

## INFORMATIONAL LEAFLET NO. 186

## ORIGINS OF SOCKEYE SALMON IN THE UPPER COOK INLET

 FISHERY OF 1978 BASED ON SCALE PATTERN ANALYSISBy
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[^0]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-Rich ${ }^{1}$ notation.

[^1]

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

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 $5_{2}$ 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 |  |  |
| :---: | :---: | :---: | :---: |
|  | Cannery | Beach Site | Total |
| 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 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 |

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 |  | 18 | 14 | 47 |
| $(n=79)$ | Number | Percent | 0.23 | 0.18 |

Overall Classification Accuracy $=74 \%$
B. Test sample classification matrix.

ACTUAL GROUP MEMBERSHIP

CLASSIFIED GROUP MEMBERSHIP
Kenai Kasilof Susitna

Kenai
( $n=97$ )
Number
75
9
13

Kasilof
( $n=93$ )
Number 2
0.09
0.14

Susitna
Percent
0.02

83
8

Number
24
19
36
( $\mathrm{n}=79$ )
Percent
0.30
0.24 0.46

$$
\text { Overall Classification Accuracy }=72 \%
$$

Table 3. Learning and test sample classification matrices from a 3 -way discriminant analyses of Kenai, Kasilof, and Susitna River age $5_{2}$ sockeye salmon, fish length included as a variable, 1978.
A. Learning sample classification matrix.

ACTUAL GROUP
MEMBERSHIP
CLASSIFIED GROUP MEMBERSHIP

|  |  | Kenai | Kasilof |  |
| :--- | :--- | ---: | ---: | ---: |
|  | Number | 74 |  | Susitna |
| Kenai | Percent | 0.76 | 0.04 | 19 |
| Kasilof | Number |  | 7 | 0.20 |
| $(n=93)$ | Percent | 0.07 | 77 | 9 |
| Susitna | Number | 18 | 0.83 | 0.10 |
| $(n=79)$ | Percent | 0.23 | 16 | 45 |

Overall Classification Accuracy $=73 \%$
B. Test sample classification matrix.

ACTUAL GROUP
MEMBERSHIP

|  |  | Kenai | Kasilof | Susitna |
| :---: | :---: | :---: | :---: | :---: |
| Kenai | Number | 72 | 9 | 16 |
| ( $\mathrm{n}=97$ ) | Percent | 0.74 | 0.09 | 0.17 |
| Kasilof | Number | 1 | 86 | 6 |
| ( $n=93$ ) | Percent | 0.01 | 0.93 | 0.06 |
| Susitna | Number | 25 | 18 | - 36 |
| ( $\mathrm{n}=79$ ) | 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.

ACTUAL GROUP MEMBERSHIP

CLASSIFIED GROUP MEMBERSHIP

|  |  | Kenai | Kasilof | Susitna | Crescent |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Kenai } \\ & (n=97) \end{aligned}$ | Number | 66 | 5 | 12 | 14 |
|  | Percent | 0.68 | 0.05 | 0.12 | 0.15 |
| $\begin{aligned} & \text { Kasilof } \\ & (n=93) \end{aligned}$ | Number | 5 | 72 | 14 | 2 |
|  | Percent | 0.06 | 0.77 | 0.15 | 0.02 |
| $\begin{aligned} & \text { Susitna } \\ & (n=79) \end{aligned}$ | Number | 13 | 18 | 35 | 13 |
|  | Percent | 0.17 | 0.22 | 0.44 | 0.17 |
| $\begin{aligned} & \text { Crescent } \\ & (n=48) \end{aligned}$ | Number | 4 | 1 | 3 | 40 |
|  | Percent | 0.08 | 0.02 | 0.06 | 0.84 |

B. Test sample classification matrix.

ACTUAL GROUP MEMBERSHIP

CLASSIFIED GROUP MEMBERSHIP
Kenai Kasilof Susitna Crescent

| Kenai | Number | 59 | 10 | 13 | 15 |
| :--- | :--- | ---: | ---: | ---: | ---: |
| ( $\mathrm{n}=97$ ) | Percent | 0.61 | 0.10 | 0.13 | 0.16 |
| Kasilof | Number | 2 | 83 | 7 | 1 |
| ( $\mathrm{n}=93$ ) | Percent | 0.02 | 0.89 | 0.08 | 0.01 |
| Susitna | Number | 17 | 18 | 36 | 8 |
| ( $\mathrm{n}=79$ ) | Percent | 0.21 | 0.23 | 0.46 | 0.10 |
| Crescent | Number |  | 6 | 0 | 4 |
| ( $n=48$ ) | Percent | 0.13 | 0.00 | 0.08 | 38 |

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 $5_{2}$ Stock Composition Estimates

During 1978 the commercial harvest consisted primarily of age $5_{2}$ 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 52 fish tended to be strongest during early fishing periods and weakened as the fishery progressed. It is more difficult to generalize about Susitna age 52 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 52 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 $5_{2}$ 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 GROUP
MEMBERSHIP
CLASSIFIED GROUP MEMBERSHIP
Kenai Kasilof Susitna

| Kenai $(n=97)$ | Number Percent | $\begin{array}{r} 67 \\ 0.69 \end{array}$ | $\begin{array}{r} 3 \\ 0.03 \end{array}$ | $\begin{array}{r} 14 \\ 0.15 \end{array}$ | $\begin{array}{r} 13 \\ 0.13 \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Kasilof } \\ & (n=93) \end{aligned}$ | Number | 6 | 72 | 12 | 3 |
|  | Percent | 0.07 | 0.77 | 0.13 | 0.03 |
| $\begin{aligned} & \text { Susitna } \\ & (n=79) \end{aligned}$ | Number | 13 | 18 | 35 | 13 |
|  | Percent | 0.16 | 0.23 | 0.45 | 0.16 |
| $\begin{aligned} & \text { Crescent } \\ & (n=48) \end{aligned}$ | Number | 4 | 1 | 3 | 40 |
|  | Percent | 0.08 | 0.02 | 0.06 | 0.84 |

B. Test Sample Classification matrix.

ACTUAL GROUP MEMBERSHIP
Kenai 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 |
| ( $n=93$ ) | Percent | 0.02 | 0.90 | 0.07 | 1. |
| Susitna | Number | 17 | 18 | 32 | 0.01 |
| ( $n=79$ ) | Percent | 0.22 | 0.23 | 0.40 | 12 |
| Crescent | Number | 7 | 0 | 0.15 |  |
| ( $n=48$ ) | Percent | 0.15 | 0.00 | 3 | 38 |

Overall Classification Accuracy $=68 \%$

Table 6. Estimates of the proportion of age $5_{2}$ 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 (90x 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 Het | Kenai <br> Kastlof <br> Susitna |  | .34 .35 .31 $\left(\begin{array}{r}0, .69 \\ .07 \\ 0, .63 \\ 0, .75\end{array}\right)$ | .04 .26 .70 $\left(\begin{array}{r}0, .49) \\ 0.67 \\ .01 .1 .0)\end{array}\right.$ | .30 $(.07, .53)$ $.53(.33, .73)$ .17 $(.12, .46)$ | $\left.\begin{array}{l}.72 \\ .22 \\ .06 \\ (.49, .98 \\ 0 . .36) \\ 0.32\end{array}\right)$ |  | $\begin{aligned} & 68(.44, .92) \\ & 18 \\ & 14\binom{04, .32}{0, .42} \end{aligned}$ |
| North Salamatof Set Net | Kenal <br> Kasilof <br> Susitna |  | .49 .34 .17 $\left(\begin{array}{r}.16, .82 \\ .10, .58 \\ 0, .56\end{array}\right\}$ | 0 .11 .89 $\left(\begin{array}{r}0 . .40) \\ 0 . .52) \\ .20 .1 .0)\end{array}\right.$ | .79 <br> . <br> 1 <br> 0$\left(\begin{array}{r}.54,1.0) \\ 06, .36) \\ 0 . .26)\end{array}\right.$ | .80 .09 .11 $\left(\begin{array}{r}.56,1.0 \\ 0 . .21 \\ 0, .39\end{array}\right)$ |  | .79 .03 .10 $\left(\begin{array}{r}.53,1.0 \\ 0, .15 \\ 0, .48\end{array}\right)$ |
| South Salamatof Set Net | Kenai <br> Kastlof <br> Susitna |  | .43 .45 .12 $\left(\begin{array}{r}.23, .63 \\ .29, .61 \\ 0, .36\end{array}\right)$ | $.44(.10, .78)$ $.24(.02 . .50)$ $.30(0.72)$ | .83 .11 .06 $\left(\begin{array}{r}.59,1.0 \\ 0, .24 \\ 0, .33)\end{array}\right.$ |  |  | .76 0 .24 $\left(\begin{array}{c}.48,1.0 \\ 0, .10 \\ 0, .58\end{array}\right)$ |
| North Kallfonsky Set Net | Kenai <br> Kasilof <br> Susitna |  |  | $.51(.28, .74)$ $.45(.27, .63)$ .04 $0 . .30)$ | .92 .07 .01 $\left(\begin{array}{r}.68,1.0) \\ 0 . .19) \\ 0 . .29)\end{array}\right.$ | $.56(.33, .79)$ $.20(.05, .35)$ $.24(0.52)$. |  | $\begin{gathered} .60(.38 . .82) \\ .25 \\ .15\binom{11, .39}{0, .43)} \end{gathered}$ |
| South Kalifonsky Set Net | Kenai <br> Kasilof <br> Susitna |  | . $61 \begin{array}{r}.39 \\ 0\end{array}\left(\begin{array}{r}.40, .82 \\ .24, .54 \\ 0, .23)\end{array}\right.$ | .58 .41 .01 $\left(\begin{array}{r}.36, .80) \\ .25, .57 \\ 0 . .25\end{array}\right)$ | $\begin{array}{r} .70 \\ .30 \\ 0 \end{array}\left(\begin{array}{r} .47, .93 \\ .74, .46 \\ 0, .25 \end{array}\right)$ | $\left.\begin{array}{r} .60(.39, .81) \\ .40(.21, .56 \\ 0 \\ 0, .24 \end{array}\right)$ |  | .67 .14 .19 $\left\{\begin{array}{r}.43, .91 \\ 0 . .28 \\ 0 . .47)\end{array}\right.$ |
| North Cohoe 1] Set Net | Kenai <br> Kasilof <br> Susitua |  | .39 .57 .04 $\left(\begin{array}{r}.20, .58) \\ .41 . .73) \\ 0 . .26\end{array}\right)$ | $.46(.24, .68)$ $.51(.33, .69)$ $.03\left(\begin{array}{rr} \\ 0 . & 28\end{array}\right)$ | .74 .23 .03 $\left(\begin{array}{r}.51, .97 \\ .09, .37 \\ 0, .29)\end{array}\right.$ | .71 .19 .10 $\left(\begin{array}{r}.48, .94 \\ .05, .33) \\ 0, .37\end{array}\right)$ |  | $\begin{gathered} .42 \\ .18 \\ 0 \\ 0 \end{gathered}(.58,1.04, .32)$ |
| Cohoe Set Net | Kenal <br> Kasilof <br> Susitna |  | .39 .56 .05 $\left(\begin{array}{r}.20, .58) \\ .40, .72) \\ 0 . .27)\end{array}\right.$ | .68 .27 .05 $\left(\begin{array}{r}.39, .97) \\ .08, .46) \\ 0, .37)\end{array}\right.$ | .90 .10 0 $\left(\begin{array}{r}.61,1.0) \\ 0\end{array}(0, .27)\right.$ | .41 .12 .47 $\left(\begin{array}{r}\text {. } 15, .67) \\ 0, .30) \\ (.12, .82)\end{array}\right)$ |  | $\left.\begin{array}{l}.50 \\ (0725, .75 \\ .07 \\ .43 \\ (.11, .75\end{array}\right)$ |
| Ninilchik Set Het | Kenai <br> Kasilof <br> Susitina |  | .34 .56 $(.15, .53)$ .10 $(0.72$ $0 . .33)$ | .82 18 0 $\left(\begin{array}{l}0, .83) \\ 0 . .36 \\ 0 . .33)\end{array}\right.$ | .86 .14 0 $\left(\begin{array}{r}.57,1.0) \\ 0, .32) \\ 0, .31)\end{array}\right.$ |  |  |  |
| Central District West-Side Set Net | Kenai <br> Kasilof <br> Susitria | $\begin{array}{r} .47\left(\begin{array}{r} (.21, .73) \\ .02 \\ .51 \\ \hline \\ (.18, .17 \end{array}\right) \end{array}$ | $.40(.03, .77)$ $0\left(\begin{array}{r}0,18\end{array}\right)$ $.60(.13,1.0)$ | .90 .03 $.07\left(\begin{array}{r}.50,1.0) \\ 0, .23) \\ 0, .51\end{array}\right)$ | .00 <br> .17 $\begin{array}{r}0, .39) \\ 0, .40) \\ (.32,1.0)\end{array}$ |  |  | $\begin{aligned} & .24 \\ & .33 \\ & .43 \end{aligned}\left(\begin{array}{r} 0, .60 \\ .03, .63 \\ 0, .92 \end{array}\right)$ |
| Chisik Island Set Net | Kenai <br> Kasilof <br> Susitna |  |  |  |  | $\begin{array}{r} .03\left(\begin{array}{r} 0, .35 \\ 0 \\ 0 \\ .97 \\ \hline(.53,1.0) \end{array}\right) \end{array}$ |  | $\begin{aligned} & 19\left(\begin{array}{r} 0, .40) \\ .08 \\ .73 \\ (1.37 .1 .0) \end{array}\right) \end{aligned}$ |
| Central District Drift Net | Kenal <br> Kasilof <br> Susitna | $\begin{array}{r} .12 \\ .55 \\ .33\left(\begin{array}{r} 0, .36 \\ (.23 . .78 \\ 0, .66 \end{array}\right) \end{array}$ | $\left.\left.\begin{array}{r} .60 \\ .16 \\ .24 \end{array}\right\} \begin{array}{r} .39, .81) \\ .06, .26) \\ 0, .50 \end{array}\right)$ | $\begin{array}{r} .90 \\ .10 \\ 0 \end{array}\left(\begin{array}{r} .59,1.0 \\ 0, .22 \\ 0 . .15 \end{array}\right)$ | .97 .03 0 $\left(\begin{array}{r}.66 .1 .0) \\ 0 . .15 \\ 0, .27\end{array}\right)$ | .98 .02 0 $\left(\begin{array}{r}.72,1.0) \\ 0, .12) \\ 0, .33)\end{array}\right.$ | .80 .04 .16 $\left(\begin{array}{r}.58,1.0 \\ 0, .13 \\ 0, .43\end{array}\right)$ | .67 .06 .27 $\left(\begin{array}{c}.44, .90 \\ 0, .16 \\ 0, .55\end{array}\right)$ |
| Northern District East-Slue Set Het | Kenal <br> Kasilof <br> Susilina |  |  |  |  | $\begin{array}{r} .32 \\ .04 \\ .64 \end{array}\left(\begin{array}{r} 0, .68) \\ 0, .25 \end{array}(18.1 .0)\right.$ |  | $\begin{aligned} & .80 \\ & .15 \\ & .05 \end{aligned}\left(\begin{array}{r} .51 .1 .0 \\ 0 . .32 \\ 0 . .37) \end{array}\right.$ |
| Northern District West-Side Set Net | Kenai <br> Kasilof <br> Susitina |  |  |  |  |  | $\begin{aligned} & 11\left(\begin{array}{r} 0, .41) \\ 13 \\ 76 \\ (.34,1.0) \end{array}\right) \end{aligned}$ |  |

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

Table 7. Estimates of the proportion of age $5_{2}$ 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 <br> 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, 7.0 ) |
| 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 | $(0, .57)$ |
| July 10 | Kenai | . 90 | (.59, 1.0) |
|  | Kasilof | . 10 | (0, .22) |
|  | Susitna | 0 | $(0, .15)$ |
| July 15 | Kenai | . 97 |  |
|  | Kasilof | . 03 | (0, .15) |
|  | Susitna | 0 | (0, .28) |
| July 17 | Kenai | . 92 | (.67, 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 |  | . 95 |  |
|  | Kasilof | . 05 | (0, .17) |
|  | Susitna | 0 | (0, . 35 ) |
| July 28 |  |  |  |
|  | Kasilof | . 09 | $(0, .29)$ |
|  | Susitna | . 64 | (.26, 7.0$)$ |

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 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 $5_{2}$ Crescent fish were predominant in three of the five samples.

Point estimates for age $5_{2}$ 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 $5_{2}$ 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.

| Sompling location | River | 6/19 - 6/26 | 7/3-717 | $7 / 10$ | 7/15 | 7/17 - 7/21 | 7/21-7/28 | 7/24-7/28 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Boulder Point Set iset | Kenal <br> Kasilof <br> Susitind Crescent |  | .40 $0, .86$ <br> .27 0.66 <br> .33 $(0, .994$ <br> 0 $0 . .18)$ | .16 $0, .68)$ <br> .31 $(.19 .81)$ <br> .46 $(0.1 .0)$ <br> .07 $(0.39)$ | $\left.\begin{array}{cc}.31 & (.01, .61 \\ 42 \\ 23 & (.16,68 \\ 04 & 0, .62 \\ 0 & 0, .20\end{array}\right)$ | .74 <br> .16 <br> 10 <br> $(0.43 .1 .0)$ <br> 0$\left(\begin{array}{r}0.34 \\ 0.45 \\ 0.45\end{array}\right)$ |  | .67 .16 .17 0 $\left(\begin{array}{c}.34,1.0 \\ 0,36 \\ 0,55 \\ 0, .15\end{array}\right)$ |
| Morth Solamazof Set Net | Kenai <br> Kasilof <br> Susitna Crescent |  | $\left.\begin{array}{rr} .52 & (.10, .94) \\ 34 & (.03,65 \\ 10 & (0.58 \\ .04 & (0.28 \end{array}\right)$ | .02 .18 .71 .09 $\left(\begin{array}{l}0 . .50) \\ 0.70 \\ 0.7 .0 \\ 0 . .40)\end{array}\right.$ | $\begin{array}{rr}.85 & (49,1.0 \\ .15 & 0.35 \\ 0 & 0, .35) \\ 0 & 0.18)\end{array}$ | .78 .08 .14 0 $\left(\begin{array}{r}(45,1.0) \\ 0.26) \\ 0 . .55) \\ 0, .16)\end{array}\right.$ |  | .84 <br> 0 <br> .16 <br> 0$\left(\begin{array}{c}47.1 .0 \\ 0.17 \\ 0, .58) \\ 0.16)\end{array}\right.$ |
| South Salamatof Set Net | Kena! <br> Kasilof <br> crescent |  |  | .46 .26 .28 0 $\left(\begin{array}{r}(02, .90) \\ 0, .58) \\ 0, .83) \\ 0 . .16)\end{array}\right.$ |  | .83 0 0 $\left(\begin{array}{c}.47,1.0 \\ .17 \\ 0\end{array}\left(\begin{array}{l}16 \\ 0.157 \\ 0 . .17\end{array}\right\}\right.$ |  |  |
| North Kallfonsky Set Net | Kensi <br> Kasilof <br> Susitna <br> Crescent |  | 40 60 0 0 $\left(\begin{array}{r}.12, .68 \\ 0\end{array}\left(\begin{array}{r}\text { a } \\ 0.85 \\ 0.32 \\ 0.12\end{array}\right)\right.$ |  |  | $\begin{gathered} .56 \\ .15 \\ .29 \\ .26, .86 \\ 0 \end{gathered}\binom{0, .65}{(0, .14}$ |  | $\begin{gathered} .62 \\ .17 \\ .21 \\ .\left(\begin{array}{r} 31, .93 \\ 0.37 \\ 0 \end{array}\binom{.58}{0 . .13}\right. \end{gathered}$ |
| South Kalifonsky Set Net | Kenal <br> Kasilof <br> Susitna <br> Crescent |  |  |  | .68 .27 0 0 $\left(\begin{array}{r}.36,1.0 \\ 0\end{array}\left(\begin{array}{l}\text {, } \\ 0 \\ 0, .32 \\ 0, .23\end{array}\right\}\right.$ |  |  | .68 .07 .25 0 $\left(\begin{array}{r}.35,1.0 \\ 0.25 \\ 0.63 \\ 0, .16\end{array}\right)$ |
| $\begin{aligned} & \text { North Cohoe }{ }^{1]} \\ & \text { Set Net } \end{aligned}$ | Kenal <br> Kasilof <br> Susitna <br> Crescent |  | .41 .58 .01 0 $\left(\begin{array}{r}.17, .65) \\ .36, .80 \\ 0, .31 \\ 0.62)\end{array}\right.$ | .42 .54 .03 .01 $\left(\begin{array}{r}.14, .70 \\ 30.78 \\ 0 . .378 \\ 0.74\end{array}\right)$ | .78 .22 0 0 $\left(\begin{array}{r}46,1.0 \\ (02, .42 \\ 0, .34 \\ 0, .16\end{array}\right)$ | .78 .11 .11 0 $\left(\begin{array}{r}44,1.0 \\ 0.30 \\ 0, .49 \\ 0, .14\end{array}\right)$ |  | $\left.\left.\begin{array}{r}.85 \\ .14 \\ .01 \\ 0\end{array}\right\} \begin{array}{c}.51,1.0 \\ 0.32 \\ 0, .37 \\ 0.16\end{array}\right\}$ |
| Cohoe Set Net | Kenal <br> Kas:10f <br> Sustena <br> Crescent |  |  |  | .73 .15 0 .12 $\left(\begin{array}{c}.33 .1 .0 \\ 0 . .37 \\ 0 . .36) \\ 0.36\end{array}\right)$ | $\left.\begin{array}{cc} .41 \\ .08 & (.09, .73) \\ .51 \\ 0 & (.07, . .95 \\ 0 & 0, .14 \end{array}\right)$ |  | .54 .02 .44 0 $\left(\begin{array}{r}.20 . .88 \\ 0.24 \\ 0 . .48 \\ 0 . .15\end{array}\right\}$ |
| Nintlehik Set Net | Kenat <br> Kastlof <br> Susitna <br> Crescent |  | .29 .56 .09 $\left(\begin{array}{r}.05, .53) \\ .34 \\ 0 . .78) \\ 0 . .29\end{array}\right)$ | .68 12 .01 .19 $\left(\begin{array}{r}.28,1.0) \\ 0, .33) \\ 0.39) \\ 0.35)\end{array}\right.$ | $\begin{array}{r} .76 \\ .12 \\ 0 \\ 0 \\ .12 \end{array}\left(\begin{array}{c} 36,1.0 \\ 0, .33 \\ 0, .35 \\ 0, .38 \end{array}\right)$ | $\begin{gathered} .75 \\ .20 \\ .05 \\ 0 \end{gathered}\left(\begin{array}{c} .42,1.0 \\ 0, .40 \\ 0 \end{array}\binom{49}{0, .13}\right.$ |  |  |
| Central District West-Side Set Net | Kena 1 <br> Kasilof <br> Susitna <br> Crescent | .06 .01 .16 .77 $\left(\begin{array}{r}0, .32 \\ 0.13 \\ 0.50 \\ (.52,1.0)\end{array}\right.$ | $\begin{array}{r} .12 \\ 0 \\ .57 \\ .31 \end{array}\left(\begin{array}{r} 0, .50 \\ 0, .22 \\ .01,1.00 \\ (.02 .60) \end{array}\right.$ | .37 .01 0 $\left(\begin{array}{r}0, .85 \\ 0, .199 \\ 0,45\end{array}\right)$ | $\begin{gathered} 0 \\ .13 \\ .09 \\ .78 \end{gathered}\left(\begin{array}{c} 0, .24 \\ (.50,48 \\ \hline \end{array}\right)$ |  |  | .34 .26 .30 .10 $\left(\begin{array}{l}0, .79 \\ 0 . .62 \\ 0 . .90 \\ 0 . .98\end{array}\right)$ |
| Chisik Island Set Net | Kenal <br> Kasilof <br> Susitena <br> Crescent |  |  |  |  | $\begin{array}{r} .02 \\ 0 \\ .65 \\ .33 \end{array}\left(\begin{array}{r} 0, .31 \\ 0,21 \\ (17,1.0 \\ 0, .67 \end{array}\right\}$ |  | $\begin{aligned} & .12 \\ & .07 \\ & .68 \\ & .13 \end{aligned}\left(\begin{array}{r} 0, .42 \\ 0 . .31 \\ 21.1 .0) \\ 0, .33 \end{array}\right)$ |
| Central District Drift Net | Kena 1 <br> Kas llof <br> Sugitna <br> Crescent | $\begin{array}{r} .21 \\ .60 \\ .19 \\ 0 \end{array}\left(\begin{array}{c} 0, .51 \\ 0, \\ 0, .58 \\ 0, .22 \end{array}\right)$ | $\begin{array}{r} .70 \\ .12 \\ .18 \\ 0 \\ 0 \end{array}\left(\begin{array}{r} 40,1,0 \\ 0,25 \\ 0, .50 \\ 0, .23 \end{array}\right)$ | .89 .04 0 .06 $\left(\begin{array}{c}.47,1.0 \\ 0, .18 \\ 0, .40 \\ 0, .40\end{array}\right)$ | .98 0 .02 0 $\left(\begin{array}{c}55,1.0 \\ 0,1.12 \\ 0.461 \\ 0, .32)\end{array}\right.$ | $\begin{array}{r} 1.0 \\ 0 \\ 0 \\ 0 \end{array}\left(\begin{array}{c} .63,1.0 \\ 0, .11 \\ 0, .38 \\ 0, .28 \end{array}\right)$ | $\begin{gathered} .64 \\ .08 \\ .04 \\ .24 \end{gathered}\left(\begin{array}{c} .36, .92 \\ 0, .17 \\ 0, .34 \\ 0, .48 \end{array}\right)$ |  |
| Northern District East-Side Set Net | Kenai <br> Kasilof <br> Susitna <br> Crescent |  |  |  |  | $\begin{gathered} .43 \\ .01 \\ .68 \\ .0, .87 \\ 0 \end{gathered}(0, .1 .08)(0, .20)$ |  | .79 .12 008 0 $\left(\begin{array}{r}.39,1.00 \\ 0, .34 \\ 0, .50 \\ 0, .20)\end{array}\right)$ |
| Horthern District Hest-Side Set Net | Kena 1 Kasilof Susitna Crescent |  |  |  |  |  | $\begin{array}{r} .10 \\ .14 \\ .59 \\ .17 \end{array}\left(\begin{array}{r} 0, .40 \\ 0, .10,1.0 \\ 0, .39 \end{array}\right)$ |  |

1] Northern section of beach only, within three miles south of the kasilof River mouth.
origin with the bulk of the remaining age $5_{2}$ 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 $5_{2}$ 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 $5_{2}$ 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 postseason age $5_{2}$ 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\%).

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.

| Sampling Location | River |  |  | oportion of Ca | ch (90\% C.I. | by Sample Per |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 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 <br> 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 | Kenaj |  |  | $.38(.20, .56)$ | . $37(.16, .58)$ | . 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 ${ }^{1}$ 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 |  |  |  | . $39(.20, .58)$ | . $66(.43, .89)$ | . 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 |  |  |  | . $34(.15, .53$ ) | . $72(.49, .95)$ | $.82(0, .83)$ | . $76(.52,7.0)$ | . $86(.57,1.0)$ |
|  | 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) | . $47(.21, .73)$ |  |  | .75 (.42, 1.0$)$ | . $90(.50,1.0)$ |  |  |
|  | Kasilof | . $09(0, .23$ ) | . $02(0, .17)$ | . 08 (0,.24) | $0(0, .78)$ | $.12(0, .34)$ | . 03 ( 0,.23) | . $37(.16, .58)$ | .17 ( $0, .45$ ) |
|  | Susitna | . $48(.24, .72)$ | $.51(.18, .84)$ | . 29 (0,.58) | . $60(.13,1.0)$ | $.13(0, .47)$ | $.07(0, .51)$ | . $41(.14, .68)$ |  |
| Chisik Island Set Net | Kenai |  |  |  |  |  |  |  |  |
|  | Kasilof |  |  |  |  |  |  |  |  |
|  | Susitna |  |  |  |  |  |  |  |  |
| Central District Drift Net | Kenai |  |  |  |  | . 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 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).

| 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 | $.17(.04, .30)$ $.27(.06, .48)$ | $\left.\begin{array}{l}.20(205, .35) \\ .24 \\ 0.52\end{array}\right)$ |  |  | $.15(.02, .27)$ $.29(.08, .50)$ | .25 .15 $\left(\begin{array}{r}\text { ( }\end{array} 11, .39\right)$ $0, .43)$ |
|  | Susitna | . 27 (.06,.48) | . 24 ( 0,.52) |  |  |  |  |
| South Kalifonsky Set Net | Kenai | . 65 (.47,.93) | . $60(.39, .01)$ |  |  |  |  |
|  | Kasilof | . 35 (.70,.50) | . $40(.24, .56)$ |  |  | $.11(0, .23)$ | .14 $\begin{aligned} & \text { ( } \\ & .19\end{aligned}(0, .28)$ |
|  | Susitna | $0(0, .17)$ | $0(0, .24)$ |  |  |  |  |
| North Coho ${ }^{1}$ 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 |  |  |  |  |  |  |  |
|  | Kasilof | . $05(0, . .18)$ | .12 .47 $(.12, .80)$ |  |  | . $16(.03, .29)$ | . $07\left(\begin{array}{r}(0, .21) \\ \hline(.11, .75)\end{array}\right.$ |
|  |  |  |  |  |  |  |  |
| 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 | $.37(.10, .64)$ | . $32(0, .68$ ) |  |  |  |  |
|  | Kasilof Susitna | .05 $.50(.0, .20)$ $(.25, .91)$ | . $04\left(\begin{array}{rl}(0, .25) \\ (.18,1.0)\end{array}\right.$ |  |  | . $152\left(\begin{array}{r}\text { (.01, } \\ 0, .31)\end{array}\right.$ | .15 .05 $\binom{0, .32)}{0, .37}$ |
| 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) |  |  |

[^2]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.

|  |  |  |  | IN-SEAS | ESTIMATE |  |  |  | POST-SEAS | ESTIMATES |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Drift |  | Prop | ion of Catch | Number | of 52 Fis | sh | Propo | ion of Catch | Number | S of 52 Fi |  |
| Date | Harvest ( 52 Only ) | River | Point Estimate | $90 \%$ Confidence Interval | Point <br> Estimate | 90\% Conf | $\begin{aligned} & \text { idence } \\ & \text { val } \end{aligned}$ | Point Estimate | 90\% Confidence Interval | Point Estimate | $\begin{aligned} & 90 \text { Conf } \\ & \text { Inter } \end{aligned}$ | jdence val |
| 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 |  | 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 | (.27, .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) |
| JuTy 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 |  | 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 75 | 476,963 | Kena | 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 |  | 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 |  | 24,695) |
| July 19-20 | 172,226 | Kenai | 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 |  |  |  |  |  |  | 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 |  |  | 8,917, | 11,733) | ) .95 | $(.66,1.00)$ | 11,746 | 7,744, | 11,733) |
| July |  | 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 |  |  |  |  | ) .27 |  |  | 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, $1978^{1}$.

|  | 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 | $\overline{1,796}$ | $\overline{83.6}$ | $\overline{100.0}$ | 375 | $\overline{77.0}$ | $\overline{100.0}$ | 225 | 76.8 | 100.0 | 22 | $\overline{0}$ | $\overline{100}$ | $\overline{2,418}$ | 82.0 | $\overline{100.0}$ |
|  | $349^{2}$ | 16.3 |  | $112^{3}$ | 23.0 |  | $68{ }^{4}$ | 23.2 | 6 |  |  |  | 529 | 18.0 |  |
| Total Return ${ }^{5}$ | 2,145 | 100.0 |  | 487 | 100.0 |  | 293 | 100.0 | 22.1 |  |  |  | 2,947 | 100.0 |  |

[^3]Table 12. Sockeye salmon catch allocation by river system, age class, and major fishery of the Central District, Upper Cook Irlet, IS7s.

| Fishery | Total <br> Catch | System | $5_{2}$ |  | $4_{2}$ |  | 53 |  | 63 |  | Other |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | No. | \% | No. | \% | No. | \% | No. | 9 | No. | \% | 110. |  |
| Central <br> District <br> Drift Gill <br> 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 |
|  |  |  |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |  |  |  | 100.0 |
|  |  | Total | 1,477 | 84.2 | 101 | 5.8 | 77 | 4.4 | 99 | 5.6 | 0 | 0 | 1,754 | 100.0 |
| Central <br> District <br> East-side <br> Set Gill <br> 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 |
|  |  |  |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |
|  |  | Tota 1 | 472 | 77.0 | 110 | 17.9 | 18 | 2.9 | 12 | 2.0 | 1 | 20.2 | 673 | 100.0 |
| Central <br> District <br> West-side <br> Set Gill Net | 51 | Kenaj | 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 |
|  |  |  |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |  |  |  | 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 |  | 82.0 | 29 | 12.9 | 62 |  | 78 |  | 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 |
|  |  |  |  | 100.0 |  | 100.0 |  | 100.0 |  | 100.0 |  |  |  | 100.0 |
|  |  | Total | 7,982 | 82.0 | 225 | 9.3 | 98 | 4.1 | 172 | 4.6 | 1 | 0.1 | 2,418 | 100.0 |

[^4]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.

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, $1978^{1}$.

| Date(s) | Tota 1 <br> Catch |  | $5_{2}$ |  | 42 |  | 53 |  | $6_{3}$ |  | Other |  | Total |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | System | No. | \% | No. | \% | No. | \% | No. | \% | No. | $\%$ | No. | $\%$ |
| June 19June 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 |
| $\begin{aligned} & \text { July } 3- \\ & \text { July } 7 \end{aligned}$ | 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 |  | 90.0 | 3,200 | 20.6 | 3,000 | 63.8 | 17,900 | 82.9 | 0 | 0 |  |  |
|  |  | 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 |  |  |  |  |  |  |  |  |  |  |  | 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 |
|  | 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 |
| July 21 |  | 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 |
|  |  | Tota 1 | 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 |

[^5]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, $1978^{1}$.

|  | Tota 1 Catch |  | $5_{2}$ |  | $4_{2}$ |  | $5_{3}$ |  | 63 |  | OTHER |  | TOTAL |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Date (s) |  | System | No. | \% | No. | \% | No. | \% | No. | \% | No. | \% | No. | \% |
| June 19June 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 |
| $\begin{aligned} & \text { July } 3- \\ & \text { July } 7 \end{aligned}$ | 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 |  | 115,300 | 79.0 | 3,700 | 9.7 90.3 | 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 |
| $\begin{aligned} & \text { July } 17- \\ & \text { July } 21 \end{aligned}$ | 317,400 |  |  | 68.0 |  |  |  |  |  |  |  |  |  |  |
|  |  | 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 24July 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 |

[^6]Table 15. Sockeye salmon allocation by river system, age class, and date(s) for the West-side set gill net fishery of the Ceritra; isiric: Upper Cook Inlet, $1978^{1}$.

|  |  |  | $5_{2}$ |  | 42 |  | 53 |  | $6_{3}$ |  | OTHER |  | TUTHL |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Date(s) | Catch | System | No. | \% | No. | \% | No. | \% | No. | $\%$ | No. | 5 No . |  |  |
| June 19- <br> 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 |
| $\begin{aligned} & \text { July 3- } \\ & \text { July } 7 \end{aligned}$ | 9,400 | Kenai | 800 | 17.8 | 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 |
|  |  | Tota] | 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 |  |  |  |  | 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, enc | 67.1 |
|  |  | Total | 17,500 | 100.0 | 1,600 | 100.0 | 600 | 100.0 | 600 | 100.0 | 0 | 0 | 14,300 | 100.0 |
|  | 12,700 |  |  |  |  |  |  |  |  |  | 0 | 0 | $700$ |  |
| July 21 |  | Kasilof | 600 | 26.1 | 4,200 | 50.0 | 7,300 | 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 |
|  | 2,500 | Kenai | 400 |  |  |  |  |  |  |  | 0 | 0 | 400 |  |
| $\text { JuTy } 28$ |  | Kasilof | 300 | 27.3 | 400 | 36.4 | 200 | 65.7 | 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 |

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:

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 possibie.

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 | $\begin{aligned} & \text { C.D. } \\ & \text { Drift } \end{aligned}$ | $\begin{aligned} & \text { Ninil. } \\ & \text { Bch. } \end{aligned}$ | $\begin{aligned} & \text { Coho } \\ & \text { Bch. } \end{aligned}$ | Kalif. Bch. | $\begin{aligned} & \text { Salam. } \\ & \text { Bch. } \end{aligned}$ | $\begin{gathered} \text { N.D. E-SD } \\ \text { Set } \end{gathered}$ | N.D. W-SD | $\begin{aligned} & \text { C.D. W-SD } \\ & \text { Set } \end{aligned}$ |
| 6-20 |  |  |  |  |  |  |  | $\begin{array}{r} 200 \mathrm{red} \\ 83 \mathrm{king} \end{array}$ |
| 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 | $\begin{aligned} & \text { SAMPLE } \\ & \text { SIZE } \end{aligned}$ | OAILY ESCAPEMENT | \% | AGE $4^{2}$ |  | AGE $5^{2}$ | \% | $\begin{aligned} & 5^{3} \\ & \text { NiO. IN } \\ & \text { ESC. } \end{aligned}$ |  | $\begin{gathered} \text { GE } 6^{3} \\ \text { NO. IN } \\ \text { ESC. } \end{gathered}$ | OTHER |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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 |  |  |  |  |  |  |  |  |  |  |
| 714 |  | 900 |  |  |  |  |  |  |  |  |  |  |
| 7/5 |  | 600 |  |  |  |  |  |  |  |  |  |  |
| $7 / 6$ |  | 700 |  |  |  |  |  |  |  |  |  |  |
| 717 |  | 1,500 |  |  |  |  |  |  |  |  |  |  |
| $7 / 8$ |  | 300 |  |  |  |  |  |  |  |  |  |  |
| 719 |  | 700 |  |  |  |  |  |  |  |  |  |  |
| 7/10 |  | 1,000 |  |  |  |  |  |  |  |  |  |  |
| 7/11 |  | 3,200 |  |  |  |  |  |  |  |  |  |  |
| $7 / 12$ |  | 3,600 |  |  |  |  |  |  |  |  |  |  |
| 7/13 |  | 1.000 |  |  |  |  |  |  |  |  |  |  |
| 7/14 |  | 1,300 |  |  |  |  |  |  |  |  |  |  |
| $7 / 15$ $7 / 16$ |  | 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 |
| $7 / 17$ | 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 |  |  |  |  |  |  |  |  |  |  |
| $\frac{7 / 30}{7 / 26-7 / 30}$ | 141 | 7,500 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 | $\begin{aligned} & \text { SAMPLE } \\ & \text { SIZE } \end{aligned}$ | CUMULATIVE ESCAPEMENT | $\%$ | $\begin{gathered} \text { AGE } 4^{2} \\ \text { NO. IN } \\ \text { ESC. } \end{gathered}$ | \% | $\begin{gathered} \text { AGE } 5^{2} \\ \text { NO. IN } \\ \text { ESC. } \end{gathered}$ | \% | AGE $5^{3}$ NO. IN ESC. | $\%$ | AGE $6^{3}$ <br> NO. IN <br> ESC. | * | OTHER <br> 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 |

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

| DATE | SAMPLE SIZE | DAILY ESCAPEMENT | $\%{ }^{\text {AG }}$ | $4^{2}$ <br> NO. IN ESC. |  | $\begin{gathered} \text { AGE } 5^{2} \\ \text { NO. IN } \\ \text { ESC. } \end{gathered}$ | \% | AGE $5^{3}$ <br> NO. IN ESC. | \% | AGE $6^{3}$ No. IN ESC. | * | $\begin{aligned} & \text { OTHER } \\ & \text { NO. IN } \\ & \text { ESC. } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 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 |  |  |  |  |  |  |  |  |  |  |  |  |
| 6/30 |  | 4,000 |  |  |  |  |  |  |  |  |  |  |
| 7/1 |  | 2,100 |  |  |  |  |  |  |  |  |  |  |
| $7 / 2$ |  | 6,000 |  |  |  |  |  |  |  |  |  |  |
| 7/3 |  | 7,400 |  |  |  |  |  |  |  |  |  |  |
| $\frac{7 / 4}{6 / 22-7 / 4}$ |  | 2,400 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 |  | 3,600 |  |  |  |  |  |  |  |  |  |  |
| $7 / 6$ |  | 2,300 |  |  |  |  |  |  |  |  |  |  |
| 717 |  | 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 |  |  |  |  |  |  |  |  |  |  |  |  |
| 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 |  |  |  |  |  |  |  |  |  |  |
| $\frac{7 / 20}{7 / 16-7 / 20}$ | 184 | 1,500 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 $7 / 21-7 / 24$ |  | 1,000 3,100 |  |  |  |  |  |  |  |  |  |  |
| 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 |  |  |  |  |  |  |  |  |  |  |
| $\frac{7 / 27}{7 / 25-7 / 27}$ | 91 | 1,000 | 39.6 | 1,505 | 12.1 | 460 | 38.4 | 1,459 | 9.9 | 376 | 0 | 0 |

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


1/ 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, $1978^{1}$.

|  | Age Class |  |  |  | Other | Total |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Number in Sample | 11 | 199 | 0 | 29 | 0 | 239 |
| Percent | 4.6 | 83.3 | 0 | 12.1 | 0 | 100.0 |

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 $5_{2}$ sockeye salmon, fish length not included as a variable, 1978.
A. Learning sample classification matrix
ACTUAL GROUPCLASSIFIED GROUP MEMBERSHIPMEMBERSHIP
Kenai Susitna
Kena ${ }^{i}$ ..... 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 GROUPCLASSIFIED GROUP MEMBERSHIPMEMBERSHIP
Kenai Susitna
Kenaj7819
( $n=97$ )0.800.20
Susitna ..... 24 ..... 55
( $n=79$ ) 0.30 ..... 0.70
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, $\{978$.
A. Learning sample classification matrix

ACTUAL GROUP
MEMBERSHIP

Kasilof
( $n=93$ )

Susitna
14
65
( $n=79$ )
CLASSIFIED GROUP MEMBERSHIP
Kasilof Susitna

77
16
0.83
0.17
0.18
0.82

Overall classification Accuracy 83\%
B. Test sample classification matrix

ACTUAL GROUP
MEMBERSHIP
CLASSIFIED GROUP MEMBERSHIP
Kasilof Susitna

Kasilof
81
0.87

12
( $n=93$ )
0.13

Susitna
17
62
( $\mathrm{n}=79$ )
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 |
| $\begin{aligned} & \text { Susitna } \\ & (n=79) \end{aligned}$ | $\begin{array}{r} 63 \\ 0.80 \end{array}$ | $\begin{array}{r} 16 \\ 0.20 \end{array}$ |
| $\begin{aligned} & \text { Crescent } \\ & (n \times 48) \end{aligned}$ | $\begin{array}{r} 6 \\ 0.12 \end{array}$ | $\begin{array}{r} 42 \\ 0.88 \end{array}$ |

## B. Test sample classification matrix

ACTUAL GROUP
MEMBERSHIP

CLASSIFIED GROUP MEMBERSHIP
Susitna Crescent

Susitna
61
18
( $\mathrm{n}=79$ )
0.77
0.23

Crescent
4
44
( $n=48$ )
0.08
0.92

Overall classification Accuracy 83\%


[^0]:    Discriminant function analysis of scale patterns of age $5_{2}$ 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.

[^1]:    ${ }^{1}$ Gilbert-Rich formula: Total years of life at maturity (superscript) year of life at outmigration from freshwater (subscript).

[^2]:    1 Northern section of beach only, within three miles south of the Kasilof River mouth.

[^3]:    Numbers of fish expressed in thousands
    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.

[^4]:    i Numbers of fish in thousands.

[^5]:    1 Number of fish rounded to nearest hundred.

[^6]:    1 Numbers of fish rounded to nearest hundred.

