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

By

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ABSTRACT

Discriminant function analysis of scale patterns of age 52 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 Westside 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, Kasilof, 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-Rich¹ notation.

¹ 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 spawing 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 5₂ 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

	Nur	mber of Samples	
Location	Cannery	Beach Site	Total
Salamatof Beach Set Net Boulder Point to East Foreland North Salamatof Beach South Salamatof Beach	745	1,139 882 1,213	3,979
Kalifonsky Beach Set Net North Kalifonsky Beach South Kalifonsky Beach	793	1,508 1,522	3,823
Cohoe Beach Set Net North Cohoe Beach	1,962	1,875	3,837
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

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

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 subpopulations 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.

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

Overall Classification Accuracy = 74%

B. Test sample classification matrix.

ACTUAL GROUP MEMBERSHIP		CLAS	SIFIED GROUP MEM	BERSHIP
		Kenai	Kasilof	Susitna
Kenai	Number	75	9	13
(n=97)	Percent	0.77	0.09	0.14
Kasilof	Number	2	83	8
(n=93)	Percent	0.02	0.89	0.09
Susitna	Number	24	19	36
(n=79)	Percent	0.30	0.24	0.46

Table 3. Learning and test sample classification matrices from a 3-way discriminant analyses of Kenai, Kasilof, and Susitna River age 5₂ sockeye salmon, fish length included as a variable, 1978.

A. Learning sample classification matrix.

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

Overall Classification Accuracy = 73%

B. Test sample classification matrix.

ACTUAL GROUP MEMBERSHIP		CLASSIFIED GROUP MEMBERSHIP						
		Kenai	Kasilof	Susitna				
Kenai	Number	72	9	16				
(n=97)	Percent	0.74	0.09	0.17				
Kasilof	Number	۲	86	6				
(n=93)	Percent	0.01	0.93	0.06				
Susitna	Number	25	18	36				
(n=79)	Percent	0.32	0.23	0.45				
		Overall Cl	assification Ac	curacy = 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.

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

Overall Classification Accuracy = 67%

B. Test sample classification matrix.

ACTUAL GRO MEMBERSHI)UP [<u>P</u>	CLASSIFIED GROUP MEMBERSHIP								
		Kenai	Kasilof	Susitna	Crescent					
Kenai	Number	59	10	13	15					
(n=97)	Perc ent	0.61	0.10	0.13	0.16					
Kasilof	Number	2	83	7	1					
(n=93)	Perc ent	0.02	0.89	0.08	0.01					
Susitna	Number	17	18	36	8					
(n=79)	Percent	0.21	0.23	0.46	0.10					
Crescent	Number	6	0.00	4	38					
(n=48)	Percent	0.13		0.08	0.79					
		Overal1	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 5₂ Stock Composition Estimates

During 1978 the commercial harvest consisted primarily of age 5₂ 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 5₂ 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_2 fish tended to be relatively weak during early fishing periods, increased as the fishery progressed, and finally dropped off. Kasilof age 5_2 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_2 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_2 fish. With the exception of Cohoe Beach during the latter fishing period (17 July - 28 July) much smaller proportions of Susitna age 5_2 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 52 Kenai fish builds sharply to a peak occurring between 15 and 21 July (Table 6). In late July the proportion of age 52 Kenai fish tended to decrease while age 52 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 GRO MEMBERSH	DUP I P		CLASSIF	IED GROUP MEMBE	RSHIP
		<u>Kenai</u>	Kasilof	Susitna	Crescent
Kenai	Number	67	3	14	13
(n=97)	Percent	0.69	0.03	0.15	0.13
Kasilof	Number	6	72	12	3
(n=93)	Percent	0.07	0.77	0.13	0.03
Susitna	Number	13	18	35	13
(n=79)	Percent	0.16	0.23	0.45	0.16
Crescent	Number	4	1	3	40
(n=48)	Percent	0.08	0.02	0.06	0.84

Overall Classification Accuracy = 68%

B. Test Sample Classification matrix.

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

Overall Classification Accuracy = 68%

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

Table 6. Estimates of the proportion of age 5₂ 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.

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

			Proportion of Catch
Date	River	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)

Table 7. Estimates of the proportion of age 5₂ fish by stock of samples collected from the Central District drift harvest, by period, 26 June through 28 July, Upper Cook Inlet, 1978.

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 fourway 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 5₂ 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	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	Kenal		.40 (0,.86)	.16 (0,.68)	.31 (.01,.61)	.74 (.43,1.0)		.67 (.34,1.0)
Set Net	Kasilof		.27 (0, 66)	.31 (.19,.81)	.42 (.16,.68)	.16 (0,.34)		.16 (0,.36)
	Crescent		0 (0,.94)	.46 (0,1.0)	.23 (0,.62)	.10 (0,.45)		.17 (0,.55)
Nouth followstaf	×/		53 (10, 01)					- (-,,
Set Net	Kenal Kasilof		.52 (.10,.94)	18(0,50)	.85 (.49,1.0)	.78 (.45,1.0)		.84 (.47,1.0)
	Susttna		.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	Kenał		.42 (.16,.68)	.46 (.02,.90)	.82 (.48,1.0)	.83 (.47,1.0)		.73 (.38,1.0)
Set Net	Kasilof		.43 (.22,.64)	.26 (0,.58)	.08 (0, 26)	0 (0.16)		0 (0,.13)
	Susitna Crescent		.12 (0,.44)	.28 (0,.83)	.10 (0,.46)	.17 (0,.57)		.25 (0,.65)
			.03 (0,.17)	0 (0,.10)	0 (0,.17)	0 (0,.17)		.02 (0,.22)
North Kallfonsky Set Net	Kenai Kasilof		.40 (.12,.68)	.51 (.20,.82)	.96 (.60,1.0)	.56 (.26,.86)		.62 (.31,.93)
	Susitna		0 (032)	.45 (.21,.69)	02(0,.19)	.15 (0,.35)		.1/ (0,.3/)
	Crescent		0 (0,.12)	.04 (0,.20)	0 (0,.18)	0 (0,.14)		0 (0, 13)
South Kalifonsky	Kenal		.65 (.3595)	58 (28, 88)	69 (36) 93	(AQ A. F.) AA		68 (35 1 0)
Set Net	Kasilof		.35 (.15,.55)	.38 (.16,.60)	.27 (.07,.47)	.36 (.1557)		.07 (025)
	Susitna		0 (0,.31)	.04 (0,.36)	0 (0,.32)	0 (0, 32)		.25 (063)
17	crescent		0 (0,.14)	0 (0,.13)	0 (0,.23)	0 (0,.12)		0 (0,.16)
North Cohoe'	Kenal		.41 (.17,.65)	.42 (.14,.70)	.78 (.46,1.0)	.78 (.44,1.0)		.85 (.51,1.0)
set net	Kastiot Susitna		.58 (.36,.80)	.54 (.30,.78)	.22 (.02,.42)	.11 (0,.30)		.14 (0,.32)
	Crescent		0 (0,.12)	.01 (0,.14)	0 (0,.34) 0 (0,.16)	0(0,.14)		0 (0,.37)
Cohoe Set Net	Kenal		.18 (018)	47 (13 83)	73 (12 1 0)	() (00 72)		EA (20 00)
	Kasllof		.51 (.31,.71)	.26 (.02,.50)	.15 (037)	.08 (030)		.02 (024)
	Susitna		.02 (0,.30)	.02 (0,.38)	0 (036)	.51 (.07,.95)		.44 (0,.88)
	crescent		.29 (.12,.46)	.25 (0,.50)	.12 (0,.36)	0 (0,.14)		0 (0,.15)
Niniichik Set Net	Kenat		.29 (.05,.53)	.68 (.28,1.0)	.76 (.36,1.0)	.75 (.42,1.0)		
	Susitna		.56 (.34,.78)	.12(0,.33)	.12 (0,.33)	.20 (0,.40)		
	Crescent		.06 (0,.20)	.19 (0,.45)	.12 (0,.38)	0(0,.41)		
Central District	Kena i	.06 (0. 32)	12 (0 50)	27 (0 86)	0 (0 24)			
West-Side Set Net	Kasilof	.01 (0,.13)	0 (0,.22)	.01 (019)	.13(0,.24)			.34 (0,.79)
	Susitna	16 (0,.50)	.57 (.01,1.0)	0 (0,.45)	.09 (0,.48)			.30 (0,.90)
	creatent	.// (.52,1.0)	.37 (.02,.60)	.62 (.22,1.0)	.78 (.50,1.0)			.10 (0,.38)
Sat Net	Kenai					.02 (0,.31)		.12 (042)
Jet Net	Susitna					0 (0, .21)		.07 (0,.31)
	Crescent					.65 (.1/,1.0)		.68(.21,1.0) .13(033)
Central District	Kena f	.21 (051)	70 (40 1 0)	90 / 47 1 01	00 (77 1 0)			
Drift Net	Kasilof	.60 (.34,.86)	.12 (025)	.04 (018)	.98 (.55,1.0)		.64 (.36,.92)	.50 (.20,.80)
	Susitna	.19 (0,.58)	.18 (0,.50)	0 (0,.40)	.02 (0,.46)	0 (0, 38)	.04 (0,.31)	.06 (0,.29)
anthan Diat t		0 (0,.22)	0 (0,.23)	.06 (0,.40)	0 (0,.32)	0 (0,.28)	.24 (0,.48)	.33 (.05,.61)
Fast-Side Set Not	Kenaj					.43 (0,.87)		.79 (.39.1.0)
Late that see het	Susitna					.01 (0, .28)		.12 (0,.34)
	Crescent					0 (0, 20)		.08 (0,.50)
orthern District	Kena (- , -,,		
West-Side Set Net	Kasilof						10 (0,.40)	
	 Susitna Crescent 						.59 (.10,1.0)	
	or eacent						.17 (039)	

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

origin with the bulk of the remaining age 52 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 52 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 52 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 52 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 52 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 52 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 52 fish (84.2%), followed by age 42 (5.8%), age 53 (4.4%), and age 63 (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%).

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

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

Table 9. In-season and post-season estimates of the proportion of age 52 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).

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

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

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.

······································		KENAI			KASILO	F		SUSITN	A	C	RESCE	NT		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	1,796	83.6	100.0	375	77.0	100.0	225	76.8	100.0	22	ō	100	2,418	82.0	100.0
S Escapement	349²	16.3		1 1 2³	23.0		68 ⁴	23.2	6				529	18.0	
Total Return⁵	2,145	100.0		487	100.0		293	100.0	22.1				2,947	100.0	

Table 11. Catch by stock for each subdistrict of the Central District, 1978¹.

¹ Numbers of fish expressed in thousands

² Escapement through July 30, 1978.

³ Escapement through July 27, 1978.

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

⁵ Does not include catches from Northern District or Kalgin Island of the Central District.

⁶ Escapement estimates not made in 1978.

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

Table 12. Sockeye salmon catch allocation by river system, age class, and major fishery of the Central District, Upper Cook Inlet, 19781.

¹ 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 52 fish (Table 12). The remaining catch was composed of 17.9% age 42, 2.9% age 53, and 2% age 63 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 42 and 53 age classes Kasilof was predominate during each time period except 24 July through 28 July. Age 52 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 52 fish predominated the catch (64.6%) followed by age 42 (27.5%), 53 (5.9%), and 63 (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.

	Total		5	2	4	2	53	}	63	3	01	ther	To	tal
Date(s)	Catch	System	No.	%	No.	%	No.	%	No.	c/ /o	No.	%	No.	7' 70
June 19- June 26	16,800	Kenai Kasilof Susitna	5,500 1,500 2,200	59.8 16.3 23.9	200 1,700 3,300	3.8 32.7 63.5	300 400 200	33.3 44.5 22.2	700 300 400	50.0 21.4 28.6	100 0 0	100.0 0 0	6,800 3,900 6,100	40.5 23.2 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 Kasilof Susitna	185,500 49,500 74,200	60.0 16.0 24.0	1,500 13,700 26,500	3.6 32.8 63.6	6,100 8,500 4,300	32.3 45.0 22.7	20,200 9,900 12,400	47.5 23.3 29.2	0 0 0	0 0 0	213,300 81,600 117,400	51.7 19.8 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 Kasilof Susitna	286,100 31,800 0	90.0 10.0 0	3,200 12,300 0	20.6 79.4 0	3,000 1,700 0	63.8 36.2 0	17,900 3,700 0	82.9 17.1 0	0 0 0	0 0 0	310,200 49,500 0	86.2 13.8 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 Kasilof Susitna	462,700 14,300 0	97.0 3.0 0	4,500 4,800 0	48.4 51.6 0	16,100 2,600 0	86.1 13.9 0	13,300 800 0	94.3 5.7 0	0 0 0	0 0 0	496,600 22,500 0	95.7 4.3 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 Kasilof Susitna	342,100 7,000 0	98.2 2.0 0	11,800 8,400 0	58.4 41.6 0	29,300 3,100 0	90.4 9.6 0	18,700 700 0	96.4 3.6 0	0 0 0	0 0 0	401,900 19,200 0	95.4 4.6 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 Kasilof Susitna	10,000 900 4,000	67.1 6.0 26.9	400 1,200 6,800	4.8 14.3 80.9	400 200 300	44.5 22.2 33.3	400 100 200	57.1 14.3 28.6	0 0 0	0 0 0	11,200 2,400 11,300	45.0 9.6 45.4
		Total	14,900	100.0	8,400	100.0	900	100.0	700	100.0	0	0	24,900	100.0

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, 1978¹.

¹ Number of fish rounded to nearest hundred.

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

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, 1978¹.

¹ Numbers of fish rounded to nearest hundred.

	T 7			2	Ĺ	2	5	³ 3	6	3	OTI	HER	τύτ	AL
Date(s)	Catch	System	No.	%	No.	%	No.	%	No.	%	No.	5	No.	
June 19- June 26	10,100	Kenai Kasilof Susitna Crescent	500 100 1,300 6,400	6.0 1.2 15.7 77.1	0 0 500 100	0 0 83.3 16.7	100 100 300 0	20.0 20.0 60.0 0	0 0 100 600	0 0 14.3 85.7	0 0 0 0	0 0 0 0	600 200 2,200 7,100	5.9 2.0 21.8 70.3
	····	IOtal	8,300	100.0	100	100.0	500	100.0	/00	100.0	0	0	10,100	100.0
July 3- July 7	9,400	Kenai Kasilof Susitna Crescent	800 0 3,900 2,100	11.8 0 57.3 30.9	0 0 2,000 0	0 0 100.0 0	0 0 400 0	0 0 100.0 0	0 0 100 100	0 0 50.0 50.0	0 0 0	0 0 0 0	800 0 6,400 2,200	8.5 0 68.1 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 Kasilof Susitna Crescent	800 0 0 1,400	36.4 0 0 63.6	100 100 0 300	20.0 20.0 0 60.0	0 0 0	0 0 0	0 0 0 100	0 0 0 100.0	0 0 0	0 0 0 0	900 100 0 1,800	32.1 3.6 0 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 Kasilof Susitna Crescent	0 1,500 1,000 9,000	0 13.0 8.7 78.3	0 700 700 200	0 43.7 43.8 12.5	0 500 100 0	0 83.3 16.7 0	0 100 100 400	0 16.7 16.7 66.6	0 0 0 0	0 0 0 0	0 2,800 1,900 9,600	0 19.6 13.3 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 Kasilof Susitna Crescent	400 600 400 900	17.4 26.1 17.4 39.1	100 4,200 3,800 300	1.2 50.0 45.2 3.6	200 1,300 300 0	11.1 72.2 16.7 0	0 100 0 100	0 50.0 0 50.0	0 0 0 0	0 0 0 0	700 6,200 4,500 1,300	5.5 48.8 35.4 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 Kasilof Susitna Crescent	400 300 300 100	36.4 27.3 27.3 9.0	0 400 700 0	0 36.4 63.6 0	0 200 100 0	0 66.7 33.3 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	400 900 1,100 100	16.0 36.0 44.0 4.0
		Total	1,100	100.0	1,100	100.0	300	100.0	0	0	0	0	2,500	100.0

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, 1978¹.

¹ 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:

- 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.

- 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

				CANNERY SA	MPLES			
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 rec 83 kir
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 1.	Numbers of	sockeye	salmon	sampled	by	date	from	the	Upper	Cook	Inlet
	sockeye sa	lmon fisl	hery, 19	978.							

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			SAMPLING AREA		₩, ⁴ 14 - 149 -
Date	Chisik Island Outside	Tuxedni Channe 1	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 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	SAMPLE SIZE	DAILY ESCAPEMENT	AGI %	E 4 ² NO. IN ESC.	% %	AGE 5 ² NO. IN ESC.	%	AGE 5 ³ NO. IN ESC.	%	AGE 6 ³ NO. IN ESC.	r	OTHER NO. IN ESC.
6/22 6/23 6/24 6/25 6/26 6/27 6/28 6/29 6/30 7/1 7/2 7/3 7/4 7/5 7/6 7/7 7/7 7/8 7/9 7/10 7/11 7/12 7/13 7/14 7/15 7/16		600 400 300 800 900 400 1,300 2,300 1,800 1,900 1,900 1,900 1,900 1,900 1,500 300 700 1,500 300 700 1,000 3,200 3,600 1,300 2,700 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 7/18 7/19 7/20 7/21	195	53,900 63,400 49,200 33,300 14,400	3.1	1,671	84.6	45,600	3.6	1,940	8.7	4,689	0.0	0
7/18-7/21 7/22 7/23 7/24 7/25	138	160,300 10,300 5,900 7,800 8,000	1.5	2,404	92.0	147,476	2.2	3,527	3.6	5,771	0.7	1,122
7/22-7/25 7/26 7/27 7/28 7/29 7/30	127	32,000 6,800 9,200 7,300 5,800 7,500	3.9	1,248	86.6	27,712	7.1	2,272	2.4	768	0.0	0
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 3. Unweighted age composition of the Kenai River sockeye salmon escapement, 1978.

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

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

DATE	SAMPLE	DAILY	AG	E 4 ²	A	GE 5 ²	A	GE 5 ³		AGE 6 ³		OTHER
DATE	SIZE	ESCAPEMENI	X	NO. IN ESC.	ž	NO. IN ESC.	%	NO. IN ESC.	z	NO. IN ESC.	ž	NQ. IN ESC.
6/22		200		· · · · · · · · · · · · · · · · · · ·			P					
6/23		100										
0/24 6/25		400										
6/26		300										
6/27		1,000										
6/28 6/20		1,300										
6/30		4,000										
7/1		2,100										
7/2		6,000										
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										
7/7		3,700										
/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										
7/8-7/10	143	7,700	42.7	3,288	38.4	2.957	5.6	431	13.3	1.024	0	0
/0 //10	170	,,		-,		2,507				,,	-	-
//11		300										
7/12		1,000										
7/14		1,500										
/15		2,700										
/11-7/15	140	7,200	40.7	2,930	37.9	2,729	14.3	1,030	7.1	511	U	U
7/16		13,600										
//17		17,800										
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										
1/23		800 500										
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										
1/21 1/25-7/27	91	3 800	39.6	1 505	12 1	460	38.4	1.459	9.9	376	0	<u>0</u>
163-1161	<i></i>	0,000		1,000	16.1	400	30.4			3, 3		•

Appendix Table 5. Unweighted age composition of the Kasilof River sockeye salmon escapement, 1978.

DATE	SAMPLE SIZE	DAILY ESCAPEMENT	AC %	NO. IN ESC.	A %	GE 5 ² NO. IN ESC.	z	AGE 5 ³ NO. IN ESC.	%	AGE 6 ³ NO. IN ESC.	%	OTHER NO. IN ESC.
6/25-6/26 6/27-6/29 6/30-7/1		100 100 200										
<u>//2-//3</u> 6/25-7/3	128	800	35.9	287	57.8	462	1.6	13	4.7	38	0	0
7/4-7/10 7/11-7/16 7/17	1/1	600 3,100 <u>1,100</u>	24.0	1 (70	50.0					240	- 1 0	0.7
7/18 7/19 7/20	101	4,800 10,200 21,100 10,100	34.8	1,670	52.8	2,534	5.0	209	5.0	240	1.8	8.7
7/18-7/20 7/21 7/22 7/23	106	41,400 14,300 2,900 3,600	51.9	21,487	36.8	15,235	3.8	1,573	7.5	3,105	0	0
7/21-7/23	92	20,800	54.4	11,315	38.0	7,904	2.2	458	5.4	1,123	0	0

Appendix Table 7. Unweighted age composition of the Susitna River sockeye salmon escapement, 1978 $^{
m J\prime}$

 $\underline{1}$ / Escapement figures from preliminary sonar counts and are subject to final edit and revision.

/

			Age Cla	SS		
	⁴ 2	⁵ 2	⁵ 3	6 ₃	Other	Total
Number in Sample	11	199	0	29	0	239
Percent	4.6	83.3	0	12.1	0	100.0

Appendix Table 9. Age composition of the Crescent River sockeye salmon escapement, 1978^1 .

¹ Samples collected during the period of 6 July through 9 July only.

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

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIED	GROUP MEMBERSHIP
	Kenai	Susitna
Kenai	78	19
(n=97)	0.80	0.20
Susitna	19	60
(n≖79)	0.24	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
	a 15 7 7 a	

Overall classification Accuracy 76%

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

A. Learning sample classification matrix

ACTUAL GROUP MEMBERSHIP	CLASSIFIE	CLASSIFIED GROUP MEMBERSHIP	
	Kasilof	Susitna	
Kasilof (n≖93)	77 0.83	16 0.17	
Susitna (n=79)	14 0.18	65 0.82	
	Overall classi	fication Accuracy 83%	

B. Test sample classification matrix

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

Overall classification Accuracy 83%

Appendix Table 15. Learning and test sample classification matrices from 2-way discriminant analyses of Susitna and Crescent River age 5, 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
	0	

Overall classification Accuracy 84%

B. Test sample classification matrix

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

Overall classification Accuracy 83%