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FORECAST RESEARCH ON 1970 COOK INLET AREA PINK SALMON FISHERIES

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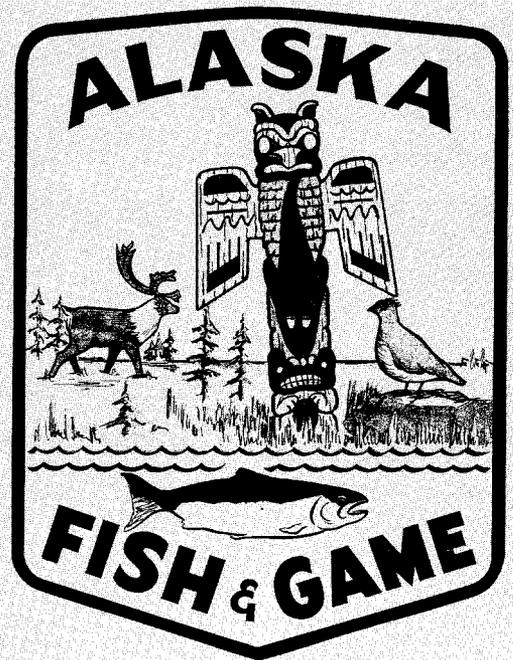


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INTRODUCTION

There are two distinct major pink salmon fisheries in the Cook Inlet area (Figure 1). Pink salmon spawning primarily in large glacial or turbid streams and rivers of the North, North Central, and South Central Districts are harvested by a gill net fishery. These fish are mainly produced in the Kenai and Kasilof rivers plus streams in the Susitna Basin. Runs during even numbered years have been much larger in size than runs during odd numbered years.

Streams in the Southern and Outer Districts are comparatively small, coastal and mainly clear water in nature. Pink salmon in these districts are harvested primarily by a seine fishery with some commercial harvest by gill nets in the Kachemak Bay region. Larger runs have occurred in these districts during recent even years; however, during the mid-1950's odd numbered years had the largest runs (Figure 2).

Forecast estimates of the numbers of pink salmon returning to the Southern and Outer Districts have been published for the years 1966 through 1969 (Alaska Department of Fish and Game Informational Leaflets 74, 98, 117, and news release: "Forecast research on 1969 Cook Inlet Area pink salmon fisheries"). The total return of pink salmon to the area includes both the commercial catch and escapement to the spawning streams. Comparisons of past predictions and actual returns are presented in Table 1.

^{1/} This investigation was financed by the Commercial Fisheries Research and Development Act (P.L. 88-309) under sub-project 5-4-R-6, Contract Number 14-17-0005-170.

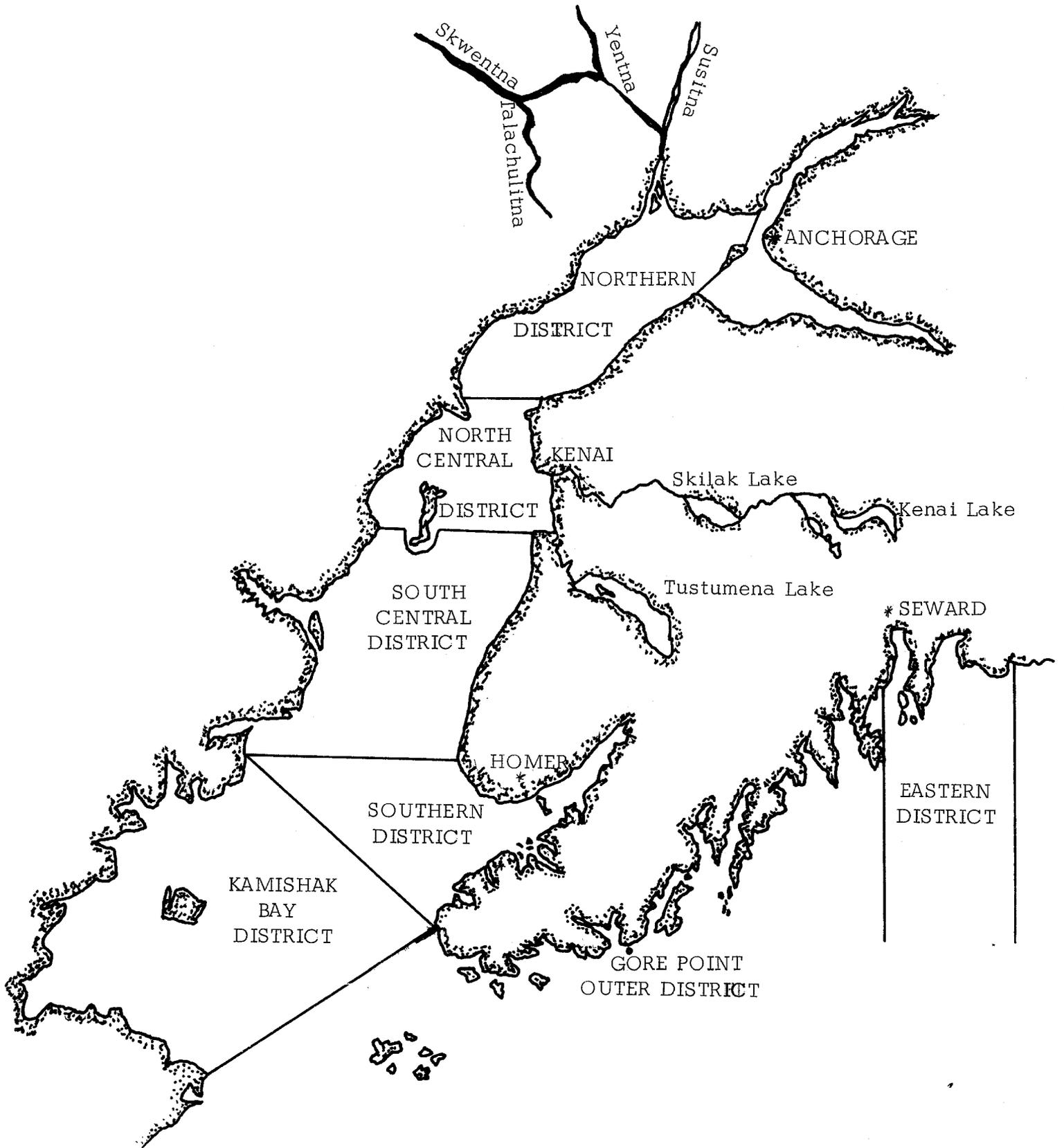


Figure 1. Cook Inlet Area Management Districts.

———— CATCH
- - - - - ESCAPEMENT

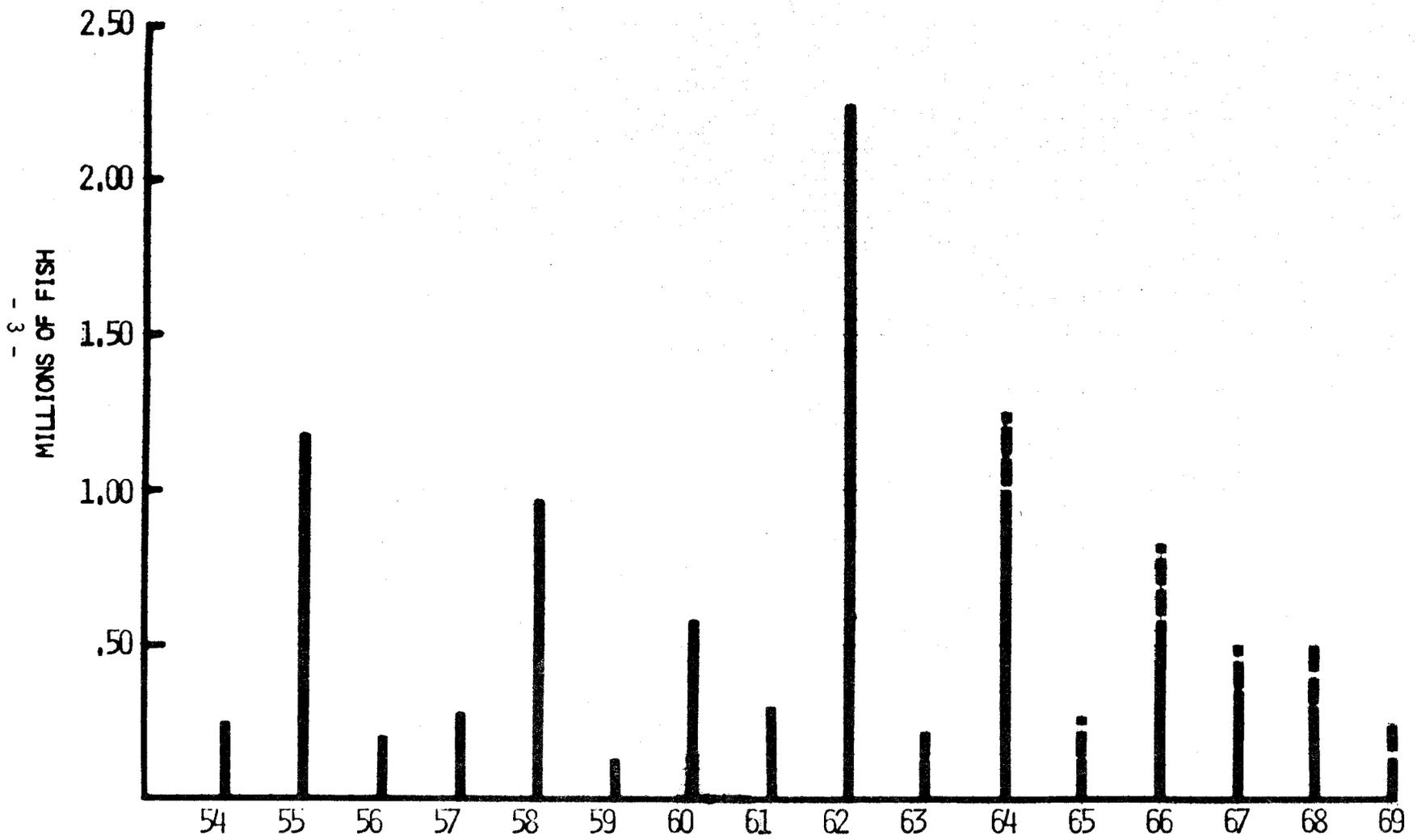


Figure 2. Pink salmon catch (1954-59) and escapement (1963-69) for the Southern and Outer Districts of Cook Inlet.

Table 1. Cook Inlet Southern and Outer Districts, summary of pink salmon catches, escapements, alevin densities, predictions and returns for the years 1962-1969 (number of adult salmon in thousands).

Brood year	Catch ^{1/}	Escapement ^{3/}	Weighted ^{4/} alevin/m ²	Adult Return		
				Year of return	Predicted return	Actual return
1962	2,114	466	210.5	1964	<u>5/</u>	1,304
1963	121	103	45.6	1965	<u>5/</u>	254
1964	1,034	270	198.5	1966	1,300	897
1965	112	142	106.7	1967	500	481
1966	645	252	84.4	1968	462	483
1967	358	123	90.5	1969	500	237
1968	287	196	385.3	1970	(2,000)	
1969	122 ^{2/}	115				

1/ Source -- fish receipts (Southern and Outer Districts only).

2/ Preliminary catch data.

3/ Includes nine study streams in Southern and Outer Districts only. Escapement figures in Informational Leaflet #117 included Middle Creek prior to 1966.

4/ Alevin density indices are derived from nine streams weighted by average escapements.

5/ Predictions were not made prior to 1966.

The ten major pink salmon producing streams in the Southern and Outer Districts were selected for sampling at the start of the program in 1963 (Figure 3). There are approximately twenty-five pink salmon producing streams in the two districts. It was not possible to sample all ten major streams during the first two years of the project, however, seven streams were successfully sampled. The alevin index calculated from these seven streams was used as the basis of the forecast for the years 1966 through 1968. Since 1964, nine streams have been sampled each year. In order to incorporate all of the sampling data into the forecast, the alevin index was back calculated for each year, and the nine stream index is the basis for the 1970 prediction (Table 2).

Middle Creek was dropped from the sample in 1964 following the Good Friday earthquake which virtually destroyed the pink salmon runs to this creek. China Poot Creek has been sampled since 1965 for general information but is not included in the forecast analysis.

1970 FORECAST

Southern and Outer Districts

The 1968 brood year alevin density as calculated from the sampling conducted in the spring of 1969 was 385 fry per square meter. On the basis of the linear regression of return on alevins as shown in Figure 4, this density results in an estimated total return of 2,000,000 pink salmon (catch plus escapement) in 1970 to the Southern and Outer Districts. With 90 percent confidence limits the range of the prediction would be 1,040,000 to 2,960,000 salmon. Note -- this forecast of two million pink salmon should be evaluated with some caution. The 1969 fry density of 385 fry per square meter is the largest density observed to date, and, as noted from Figure 4, this requires forecasting on the basis of a fry density level nearly twice as large as any previously observed density. From a statistical standpoint, the resulting 1970 forecast is made with less confidence than a forecast based on a fry density of a level previously observed. This is partially illustrated by the relatively wide range of the confidence interval.

The escapement needs for the districts vary with the return distribution. Approximately 225,000 pinks are needed for spawning purposes if all streams receive adequate numbers of fish. General desired escapement levels in the nine streams used for index purposes are as follows:

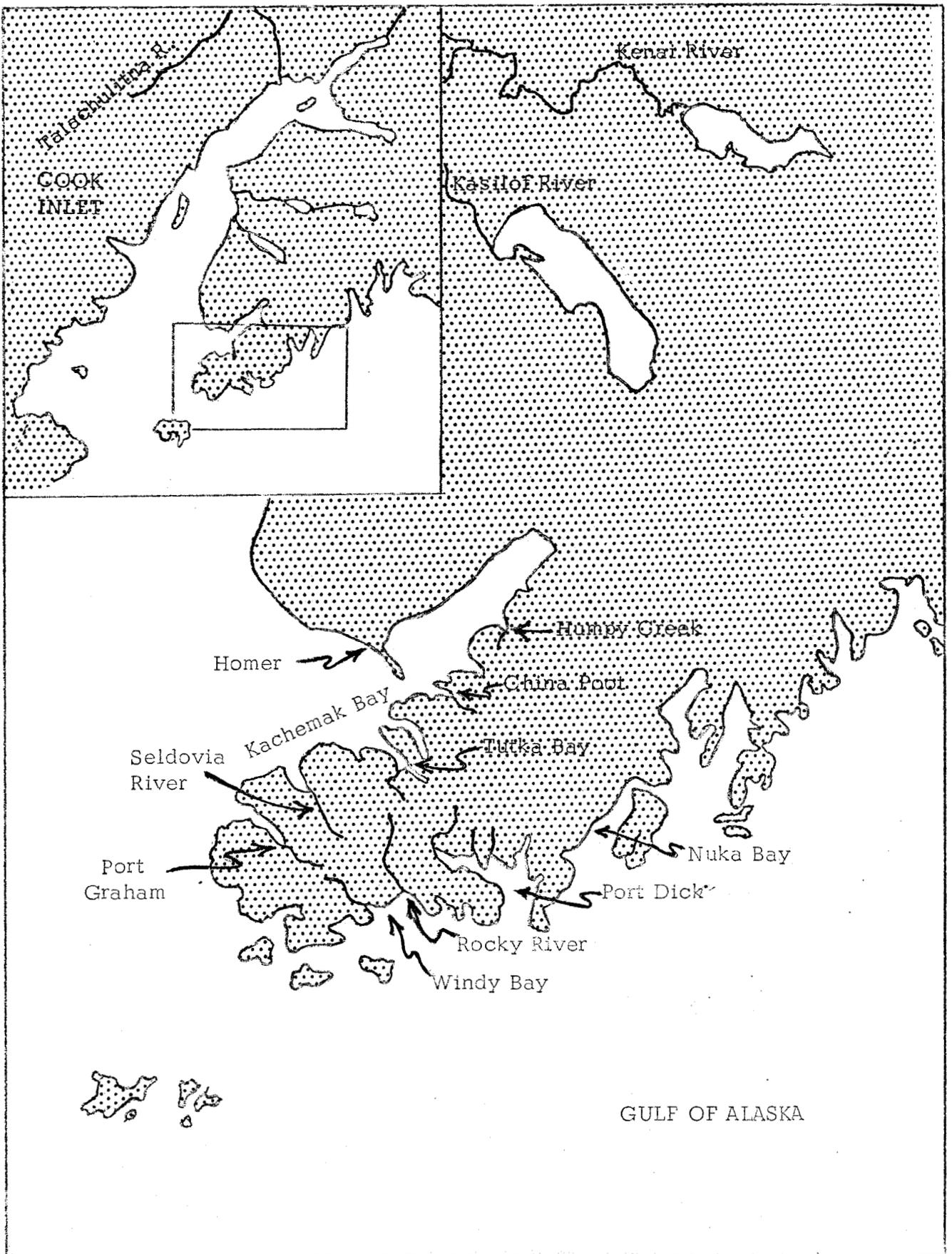


Figure 3. Cook Inlet Pink Salmon Study Stream Locations.

Table 2. Cook Inlet pink salmon alevin density data (1962-1968).

Stream	Fry per m ² per brood year						
	1962	1963	1964	1965	1966	1967	1968
Humpy ^{1/}	118.4	86.4	199.1	245.7	131.3	42.0	942.5
Tutka ^{1/}	139.9	72.3	195.8	154.7	120.5	40.5	516.5
Seldovia ^{1/}	231.4	84.3	284.1	151.3	136.6	117.8 ^{6/}	506.5
Pt. Graham ^{1/}	279.9	(40.0) ^{2/}	242.1	40.5	165.7	58.1	302.2
Windy L. ^{1/}	56.8 ^{8/}	56.8 ^{8/}	100.1	21.2	28.3	39.8	94.6
Windy R. ^{1/}	83.3 ^{8/}	83.3 ^{8/}	75.3	48.4	13.9	83.9	195.2
Rocky ^{1/}	(284.1) ^{3/}	0.0	131.3	(0.0) ^{5/}	11.4	0.0 ^{5/}	142.0 ^{7/}
Pt. Dick ^{1/}	240.0	5.4	222.7	149.6	43.4	319.6	236.1
Island ^{1/}	113.0	0.0	80.7	0.0	67.4	0.0	67.3
China Poot				244.3	673.9	973.8	1933.6
Weighted pre-emergent fry index ^{4/}	210.5	45.6	198.5	106.7	84.4	90.5	385.3

^{1/} Used only these streams when calculating weighted averages.

^{2/} Given same value as 1965 because of similar escapements.

^{3/} Used highest density observed because of large 1962 spawning density in Rocky River.

^{4/} Stream fry densities weighted by average escapement.

^{5/} Estimated zero fry density since escapement was estimated to be only 300 spawners.

^{6/} Used average pre-emergent fry density from previous two odd-years not sampled for 1967 brood year due to ice conditions.

^{7/} Average even year density from years (1962, 1964, 1966).

^{8/} Average density (1964-1968).

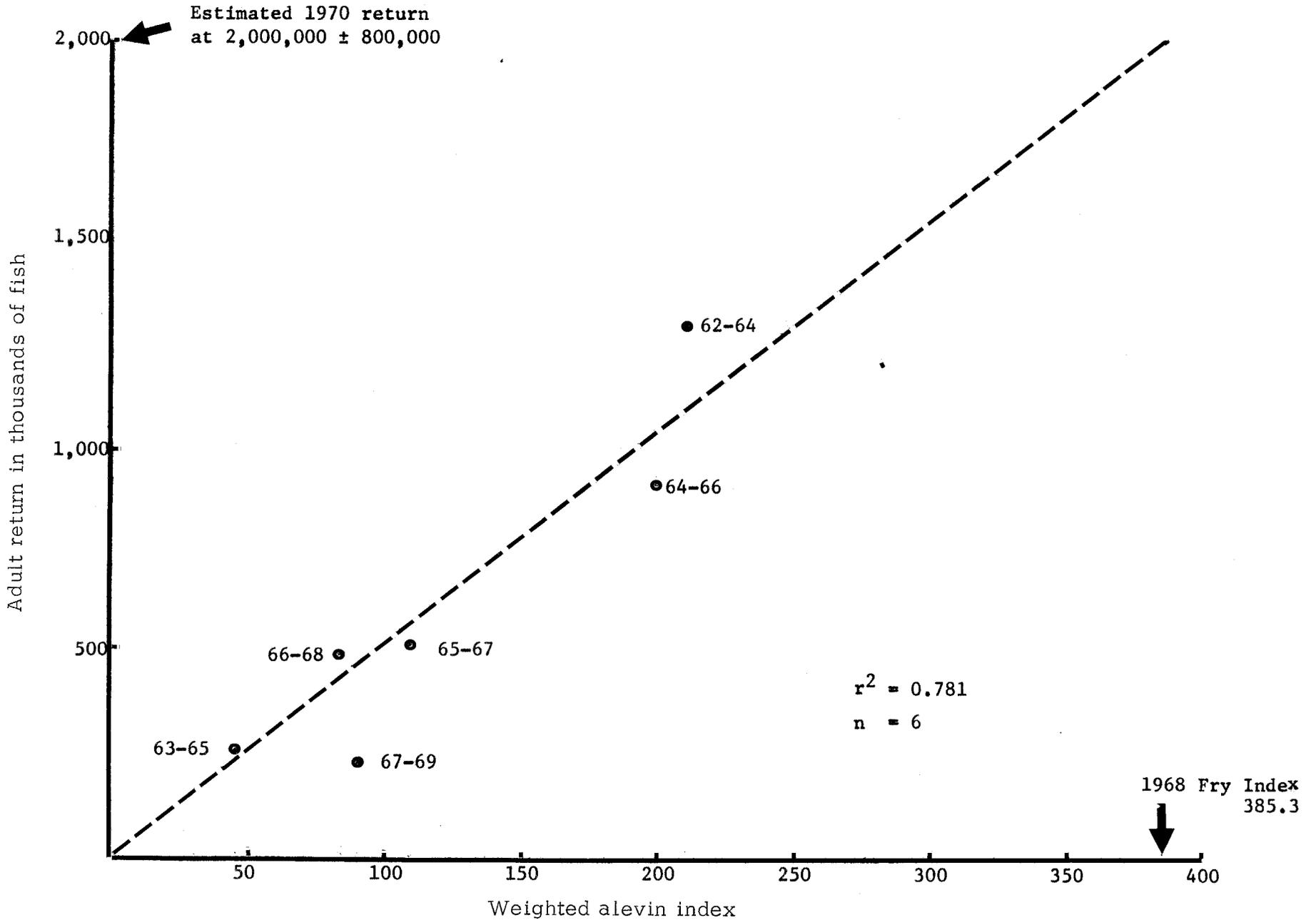


Figure 4. Cook Inlet Southern and Outer Districts, pink salmon, relationship between total return (catch plus escapement) and weighted alevin index.

<u>District</u>	<u>Stream</u>	<u>Desired Escapement Level</u>
Southern District	Humpy	22,500 - 30,000
	Tutka	4,500 - 6,000
	Seldovia	18,000 - 24,000
	Pt. Graham	<u>45,000 - 60,000</u>
	Sub-total	90,000 - 120,000
Outer District	Windy Left	7,500 - 10,000
	Windy Right	7,500 - 10,000
	Rocky	37,500 - 50,000
	Pt. Dick	22,500 - 30,000
	Island	<u>18,000 - 24,000</u>
	Sub-total	93,000 - 124,000
Total		<u><u>183,000 - 244,000</u></u>

These escapement levels were derived by applying a spawning density of 1.5 - 2.0 fish per square meter to the measured preferred spawning area in each of the study streams (McNeil, 1962). The lower end of this density range is higher than that quoted by some workers for natural spawning areas, but in this study only known preferred spawning areas were measured. The preferred spawning areas are those riffles that are used by salmon in most years. During years of peak abundance riffles not included in the total measured area may be utilized by a portion of the spawning population.

Sheridan (1969) states a desired spawning density of 1.0 fish per square meter (.1 per square foot) which would yield an escapement of about one half the upper limit given in the table above or about 60,000 and 62,000 for the Southern and Outer Districts respectively. On the basis of observation of past escapements and taking into account that all available spawning area in the stream was not measured, these figures seem low. In the absence of more refined estimates it is felt that 122,000 spawners for the Southern and Outer Districts would be very minimal and should not represent a management goal.

The stated levels are obviously of a very general nature and may be refined or modified as more information is gathered concerning spawning distributions within the individual study streams, escapement to alevin production and odd and even year run differences. These levels have been computed only as a general yardstick of adequacy of escapement during and following the fishing season.

Escapement of the same size in these districts may produce quite variable returns. This is apparently due to extreme fluctuations in over-winter survival in the eggs to alevin portion of the life history. These mortalities may be unusually severe in streams of the Southern and Outer Districts as a result of commonly adverse flooding conditions in the late fall-winter period.

Table 2 lists the alevin data for the streams sampled from 1962 through 1968. These data indicate that the major area of return will be in the Southern District. Humpy, Tutka, Seldovia, and Port Graham streams should all have large returning runs in 1970. Streams in the Outer District have average or above alevin densities.

Table 3 lists the estimated escapements to the study streams for the years 1962 through 1969.

The forecasted return of two million pink salmon is approximately the same level experienced in 1962. The largest portion of the 1962 return was made up of fish bound for streams in the Outer District, while a major share of the 1970 returns are expected in the Southern District (Table 4).

Northern, North Central, and South Central Districts

No predictions are made for the numbers of returning pink salmon to these districts. Pre-emergent fry sampling in the Susitna Basin has been attempted during even numbered years, but ice conditions in the area have limited success of the program. The average catch of pink salmon in the Northern District during even numbered years since 1960 was 443,000 pink salmon. The average catch for the North and South Central Districts during the same time period was 1,887,000 pinks.

Kamishak District

No prediction work has been conducted in the Kamishak District. The average even year catch of pink salmon since 1960 has been 47,000 salmon; however, the catch in 1968 was 198,000 pink salmon.

RUN TIMING

Southern and Outer Districts

Figure 5 illustrates the pink salmon catches by seine gear in the Southern

Table 3. Cook Inlet, estimated pink salmon escapements in thousands of fish^{2/}.

Stream	1962	1963	1964	1965	1966	1967	1968	1969	8 yr. average
Humpy	56.0	34.7 ^{1/}	18.5 ^{1/}	28.0 ^{1/}	30.0	25.0	24.7	5.4	27.8
Tutka	30.0	10.0	20.0	20.0	12.0	7.0	7.9	6.5	14.2
Seldovia	50.0	15.0	60.0	30.0	86.0	55.0	53.2	60.0	51.2
Pt. Graham	50.0	2.0	16.0	1.5	24.0	2.0	24.4	4.0	15.5
Windy L.	12.5	4.5	7.7	10.0	7.0	6.0	6.9	23.0	9.7
Windy R.	12.5	4.9	6.2	2.0	7.0	6.0	2.8	3.2	5.6
Rocky	200.0	12.0	80.0	.3	44.0	1.0	43.1	1.0	47.7
Pt. Dick	40.0	16.0	31.5	50.0	35.0	20.0	29.0	12.0	29.2
Island	15.0	3.6	30.0	.5	7.0	.5	4.3	.1	7.6
Total ^{3/}	466	103	270	142	252	123	196	115	209

^{1/} Weir count

^{2/} Escapement estimates were derived from peak counts or calculated from counts made throughout the spawning season. When series counts were available the total fish/days was divided by average stream life (2.5 wks.) to estimate total escapement.

^{3/} Rounded to nearest thousand.

Table 4. Cook Inlet pink salmon catches by bay during 1962, 1964, 1966, and 1968^{1/} (catches in thousands of fish).

Catch Location	1962	Percent	1964	Percent	1966	Percent	1968	Percent
Upper Kachemak ^{2/}	110	5.2	83	8.0	41	6.3	81	28.0
Tutka	269	12.7	101	9.8	54	8.3	27	9.4
Seldovia	145	6.9	44	4.3	59	9.1	24	8.2
Port Graham	10	.5	36	3.5	24	3.7	19	6.7
English	8	.4	2	.2			4	1.4
Dogfish	.3	0	.1	0				
Port Chatham	96	4.5	67	6.5				
Chugach	16	.8	29	2.7			19	6.7
Windy	63	3.0	69	6.7	35	5.4	3	1.2
Rocky	199	9.4	53	5.1	23	3.6	11	3.7
Port Dick	1,099	52.0	526	51.0	298 ^{3/}	46.3	55	19.2
Nuka	99	4.6	24	2.2	111	17.3	44	15.5
Total	2,114		1,034		645		287	

^{1/} Source - fish ticket receipts.

^{2/} Includes catches of pink salmon bound for Humpy and China Poot creeks.

^{3/} Includes 75,600 pinks which were caught and dumped due to lack of tender service and were not entered on fish tickets.

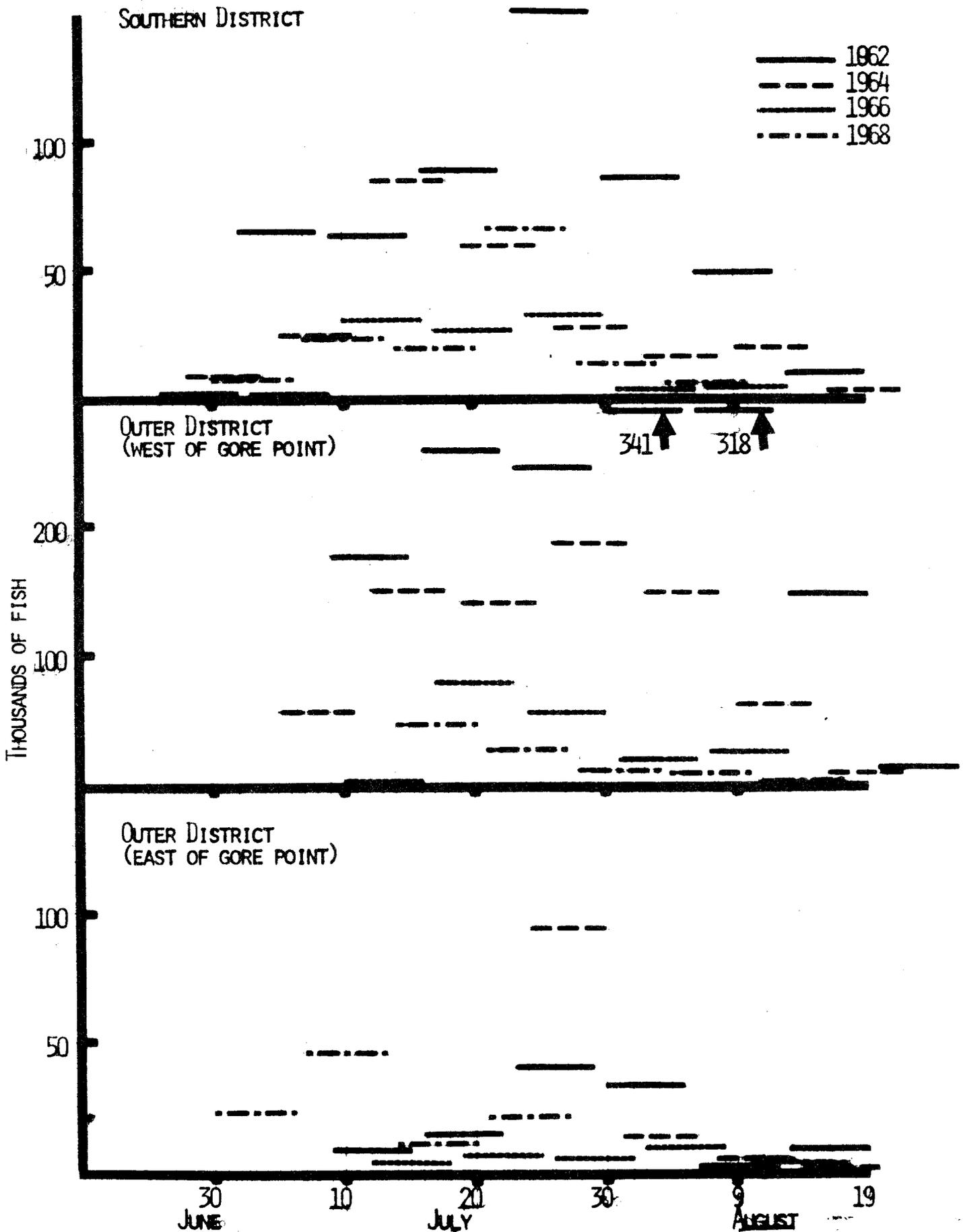


Figure 5. Pink salmon catches in selected seine net districts of Cook Inlet, 1962, 1964, 1966, and 1968.

and Outer Districts during 1962, 1964, 1966, and 1968. The lines indicate the total harvest of pink salmon during the inclusive dates. For purposes of these data, the two districts were separated into three fishing areas; Southern District (Kachemak Bay including Port Graham, Seldovia, and Tutka bays), Outer District west of Gore Point (Port Dick, Rocky, Windy, and Port Chatham bays), and Outer District East of Gore Point. Harvestable numbers of pink salmon generally appear in the Southern District close to the end of June or the last week in July. The peak of the harvest during even numbered years since 1962 has occurred in the last two weeks of July. It is anticipated that a large portion of the 1970 return will occur in the Southern District; therefore, relatively large catches of pink salmon should be made during July with catches tapering off in early August.

The Outer District west of Gore Point, which includes Port Dick, Rocky, Windy, and Port Chatham bays is not opened for commercial fishing until harvestable numbers of salmon are observed in the bays or estuaries. Pink salmon during even numbered years have generally entered the bays in commercial quantities by the second week in July with the peak catches occurring anywhere from mid-July to early August. Since 1962, the harvest peaks during years of high abundance have occurred somewhat later than in even numbered years of less abundance. The pink salmon timing of the returns to the Outer District east of Gore Point is similar to the Outer District west of Gore Point. The peak week of harvest should be in late July with some harvest occurring in early August.

Northern, North Central and South Central Districts

Figure 6 illustrates the pink salmon catches in selected gill net districts of Cook Inlet. Three fishing areas were selected for comparison purposes: Northern District (set net gear only), east side of the North Central District (drift net gear), and the Kalifonski Beach area (set net gear). Two distinct pink salmon runs enter the fishing districts and are available for harvest. The earliest run is bound for streams in the Susitna Basin and the harvest starts in the first week of July and continues until early August. The majority of the harvest of the Susitna bound fish will be made by drift nets in the North Central District and set nets in the Northern District. The second pink salmon run to enter the commercial fishery is bound for the Kenai and Kasilof rivers. The timing of this run makes it available for harvest during late July and early August with the peak occurring during the first week of August. Drift and set nets in the North and South Central Districts will harvest the majority of the catch.

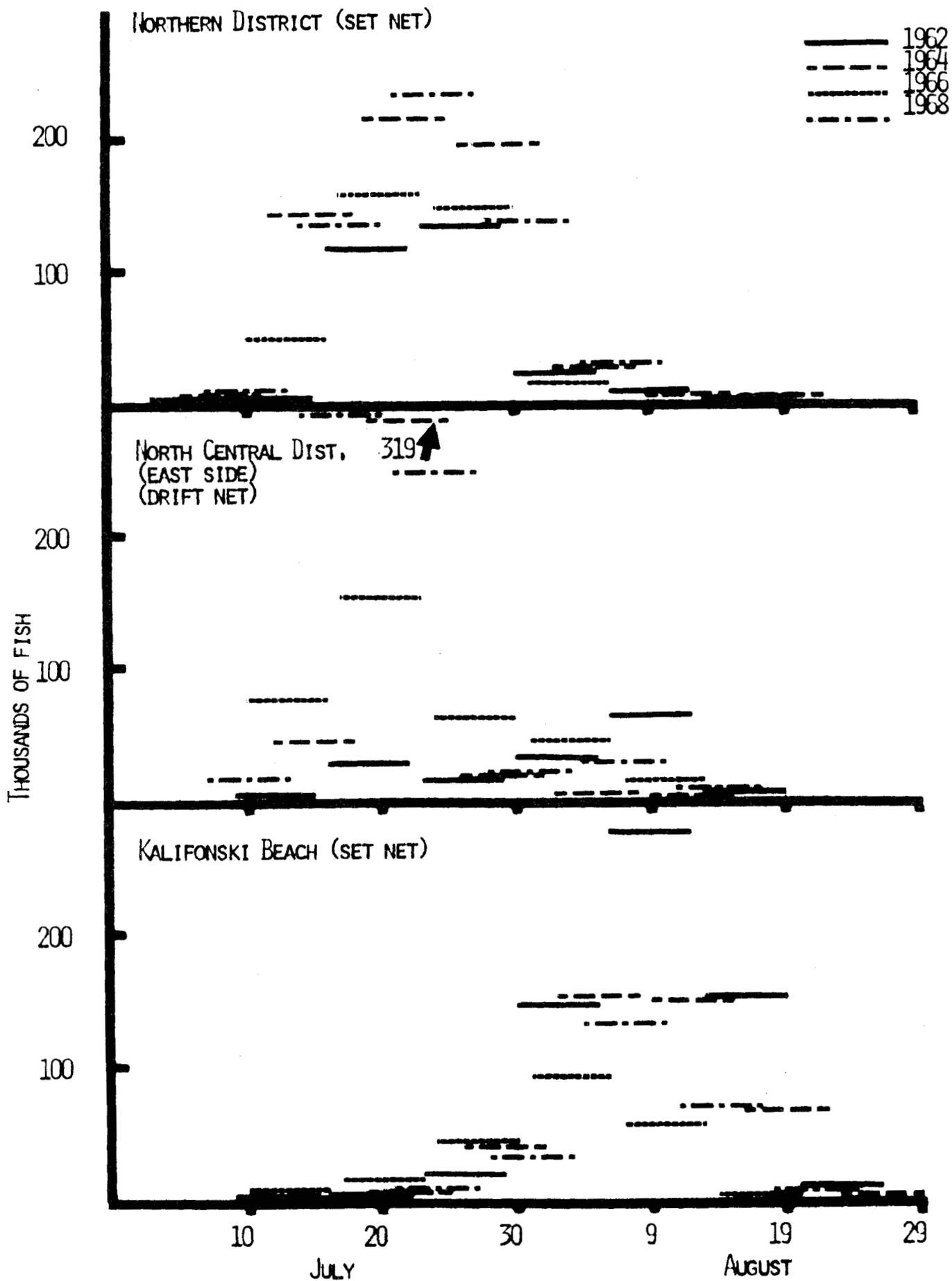


Figure 6. Pink salmon catches in selected gill net districts of Cook Inlet, 1962, 1964, 1966, and 1968.

SUMMARY

Pre-emergent fry sampling in the spring of 1969 resulted in a fry index of 385 alevin per square meter for the Southern and Outer Districts, and a subsequent 1970 forecast of two million pink salmon for these districts. Approximately 200,000 pink salmon are required for escapement to the streams in these two districts, consequently an estimated 1.8 million fish would be available for commercial harvest.

Data is not available on which to base forecasts of total pink salmon returns to the other districts. However, on the basis of recent commercial harvest trends a commercial harvest of approximately 2.4 million fish is projected for the Northern, North Central, South Central and Kamishak Districts.

Combining all districts, a commercial harvest of approximately 4.2 million pink salmon is projected for Cook Inlet in 1970.

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