

# INFORMATIONAL LEAFLET NO. 169

## A SUMMARY OF PRELIMINARY 1976 FORECASTS FOR ALASKAN SALMON FISHERIES

Prepared by:  
Division of Commercial Fisheries  
ALASKA DEPARTMENT OF FISH AND GAME

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January 1976

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ERRATA SHEET FOR INFORMATIONAL LEAFLET NO. 169 - A SUMMARY OF  
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There are errors in the second paragraph on page 43 of Informational Leaflet No 169 - A summary of preliminary 1976 forecasts for Alaskan salmon fisheries. The point estimates of forecast inshore harvests for Egegik, Nushagak, Ugashik and Togiak should be:

Egegik	-	760,000
Nushagak	-	875,000
Ugashik	-	190,000
Togiak	-	175,000

The corrected paragraph is:

Forecast returns indicate harvestable surpluses in all systems except Snake River. (Escapement requirements for the Kvichak River for a year following a peak year are 2 million fish. This level would allow a projected inshore harvest of 2.6 million fish.) Point estimates of forecast inshore harvests by district in descending order of magnitude are: Naknek-Kvichak - 3,700,000; Nushagak - 875,000; Egegik - 760,000; Ugashik - 190,000; and Togiak - 175,000. The point estimate of total inshore harvest (5.7 million fish) takes into account an estimated 1976 Japanese high seas harvest of 824,000 Bristol Bay sockeye (range = 165,000 - 1,489,000). If the reduced level of exploitation by the Japanese on Bristol Bay stocks evidenced in 1974 and 1975 is continued in 1976, the estimated high seas harvest might be as low as 281,000 fish. This would increase the point estimate of inshore harvest to 6.25 million sockeye salmon.

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## SUMMARY

A 37.1 million commercial salmon harvest is projected for Alaskan fisheries in 1976. Probable lower and upper limits for the harvest are 26.3 and 47.9 million salmon, the range of the limits having been calculated on the basis of the average difference between preseason projections and actual harvests for the years 1971-1975.

The projected 37.1 million salmon harvest for 1976 is higher than recent harvests. As reflected in the 1976 projected harvest, the severe winters of 1970-71 and 1971-72 continue to affect (although to a lesser degree than in previous years) the production of salmon in Alaska. A number of fisheries, particularly the pink salmon fishery at Kodiak and the pink and chum salmon fisheries in Prince William Sound, are forecasted to show a strong recovery due to adequate escapements and good survival.

Salmon returns to Southeastern Alaska, including Yakutat, are expected to contribute only 3.2 million fish or 9 percent of the total state harvest. An estimated 22.5 million salmon or 61 percent of the total are expected from the Central statistical region. The remaining 11.3 million or 30 percent of the salmon harvest is projected for the Western region.

The species composition of the projected 1976 salmon harvest is as follows: Chinook - 0.5 million (1%); Coho - 1.7 million (5%); Chum - 6.6 million (18%); Sockeye - 8.8 million (24%); Pink - 19.5 million (52%).

## INTRODUCTION

This is the seventh in a series of annual reports prepared by the Division of Commercial Fisheries, Alaska Department of Fish and Game, for the purpose of presenting pre-season forecasts of Alaska's commercial salmon fisheries. These reports are released in December, which makes the information available for some of the major fisheries in the state well before the season begins.

In order to provide pre-season forecast information at this time it is necessary to include preliminary data collected during the previous season in some of the analyses. Special attention is drawn to the use of preliminary data for commercial catches in 1975. Final compilation of the 1975 commercial catch statistics will not be completed until the spring of 1976. Some differences, though generally minor, will exist between preliminary commercial harvest data used in this report and the final data being compiled.

Salmon forecasts in this leaflet are also considered preliminary. Revision of data on which these forecasts are based and further analyses may require modification of the preliminary forecasts. In the past preliminary forecasts have not differed substantially from final forecasts. Final forecasts are published by the Department and/or are made available via the news media.

Pre-season projections of statewide commercial salmon harvests have been made annually since 1970. These past projections and subsequent commercial salmon harvests are shown below: (Numbers of fish in millions)

Year	Pre-season Projected Harvest	Actual Harvest
1970	95.5	68.5
1971	41.5	47.5
1972	46.7	32.0
1973	30.0	22.3
1974	15.6	21.8
1975	19.9	25.7 <sup>1/</sup>
1976: Point	37.1	
Range	26.3 - 47.9	
<sup>1/</sup> Preliminary data		

Differences between projected and actual harvest levels reflect the lack of precise information on salmon escapements, fry or smolt production and subsequent marine survival of salmon in many of the state's fisheries. Forecasting of annual salmon returns should continue to improve, as the state of knowledge on factors affecting survival increases and data bases expand.

### Terminology and Definitions

Definitions of some key terms frequently used in this report are as follows:

Salmon return or run - the total number of salmon returning in a given year to Alaskan waters from ocean rearing areas. A portion of these returning salmon is normally harvested while the remaining fish are allowed to reach the spawning grounds.

Commercial catch or harvest - that portion of a returning salmon run harvested by commercial fisheries.

Escapement, spawning population or brood stock - that portion of a returning salmon run which is not harvested and survives to reach the spawning grounds.

Different common names are often used for a particular species of salmon. The scientific names and most frequently used common names for the five Pacific salmon species are given below:

<u>Scientific Name</u>	<u>Common Name</u>
<u>Oncorhynchus tshawytscha</u>	king, chinook
<u>Oncorhynchus nerka</u>	red, sockeye
<u>Oncorhynchus kisutch</u>	silver, coho
<u>Oncorhynchus gorbuscha</u>	pink, humpback, humpy
<u>Oncorhynchus keta</u>	dog, keta, chum

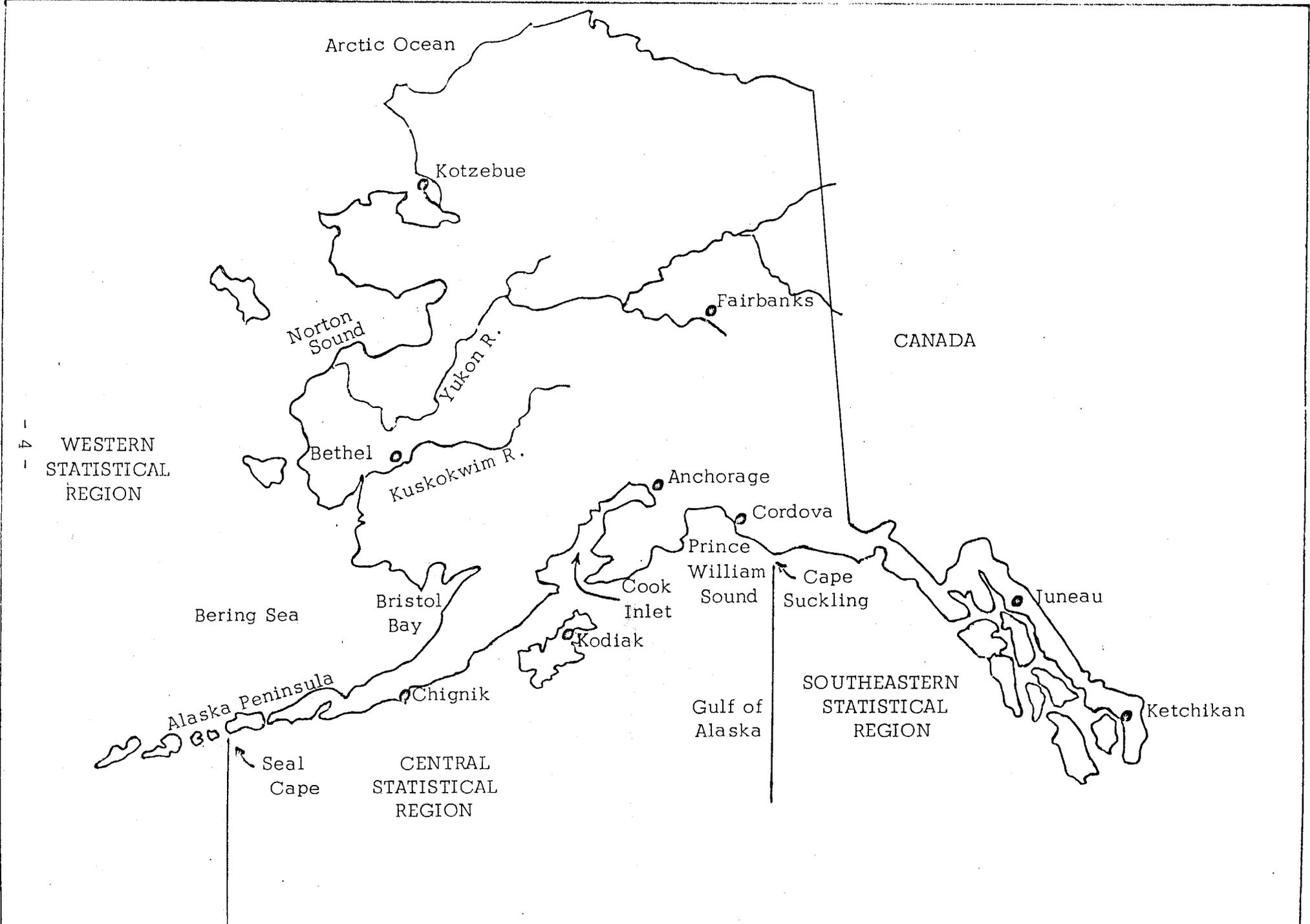
The three regions used for the purpose of this report are the statistical regions by which commercial fisheries statistics are presented in the Department's Statistical Leaflet series and in prior statistical reports. The boundaries of these regions are shown in Figure 1 and are defined as follows:

- SOUTHEASTERN: Dixon Entrance to Cape Suckling (including the Southeastern Alaska and Yakutat areas).
- CENTRAL: Cape Suckling to Seal Cape on the southwestern tip of Unimak Island (including the Copper River-Bering River, Prince William Sound, Cook Inlet, Kodiak, Chignik and South Side Alaska Peninsula areas).
- WESTERN: Seal Cape to, and including, the Aleutian Islands and the Bering Sea north through Kotzebue Sound (including the Aleutian Islands, North Side Alaska Peninsula, Bristol Bay, and Arctic-Yukon-Kuskokwim areas).

#### Acknowledgments

Materials presented in this report were prepared by Division of Commercial Fisheries biologists located in field offices throughout the state. Area biologists, not individually identified, contributed the materials for the discussion of the 1975 fishing season. Individual credit for forecast material is given following the area forecasts presented in Appendix A.

FIGURE 1. ALASKA DEPARTMENT OF FISH AND GAME COMMERCIAL FISHERIES STATISTICAL REGIONS.



## REVIEW OF THE 1975 SEASON

The 1975 Alaska commercial salmon harvest of 25.7 million fish, based on preliminary data, was somewhat higher than the previous record low of 20.9 million fish harvested in 1967, but the 1975 harvest represented only about 55 percent of the 1960 to 1974 average harvest of 47 million salmon.

The primary weakness in statewide harvests during the 1975 season was due to poor catches in the Southeastern, Kodiak, Chignik, and South Side of the Alaska Peninsula areas. It appears that stocks from most of these areas of the state continued to feel the effects of the unusually severe winters in 1970-71 and 1971-72.

The statewide harvest, although relatively low, exceeded the projected harvest range of 14.2 to 23.7 million fish. Stronger than anticipated returns of lower Cook Inlet and Prince William Sound pinks, Bristol Bay sockeye, and Arctic-Yukon-Kuskokwim chum contributed to the increase over the predicted harvest. A more thorough discussion of forecast accuracy and factors thought to be responsible for differences between pre-season forecasts and actual 1975 returns is given in the individual forecast reports for specific salmon fisheries for 1976. (See Table 1 for a comparison of the 1975 pre-season forecasts with the actual returns. It should be noted that the total returns include both catch and escapement figures.)

Commercial salmon harvests by species and major fishing areas in 1975 are shown in Table 2. As this information is compiled from preliminary in-season catch reports, some revisions will occur when final catch statistics are tabulated.

Additional comments on the 1975 commercial fishing season for specific areas are presented below.

### Southeastern Alaska and Yakutat

The total harvest of all species for Southeastern and Yakutat was 5.3 million fish, only about 34 percent of the average harvest since 1960. Coho, chum, and sockeye catches, expected to help offset the anticipated weak pink salmon return, were some of the lowest on record and amounted to only 35 percent, 32 percent, and 28 percent of their respective 15-year averages. The poor showing for these species is thought to reflect the high mortalities induced by severe winters in 1970-71 and 1971-72.

TABLE 1. COMPARISON OF PRELIMINARY 1975 SALMON RETURNS WITH PRE-SEASON FORECASTS FOR SOME MAJOR ALASKAN SALMON FISHERIES (Compiled 1/12/76).

(Number of fish in thousands)

Area	Species	Average harvest 1960-74 <sup>1/</sup>	Harvest <sup>2/</sup>	Escapement <sup>2/</sup>	Pre-season total return forecasted	Total return
Southern Southeastern	Pink	3,910	3,100	4,480	2,000	7,580
Northern Southeastern	Pink	5,533	583	1,500	4,600	2,083
Southeastern Subtotal		9,443	3,683	5,980	6,600	9,663
Prince William Sound	Pink	3,839	4,453	1,500	3,100	5,953
	Chum	414	101	60	220	161
Cook Inlet - Southern and Outer District	Pink	238	1,032	200	620	1,232
Kodiak	Pink	4,261	2,945	885	3,000	3,830
Chignik	Sockeye	688	399	534	1,090	933
Bristol Bay	Sockeye	8,064	4,828	19,337	12,900	24,165

<sup>1/</sup> Odd-year average for pink salmon.

<sup>2/</sup> Harvest and escapement figures are preliminary.

TABLE 2. PRELIMINARY 1975 ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND MAJOR FISHING AREAS (Compiled 1/12/76).

(Number of fish in thousands)

AREA	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeastern Alaska	283.3	159.4	355.5	3,682.8	624.1	5,105.1
Yakutat	2.2	73.5	37.2	78.5	3.7	195.1
SOUTHEASTERN REGION SUBTOTAL	285.5	232.9	392.7	3,761.3	627.8	5,300.2
Prince William Sound	22.1	542.7	83.5	4,453.4	101.4	5,203.1
Cook Inlet	4.9	713.1	230.2	1,403.7	975.1	3,327.0
Kodiak	0.1	136.3	21.9	2,944.5	84.6	3,187.4
Chignik	0.6	399.0	53.0	66.1	25.2	543.9
Alaska Peninsula - S. Side	--	235.0	--	60.0	111.0	406.0
CENTRAL REGION SUBTOTAL	27.7	2,026.1	388.6	8,927.7	1,297.3	12,667.4
Alaska Peninsula - N. Side	2.0	232.0	33.0	--	11.0	278.0
Aleutian Islands	No Fishery					
Bristol Bay	29.3	4,827.8	40.2	0.3	320.0	5,217.6
Arctic-Yukon-Kuskokwim	92.8	18.0	120.6	33.3	1,978.8	2,243.5
WESTERN REGION SUBTOTAL	124.1	5,077.8	193.8	33.6	2,309.8	7,739.1
TOTAL ALASKA	437.3	7,336.8	975.1	12,722.6	4,234.9	25,706.7

Although the 1975 Southeastern pink salmon harvest of 3.7 million was almost three times the point forecast of 1.3 million, it compared poorly to the average odd-year pink harvest since 1960 of 9.4 million. As anticipated, the early run of pinks was extremely weak. Net fisheries were closed for 3 weeks in mid-season, and the landing of troll-caught pinks was restricted during the same period. Middle and late run systems in southern Southeastern and the Sitka area produced larger than anticipated returns. About 3.1 million pinks were harvested in southern Southeastern compared to the forecast range of 0 to 0.3 million. The escapement of 4.5 million in the southern area also surpassed the forecast level but was below the overall goal of 6.0 million; the early run segment fell short of goal, but the later segments produced adequate escapements in most middle and late run systems. The pink catch of 0.6 million in the Sitka area accounted for the bulk of the pink harvest in northern Southeastern. Although the Sitka pink fishery was one of the best on record, the remainder of northern Southeastern produced fewer than 30,000 fish (only about 5% of the northern catch from Icy Straits which normally accounts for 80%). Escapement to northern streams accounted for only 1.5 million, less than half the forecast range of 1.8 to 3.9 million and far less than the goal of 4.0 million. One major reason underlying the particularly depressed return of northern Southeastern pinks is considered to be the severe cold spell in early November 1973 which exposed streams to near zero temperatures without the protection of snow cover.

#### Prince William Sound

A strong early and middle run of pink salmon in the Sound produced the largest pink catch since 1971, and the total return of 5.9 million pinks fell outside the pre-season forecast range of 1.3 to 4.9 million. A corrected forecast using additional data was made just prior to the season and gave an upper limit of 5.7 million pinks. The total commercial harvest of 4.4 million pinks was above the 3.8 million average for odd-years since 1960, and the overall escapement goal for the Sound was achieved.

The total return for chum salmon of 161,000 was 27 percent below the forecasted point return but still within the forecast range of 137,000 to 293,000. Because of the strong commercial effort for pinks in the Sound, this contributed to a chum harvest above the upper limit of the forecast range, but the escapement to the Sound was below the lower limit of the range and well below goal.

The king salmon catch on the Copper River was above average, but sockeye and coho catches were below average. The Bering River sockeye and coho harvests were also below average.

## Cook Inlet

The 1975 pink salmon harvest of 1.0 million in lower Cook Inlet was the largest odd-year catch since 1960 and was more than 4 times the odd-year average. The total return of 1.2 million pinks to the lower Inlet was above the upper end of the forecast range of 251,000 to 986,000. Escapement goals were achieved in all lower Inlet systems. The high return per spawner is thought to be at least partially due to favorable estuarine conditions in the spring of 1974 during fry emigration.

Cook Inlet coho and chum catches were the largest since 1970 and above their 1960-74 averages, but the sockeye harvest was below average. The total Cook Inlet catch of 3.3 million was the largest odd-year catch since statehood.

## Kodiak

The 1975 Kodiak catch of 2.9 million pinks was the largest since 1971, but was 37 percent below the odd-year average. The total return of 3.8 million was within the pre-season forecast range of 2.1 to 4.4 million, and the odd-year escapement goal of 0.8 to 1.0 million was achieved.

The total catch of 3.2 million for all species of salmon was only 54 percent of the 1960-74 average. Chum and sockeye catches were some of the poorest on record, reflecting the adverse effects of severe winters in the early 1970's. A weak chum return produced a catch of 84,600, which is only 11 percent of the 1960-74 average. The sockeye catch totaled 136,300 of which only 29,600 were taken in the Mainland District. The total sockeye catch was 29 percent of the 1960-74 average.

## Chignik

The Chignik fishery was one of the poorest in recent years. The early Black Lake sockeye run was weak, and the fishery was closed from June 9 until the end of the run. Despite the closures, the escapement of 309,000 lagged behind the goal of 350,000 to 400,000. The later Chignik Lake sockeye run was considerably stronger, and the escapement goal of 200,000 to 250,000 was reached. Almost 400,000 late run sockeye were harvested. Although the total run of 933,000 sockeye was within the forecast range of 760,000 to 1,480,000, the early run was only 52 percent of the point estimate for that run, whereas the late run exceeded its point estimate by 27 percent.

Pink and chum catches and escapements were also extremely poor.

## Alaska Peninsula and Aleutian Islands

The total salmon harvest of 684,000 was far below average. The commercial salmon harvest normally ranges between 2 and 4 million. Pink salmon, generally producing one-half of the total harvest, contributed a meager 9 percent this year. Chum catches were also poor on both sides of the Peninsula. The sockeye harvest along the South Peninsula was limited by a Board of Fish and Game directive to 235,000, only 40 percent of the average catch, while the North Peninsula catch of 232,000 was only slightly below the 15-year average. The total Peninsula harvest of 467,000 sockeye contributed 68 percent of the total catch, and sockeye salmon escapement goals were achieved in the major North Peninsula systems.

There was no active fishery in the Aleutians again this year.

## Bristol Bay

The 1975 return of 24.2 million sockeye to Bristol Bay substantially exceeded the forecast range of 8.4 to 17.4 million, and escapement goals were achieved in all the major systems, including the Kvichak. The commercial harvest of 4.8 million sockeye was the largest since 1971 but only about half the 1960-74 average and one of the lowest cycle year catches on record. Escapement goals were attained or exceeded in every major system. With the total escapement of 19.3 million and given average survival conditions, the Bay can be expected to produce another strong return in 1979 or 1980.

Coho catches were above average, but chinook and chum catches were considerably poorer. Pink returns are negligible during odd-years.

## Arctic-Yukon-Kuskokwim

The 1975 commercial salmon harvest of 2.2 million was the second largest ever recorded. A record harvest of 2.0 million chums accounted for 88 percent of the total harvest. Harvests of sockeye and coho salmon were also above average, but pink and chinook catches were below average. The 1975 chinook catch was the lowest since statehood.

The summer run of chums in the Yukon was the largest in recent years, and the Yukon River fall chum run was also above average. The Kuskokwim and Kotzebue district chum runs were also larger than average. The Norton Sound chum runs were considered only slightly better than average, and the record catch was influenced by greater effort in areas not previously fished.

The chinook salmon runs in both the Yukon and Kuskokwim rivers were considerably below average. Only 35 percent of the chinook salmon in both river systems were 4-ocean fish, normally the dominant age class.

## PRELIMINARY FORECASTS OF TOTAL SALMON RETURNS TO SOME MAJOR ALASKAN FISHERIES IN 1976

The Department's salmon management program includes a number of projects designed to provide pre-season forecasts of total salmon returns to some of the major salmon fisheries throughout the state. Areas and species on which intensified forecast research is presently being conducted were chosen on a priority basis relative to economic importance, potential predictability of annual returns, compatibility with existing programs and the need for management.

These intensified forecasting programs are generally designed to provide a more reliable forecasting basis than merely number of spawners in parent years. This may include more refined information on spawning distributions, survival to an intermediate life stage, population age compositions or some combinations of these factors. In addition to forecasts of total salmon returns to an area, information on the relative strength of returns to specific districts or systems obtained from these studies provides assessment of escapement goals and allowable harvests for improved management of these stocks.

Salmon stocks included in these intensified forecast studies have contributed from 50 percent to 70 percent of the total statewide salmon harvest in recent years.

### Preliminary 1976 Forecasts of Total Returns to Some Major Systems

Forecasts of 1976 returns to major Alaskan salmon fisheries for which forecasts of total returns are available are summarized in Table 3. Point and range forecasts are given for both total returns and anticipated harvest levels after escapement requirements (also listed) have been satisfied. Special attention is drawn to the range forecasts for both total returns and anticipated harvests as these ranges reflect the variability inherent in forecasting salmon runs.

Forecasts of pink salmon returns in 1976 are available for Southeastern Alaska, Prince William Sound, the Southern and Outer districts of Cook Inlet, Kodiak, Chignik, South Side of the Alaska Peninsula, and the Nushagak District of Bristol Bay. Forecasted pink salmon returns for these areas in 1976 total 30.6 million with an indicated harvest of 18.4 million fish. The forecasted runs to several areas are below optimal escapement requirements and will require harvest closures in an attempt to achieve escapement to these areas.

The predicted 5.6 million pink salmon return to Southeastern Alaska in

TABLE 3. PRELIMINARY FORECASTS OF TOTAL SALMON RETURNS TO SOME MAJOR ALASKAN FISHERIES IN 1976.

(Number of fish in thousands)

Area	Species	Forecasted Total Return		Escapement Goal	Estimated Harvest	
		Range	Point		Range	Point
Southeastern						
Southern	Pink	< 1- 9,600	4,100	6,000	0 - 3,600	200
Northern	Pink	< 1- 4,800	1,500	4,000	0 - 1,300	0
Subtotal	Pink	< 1- 14,400	5,600	10,000	0 - 4,900	200
Prince William Sound						
	Pink	4,700 - 8,700	6,700	1,500	3,200 - 7,200	5,200
	Chum	1,100 - 2,500	1,800	300	800 - 2,200	1,500
Cook Inlet - Southern & Outer Districts						
	Pink	208 - 1,350	780	250	0 - 1,100	530
Kodiak						
	Pink	10,600 - 14,000	12,900	2,500 - 3,000	7,600 - 11,500	10,150
Chignik						
	Pink	200 - 820	510 <sup>1/</sup>	500 - 700	0 - 120	60 <sup>1/</sup>
	Sockeye	460 - 1,170	715	650	0 - 520	65
South Side - Alaska Peninsula						
	Pink	800 - 1,500	1,150 <sup>1/</sup>	800 - 1,400	0 - 100	50 <sup>1/</sup>
Bristol Bay - Nushagak District						
	Pink	1,500 - 5,700	3,047	600 - 1,000	900 - 4,700	2,247
Bristol Bay						
	Sockeye	5,200 - 18,800	12,000	5,500	0 - 13,300	5,700 <sup>2/</sup>
Totals		24,768 - 68,940	45,202	23,450	10,900 - 45,640	25,702

<sup>1/</sup> Because of the relatively small amount of data accumulated to date in some new forecast programs, numerical calculations were made only for the lower and upper range of the forecast. The point estimates are merely mid-points of the ranges.

<sup>2/</sup> Inshore harvest - average Japanese high seas harvest already subtracted.

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1976 represents one of the poorest outlooks for major fisheries in the state. The estimated harvest is projected to be negligible unless the return reaches the upper half of the forecast range (5.6 to 14.4 million fish). Achievement of escapement goals will be critically important in 1976 to insure the future production of even-year pink stocks in Southeastern Alaska.

The point estimate for the 1976 return to southern Southeastern is 4.1 million pink salmon. At that level only a limited commercial harvest would be permissible. The return may reach 9.6 million which would allow for a harvest of about 3.6 million. If there is a harvestable surplus, it would probably be restricted to portions of Districts 1, 2, or 3, but there is little prospect for prolonged fishing in broad areas. Return timing should be about 25 percent early (spawning before August 10), 30 percent middle (August 10 to 30) and 45 percent late spawning (September 1 or later). There is also a very real possibility of extremely poor pink salmon returns in some areas, and achievement of well distributed escapement will be critically important in 1976.

The pink salmon return to northern Southeastern is expected to be extremely weak. The point estimate (1.5 million) would not support any commercial harvest. If a surplus does develop, it will probably occur in District 10 and 11. If the timing pattern of the parent year is repeated the return should be about 35 percent early, 55 percent middle, and 10 percent late. The spawning populations of District 14 (Icy Strait) streams are severely depleted and complete protection of those runs is essential. Low returns are also expected throughout Districts 9, 12, and 13.

For Prince William Sound a total return of 6.7 million pink salmon is forecast for 1976 with a projected allowable harvest of 5.2 million fish. Probable lower and upper limits for the total returns are 4.7 and 8.7 million fish. The 1976 returning adult pink salmon are the progeny of the 1974 estimated escapement of 872,000. Variability between past forecasts and actual returns indicates a range of  $\pm 2.0$  million fish. With an optimum estimated escapement level of 1.5 million, the commercial catch should range between 3.2 and 7.2 million pinks.

Because of good density distributions of pre-emergent alevins in the Eastern, Northern and Northwestern districts the major portion of the commercial harvest should be comprised of these stocks.

The Prince William Sound 1972 chum escapement of 301,680 produced an alevin density index of 141 alevins per square meter, one of the largest indices in the program's history. This apparent low egg to fry mortality, coupled with normal marine survival, could produce a return of 4 fish per spawner. Even if the 1976 adult return is in the lower forecasted range, it will be among the largest on record. The preliminary point estimate is 1.8 million

chum with a range of 1.1 to 2.5 million.

In the Southern and Outer districts of Cook Inlet a 1976 pink salmon return of 780,000 is predicted. The 1974 total escapement of 40,000 was the lowest on record since the March 1964 earthquake. The weighted alevin index for 1974 was the third greatest for these years indicating good stream survival for the winter of 1974-75. A conservative management approach to the 1976 season will be necessary. Nearly 90 percent of the harvest is expected to come from the Southern District between Seldovia Bay and Chugachik Island in Kachemak Bay, and only a limited seine fishery is anticipated for Port Graham in the Outer District.

A total return of 12.9 million pink salmon is forecast for the Kodiak area for 1976 with a range of 10.6 to 14.0 million. Pre-emergent sampling indicated good to excellent overwinter survival from a well-distributed brood year escapement although the escapement was 13 percent below the even-year average. Sampling yielded an unweighted index of 203.4 fry per square meter, a 16 percent increase above the average even-year index of 170.7 and second only to the 292.3 index which produced a peak return of 15.1 million pinks in 1970. Since the escapement goal for even-year returns is 2.5 to 3.0 million pinks, a harvest range of 7.6 to 11.5 million pinks can be expected, depending upon the actual magnitude and distribution of the 1976 return.

Sockeye salmon are normally the most important species in the Chignik fishery. For 1976, the sockeye return is expected to range between 460,000 and 1,170,000 with the point return estimated at 715,000. The escapement goals are 400,000 for the early Black Lake run and 250,000 for the late Chignik Lake run. If both runs are near the low end of the range, there will be no commercial harvest of sockeye salmon in 1976. A limited harvest of 100,000 to 450,000 early Black Lake sockeye is anticipated with a return in the upper portion of the forecast range. No fishery on the late Chignik Lake run is anticipated prior to August, and the total late run harvest is not expected to exceed 95,000 fish.

Pink salmon returns to Chignik are expected to remain depressed in 1976. The point return is forecast at 510,000 with a range of 200,000 to 820,000 fish. With an escapement goal of 500,000 to 700,000, a harvest of no more than 120,000 pinks can be anticipated, even if the returns fall within the upper portion of the forecast range.

A return of 1.2 million pink salmon is anticipated for the south side of the Alaska Peninsula. Although the Peninsula pre-emergent project is still in the developmental stage, after readjustment and the addition of these 1975 pre-emergent sampling and escapement data the correlation coefficient between

fry densities and subsequent returns is very good. The forecast for this area is the first attempt based primarily on pre-emergent sampling results. The 1974 escapement was low, but stream sampling showed considerable improvement in alevin densities over the 1972 and 1973 brood year fish, indicating reduced mortalities from freezing and scouring. Estuarine and marine survival conditions also appear improved as evidenced by the 1974 and 1975 returns.

An estimated 1.5 to 5.7 million pink salmon are expected to return to the Nushagak District in 1976, with the point forecast set at 3.0 million. A harvestable surplus of 2.0 to 2.4 million pinks is anticipated above escapement requirements of 0.6 to 1.0 million. Survival conditions for the 1974 brood year fish were good. Escapement was well distributed; spawning conditions were excellent; a heavy snow cover provided good insulation during severe winter temperatures. The only factor which might adversely affect survival was the late breakup experienced in 1975.

The 1976 forecasted return for Bristol Bay sockeye is 12.0 million (range 5.2 to 18.8 million) of which 47 percent are expected to be 2-ocean and 53 percent 3-ocean fish. More than 38 percent of the run is expected to be 5 and 6-year old fish from the Kvichak River. Escapement requirements for Bristol Bay total 5.5 million fish. Forecast returns indicate harvestable surpluses in all systems except Snake River. The point estimate forecast of inshore harvests for Bristol Bay is 5.7 million fish taking into account an average Japanese high seas harvest of returning sockeye. The inshore harvest would be expected to change depending on the actual impact of the high seas fishery.

Salmon runs for which forecasts of total returns have just been presented are expected to contribute an estimated 25.7 million salmon to the 1976 Alaska commercial harvest. By comparison, these runs contribute about 16 million in 1975, 10 million in 1974, and 12 million in 1973.

Additional information on forecast techniques, relative strength of returns to specific districts or systems, potential problems anticipated for the 1976 season, and other items of interest related to the above forecasts are presented in Appendix A.

PROJECTED TOTAL COMMERCIAL SALMON HARVEST FOR ALASKAN FISHERIES  
IN 1976

Pre-season forecasts of salmon runs and anticipated harvests for specific fisheries are of value to fishermen and processors planning to operate in the coming year. At the same time, the forecast also provides information to many agencies, industries or persons only indirectly involved in fisheries, such as industrial suppliers, the transportation industry, and the state government (for projection of state revenues). As a result, the Department is continuing to develop a basis for providing useful and accurate pre-season estimates of total state salmon production.

For salmon fisheries not discussed in the previous section, it is generally necessary to base pre-season estimates of harvest on recent harvest trends. Projections based on this method will generally reflect more variation from actual harvests since adjustments are not made for variations in brood stock abundance or annual survival rates.

The trend of reduced salmon harvests experienced in 1973, 1974 and to some extent in 1975 (primarily because of the abnormally high mortalities experienced by Alaska salmon stocks due to the severe winters of 1970-71 and 1971-72), may account for some of the variability in projecting the statewide salmon harvest for 1976. As shown below, salmon spawned in 1970 and 1971 will still contribute to the 1976 return.

Primary Brood Years Contributing to the 1976 Alaska Salmon Return

Species	Age of Returning Salmon in Years				
	2	3	4	5	6
Pink	1974				
Chum		1973	1972		
Coho		1973	1972		
Sockeye			1972	1971	1970
Chinook			1972	1971	1970
Note: The above age classes generally contribute in excess of 90 percent of adult salmon returns.					

Pink salmon returns in 1976, while emanating from the 1974 brood year spawning, will in some areas reflect indirectly the poor survival of fish spawned in 1972. Pink salmon escapements in 1974 - returning from the 1972 brood year spawning - were substantially below optimum levels in some areas in spite of very restricted fisheries. Thus while an apparent average to good fry survival occurred in some areas during the 1974-75 winter and spring, projected total 1976 pink salmon harvests will remain below pre-1974 average levels. Since the majority of Alaskan chum salmon mature as 4-year fish, the 1976 chum harvest will be primarily from the 1972 spawning class and can be expected to have a stronger return because of good escapements to the major fisheries that year. The majority of sockeye salmon returning in 1976 will be 4-year and 5-year fish from 1972 and 1971 brood years and, hence, the statewide sockeye harvest in 1976 is also expected to remain depressed. There is little direct information on the effect of the recent severe winters on coho and chinook salmon expected to return in 1976.

The projection for Alaska's 1976 commercial salmon harvest of 37.1 million salmon of all species by statistical region and species is presented in Table 4.

The Southeastern statistical region is expected to produce 3.2 million salmon, about 9 percent of the total 1976 statewide harvest. Pink salmon are expected to contribute only 200,000 (6%) of the projected Southeastern harvest, far below the even-year average harvest of 13.2 million for 1960-74. Chum and coho are expected to contribute approximately 1.0 million fish each (31%), catches which are nearly equal to the 1960-74 average harvests. The sockeye catch should be 600,000 (19%) of the harvest, somewhat less than the 1960-74 average of 770,000. An average harvest of chinooks is expected to contribute 300,000 (9%) of the catch. Although near-average runs are anticipated for species other than pinks, it is uncertain whether the factors responsible for near-record low returns of sockeye, coho, and chum in 1975 are still operative. A conservative management approach may be required to protect these runs if they fail to return at the anticipated levels.

Sixty-one percent of the 1976 catch, or 22.5 million salmon, is expected to come from the Central statistical region. A majority of this catch will be pink salmon (16.5 million fish, or 73%). The even-year pink salmon average is 15.8 million. The anticipated 5.2 million pink harvest for Prince William Sound is twice the even-year average, and the anticipated Kodiak catch of 10.1 million pinks is also above average. Chum salmon are expected to contribute 3.4 million (15%) of the regional harvest, above the 1960-74 average of 2.6 million. The large chum harvest of 1.5 million expected in Prince William Sound will be more than four times the 1960-74 average of 414,000. Sockeye are expected to contribute only 2.2 million (10%) of the regional harvest, below the 1960-74 average of 3.4 million. Cook Inlet, Chignik, Copper River, and

Kodiak systems are expected to produce in descending order the majority of the sockeye salmon harvest for the Central region. Coho are expected to contribute 400,000 fish (2%) of the harvest, also below the 1960-74 average of 517,000.

The remaining 11.4 million salmon (31%) is expected to be harvested from the Western statistical region. Projected sockeye and pink salmon catches represent 53 percent and 25 percent, respectively, of the Western regional harvest. The greater part of this catch is anticipated to come from Bristol Bay. The projected harvest for Bristol Bay sockeye is only 71 percent of the 1960-74 average (8.0 million), but the anticipated harvest for pink salmon is approximately three times the even-year average of 1.0 million. For the remainder of the Western region, the chum fishery on the Yukon River is expected to contribute about half of the area chum harvest, with Kotzebue, Norton Sound, and the Kuskokwim making up the difference. The anticipated 2.2 million chum catch is twice the 1960-74 average and reflects the increased importance of this fishery in the last 5 years. King salmon are expected to make up 1 percent (150,000) of the harvest, slightly less than the 1960-74 average of 238,000.

The projected 1976 harvest is expected to produce approximately 1.7 million 48-lb. cases and about 50.9 million pounds of fresh/frozen and cured salmon products. Estimates of case pack, fresh/frozen and cured products are based on the assumption that relative demands for these products in 1976 will be similar to those in 1974 and 1975. The percentage of Alaska's salmon processed as fresh/frozen and cured products has increased in recent years.

In addition to the point projection of 37.1 million for the 1976 salmon harvest, a probable harvest range has also been provided to indicate the variability or projection error which might be expected. Deviations between pre-season projections and actual harvests for the 5 years 1971-75 have averaged about 29 percent ignoring the direction of deviation. On this basis a probable harvest range of 26.3 to 47.9 million fish has been calculated for the 1976 season.



## CONCLUDING REMARKS

Annual Alaska commercial salmon harvests since 1950 are presented by statistical region and species in Appendix B with total annual harvests being shown graphically in Figure 2. The largest harvest since 1950 was 68 million in 1970 while a harvest of 20 million in 1967 was the smallest. Annual harvests averaged 41 million during the 1950's, 51 million during the 1960's, and 36 million during the first 6 years of the 1970's. These figures include only domestic, inshore salmon catches and do not include Alaska salmon harvested by foreign fishing fleets on the high seas.

The upward trend reflected in Alaska's salmon harvests during the period 1959-71 was reversed in 1972 with a catch of 32 million and subsequent catches of 22 million in 1973 and 22 million in 1974. The 1975 catch of 26 million indicated a slight increase in the harvest. If the 1976 projection of 37 million is substantially correct, this would mark a further increase in the harvest exceeding the 1970-75 average of 36 million fish.

Available information continues to indicate that the primary factors responsible for the present depressed state of Alaska's salmon runs was the unusually severe winters and springs of 1970-71 and 1971-72 during which juvenile salmon suffered above average mortalities. There is further evidence that in some areas of the state unusually high mortalities occurred in both freshwater and early marine life stages of young salmon. There have been no changes in Alaska's basic fisheries management policies or strategies which would have adversely affected salmon harvests or production levels on such a statewide basis.

If the projected pink salmon harvest in the Prince William Sound (5.2 million) and Kodiak (10.1 million) areas, the chum salmon harvest in Prince William Sound (1.5 million), and the sockeye salmon harvest in Bristol Bay (5.7 million) materialize, these three areas will contribute 61 percent of the total projected harvest for 1976.

As already indicated, recent reduction in the number of commercial salmon harvested annually in Alaska has been largely due to the reduction in pink and sockeye salmon harvests. As shown in Figure 3, the average annual pink salmon harvest during 1970-75 declined 26 percent below the harvest level of the 1960's; the sockeye salmon harvested declined 10 percent and coho 5 percent. During the 1970-75 period, average chinook harvests were the same while chum harvests increased 8 percent, the latter being due primarily to increased effort in the northern areas of the state.

Because recent reductions in salmon harvest has been largely due to

FIGURE 2. ANNUAL COMMERCIAL HARVESTS OF ALASKAN SALMON, 1950-1976.

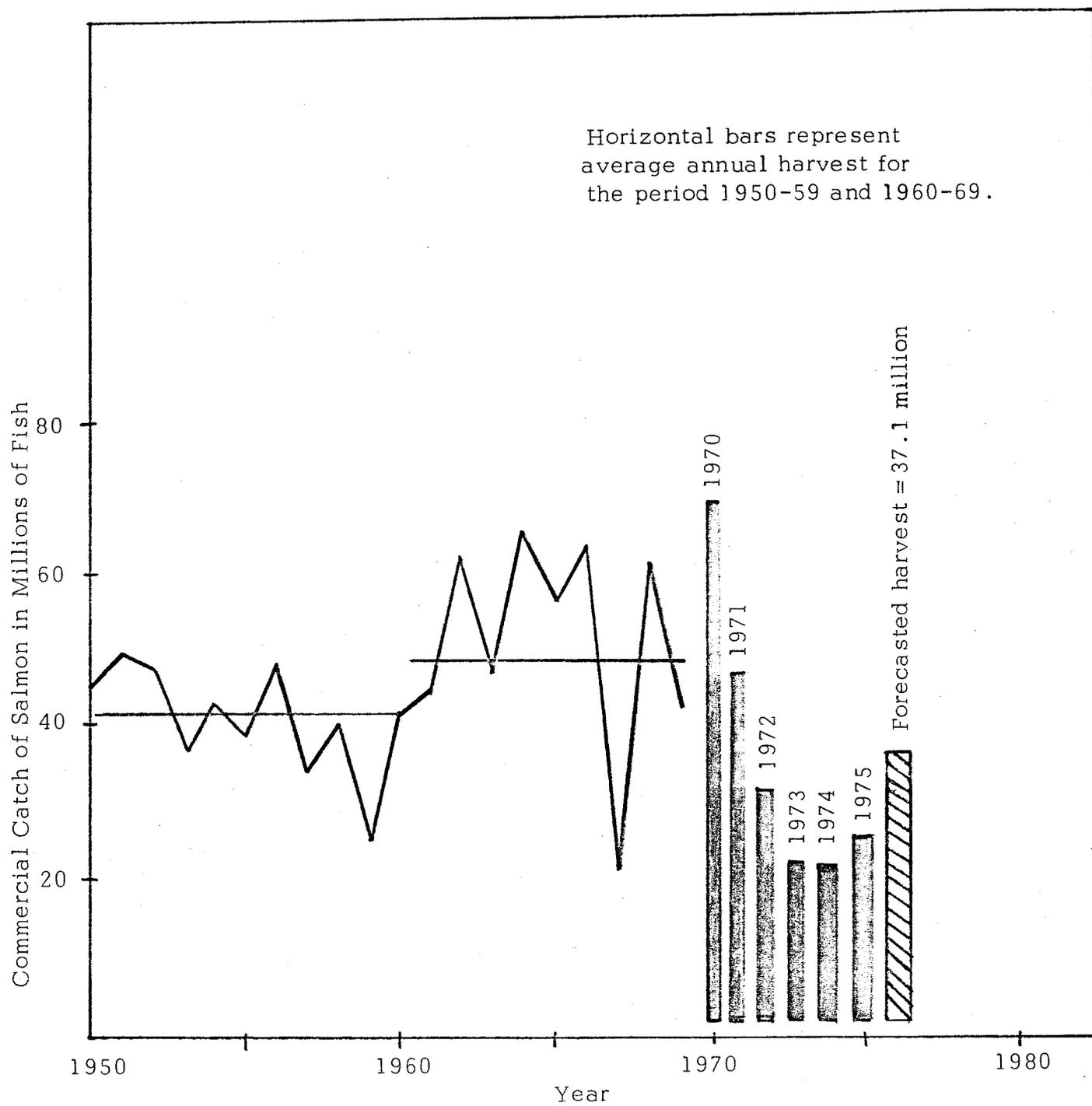
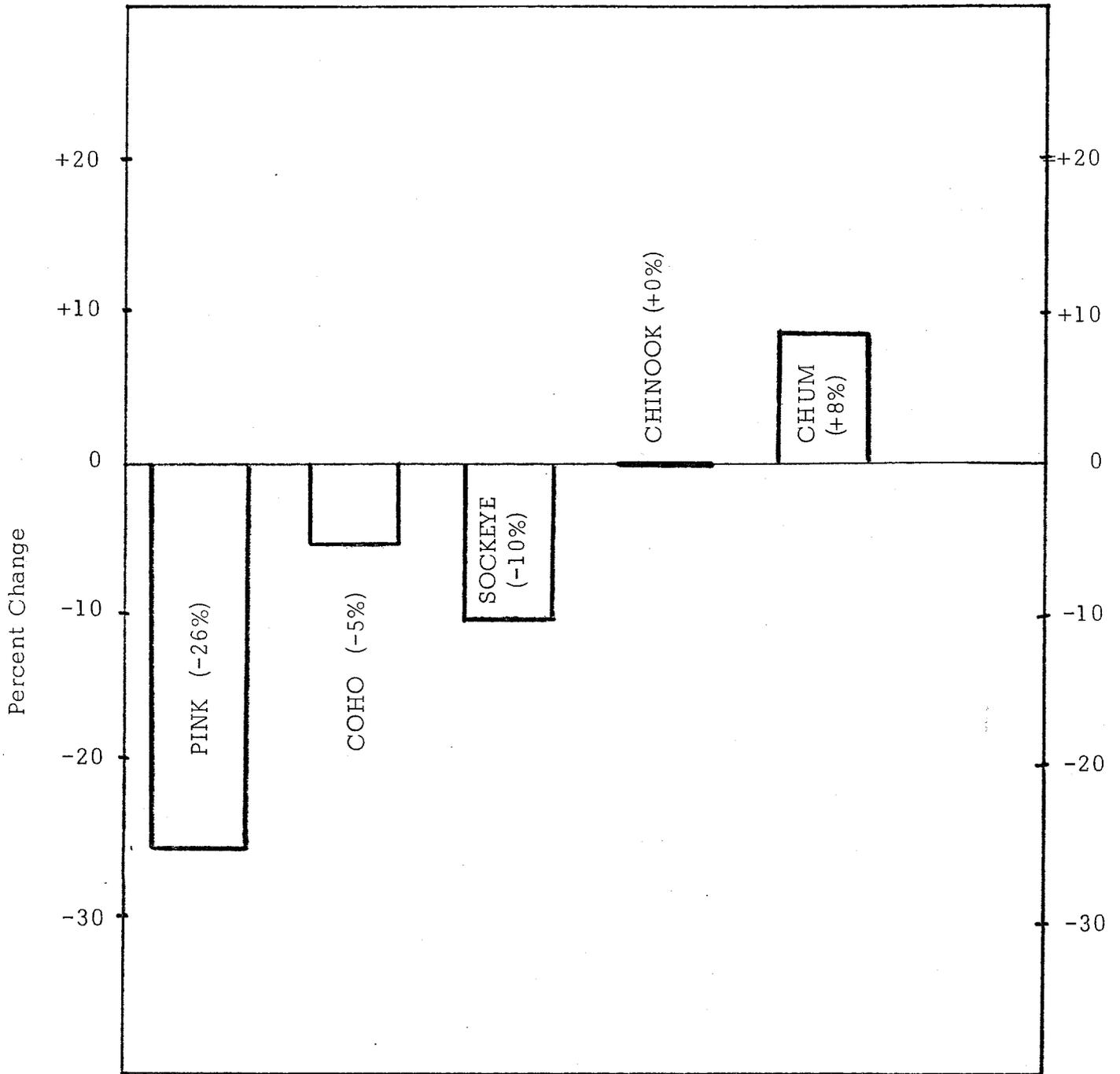


Figure 3. Percent changes in average Alaska salmon harvest by species from the period 1960-69 to the period 1970-75.



reduced pink salmon catches, the relative reduction in total pounds of salmon harvested and total value received by fishermen has not been as great as the relative reduction in numbers of fish. Pinks are normally both the smallest in average size and least valuable on a per pound basis of the five species of salmon.

The 1976 projected harvest of salmon shows an increase above the average 1970-75 harvest. This increase indicates that the declining trend in harvests may have been reversed. Salmon harvests for 1974 and 1975 and the projected 1976 harvest show an increasing trend. Historically since 1900, Alaska's salmon runs have demonstrated an ability to produce at or above the 20 million mark in spite of the occurrence of unfavorable natural survival conditions. These recent harvests, coupled with improved attainment of escapement goals, indicate that an initial recovery of Alaska's salmon runs has occurred.

Chum salmon returns to the Arctic-Yukon-Kuskokwim regions in 1975 were at near record levels and the return of Bristol Bay sockeye was nearly twice the projected run. Pink salmon escapement goals were achieved in parts of the Alaska Peninsula and in Kodiak, Southern Cook Inlet, Prince William Sound, and most of southern Southeastern Alaska. This information, combined with the fact that the basic productive potential of Alaska's salmon does not appear to have been impaired in recent years, indicates that with average survival conditions, the state's salmon runs can again recover as they did from the low of the 1950's and produce again at the level of the 1960's.

In conclusion the Department wishes to emphasize that the estimates of salmon harvests for 1976 are dependent on salmon returns being of the magnitude anticipated. Returns weaker than forecasted may require additional restriction on harvests to insure escapement goals while returns larger than anticipated may result in relaxation of regulations to insure maximum sustainable harvests.

APPENDIX A. PRELIMINARY FORECASTS, FORECAST TECHNIQUES AND  
DISCUSSION OF ANTICIPATED 1976 SEASON FOR MAJOR SALMON FISHERIES  
FOR WHICH FORECASTS OF TOTAL RETURNS ARE AVAILABLE.

FORECAST AREA: Southeastern Alaska

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Southern Southeastern

Point Estimate = 4.1 million

Range Estimate = <1 - 9.6 million

Northern Southeastern

Point Estimate = 1.5 million

Range Estimate = <1 - 4.8 million

Total Southeastern

Point Estimate = 5.6 million

Range Estimate = <1 - 14.4 million

FORECAST METHODS:

Returns referred to in this forecast are more precisely return indices, as they represent the sum of the commercial catch and escapement index rather than the sum of the catch and total escapement estimates.

Southeastern pink salmon forecasts are based primarily upon the analysis of relationships between pre-emergent fry density indices and subsequent adult returns. Additionally, data on escapements, estuarine temperature, air temperature, precipitation, and other factors are examined to improve the forecast analysis. Separate forecasts for southern and northern Southeastern have been calculated since 1967 because of differences in migration routes and abundance trends of pink salmon stocks from the two segments.

For the 1976 southern unit forecast a multiple linear regression of fry index, Ketchikan sea water temperature, and adult return was used because this method was quite successful in predicting the 1974 southern return. The 1976 northern unit forecast is based on a multiple regression of weighted pre-emergent fry values, air temperatures, and

adult returns. The raw district fry indices are weighted to compensate for the variation in the proportion of the escapement which occurs in sample streams and also to account for differences in the available spawning area between districts.

#### DISCUSSION OF THE 1976 FORECAST:

Conditions for the 1975 pre-emergent fry sampling (ice cover, water levels, flying conditions) were ideal and the sampling program was the most extensive in thirteen years of sampling in Southeastern. Nearly 5,800 hydraulic samples were collected in 143 individual sections of 102 major spawning streams throughout the region. The very low fry densities observed clearly point toward very poor pink salmon return in 1976 in both southern and northern units. Sixty percent of the areas sampled produced either very few live fry or none at all. Only 7 percent of the areas produced substantial numbers of live fry.

Several factors contributed to the low fry production: 1) Low escapement. Due to generally poor returns, the 1974 escapements in both southern and northern Southeastern were the lowest for even-years since 1960 and in most districts were less than half of the district goals. 2) Loss of spawn during high water. Heavy rainfall occurred throughout Southeastern during October, November and December of 1974. October rainfall at Ketchikan, for example, was 17.6 inches above average. Some streams showed obvious signs of flooding when sampled the following spring and egg loss was probably widespread. 3) Freezing and desiccating of fry. Below normal temperatures were prevalent in Southeastern during February 1975. Deviation ranged from 3.5 to 7.4° F below average at a time when streams were low and snow cover was lacking. Substantial numbers of dead fry were found during sampling in March and April.

The possibility of early fry outmigration, prior to the time of our stream sampling, has been examined as a factor. Trapping of outmigrant fry was conducted on a limited scale in the southern area and records of similar studies involving 17 Southeastern streams over a period of several years were carefully reviewed. The analysis shows that very few pink salmon fry leave the streams prior to April 2. Fry that do go out early seldom survive due to low food abundance, slow growth, cold temperatures and extended predation.

In Southern Southeastern we expect that low fry production may be partially offset by favorable estuarine conditions at the time when the fry were leaving the streams. Ketchikan sea surface temperatures were above average and dense plankton blooms were observed. Survival of

the few fry entering the estuaries was probably enhanced. Northern Southeastern estuaries were colder than average and fry survival was probably not exceptional.

Prepared by: Alan Kingsbury  
Fisheries Research Biologist  
Juneau

Paul Larson  
Fisheries Research Biologist  
Ketchikan

FORECAST AREA: Prince William Sound

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 6.7 million

Range Estimate = 4.7 - 8.7 million

FORECAST METHODS:

Prince William Sound pink salmon forecasts are based on pre-emergent alevin indices obtained from a standard list of streams and sample zones. The data obtained from this list are analyzed using linear regression analysis to establish the point and range estimates for the brood year adult return.

DISCUSSION OF THE 1976 FORECAST:

The 1976 adult pink salmon return is the progeny of the 1974 estimated escapement of 872,000. The resultant pre-emergent alevin index was 264 alevin per square meter which indicates an adult return of 6.7 million pink salmon in 1976. Variability between past forecasts and actual returns indicate a small probable range of  $\pm 2.0$  million.

With an optimum estimated escapement level of 1.5 million, the commercial harvest should range between 3.2 and 7.2 million pinks.

Brood year pre-emergent alevin indices indicate that the commercial harvest should be the result of stocks destined for streams in the Eastern, Northern and Northwestern districts.

SPECIES: Chum Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 1.8 million

Range Estimate = 1.1 - 2.5 million

## FORECAST METHODS:

The method used for forecasting chum salmon adult returns is the same as for pink salmon with two basic exceptions. These exceptions are: 1) a different standard stream list is used for chum salmon and 2) the forecast is based primarily on 4 year old fish which have averaged 75 percent of the total annual returns. Chum salmon also mature at 3, 5, and 6 years of age.

## DISCUSSION OF THE 1976 FORECAST:

The 1972 brood year alevin index of 141 alevins per square meter is by far the largest in the programs history. The 1972 brood year estimated escapement which produced this index was 301,680. If the forecast's point estimate is correct the brood year escapement will have produced at a rate of nearly 6 fish per spawner. At the lower forecast range the return rate will be nearly 4 fish per spawner. If the 1976 adult return comes in even at the lower forecasted range it will be among the largest recorded chum salmon return on record.

The reason, or reasons, for the extremely high pre-emergent alevin survival is not understood. Examination of weather records shows that the mean air temperatures for November 1972 through March of 1973 were slightly below the mean based on the years 1952 through 1974. Rainfall for the August-September period of 1972 was also just slightly below the mean for the same period of years.

One explanation for this abnormally high alevin index is that the 1972 pink salmon estimated escapement was very low (618,000). This could very well mean that there was considerably less displacement and/or superimposition of chum salmon eggs by spawning pinks.

It should be emphasized that this forecast is well beyond the range of any previous chum salmon forecast in Prince William Sound. Therefore, the staff thinks it appropriate to state that they are expecting a good chum salmon year for 1976. It is quite possible that the actual return may be somewhat lower than the point estimate forecast.

Prepared by: Michael L. McCurdy  
Fishery Research Biologist  
Cordova

FORECAST AREA: Cook Inlet - Southern and Outer districts only

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 780,000

Range Estimate = 208,000 - 1,350,000

FORECAST METHODS:

The 1976 pink salmon forecast for the Southern and Outer districts of Cook Inlet was derived from the relationship between alevin density and subsequent return. Indices of alevin abundance from nine major spawning streams are obtained in the spring prior to fry emergence. The fry densities of each stream are weighted by mean escapement for that stream. The resultant individual stream indices are combined to derive a weighted alevin index for the two districts as a whole. This index is correlated with subsequent return and the regression line computed.

Prepared by: Scott C. Kyle  
Assistant Area Biologist  
Homer

FORECAST AREA: Kodiak

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 12.9 million

Range Estimate = 10.6 - 14.0 million

FORECAST METHODS:

The 1976 pink salmon forecast for the Kodiak area, excluding the Mainland District, was based upon the relationship between alevin densities and subsequent adult returns. Densities obtained from twenty-nine index streams were developed into an overall alevin index which was then correlated with past indices and returns. Data analysis was as follows: the low estimate resulted from a linear regression using all years data, the point estimate by using the upper confidence limit from the preceding regression, and the high estimate by using a ratio calculation expressing cycle year averages. Qualitative indicators suggested a return exceeding the upper range provided by the above regression, thus the ratio calculation yielded a more credible high estimate. Analysis of estuarine temperature data, yet unfinished, may necessitate minor adjustments to this preliminary forecast. District catch projections presuppose two conditions: achieving minimum escapement goals from an actual return equivalent to the point estimate and achieving district returns proportional to brood year district returns.

DISCUSSION OF THE 1976 FORECAST:

Pre-emergent sampling indicated good to excellent overwinter survival from a well distributed brood year escapement which was 13 percent below the average even-year escapement. Sampling yielded an unweighted index of 203.4 fry per square meter; a 16 percent increase above the average even-year index of 170.7 and one which is second only in magnitude to the 292.3 index which brought back the excellent 1970 return of 15.1 million pinks. Brood year escapement accounted for 90 percent of the spawners entering the index streams as opposed to the even-year average of 70 percent. This fact does tend to emphasize the lower portion of the forecast range, however the point estimate does favor the upper portion of the range as indicated under FORECAST METHODS.

For 1976, indications are that a total of 10.6 to 14.0 million pink salmon will return to the Kodiak forecast area. Since the spawner escapement goal for even-year returns is 2.5 to 3.0 million pinks, a harvest range of 7.6 to 11.5 million pinks can be expected, depending upon the actual magnitude and distribution of the 1976 return.

Preliminary analysis by the Fisheries Research Institute (University of Washington) of their 1975 estuarine tow-netting data strongly supports this ADF&G forecast.

A breakdown by major geographical districts as to strengths and weaknesses of the expected return is indicated below:

- (1) Afognak District: District alevin density was 63 percent below the even-year average. However, survival was good from this low brood year escapement. Index systems received 71 percent of the district escapement, thus Afognak and Marka rivers should be the major natural contributors to this district's return. In addition, supplemental production from the Kitoi Bay hatchery will provide a harvestable surplus for that portion of the district. The anticipated district harvest of 1.0 million pinks includes, as always, intercepted fish bound for the westside and Alitak districts.
- (2) Westside District: District alevin density was 30 percent above even-year average, and survival was generally excellent from an excellent brood year escapement. Index systems received 98 percent of the district escapement. Red River and Karluk remain the major pink salmon producers for the forecast area and should provide, along with Uganik and Zachar rivers, a district harvest of approximately 6.4 million pinks.
- (3) Alitak District: District alevin density was 35 percent above even-year average, and survival was also excellent from an excellent brood year escapement. Index systems received 69 percent of the district escapement. Deadman and Humpy remain the major producers, although Dog Salmon and Lesser Olga Bay systems will be significant contributors to this district's anticipated harvest of 1.1 million pinks.
- (4) General District: District alevin density was 14 percent above even-year average, and survival was excellent from a fairly good escapement. Index systems received 80 percent of the district escapement. Northend production will contribute heavily to this district's anticipated harvest of 1.9 million pinks.

Prepared by: Larry Malloy  
Assistant Area Management  
Finfish Biologist  
Kodiak

FORECAST AREA: Chignik

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Early (Black Lake) Run

Point Estimate = 500,000

Range Estimate = 350,000 - 850,000

Late (Chignik Lake) Run

Point Estimate = 215,000

Range Estimate = 110,000 - 320,000

Total Chignik System

Point Estimate = 715,000

Range Estimate = 460,000 - 1,170,000

FORECAST METHODS:

Early Run

The method used in previous years to forecast the early run is based on the relationship between the numbers of returning 2-ocean age and 3-ocean age sockeye. The early system sockeye salmon are usually dominated by age 1.3\* fish. However, age classes of 2.3, 1.2, and 2.2 are also important contributors to the return. Also, usually, the larger the return of 2-ocean age fish in one year, the larger will be the return of 3-ocean age fish in the following year. The forecast return is then the sum of the forecasted return of 3-ocean age fish plus the average number of returning 2-ocean age fish over the previous 10 years.

A return of 401,000 3-ocean age sockeyes is expected in 1976 based on samples of 2-ocean age fish taken from Chignik Lagoon and the river in 1975. An average of 57,000 2-ocean age fish return each year. Thus, the total expected return is 458,000 sockeye. However, if samples of 2-ocean age fish from the spawning grounds are used, the total forecast is reduced to 369,000 fish. The forecast range of 350,000 to 850,000 is based on Fisheries Research Institute (FRI) tow-net fry sampling data collected from Black Lake during the summer of 1972.

\* European Formula - number of freshwater annuli - decimal - number of saltwater annuli.

Although the 1971 escapement of approximately 670,000 sockeye was the largest early run escapement since 1947, it was followed immediately by the severe winter of 1971-72. Nevertheless, FRI Black Lake tow-net data indicated a fair abundance of fry in 1972, and Chignik fishermen reported large numbers of smolt in the lagoon during the 1973 season. The Department did not obtain any information from these smolt, but the chances of their belonging to the early Black Lake run is much greater than to the later Chignik Lake run, and a return of approximately 500,000 early run sockeye can be anticipated.

#### Late Run

In contrast to the early Black Lake forecasts, the Chignik Lake forecasts have been made using average return per spawner and average total run figures. This difference in methods is necessary because the 2-ocean age to 3-ocean age relationship has not worked for late run forecasts and because FRI tow-netting in Chignik Lake has also shown a very poor correlation between tow-net catches of fry and adult returns.

Late Chignik sockeyes are predominantly 2.3 age fish. Other important age classes are 2.2 and 3.3 and sometimes 1.3. The parent escapement in 1970 was only 120,000 fish compared to a goal of 250,000. This small escapement was followed by two severe winters. Consequently, the run is expected to be small and even by using the average run size method, the forecast would probably err on the high side of the return. The average return per spawner during the previous 10 years is 2.67 with a range of 0.92 to 5.91. Because of the severe winters following the 1970 escapement, the figure of 5.91 is considered unrealistically high. Instead, by using the average figure of 2.67 as the high point and 0.92 as the low point, a more realistic return range of 110,000 to 320,000 fish with a midpoint of 215,000 is forecast.

#### DISCUSSION OF THE 1976 FORECAST:

The escapement goals are 400,000 for the early run and 250,000 for the late run. If both runs are near the low end of the range, there will be no commercial fishing for sockeye salmon in 1976. The point estimate of 500,000 early sockeye would allow for a harvest of 100,000 fish. A harvest of 450,000 could be anticipated if the high end of the range is achieved. No fishing is anticipated on the second run before early August, and even then catches are expected to be modest.

Prepared by: Arnold R. Shaul  
Chignik Area Management Biologist  
Kodiak

FORECAST AREA: Chignik

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate: Because of the relatively small amount of data accumulated to date in this new forecast project, numerical calculations were made only for the lower and upper range of the forecast.

Range Estimate: 200,000 - 820,000

FORECAST METHODS:

The lack of continuity in the limited pre-emergent fry sampling data for Chignik area pink salmon prevents a forecast based on formal regression analysis. It is possible, though, by using other factors such as historical production data, weather conditions, and pre-emergent densities to evolve a general forecast which may serve at least as a guideline for those involved in the Chignik area pink salmon fishery.

DISCUSSION OF THE 1976 FORECAST:

Eastern District

The very low fry densities for the two even-year index streams indicate a very poor return. However, presampling fry emergence probably occurred in one system, and the low escapements in both streams considerably reduced the odds of finding fry. Low densities, therefore, do not necessarily reflect poor survival. Since the 1973 sampling densities were equally as poor as those of 1975 and yet yielded a 1974 return of 5.68 fish per spawner, the Eastern District forecast is based primarily on return per spawner ratios.

Using the minimum return per spawner ratio (r/s) of 1.04 (excluding 1970-72 data) yields a low range estimate of 85,000 pink salmon. Since the Aniakchak River had one-third of the 1974 Eastern District escapement, the maximum r/s for this system is utilized to give an upper range limit of 325,000. The midpoint of the range is approximated by using the average even-year Eastern District r/s of 2.26.

The severe spring weather in the Eastern District in 1975, the extremely

poor pre-emergent densities, and the low r/s for 1973-75 which was not indicated by the fair 1974 pre-emergent densities all tend to accentuate the lower range of this forecast.

#### Western District

The Western District is the only one in the Chignik management area which shows a relatively good correlation between pre-emergent data and the corresponding return. Since one of the major systems, Coal Cape Creek, which contributed 85 percent of the escapement in 1974, was not sampled, it has been necessary to adjust the calculations in order to compensate for the absence of the Coal Cape Creek information. It is still too early then to base a forecast strictly on the regression relationship between pre-emergent fry densities and the corresponding pink salmon return.

The low limit of 75,000 and the upper limit of 300,000 are approximated by using the lowest r/s for the Western District of 1.15 (excluding 1970-72) and the highest even-year r/s (excluding 1972-74). A midpoint of 190,000 is indicated by both the pre-emergent data and by the average even-year r/s of 2.43.

The Western District was spared from the harsh winter weather conditions of the Eastern District. Streams were either open and flowing through most of the winter or were insulated by a deep blanket of snow. Mild weather plus fair escapements into most systems seem to account for the good fry densities in two index streams. The return could easily be in the upper range of the forecast although the major producing system, Ivan River, will not receive an adequate escapement because of poor returns in 1974.

#### Perryville District

The Perryville District has the best average return per spawner on both the odd and even year cycles within the Chignik area. However, low pre-emergent densities indicate a poor return even with improved escapement to the largest system, Ivanoff River.

Since pre-emergent indices point to such a low return, 40,000 pink salmon, this estimate is used as the lower limit of the forecast. The average Perryville District r/s of 3.21 is used as the upper limit of 200,000, with the midpoint of 120,000 calculated from the even-year average r/s of 2.32.

This year the lowest pre-emergent fry density was found in Ivanoff River, which received 70 percent of the escapement in the Perryville District. Considering also that the average r/s for even years is lower than that for odd-years, the 1976 return will most probably fall in the lower portion of the range.

Summary

In general then, the 1976 pink salmon catch will be restricted to the incidental catch of pink salmon within the Chignik district and to possible short openings in the other three districts should there be a harvestable surplus.

Information on probable 1976 returns by district is given below:

<u>District</u>	<u>Forecast Range</u>	<u>Forecast Point Estimate</u>
Perryville	40,000 - 200,000	120,000
Western	75,000 - 300,000	190,000
Eastern	85,000 - 320,000	-
Chignik Bay	30,000 - 70,000	-
Area Total	200,000 - 820,000	-

Escapement Goal: 500,000 - 700,000

Prepared by: Phillip Rigby  
 Ass't. Area Management Biologist  
 Chignik Area

FORECAST AREA: South Side Alaska Peninsula

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 1,150,000

Range Estimate = 800,000 - 1,500,000

FORECAST METHODS:

The Peninsula area pre-emergent project is in the developmental stages, and changes are still being made in sampling design and sampling areas within the index streams. However, after readjustment and the addition of 1975 sampling and escapement data, the correlation coefficient between fry densities and subsequent returns was 0.999. This forecast will be the first attempt based primarily on pre-emergent sampling results. The calculated midpoint is 1.15 million. The upper and lower limits of the range are 1.5 and 0.8 million pink salmon. The upper range of the forecast has a return per spawner ratio similar to those of the exceptional years of 1967-69 and 1973-75, and the lower range has a similar ratio to that of 1972-74. This is an optimistic forecast considering the low 1974 escapement of only 258,000 pinks. This forecast does not include areas west of Pavlof Bay.

DISCUSSION OF THE 1976 FORECAST:

Factors tend to favor a more moderate forecast for 1976. These factors are (1) harsh spring weather conditions in 1975 possibly contributing to less favorable estuarine and marine survival conditions and (2) Mino Creek, a major producing system, and the pre-emergent index streams west of Pavlof Bay were not sampled because of heavy ice and snow conditions leaving overwinter survival open to question within these systems.

On the other hand most of the streams sampled showed an improvement over 1974 and 1975 densities, little indication of mortality from freezing and scouring was evident, and estuarine and/or marine survival conditions seem to be on the upswing as evidenced by the 1974 and 1975 returns. Therefore, I feel the return per spawner ratio of 1976 should be at least as good or better than the odd-year average of 3.2, hence the low range estimate of 800,000 pink salmon.

Of the areas sampled, Pavlof and Canoe Bays should have the strongest returns with possible harvestable surpluses while many systems will, however, not receive a sufficient escapement. The escapement goal is 800,000 to 1,400,000.

Prepared by: Phillip Rigby  
Ass't. Area Mgmt. Biologist  
Chignik Area

FORECAST AREA: Bristol Bay - Nushagak District Only

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 3.047 million

Range Estimate = 1.5 - 5.7 million

FORECAST METHODS:

The 1976 forecast is based on the ratio of numbers of returning fish to the numbers of spawners in the parent run. A return/spawner ratio of 5.2 was used to produce a 1976 forecast of 3.047 million pinks. This ratio is based on ratios of the 4 years which had returns most similar to the 1974 return (i.e., 1960-66). However, if the average r/s ratio of 4.9 for all even-year runs from 1958-74 is used, then an estimated return of 2.871 million pinks is forecast. The range of the 1976 forecast is 1.5 to 5.7 million pink salmon.

One of the major problems in forecasting returns of Bristol Bay pink salmon has been the inconsistency of aerial survey estimates in areas other than the Nuyakuk River. For instance, in 1974 130,000 pinks spawned in systems not normally covered by aerial means. Future escapement estimates will be made for these areas in order to improve the forecast accuracy for even-year pink returns.

DISCUSSION OF THE 1976 FORECAST:

The 1974 escapement was very well distributed and water levels and spawning conditions were excellent for good initial survival of eggs. Although winter temperatures were severe, a heavy snow cover provided excellent insulation in the winter of 1974-75. The only factor which might adversely affect survival was the late spring breakup in 1975. Escapement requirements will approximate 600,000 to 1,000,000, leaving 2.0 to 2.4 million for harvest.

Prepared by: Michael L. Nelson  
Fisheries Management Biologist  
Dillingham

FORECAST AREA: Bristol Bay

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1976 TOTAL RETURN:

Point Estimate = 12.0 million

Range Estimate = 5.2 million - 18.8 million

FORECAST METHODS:

Most Bristol Bay sockeye mature 4 to 6 years from the time of spawning. The run in 1976 will, therefore, be the progeny of the escapements in 1970, 1971, and 1972. Forecasts of Bristol Bay sockeye by the Alaska Department of Fish and Game are generally based on one or more of the following methods:

- (1) Escapement-return relationships, based on historical data, provide estimates of total production from each brood year escapement. Average marine maturity schedules are then applied to determine the anticipated numbers of adult salmon returning each year.
- (2) On the Kvichak, Naknek and Ugashik rivers, numbers of smolt migrating to the ocean are enumerated annually. The return of adult salmon each year is then estimated on the basis of past survival data and average marine maturity schedules.
- (3) For all systems, relationships have been developed between the numbers of adult fish returning in a particular year and the number of adult fish from the same age group of smolt and parent escapement that will return the following year.

To aid in the selection of forecast techniques, a measure of residual variance, the "standard error of forecast" is calculated for each method, age class and system. The total Bristol Bay forecast is the sum of the forecasts of individual river systems, each based on one or more of the above methods.

DISCUSSION OF THE 1976 FORECAST:

The 1976 forecast is for a run of 12.0 million sockeye (range = 5.2 million to 18.8 million) of which 47 percent are 2-ocean and 53 percent

are 3-ocean fish. More than 38 percent of the run is expected to be 5 and 6-year old fish from the Kvichak River. Escapement requirements for Bristol Bay in 1976 total 5.5 million fish.

Forecast returns indicate harvestable surpluses in all systems except Snake River. (Escapement requirements for the Kvichak River for a year following a peak year are 2 million fish. This level would allow a projected inshore harvest of 2.6 million fish.) Point estimates of forecast inshore harvests by district in descending order of magnitude are: Naknek-Kvichak - 3,700,000; Egegik - 690,000; Nushagak - 175,000; Ugashik - 165,000; and Togiak - 150,000. The point estimate of total inshore harvest (5.7 million fish) takes into account an estimated 1976 Japanese high seas harvest of 824,000 Bristol Bay sockeye (range = 165,000 - 1,489,000). If the reduced level of exploitation by the Japanese on Bristol Bay stocks evidenced in 1974 and 1975 is continued in 1976, the estimated high seas harvest might be as low as 281,000 fish. This would increase the point estimate of inshore harvest to 6.25 million sockeye salmon.

APPENDIX B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY  
SPECIES AND STATISTICAL REGION, 1950 TO PRESENT

APPENDIX TABLE B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950 TO PRESENT.

Year	Statistical Region <sup>1/</sup>	Number of Fish in Thousands					No. of 48-lb. Cases in	
		Species					Total	Thousands <sup>2/</sup>
		Chinook	Sockeye	Coho	Pink	Chum		
1950	SOUTHEASTERN	379	552	1,652	9,424	4,779	16,786	1,199
	CENTRAL	137	5,947	762	11,978	2,515	21,339	1,465
	WESTERN	95	7,267	83	30	447	7,922	644
	Subtotal	611	13,766	2,497	21,432	7,741	46,047	3,308
1951	SOUTHEASTERN	474	820	3,310	22,211	4,123	30,938	2,028
	CENTRAL	213	4,136	645	6,185	2,040	13,219	1,068
	WESTERN	102	4,697	76	21	454	5,350	389
	Subtotal	789	9,653	4,031	28,417	6,617	49,507	3,485
1952	SOUTHEASTERN	528	919	1,746	9,819	4,179	17,191	1,321
	CENTRAL	115	4,341	617	10,012	3,463	18,548	1,456
	WESTERN	92	11,664	70	47	522	12,395	797
	Subtotal	735	16,924	2,433	19,878	8,164	48,134	3,574
1953	SOUTHEASTERN	498	1,376	1,164	4,980	3,542	11,560	978
	CENTRAL	112	3,763	387	10,602	3,132	17,996	1,351
	WESTERN	102	6,654	31	88	619	7,494	534
	Subtotal	712	11,793	1,582	15,670	7,293	37,050	2,863
1954	SOUTHEASTERN	398	1,208	1,771	8,909	4,242	16,528	1,303
	CENTRAL	85	3,190	679	12,576	3,323	19,853	1,395
	WESTERN	128	5,014	59	688	820	6,709	397
	Subtotal	611	9,412	2,509	22,173	8,385	43,090	3,095
1955	SOUTHEASTERN	372	681	1,338	9,334	1,527	13,252	840
	CENTRAL	74	2,675	468	14,758	1,631	19,606	1,163
	WESTERN	135	5,148	27	32	342	5,684	383
	Subtotal	581	8,504	1,833	24,124	3,500	38,542	2,386
1956	SOUTHEASTERN	239	921	935	13,472	2,736	18,303	1,032
	CENTRAL	82	3,432	495	11,940	3,674	19,623	1,349
	WESTERN	137	10,252	52	125	791	11,357	641
	Subtotal	458	14,605	1,482	25,537	7,201	49,283	3,022

APPENDIX TABLE B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950 TO PRESENT (cont.)

Year	Statistical Region <sup>1/</sup>	Number of Fish in Thousands					Total	No. of 48-lb. Cases in Thousands <sup>2/</sup>
		Chinook	Sockeye	Coho	Pink	Chum		
1957	SOUTHEASTERN	298	1,031	1,217	6,858	3,369	12,773	905
	CENTRAL	57	2,071	301	6,659	4,362	13,450	1,002
	WESTERN	158	6,631	87	4	548	7,428	557
	Subtotal	513	9,733	1,605	13,521	8,279	33,651	2,464
1958	SOUTHEASTERN	323	971	955	9,836	2,767	14,852	1,181
	CENTRAL	45	1,636	459	14,452	3,244	19,836	1,354
	WESTERN	182	3,460	193	1,809	613	6,257	437
	Subtotal	550	6,067	1,607	26,097	6,624	40,945	2,972
1959	SOUTHEASTERN	359	777	1,094	7,851	1,247	11,328	759
	CENTRAL	47	1,937	332	3,057	1,908	7,281	573
	WESTERN	195	5,249	76	22	886	6,428	446
	Subtotal	601	7,963	1,502	10,930	4,041	25,037	1,778
1960	SOUTHEASTERN	310	588	721	2,985	1,019	5,623	318
	CENTRAL	41	2,835	618	12,313	3,682	19,489	1,205
	WESTERN	196	14,411	66	782	1,923	17,378	1,049
	Subtotal	547	17,834	1,405	16,080	6,624	42,490	2,572
1961	SOUTHEASTERN	230	744	889	12,638	2,559	17,060	1,224
	CENTRAL	31	3,030	357	8,736	2,080	14,234	940
	WESTERN	243	12,307	67	132	991	13,740	1,048
	Subtotal	504	16,081	1,313	21,506	5,630	45,034	3,212
1962	SOUTHEASTERN	206	772	1,223	11,585	1,996	15,782	935
	CENTRAL	42	3,534	692	29,297	4,024	37,589	2,013
	WESTERN	213	4,990	124	2,981	1,128	9,436	528
	Subtotal	461	9,296	2,039	43,863	7,148	62,807	3,476
1963	SOUTHEASTERN	258	678	1,275	19,145	1,479	22,835	1,216
	CENTRAL	35	2,437	627	14,976	2,350	20,425	1,135
	WESTERN	208	3,101	121	154	635	4,219	305
	Subtotal	501	6,216	2,023	34,275	4,464	47,479	2,656

APPENDIX TABLE B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950 TO PRESENT (cont.)

Year	Statistical Region <sup>1/</sup>	Number of Fish in Thousands					Total	No. of 48-lb Cases in Thousands <sup>2/</sup>
		Chinook	Sockeye	Coho	Pink	Chum		
1964	SOUTHEASTERN	357	924	1,588	18,581	1,936	23,386	1,263
	CENTRAL	22	3,198	866	24,945	4,160	33,191	1,724
	WESTERN	260	5,839	105	1,747	1,179	9,130	563
	Subtotal	639	9,961	2,559	45,273	7,275	65,707	3,550
1965	SOUTHEASTERN	287	1,085	1,548	10,880	1,474	15,274	758
	CENTRAL	31	4,229	393	9,464	1,635	15,752	985
	WESTERN	265	24,732	57	3	271	25,328	1,525
	Subtotal	583	30,046	1,998	20,347	3,380	56,354	3,268
1966	SOUTHEASTERN	308	1,054	1,227	20,438	3,273	26,300	1,562
	CENTRAL	24	4,458	574	17,028	2,574	24,658	1,532
	WESTERN	208	9,562	119	2,585	609	13,083	897
	Subtotal	540	15,074	1,920	40,051	6,456	64,041	3,991
1967	SOUTHEASTERN	301	972	866	3,111	1,810	7,060	431
	CENTRAL	26	3,049	450	3,409	1,198	8,132	609
	WESTERN	284	4,557	172	39	646	5,698	424
	Subtotal	611	8,578	1,488	6,559	3,654	20,890	1,464
1968	SOUTHEASTERN	332	831	1,543	25,085	2,644	30,435	1,372
	CENTRAL	20	4,260	875	16,664	2,837	24,656	1,437
	WESTERN	259	3,039	333	2,977	601	7,209	359
	Subtotal	611	8,130	2,751	44,726	6,082	62,300	3,168
1969	SOUTHEASTERN	314	812	596	4,870	561	7,153	292
	CENTRAL	38	3,650	274	20,565	1,644	26,171	1,412
	WESTERN	287	6,931	263	332	770	8,583	519
	Subtotal	639	11,393	1,133	25,767	2,975	41,907	2,223
1970	SOUTHEASTERN	322	668	759	10,657	2,446	14,852	676
	CENTRAL	33	6,020	647	19,263	3,609	29,572	1,662
	WESTERN	291	20,946	121	1,228	1,445	24,031	1,227
	Subtotal	646	27,634	1,527	31,147	7,500	68,455	3,565

APPENDIX TABLE B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950 TO PRESENT (cont.)

Year	Statistical Region <sup>1/</sup>	Number of Fish in Thousands						No. of 48 lb.
		Species						Cases in
		Chinook	Sockeye	Coho	Pink	Chum	Total	Thousands <sup>2/</sup>
1971	SOUTHEASTERN	334	623	914	9,345	1,946	13,162	687
	CENTRAL	45	3,611	487	14,133	4,317	22,593	1,425
	WESTERN	283	9,945	46	51	1,417	11,742	787
	Subtotal	662	14,179	1,447	23,529	7,680	47,497	2,899
1972	SOUTHEASTERN	287	917	1,509	12,400	2,942	18,054	748
	CENTRAL	42	3,073	252	3,344	2,726	9,437	676
	WESTERN	224	2,600	70	177	1,396	4,468	281
	Subtotal	553	6,590	1,831	15,921	7,064	31,959	1,705
1973	SOUTHEASTERN	344	1,011	836	6,455	1,832	10,479	449
	CENTRAL	30	2,540	338	3,295	2,143	8,345	643
	WESTERN	177	939	282	52	2,045	3,495	123
	Subtotal	551	4,490	1,456	9,802	6,020	22,319	1,215
1974	SOUTHEASTERN	347	687	1,278	4,889	1,683	8,884	482
	CENTRAL	29	2,545	318	3,811	861	7,564	669
	WESTERN	183	1,646	265	1,160	2,186	5,440	192
	Subtotal	559	4,878	1,861	9,860	4,730	21,888	1,343
1975 <sup>3/</sup>	SOUTHEASTERN	285	233	393	3,761	628	5,300	196
	CENTRAL	28	2,026	389	8,928	1,297	12,668	637
	WESTERN	124	5,078	194	34	2,310	7,740	352
	Subtotal	437	7,337	976	12,723	4,235	25,708	1,185

- Data Sources:
- i) Alaska Department of Fish and Game Commercial Fisheries Statistical Leaflets.
  - ii) Alaska Department of Fish and Game Statistics Section. Unpublished data.
  - iii) Alaska Fisheries Reports, 1954-59. Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service.

<sup>1/</sup> For the purpose of reporting Alaska commercial fisheries statistics, the statistical regions are defined as follows:

SOUTHEASTERN: Dixon Entrance to Cape Suckling

CENTRAL: Cape Suckling to Seal Cape on the southwestern tip of Unimak Island.

APPENDIX TABLE B. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY  
SPECIES AND STATISTICAL REGION, 1950 TO PRESENT (cont.)

WESTERN: Seal Cape to, and including, the Aleutian Islands  
and the Bering Cape north through Kotzebue Sound.

2/ Although the majority of commercially harvested salmon in Alaska are processed as canned products, in some regions certain species (such as king and coho salmon in the Southeastern region) are processed predominantly as fresh/frozen or cured products. These case pack figures do not include salmon processed in ways other than canning.

3/ Preliminary data.

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