

STATE OF ALASKA

*Jay S. Hammond, Governor*



Annual Performance Report for

EVALUATION OF CHINOOK SALMON FISHERIES  
OF THE KENAI PENINSULA

by

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Job No. G-II-L  
Evaluation of Chinook  
Salmon Fisheries of the  
Kenai Peninsula

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## RESEARCH PROJECT SEGMENT

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Salmon Fisheries of the  
Kenai Peninsula

Period Covered: July 1, 1977 to June 30, 1978.

## ABSTRACT

The four-weekend fishery for chinook salmon, Oncorhynchus tshawytscha (Walbaum), on Anchor River, Deep Creek and Ninilchik River is discussed. Total angler effort in 1977 was estimated at 24,520 man-days derived by vehicle counts on location. Analysis of the returns from 19,388 punch cards issued to potential anglers yielded an estimated total harvest of 2,170 fish longer than 508 mm (20 inches). Estimated harvests from each stream are: Anchor River, 1,020; Ninilchik River, 910; and Deep Creek, 240.

Age composition of the recreational harvest is discussed. The predominant age class was 1.3 (brood year 1972). Punch cards were returned at the second lowest rate (54.4%) since 1973, the first year the punch card system included only the three streams. Historical analyses of the punch card results are presented.

Chinook salmon escapement surveys conducted by both helicopter and ground crews resulted in the following minimum escapement estimates: Anchor River, 4,173; Ninilchik River, 1,399; Deep Creek, 990; and Stariski Creek, 711.

The 1977 saltwater chinook salmon fishery in Cook Inlet near Deep Creek was monitored by creel census. Harvest was the second largest since the projects inception in 1972. The early run harvest was not as large as the 1976 harvest but still considered excellent. The late run harvest of 366 fish is considered poor but not indicative of the abundance of late run chinook salmon in Cook Inlet. Probable causes for the lack of harvest are explored. Total harvest was estimated at 4,923 fish while angler effort was estimated at 25,741 man-days, most of which (73%) occurred during the early run. Estimates were calculated on the basis of 3,022 angler interviews, 173 instantaneous boat counts and 402 chinook salmon creel checked. Harvest estimates for other species are also presented.

Age structure of the recreational harvest from Cook Inlet near Deep Creek was based on 257 readable scales collected during the fishery. The predominate age class during the early run was 1.3 (brood year 1972) while the predominate age class of the late run was 1.4 (brood year 1971).

For the fourth year, a creel census was conducted on the Kenai River with chinook salmon being the target species. Effort in man-days has increased steadily since it was first monitored in 1974. In 1977 an estimated 83,018 man-days were expended in pursuit of chinook salmon; 35,479 and 47,539 during the early and late runs, respectively. Harvest of chinook salmon over 508 mm (20 inches) in length was estimated at 7,321, 2,173 from the early run and 5,148 from the late run.

Catch sampling produced 380 readable scales, analysis of which revealed an age composition dominated by age class 1.4 (brood year 1971) for both runs migrating into the Kenai River.

A management policy adopted by the Board of Fisheries in 1975 was enacted for the first time resulting in the elimination of the last four days of the Kenai River chinook salmon season. The events leading up to the decision to close the fishery and results of the closure are discussed.

## BACKGROUND

Chinook salmon fishing has been popular on the Kenai Peninsula for many years. Initially effort was centered around the lower Peninsula streams of Deep Creek, Ninilchik River and Anchor River. These streams have been managed by a variety of programs, but since 1966 have been regulated by a limited season and restricted bag limits, utilizing a punch card system.

Pertinent historical data are presented in Reports of Progress by Dunn (1961), Logan (1962, 1963, 1964), Engel (1965, 1966, 1967), Redick (1968), McHenry (1969), Watsjold (1970), Nelson (1971, 1972a, 1972b) and Hammarstrom (1974, 1975, 1976, 1977).

In 1972 anglers discovered that chinook salmon could be readily taken in the waters of Cook Inlet in the vicinity of Deep Creek. This fishery has grown from 3,610 man-days in 1972 to 25,741 man-days in 1977. The chinook salmon fished upon near Deep Creek are of mixed stocks, originating from many streams of the Cook Inlet Basin. Annual harvest and effort have been estimated by creel census since 1972. Fluctuations in angling effort and success are primarily due to prevailing local weather conditions. Historical data regarding this fishery are presented by Hammarstrom (1974, 1975, 1976, 1977).

Historically the Kenai River has been one of the more popular locations on the Kenai Peninsula for recreational fishing. The Kenai River system is a productive body of water, contributing heavily to the commercial harvest in Cook Inlet of all salmon species except chum salmon. Anglers have utilized this river for salmon, trout and char, but until recently, chinook salmon have not been major contributors to the creel. Currently though, recreational effort directed toward chinook salmon on the Kenai River has made it the largest sport fishery in Alaska.

The Kenai River is a large glacially turbid stream, not conducive to the harvest of large fish by shore anglers so the chinook salmon fishery is essentially conducted from small boats. In 1973, relatively large numbers of anglers discovered that chinook salmon were susceptible to harvest by bouncing terminal gear along the bottom from a drifting boat. Anglers began realizing good catches with individual fish weighing up to 80 pounds. In 1974 a creel census program was initiated to monitor harvest and effort on a 10-mile section of the river from Skilak Lake downstream to Naptowne Rapids (Hammarstrom, 1975). The creel census was expanded in 1975 to include anglers along an 11-mile section from the Soldotna Bridge downstream to Beaver Creek, as well as shore anglers in the entire area open to chinook salmon fishing. From 1974 to 1977 estimated angler effort has expanded by 252%, from 23,610 to 83,018.

From 1966 to 1972 the chinook salmon harvest from the Kenai River was monitored by evaluating punch card returns (Nelson, 1972). Since punch card returns declined to 42.2%, and as such were of little value, the Kenai River was eliminated from a punch card requirement in 1973. In 1970 a relaxation of the fishery was initiated by the Alaska Board of Fish and Game, and the season was extended from a 6-day weekend-only fishery to a 62-day fishery (May 30-July 31). In 1975 the Board further extended the season to 212 days (January 1-July 31). However fishing was actually extended by only a few weeks because low water and arrival of fish make harvest unlikely prior to mid-May.

In 1975 the Board of Fisheries adopted a management policy regarding the sport harvest of late run chinook salmon in the Deep Creek marine and Kenai River fisheries. In essence, the sport harvest from these two fisheries is not allowed to exceed the late run commercial set net harvest from statistical areas 244-20, 30, 40 (Figure 1.) by more than 10% based on the regularly scheduled two 12-hour commercial fishing periods per week. This policy was first enacted in 1977 and the Kenai River was closed to the taking of chinook salmon on July 28.

## RECOMMENDATIONS

1. Explore possibilities of determining escapement of chinook salmon into the Kenai River.
2. Examine possibilities of determining racial separation of early run chinook salmon harvested in salt water.

## OBJECTIVES

1. To determine the sport harvest of chinook salmon and evaluate angler pressure in the Kenai Peninsula area.
2. To determine spawning escapement into the major chinook salmon producing streams in the area.

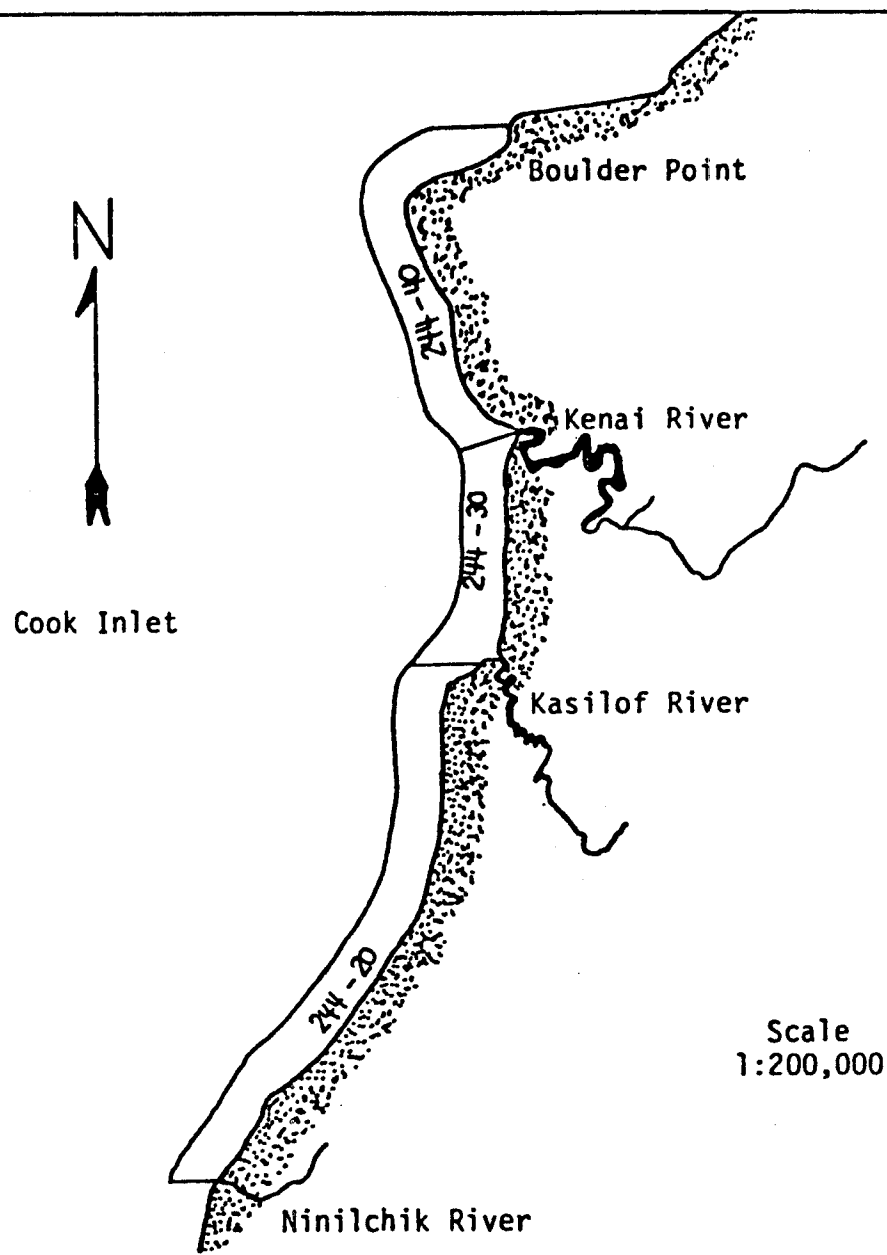


Figure 1. East Side Cook Inlet Commercial Set Net Statistical Areas Most Influential in Affecting Kenai River Stocks.

3. To determine chinook salmon population trends in the major recreational waters of the Kenai Peninsula.
4. To determine and develop plans for the enhancement of chinook salmon stocks, to provide recommendations for their management, and to direct the course of future studies.

## TECHNIQUES USED

### Harvest, Effort and Escapement Estimation

The techniques used during the 1977 punch card fishery were identical to those used in 1976 (Hammarstrom 1977) except that effort calculations differed slightly.

Prior to 1977, the marine waters within a one-mile radius of the mouth of Anchor River, Deep Creek and Ninilchik River were considered fresh water thus requiring a punch card during the open chinook salmon season. Anglers moved in and out of this one-mile radius in pursuit of fish and this effort was attributed to both fisheries. In 1977, however, a regulation change by the Board of Fisheries closed these waters within the one-mile radius to chinook salmon fishing from January 1 through June 30, hence it was possible to define effort as belonging to either the marine fishery or the fresh water punch card fishery.

Effort attributed to the punch card fishery is calculated by vehicle count and effort from the marine fishery is calculated by boat count. Since both marine anglers and punch card anglers utilize a common parking area total effort for the parking area was determined. The marine effort, for those days of the punch card fishery, was calculated by creel census from boat counts then subtracted from the total effort determined from the vehicle counts in that common parking area, resulting in effort that could be attributed to the punch card fishery. Also, since extreme crowding conditions existed in the limited parking and camping area, it was determined that the 100% turn-over rate which has been used in the past was inappropriate so a 20% turn-over rate was adopted for 1977 for Deep Creek-Ninilchik River estimates. The 100% rate was used on the Anchor River. These figures will have to be upgraded in future years.

The techniques used on the Deep Creek marine creel census in 1977 were identical to those used in 1976 (Hammarstrom 1977).

Techniques on the Kenai River creel census in 1977 were identical to those described by Hammarstrom (1977). Aerial surveys were increased from 5 to 13 in 1977 to determine relative angling pressure in the uncensused area.

## FINDINGS

### Punch Card Fishery

During the 1977 punch card season for chinook salmon, Oncorhynchus tshawytscha (Walbaum), effort was estimated at 24,520 man-days. This

represents an apparent drop of 33.6% from 1976 estimates. In reality, it is not a drop but results from different apportionments due to a regulation change.

In previous years, those anglers fishing salt water within a one-mile radius of the mouths of Deep Creek and Ninilchik River were assumed to be utilizing both the punch card fishery and the Deep Creek marine fishery on those weekends the streams were open. During 1977, however, the regulations were changed and that area within a one-mile radius remained closed to chinook salmon fishing until June 30, so effort that had previously been assigned to both saltwater and freshwater fisheries was assigned to one or the other.

In addition, previous studies revealed that a vehicle count conducted at noon represented 50% of those vehicles utilizing the fishery. The camping, parking facilities were completely saturated in 1977 and agents from the Alaska Division of Parks that manage the facilities had to turn vehicles away because of over crowded conditions. Thus it was apparent that vehicle counts made in those areas approached a total count for the day. It was assumed that counts in the Deep Creek-Ninilchik River area represented 80% of the total vehicles utilizing these two streams, while one made in the Anchor River area represented 50% of the total. The following effort estimates were made: Anchor River, 10,978 man-days (1,372 per day for 8 days); Ninilchik River, 9,224 man-days (1,537 per day for 6 days); Deep Creek, 4,318 man-days (540 per day for 8 days).

Historically, fishermen have been more successful on Saturdays than Sundays. Analysis of data from 1973 through 1977 indicates a strong linear correlation between the harvest of respective weekend days by individual streams with all streams appearing very similar (Figure 2). The following relationships exist where x is equal to Saturday's harvest and y is equal to that corresponding Sunday's harvest.

Anchor River	$y = 0.35x + 13.7$ $n = 17$ $r = 0.82$
Ninilchik River	$y = 0.39x + 4.7$ $n = 14$ $r = 0.84$
Deep Creek	$y = 0.36x + 8.6$ $n = 17$ $r = 0.87$
All streams combined	$y = 0.36x + 9.5$ $n = 48$ $r = 0.89$

Fishing conditions in 1977 were the same as in past years. Ninilchik River was the only stream in fishable condition during the opening weekend (May 28 and 29) while Anchor River and Deep Creek were high and



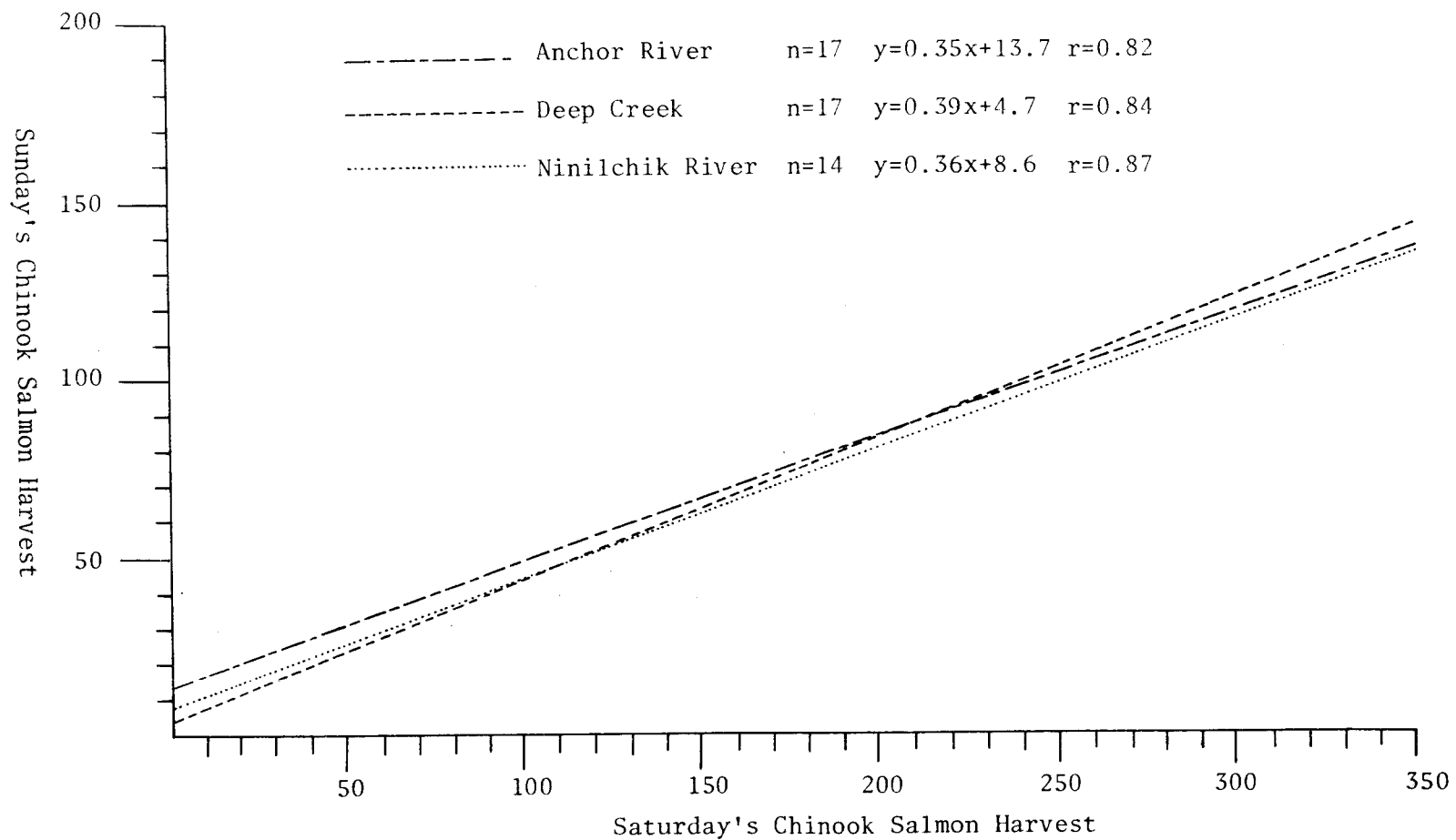


Figure 2. Linear Regression Between Saturday's Chinook Salmon Harvest and Corresponding Sunday's Chinook Salmon Harvest from Anchor River, Deep Creek and Ninilchik River, 1973-1977.

turbid. Subsequent weekends were more favorable on the Anchor River but Deep Creek was not fishable until the third weekend (June 18 and 19). Ninilchik River was again closed early by emergency order after the third weekend, to preclude the possibility of over-harvest.

The 1977 sport harvest of chinook salmon over 508 mm (20 inches) in length was the highest recorded since 1966 totaling 2,170. Individual stream totals are as follows: Anchor River, 1,020; Deep Creek, 240; Ninilchik River, 910. Data regarding 1977 harvest and effort are presented in Table 1. Historical data appear in Tables 2 and 3.

Harvest was determined by evaluating punch card returns. The 1977 returns were slightly higher than last year (Table 4), with 54.4% of the anglers who received cards returning them. As has been reported before nearly half (46.3%) of the people who returned cards did not fish or did not supply complete information (Table 5). Of those anglers who reported they had fished, most (83.4%) were unsuccessful, 12.0% reported capturing one fish, and 4.6% captured the season limit of two fish. Table 6 presents historical data regarding the success of those anglers who participated in the fishery.

Since 1973, informal creel census harvest estimates have been made in order to make necessary in season management decisions. Results have differed little from the results derived from punch card estimates as is seen in Table 7. The 1977 creel census estimate was 8.4% less than that estimated by punch card evaluation. The five year mean has been 4.4% below that harvest estimated by punch card.

Readable scale samples were collected from 370 chinook salmon over 508 mm (20 inches) in length harvested from the three streams. The sex ratio (excluding age 1.1 precocial "jack" males) was 1.2:1 males to females. Assuming the harvest is representative of the run, the predominant age class was five-year-old fish (1.3) from 1972 brood year which made up 60.8% of the harvest. In 1976 age 1.3 fish (1971 brood year) made up 36.9% of the harvest. Fish from the same brood year made up only 28.1% of the 1977 harvest. Because "jacks" are under 508 mm in length, they are not required to be reported on a punch card. Observations made during the fishery indicate that this age class was not strong. Table 8 shows age composition of the sport harvest while Table 9 compares fork length data for the various age classes.

Chinook salmon escapement surveys were conducted in late July. An average of 85.2% of the spawning fish seen in the index area of each stream by the ground observer were also observed from the helicopter (Table 10). This figure compares to an average of 73% in 1976 when an afternoon rain shower decreased visibility from the air on two of the three streams. Minimum escapement estimates into each stream are as follows: Anchor River, 4,173; Deep Creek, 990; Ninilchik River, 1,399. In addition, 711 fish were estimated to have escaped into Stariski Creek which is a small stream located between Anchor River and Deep Creek. Stariski Creek has no freshwater fishery but some fish are harvested in salt water. No ground observations were made, only an aerial count. The expansion value was the average value from the other three streams.

Table 1 . Chinook Salmon Harvest and Effort (Man-Days) by Date, as Determined by Punch Cards, 1977.

Date	Anchor River		Deep Creek		Ninilchik River		Total	
	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort
5/28	114	2,104	22	613	287	2,168	423	4,885
5/29	58	1,722	17	778	86	1,999	161	4,499
6/4	112	1,180	9	983	217	1,352	338	3,515
6/5	95	970	5	603	97	1,540	197	3,113
6/11	221	1,436	50	121	175	1,238	446	2,795
6/12	87	1,004	27	76	48	927	162	2,007
6/18	230	1,617	81	531	Closed		311	2,148
6/19	103	945	29	613	Closed		132	1,558
Total	1,020	10,978	240	4,318	910	9,224	2,170	24,520
1st Weekend	172	3,826	39	1,391	373	4,167	584	9,384
2nd Weekend	207	2,150	14	1,586	314	2,892	535	6,628
3rd Weekend	308	2,440	77	197	223	2,165	608	4,802
4th Weekend	333	2,562	110	1,144	Closed		443	3,706

Table 2 . Historical Chinook Salmon Harvest and Effort Data From Lower  
Three Kenai Peninsula Streams, 1971-1977.

<u>Year</u>	<u>Effort (Man-Days)</u>	<u>Harvest</u>	<u>Length of Season Days</u>	<u>Average Effort/Day</u>	<u>Average Harvest/Day</u>	<u>Man Days/Fish</u>
1971	15,900	240	6	2,650	40	66
1972	13,520	490	4	3,380	123	28
1973	24,100	770	6	4,017	128	31
1974	21,000	1,080	6	3,500	180	19
1975	19,600	850	6	3,267	142	23
1976	36,920	1,680	8	4,615	210	22
1977	<u>24,520</u>	<u>2,170</u>	<u>8</u>	<u>3,065</u>	<u>271</u>	<u>11</u>
Mean	22,223	1,040	6.3	3,527	165	21

Table 3. Historical Harvest and Escapement Data for the Three Lower Kenai Peninsula Chinook Salmon Streams from 1966-1977.\*

Year	Anchor River			Deep Creek			Ninilchik River			Total		
	Harvest	Escapement	% Harvest	Harvest	Escapement	% Harvest	Harvest	Escapement	% Harvest	Harvest	Escapement	Run
1966	290	1,330	18	50	540	9	220	670	25	560	2,540	3,100
1967	240	1,200	17	180	270	40	120	360	25	540	1,830	2,370
1968	250	530	32	160	200	44	210	450	32	620	1,180	1,800
1969	80	1,800	4	40	960	4	130	760	15	250	3,520	3,770
1970	170	1,850	8	60	-	-	280	-	-	510	1,850+	2,360+
1971	60	1,220	5	40	-	-	140	-	-	240	1,220+	1,460+
1972	180	1,890	9	140	530	21	170	1,360	11	490	3,780	4,270
1973	330	1,660	17	140	220	39	300	640	32	770	2,520	3,290
1974	440	1,000	31	290	740	28	350	510	41	1,080	2,250	3,330
1975	210	1,290	14	100	610	14	540	830	39	850	2,730	3,580
1976	830	3,080	21	220	1,680	12	630	1,180	35	1,680	5,940	7,620
1977	1,020	4,170	16	240	990	21	910	1,400	40	2,170	6,560	8,730
Mean**												
1966-77	380	1,800	18	160	670	23	360	820	30	900	3,290	4,190

\* Figures rounded to nearest 10.

\*\* Excludes all 1970 and 1971 data.

Table 4 . Summary of Chinook Salmon Punch Cards Issued and Returned,  
1966-76.

<u>Year</u>	<u>Number Issued</u>	<u>Number Returned</u>	<u>Percent Returned</u>
1966	8,853	6,835	77.2
1967	5,977	4,909	82.1
1968	9,524	6,724	70.6
1969	6,680	4,651	69.6
1970	16,687	12,518	75.0
1971	23,419	10,435	44.6*
1972	23,991	10,138	42.2*
1973	12,069	7,188	59.6
1974	11,309	6,465	57.2
1975	9,808	5,443	55.5
1976	16,054	8,151	50.8
1977	19,388	10,544	54.4

\* Years in which a punch card was in effect on the Kenai River.

Table 5 . A Summary of Chinook Salmon Punch Card Utilization in Percent by Anglers, 1973-1977.

<u>Angler Returns</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>Mean</u>
Fished	50.7	53.9	50.4	53.7	53.1	52.4
Did Not Fish	44.6	42.2	43.9	41.0	41.0	42.6
Incomplete Information	4.7	3.9	5.7	5.3	5.3	5.0

Table 6 . Summary of Chinook Salmon Punch Card Returns in Percent of Anglers Fishing, 1973-1977.

<u>Angler Returns</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>Mean</u>
Unsuccessful	90.8	84.7	87.2	84.1	83.4	86.1
Successful (1 fish)	7.1	11.6	10.0	12.5	12.0	10.6
Successful (2 fish)	2.1	3.7	2.8	3.4	4.6	3.3

Table 7 . A Comparison of Punch Card and Partial Creel Census Estimates of Chinook Salmon Harvest in the Anchor River, Deep Creek and Ninilchik River, 1973-77.

<u>Year</u>	<u>Punch Card Estimate</u>	<u>Creel Census Estimate</u>	<u>Percent Difference</u>
1973	770	730	-5.2
1974	1,090	1,050	-3.7
1975	850	820	-3.5
1976	1,674	1,680	+0.3
1977	2,180	1,995	-8.5
Total	6,565	6,275	-4.4

Table 8 . Age Composition of Sport Caught Chinook Salmon Taken During the Punch Card Fishery from Three Lower Kenai Peninsula Streams, 1977.

	Age Class*				Total
	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>	<u>1.5</u>	
Number	39	225	104	2	370
Percent	10.6	60.8	28.1	0.5	100.0
	Brood Year				Total
	<u>1973</u>	<u>1972</u>	<u>1971</u>	<u>1970</u>	
Number	39	225	104	2	370
Percent	10.6	60.8	28.1	0.5	100.0

\* Age Class 1.1 (1 ocean jacks) excluded.

Table 9 . Fork Length Comparison for Sport Caught Chinook Salmon Taken During the Punch Card Fishery from Three Lower Kenai Peninsula Streams, 1977.

	Age Class				
	<u>1.1</u>	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>	<u>1.5</u>
Number	9	39	221	104	1
Range (mm)	410-442	540-725	640-1,070	775-1,140	1,145
Mean (mm)	423.4	622.7	884.7	991.4	1,145
S.D.*	12.6	80.1	55.9	69.7	-

\* Standard Deviation



Table 10. Chinook Salmon Escapement Surveys for Lower Kenai Peninsula Streams, 1977.

	Index Area			Remainder of Stream		Total Escapement Estimated
	Ground Count	Aerial Count	Percent Aerial	Aerial Count	Expanded Count	
Ninilchik River	719	601	83.6	568	680	1,399
Deep Creek	193	165	85.5	683	797	990
Anchor River	1,676	1,440	85.9	2,145	2,497	4,173
Stariski Creek	-	-	85.2*	606	711	711
Total	2,588	2,206	85.2	4,002	4,685	7,269

\* Mean value calculated from three other streams.

## Deep Creek Marine Fishery

Sport effort on chinook salmon increased by 38.1% over 1976, from 18,635 man-days to 25,741 man-days (Table 11). As occurred in 1976 most of the effort was directed toward early run fish, May 21 to June 24. A man-day averaged 3.4 man-hours over the season.

During the period May 21 through July 31, 3,022 completed anglers were interviewed, 11.7% of the estimated effort. In addition, 402 chinook salmon over 20 inches were creel checked, 8.1% of the estimated harvest. In 1977, 173 instantaneous boat counts were conducted totaling 6,256 boats or an average of 36.2 boats per count.

The early run season extended 35 days (May 21 through June 24). During this time 25 days were censused. Effort was estimated at 18,803 man-days, each man-day averaging 3.6 man-hours. Harvest was estimated at 4,617 chinook salmon over 508 mm in length with the catch per hour being 0.068. It appears that fish bound for the Susitna River system again contributed significantly to the harvest off Deep Creek. A very good run into the local streams, Ninilchik River and Deep Creek, also probably accounted for the good fishing.

Weather has been a significant factor in determining the harvest and effort in this marine fishery. During the 1977 early run, weather was responsible for precluding effort on 3 days.

The late run season occurred for 37 days (June 25 through July 31). During this time 27 days were censused. The effort and harvest estimates are 6,938 man days (average 3.0 hours per man-day) and 366 chinook salmon. The harvest rate was 0.017 fish per hour. Weather limited the season to 32 days.

The low harvest and harvest rate appear to be due to a change in the migration pattern. Normally the fish move north in Cook Inlet near the shore. During the late run, anglers reported many chinook salmon jumping or surfacing farther off shore, up to four miles. Anglers also reported the reluctance of fish to strike. The commercial harvest and the harvest in the Kenai River did not indicate the late run to be weak; therefore, it is assumed that a change in the migration patterns caused the poor fishing during the late run.

Readable scales were collected from 169 adult chinook salmon during the early run and 88 during the late run. There is a marked difference between the age structures of these two segments (Table 12). The early run contained 46.7% age 1.3 (brood year 1972) while the late run contained 21.6% age 1.3. Age 1.4 (brood year 1971) made up 38.5% of the early run and 73.9% of the late run. It is also interesting to note the complete lack of age 1.2 (brood year 1973) from the late run. Historically very few age 1.1 fish are reported from the marine fishery off Deep Creek. Also differing from the fresh water fisheries is the harvest of proportionately more females than males in salt water. The sex composition of the total chinook salmon sport harvest off Deep Creek was 0.7:1 males to females. This represents an effective harvest of 2,955 females and 2,028 males.

Table 11. Historical Summary of the Chinook Salmon Sport Fishery off Deep Creek, 1972-1977.

Year	Early Run			Late Run			Total		
	Harvest	Effort Man-Days	Catch/ Hour	Harvest	Effort Man-Days	Catch/ Hour	Harvest	Effort Man-Days	Catch/ Hour
1972	1,000	2,357	0.119	1,250	1,253	0.272	2,250	3,610	0.173
1973	519	5,245	0.028	491	2,795	0.050	1,010	8,040	0.034
1974	500	3,810	0.037	100	1,280	0.034	600	5,090	0.036
1975	540	3,370	0.061	345	4,680	0.031	885	8,050	0.044
1976	5,495	12,268	0.101	1,382	6,365	0.057	6,877	18,635	0.088
1972-76 Mean	1,611	5,410	0.069	714	3,275	0.089	2,324	8,685	0.075
1977	4,617	18,803	0.069	366	6,938	0.017	4,983	25,741	0.056

Table 12. Age Structure of Sport Caught Chinook Salmon Taken During the Deep Creek Marine Fishery, 1977.

	Age Class*						
	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>	<u>1.5</u>	<u>1.6</u>	<u>2.3</u>	<u>Total</u>
	Early Run						
Number	22	79	65	2		1	169
Percent	13.0	46.7	38.5	1.2		0.6	100.0
	Late Run						
Number		19	65	3	1		88
Percent		21.6	73.9	3.4	1.1		100.0
	Brood Year						
	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>		
	Early Run						
Number		3	65	79	22		169
Percent		1.8	38.5	46.7	13.0		100.0
	Late Run						
Number	1	3	65	19			88
Percent	1.1	3.4	73.9	21.6			100.0

\* Age class 1.1 (ocean jacks) excluded.

In addition to chinook salmon, an estimated 4,250 pacific halibut, Hippoglossus stenolepis Schmidt; 1,044 sockeye, O. nerka (Walbaum); 116 pink salmon, O. gorbuscha (Walbaum); and 99 coho salmon, O. kisutch (Walbaum), were harvested during the time the creel census was conducted.

### Kenai River

Creel census activities on the Kenai River began June 1 and terminated July 27 with the enactment of an emergency order closing the season four days early.

Angling effort directed toward chinook salmon in 1977 increased by 86.7% over 1976, from 44,460 man-days to 83,018 man-days. Most of the effort (57.3%) occurred during the late run. Effort estimated for the early and late runs are 35,479 man-days and 47,539 man-days. A man day averaged 3.5 hours during the early run and 2.8 hours during the late run.

The total harvest of chinook salmon over 508 mm was estimated at 7,321 fish; 2,173 and 5,148 during early and late runs. This represents a 21.4% increase over 1976 estimated harvest. In addition, 1,462 one ocean "jacks" were estimated to have been harvested in 1977.

Catch per man-hour during the early run was 0.019 and was 0.036 during the late run, with a combined success rate of 0.029 fish per man-hour.

Throughout the season, the most popular area was the segment of river from the Soldotna Bridge to Beaver Creek (downstream section). This area received 57.4% of the total effort (Table 13). Because of run timing through the river, anglers in the downstream section fish more equally upon both runs. Early run fish were harvested in the lower section for 33 days while the late run was fished upon for 24 days, 58% and 42% of the available fishing time, respectively. Corresponding figures for the upstream section are 40 days and 17 days; 70% and 30%, respectively.

Harvest and effort in the upstream and downstream sections were estimated on the basis of 143 instantaneous angler counts, 13 aerial boat counts, 11,086 angler interviews and 897 chinook salmon reported harvested. Harvest and effort in the mid-stream section was projected from the 13 aerial boat counts. Data indicated that effort in the mid-stream section was 9.1% of the effort in the upstream and downstream sections combined. Harvest and effort estimates for shore anglers were arrived at by taking 21.8% of the combined upstream and downstream estimates. This figure was determined from the results of a shore angler creel census conducted in 1975 (Hammarstrom, 1976).

The 11,087 angler interviews conducted represents 13.4% of the estimated effort. The 897 creel checked fish represents 12.3% of the estimated harvest. Including "jacks", an estimated 8,783 chinook salmon were harvested. The harvest of "jacks" was estimated at 497 and 965 from the early and late runs. The harvest of "jacks" is substantially larger for shore anglers than for boat anglers.

Table 13. Angler Effort in Man-Days on Kenai River Chinook Salmon, 1977.

	<u>Downstream Section</u>	<u>Midstream Section</u>	<u>Upstream Section</u>	<u>Shore Anglers</u>	<u>Total</u>
Early Run	16,426	2,484	10,679	5,890	35,479
Late Run	31,233	3,328	5,087	7,891	47,539
Total	47,659	5,812	15,766	13,781	83,018
Percent Total	57.4	7.0	19.0	16.6	100.0

From the 897 creel checked chinook salmon, 380 readable scales were collected which provided the basis for age structure, length and sex data. During the 1977 season males, excluding jacks, were harvested at 1.5:1 males to females. As the estimated adult harvest is considered 7,321, 2,877 were females.

During the early run, the downstream section accounted for 49.8% of the total early run adults harvested and the upstream section for 33.9%. Corresponding figures for the late run are 78.6% and 4.5%, respectively. Catch distribution by river section is presented in Table 14. Table 15 presents historical data regarding the Kenai River chinook salmon fishery.

Analysis of scales indicated the predominate age class to be 1.4 (brood year 1970) in both early and late runs, 52.4% and 44.8%, respectively. Age class 1.3 (brood year 1971) was stronger during the late run than the early run, (Table 16). Table 17 shows length data from the 1977 early and late run chinook salmon by age class.

Chinook salmon are still entering the Kenai River system when the sport season normally closes July 31. Historical commercial records indicate that an average of 35.5% of the run enter the river after July 31. Also because of the one week timing delay between the commercial fishery and sport fishery it is felt that chinook salmon present in Cook Inlet after July 24 are not subjected to recreational effort. Commercial catch figures for the same years the creel census has operated on the Kenai River are presented in Table 18.

A management policy adopted by the Board of Fisheries in 1975 restricted the recreational harvest of late run chinook salmon from the Deep Creek Marine fishery and Kenai River fishery to that of the commercial east side set net harvest (statistical areas 244-20,30,40) with a 10% margin of error. This figure is based on the regularly scheduled two 12-hour periods per week. Because these limits would have been exceeded, the 1977 sport fishery was closed July 27.

Due to an abnormal abundance of sockeye salmon in Cook Inlet and another directive of the Board of Fisheries, the commercial harvest of chinook salmon was estimated at 13,350 and of these approximately 10,500 were assumed late run fish bound for the Kenai River. To protect coho salmon bound for the Susitna River system which are believed to travel north near the center of Cook Inlet, and still adequately harvest the sockeye salmon present, the Department of Fish and Game tried holding the drift gill net fleet along the east side beaches. This resulted in a harvest of about 3,000 chinook salmon by the drift fleet incidental to its harvest of sockeye salmon. The recent historical drift fleet average (1971 to 1976) has been approximately 300 chinook salmon. In addition, in order to harvest the record run of sockeye salmon, commercial fishing was allowed for eight continuous days during the peak of the migration. The results were that in 1977, 4,725 late run chinook salmon were harvested during the regularly scheduled two 12-hour periods in the east side set net fishery and an additional 2,888 were harvested during extra periods.

Table 14. Summary of Chinook Salmon Harvest on the Kenai River, 1977.

	Early Run				Total
	<u>Downstream</u>	<u>Midstream</u>	<u>Upstream</u>	<u>Shore Anglers</u>	
Adults	1,083	166	737	187	2,173
Jacks	222	21	9	245	497
Total	1,305	187	746	432	2,670
	Late Run				Total
	<u>Downstream</u>	<u>Midstream</u>	<u>Upstream</u>	<u>Shore Anglers</u>	
Adults	4,046	389	232	481	5,148
Jacks	323	29	0	613	965
Total	4,369	418	232	1,094	6,113
	Total Both Runs				Total
	<u>Downstream</u>	<u>Midstream</u>	<u>Upstream</u>	<u>Shore Anglers</u>	
Adults	5,129	555	969	668	7,321
Jacks	545	50	9	858	1,462
Total	5,674	605	978	1,526	8,783



Table 15. Historical Data Regarding Chinook Salmon Fishery on the Kenai River, 1974-1977.

<u>Year</u>	<u>Early Run</u>			<u>Late Run</u>			<u>Total</u>		
	<u>Harvest</u>	<u>Effort</u>	<u>Catch/ Hour</u>	<u>Harvest</u>	<u>Effort</u>	<u>Catch/ Hour</u>	<u>Harvest</u>	<u>Effort</u>	<u>Catch/ Hour</u>
1974	1,685	11,275	0.041	3,225	12,335	0.073	4,910	23,610	0.058
1975	615	15,047	0.011	2,355	14,943	0.044	2,970	29,990	0.024
1976	1,554	16,430	0.024	4,477	28,030	0.039	6,031	44,460	0.033
Mean	1,285	14,251	0.026	3,352	18,436	0.052	4,637	32,687	0.038
1977	2,173	35,479	0.019	5,148	47,539	0.036	7,321	83,018	0.029

Table 16. Age Structure of Sport Caught Chinook Salmon from the Kenai River, 1977.

	Age Class*								
	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>	<u>1.5</u>	<u>1.6</u>	<u>2.3</u>	<u>2.4</u>	<u>2.5</u>	<u>Total</u>
Early Run									
Number	29	61	108	3		1	3	1	206
Percent	14.0	29.6	52.4	1.5		0.5	1.5	0.5	100.0
Late Run									
Number	20	72	78	3			1		174
Percent	11.5	41.4	44.8	1.7			0.6		100.0
Brood Year									
	<u>1969</u>		<u>1970</u>	<u>1971</u>		<u>1972</u>		<u>1973</u>	
Early Run									
Number	1		6	109		61		29	206
Percent	0.5		2.9	52.9		29.6		14.1	100.0
Late Run									
Number			4	78		72		20	174
Percent			2.3	44.8		41.4		11.5	100.0

\* Age class 1.1 (ocean jacks) excluded.

Table 17. Fork Length Data from Sport Caught Chinook Salmon, Kenai River, 1977.

	Age Class			
	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>	<u>1.5</u>
	Early Run			
n	26	60	96	5
Range mm	482-723	680-1092	900-1320	1066-1295
Mean mm	640	915	1,117	1,195
S.D. *	53.2	89.8	97.7	82.6
	Late Run			
n	20	70	80	3
Range mm	558-768	635-1206	923-1339	1092-1403
Mean mm	700	953	1,137	1,246
S.D. *	53.4	123.0	87.9	155.5

\* Standard Deviation

Table 18. Commercial Chinook Salmon Harvest Data from Cook Inlet East Side Set Net Beaches (Statistical Areas 244-20,30,40) 1974-1977.

	<u>Early Run</u>	<u>Late Run</u>	<u>Total</u>
1974	211	5,560	5,771
1975	185	3,476	3,661
1976	876	7,362	8,238
Mean	424	5,466	5,890
1977	1,075	7,613	8,688

Hence, the allowable sport harvest from the Kenai River and Deep Creek was 5,200 fish. When it was apparent the recreational harvest would exceed the commercial harvest by more than the limits allowed by Board policy, the Kenai River was closed. At that time data indicated about 250 fish per day were being taken from the Kenai River. Thus, it is felt about 1,000 fish were prevented from being harvested. The total late run recreation harvest in 1977 was 5,514, exceeding the limits of the Board policy by 314 fish, 6.1%.

No escapement surveys were conducted in 1977 on the Kenai River due to flooding conditions prompted by an abnormally high snow pack in the Chugach Mountain Range. Reports from anglers fishing near the outlet of Skilak Lake indicated substantial spawning chinook salmon present and it is felt by the author that escapement was adequate.

## DISCUSSION

### Punch Card Fishery

The 1977 punch card fishery produced a record harvest and record escapement. More punch cards were issued to potential anglers in 1977 than in the previous years during which only the three streams were covered by the punch card system. With the demand for punch cards constantly increasing, the program is becoming extremely costly and very inefficient in terms of timely application of data for management purposes. Since the punch card system is not justified as a management tool and increasing costs have grown to a point where the cards can no longer be disseminated as a service, there appears to be two viable alternatives. One is complete elimination of the punch card and the other is to attach a fee large enough to cover costs of the system itself and possibly generate monies needed to expand the research programs on this species.

Analysis of this year's age structure indicated a strong showing of five year old fish (age class 1.3). It is likely that this will also result in a good showing of six year old fish in 1978, but unless the other age classes help out, there is no indication that next year will be as strong a return as was the 1977 season. Historical data indicate a smaller total run than was observed in the last two years. Also, the fact that chinook salmon runs were reported in many areas of Alaska does not conclusively indicate that these streams are showing the beginning of a continuing trend.

### Deep Creek Marine Fishery

The 1977 fishery off Deep Creek displayed a similar pattern to the 1976 fishery in that the early run provided most of the fish. Again an abnormally large escapement of chinook salmon was reported into the Susitna System; this, coupled with large runs into the local streams of Deep Creek and Ninilchik River, made for a very successful fishery.

Effort increased by 53.2% during the early run, but this can be partially explained by the changes in computation methods previously mentioned. Harvest from the early run decreased by 16.0%. Since the run into the Susitna was reported larger this year than last and the runs into the local

streams were comparable to last year's, the decrease in harvest cannot be readily explained as weather conditions were similar. Possibly the increased effort with more boat traffic had the effect of moving the fish around more than last year.

The late run received 9.0% more effort but the harvest decreased by 73.5%. These fish are bound primarily for the Kenai River and are also harvested in the commercial fishery. Since both the commercial fishery and the Kenai River fishery occur further up the Inlet than does the marine fishery off Deep Creek and no apparent absence of chinook salmon was noted in either of these fisheries, it is assumed that the run avoided the Deep Creek area. Fishermen reported large numbers of chinook salmon located farther off shore than most boats normally fished and that the fish were not striking.

The Commercial Fisheries Division is currently working on a computer analysis of the scales collected from the early run in conjunction with their stock separation program. It is hoped that enough differences will be found to assign the harvest off Deep Creek to various systems of origin. It has been suggested that many of the early run fish are bound for the Susistna Basin and the results of their work may lend credibility to this assumption.

#### Kenai River Fishery

With the collection of additional seasonal data it becomes more evident that escapement estimates of chinook salmon into the Kenai River System are needed. As increased effort by both sport and commercial fishermen is placed upon this resource, management problems will continue. The harvest of these stocks is growing and with the potential increase is reaching a point that damage to the run could result, especially if mangement decisions must be based on limited information. The need for accurate escapement estimates can no longer be avoided if this valuable resource is to be properly managed to the benefit of the recreational and commercial user as well as to insure of the viability of the resources.

A program, described by Hammarstrom (1977), utilizing a trap located below the fishery to capture and tag fish to be recovered in the sport fishery, still appears to be the most promising solution. Should this program be funded, it should be implemented as soon as possible.

The current Board policy regarding late run chinook salmon into the Kenai River is unsatisfactory when large runs of other salmon species are being targeted by the commercial fishery. Should the chinook salmon run be weak and the other species runs be large requiring additional fishing time, the incidental harvest of chinook salmon in the commercial fishery would become so high that the sport fishery harvest would not approach it, thus no closure would be enacted and an overharvest situation could become likely.

During years that this situation occurs it may be necessary to close the recreational fishery in order to protect the remaining chinook salmon even though the limits prescribed by the Board Policy are not reached.

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