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RETURNS-PER-SPAWNER RATIOS FOR SOCKEYE SALMON IN UPPER COOK INLET, ALASKA

By

Beverly A. Cross

David R. Bernard

and

Scott L. Marshall

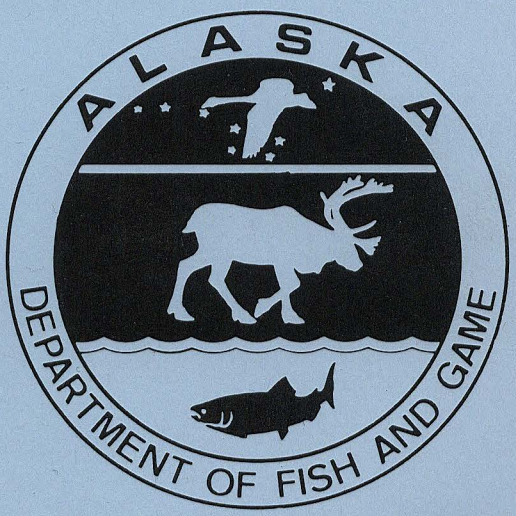
STATE OF ALASKA

Bill Sheffield, Governor

DEPARTMENT OF FISH AND GAME

Don W. Collinsworth, Commissioner

P.O. Box 3-2000, Juneau 99802



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ABSTRACT

Returns-per-spawner ratios for sockeye salmon *(Oncorhynchus nerka)* from the Susitna, Kenai, Kasilof, and Crescent Rivers were calculated with catch allocations and with escapement estimates. Fish Creek was included in the catch allocation, but returns-per-spawner ratios were not calculated for it because rehabilitation work has altered spawner-return relationships. The catch was not allocated to minor sockeye salmon systems because of insufficient data. For 1978-1981 harvests, scale pattern analysis was used to allocate catches to rivers of origin. For 1972-1977 catches, allocations were made with either estimated age compositions of catch and escapement (Method I) or with estimated average exploitation rates (Method II). Although we suspect both Methods biased the returns-per-spawner ratios, but were still used because we know of no alternative procedures for the 1972-1977 period. Average returns and returns-per-spawner ratios for 1972-1981 with Method I were 416,040 and 4.5 for the Susitna, 1,652,616 and 6.7 for the Kenai, 398,017 and 6.2 for the Kasilof, and 45,773 and 2.6 for the Crescent River. Average returns and returns-per-spawner ratios for 1972-1981 with Method II were 422,116 and 4.6 for the Susitna, 1,013,595 and 6.2 for the Kenai, 451,357 and 7.0 for the Kasilof, and 41,926 and 2.6 for the Crescent River.

INTRODUCTION

Sockeye salmon *(Oncorhynchus nerka)* are a valuable resource to Upper Cook Inlet, Alaska (Figure 1) which includes the marine waters and drainages north of Anchor Point. The average annual commercial harvest of sockeye salmon from 1972 through 1981 was 1.3 million fish, and the value to the fishermen of the 1981 sockeye salmon harvest was approximately $11.5 million. There are 599 drift net permits and 747 set net permits for the fishery.

Migrations of the major sockeye salmon runs through Upper Cook Inlet overlap geographically and through time. Consequently the commercial fishery is a mixed-stock fishery, harvesting different proportions of fish from each river. To effectively manage individual runs, a biologist must know the run composition of the commercial catch. Once the catch is apportioned into component runs, it can be added to estimates of escapements to calculate returns by river systems. Return information can then be used to evaluate spawner-return relationships and ultimately analyzed with other production data to establish optimum escapement goals.

The Upper Cook Inlet management area is divided into two fishing districts, the Northern and Central (Figure 1). The Northern District has two set net fisheries: the Northern District east-side and the Northern District west-side. The Central District has a drift net fishery and five set net fisheries: Central District west-side, Kalgin Island, Salamatof Beach, Kalifonsky Beach, and Cohoe/Ninilchik Beach. The Kenai, Kasilof, and Susitna Rivers have produced most of the sockeye salmon in Upper Cook Inlet, followed in magnitude by Crescent River and Fish Creek (outlet stream of Big Lake). The Chakachatna River, Packers Creek, Big River, Cottonwood Creek, and Lake Creek (outlet stream of Nancy Lake) also produce sockeye salmon.

The purpose of this analysis was to: (1) compile historic sockeye salmon catch, escapement, and age composition information; (2) to apportion the catch into principal runs; (3) to estimate returns by river and year; and (4) to calculate returns-per-spawner ratios for the major river systems. Our analysis of Upper Cook Inlet sockeye salmon production was limited to years between 1968 and 1981 because escapement information prior to that time were not available. We allocated the catch only to the five principal runs (Susitna, Kenai, Kasilof, Crescent Rivers, and Fish Creek). Allocation of the catch to minor systems was not possible because of insufficient data.

METHODS

Catch Numbers

Commercial catch figures for 1972-1979 were final numbers taken from computer summaries compiled by the Alaska Department of Fish and Game (ADF&G) from fish tickets. Catch statistics for 1980 and 1981 were preliminary and were taken from ADF&G fish ticket summaries dated 6 June 1982. Commercial catch figures were reported in total numbers of sockeye salmon by fishery.

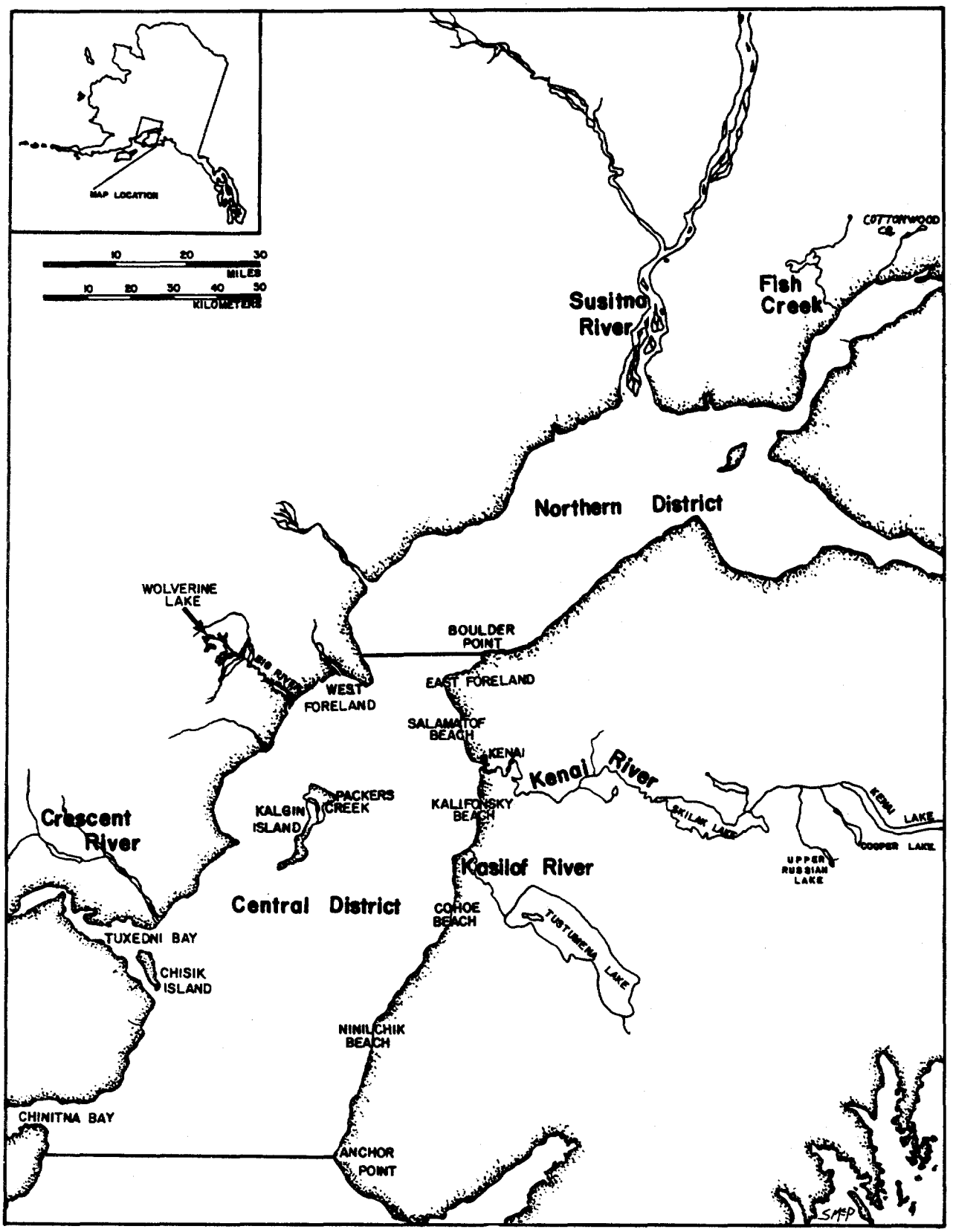

Figure 1. The Upper Cook Inlet area showing the location of the Northern and Central Districts and the major sockeye salmon spawning drainages.

Ruesch (1981) documents the harvests made by subsistence and non-commercial fisheries. We only included catches for 1979-1981 in our analysis because earlier harvests were relatively insignificant (<50 fish).

Mills (1979; 1981; 1982) reports sport catches from the Susitna, Kenai, and Kasilof Rivers for 1977 through 1981. Nelson (1982) summarizes Russian River sport catches and the 1974-1976 Kenai River mainstem harvests (personal communication). We divided sport harvests from the Kenai River mainstem into those occurring upriver of the sonar counters and those occurring downriver. To estimate catches for these categories, we used the proportions reported in 1981 (Mills 1982) of catch harvested above and below the Soldotna bridge for proportions above and below the sonar, respectively. The catches were partitioned so that fish included in the sonar counts and later harvested by the sport fishery could be subtracted to estimate number of spawners.

Escapement Numbers

Tarbox (1983) provides estimates of the numbers of sockeye salmon entering the Susitna River from 1975 through 1981. Escapement figures for 1978 through 1981 were final apportioned sonar counts, while 1975-1977 escapements were estimates from mark-recapture programs. Abundance data for the Susitna River before 1975 were limited and were primarily survey counts of spawning index areas. Index areas and survey methods were standardized in 1972, and surveys have been conducted each year thereafter.

We used a functional linear regression (Ricker 1973) of the mean numbers of fish per surveyed index stream in 1975 through 1981 (independent variable) to Susitna River escapements (dependent variable) during the same years to predict the 1972-1974 Susitna River sockeye salmon escapements. The linear equation is $y = 21{,}285 + 120x$ $\{r = 0.83;\ p<0.025\}$. Survey data were not available for 1968 through 1971, therefore, we estimated those escapements from a functional linear regression of the 1975 through 1980 Kenai and Kasilof Rivers escapements totaled (independent variable) to Susitna River escapements $\{y = 16{,}388 + .2521x;\ r = 0.79;\ p<0.10\}$. We used a functional regression instead of the ordinary predictive regression because of the probability of measurement error in the independent variables. The standard deviations for the 1968 through 1974 Susitna River escapements were calculated to illustrate to the reader the precision of the estimates.

Tarbox (1983) provides estimates of the escapements of the late run of sockeye salmon entering the Kenai River for 1968 through 1981. Our analysis only reported on the more numerous late run which was commercially exploited and enters the river from late June through August. For all years except 1971, estimates were final apportioned sonar counts. The 1971 escapement was estimated from surveys of spawning index areas and partial sonar counts.

Kasilof River escapements for 1968 through 1981 were final apportioned sonar counts except for the 1971 count which was estimated from partial sonar counts and surveys of spawning index areas (Tarbox 1983).

Tarbox (1983) provides final sonar counts of sockeye salmon escaping to Crescent River during 1979 through 1981. We estimated escapements prior to 1979 by applying the 1979 through 1981 average exploitation rate determined from scale pattern

analysis to the numbers of Crescent River fish harvested. Analyses of 1978 through 1981 scale patterns indicated that Crescent River runs comprised, on average, 63.7% of the harvest made by the Central District west-side set nets. Furthermore, the west-side fishery harvested 92.1% of all Crescent River fish caught, and set nets on Kalgin Island harvested the remainder. We used these percentages to estimate the numbers of Crescent River fish harvested. Subsequently we estimated escapements by applying the 1979 through 1981 average exploitation rate (.374). Escapements to Fish Creek were weir counts except the 1968 counts which was estimated from a counting screen (Chlupach 1982).

Number of Spawners

Numbers of spawners equaled escapement minus any fish taken upstream of where the escapements were counted. Sport harvests on the Kasilof River occurred downstream of the enumeration site, hence, we did not subtract it from the escapement to estimate numbers of spawners. Sport fishing for sockeye salmon on the Susitna River occurred above and below the escapement counting site, however, catches were relatively small (<5,500) and were counted only in recent years, so we did not subtract them from the escapement figures. We did subtract sport harvests on the Russian River and on the Kenai River above the sonar from the escapement into the Kenai River to calculate its spawners. We assumed sport fish harvests from Crescent River and Fish Creek were insignificant. ADF&G Fisheries Rehabilitation and Enhancement Division (FRED) have taken eggs from Kasilof River fish for artificial propagation since 1974 and have released some of the fry into other systems. We estimated the numbers of fish taken for eggs whose offspring were not returned to the Kasilof River by applying the percentage of fry not returned to the number of adults; and subsequently we subtracted these fish from escapements to estimate numbers of spawners. We included as spawners those fish taken for eggs whose progeny were returned to the Kasilof River and assumed survival rates for their progeny equaled the natural populations.

Age Composition

Scales for aging sockeye salmon were collected from the preferred area on the left side of the fish two rows above the lateral line in the diagonal scale row downward from the posterior edge of the dorsal fin (INPFC 1963). Scales were mounted on gum cards and impressions made in cellulose acetate (Clutter and Whitesel 1956).

Escapement:

The age compositions of escapements into the Susitna, Kenai, Kasilof, and Crescent Rivers were summarized from scale data cataloged in the ADF&G statewide scale archives located in Anchorage. In general, samples from the Susitna, Kenai, and Kasilof Rivers were collected via fishwheels adjacent to the counting sites. Scale samples from Crescent River came from fish captured with fishwheels, beach seines, and trip seines. Age compositions of escapements into Fish Creek were estimated with samples from fish captured in a weir live box (Chlupach 1982).

For those years when scales were not sampled from one of the rivers, the average age composition from available data for that river was used. Age compositions for 1978 through 1981 were weighted by escapement numbers through time. Escape-

ment age compositions prior to 1978 were not weighted through time because daily escapements were not counted prior to 1978.

Scales were not sampled from fish taken from the Kasilof River for eggs, hence, the age compositions of escapements were applied to those fish. The age composition of spawners equaled the numbers of fish by age group of the escapement minus the sport harvest by age group.

Catch:

The age compositions of the commercial catches were compiled from scale data cataloged in the ADF&G statewide scale archives. Age compositions were summarized for individual fisheries (Northern District east-side, Northern District west-side, Central District drift, Central District west-side, Kalgin Island, Salamatof Beach, Kalifonsky Beach, Cohoe/Ninilchik Beach) whenever data were available. Scales were not sampled from individual beaches before 1977, consequently information for Salamatof, Kalifonsky, and Cohoe/Ninilchik Beaches were pooled to represent the Central District east-side, and the Northern District east-side and the Northern District west-side were combined to represent the Northern District. Average age composition for specific fisheries were applied to those years in which samples were not taken for a particular fishery. For those catches with more than 250 scale samples per statistical week, the age compositions were weighted through time by the catch.

Because scales were not sampled from the sport catches, the age compositions of the sockeye salmon escapement into the Susitna, Kenai, Russian, and Kasilof Rivers were applied to their respective sport harvests.

Scales were not taken from the subsistence catches, consequently the age compositions of commercial catches from the same area and time periods were applied to the subsistence harvests.

Catch Apportionment

Upper Cook Inlet commercial, subsistence, and sport harvests of sockeye salmon from 1972-1981 were apportioned to river of origin by age group. Catches were allocated only to the Susitna, Kenai, Kasilof, and Crescent Rivers, and Fish Creek. Insufficient age and abundance data prohibit allocation of the catch to minor sockeye salmon systems. Consequently, estimates of the contributions from the five principal runs to the catch are inflated. We did not know if this bias affected one estimated return more than another, but most of the estimated returns by river were high because sockeye salmon runs existed which were not included in the analysis. Commercial harvests of sockeye salmon were apportioned by river system with scale pattern analyses, age composition, and average exploitation rates. Allocations to river of origin of the subsistence harvest were based on the results from the commercial catch allocation for the same area and time period. Sport harvests were allocated to the river in which they were caught. Fish from other rivers straying into the sport harvest area were assumed to be insignificant.

Catch Allocation Based on Scale Pattern Analysis, 1978-1981:

Scale pattern recognition techniques were used to allocate the 1978 through 1981 commercial harvests. Scale patterns of sockeye salmon sampled from the escapements were compared with linear discriminant function analysis (Fisher 1936; Dixon and Brown 1976) and classification models representing the five primary runs were built. Catch samples were classified to river of origin with the identification models. Cross et al. (1981; 1982; 1983); and Bethe, Krasnowski, and Marshall (1980) present detailed summaries of the methods and results of the 1978-1981 catch allocations. The 1979 through 1981 run composition estimates in this report are from Cross et al. (1981; 1982; 1983) and were applied to final catch figures.

The 1978 catch allocation was based primarily on results from Bethe, Krasnowski, and Marshall (1980). Age 5_2[1] run composition estimates for Boulder Point, North Salamatof, and South Salamatof were summed and averaged to calculate a Salamatof Beach age 5_2 run estimate; estimates of run compositions for North and South Kalifonsky Beaches and those for Cohoe and Ninilchik Beaches were similarly combined. Subsequently, the age 5_2 run composition estimates were expanded to the remaining age groups using methods documented by Cross et al. (1982). Bethe, Krasnowski, and Marshall (1980) did not include Fish Creek in their analyses of scale patterns. We estimated the contribution of Fish Creek to the 1978 catch with the age composition technique which is explained in detail in the following section. The estimated contributions by Fish Creek were subtracted from catch totals and the proportions by run developed by Bethe, Krasnowski, and Marshall (1980) for the other systems were applied to the adjusted catches.

Catch Allocation Based on Age Composition, 1972-1977 (Method I):

The age composition of the catch and escapement were used to estimate the proportions by run in the catch. Catch by age group was apportioned to rivers or origin using the following formula:

$$\hat{C}_{ij} = \hat{C}_i \frac{\hat{E}_{ij}}{\sum_{j=1}^{n} \hat{E}_{ij}}$$

$\hat{C}_{ij}$ = Estimated catch of age i fish from river j.

$\hat{C}_i$ = Estimated catch of age i fish.

$\hat{E}_{ij}$ = Estimated escapement of age i fish to river j.

n = Number of rivers.

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[1] Gilbert-Rich Formula: Total years of life at maturity (superscript). Year of life at outmigration from freshwater (subscript).

Trends in the run composition of specific fisheries demonstrated from scale pattern analyses were taken into account when deciding which runs to include in each fisheries allocation. For example, the Susitna River, Kenai River, and Fish Creek were included in the allocation of the Northern District catches. Susitna, Kenai, Kasilof Rivers, and Fish Creek were included in the allocation of the Central District drift and east-side beach harvests. Crescent River was not included in the allocation of the drift harvests because they were not harvested in significant numbers by that fishery according to analyses of 1978-1981 scale patterns. All five runs were included in the catch allocation of Kalgin Island harvests.

Harvests made by set nets on the Central District west-side were allocated with a different method than that outlined above. Analyses of 1978 through 1981 scale patterns demonstrated that the majority of fish (average 63.7%) harvested by Central District west-side set nets were of Crescent River origin and most of the remainder were of Susitna River origin. Because this trend appeared stable and because applying escapement age ratios would have greatly overestimated the contributions of Susitna River and underestimated the contribution of Crescent River, the average run compositions (63.7% Crescent and 27.3% Susitna) were used to allocate the catches. The contributions of Kenai and Kasilof Rivers were assumed to be insignificant.

The age composition method of catch allocation assumes equal exploitation rates for all runs involved. If exploitation rates differed slightly between runs, especially if the run with the different rate was large, the catch allocation would be biased. Past exploitation rates of the major sockeye salmon runs in Upper Cook Inlet were probably not equal because of differences in migratory timing and fishing effort. Consequently, there are probably inaccuracies in the catch allocations developed from the age compositions. The effects of the biases on the catch allocation were unknown because the exploitation rates by run for 1972 through 1977 were not known.

Catch Allocation Based on Average Exploitation Rates, 1972-1977 (Method II):

The probable biases in the catch allocations made with age compositions for years 1972 through 1977 prompted us to use a different method of catch allocation, a method based on the ratio of average exploitation rates. The catch allocations made with scale pattern analysis and escapements by age for years 1978 through 1981 were used to estimate exploitation rates by age by river for those years. Then catch allocations by age by river for 1972 through 1977 were made with these average exploitation rates:

$$\hat{C}_{ij} = \frac{\hat{E}_{ij}\,(a_i\,\bar{U}_{ij})}{1 - a_i\bar{U}_{ij}}$$

where:

$\hat{C}_{ij}$ = Estimated catch of age i fish from river j.

$\hat{E}_{ij}$ = Estimated escapement of age i fish to river j.

$\bar{U}_{ij}$ = Average exploitation rate of age i fish from river j. (1978-1981 average exploitation rates)

a_i = Change in the magnitude of average exploitation rates within an age group from late to early years.

Although the magnitude of exploitation rates vary annually, average rates can be used for allocations for past years if the ratio of the rates of one river to another remains constant within the same age group (i.e., the ratio $\bar{U}_{ij}/\bar{U}_{ij}$ in 1 year is the same in all years for all values of j). When the assumption of constant ratios holds:

$$\hat{C}_{i.} = \sum_{j=1}^{n} \frac{E_{ij} a_i \bar{U}_{ij}}{1 - a_i \bar{U}_{ij}}$$

where $\hat{C}_{i.}$ is estimated from catch sampling programs for age composition. A FORTRAN program was used to iteratively solve the equation above for a_i for each year 1972 through 1977, and the solutions were used to calculate $\hat{C}_{ij}$. We did not know if ratios among exploitation rates were constant from year to year before 1978 or if they were the same after 1977 as before. However, the ratios for years 1978 through 1981 were not constant from year to year, which was not encouraging. Until some new information is available, Methods I and II were the best available for catch allocations.

Returns

Return estimates for each age group and for each river were derived by adding the commercial catch, sport catch, and subsistence catch to the numbers of spawners. Two methods were used to allocate the 1972-1977 harvests, therefore, two sets of return estimates were developed, one from each method. Ratios of returns to spawners were calculated for the Susitna, Kenai, Kasilof, and Crescent Rivers. Returns-per-spawner ratios were not developed for Fish Creek. Extensive rehabilitation work has been conducted on Fish Creek, thus, altering relationships between returns and spawners.

RESULTS AND DISCUSSION

Catch Numbers

The average annual sockeye salmon commercial harvest from 1972 through 1981 was 1,300,116 fish (Table 1). The Central District drift net fishery took on average 55% of the catch from 1972-1981 (730,618 fish annually). The Central District east-side beaches collectively harvested on average 29% of the total annual sockeye salmon catch. From 1972 through 1981, average annual harvests at Salamatof, Kalifonsky, and Cohoe/Ninilchik Beaches were 122,418, 90,622, and 177,055 fish, respectively. The Northern District, the Central District west-side, and the Kalgin Island set nets caught an average 8%, 4%, and 4%, respectively, of the annual catch from 1972-1981.

Because the subsistence harvests of sockeye salmon from 1972 through 1978 are insignificant (less than 50 fish per year), they were not included in the analysis. The 1979 and 1980 subsistence sockeye salmon catches were 5,564 and 5,459, res-

Table 1. Commercial catch of sockeye salmon by fishery and year, Upper Cook Inlet, 1972-1981[1].

Year	Northern District East-side	Northern District West-side	Central District Drift	Central District West-side	Kalgin Island	Salamatof Beach	Kalifonsky Beach	Cohoe/ Ninilchik Beach	Total
1972	27,217	58,520	506,181	53,980	29,196	50,245	61,995	92,377	879,711
1973	15,997	29,617	375,695	25,144	34,829	64,258	49,710	74,775	670,025
1974	11,197	30,366	265,751	24,298	28,659	58,635	28,854	49,400	497,160
1975	30,222	35,304	368,116	35,358	32,400	57,022	35,852	84,462	678,736
1976	29,873	39,776	1,055,767	44,433	17,905	140,301	87,547	248,528	1,664,130
1977	35,051	88,699	1,073,098	75,649	28,616	233,221	195,152	322,995	2,052,481
1978	18,293	33,331	1,803,479	63,512	42,255	269,934	174,651	216,212	2,621,667
1979	60,912	51,537	454,707	63,442	44,980	80,920	47,622	120,286	924,406
1980	44,077	61,570	770,247	80,628	57,294	131,221	124,189	304,402	1,573,628
1981	100,856	148,806	633,145	26,272	33,945	138,428	100,652	257,116	1,439,220
Average	37,370	57,753	730,618	49,272	35,008	122,418	90,622	177,055	1,300,116

[1] Catch statistics were taken from the Alaska Department of Fish and Game fish ticket summaries. The IBM statistical runs were considered final and were dated as follows: 1972 catches taken from 13 October 1973 run; 1973 catches taken from 9 September 1974 run; 1974 catches taken from 2 June 1976 run; 1975 catches from a 29 July 1976 run; 1976 catches from 20 May 1978 run; 1977 catches from 25 February 1979 run; 1978 catches from 17 October 1980 run; 1979 catches from 9 July 1981 run; and 1980 and 1981 catches were taken from IBM statistical run dated 6 June 1982.

pectively, mostly from the Northern District east-side (Table 2). In 1981, a non-commercial gill net fishery directed at coho salmon *(O. kisutch)* incidentally harvested 193 sockeye salmon.

Most sport fishing for sockeye salmon occurred on the Kenai River and on its tributary, the Russian River (Table 3). Numbers reported for Kenai River sport harvests represent fish caught from the late run. Russian River sport fishery harvested on average 14,991 sockeye salmon annually from 1968 through 1981 (range 600 in 1970 to 33,490 in 1980). From 1974-1981 average annual sport harvests from the Kenai River mainstream below the Soldotna bridge were 5,221 sockeye salmon and average annual harvests above the bridge were 14,141 fish. Estimates of average annual sport harvests from the Susitna River were available only since 1977 and were 2,363 fish. In 1981, a dip net fishery caught 10,000 fish, and the hook and line fishery took 743 sockeye salmon from the Kasilof River. Estimates of the sport harvest from the Kasilof River before 1981 were not available.

Escapement Numbers

Average annual escapement into the Kenai River from 1968-1981 was 296,143 fish (range 53,000 in 1969 to 708,000 in 1977), and average escapement into the Kasilof River is 110,000 fish (range 38,000 in 1970 to 257,000 in 1981) annually (Table 4). The numbers of sockeye salmon taken for eggs annually from the Kasilof River ranged from 205 in 1974 to 10,006 in 1981 (Appendix Table 1), and progeny from approximately 64% of the fish taken were returned to the system.

Escapements into the Susitna River have been enumerated since 1975 and averaged 177,000 fish annually with a range of 94,000 in 1978 to 340,000 in 1981 (Table 4). We predicted escapements into the Susitna River prior to 1975 with regression analysis (Appendix Table 2), but the standard deviations of the predicted escapements were extremely large, partly because there were only seven data pairs in the regression.

Crescent River sockeye salmon escapements have been monitored since 1979 and averaged 73,000 fish annually and ranged from 41,000 in 1981 to 91,000 in 1980 (Table 4). Escapements into the Crescent River prior to 1979 were estimated with recent exploitation rates. Estimates of escapements from 1968 through 1978 ranged from a low of 28,000 fish to a high of 87,000 fish. Sockeye salmon escapements into Fish Creek averaged 24,956 from 1968 through 1981, and ranged from 2,705 in 1973 to 68,739 in 1979.

Escapement estimates for the sockeye salmon escapement into the minor systems of Cook Inlet are given in Appendix Table 3.

Number of Spawners

Sport fisheries on the Susitna, Kasilof, and Crescent Rivers are small and most fish escaping the commercial fisheries were considered spawners. However, Kenai River sport fisheries, as previously described, took substantial numbers of sockeye salmon and, therefore, reduced the spawning populations. The sport fishery on the Kenai River harvested on average 29,000 sockeye salmon annually.

Table 2. Subsistence and non-commercial gill net catch of sockeye salmon by area, Upper Cook Inlet, 1979-1981[1].

Area	1979	1980	1981
Northern District West-side (Tyonek)		261	
Northern District East-side	5,564	5,178	
Central District East-side		20	
Salamatof Beach			83
Kalifonsky Beach			51
Cohoe/Ninilchik Beach			59
Total	5,564	5,459	193

[1] Catch figures for 1979-1980 taken from 1981 Upper Cook Inlet Report to the Board. Alaska Department of Fish and Game. Commercial Fisheries Division. Catch figures for 1981 taken from 1981 Upper Cook Inlet Non-Commercial Set Gill Net Fishery. Ken Tarbox. Alaska Department of Fish and Game. Division of Commercial Fisheries.

Table 3. Sport catch of sockeye salmon by system and year, Upper Cook Inlet, 1968-1981[1].

Year	Susitna River	Kenai Mainstream Below Soldotna Bridge	Kenai Mainstream Above Soldotna Bridge	Russian River	Kasilof River
1968				5,820	
1969				1,150	
1970				600	
1971				10,730	
1972				16,050	
1973				8,930	
1974		2,970	8,030	8,500	
1975		1,890	5,110	8,390	
1976		4,860	13,140	13,700	
1977	5,276	6,263	16,933	27,440	
1978	971	9,077	24,542	24,530	
1979	2,152	4,559	12,328	26,830	
1980	1,769	6,876	18,592	33,490	
1981	1,647	5,270	14,451	23,720	10,743
Average	2,363	5,221	14,141	14,991	

[1] Sport harvest figures from 1977-1981 for the Susitna River, Kenai Mainstream, and Kasilof River were taken from the Statewide Harvest Study, Volume 20 and Volume 22, Michael Mills, Alaska Department of Fish and Game. Russian River sport harvest figures were taken from 1981 Russian River sockeye salmon study, Dave Nelson, Alaska Department of Fish and Game, Sport Fish Division. Kenai River Mainstream 1974-1976 sport harvest figures were taken from personal communication with Dave Nelson, Alaska Department of Fish and Game.

The Kenai River Mainstream sport harvest was divided into two categories: that occurring above and below the Soldotna bridge. This division was reported in 1981 by Mike Mills. The 1981 percentages above and below the bridge were assumed to be typical and were applied to the 1974-1980 total Kenai River Mainstream sport harvests.

Table 4. Escapement of sockeye salmon to Upper Cook Inlet by river system and year, 1968-1981[1].

Year	Susitna [2]	Kenai [3]	Kasilof [4]	Crescent [5]	Fish [6]
1968	61,010	88,000	89,000	55,000	19,616
1969	41,346	53,000	46,000	51,000	12,456
1970	44,371	73,000	38,000	38,000	25,000
1971	114,707	300,000	90,000	44,000	31,900
1972	91,927	318,000	113,000	62,000	6,981
1973	116,093	367,000	40,000	29,000	2,705
1974	71,849	161,000	70,000	28,000	16,225
1975	108,000	142,000	48,000	41,000	29,882
1976	111,000	380,000	139,000	51,000	14,032
1977	238,000	708,000	155,000	87,000	5,183
1978	94,000	399,000	116,000	74,000	3,555
1979	157,000	285,000	152,000	87,000	68,739
1980	191,000	464,000	187,000	91,000	62,628
1981	340,000	408,000	257,000	41,000	50,479
Average [7]	177,000	296,143	110,000	73,000	24,956

1 Escapement figures for Susitna River 1975 through 1981, Crescent River 1979 through 1981, and Kenai and Kasilof Rivers 1968 through 1981 taken from Tarbox et al. Cook Inlet sockeye salmon studies. Alaska Department of Fish and Game Technical Report for period July 1, 1977 to June 30, 1982. Project No. AFC-62.2. Anadromous Fish Conservation Act. National Marine Fisheries. Estimates rounded to the nearest one thousand fish.

2 Susitna River escapements for 1972 through 1974 were estimated from a geometric mean functional regression of the mean number of fish per surveyed index stream to measured escapements into the Susitna River ($y = 21,285.3 + 120.1 x$; $R = .8298$, significant at .025 level). Survey data for index streams not available prior to 1972. Escapement estimates for 1968-1971 were calculated from a geometric mean functional regression of the 1975-1980 Kenai and Kasilof Rivers total escapement to measured Susitna escapement ($y = 16,388 + .2521x$; $R = .779$, significant at the .10 level). Escapement estimates for 1975 through 1977 derived from tag/recapture plus fishwheel catch ratios. Escapement estimates for 1978 through 1981 represent final apportioned sonar counts.

3 Kenai River escapement estimates for 1968-1970 and 1972-1981 represent final apportioned sonar counts of the late Kenai River sockeye run. Escapement estimate for 1971 developed from estimates from spawning index areas and partial sonar counts.

4 Kasilof River escapement estimates for 1968-1970 and 1972-1981 represent final apportioned sonar counts. Escapement estimates for 1971 developed from estimates from spawning index areas and partial sonar counts. Sonar estimates for 1979-1981 escapement include counts from designated early period (prior to 21 June).

5 Crescent River escapement figures for 1968-1978 were estimated by calculating the the total numbers of Crescent River fish harvested based on 1978-1981 scale pattern trends, and then applying the average exploitation rate to estimate total return.

Scale pattern analysis (1978-1981) showed that Crescent River stocks comprised on the average 63.7% of the Central District West-side sockeye harvest. Also from scale pattern analysis it was shown that of all the Crescent river fish harvested commercially, 92.1% were taken by the Central District West-side set net fishery. Finally, the average exploitation rate of Crescent River stocks equals .374.

Crescent River escapement figures for 1979-1981 represent final sonar counts.

6 Fish Creek escapement figures for 1968-1979 taken from Chlupach, R. 1979. Ennumeration of 1979 adult salmon immigration into Big Lake watershed. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation and Enhancement. Escapement figures for 1980-1981 from Robert Chlupach, personal communication. The escapement figures for 1968 represent totals estimated from a counting screen. Escapement figures for the remaining years represent weir counts.

7 Average for Kenai, Kasilof River and Fish Creek includes years 1968-1981. Average for Susitna River and Crescent River include years when the escapement was actually enummerated, 1975-1981 and 1979-1981, respectively.

Table 5. Summary of the age composition of the Upper Cook Inlet commercial sockeye salmon harvest, 1972-1981[1].

Year		4 2	5 2	5 3	6 3	Other	Total
1972	Numbers	172,478	456,129	84,246	156,270	10,588	879,711
	Percent	19.6	51.8	9.6	17.8	1.2	100.0
1973	Numbers	35,628	512,487	42,351	64,435	15,124	670,025
	Percent	5.3	76.5	6.3	9.6	2.3	100.0
1974	Numbers	84,942	297,399	56,760	54,328	3,731	497,160
	Percent	17.1	59.8	11.4	10.9	0.8	100.0
1975	Numbers	142,078	309,451	152,098	65,225	9,884	678,736
	Percent	20.9	45.6	22.4	9.6	1.5	100.0
1976	Numbers	436,706	834,977	229,841	153,990	8,616	1,664,130
	Percent	26.2	50.2	13.8	9.3	0.5	100.0
1977	Numbers	207,082	1,403,335	197,428	227,630	17,006	2,052,481
	Percent	10.1	68.4	9.6	11.1	0.8	100.0
1978	Numbers	255,970	2,135,537	108,103	121,117	940	2,621,667
	Percent	9.8	81.5	4.1	4.6	<0.1	100.0
1979	Numbers	338,204	424,360	107,376	40,263	14,203	924,406
	Percent	36.6	45.9	11.6	4.4	1.5	100.0
1980	Numbers	494,693	742,096	165,556	167,563	3,720	1,573,628
	Percent	31.4	47.2	10.5	10.7	0.2	100.0
1981	Numbers	240,189	1,032,703	95,270	69,863	1,195	1,439,220
	Percent	16.7	71.8	6.6	4.8	0.1	100.0
Average[2]	Numbers	252,223	777,469	137,812	120,911	11,701	1,300,116
	Percent	19.4	59.8	10.6	9.3	0.9	100.0

[1] Gilbert-Rich Formula: Total years of life at maturity (superscript). Year of life at outmigration from freshwater (subscript).

[2] Average catch by age group was not weighted through time. It was calculated by applying the average annual percentage by age group to the average catch of all ages.

Table 6. Summary of age composition of Upper Cook Inlet sockeye salmon escapement by system, 1968-1981 (continued).

Year	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total %	Total Numbers
1973	Susitna	37.5	43,535	48.5	56,305	4.2	4,876	5.4	6,269	4.4	5,108	100.0	116,093
	Kenai	4.9	17,983	68.4	251,028	8.1	29,727	16.1	59,087	2.5	9,175	100.0	367,000
	Kasilof	19.5	7,800	57.0	22,800	19.0	7,600	4.5	1,800	0	0	100.0	40,000
	Crescent	16.9	4,901	66.6	19,314	3.5	1,015	11.6	3,364	1.4	406	100.0	29,000
	Fish	29.0	784	8.1	219	31.6	855	0.4	11	30.9	836	100.0	2,705
	Total	13.5	75,003	63.0	349,666	8.0	44,073	12.7	70,531	2.8	15,525	100.0	554,798
1974	Susitna	53.8	38,655	40.2	28,883	3.4	2,443	2.0	1,437	0.6	431	100.0	71,849
	Kenai	18.0	28,980	46.4	74,704	18.0	28,980	12.5	20,125	5.1	8,211	100.0	161,000
	Kasilof	34.6	24,220	59.1	41,370	4.3	3,010	1.6	1,120	0.4	280	100.0	70,000
	Crescent	39.7	11,116	53.0	14,840	4.4	1,232	2.9	812	0	0	100.0	28,000
	Fish	13.6	2,207	0.4	65	1.6	259	0.1	16	84.3	13,678	100.0	16,225
	Total	30.3	105,178	46.1	159,862	10.3	35,924	6.8	23,510	6.5	22,600	100.0	347,074
1975	Susitna	56.5	61,020	37.6	40,608	2.7	2,916	0.6	648	2.6	2,808	100.0	108,000
	Kenai	10.4	14,768	35.6	50,552	30.7	43,594	13.5	19,170	9.8	13,916	100.0	142,000
	Kasilof	29.4	14,112	6.9	3,312	57.6	27,648	4.4	2,112	1.7	816	100.0	48,000
	Crescent	14.5	5,945	74.6	30,586	3.2	1,312	3.0	1,230	4.7	1,927	100.0	41,000
	Fish	87.5	26,147	1.0	299	5.2	1,554	0	0	6.3	1,882	100.0	29,882
	Total	33.0	121,992	34.0	125,357	20.9	77,024	6.3	23,160	5.8	21,349	100.0	368,882
1976	Susitna	44.8	49,728	45.7	50,727	1.9	2,109	0.3	333	7.3	8,103	100.0	111,000
	Kenai	46.0	174,800	20.0	76,000	22.0	83,600	8.0	30,400	4.0	15,200	100.0	380,000
	Kasilof	35.8	49,762	24.2	33,638	28.0	38,920	11.6	16,124	0.4	556	100.0	139,000
	Crescent	16.9	8,619	66.6	33,966	3.5	1,785	11.6	5,916	1.4	714	100.0	51,000
	Fish	70.6	9,907	20.8	2,919	5.7	800	0.2	28	2.7	378	100.0	14,032
	Total	42.1	292,816	28.4	197,250	18.3	127,214	7.6	52,801	3.6	24,951	100.0	695,032
1977	Susitna	21.7	51,646	72.8	173,264	3.5	8,330	0.5	1,190	1.5	3,570	100.0	238,000
	Kenai	6.0	42,480	76.0	538,080	7.0	49,560	10.0	70,800	1.0	7,080	100.0	708,000
	Kasilof	30.0	46,500	29.9	46,345	27.6	42,780	11.4	17,670	1.1	1,705	100.0	155,000
	Crescent	16.9	14,703	66.6	57,942	3.5	3,045	11.6	10,092	1.4	1,218	100.0	87,000
	Fish	34.4	1,783	51.2	2,654	2.6	135	0	0	11.8	611	100.0	5,183
	Total	13.2	157,112	68.6	818,285	8.7	103,850	8.3	99,752	1.2	14,184	100.0	1,193,183

-Continued-

fish. Escapements into Fish Creek averaged 55.4% age 4_2, 17.0% age 5_2, 4.8% age 5_3, 0.3% age 6_3, and 22.5% age "other" which are mostly age 3_2.

There were consistently higher percentages of age 4_2 fish (younger fish) in the escapement than in the catch; and conversely, higher percentages of age 5_2 fish were found in the catch than in the escapement (Tables 5-6). Factors which may have contributed to differences between the age compositions of the catch and escapement include:

1) Scale samples were not representative of the catch and/or escapement, therefore, the age compositions were inaccurate.

2) Minor stocks, not included in the analysis, contributed significantly to the catch, thus, the catch age compositions included stocks not represented in the escapement age compositions.

3) Commercial gear selectivity harvested older, larger fish (age 5_2).

4) Exploitation rates differed among runs.

5) Commercial fishing harvest rates were higher on older fish (age 5_2) because fishing effort was greater on the early portion of the run. In general, older fish migrate through the fishery earlier than younger fish. If fishery managers direct fishing effort towards the early segment of the run to test its strength, higher percentages of older fish are caught.

Combinations of all of the above factors probably produced the differences in the catch and escapement age compositions.

Catch Allocation Based on Scale Pattern Analysis 1978-1981

Analyses of scale patterns of fish harvested from 1978-1981 showed geographic trends in the run composition. The Northern District east-side harvests from 1978-1981 was 37.6% Susitna River fish, 37.6% Kenai River fish, 18.0% Fish Creek fish, and 6.8% Kasilof River fish. The Northern District west-side harvests from 1978-1981 were 60.8% Susitna River fish, 29.3% Kenai River fish, 4.0% Kasilof River fish, 2.7% Crescent River fish, and 3.2% Fish Creek fish. Appendix Tables 29-32 give the run composition of the sockeye salmon harvest for each year 1978-1981 and Appendix Tables 33 shows the run composition by age group and fishery for the subsistence and non-commercial gillnet fishery from 1979-1981.

Central District drift net harvests from 1978 through 1981 were 22.3% Susitna River fish, 47.2% Kenai River fish, and 25.8% Kasilof River fish. The 1978 through 1981 average run compositions of Kalgin Island set net harvests were similar to that of the drift fishery and equaled 22.3% Susitna River, 33.5% Kenai River, and 34.5% Kasilof River. Set net harvests from the Central District west-side from 1978 through 1981 were 20.7% Susitna River, 63.6% Crescent River, 7.4% Kenai River, and 8.3% Kasilof River fish. Set nets on the Central District east-side beaches harvested mostly Kenai River and Kasilof River fish. The average run compositions by beach were: 60.7% Kenai River and 28.2 Kasilof River fish for Salamatof Beach, 48.8% Kenai River and 41.9% Kasilof River fish for

exploitation rates applied were greater for the Kasilof River than for the Kenai River. Differences in actual numbers of fish were greatest between the two methods for the years 1976 and 1977 because total catches were larger.

Returns

Returns of sockeye salmon to Upper Cook Inlet from 1972 through 1981 averaged 2,034,472 fish annually. The average annual exploitation rate was 0.641. Annual returns by river from 1972 through 1981 based on Method I and the scale pattern catch allocations (Appendix Tables 37 and 38) averaged: Susitna River 416,040, Kenai River 1,652,616, Kasilof River 398,017, Crescent River 45,773, and Fish Creek 55,225. Annual returns by river based on Method II and the scale pattern catch allocations (Appendix Tables 38 and 39) averaged: Susitna River 422,116, Kenai River 1,013,595, Kasilof River 451,357, Crescent River 41,926, and Fish Creek 53,538. Estimates of returns from the two catch allocations differed the most for the Kasilof and Kenai Rivers and for the years 1976 and 1977 (Figure 2).

Returns Per Spawner

The ratios of returns to spawners calculated from Method I and Method II catch allocations differed most significantly for Kenai and Kasilof Rivers. Method I catch allocations estimated higher ratios of returns to spawners for the Kenai River and lower ratios of returns to spawners for the Kasilof River than Method II catch allocation.

The 1968-1975 average ratios of returns to spawners developed from Method I and the scale pattern catch allocations (Tables 7-10) were highest for the Kenai River (6.7) followed by Kasilof River (6.2), Susitna River (4.5), and Crescent River (2.6). Returns-per-spawner ratios for the Susitna River ranged from 2.9 in 1973 to 7.3 in 1972 (Table 7). Returns-per-spawner ratios for the Kenai River varied from 3.4 in 1971 to 11.1 in 1968 (Table 8). The lowest ratio of returns to spawners for the Kasilof River equaled 2.0 in 1968; while the highest equaled 12.5 in 1975 (Table 9). Ratios of returns to spawners for the Crescent River ranged from 0.8 in 1969 to 5.2 in 1975 (Table 10).

The 1968-1975 average ratios of returns to spawners developed from Method II and the scale pattern catch allocations (Tables 11-14) were highest for the Kasilof River (7.0), followed by the Kenai River (6.2), Susitna River (4.6), and Crescent River (2.6). The lowest returns-per-spawner ratio for the Susitna River equaled 2.7 in 1973 and the highest equaled 7.7 in 1972 (Table 11). Ratios of returns to spawners for the Kenai River ranged from 2.7 in 1971 to 10.5 in 1968 (Table 12). Returns-per-spawner ratios for the Kasilof River were lowest in 1968 (2.5) and highest (12.4) in 1973 (Table 13). The ratios of returns to spawners for the Crescent River ranged from 0.7 in 1969 to 5.2 in 1975 (Table 14).

Ratios of returns to spawners from both methods of catch allocation were extremely variable and appeared high for the Susitna, Kenai, and Kasilof Rivers. We compared returns to all systems to total known spawners (Susitna, Kenai, Kasilof, Crescent Rivers, and Fish Creek) and calculated ratios of returns to spawners for the entire Upper Cook Inlet area. By combining returns and spawners we essentially removed the biases caused by the catch allocations. The 1968-1975 average ratio of returns to spawners for the Upper Cook Inlet area is 4.9 and varied from 3.5 in

Table 7. Progress of spawners and returns of sockeye salmon to the Susitna River, Upper Cook Inlet, developed from the catch apportionment based on scale pattern and age composition[1].

Brood		Returns by Age Group					Return
Year	Spawners	4 2	5 2	5 3	6 3	Total[3]	Spawner
1966					43,207		
1967		21,005	206,250	6,656	12,717		
1968	61,010	21,005	147,208	10,043	4,997	183,253	3.0
1969	41,346	64,808	92,160	6,678	3,363	167,009	4.0
1970	44,371	75,213	170,546	9,537	2,488	257,784	5.8
1971	114,707	135,948	314,288	6,891	5,594	462,721	4.0
1972	91,927	128,451	502,234	25,950	17,350	673,985	7.3
1973	116,093	128,475	185,407	11,822	6,806	332,510	2.9
1974	71,849	133,795	118,312	26,451	34,547	313,105	4.4
1975	108,000	197,737	206,863	27,441	39,755	471,796	4.4
1976	111,000	214,715	640,532	23,349			
1977	232,724	57,533					
1978	93,029						
1979	154,848						
1980	189,231						
1981	338,353						
Average[2]	81,163	110,679	217,127	15,602	14,362	357,770	4.5

[1] Allocation of 1978-1981 commercial catches based on scale pattern analyses. Allocation of 1972-1977 commercial catches based on the age composition.

[2] Total returns only include age groups 4_2, 5_2, 5_3, and 6_3.

[3] Average calculated for brood years 1968 through 1975.

Table 9. Progress of spawners and returns of sockeye salmon to the Kasilof River, Upper Cook Inlet, developed from the catch apportionment based on scale pattern and age composition[1].

Brood		Returns by Age Group					Return
Year	Spawners	4 2	5 2	5 3	6 3	Total[2]	Spawner
1966					47,724		
1967			107,418	7,327	3,446		
1968	89,000	104,619	54,201	14,693	3,572	177,085	2.0
1969	46,000	10,677	115,328	7,492	7,709	141,206	3.1
1970	38,000	40,883	11,891	80,516	66,341	199,631	5.2
1971	90,000	28,182	191,159	107,736	58,593	385,670	4.3
1972	113,000	121,115	122,578	122,678	35,036	401,407	3.5
1973	40,000	108,465	299,775	48,922	15,763	472,925	11.8
1974	69,795	183,732	180,601	59,799	67,629	491,761	7.0
1975	47,832	194,165	304,276	80,138	11,643	590,222	12.3
1976	133,537	351,938	354,229	48,702			
1977	153,493	185,027					
1978	112,550						
1979	151,758						
1980	185,672						
1981	256,137						
Average[2]	66,703	98,980	159,976	65,246	33,286	357,488	6.2

[1] Allocation of 1978-1981 commercial catches based on scale pattern analyses. Allocation of 1972-1977 commercial catches based on the age composition.

[2] Total returns only include age groups 4_2, 5_2, 5_3, and 6_3.

[3] Averages calculated for brood years 1968 through 1975.

Table 11. Progress of spawners and returns of sockeye salmon to the Susitna River, Upper Cook Inlet, developed from the catch apportionment based on scale pattern and average exploitation rates[1].

Brood Year	Spawners	Returns by Age Group 4 2	5 2	5 3	6 3	Total [2]	Return Spawner
1966					48,113		
1967			208,030	6,465	14,127		
1968	61,010	15,806	159,372	10,301	7,140	192,619	3.2
1969	41,346	64,426	91,391	7,491	4,057	167,365	4.0
1970	44,371	69,273	188,096	8,872	1,803	268,044	6.0
1971	114,707	134,018	335,036	6,248	5,614	480,916	4.2
1972	91,927	119,871	548,458	24,084	17,350	709,763	7.7
1973	116,093	114,603	185,407	11,822	6,806	318,638	2.7
1974	71,849	133,795	118,312	26,451	34,547	313,105	4.4
1975	108,000	197,737	206,863	27,441	39,755	471,796	4.4
1976	111,000	214,715	640,532	23,349			
1977	232,724	57,533					
1978	93,029						
1979	154,848						
1980	189,231						
1981	338,353						
Average [3]	81,163	106,191	229,117	15,339	14,634	365,281	4.6

[1] Allocation of 1978-1981 commercial catches based on scale pattern analyses. Allocation of 1972-1977 commercial catches based on 1978-1981 average exploitation rates.

[2] Total returns only include age groups 4_2, 5_2, 5_3, and 6_3.

[3] Averages calculated for brood years 1968 through 1975.

Table 13. Progress of spawners and returns of sockeye salmon to the Kasilof River, Upper Cook Inlet, developed from the catch apportionment based on scale pattern and average exploitation rates[1].

Brood Year	Spawners	Returns by Age Group 4 2	5 2	5 3	6 3	Total[2]	Return Spawner
1966					59,468		
1967			143,200	10,497	4,153		
1968	89,000	128,465	70,300	18,340	6,008	223,113	2.5
1969	46,000	12,600	144,956	12,006	14,655	184,217	4.0
1970	38,000	50,382	18,322	109,051	95,081	272,836	7.2
1971	90,000	39,193	296,648	147,761	89,547	573,149	6.4
1972	113,000	159,226	162,462	156,902	35,036	513,626	4.5
1973	40,000	131,137	299,775	48,922	15,763	495,597	12.4
1974	69,795	183,732	180,601	59,799	67,629	491,761	7.0
1975	47,832	194,165	304,276	80,138	11,643	590,222	12.3
1976	133,537	351,938	354,229	48,702			
1977	153,493	185,027					
1978	112,550						
1979	151,758						
1980	185,672						
1981	256,137						
Average[3]	66,703	112,362	184,668	79,115	41,920	418,065	7.0

[1] Allocation of 1978-1981 commercial catches based on scale pattern analyses. Allocation of 1972-1977 commercial catches based on 1978-1981 average exploitation rates.

[2] Total returns only include age groups 4_2, 5_2, 5_3, and 6_3.

[3] Averages calculated for brood years 1968 through 1975.

1971 to 6.3 in 1975 (Table 15). The combined returns-per-spawner ratios also appeared high, but were less variable than those developed for individual rivers. This suggests that our catch allocations are inaccurate and are responsible for the extreme fluctuations in the returns-per-spawner ratios within systems. Examples are provided by results for the 1968 brood year when returns-per-spawner ratios were extremely high for the Kenai River (11.1 in Method I and 10.5 in Method II); while returns-per-spawner ratios for the Susitna River (3.0 in Method I and 3.2 Method II) and Kasilof River (2.0 in Method I and 2.5 in Method II) were comparably low. Similarly, returns-per-spawner ratios for the 1973 brood year were high for the Kasilof River (11.8 in Method I and 12.4 in Method II) and low for the Susitna River (2.9 in Method I and 2.7 in Method II).

Average ratios of returns to spawners for other Alaskan sockeye salmon systems are lower than those estimated for rivers in Upper Cook Inlet. The average ratio of returns to spawners for the Dog Salmon (Frazer) River, Kodiak Island, Alaska, is 3.2 for the 1966-1971 brood years (Blackett 1979), and the average ratio of returns to spawners for the combined early and late runs to Chignik River is 3.3 for the 1963-1975 brood years (Nicholson et al. 1981). In Bristol Bay, average returns-per-spawner ratios for 1968-1975 by system are as follows: Kvichak River 3.0, Naknek River 2.9, Egegik River 3.2, and Ugashik River 3.6 (ADF&G Bristol Bay staff files).

The 1968-1975 average ratio of returns-per-spawner for Upper Cook Inlet (4.9) is approximately 1.6 times greater than the average ratio of returns to spawner for the Kvichak River (3.0) for the same time period. We know that our estimates of returns-per-spawner for Upper Cook Inlet are high because there are minor sockeye salmon systems which we did not include in our analysis. In addition, our estimates of escapements for the major systems may also be low. Escapements were not enumerated before 1975 in the Susitna River or before 1979 in the Crescent River. We had to estimate these escapements from limited data and we question their accuracies. For the Susitna River, we estimated escapements for 1968 through 1975 based on more recent sonar counts which also may be in error because of difficulties with using sonar on the Susitna River (King and Tarbox 1983).

In summary, there are several biases in our analysis which could be responsible for the high and variable return-per-spawner ratios. The biases include: (1) biases in the catch allocation procedures, (2) minor systems which produce sockeye salmon and are not included in the analysis, and (3) low estimates of escapements.

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APPENDICES

Appendix Table 2. Estimates and their standard deviations of sockeye salmon escapements into the Susitna River during 1968 through 1974 based on regression analyses[1].

Year	Estimated Escapement	Standard Deviation
1968	61,010	50,961
1969	41,346	54,572
1970	44,371	53,986
1971	114,707	44,080
1972	91,927	61,558
1973	116,093	59,747
1974	71,849	63,462

[1] Escapement estimates from 1968-1971 were predicted from a geometric mean functional regression of the 1975-1980 Kenai and Kasilof Rivers total escapement to measured Susitna escapement for the same years ($y = 16{,}388 + .2521x$; $R = .779$, significant at the .10 level).

Escapement estimates for 1972 through 1974 were predicted from a geometric mean functional regression of the mean number of fish per surveyed index stream during 1975 through 1981 to measured total escapements into the Susitna River during the same years ($y = 21{,}285.3 + 120.1x$; $R = .830$, significant at .025 level).

Appendix Table 4. Age composition by fishery of the Upper Cook Inlet commercial sockeye salmon harvest, 1972[1].

Fishery		3 2	4 1	4 2	5 2	5 3	5 4	6 2	6 3	6 4	7 3	7 4	Total
Northern District [2] Set Net	Numbers			12,192	55,237	8,374			9,714	220			85,737
	Percent			14.2	64.4	9.8			11.3	0.3			100.0
Central District [2] Drift Net	Number			95,216	265,882	48,190			96,711	182			506,181
	Percent			18.8	52.5	9.5			19.1	0.1			100.0
Central District [3] West-side Set Net	Numbers		108	10,094	37,084	3,077		54	3,563				53,980
	Percent		0.2	18.7	68.7	5.7		0.1	6.6				100.0
Kalgin Island [4] Set Net	Numbers	29		5,460	13,693	2,774		1,401	5,460		379		29,196
	Percent	0.1		18.7	46.9	9.5		4.8	18.7		1.3		100.0
Central District [2] East-side Set Net	Numbers			49,516	84,233	21,831		5,259	40,822	537	2,312	107	204,617
	Percent			24.2	41.2	10.7		2.6	19.9	0.3	1.1	<0.1	100.0
Total	Numbers	29	108	172,478	456,129	84,246		6,714	156,270	939	2,691	107	879,711
	Percent	<0.1	<0.1	19.6	51.8	9.6		0.8	17.8	0.1	0.3	<0.1	100.0

[1] Catch statistics were taken from the Alaska Department of Fish and Game fish ticket summaries dated October 13, 1973.

[2] Age composition taken from summaries of historic scale data. Age composition was weighted by the catch through time.

[3] Scales were not sampled from the 1972 Central District west-side set net harvest. The average age composition of the Central District west-side sockeye salmon harvest for 1974, 1977-1981 was applied to the 1972 catch. Age composition was not weighted by the catch through time.

[4] Scales were not sampled from the 1972 Kalgin Island set net harvest. The age composition of the 1972 Central District drift set net sockeye salmon harvest was applied to the 1972 Kalgin Island catch. Age composition was not weighted by the catch through time.

Appendix Table 6. Age composition by fishery of the Upper Cook Inlet commercial sockeye salmon harvest, 1974[1].

Fishery		3 2	4 2	4 3	5 2	5 3	6 2	6 3	6 4	7 4	Total
Northern District East-side Set Net	Numbers	24	4,693		4,216	1,682		582			11,197
	Percent	0.2	41.9		37.7	15.0		5.2			100.0
Northern District West-side Set Net	Numbers		9,901		14,326	2,580		3,559			30,366
	Percent		32.6		47.2	8.5		11.7			100.0
Central District Drift Net	Numbers	253	38,846	599	161,779	28,363	209	34,475	711	516	265,751
	Percent	0.1	14.6	0.2	60.9	10.7	0.1	13.0	0.2	0.2	100.0
Central District West-side Set Net	Numbers		5,190		17,828	742	156	382			24,298
	Percent		21.4		73.4	3.0	0.6	1.6			100.0
Kalgin Island [2] Set Net	Numbers	29	4,184	57	17,453	3,067	29	3,726	57	57	28,659
	Percent	0.1	14.6	0.2	60.9	10.7	0.1	13.0	0.2	0.2	100.0
Central District East-side Set Net	Numbers	90	22,128		81,797	20,326	709	11,604	235		136,889
	Percent	0.1	16.2		59.7	14.8	0.5	8.5	0.2		100.0
Total	Numbers	396	84,942	656	297,399	56,760	1,103	54,328	1,003	573	497,160
	Percent	0.1	17.1	0.2	59.8	11.4	0.2	10.9	0.2	0.1	100.0

[1] Catch statistics were taken from Alaska Department of Fish and Game final fish ticket summaries dated June 2, 1976. Age composition taken from summaries of historic scale data. Age composition was weighted by the catch through time.

[2] Scales were not sampled from the 1974 Kalgin Island set net harvest. The age composition of the 1974 Central District drift net sockeye salmon harvest was applied to the 1974 Kalgin Island harvest. Age composition was not weighted by the catch through time.

Appendix Table 8. Age composition by fishery of the Upper Cook Inlet commercial sockeye salmon harvest, 1976[1].

Fishery		4 2	5 2	5 3	6 3	Other	Total
Northern District [2] Set Net	Numbers	20,755	38,168	5,502	4,876	348	69,649
	Percent	29.8	54.8	7.9	7.0	0.5	100.0
Central District [3] Drift Net	Numbers	271,938	566,389	127,645	85,006	4,789	1,055,767
	Percent	25.8	53.6	12.1	8.0	0.5	100.0
Central District [4] West-side Set Net	Numbers	8,309	30,525	2,533	2,933	133	44,433
	Percent	18.7	68.7	5.7	6.6	0.3	100.0
Kalgin Island [5] Set Net	Numbers	4,619	9,597	2,167	1,432	90	17,905
	Percent	25.8	53.6	12.1	8.0	0.5	100.0
Central District [3] East-side Set Net	Numbers	131,085	190,298	91,994	59,743	3,256	476,376
	Percent	27.5	40.0	19.3	12.5	0.7	100.0
Total	Numbers	436,706	834,977	229,841	153,990	8,616	1,664,130
	Percent	26.2	50.2	13.8	9.3	0.5	100.0

[1] Catch statistics were taken from the Alaska Department of Fish and Game final fish ticket summaries dated May 20, 1978.

[2] Scales were not sampled from the 1976 Northern District set net harvest. The 1972-1974 and 1977-1981 average age composition for the Northern District was applied to the 1976 harvest. Age composition was not weighted by the catch through time.

[3] Source 1978, Namtvedt et al. Investigations of Cook Inlet sockeye salmon. Completion Report for period July 1, 1974 to June 30, 1977. Alaska Department of Fish and Game. Project No. AFC-53. National Oceanic and Atmospheric Administration. National Marine Fisheries Service. Age composition was weighted by the catch through time.

[4] Scales were not sampled from the 1976 Central District west-side set net harvest. The 1974, 1977-1981 average age composition for the Central District west-side was applied to the 1976 harvest. Age composition was not weighted by the catch through time.

[5] Scales were not sampled from the 1976 Kalgin Island set net harvest. The age composition of the 1976 Central District drift sockeye salmon harvest was applied to the 1976 Kalgin Island harvest. Age composition was not weighted by the catch through time.

Appendix Table 10. Age composition by fishery of the Upper Cook Inlet commercial sockeye salmon harvest, 1978[1].

Fishery		4 2	5 2	5 3	6 3	Other	Total
Northern District East-side Set Net	Numbers	7,227	5,895	3,889	1,282	0	18,293
	Percent	39.5	32.2	21.3	7.0	0	100.0
Northern District West-side Set Net	Numbers	19,032	11,932	1,567	800	0	33,331
	Percent	57.1	35.8	4.7	2.4	0	100.0
Central District Drift Net	Numbers	104,602	1,518,529	79,353	100,995	0	1,803,479
	Percent	5.8	84.2	4.4	5.6	0	100.0
Central District West-side Set Net	Numbers	17,466	41,029	3,747	1,270	0	63,512
	Percent	27.5	64.6	5.9	2.0	0	100.0
Kalgin Island [2] Set Net	Numbers	2,451	35,579	1,859	2,366	0	42,255
	Percent	5.8	84.2	4.4	5.6	0	100.0
Salamatof Beach Set Net	Numbers	38,048	223,153	3,645	4,400	688	269,934
	Percent	14.1	82.7	1.3	1.6	0.3	100.0
Kalifonsky Beach Set Net	Numbers	26,061	132,511	8,600	7,349	130	174,651
	Percent	14.9	75.9	4.9	4.2	0.1	100.0
Cohoe/Ninilchik Beach Set Net	Numbers	41,083	166,909	5,443	2,655	122	216,212
	Percent	19.0	77.2	2.5	1.2	0.1	100.0
Total	Numbers	255,970	2,135,537	108,103	121,117	940	2,621,667
	Percent	9.8	81.5	4.1	4.6	<0.1	100.0

[1] Age composition was taken from summaries of historic scale data. Age composition was weighted by the catch through time, except for the Northern District west-side which did not have sufficient samples to divide into time periods. Catch periods were taken from Alaska Department of Fish and Game final fish ticket summaries dated October 17, 1980.

Appendix Table 12. Age composition by fishery of the Upper Cook Inlet commercial sockeye salmon harvest, 1980[1].

Fishery		4 2	5 2	5 3	6 3	Other	Total
Northern District East-side Set Net	Numbers	19,923	14,457	8,463	1,146	88	44,077
	Percent	45.2	32.8	19.2	2.6	0.2	100.0
Northern District West-side Set Net	Numbers	25,120	25,675	5,357	5,357	61	61,570
	Percent	40.8	41.7	8.7	8.7	0.1	100.0
Central District Drift Net	Numbers	243,398	382,812	60,850	80,876	2,311	770,247
	Percent	31.6	49.7	7.9	10.5	0.3	100.0
Central District West-side Set Net	Numbers	8,385	63,696	5,644	2,903	0	80,628
	Percent	10.4	79.0	7.0	3.6	0	100.0
Kalgin Island Set Net	Numbers	11,115	25,668	12,032	8,365	114	57,294
	Percent	19.4	44.8	21.0	14.6	0.2	100.0
Salamatof Beach Set Net	Numbers	26,105	63,885	18,759	22,432	40	131,221
	Percent	19.9	48.7	14.3	17.1	<0.1	100.0
Kalifonsky Beach Set Net	Numbers	33,407	59,362	13,661	17,262	497	124,189
	Percent	26.9	47.8	11.0	13.9	0.4	100.0
Cohoe/Ninilchik Beach Set Net	Numbers	127,240	106,541	40,790	29,222	609	304,402
	Percent	41.8	35.0	13.4	9.6	0.2	100.0
Total	Numbers	494,693	742,096	165,556	167,563	3,720	1,573,628
	Percent	31.4	47.2	10.5	10.7	0.2	100.0

[1] Age composition weighted by the catch through time. Weighted age composition taken from Cross et al. 1982. Origins of sockeye salmon in the Upper Cook Inlet fishery of 1980 based on scale pattern analysis. Alaska Department of Fish and Game, Technical Data Report No. 68, 81 pp. Catch statistics taken from Alaska Department of Fish and Game fish ticket summaries dated from June 6, 1982.

Appendix Table 14. Age composition by fishery and year of the Upper Cook Inlet subsistence and non-commercial gill net sockeye salmon harvest, 1979-1981[1].

Year	Fishery	4 2 %	Numbers	5 2 %	Numbers	5 3 %	Numbers	6 3 %	Numbers	Other %	Numbers	Total %	Numbers
1979	Northern District East-side	76.4	4,249	15.4	859	7.0	388	0.6	34	0.6	34	100.0	5,564
1980	Northern District West-side (Tyonek) 5/23-6/16	42.9	112	42.1	110	9.2	24	5.8	15	0	0	100.0	261
	Northern District East-side 6/21-8/15	45.2	2,340	32.8	1,696	19.2	995	2.5	132	0.3	15	100.0	5,178
	Central District East-side 8/18-9/23	25.0	5	50.0	10	10.0	2	15.0	3	0	0	100.0	20
	Total	45.0	2,457	33.3	1,816	18.7	1,021	2.7	150	0.3	15	100.0	5,459
1981	Salamatof Beach 8/18-9/19	24.6	20	65.2	54	4.4	4	5.1	4	0.7	1	100.0	83
	Kalifonsky Beach 8/18-9/05	15.1	8	71.0	36	6.1	3	7.8	4	0	0	100.0	51
	Cohoe/Ninilchik Beach 8/18-9/08	22.4	13	62.7	37	6.2	4	6.8	4	1.9	1	100.0	59
	Total	21.3	41	65.8	127	5.7	11	6.2	12	1.0	2	100.0	193

[1] Scales were not collected from the subsistence catches, there the age compositions of the commercial catch from the same area and nearest date were used.

Appendix Table 16. Age composition by river of sockeye salmon escapement, Upper Cook Inlet, 1969.

River		3 1	3 2	4 1	4 2	4 3	5 2	5 3	5 4	6 2	6 3	6 4	7 3	7 4	Total
Susitna River [1]															
	Numbers	124	827	83	15,505	413	20,053	1,736		289	2,233		83		41,346
	Percent	0.3	2.0	0.2	37.5	1.0	48.5	4.2		0.7	5.4		0.2		100.0
Kenai River [2]															
Escapement	Numbers		159		4,558	1,537	19,133	19,239	159	848	6,943		159	265	53,000
	Percent		0.3		8.6	2.9	36.1	36.3	0.3	1.6	13.1		0.3	0.5	100.0
Russian River	Numbers				21		68	839			213	5		4	1,150
Sport Harvest	Percent				1.8		5.9	73.0			18.5	0.4		0.4	100.0
Spawners	Numbers		159		4,537	1,537	19,065	18,400	159	848	6,730	<1	159	261	51,850
	Percent		0.3		8.7	3.0	36.8	35.5	0.3	1.6	13.0	0	0.3	0.5	100.0
Kasilof River [3]															
	Numbers				6,440		17,940	14,030		414	7,176				46,000
	Percent				14.0		39.0	30.5		0.9	15.6				100.0
Crescent River [4]															
	Numbers		153		8,619		33,966	1,785		561	5,916				51,000
	Percent		0.3		16.9		66.6	3.5		1.1	11.6				100.0
Fish Creek [5]															
	Numbers		7,536		4,148		648	124							12,456
	Percent		60.5		33.3		5.2	1.0							100.0

[1] Scales were not collected from the Susitna River in 1969. The 1970-1981 average age composition was applied to the 1969 escapement. Age proportions were not weighted through time.

[2] Age composition for the Kenai River escapement was developed from scales collected by fishwheel. Age proportions were not weighted through time. Age composition for the Russian River sport harvest was derived from scales taken from fish passing through the Russian River weir. The Russian River sport harvest was subtracted from the escapement to calculate numbers of spawners.

[3] Age composition for the Kasilof River escapement was developed from scales collected by fishwheel. Age proportions were not weighted through time.

[4] Scales were not collected from the Crescent River in 1969. The 1974-1975, 1978-1981 average age composition was applied to the 1969 escapement. Age proportions were not weighted through time.

[5] Age composition of Fish Creek escapement developed from scale samples collected at the weir. Age proportions were not weighted through time.

Appendix Table 18. Age composition by river of sockeye salmon escapement, Upper Cook Inlet, 1971.

River		3 2	4 2	4 3	5 2	5 3	6 2	6 3	6 4	7 3	Total
Susitna River [1]											
	Numbers		26,497		68,710	7,800	229	11,471			114,707
	Percent		23.1		59.9	6.8	0.2	10.0			100.0
Kenai River [2]											
Escapement	Numbers		24,900	8,700	116,100	112,500	3,900	33,900			300,000
	Percent		8.3	2.9	38.7	37.5	1.3	11.3			100.0
Russian River	Numbers		204	107	558	6,535		3,219	107		10,730
Sport Harvest	Percent		1.9	1.0	5.2	60.9		30.0	1.0		100.0
Spawners	Numbers		24,696	8,593	115,542	105,965	3,900	30,681	<1		289,270
	Percent		8.5	3.0	39.9	36.6	1.4	10.6	0		100.0
Kasilof River [3]	Numbers		5,850		62,370	7,650		14,130			90,000
	Percent		6.5		69.3	8.5		15.7			100.0
Crescent River [4]	Numbers	132	7,436		29,304	1,540	484	5,104			44,000
	Percent	0.3	16.9		66.6	3.5	1.1	11.6			100.0
Fish Creek [5]	Numbers	2,680	26,190	159	1,978	893					31,900
	Percent	8.4	82.1	0.5	6.2	2.8					100.0

[1] Age composition for the Susitna River escapement was developed from scales collected by fishwheel at Susitna Station. Age proportions were not weighted through time.

[2] Age composition for the Kenai River escapement was developed from scale samples collected by fishwheel. Age proportions were not weighted through time. Age composition for the Russian River sport harvest was developed from scales taken from fish passing through the Russian River weir. The Russian River sport harvest was subtracted from the escapement to calculate numbers of spawners.

[3] Age composition for the Kasilof River escapement was developed from scales collected by fishwheel. Age proportions were not weighted through time.

[4] Scales were not collected from Crescent River in 1971. The 1974-1975, 1978-1981 average age composition was applied to the 1971 escapement. Age proportions were not weighted through time.

[5] Age composition of Fish Creek escapement developed from scale samples collected at the weir. Age proportions were not weighted through time. Source: Chlupach, R. 1979. Enumeration of 1979 adult salmon immigration into Big Lake watershed. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation and Enhancement, 15 pp. (Unpublished manuscript).

Appendix Table 20. Age composition by river of sockeye salmon escapement, sport harvest, Upper Cook Inlet, 1973.

River		3 1	3 2	4 1	4 2	4 3	5 2	5 3	6 2	6 3	6 4	7 3	7 4	Total
Susitna River [1]														
	Numbers	348	2,322	232	43,535	1,161	56,305	4,876	813	6,269		232		116,093
	Percent	0.3	2.0	0.2	37.5	1.0	48.5	4.2	0.7	5.4		0.2		100.0
Kenai River [2]														
Escapement	Numbers		1,101		17,983	4,037	251,028	29,727	2,936	59,087		1,101		367,000
	Percent		0.3		4.9	1.1	68.4	8.1	0.8	16.1		0.3		100.0
Russian River	Numbers				670		464	5,983		1,768	36		9	8,930
Sport Harvest	Percent				7.5		5.2	67.0		19.8	0.4		0.1	100.0
Spawners	Numbers		1,101		17,313	4,037	250,564	23,744	2,936	57,319	<1	1,101	<1	358,070
	Percent		0.3		4.9	1.1	70.0	6.6	0.8	16.0	0	0.3	0	100.0
Kasilof River [3]														
	Numbers				7,800		22,800	7,600		1,800				40,000
	Percent				19.5		57.0	19.0		4.5				100.0
Crescent River [4]														
	Numbers		87		4,901		19,314	1,015	319	3,364				29,000
	Percent		0.3		16.9		66.6	3.5	1.1	11.6				100.0
Fish Creek [5]														
	Numbers		747		784	19	219	855		11	70			2,705
	Percent		27.6		29.0	0.7	8.1	31.6		0.4	2.6			100.0

[1] Scales were not sampled from the Susitna River sockeye salmon escapement in 1973. The 1970-1972 and 1975-1981 average age composition was applied to the 1973 escapement. Age proportions were not weighted through time.

[2] Age composition of the Kenai River spawners developed from scale samples collected by fishwheels at the sonar counting site. Age proportions were not weighted through time. Scales were not collected from the Russian River escapement in 1973. The 1970-1971, 1974-1981 average age composition of the Russian River escapement was applied to the 1973 sport harvest. The Russian River sport harvest was subtracted from the escapement to calculate numbers of spawners.

[3] Age composition of the Kasilof River escapement was developed from scale samples collected by fishwheels located at the sonar counting site. Age proportions were not weighted through time.

[4] Scales were not collected from Crescent River in 1973. The 1974-1975, 1978-1981 average age composition was applied to the 1971 escapement. Age proportions were not weighted through time.

[5] Age composition of Fish Creek escapement developed from scale samples collected at the weir. Age proportions were not weighted through time. Source: Chlupach, R. 1979. Enumeration of 1979 adult salmon immigration into Big Lake watershed. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation and Enhancement. 15 pp. (Unpublished manuscript).

Appendix Table 22. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1975.

River		3_2	4_2	4_3	5_2	5_3	6_2	6_3	6_4	Total
Susitna River [1]	Numbers	2,592	61,020	216	40,608	2,916		648		108,000
	Percent	2.4	56.5	0.2	37.6	2.7		0.6		100.0
Kenai River [2]										
Escapement	Numbers	3,408	14,768	6,106	50,552	43,594	3,550	19,170	852	142,000
	Percent	2.4	10.4	4.3	35.6	30.7	2.5	13.5	0.6	100.0
Russian River Sport Harvest	Numbers		453		243	5,529		2,005	160	8,390
	Percent		5.4		2.9	65.9		23.9	1.9	100.0
Kenai River Sport Harvest Below Sonar	Numbers	46	197	81	673	580	47	255	11	1,890
	Percent	2.4	10.4	4.3	35.6	30.7	2.5	13.5	0.6	100.0
Kenai River Sport Harvest Above Sonar	Numbers	122	531	220	1,819	1,569	128	690	31	5,110
	Percent	2.4	10.4	4.3	35.6	30.7	2.5	13.5	0.6	100.0
Spawners	Numbers	3,286	13,784	5,886	48,490	36,496	3,422	16,475	661	128,500
	Percent	2.6	10.7	4.6	37.7	28.4	2.7	12.8	0.5	100.0
Kasilof River [3]										
Escapement	Numbers	480	14,112	192	3,312	27,648	144	2,112		48,000
	Percent	1.0	29.4	0.4	6.9	57.6	0.3	4.4		100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers	32	940	13	220	1,841	10	141		3,197
	Percent	1.0	29.4	0.4	6.9	57.6	0.3	4.4		100.0
Fish Taken for Eggs and Offspring Not Returned Kasilof	Numbers	2	49	1	12	97	<1	7		168
	Percent	1.0	29.4	0.4	6.9	57.6	0.3	4.4		100.0
Spawners	Numbers	478	14,063	191	3,300	27,551	144	2,105		47,832
	Percent	1.0	29.4	0.4	6.9	57.6	0.3	4.4		100.0
Crescent River [4]	Numbers	287	5,945		30,586	1,312	1,640	1,230		41,000
	Percent	0.7	14.5		74.6	3.2	4.0	3.0		100.0
Fish Creek [5]	Numbers	1,494	26,147	388	299	1,554				29,882
	Percent	5.0	87.5	1.3	1.0	5.2				100.0

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[1] Age composition of Susitna River escapement developed from scale samples collected by fishwheel at the sonar counting site. Age proportions were not weighted through time.

Appendix Table 23. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1976.

River		3_2	4_2	4_3	5_2	5_3	6_2	6_3	Other	Total
Susitna River [1]	Numbers	7,326	49,728		50,727	2,109	777	333		111,000
	Percent	6.6	44.8		45.7	1.9	0.7	0.3		100.0
Kenai River [2] Escapement	Numbers	3,800	174,800	7,600	76,000	83,600		30,400	3,800	380,000
	Percent	1.0	46.0	2.0	20.0	22.0		8.0	1.0	100.0
Russian River Sport Harvest	Numbers		1,494		589	8,165		3,233	219	13,700
	Percent		10.9		4.3	59.6		23.6	1.6	100.0
Kenai River Sport Harvest Below Sonar	Numbers	49	2,235	97	972	1,069		389	49	4,860
	Percent	1.0	46.0	2.0	20.0	22.0		8.0	1.0	100.0
Kenai River Sport Harvest Above Sonar	Numbers	131	6,045	263	2,628	2,891		1,051	131	13,140
	Percent	1.0	46.0	2.0	20.0	22.0		8.0	1.0	100.0
Spawners	Numbers	3,669	167,261	7,337	72,783	72,544		26,116	3,450	353,160
	Percent	1.0	47.4	2.1	20.6	20.5		7.4	1.0	100.0
Kasilof River [3] Escapement	Numbers	278	49,762		33,638	38,920		16,124	278	139,000
	Percent	0.2	35.8		24.2	28.0		11.6	0.2	100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers	11	1,956		1,322	1,529		634	11	5,463
	Percent	0.2	35.8		24.2	28.0		11.6	0.2	100.0
Spawners	Numbers	267	47,806		32,316	37,391		15,490	267	133,537
	Percent	0.2	35.8		24.2	28.0		11.6	0.2	100.0
Crescent River [4]	Numbers	153	8,619		33,966	1,785	561	5,916		51,000
	Percent	0.3	16.9		66.6	3.5	1.1	11.6		100.0
Fish Creek [5]	Numbers	140	9,907	238	2,919	800		28		14,032
	Percent	1.0	70.6	1.7	20.8	5.7		0.2		100.0

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[1] Age composition of Susitna River escapement developed from scale samples collected by fishwheel at the sonar counting site. Age proportions were not weighted through time.

[2] Age composition of Kenai River spawners developed from scale samples collected by fishwheels at the sonar counting site. Age proportions were not weighted through time. Age composition of the Russian River sport harvest was developed from scale samples taken from fish passing through the Russian River weir, age proportions were not weighted through time. Scales were not taken from Kenai River sport harvest, therefore, the Kenai escapement age composition was used. Russian River sport harvest and the Kenai River sport harvest above the sonar were subtracted from the escapement to calculate numbers of spawners.

Appendix Table 24. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1977.

River		3 2	4 2	4 3	5 2	5 3	6 2	6 3	Total
Susitna River [1]									
Escapement	Numbers	3,094	51,646	238	173,264	8,330	238	1,190	238,000
	Percent	1.3	21.7	0.1	72.8	3.5	0.1	0.5	100.0
Sport Harvest	Numbers	69	1,145	5	3,841	185	5	26	5,276
	Percent	1.3	21.7	0.1	72.8	3.5	0.1	0.5	100.0
Spawners	Numbers	3,025	50,501	233	169,423	8,145	233	1,164	232,724
	Percent	1.3	21.7	0.1	72.8	3.5	0.1	0.5	100.0
Kenai River [2]									
Escapement	Numbers		42,480		538,080	49,560	7,080	70,800	708,000
	Percent		6.0		76.0	7.0	1.0	10.0	100.0
Russian River Sport Harvest	Numbers		1,811		2,113	19,921		3,595	27,440
	Percent		6.6		7.7	72.6		13.1	100.0
Kenai River Sport Harvest Below Sonar	Numbers		376		4,760	438	63	626	6,263
	Percent		6.0		76.0	7.0	1.0	10.0	100.0
Kenai River Sport Harvest Above Sonar	Numbers		1,016		12,869	1,185	170	1,693	16,933
	Percent		6.0		76.0	7.0	1.0	10.0	100.0
Spawners	Numbers		39,653		523,098	28,454	6,910	65,512	663,627
	Percent		6.0		78.8	4.3	1.0	9.9	100.0
Kasilof River [3]									
Escapement	Numbers	465	46,500	1,240	46,345	42,780		17,670	155,000
	Percent	0.3	30.0	0.8	29.9	27.6		11.4	100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers	1	86	2	86	79		33	287
	Percent	0.3	30.0	0.8	29.9	27.6		11.4	100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers	4	452	12	451	416		172	1,507
	Percent	0.3	30.0	0.8	29.9	27.6		11.4	100.0
Spawners	Numbers	461	46,048	1,228	45,894	42,364		17,498	153,493
	Percent	0.3	30.0	0.8	29.9	27.6		11.4	100.0

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Appendix Table 25. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1978.

River		3_2	4_2	4_3	5_2	5_3	6_2	6_3	Total
Susitna River [1]									
Escapement	Numbers	3,478	45,308	7,520	33,841	2,350	94	1,409	94,000
	Percent	3.7	48.2	8.0	36.0	2.5	0.1	1.5	100.0
Sport Harvest	Numbers	36	468	78	350	24	1	14	971
	Percent	3.7	48.2	8.0	36.0	2.5	0.1	1.5	100.0
Spawners	Numbers	3,442	44,840	7,442	33,491	2,326	93	1,395	93,029
	Percent	3.7	48.2	8.0	36.0	2.5	0.1	1.5	100.0
Kenai River [2]									
Escapement	Numbers		9,975	1,197	345,933	19,551	798	21,546	399,000
	Percent		2.5	0.3	86.7	4.9	0.2	5.4	100.0
Russian River Sport Harvest	Numbers		221		1,300	14,424		8,585	24,530
	Percent		0.9		5.3	58.8		35.0	100.0
Kenai River Sport Harvest Below Sonar	Numbers		227	27	7,870	445	18	490	9,077
	Percent		2.5	0.3	86.7	4.9	0.2	5.4	100.0
Kenai River Sport Harvest Above Sonar	Numbers		613	74	21,278	1,203	49	1,325	24,542
	Percent		2.5	0.3	86.7	4.9	0.2	5.4	100.0
Spawners	Numbers		9,141	1,123	323,355	3,924	749	11,636	349,928
	Percent		2.6	0.3	92.4	1.1	0.2	3.4	100.0
Kasilof River [3]									
Escapement	Numbers		47,908		46,516	12,064		9,512	116,000
	Percent		41.3		40.1	10.4		8.2	100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers		1,334		1,296	336		265	3,231
	Percent		41.3		40.1	10.4		8.2	100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers		1,425		1,383	359		283	3,450
	Percent		41.3		40.1	10.4		8.2	100.0
Spawners	Numbers		46,483		45,133	11,705		9,229	112,550
	Percent		41.3		40.1	10.4		8.2	100.0
Crescent River [4]	Numbers		3,404		61,642			8,954	74,000
	Percent		4.6		83.3			12.1	100.0
Fish Creek [5]	Numbers	1,884	1,422		178	35		36	3,555
	Percent	53.0	40.0		5.0	1.0		1.0	100.0

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[1] Age composition of Susitna River spawners developed from scale sampled collected fishwheel at the sonar site. Age proportions not weighted through time. Scales were not taken from sport harvest, therefore, age composition of escapement was used. The sport harvest was subtracted from the escapement to calculate the number of spawners.

Appendix Table 26. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1979[1].

River		3_1	3_2	4_1	4_2	4_3	5_2	5_3	6_2	6_3	6_4	7_4	Total
Susitna River [1] Escapement	Numbers	5,338	7,065	3,925	95,770	2,198	32,342	8,321	471	1,570			157,000
	Percent	3.4	4.5	2.5	61.0	1.4	20.6	5.3	0.3	1.0			100.0
Sport Harvest	Numbers	73	97	54	1,313	30	443	114	6	22			2,152
	Percent	3.4	4.5	2.5	61.0	1.4	20.6	5.3	0.3	1.0			100.0
Spawners	Numbers	5,265	6,968	3,871	94,457	2,168	31,899	8,207	465	1,548			154,848
	Percent	3.4	4.5	2.5	61.0	1.4	20.6	5.3	0.3	1.0			100.0
Kenai River [2] Escapement	Numbers		855	1,140	57,570		174,135	33,630		17,670			285,000
	Percent		0.3	0.4	20.2		61.1	11.8		6.2			100.0
Russian River Sport Harvest	Numbers			563		107	23,664			2,200	242	54	26,830
	Percent			2.1		0.4	88.2			8.2	0.9	0.2	100.0
Kenai River Sport Harvest Below Sonar	Numbers		14	18	921		2,785	538		283			4,559
	Percent		0.3	0.4	20.2		61.1	11.8		6.2			100.0
Kenai River Sport Harvest Above Sonar	Numbers		37	49	2,490		7,533	1,455		764			12,328
	Percent		0.3	0.4	20.2		61.1	11.8		6.2			100.0
Spawners	Numbers		818	1,091	54,517		166,495	8,511		14,706			245,842
	Percent		0.3	0.4	22.2		67.6	3.5		6.0			100.0
Kasilof River [3] Escapement	Numbers			152	79,344	608	56,544	12,768		2,584			152,000
	Percent			0.1	52.2	0.4	37.2	8.4		1.7			100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers			3	1,452	11	1,035	234		47			2,782
	Percent			0.1	52.2	0.4	37.2	8.4		1.7			100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers			<1	127	1	90	20		4			242
	Percent			0.1	52.2	0.4	37.2	8.4		1.7			100.0
Spawners	Numbers			152	79,217	607	56,454	12,748		2,580			151,758
	Percent			0.1	52.2	0.4	37.2	8.4		1.7			100.0
Crescent River [4]	Numbers		783		24,186	174	60,987	609	174	87			87,000
	Percent		0.9		27.8	0.2	70.1	0.7	0.2	0.1			100.0
Fish Creek [5]	Numbers		4,124		61,865	688	1,375	687					68,739
	Percent		6.0		90.0	1.0	2.0	1.0					100.0

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[1] Age compositions of Susitna River spawners and the sport harvest were developed from scale samples collected by fishwheel at the sonar site. Age proportions were weighted through time by escapement numbers. The sport harvest was subtracted to the escapement to calculate numbers of spawners.

Appendix Table 27. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1980.

River		4_2	5_2	5_3	6_3	Other	Total
Susitna River [1]							
Escapement	Numbers	95,500	69,142	8,977	9,832	7,449	191,000
	Percent	50.0	36.2	4.7	5.2	3.9	100.0
Sport Harvest	Numbers	885	640	83	92	69	1,769
	Percent	50.0	36.2	4.7	5.2	3.9	100.0
Spawners	Numbers	94,615	68,502	8,894	9,840	7,380	189,231
	Percent	50.0	36.2	4.7	5.2	3.9	100.0
Kenai River [2]							
Escapement	Numbers	128,528	209,264	75,168	46,864	4,176	464,000
Escapement	Percent	27.7	45.1	16.2	10.1	0.9	100.0
Russian River Sport Harvest	Numbers	8,440	2,478	18,955	3,617	0	33,490
	Percent	25.2	7.4	56.6	10.8	0	100.0
Kenai River Sport Harvest Below Sonar	Numbers	1,905	3,101	1,114	694	62	6,876
	Percent	27.7	45.1	16.2	10.1	0.9	100.0
Kenai River Sport Harvest Above Sonar	Numbers	5,150	8,385	3,012	1,878	167	18,592
	Percent	27.7	45.1	16.2	10.1	0.9	100.0
Spawners	Numbers	114,938	198,401	53,201	41,369	4,009	411,918
	Percent	27.9	48.2	12.9	10.0	1.0	100.0
Kasilof River [3]							
Escapement	Numbers	109,769	51,986	14,960	8,415	1,870	187,000
	Percent	58.7	27.8	8.0	4.5	1.0	100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers	2,760	1,307	376	212	47	4,702
	Percent	58.7	27.8	8.0	4.5	1.0	100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers	780	369	106	60	13	1,328
	Percent	58.7	27.8	8.0	4.5	1.0	100.0
Spawners	Numbers	108,989	51,617	14,854	8,355	1,857	185,672
	Percent	58.7	27.8	8.0	4.5	1.0	100.0
Crescent River [4]	Numbers	5,906	78,960	2,635	1,454	1,908	90,863
	Percent	6.5	86.9	2.9	1.6	2.1	100.0
Fish Creek [5]	Numbers	43,151	9,645	3,757	376	5,699	62,628
	Percent	68.9	15.4	6.0	0.6	9.1	100.0

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[1] Age composition of Susitna River escapement developed from scale samples collected by fishwheel at the sonar site. Age proportions were weighted through time by escapement numbers. Scales were not sampled from the sport harvest, therefore, age composition of the escapement was used. The "other" age class category was comprised of 4,328 age 3_2 fish, 238 age 4_3 fish, 2,645 age 6_2 fish, and 238 age 7_3 fish. The sport harvest was subtracted from the escapement to calculate numbers of spawners.

[2] Age composition of Kenai River escapement developed from scales collected by fishwheels and gillnets. Age proportions for the escapement were weighted through time by escapement numbers. Age composition of the Russian River sport harvest was developed from scale samples taken from fish passing through the Russian River weir, age proportions were not weighted through time. Scales were not taken from the Kenai River sport harvest, therefore, the Kenai River escapement age composition was used. The "other" age class category was comprised of 3,477 age 3_2 fish and 397 age 4_3 fish. The Russian River sport harvest and the Kenai River sport harvest above the sonar site were subtracted from the escapement to calculate number of spawners.

Appendix Table 28. Age composition by river of sockeye salmon escapement, sport harvest, fish taken for eggs and spawners, Upper Cook Inlet, 1981.

River		4_2	5_2	5_3	6_3	Other	Total
Susitna River [1]							
Escapement	Numbers	30,260	282,200	10,200	15,300	2,040	340,000
	Percent	8.9	83.0	3.0	4.5	0.6	100.0
Sport Harvest	Numbers	147	1,367	49	74	10	1,647
	Percent	8.9	83.0	3.0	4.5	0.6	100.0
Spawners	Numbers	30,113	280,833	10,151	15,226	2,030	338,353
	Percent	8.9	83.0	3.0	4.5	0.6	100.0
Kenai River [2]							
Escapement	Numbers	66,096	289,272	33,048	19,584	0	408,000
	Percent	16.2	70.9	8.1	4.8	0	100.0
Russian River Sport Harvest	Numbers	3,273	1,566	14,279	4,483	119	23,720
	Percent	13.8	6.6	60.2	18.9	0.5	100.0
Kenai River Sport Harvest Below Sonar	Numbers	854	3,736	427	253	0	5,270
	Percent	16.2	70.9	8.1	4.8	0	100.0
Kenai River Sport Harvest Above Sonar	Numbers	2,341	10,246	1,170	694	0	14,451
	Percent	16.2	70.9	8.1	4.8	0	100.0
Spawners	Numbers	60,482	277,460	17,599	14,407	0	369,829
	Percent	16.3	75.0	4.8	3.9	0	100.0
Kasilof River [3]							
Escapement	Numbers	77,614	159,854	15,420	4,112	0	257,000
	Percent	30.2	62.2	6.0	1.6	0	100.0
Sport Harvest	Numbers	3,244	6,682	645	172	0	10,743
	Percent	30.2	62.2	6.0	1.6	0	100.0
Fish Taken for Eggs and Offspring Returned to Kasilof	Numbers	2,761	5,687	549	146	0	9,143
	Percent	30.2	62.2	6.0	1.6	0	100.0
Fish Taken for Eggs and Offspring Not Returned to Kasilof	Numbers	261	536	52	14	0	863
	Percent	30.2	62.2	6.0	1.6	0	100.0
Spawners	Numbers	77,353	159,318	15,368	4,098	0	256,137
	Percent	30.2	62.2	6.0	1.6	0	100.0
		2	2	3	3		
Crescent River [4]	Numbers	3,370	13,243	3,960	20,549	91	41,213
	Percent	8.2	32.1	9.6	49.9	0.2	100.0
Fish Creek [5]	Numbers	30,779	18,212	695	0	793	50,479
	Percent	61.0	36.1	1.4	0	1.6	100.0

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[1] Age composition of Susitna River escapement developed from scale samples collected by fishwheel at the sonar site. Age proportions were weighted through time by escapement numbers. Scales were not sampled from the sport harvest, therefore, age composition of the escapement was used. The "other" age class category was comprised of 1,699 age 3_2 fish, 341 age 6_2 fish. The sport harvest was subtracted from the escapement to calculate numbers of spawners.

[2] Age composition of Kenai River escapement was developed from scales collected by fishwheels and gillnets. Age proportions for the escapement were weighted through time by escapement counts. Scales were not taken from the Kenai River sport harvest, therefore, the age composition of the Kenai River escapement was used. Scales were not taken from the Russian River sport harvest, therefore, the age composition of the Russian River escapement was used. Russian River sport harvest and Kenai River sport harvest above the sonar site were subtracted from the Kenai River escapement to calculate numbers of spawners.

Appendix Table 29. Run composition estimates of the Upper Cook Inlet sockeye salmon harvest by fishery and age group, 1978[1].

Fishery	System	4_2 %	4_2 Numbers	5_2 %	5_2 Numbers	5_3 %	5_3 Numbers	6_3 %	6_3 Numbers	Other %	Other Numbers	Total %	Total Numbers
Northern District East-side Set	Susitna	54.2	3,916	50.3	2,968	41.6	1,620	66.8	857	0	0	51.2	9,361
	Kenai	4.8	350	43.1	2,538	20.1	781	13.6	161	0	0	20.6	3,830
	Kasilof	39.7	2,867	6.5	383	38.2	1,484	20.5	263	0	0	27.3	4,997
	Fish	1.3	94	0.1	6	0.1	4	0.1	1	0	0	0.6	105
	Total	100.0	7,227	100.0	5,895	100.0	3,889	100.0	1,282	0	0	100.0	18,293
Northern District West-side Set	Susitna	82.3	15,667	58.9	7,033	55.2	865	62.9	503	0	0	72.2	24,068
	Kenai	0.3	56	10.0	1,192	6.0	94	3.9	31	0	0	4.1	1,373
	Kasilof	15.1	2,874	14.0	1,669	38.7	606	17.7	142	0	0	15.6	5,291
	Crescent	1.0	188	17.0	2,026	0	0	15.4	123	0	0	7.0	2,337
	Fish	1.3	247	0.1	12	0.1	2	0.1	1	0	0	0.8	262
	Total	100.0	19,032	100.0	11,932	100.0	1,567	100.0	800	0	0	100.0	33,331
Central District Drift	Susitna	36.1	37,787	5.4	81,919	6.5	5,153	13.1	13,217	0	0	7.6	138,076
	Kenai	21.5	22,507	87.4	1,327,384	71.3	56,602	71.5	72,341	0	0	82.0	1,478,834
	Kasilof	41.1	42,948	7.1	107,708	22.1	17,519	15.2	15,336	0	0	10.2	183,511
	Fish	1.3	1,360	0.1	1,518	0.1	79	0.1	101	0	0	0.2	3,058
	Total	100.0	104,602	100.0	1,518,529	100.0	79,353	100.0	100,995	0	0	100.0	1,803,479
Central District West-side Set	Susitna	57.2	9,991	21.2	8,698	33.3	1,248	0	0	0	0	31.4	19,937
	Kenai	0	0	9.1	3,734	0	0	0	0	0	0	5.9	3,734
	Kasilof	35.7	6,235	9.1	3,734	66.7	2,499	0	0	0	0	19.6	12,468
	Crescent	7.1	1,240	60.6	24,863	0	0	100.0	1,270	0	0	43.1	27,373
	Total	100.0	17,466	100.0	41,029	100.0	3,747	100.0	1,270	0	0	100.0	63,512
Kalgin Island [2] Set	Susitna	42.2	1,033	7.2	2,559	5.0	93	2.9	69	0	0	8.9	3,754
	Kenai	8.9	218	69.3	24,774	69.2	1,289	59.1	1,399	0	0	65.5	27,680
	Kasilof	44.5	1,091	9.9	3,519	25.6	475	19.5	461	0	0	13.1	5,546
	Crescent	3.1	77	13.2	4,692	0	0	18.4	435	0	0	12.3	5,204
	Fish	1.3	32	0.1	35	0.1	2	0.1	2	0	0	0.2	71
	Total	100.0	2,451	100.0	35,579	100.0	1,859	100.0	2,366	0	0	100.0	42,255
Salamatof Beach [3] Set	Susitna	23.0	8,750	9.5	21,178	5.5	200	11.7	514	9.7	67	11.4	30,709
	Kenai	3.3	1,239	62.8	140,223	8.5	310	16.7	734	77.6	534	53.0	143,040
	Kasilof	72.4	27,564	27.6	61,529	85.9	3,131	71.5	3,148	0	0	35.3	95,372
	Fish	1.3	495	0.1	223	0.1	4	0.1	4	12.7	87	0.3	813
	Total	100.0	38,048	100.0	223,153	100.0	3,645	100.0	4,400	100.0	688	100.0	269,934
Kalifonsky Beach [4] Set	Susitna	13.0	3,395	6.7	8,869	1.2	103	5.4	396	6.9	9	7.3	12,772
	Kenai	4.6	1,183	68.5	90,811	17.7	1,521	31.9	2,342	80.8	105	54.9	95,962
	Kasilof	81.1	21,144	24.7	32,698	81.0	6,967	62.6	4,604	0	0	37.5	65,413
	Fish	1.3	339	0.1	133	0.1	9	0.1	7	12.3	16	0.3	504
	Total	100.0	26,061	100.0	132,511	100.0	8,600	100.0	7,349	100.0	130	100.0	174,651
Cohoe/Ninilchik [5] Beach Set	Susitna	19.4	7,948	11.0	18,342	3.5	190	14.5	385	8.2	10	12.4	26,875
	Kenai	3.6	1,500	63.7	106,381	19.7	1,071	26.3	697	79.5	97	50.8	109,746
	Kasilof	75.7	31,101	25.2	42,019	76.7	4,177	59.1	1,570	0	0	36.5	78,867
	Fish	1.3	534	0.1	167	0.1	5	0.1	3	12.3	15	0.3	724
	Total	100.0	41,083	100.0	166,909	100.0	5,443	100.0	2,655	100.0	122	100.0	216,212
Total	Susitna	34.6	88,487	7.1	151,566	8.8	9,472	13.2	15,941	9.1	86	10.2	265,552
	Kenai	10.6	27,053	79.4	1,697,037	57.0	61,668	64.1	77,705	78.3	736	74.1	1,864,199
	Kasilof	53.0	135,824	11.9	253,259	34.1	36,858	21.1	25,524	0	0	17.2	451,465
	Crescent	0.6	1,505	1.5	31,581	0	0	1.5	1,828	0	0	1.3	34,914
	Fish	1.2	3,101	0.1	2,094	0.1	105	0.1	119	12.6	118	0.2	5,537
	Total	100.0	255,970	100.0	2,135,537	100.0	108,103	100.0	121,117	100.0	940	100.0	2,621,667

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[1] Allocation of the catch to river of origin based on results from scale pattern analyses as reported by Bethe et al. 1980. Origins of sockeye salmon in the Upper Cook Inlet fishery of 1978 based on scale pattern analysis. Alaska Department of Fish and Game, Informational Leaflet No. 186, 45 pp. Estimates of Fish Creek's contribution were developed by taking the proportions by age class that Fish Creek represented of the total escapement and applying those proportions to the catch. Fish Creek's contribution was subtracted from the catch totals and run proportions for the other systems which were developed from scale patterns were applied to the adjusted catch. Age 5_2 run composition estimates developed by Bethe 1980 were expanded by the remaining age class using techniques documented in Cross et al. 1981, Origins of sockeye salmon in Upper Cook Inlet fishery of 1979 based on scale pattern analysis. Alaska Department of Fish and Game, Technical Data Report No. 58, 76 pp.

Appendix Table 30. Run composition estimates of the Upper Cook Inlet sockeye salmon harvest by fishery and age group, 1979[1].

Fishery	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total Numbers
Northern District East-side Set	Susitna	36.7	17,067	8.1	762	13.7	580	7.4	28	8.1	30	18,467
	Kenai	41.1	19,106	89.5	8,409	83.6	3,550	92.6	348	3.0	11	31,424
	Fish	22.2	10,347	2.4	230	2.7	115	0	0	88.9	329	11,021
	Total	100.0	46,520	100.0	9,401	100.0	4,245	100.0	376	100.0	370	60,912
Northern District West-side Set	Susitna	42.7	10,739	11.0	1,684	13.8	989	4.4	91	74.6	1,384	14,887
	Kenai	47.0	11,821	88.6	13,562	85.9	6,154	95.6	1,970	14.8	274	33,781
	Fish	10.3	2,590	0.4	61	0.3	21	0	0	10.6	197	2,869
	Total	100.0	25,150	100.0	15,307	100.0	7,164	100.0	2,061	100.0	1,855	51,537
Central District Drift	Susitna	29.9	39,564	25.1	58,207	18.4	10,040	10.6	2,747	78.5	7,852	118,410
	Kenai	8.4	11,115	43.9	101,804	32.7	17,843	56.8	14,722	4.8	480	145,964
	Kasilof	37.3	49,355	30.7	71,194	48.2	26,300	32.6	8,449	1.2	120	155,418
	Fish	24.4	32,286	0.3	696	0.7	382	0	0	15.5	1,551	34,915
	Total	100.0	132,320	100.0	231,901	100.0	54,565	100.0	25,918	100.0	10,003	454,707
Central District West-side Set	Susitna	28.4	5,207	19.6	7,883	41.5	1,527	57.4	583	34.5	66	15,266
	Kenai	7.2	1,320	5.7	2,293	40.2	1,479	26.2	266	11.3	21	5,379
	Kasilof	6.4	1,174	2.7	1,086	4.4	162	3.7	37	0	0	2,459
	Crescent	58.0	10,634	72.0	28,960	13.9	512	12.7	129	54.2	103	40,338
	Total	100.0	18,335	100.0	40,222	100.0	3,680	100.0	1,015	100.0	190	63,442
Kalgin Island Set	Susitna	48.2	9,409	41.0	6,215	22.0	1,811	27.6	509	64.5	145	18,089
	Kenai	6.5	1,269	31.1	4,714	29.6	2,437	39.2	723	0	0	9,143
	Kasilof	43.8	8,550	22.5	3,411	48.2	3,968	33.2	612	29.0	65	16,606
	Crescent	1.5	293	5.4	818	0.2	16	0	0	6.5	15	1,142
	Total	100.0	19,521	100.0	15,158	100.0	8,232	100.0	1,844	100.0	225	44,980
Salamatof Beach Set	Susitna	33.8	9,792	16.2	6,358	19.1	1,561	18.0	699	45.6	295	18,705
	Kenai	17.7	5,128	64.0	25,117	45.6	3,727	64.8	2,517	37.5	243	36,732
	Kasilof	48.5	14,050	19.8	7,771	35.3	2,885	17.2	668	16.9	109	25,483
	Fish	0	0	0	0	0	0	0	0	0	0	0
	Total	100.0	28,970	100.0	39,246	100.0	8,173	100.0	3,884	100.0	647	80,920
Kalifonsky Beach Set	Susitna	11.9	2,437	2.9	631	2.7	121	2.8	20	30.5	58	3,267
	Kenai	38.1	7,802	56.6	12,318	59.4	2,659	62.4	446	47.1	90	23,315
	Kasilof	49.2	10,074	39.5	8,596	37.8	1,692	34.8	248	21.9	42	20,652
	Fish	0.8	164	1.0	218	0.1	5	0	0	0.5	1	388
	Total	100.0	20,477	100.0	21,763	100.0	4,477	100.0	714	100.0	191	47,622
Cohoe/Ninilchik Beach Set	Susitna	13.2	6,192	8.1	4,160	8.6	1,448	12.5	556	49.4	357	12,713
	Kenai	19.4	9,101	29.6	15,203	20.0	3,368	16.4	730	39.3	284	28,686
	Kasilof	67.4	31,618	62.3	31,999	71.4	12,024	71.1	3,165	11.3	81	78,887
	Fish	0	0	0	0	0	0	0	0	0	0	0
	Total	100.0	46,911	100.0	51,362	100.0	16,840	100.0	4,451	100.0	722	120,286
Total	Susitna	29.7	100,407	20.3	85,900	16.8	18,077	13.0	5,233	71.7	10,187	219,804
	Kenai	19.7	66,662	43.2	183,420	38.4	41,217	54.0	21,722	9.9	1,403	314,424
	Kasilof	34.0	114,821	29.2	124,057	43.8	47,031	32.7	13,179	3.0	417	299,505
	Crescent	3.2	10,927	7.0	29,778	0.5	528	0.3	129	0.8	118	41,480
	Fish	13.4	45,387	0.3	1,205	0.5	523	0	0	14.6	2,078	49,193
	Total	100.0	338,204	100.0	424,360	100.0	107,376	100.0	40,263	100.0	14,203	924,406

[1] Source of run composition estimates, Cross et al. 1981. Origins of sockeye salmon in the Upper Cook Inlet fishery of 1979 based on scale pattern analysis. Alaska Department of Fish and Game, Technical Data Report No. 58, 76 pp. Catch statistics taken from Alaska Department of Fish and Game final fish ticket summaries dated 6 June 1982.

Appendix Table 32. Run composition estimates of the Upper Cook Inlet sockeye salmon harvest by fishery and age group, 1981[1].

Fishery	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total %	Total Numbers
Northern District East-side Set	Susitna	14.7	3,810	60.4	37,159	37.4	3,621	67.7	2,321	30.4	92	46.6	47,003
	Kenai	9.2	2,385	19.3	11,874	42.7	4,134	32.3	1,108	0	0	19.3	19,501
	Fish	76.1	19,725	20.3	12,489	19.9	1,927	0	0	69.6	211	34.1	34,352
	Total	100.0	25,920	100.0	61,522	100.0	9,682	100.0	3,429	100.0	303	100.0	100,856
Northern District West-side Set	Susitna	42.3	8,560	75.1	85,380	46.3	2,618	76.7	7,076	0	0	69.7	103,634
	Kenai	31.9	6,456	22.4	25,466	52.2	2,952	23.3	2,150	0	0	24.8	37,024
	Fish	25.8	5,221	2.5	2,842	1.5	85	0	0	0	0	5.5	8,148
	Total	100.0	20,237	100.0	113,688	100.0	5,655	100.0	9,226	0	0	100.0	148,806
Central District Drift	Susitna	7.9	6,302	35.9	175,929	12.2	4,094	36.2	10,772	0	0	31.1	197,097
	Kenai	21.7	17,311	41.5	203,372	48.0	16,107	49.9	14,850	0	0	39.8	251,640
	Kasilof	54.1	43,159	19.5	95,561	38.9	13,054	13.9	4,136	0	0	24.6	155,910
	Fish	16.3	13,004	3.1	15,192	0.9	302	0	0	0	0	4.5	28,498
	Total	100.0	79,776	100.0	490,054	100.0	33,557	100.0	29,758	0	0	100.0	633,145
Central District West-side Set	Susitna	42.7	1,638	19.6	2,657	12.7	264	0.8	54	0	0	17.6	4,613
	Kenai	3.5	134	13.0	1,762	5.6	116	0.9	61	0	0	7.8	2,073
	Kasilof	10.8	414	7.3	990	4.5	93	0.2	14	0	0	5.8	1,511
	Crescent	43.0	1,650	60.1	8,147	77.2	1,603	98.1	6,675	0	0	68.8	18,075
	Total	100.0	3,836	100.0	13,556	100.0	2,076	100.0	6,804	0	0	100.0	26,272
Kalgin Island Set	Susitna	6.6	437	35.9	6,338	9.5	461	33.4	1,610	0	0	26.1	8,846
	Kenai	10.0	662	34.1	6,019	24.6	1,194	31.7	1,528	0	0	27.7	9,403
	Kasilof	67.5	4,467	18.3	3,230	58.2	2,825	15.4	742	0	0	33.2	11,264
	Crescent	0.6	40	2.8	494	3.5	170	19.5	940	0	0	4.8	1,644
	Fish	15.3	1,013	8.9	1,571	4.2	204	0	0	0	0	8.2	2,788
	Total	100.0	6,619	100.0	17,652	100.0	4,854	100.0	4,820	0	0	100.0	33,945
Salamatof Beach Set	Susitna	4.8	910	9.3	9,771	2.5	239	8.5	388	58.2	161	8.3	11,469
	Kenai	76.7	14,546	86.5	90,884	82.0	7,832	88.2	4,029	0	0	84.7	117,291
	Kasilof	15.5	2,940	3.6	3,782	15.3	1,461	3.3	151	0	0	6.0	8,334
	Fish	3.0	569	0.6	630	0.2	19	0	0	41.8	116	1.0	1,334
	Total	100.0	18,965	100.0	105,067	100.0	9,551	100.0	4,568	100.0	277	100.0	138,428
Kalifonsky Beach Set	Susitna	7.9	1,908	17.2	11,634	6.9	431	17.8	448	71.1	72	14.4	14,493
	Kenai	44.6	10,774	56.8	38,418	60.3	3,762	71.8	1,806	0	0	54.4	54,760
	Kasilof	44.6	10,774	25.5	17,248	32.5	2,028	10.4	262	0	0	30.1	30,312
	Fish	2.9	701	0.5	338	0.3	19	0	0	28.9	29	1.1	1,087
	Total	100.0	24,157	100.0	67,638	100.0	6,240	100.0	2,516	100.0	101	100.0	100,652
Cohoe/Ninilchik Beach Set	Susitna	6.1	3,701	18.0	29,435	6.0	1,419	20.4	1,783	72.4	372	14.3	36,710
	Kenai	22.3	13,531	40.7	66,555	38.2	9,036	56.1	4,905	0	0	36.6	94,027
	Kasilof	69.9	42,415	40.9	66,882	55.7	13,176	23.5	2,054	Trace	Trace	48.4	124,527
	Fish	1.7	1,032	0.4	654	0.1	24	0	0	27.6	142	0.7	1,852
	Total	100.0	60,679	100.0	163,526	100.0	23,655	100.0	8,742	100.0	514	100.0	257,116
Total	Susitna	11.4	27,266	34.7	358,303	13.8	13,147	35.0	24,452	58.3	697	29.4	423,865
	Kenai	27.4	65,799	43.0	444,350	47.3	45,133	43.6	30,437	0	0	40.7	585,719
	Kasilof	43.3	104,169	18.2	187,693	34.3	32,637	10.5	7,359	0	0	23.1	331,858
	Crescent	0.7	1,690	0.8	8,641	1.9	1,773	10.9	7,615	0	0	1.4	19,719
	Fish	17.2	41,265	3.3	33,716	2.7	2,580	0	0	41.7	498	5.4	78,059
	Total	100.0	240,189	100.0	1,032,703	100.0	95,270	100.0	69,863	100.0	1,195	100.0	1,439,220

[1] Source of run composition estimates, Cross et al. Origins of sockeye salmon in the Upper Cook Inlet fishery of 1981 based on scale pattern analyis. Alaska Department of Fish and Game, Division of Commercial Fisheries, (In press). Catch statistics taken from Alaska Department of Fish and Game fish ticket summaries dated 6 June 1982.

Appendix Table 34. Run composition estimates of the Upper Cook Inlet 1972-1977 commercial sockeye salmon harvests based on the age composition[1].

Year	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total %	Total Numbers
1972	Susitna	7.9	13,651	31.1	141,901	4.6	3,898	17.0	26,660	24.0	2,544	21.4	188,654
	Kenai	53.2	91,850	46.5	212,126	88.7	74,750	63.3	98,887	41.9	4,438	54.8	482,051
	Kasilof	33.1	57,046	14.7	67,303	4.2	3,485	17.9	27,949	29.9	3,169	18.1	158,952
	Crescent	4.0	6,852	5.7	25,828	2.4	2,033	1.7	2,633	4.0	420	4.3	37,766
	Fish	1.8	3,079	2.0	8,971	0.1	80	0.1	141	0.2	17	1.4	12,288
	Total	100.0	172,478	100.0	456,129	100.0	84,246	100.0	156,270	100.0	10,588	100.0	879,711
1973	Susitna	59.7	21,271	17.7	90,903	12.2	5,167	10.0	6,448	59.5	9,002	19.8	132,791
	Kenai	22.7	8,081	73.6	377,328	66.9	28,330	85.5	55,089	40.0	6,041	70.9	474,869
	Kasilof	8.1	2,877	6.1	31,401	16.7	7,093	2.6	1,646	0	0	6.4	43,017
	Crescent	8.5	3,047	2.5	12,526	2.3	946	1.9	1,241	0.5	81	2.7	17,841
	Fish	1.0	352	0.1	329	1.9	815	<0.1	11	0	0	0.2	1,507
	Total	100.0	35,628	100.0	512,487	100.0	42,351	100.0	64,435	100.0	15,124	100.0	670,025
1974	Susitna	43.1	36,558	21.3	63,277	7.5	4,235	6.5	3,560	3.4	125	21.7	107,755
	Kenai	30.6	25,994	49.4	146,970	82.9	47,044	88.2	47,906	34.8	1,299	54.1	269,213
	Kasilof	19.6	16,663	24.9	73,958	7.9	4,482	4.5	2,452	1.2	44	19.6	97,599
	Crescent	4.4	3,748	4.3	12,976	1.0	578	0.7	372	2.6	99	3.6	17,773
	Fish	2.3	1,979	0.1	218	0.7	421	0.1	38	58.0	2,164	1.0	4,820
	Total	100.0	84,942	100.0	297,399	100.0	56,760	100.0	54,328	100.0	3,731	100.0	497,160
1975	Susitna	52.7	74,928	42.0	129,938	4.4	6,621	4.2	2,715	14.6	1,447	31.8	215,649
	Kenai	12.4	17,553	48.7	150,781	57.9	88,054	84.6	55,237	70.6	6,975	46.9	318,600
	Kasilof	9.9	14,070	2.8	8,579	34.8	52,868	8.6	5,597	4.0	394	12.0	81,508
	Crescent	3.1	4,449	6.2	19,260	0.9	1,417	2.6	1,676	1.3	125	4.0	26,927
	Fish	21.9	31,078	0.3	893	2.0	3,138	0	0	9.5	943	5.3	36,052
	Total	100.0	142,078	100.0	309,451	100.0	152,098	100.0	65,225	100.0	9,884	100.0	678,736
1976	Susitna	18.0	78,723	31.6	263,561	2.1	4,782	1.4	2,155	33.5	2,886	21.2	352,107
	Kenai	60.9	266,118	45.3	378,270	66.6	153,133	64.6	99,498	61.8	5,322	54.2	902,341
	Kasilof	16.3	71,353	18.9	157,521	30.0	68,816	32.6	50,217	2.2	187	20.9	348,094
	Crescent	1.3	5,429	2.5	21,097	0.7	1,644	1.3	2,028	1.0	88	1.8	30,286
	Fish	3.5	15,083	1.7	14,528	0.6	1,466	0.1	92	1.5	133	1.9	31,302
	Total	100.0	436,706	100.0	834,977	100.0	229,841	100.0	153,990	100.0	8,616	100.0	1,664,130
1977	Susitna	37.1	76,829	23.4	328,970	8.9	17,620	1.9	4,404	28.1	4,771	21.1	432,594
	Kenai	29.5	61,143	68.0	953,492	49.3	97,375	78.9	179,500	53.2	9,043	63.3	1,300,553
	Kasilof	30.0	61,965	5.4	76,233	40.5	79,898	18.0	40,923	12.7	2,164	12.7	261,183
	Crescent	2.2	4,578	2.9	39,936	1.2	2,270	1.2	2,803	4.0	688	2.5	50,275
	Fish	1.2	2,567	0.3	4,704	0.1	265	0	0	2.0	340	0.4	7,876
	Total	100.0	207,082	100.0	1,403,335	100.0	197,428	100.0	227,630	100.0	17,006	100.0	2,052,481

[1] Run composition estimates for the 1972-1977 sockeye harvests were calculated by using the age composition of the escapement as an estimator. The proportions by age class of the total escapement which returned to each river were applied to the catch.

Appendix Table 36. Run composition estimates of the Upper Cook Inlet 1972-1977 commercial sockeye salmon harvests based on the application of 1978-1981 average exploitation rates[1].

Year	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total %	Total Numbers
1972	Susitna	4.9	8,452	31.5	143,681	4.4	3,707	20.2	31,566	9.9	1,048	21.4	188,454
	Kenai	44.2	76,235	38.9	177,434	86.5	72,873	52.0	81,240	61.8	6,543	47.1	414,325
	Kasilof	46.9	80,892	22.6	103,085	7.9	6,655	25.4	39,693	18.2	1,927	26.4	232,252
	Crescent	2.8	4,829	5.6	25,543	1.1	927	2.4	3,750	9.3	985	4.1	36,034
	Fish	1.2	2,070	1.4	6,386	0.1	84	<0.1	21	0.8	85	1.0	8,646
	Total	100.0	172,478	100.0	456,129	100.0	84,246	100.0	156,270	100.0	10,588	100.0	879,711
1973	Susitna	58.6	20,891	20.1	103,067	12.8	5,425	12.2	7,858	29.2	4,417	21.1	141,658
	Kenai	23.8	8,467	68.5	351,185	59.2	25,082	82.0	52,848	48.5	7,344	66.4	444,926
	Kasilof	13.5	4,800	9.3	47,500	25.4	10,740	3.7	2,353	0	0	9.8	65,393
	Crescent	3.2	1,160	2.0	10,464	0.9	374	2.1	1,373	0.2	26	2.0	13,397
	Fish	0.9	310	0.1	271	1.7	730	<0.1	3	22.1	3,337	0.7	4,651
	Total	100.0	35,628	100.0	512,487	100.0	42,351	100.0	64,435	100.0	15,124	100.0	670,025
1974	Susitna	36.1	30,618	21.0	62,508	8.9	5,048	10.5	5,703	1.3	48	20.9	103,925
	Kenai	26.9	22,849	41.2	122,436	73.5	41,697	79.4	43,152	23.3	868	46.5	231,002
	Kasilof	30.8	26,162	34.8	103,586	15.8	8,996	9.0	4,888	0.5	21	28.9	143,653
	Crescent	4.6	3,923	3.0	8,777	1.1	647	1.1	579	0	0	2.8	13,926
	Fish	1.6	1,390	<0.1	92	0.7	372	<0.1	6	74.9	2,794	0.9	4,654
	Total	100.0	84,942	100.0	297,399	100.0	56,760	100.0	54,328	100.0	3,731	100.0	497,160
1975	Susitna	51.4	72,998	47.7	147,488	3.9	5,956	5.2	3,409	13.0	1,285	34.1	231,136
	Kenai	12.3	17,409	40.0	123,640	40.7	61,843	74.1	48,314	61.2	6,049	37.9	257,255
	Kasilof	17.6	25,081	4.8	15,010	53.5	81,403	19.2	12,543	2.4	241	19.8	134,278
	Crescent	2.0	2,816	7.3	22,704	0.4	685	1.5	959	0.9	83	4.0	27,247
	Fish	16.7	23,774	0.2	609	1.5	2,211	0	0	22.5	2,226	4.2	28,820
	Total	100.0	142,078	100.0	309,451	100.0	152,098	100.0	65,225	100.0	9,884	100.0	678,736
1976	Susitna	16.1	70,143	34.1	284,309	1.8	4,139	1.0	1,470	33.9	2,920	21.8	362,981
	Kenai	55.4	242,174	30.0	250,856	50.0	114,844	44.9	69,180	60.6	5,220	41.0	682,274
	Kasilof	25.1	109,464	31.5	263,010	47.3	108,841	51.3	78,957	1.5	132	33.7	560,404
	Crescent	1.0	4,547	3.5	29,064	0.4	914	2.8	4,372	0.3	26	2.3	38,923
	Fish	2.4	10,378	0.9	7,738	0.5	1,103	<0.1	11	3.7	318	1.2	19,548
	Total	100.0	436,706	100.0	834,977	100.0	229,841	100.0	153,990	100.0	8,616	100.0	1,664,130
1977	Susitna	30.4	62,957	26.7	375,194	8.0	15,754	1.9	4,424	22.5	3,825	22.5	462,154
	Kenai	24.5	50,786	62.3	874,001	33.3	65,842	63.4	144,294	41.1	6,990	55.7	1,141,913
	Kasilof	40.9	84,637	8.3	116,117	57.8	114,122	31.6	71,877	6.0	1,022	18.9	387,775
	Crescent	3.4	7,054	2.4	34,278	0.8	1,529	3.1	7,035	0.5	89	2.4	49,985
	Fish	0.8	1,648	0.3	3,745	0.1	181	0	0	29.9	5,080	0.5	10,654
	Total	100.0	207,082	100.0	1,403,335	100.0	197,428	100.0	227,630	100.0	17,006	100.0	2,052,481

[1] Run composition estimates for the 1972-1977 sockeye harvests were calculated from the 1978-1981 average exploitation rates by system and age class developed from scale pattern analysis. The average exploitation rates were applied to the escapement to estimate catch by river by age.

Appendix Table 38. Total return of sockeye salmon by age group and river developed from the catch apportionment based on scale pattern analyses, Upper Cook Inlet, 1978-1981.

Year	System	4 2 %	4 2 Numbers	5 2 %	5 2 Numbers	5 3 %	5 3 Numbers	6 3 %	6 3 Numbers	Other %	Other Numbers	Total %	Total Numbers
1978	Susitna	36.8	133,795	7.0	185,407	8.3	11,822	10.6	17,350	70.1	11,178	10.8	359,552
	Kenai	10.2	37,255	78.0	2,050,840	57.3	81,664	61.2	99,741	17.4	2,776	68.5	2,272,276
	Kasilof	50.5	183,732	11.4	299,755	34.3	48,922	21.5	35,036	0	0	17.1	567,465
	Crescent	1.3	4,909	3.5	93,223	0	0	6.6	10,782	0	0	3.3	108,914
	Fish	1.2	4,523	0.1	2,272	0.1	140	0.1	155	12.5	2,002	0.3	9,092
	Total	100.0	364,214	100.0	2,631,517	100.0	142,548	100.0	163,064	100.0	15,956	100.0	3,317,299
1979	Susitna	29.9	197,737	15.7	118,312	16.1	26,451	10.9	6,806	69.1	29,187	22.5	378,493
	Kenai	19.2	126,899	48.0	361,109	46.1	75,709	63.6	39,706	8.8	3,727	36.0	607,150
	Kasilof	29.3	194,165	24.0	180,601	36.4	59,799	25.2	15,763	2.8	1,177	26.8	451,505
	Crescent	5.3	35,113	12.0	90,765	0.7	1,137	0.3	216	2.9	1,249	7.6	128,480
	Fish	16.3	108,195	0.3	2,600	0.7	1,221	0	0	16.4	6,920	7.1	118,936
	Total	100.0	662,109	100.0	753,387	100.0	164,317	100.0	62,491	100.0	42,260	100.0	1,684,564
1980	Susitna	24.3	214,715	17.7	206,863	10.0	27,441	14.7	34,547	34.0	8,460	19.1	492,026
	Kenai	25.8	226,646	41.5	484,014	54.9	149,819	54.6	128,564	18.0	4,482	38.5	993,525
	Kasilof	39.9	351,938	26.1	304,276	29.3	80,138	28.7	67,629	9.1	2,261	31.2	806,242
	Crescent	1.0	9,035	12.2	141,777	2.5	6,867	1.3	3,131	8.1	2,023	6.3	162,833
	Fish	9.0	79,575	2.5	29,080	3.3	8,923	0.7	1,577	30.8	7,673	4.9	126,828
	Total	100.0	881,909	100.0	1,166,010	100.0	273,188	100.0	235,448	100.0	24,899	100.0	2,581,454
1981	Susitna	12.7	57,533	35.5	640,532	14.6	23,349	30.6	39,755	64.7	2,739	29.9	763,908
	Kenai	29.4	132,782	40.8	737,456	49.3	78,617	38.7	50,283	2.8	119	39.1	999,257
	Kasilof	40.9	185,027	19.6	345,229	30.5	48,702	9.0	11,643	0	0	23.6	599,601
	Crescent	1.1	5,060	1.2	21,884	3.6	5,733	21.7	28,164	2.1	91	2.4	60,932
	Fish	15.9	72,045	2.9	51,928	2.0	3,275	0	0	30.4	1,291	5.0	128,539
	Total	100.0	452,447	100.0	1,806,029	100.0	159,676	100.0	129,845	100.0	4,240	100.0	2,552,237