<u>100.0</u>	<u>22</u>	<u>0</u>	<u>100</u>	<u>2,418</u>	<u>82.0</u>	<u>100.0</u>
Escapement	349 <sup>2</sup>	16.3		112 <sup>3</sup>	23.0		68 <sup>4</sup>	23.2	<sup>6</sup>				529	18.0	
Total Return <sup>5</sup>	2,145	100.0		487	100.0		293	100.0	22.1				2,947	100.0	

<sup>1</sup> Numbers of fish expressed in thousands

<sup>2</sup> Escapement through July 30, 1978.

<sup>3</sup> Escapement through July 27, 1978.

<sup>4</sup> Escapement through July 23, 1978. Figure represents preliminary estimate and is subject to final edit and review.

<sup>5</sup> Does not include catches from Northern District or Kalgin Island of the Central District.

<sup>6</sup> Escapement estimates not made in 1978.

Table 12. Sockeye salmon catch allocation by river system, age class, and major fishery of the Central District, Upper Cook Inlet, 1978<sup>1</sup>.

Fishery	Total Catch	System	5 <sub>2</sub>		4 <sub>2</sub>		5 <sub>3</sub>		6 <sub>3</sub>		Other		Total	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Central District Drift Gill Net	1,750	Kenai	1,292	87.5	22	21.8	55	71.4	71	71.7	0	0	1,440	82.1
		Kasilof	105	7.1	42	41.6	17	22.1	15	15.2	0	0	179	10.2
		Susitna	80	5.4	37	36.6	5	6.5	13	13.1	0	0	135	7.7
		Total	1,477	84.2	101	5.8	77	4.4	99	5.6	0	0	1,754	100.0
Central District East-side Set Gill Net	613	Kenai	331	70.1	7	6.3	7	38.9	7	58.4	1	100.0	353	57.6
		Kasilof	98	20.8	74	67.3	10	55.6	4	33.3	0	0	186	30.3
		Susitna	43	9.1	29	26.4	1	5.5	1	8.3	0	0	74	12.1
		Total	472	77.0	110	17.9	18	2.9	12	2.0	1	20.2	613	100.0
Central District West-side Set Gill Net	51	Kenai	3	9.1	0	0	0	0	0	0	0	0	3	5.9
		Kasilof	3	9.1	5	35.7	2	66.7	0	0	0	0	10	19.6
		Susitna	7	21.2	8	57.2	1	33.3	0	0	0	0	16	31.4
		Crescent	20	60.6	1	7.1	0	0	1	100.0	0	0	22	43.1
Total	33	64.6	14	27.5	3	5.9	1	2.0	0	0	51	100.0		
Combined Central District	2,418	Kenai	1,626	82.0	29	12.9	62	63.3	78	69.6	1	100.0	1,796	74.3
		Kasilof	206	10.4	121	53.8	79	29.6	19	17.0	0	0	375	15.5
		Susitna	130	6.6	74	32.9	7	7.1	14	12.5	0	0	225	9.3
		Crescent	20	1.0	1	0.4	0	0	1	0.9	0	0	22	0.9
Total	1,982	82.0	225	9.3	98	4.1	112	4.6	1	0.1	2,418	100.0		

<sup>1</sup> Numbers of fish in thousands.

Kenai fish predominated within the drift fishery throughout most of the season (Table 13). The proportion of Kenai stocks increased from 40.5% during the period of 19 June - 26 June to 95.7% on 15 July. During the period of 17 July - 21 July the proportion remained nearly the same (95.4%) and then decreased to 45.0% during the period of 24 July - 28 July.

#### East-side Set Net Fishery:

The East-side set net fishery accounted for 613,000 fish or 25.4% of the district total (Table 11). This harvest was 77% age 5<sub>2</sub> fish (Table 12). The remaining catch was composed of 17.9% age 4<sub>2</sub>, 2.9% age 5<sub>3</sub>, and 2% age 6<sub>3</sub> fish. Kenai fish comprised 57.6% of the total catch followed by Kasilof and Susitna stocks at 30.3% and 12.1%, respectively (Table 12).

Catch allocation estimated for the East-side set net fishery by date (Table 14) shows several differences when compared to the drift fishery. From 19 June through 10 July Kasilof stocks were predominate, followed by Kenai and Susitna River stocks. From 15 July through 28 July Kenai stocks comprised the largest proportion followed by Kasilof and Susitna. Within the 4<sub>2</sub> and 5<sub>3</sub> age classes Kasilof was predominate during each time period except 24 July through 28 July. Age 5<sub>2</sub> fish from the Kenai River accounted for 331,000 fish or 54% of the 613,000 harvested in this area.

#### West-side Set Net Fishery:

Set net catches along the West-side beaches in the Central District accounted for 51,000 or 2.1% of the 2.4 million harvest (Table 11). The 4-way classification model which included the Crescent River was used to allocate the harvest. Age 5<sub>2</sub> fish predominated the catch (64.6%) followed by age 4<sub>2</sub> (27.5%), 5<sub>3</sub> (5.9%), and 6<sub>3</sub> (2.0%) Table 12. Apportionment of the harvest by stock showed that Crescent River stocks accounted for 43.1% of the catch followed by Susitna (31.4%), Kasilof (19.6%) and Kenai stocks (5.9%).

Susitna and Crescent River fish essentially shared predominance within the West-side set net fishery (Table 11). During the period (19 June - 26 June) Crescent stocks accounted for 73.3% of the harvest, during the following period (3 July - 7 July) Susitna fish predominated with 68.1% of the catch (Table 15). On 10 July and 15 July Crescent River fish were most abundant with 64.3 and 67.1% of the cumulative catch from the two periods, respectively. Finally, during the last period (24 July - 28 July) Susitna fish were strongest accounting for 44% of the total catch. Only during the period of 17 July through 21 July did another stock (Kasilof) account for the largest proportion (48.8%) of the catch.

Results of allocating the West-side tends to support the idea that Crescent River fish comprise a significant portion of the harvest from that area. Somewhat surprising, however, is the indication that Kasilof stocks are also present and may occasionally be relatively abundant within the fishery. This strength is particularly unexpected when it is noted that Kenai stocks represent the smallest proportion of the harvest on the West-side, yet had by far the largest total return within Cook Inlet. One explanation for this disparity is that those fish allocated to the Kasilof might in fact be "other" stocks not represented in the 4-way classification model.

Table 13. Sockeye salmon catch allocation by river system, age class, and date(s) for the drift gill net fishery of the Central District, Upper Cook Inlet, 1978<sup>1</sup>.

Date(s)	Total Catch	System	5 <sub>2</sub>		4 <sub>2</sub>		5 <sub>3</sub>		6 <sub>3</sub>		Other		Total	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
June 19- June 26	16,800	Kenai	5,500	59.8	200	3.8	300	33.3	700	50.0	100	100.0	6,800	40.5
		Kasilof	1,500	16.3	1,700	32.7	400	44.5	300	21.4	0	0	3,900	23.2
		Susitna	2,200	23.9	3,300	63.5	200	22.2	400	28.6	0	0	6,100	36.3
		Total	9,200	100.0	5,200	100.0	900	100.0	1,400	100.0	100	100.0	16,800	100.0
July 3- July 7	412,300	Kenai	185,500	60.0	1,500	3.6	6,100	32.3	20,200	47.5	0	0	213,300	51.7
		Kasilof	49,500	16.0	13,700	32.8	8,500	45.0	9,900	23.3	0	0	81,600	19.8
		Susitna	74,200	24.0	26,500	63.6	4,300	22.7	12,400	29.2	0	0	117,400	28.5
		Total	309,200	100.0	41,700	100.0	18,900	100.0	42,500	100.0	0	0	412,300	100.0
July 10	359,700	Kenai	286,100	90.0	3,200	20.6	3,000	63.8	17,900	82.9	0	0	310,200	86.2
		Kasilof	31,800	10.0	12,300	79.4	1,700	36.2	3,700	17.1	0	0	49,500	13.8
		Susitna	0	0	0	0	0	0	0	0	0	0	0	0
		Total	317,900	100.0	15,500	100.0	4,700	100.0	21,600	100.0	0	0	359,700	100.0
July 15	519,100	Kenai	462,700	97.0	4,500	48.4	16,100	86.1	13,300	94.3	0	0	496,600	95.7
		Kasilof	14,300	3.0	4,800	51.6	2,600	13.9	800	5.7	0	0	22,500	4.3
		Susitna	0	0	0	0	0	0	0	0	0	0	0	0
		Total	477,000	100.0	9,300	100.0	18,700	100.0	14,100	100.0	0	0	519,100	100.0
July 17- July 21	421,100	Kenai	342,100	98.2	11,800	58.4	29,300	90.4	18,700	96.4	0	0	401,900	95.4
		Kasilof	7,000	2.0	8,400	41.6	3,100	9.6	700	3.6	0	0	19,200	4.6
		Susitna	0	0	0	0	0	0	0	0	0	0	0	0
		Total	349,100	100.0	20,200	100.0	32,400	100.0	19,400	100.0	0	0	421,100	100.0
July 24- July 28	24,900	Kenai	10,000	67.1	400	4.8	400	44.5	400	57.1	0	0	11,200	45.0
		Kasilof	900	6.0	1,200	14.3	200	22.2	100	14.3	0	0	2,400	9.6
		Susitna	4,000	26.9	6,800	80.9	300	33.3	200	28.6	0	0	11,300	45.4
		Total	14,900	100.0	8,400	100.0	900	100.0	700	100.0	0	0	24,900	100.0

<sup>1</sup> Number of fish rounded to nearest hundred.

Table 14. Sockeye salmon catch allocation by river system, age class, and date(s) for the East-side set gill net fishery of the Central District, Upper Cook Inlet, 1978<sup>1</sup>.

Date(s)	Total Catch	System	5 <sub>2</sub>		4 <sub>2</sub>		5 <sub>3</sub>		6 <sub>3</sub>		OTHER		TOTAL	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
June 19- June 26	7,200	Kenai	1,700	42.5	0	0	100	25.0	200	33.3	100	100.0	2,100	29.2
		Kasilof	2,100	52.5	1,900	90.5	300	75.0	400	66.7	0	0	4,700	65.3
		Susitna	200	5.0	200	9.5	0	0	0	0	0	0	400	5.5
		Total	4,000	100.0	2,100	100.0	400	100.0	600	100.0	100	100.0	7,200	100.0
July 3- July 7	25,500	Kenai	6,600	42.9	200	2.3	100	14.3	200	28.6	100	100.0	7,200	28.2
		Kasilof	8,000	51.9	7,500	87.2	600	85.7	500	71.4	0	0	16,600	65.1
		Susitna	800	5.2	900	10.5	0	0	0	0	0	0	1,700	6.7
		Total	15,400	100.0	8,600	100.0	700	100.0	700	100.0	100	100.0	25,500	100.0
July 10	19,200	Kenai	6,400	52.0	200	3.2	100	25.0	100	33.3	0	0	6,800	35.4
		Kasilof	4,400	35.8	4,200	67.8	300	75.0	200	66.7	0	0	9,100	47.4
		Susitna	1,500	12.2	1,800	29.0	0	0	0	0	0	0	3,300	17.2
		Total	12,300	100.0	6,200	100.0	400	100.0	300	100.0	0	0	19,200	100.0
July 15	194,500	Kenai	115,300	79.0	3,700	9.7	2,400	42.1	3,100	67.4	200	100.0	124,700	64.1
		Kasilof	30,600	21.0	34,400	90.3	3,300	57.9	1,500	32.6	0	0	69,800	35.9
		Susitna	0	0	0	0	0	0	0	0	0	0	0	0
		Total	145,900	100.0	38,100	100.0	5,700	100.0	4,600	100.0	200	100.0	194,500	100.0
July 17- July 21	317,400	Kenai	175,400	68.0	2,400	5.3	3,100	36.1	2,600	54.2	600	85.7	184,100	58.0
		Kasilof	49,000	19.0	22,800	50.2	4,500	52.3	1,400	29.2	0	0	77,700	24.5
		Susitna	33,500	13.0	20,200	44.5	1,000	11.6	800	16.6	100	14.3	55,600	17.5
		Total	257,900	100.0	45,400	100.0	8,600	100.0	4,800	100.0	700	100.0	317,400	100.0
July 24- July 28	48,800	Kenai	25,400	70.0	500	5.2	900	45.0	500	55.6	0	0	27,300	55.9
		Kasilof	4,000	11.0	2,800	29.2	700	35.0	200	22.2	0	0	7,700	15.8
		Susitna	6,900	19.0	6,300	65.6	400	20.0	200	22.2	0	0	13,800	28.3
		Total	36,300	100.0	9,600	100.0	2,000	100.0	900	100.0	0	0	48,800	100.0

<sup>1</sup> Numbers of fish rounded to nearest hundred.

Table 15. Sockeye salmon allocation by river system, age class, and date(s) for the West-side set gill net fishery of the Central District, Upper Cook Inlet, 1978<sup>1</sup>.

Date(s)	Total Catch	System	5 <sub>2</sub>		4 <sub>2</sub>		5 <sub>3</sub>		6 <sub>3</sub>		OTHER		TOTAL	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
June 19- June 26	10,100	Kenai	500	6.0	0	0	100	20.0	0	0	0	0	600	5.9
		Kasilof	100	1.2	0	0	100	20.0	0	0	0	0	200	2.0
		Susitna	1,300	15.7	500	83.3	300	60.0	100	14.3	0	0	2,200	21.8
		Crescent	6,400	77.1	100	16.7	0	0	600	85.7	0	0	7,100	70.3
		Total	8,300	100.0	100	100.0	500	100.0	700	100.0	0	0	10,100	100.0
July 3- July 7	9,400	Kenai	800	11.8	0	0	0	0	0	0	0	0	800	8.5
		Kasilof	0	0	0	0	0	0	0	0	0	0	0	0
		Susitna	3,900	57.3	2,000	100.0	400	100.0	100	50.0	0	0	6,400	68.1
		Crescent	2,100	30.9	0	0	0	0	100	50.0	0	0	2,200	23.4
		Total	6,800	100.0	2,000	100.0	400	100.0	200	100.0	0	0	9,400	100.0
July 10	2,800	Kenai	800	36.4	100	20.0	0	0	0	0	0	0	900	32.1
		Kasilof	0	0	100	20.0	0	0	0	0	0	0	100	3.6
		Susitna	0	0	0	0	0	0	0	0	0	0	0	0
		Crescent	1,400	63.6	300	60.0	0	0	100	100.0	0	0	1,800	64.3
		Total	2,200	100.0	500	100.0	0	0	100	100.0	0	0	2,800	100.0
July 15	14,300	Kenai	0	0	0	0	0	0	0	0	0	0	0	0
		Kasilof	1,500	13.0	700	43.7	500	83.3	100	16.7	0	0	2,800	19.6
		Susitna	1,000	8.7	700	43.8	100	16.7	100	16.7	0	0	1,900	13.3
		Crescent	9,000	78.3	200	12.5	0	0	400	66.6	0	0	9,600	67.1
		Total	11,500	100.0	1,600	100.0	600	100.0	600	100.0	0	0	14,300	100.0
July 17- July 21	12,700	Kenai	400	17.4	100	1.2	200	11.1	0	0	0	0	700	5.5
		Kasilof	600	26.1	4,200	50.0	1,300	72.2	100	50.0	0	0	6,200	48.8
		Susitna	400	17.4	3,800	45.2	300	16.7	0	0	0	0	4,500	35.4
		Crescent	900	39.1	300	3.6	0	0	100	50.0	0	0	1,300	10.3
		Total	2,300	100.0	8,400	100.0	1,800	100.0	200	100.0	0	0	12,700	100.0
July 24- July 28	2,500	Kenai	400	36.4	0	0	0	0	0	0	0	0	400	16.0
		Kasilof	300	27.3	400	36.4	200	66.7	0	0	0	0	900	36.0
		Susitna	300	27.3	700	63.6	100	33.3	0	0	0	0	1,100	44.0
		Crescent	100	9.0	0	0	0	0	0	0	0	0	100	4.0
		Total	1,100	100.0	1,100	100.0	300	100.0	0	0	0	0	2,500	100.0

<sup>1</sup> Numbers of fish rounded to nearest hundred.

The heavy exploitation of Kenai fish in the drift fishery and not on the East-side set net fishery can be partially explained by the entrance pattern of the escapement into the Kenai River. Within 5 days following 15 July over 235,000 fish entered the river. Prior to 15 July catches were relatively low in the East-side set net fishery and quite high in the drift fishery. Estimates of the proportion of age 52 fish from the drift fishery show that for the fishing periods occurring on 5, 10, and 15 July the catch was composed of 75%, 90%, and 97% Kenai fish, respectively (Table 7). As a result, Kenai fish were more subject to harvest within the drift fishery and relatively unavailable for harvest along the East-side beaches.

## RECOMMENDATIONS

As mentioned in the introduction section of this paper, the objectives of this study were to:

- 1) Define procedures for and develop an in-season stock identification capability for the Upper Cook Inlet commercial sockeye salmon fishery,
- 2) Describe the spatial and temporal distribution of the major sockeye salmon stocks, and
- 3) Allocate the commercial sockeye salmon harvest by river system.

These objectives are specific and reflect the desire of the ADF&G to develop methods which will improve the management of the fishery.

The first objective, that of developing an in-season stock separation capability was accomplished. However, certain aspects do need improvement and several recommendations are presented.

1. More effort must be made to insure the collection of adequate escapement samples from each system early during the season. In-season efforts are primarily dependent upon obtaining these samples early enough to begin processing catch samples for stock composition estimates. Without these samples an "in-season" stock separation program is impossible.
2. Assuming that escapement samples have been collected in a timely manner and that catch samples are available from each fishery, in-season performance is limited primarily by the ability to process and analyze the samples. With the addition of stock composition and allocation information from each component fishery more precise management decisions become possible.

The second objective, description of spatial and temporal distributions of each major run has also, to some extent, been accomplished. However, this also can be improved through modification and/or additions to an existing program. Specifically, catch reports from processors should be more specific

and reflect a finer geographical breakdown of the catch. For example, if catches for the East-side beaches had been available a finer allocation would have been possible.

The third objective, that of commercial harvest catch allocation, was achieved except for Kalgin Island within the Central District. Because of inadequate sampling in the Northern District, only limited allocation was possible. In order to begin the development of a total return data base sampling from these areas needs to be specifically addressed. Finally, the catch allocation of the combined Central District catch was achieved through a combination of scale pattern analysis and age class composition techniques. A more precise allocation may be possible through the use of scale analysis techniques for the allocation of each age class.

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APPENDICES

Appendix Table 1. Numbers of sockeye salmon sampled by date from the Upper Cook Inlet sockeye salmon fishery, 1978.

CANNERY SAMPLES								
Date	C.D. Drift	Ninil. Bch.	Coho Bch.	Kalif. Bch.	Salam. Bch.	N.D. E-SD Set	N.D. W-SD Set	C.D. W-SD Set
6-20								200 red 83 king
6-24								175
6-26	120		120					80
6-30	141	150	150	150				
7-03	250	195	200					
7-05	250	200	200					
7-07	closed	155	156	26				79
7-10	250	198	186					75
7-15	250	200	200	150	150			106
7-17	250	-0-	200	149	150			150
7-19	250	200	120	61	150	150		
7-21	250	180	200	150	145	56	150	
7-24	closed	closed	closed	closed	closed	193	104	84
7-26	250		200			57	80	60
7-28	200		150			150	17	
Total	2,461	1,478	1,962	793	745	606	351	1,061

Appendix Table 2. Numbers of sockeye salmon sampled by date and area from the West-side set gill net fishery of the Central District, Upper Cook Inlet, 1978.

Date	SAMPLING AREA				
	Chisik Island Outside	Tuxedni Channel	Tuxedni Bay	Polly Creek	Harriet Point
7-19	9	-0-	-0-	-0-	-0-
7-20	63	2	-0-	28	-0-
7-21	117	30	40	40	-0-
7-24	101	25	38	-0-	-0-
7-26	57	23	20	40	30
7-28	29	5	-0-	-0-	-0-
7-31	26	17	14	-0-	-0-
8-04	-0-	-0-	12	-0-	-0-
Total	402	102	134	108	30

Appendix Table 3. Unweighted age composition of the Kenai River sockeye salmon escapement, 1978.

DATE	SAMPLE SIZE	DAILY ESCAPEMENT	%	AGE 4 <sup>2</sup> NO. IN ESC.	%	AGE 5 <sup>2</sup> NO. IN ESC.	%	AGE 5 <sup>3</sup> NO. IN ESC.	%	AGE 6 <sup>3</sup> NO. IN ESC.	%	OTHER NO. IN ESC.
6/22		600										
6/23		400										
6/24		300										
6/25		800										
6/26		800										
6/27		900										
6/28		400										
6/29		1,300										
6/30		2,300										
7/1		1,800										
7/2		1,900										
7/3		1,900										
7/4		900										
7/5		600										
7/6		700										
7/7		1,500										
7/8		300										
7/9		700										
7/10		1,000										
7/11		3,200										
7/12		3,600										
7/13		1,000										
7/14		1,300										
7/15		2,700										
7/16		35,300										
6/22-7/16	213	66,200	1.9	1,258	83.1	55,012	4.7	3,111	9.8	6,488	0.5	331
7/17	195	53,900	3.1	1,671	84.6	45,600	3.6	1,940	8.7	4,689	0.0	0
7/18		63,400										
7/19		49,200										
7/20		33,300										
7/21		14,400										
7/18-7/21	138	160,300	1.5	2,404	92.0	147,476	2.2	3,527	3.6	5,771	0.7	1,122
7/22		10,300										
7/23		5,900										
7/24		7,800										
7/25		8,000										
7/22-7/25	127	32,000	3.9	1,248	86.6	27,712	7.1	2,272	2.4	768	0.0	0
7/26		6,800										
7/27		9,200										
7/28		7,300										
7/29		5,800										
7/30		7,500										
7/26-7/30	141	36,500	5.7	2,081	73.1	26,682	17.0	6,205	3.5	1,277	0.7	255

Appendix Table 4. Weighted cumulative age composition of the Kenai River sockeye salmon escapement, 1978.

DATE	SAMPLE SIZE	CUMULATIVE ESCAPEMENT	% AGE 4 <sup>2</sup> NO. IN ESC.	% AGE 5 <sup>2</sup> NO. IN ESC.	% AGE 5 <sup>3</sup> NO. IN ESC.	% AGE 6 <sup>3</sup> NO. IN ESC.	OTHER NO. IN ESC.					
6/22		600										
6/23		1,000										
6/24		1,300										
6/25		2,100										
6/26		2,900										
6/27		3,800										
6/28		4,200										
6/29		5,500										
6/30		7,800										
7/1		9,600										
7/2		11,500										
7/3		13,400										
7/4		14,300										
7/5		14,900										
7/6		15,600										
7/7		17,100										
7/8		17,400										
7/9		18,100										
7/10		19,100										
7/11		22,300										
7/12		25,900										
7/13		26,900										
7/14		28,200										
7/15		30,900										
7/16		66,200										
6/22-7/16	213	66,200	1.9	1,258	83.1	55,012	4.7	3,111	9.8	6,488	0.5	331
7/17	408	120,100	2.4	2,929	83.8	100,612	4.2	5,051	9.3	11,177	0.3	331
7/18		183,500										
7/19		232,700										
7/20		266,000										
7/21		280,400										
7/18-7/21	546	280,400	1.9	5,333	88.5	248,088	3.1	8,578	6.0	16,948	0.5	1,453
7/22		290,700										
7/23		296,600										
7/24		304,400										
7/25		312,400										
7/22-7/25	673	312,400	2.1	6,581	88.3	275,800	3.5	10,850	5.7	17,716	0.4	1,453
7/26		319,200										
7/27		328,400										
7/28		335,700										
7/29		341,500										
7/30		348,900										
7/26-7/30	814	348,900	2.5	8,662	86.7	302,482	4.9	17,055	5.4	18,993	0.5	1,708

DATE	SAMPLE SIZE	DAILY ESCAPEMENT	AGE 4 <sup>2</sup> % NO. IN ESC.	AGE 5 <sup>2</sup> % NO. IN ESC.	AGE 5 <sup>3</sup> % NO. IN ESC.	AGE 6 <sup>3</sup> % NO. IN ESC.	OTHER % NO. IN ESC.
6/22		200					
6/23		100					
6/24		400					
6/25		600					
6/26		300					
6/27		1,000					
6/28		1,300					
6/29		4,700					
6/30		4,000					
7/1		2,100					
7/2		6,000					
7/3		7,400					
7/4		2,400					
6/22-7/4	138	30,500	43.5 13,267	45.7 13,939	3.6 1,098	7.2 2,196	0 0
7/5		3,600					
7/6		2,300					
7/7		3,700					
7/5-7/7	139	9,600	43.9 4,215	42.4 4,070	5.8 557	7.9 758	0 0
7/8		4,600					
7/9		1,900					
7/10		1,200					
7/8-7/10	143	7,700	42.7 3,288	38.4 2,957	5.6 431	13.3 1,024	0 0
7/11		300					
7/12		1,000					
7/13		1,700					
7/14		1,500					
7/15		2,700					
7/11-7/15	140	7,200	40.7 2,930	37.9 2,729	14.3 1,030	7.1 511	0 0
7/16		13,600					
7/17		17,800					
7/18		13,500					
7/19		3,800					
7/20		1,500					
7/16-7/20	184	50,200	39.1 19,628	40.2 20,181	12.5 6,275	8.2 4,116	0 0
7/21		800					
7/22		800					
7/23		500					
7/24		1,000					
7/21-7/24	140	3,100	47.2 1,463	20.0 620	26.4 819	6.4 198	0 0
7/25		1,400					
7/26		1,400					
7/27		1,000					
7/25-7/27	91	3,800	39.6 1,505	12.1 460	38.4 1,459	9.9 376	0 0

Appendix Table 6. Weighted cumulative age composition of the Kaslof River sockeye salmon escapement, 1978.

DATE	SAMPLE SIZE	CUMULATIVE ESCAPEMENT	% AGE 4 <sup>2</sup>	NO. IN ESC.	% AGE 5 <sup>2</sup>	NO. IN ESC.	% AGE 5 <sup>3</sup>	NO. IN ESC.	% AGE 6 <sup>3</sup>	NO. IN ESC.	% OTHER	NO. IN ESC.
6/22		200										
6/23		300										
6/24		700										
6/25		1,300										
6/26		1,600										
6/27		2,600										
6/28		3,900										
6/29		8,600										
6/30		12,600										
7/1		14,700										
7/2		20,700										
7/3		28,100										
7/4		30,500										
6/22-7/4	138	30,500	43.5	13,267	45.7	13,939	3.6	1,098	7.2	2,196	0	0
7/5		34,100										
7/6		36,400										
7/7		40,100										
7/5-7/7	277	40,100	43.6	17,482	44.9	18,009	4.1	1,655	7.4	2,954	0	0
7/8		44,700										
7/9		46,600										
7/10		47,800										
7/8-7/10	420	47,800	43.4	20,770	43.9	20,966	4.4	2,086	8.3	3,978	0	0
7/11		48,100										
7/12		49,100										
7/13		50,800										
7/14		52,300										
7/15		55,000										
7/11-7/15	560	55,000	43.1	23,700	43.1	23,695	5.7	3,116	8.1	4,489	0	0
7/16		68,600										
7/17		86,400										
7/18		99,900										
7/19		103,700										
7/20		105,200										
7/16-7/20	744	105,200	41.2	43,328	41.7	43,876	8.9	9,391	8.2	8,605	0	0
7/21		106,000										
7/22		106,800										
7/23		107,300										
7/24		108,300										
7/21-7/24	884	108,300	41.4	44,791	41.1	44,496	9.4	10,210	8.1	8,803	0	0
7/25		109,700										
7/26		111,100										
7/27		112,100										
7/25-7/27	975	112,100	41.3	46,296	40.1	44,956	10.4	11,669	8.2	9,179	0	0

Appendix Table 7. Unweighted age composition of the Susitna River sockeye salmon escapement, 1978 <sup>1/</sup>

DATE	SAMPLE SIZE	DAILY ESCAPEMENT	AGE 4 <sup>2</sup>		AGE 5 <sup>2</sup>		AGE 5 <sup>3</sup>		AGE 6 <sup>3</sup>		OTHER	
			%	NO. IN ESC.	%	NO. IN ESC.						
6/25-6/26		100										
6/27-6/29		100										
6/30-7/1		200										
7/2-7/3		400										
6/25-7/3	128	800	35.9	287	57.8	462	1.6	13	4.7	38	0	0
7/4-7/10		600										
7/11-7/16		3,100										
7/17		1,100										
7/4-7/17	161	4,800	34.8	1,670	52.8	2,534	5.6	269	5.0	240	1.8	8.7
7/18		10,200										
7/19		21,100										
7/20		10,100										
7/18-7/20	106	41,400	51.9	21,487	36.8	15,235	3.8	1,573	7.5	3,105	0	0
7/21		14,300										
7/22		2,900										
7/23		3,600										
7/21-7/23	92	20,800	54.4	11,315	38.0	7,904	2.2	458	5.4	1,123	0	0

<sup>1/</sup> Escapement figures from preliminary sonar counts and are subject to final edit and revision.

Appendix Table 8. Weighted age composition of the Susitna River sockeye salmon escapement, 1978. <sup>1/</sup>

DATE	SAMPLE SIZE	CUMULATIVE ESCAPEMENT	% AGE 4 <sup>2</sup> NO. IN ESC.	% AGE 5 <sup>2</sup> NO. IN ESC.	% AGE 5 <sup>3</sup> NO. IN ESC.	% AGE 6 <sup>3</sup> NO. IN ESC.	% OTHER NO. IN ESC.					
6/25-6/26		100										
6/27-6/29		200										
6/30-7/1		400										
7/2-7/3		800										
6/25-7/3	128	800	35.9	287	57.8	462	1.6	13	4.7	38	0	0
7/4-7/10		1,400										
7/11-7/16		4,500										
7/17		5,600										
7/4-7/17	289	5,600	34.9	1,957	53.5	2,996	5.0	282	5.0	278	1.6	87
7/18		15,800										
7/19		36,900										
7/20		47,000										
7/18-7/20	395	47,000	49.9	23,444	38.8	18,231	3.9	1,855	7.2	3,383	0.2	87
7/21		61,300										
7/22		64,200										
7/23		67,800										
7/21-7/23	487	67,800	51.3	34,759	38.6	26,135	3.4	2,313	6.6	4,506	0.1	87

<sup>1/</sup> Escapement figures from preliminary sonar counts and are subject to final edit and revision.

Appendix Table 9. Age composition of the Crescent River sockeye salmon escapement, 1978<sup>1</sup>.

	Age Class					Total
	4 <sub>2</sub>	5 <sub>2</sub>	5 <sub>3</sub>	6 <sub>3</sub>	Other	
Number in Sample	11	199	0	29	0	239
Percent	4.6	83.3	0	12.1	0	100.0

<sup>1</sup> Samples collected during the period of 6 July through 9 July only.

Appendix Table 10. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Kasilof River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Kasilof
Kenai (n=97)	90 0.93	7 0.07
Kasilof (n=93)	9 0.10	84 0.90

Overall classification Accuracy 92%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Kasilof
Kenai (n=97)	87 0.90	10 0.10
Kasilof (n=93)	4 0.04	89 0.96

Overall classification Accuracy 93%

Appendix Table 11. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Susitna River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Susitna
Kenai (n=97)	78 0.80	19 0.20
Susitna (n=79)	19 0.24	60 0.76

Overall classification Accuracy 78%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Susitna
Kenai (n=97)	78 0.80	19 0.20
Susitna (n=79)	24 0.30	55 0.70

Overall classification Accuracy 76%

Appendix Table 12. Learning and test sample classification matrices from 2-way discriminant analyses of Kenai and Crescent River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable,<sup>2</sup>1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Crescent
Kenai (n=97)	78 0.80	19 0.20
Crescent (n=48)	8 0.17	40 0.83

Overall classification Accuracy 81%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kenai	Crescent
Kenai (n=97)	77 0.79	20 0.21
Crescent (n=48)	12 0.27	36 0.75

Overall classification Accuracy 78%

Appendix Table 13. Learning and test sample classification matrices from 2-way discriminant analyses of Kasilof and Susitna River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kasilof	Susitna
Kasilof (n=93)	77 0.83	16 0.17
Susitna (n=79)	14 0.18	65 0.82

Overall classification Accuracy 83%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kasilof	Susitna
Kasilof (n=93)	81 0.87	12 0.13
Susitna (n=79)	17 0.21	62 0.79

Overall classification Accuracy 83%

Appendix Table 14. Learning and test sample classification matrices from 2-way discriminant analyses of Kasilof and Crescent River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kasilof	Crescent
Kasilof (n=93)	85 0.91	8 0.09
Crescent (n=48)	2 0.04	46 0.96

Overall classification Accuracy 93%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Kasilof	Crescent
Kasilof (n=93)	88 0.95	5 0.05
Crescent (n=48)	1 0.02	47 0.98

Overall classification Accuracy 96%

Appendix Table 15. Learning and test sample classification matrices from 2-way discriminant analyses of Susitna and Crescent River age 5<sub>2</sub> sockeye salmon, fish length not included as a variable, 1978.

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Susitna	Crescent
Susitna (n=79)	63 0.80	16 0.20
Crescent (n=48)	6 0.12	42 0.88

Overall classification Accuracy 84%

B. Test sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED GROUP MEMBERSHIP	
	Susitna	Crescent
Susitna (n=79)	61 0.77	18 0.23
Crescent (n=48)	4 0.08	44 0.92

Overall classification Accuracy 83%

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