

INFORMATIONAL LEAFLET NO. 253

PRELIMINARY FORECASTS AND PROJECTIONS FOR 1986 ALASKA SALMON FISHERIES

Edited by
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TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	i
LIST OF FIGURES	ii
ABSTRACT	1
INTRODUCTION	1
REVIEW OF THE 1985 ALASKA COMMERCIAL SALMON FISHERY	8
PRELIMINARY FORECASTS OF 1986 SALMON RETURNS TO SELECTED ALASKA FISHERIES	23
PROJECTED 1986 ALASKA COMMERCIAL SALMON HARVESTS	27
Species Outlook	27
 APPENDIX. FORECAST METHODS AND DISCUSSIONS	 30
Southeastern Alaska Pink Salmon	30
Prince William Sound Pink and Chum Salmon, and Coghill River Sockeye Salmon	33
Prince William Sound/Copper River Sockeye and Chinook Salmon	39
Lower Cook Inlet, Southern and Outer Districts	41
Upper Cook Inlet Sockeye Salmon	43
Kodiak Pink Salmon	44
Chignik Pink Salmon	47
Chignik Sockeye Salmon	48
South Peninsula Pink Salmon	50
Bristol Bay Sockeye Salmon	51
Bristol Bay, Togiak District Chinook Salmon	53
Bristol Bay, Nushagak District Chinook Salmon	54
LITERATURE CITED	55

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Forecasted return, harvest, escapement goal, preliminary return, escapement, harvest, management error (i.e., difference between realized escapement and escapement goal), and return forecast error for major salmon fisheries where formal forecasts were made, 1970-1985. Projected and realized Alaska commercial salmon harvests with absolute and relative error, 1979-1985. Figures are in thousands of salmon	3
2. Comparison of actual and forecast 1985 salmon returns, with errors and relative errors, for some major Alaska salmon fisheries	10
3. Preliminary 1985 Alaska commercial salmon harvest by species and fishing area	11
4. Preliminary 1985 Southeastern Alaska commercial salmon harvest by species and management area	12
5. Preliminary 1985 Central Region Alaska commercial salmon harvest by species and management area	13
6. Preliminary 1985 Westward Region Alaska commercial salmon harvest by species and management area	14
7. Preliminary 1985 Arctic-Yukon-Kuskokwim Region Alaska commercial salmon harvest by species and management area	15
8. Preliminary forecasts of salmon returns and commercial harvests for some major Alaska fisheries in 1986	24
9. Preliminary projections of 1986 Alaska commercial salmon harvests by statistical region and species	28
10. Preliminary projections of 1986 Alaska commercial salmon harvests by management region and species	29

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Relationship between observed return (millions) and forecasted return (millions) for major salmon fisheries with formal forecasts, 1970-1985. Also shown are the regression line, $Y = 6.54 + 1.027 X$, R squared = 0.690, together with 80% confidence intervals; where, Y = Observed Return and X = Forecasted Return	4
2. Relationship between observed harvest (millions) and projected harvest (millions) for Alaska commercial salmon fisheries, 1970-1985. Also shown are the fitted regression line, $Y = 7.40 + 1.027 X$, R squared = 0.771, together with 80% confidence intervals; where, Y = Observed Harvest and X = Forecasted Harvest	5
3. Alaska Department of Fish and Game Commercial Fisheries Statistical Regions	7
4. Alaska commercial salmon harvests by species, 1955-1985, and the 1986 projected harvest	9

ABSTRACT

More than 144 million salmon were taken by commercial fishermen in Alaska in 1985, the largest Alaska salmon harvest in history. This is the sixth consecutive year that Alaskan salmon harvests have exceeded 100 million fish. The ex-vessel value of the 1985 salmon harvest was \$370 million. The 1985 salmon harvest was stronger than anticipated, exceeding the 1985 midpoint harvest projection of 109.2 million. The error was due almost entirely to the unanticipated record pink salmon harvest, with harvests realized for other salmon species very close to that projected. The 1985 catch of Bristol Bay sockeye salmon was 23.4 million down from the 1984 level but very strong relative to historical levels.

The projected 1986 salmon harvest is 138 million fish, down slightly from the record 1985 harvest. Pink salmon returns are expected to be particularly strong in 1986, with large returns expected to continue in Southeastern Alaska and Prince William Sound. The peak year of the pink salmon cycle for Western Alaska will be 1986; with returns to Bristol Bay, Kodiak, and South Peninsula expected to be much larger than what occurred in 1985. Thus pink salmon harvests are expected to be large statewide and are expected to exceed the 1985 record level. The 1986 harvest of sockeye salmon is expected to be down substantially from the 1985 harvest. This is primarily due to an anticipated lower harvest in Bristol Bay, with the return to the Kvichak expected to be near or below escapement goals.

There is much uncertainty associated with the 1985 Alaska salmon harvest projections, but the actual harvest is not expected to be below 90 million or above 200 million. Based on the statistical performance of the harvest projections, 1970-1985, only one of five realized harvests would be expected to fall outside this range.

KEY WORDS: salmon, *Oncorhynchus* spp., salmon return forecast, salmon harvest projection.

INTRODUCTION

This report reviews Alaska's 1985 commercial salmon season and presents preliminary salmon return forecasts and harvest projections for the 1986 commercial salmon fisheries. The report is released in November, before final catch figures are available. This is to provide preliminary information to the Board of Fisheries, the fishing industry, and the public well before the season begins.

Forecasts of returns (catch + escapements) for major salmon fisheries as well as projections of the statewide commercial salmon harvest have been published yearly by the Alaska Department of Fish and Game since 1969 (ADF&G 1969-1984; Eggers 1985). The accuracy of those forecasts and harvest projections are

summarized in Table 1. On the average, the return forecasts have been very close to the actual returns, with the forecast exceeding the return by less than 1% (Table 1). With regard to sign, the error has been 32%. The projected statewide harvest has, on the average, been lower than the actual harvest by 8% of the projected harvest (Table 1). The error without regard to sign has been 26%. The historical performance of the forecasted return to major salmon fisheries (Figure 1), as evidenced by the breadth of the 80% confidence interval on the relation between observed and actual return (1970-1985), has been somewhat poorer than the historical performance of the projected statewide commercial harvest projections (Figure 2). The errors have been due to inadequate knowledge of salmon escapements, the numbers of juvenile salmon produced from these escapements, and of the natural variation in survival of salmon throughout various life history stages.

Glossary

- Salmon return or run: The total number of mature salmon returning in a given year from ocean rearing areas to coastal waters.
- Escapement, spawning population or brood stock: That portion of a salmon run which is not harvested and survives to reach the spawning grounds or hatchery.
- Forecast: Forecast harvests and returns are estimated using information such as parent-year escapements, subsequent fry abundance, spring sea water temperatures, and escapement requirements.
- Harvest projections: Harvest projections are averages of recent harvests. They may be modified subjectively when qualitative escapement or other relevant information is available. Only harvests are projected, and harvest projections are given only for salmon runs which have no forecast.

Alaska Pacific Salmon Species

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

Table 1. Forecasted return, harvest, escapement goal, preliminary return, escapement, harvest, management error (i.e., difference between realized escapement and escapement goal), and return forecast error for major salmon fisheries where formal forecasts were made, 1970-1985. Projected and realized Alaska commercial salmon harvests with absolute and relative error, 1979-1985. Figures are in thousands of salmon.

Year	Only Major Fisheries Where Formal Forecasts Are Made ¹										Projected Collective Harvest of all Alaska Salmon Fisheries				((1)-(2))/(7) Forecasted Harvest Relative to Projected Statewide Harvest
	Forecasted		(2) Escapement Goal	Actual (Note that Figures Based on Preliminary Returns) ¹			(5) (4)-(2) Management Error (thousands)	(5)/(2) %	(6) (1)-(3) Forecast Error (thousands)	(6)/(1) %	(7) Projected Harvest	(8) Actual Harvest	(9) (7)-(8) Error	(9)/(7) Relative Error	
	(1) Return	Harvest		(3) Return	(4) Escapement	Harvest									
1970	114347	77080	37267	64653	17271	47382	19996	54%	49694	77%	95500	68500	27000	39%	81%
1971	41140	28110	13030	50780	18643	32137	-5613	-43%	-9640	-19%	41500	47500	-6000	-13%	68%
1972	52790	30470	22320	30995	13616	17379	8704	39%	21795	70%	46700	32000	14700	46%	65%
1973	38650	18820	19830	21650	10636	11014	9194	46%	17000	79%	30000	22300	7700	35%	63%
1974	27830	7500	20330	29150	19334	9816	996	5%	-1320	-5%	15600	21900	-6300	-29%	48%
1975	28740	8435	20305	45937	28496	17441	-8191	-40%	-17197	-37%	19900	26200	-6300	-24%	42%
1976	45202	25702	19500	48940	18860	30080	640	3%	-3738	-8%	37100	44400	-7300	-16%	69%
1977	43650	23740	19910	56495	21695	34800	-1785	-9%	-12845	-23%	34700	50800	-16100	-32%	68%
1978	70323	48737	21586	97940	36020	61920	-14434	-67%	-27617	-28%	62900	82300	-19400	-24%	77%
1979	84960	57210	27750	108323	37985	70338	-10235	-37%	-23363	-22%	72000	88800	-16800	-19%	79%
1980	124930	86360	38570	144096	62490	81606	-23920	-62%	-19166	-13%	102600	110000	-7400	-7%	84%
1981	78500	55420	23080	116095	28895	87200	-5815	-25%	-37595	-32%	74500	113300	-38800	-34%	74%
1982	136060	109940	26120	105503	27983	77520	-1863	-7%	30557	29%	135000	109100	25900	24%	81%
1983	97210	74330	22880	129363	28672	100691	-5792	-25%	-32153	-25%	94000	127200	-33200	-26%	79%
1984	119068	81671	37397	150034	47410	102624 ²	-10013	-27%	-30966	-21%	103560	132505	-28945	-22%	79%
1985	123629	86891	35934	164115	43916	120199 ²	-7982	-22%	-40486	-25%	108241	144610	-36369	-25%	80%
1970-19 Averages	76689	51276	25363	85254	28870	56384	-3507	-14%	-8565	-0.14%	67113	76338	-9226	-8%	71%
Averages without							8448	32%	23446	32%			18638	26%	

¹ Preliminary data published in ADF&G (1970-1985).

² Preliminary harvest figures.

Obs. Return versus Fcst. Return

Major Fisheries with Formal Forecasts

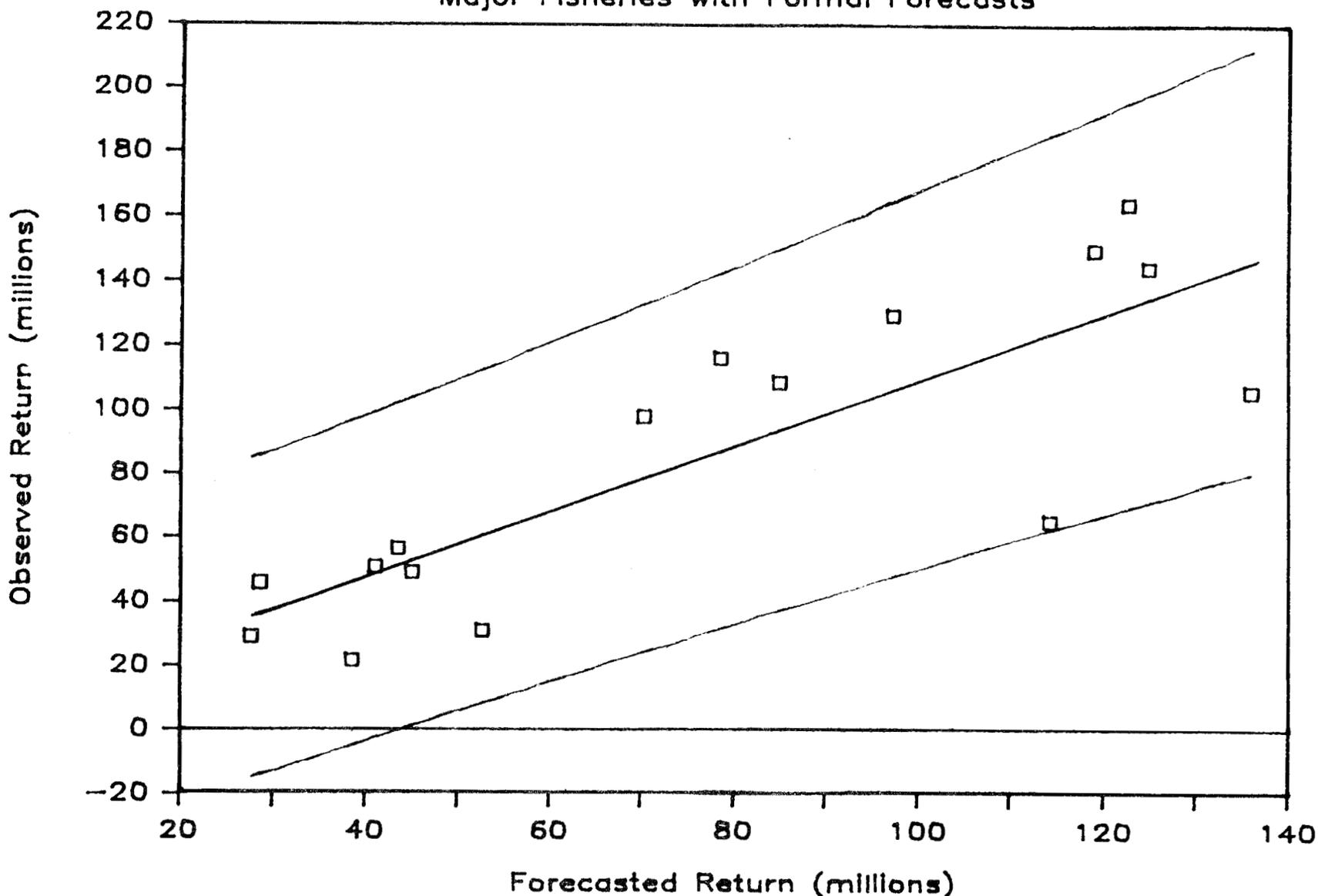


Figure 1. Relationship between observed return (millions) and forecasted return (millions) for major salmon fisheries with formal forecasts, 1970-1985. Also shown are the regression line, $Y = 6.54 + 1.027 X$, $R^2 = 0.690$, together with 80% confidence intervals; where, $Y =$ Observed Return and $X =$ Forecasted Return.

Obs. Harvest versus Fcst. Harvest

Projected Statewide Harvest

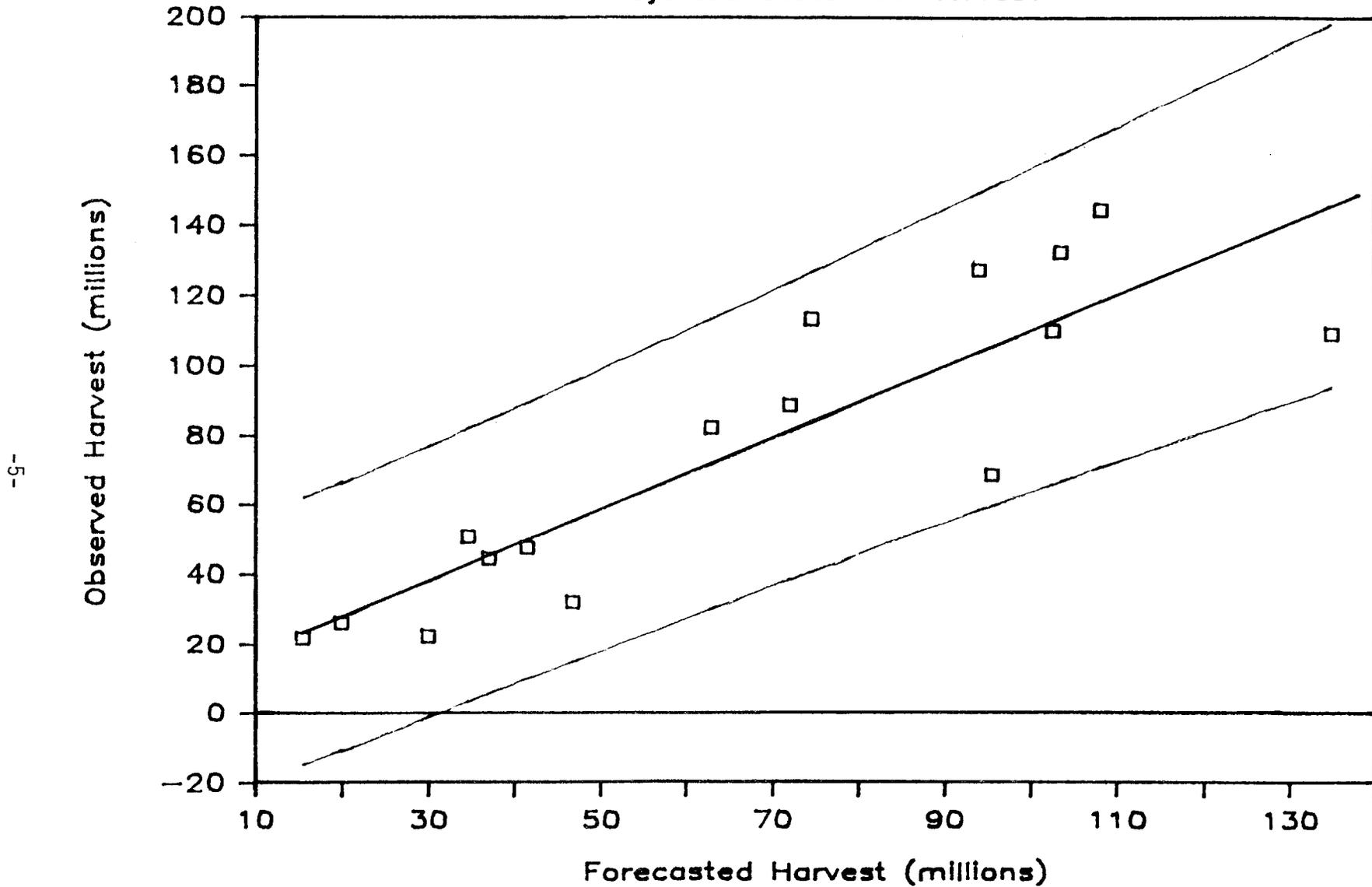


Figure 2. Relationship between observed harvest (millions) and projected harvest (millions) for Alaska commercial salmon fisheries, 1970-1985. Also shown are the fitted regression line, $Y = 7.40 + 1.027 X$, $R^2 = 0.771$, together with 80% confidence intervals; where, $Y =$ Observed Harvest and $X =$ Forecasted Harvest.

Brood years of salmon returning to spawn in 1986, by species and age¹

Species	Age of Returning Salmon in Years				
	2	3	4	5	6
Pink	1984				
Chum		1983	1982	1981	
Coho		1983	1982		
Sockeye			1982	1981	1980
Chinook			1982	1981	1980

¹ The brood years listed for each species generally comprise more than 90% of the run.

Increasing salmon escapement levels through the period 1970-1985, as well as mild winters and generally warmer ocean water temperature contributing to higher juvenile survival are thought to be the major factors responsible for the recent record-breaking commercial salmon harvest in Alaska. These favorable environmental conditions have worked in tandem with industry sacrifices and careful fisheries management that insured adequate well-distributed salmon escapements in the early 1970s when salmon returns were weak throughout the state. Sockeye and pink salmon returns in almost all areas of the state have now rebounded to robust levels. State and non-profit hatcheries have contributed several million salmon to the 1985 harvest of 144 million fish. These supplemental production sources are becoming increasingly significant in Cook Inlet and Prince William Sound areas.

The boundaries of and major fishing areas within the Southeastern, Central, and Western statistical regions are shown in Figure 3. These regions and areas are the ones used in the Department's statistical leaflet series and prior statistical reports.

Acknowledgments

Information on which this report is based was contributed by Division of Commercial Fisheries biologists located in field offices throughout the state. Area biologists, not individually identified, supplied reviews of the 1985 fishing season. These were summarized by Mike Dean. Individual credit for forecast material is given with the area forecast discussions in the Appendix.

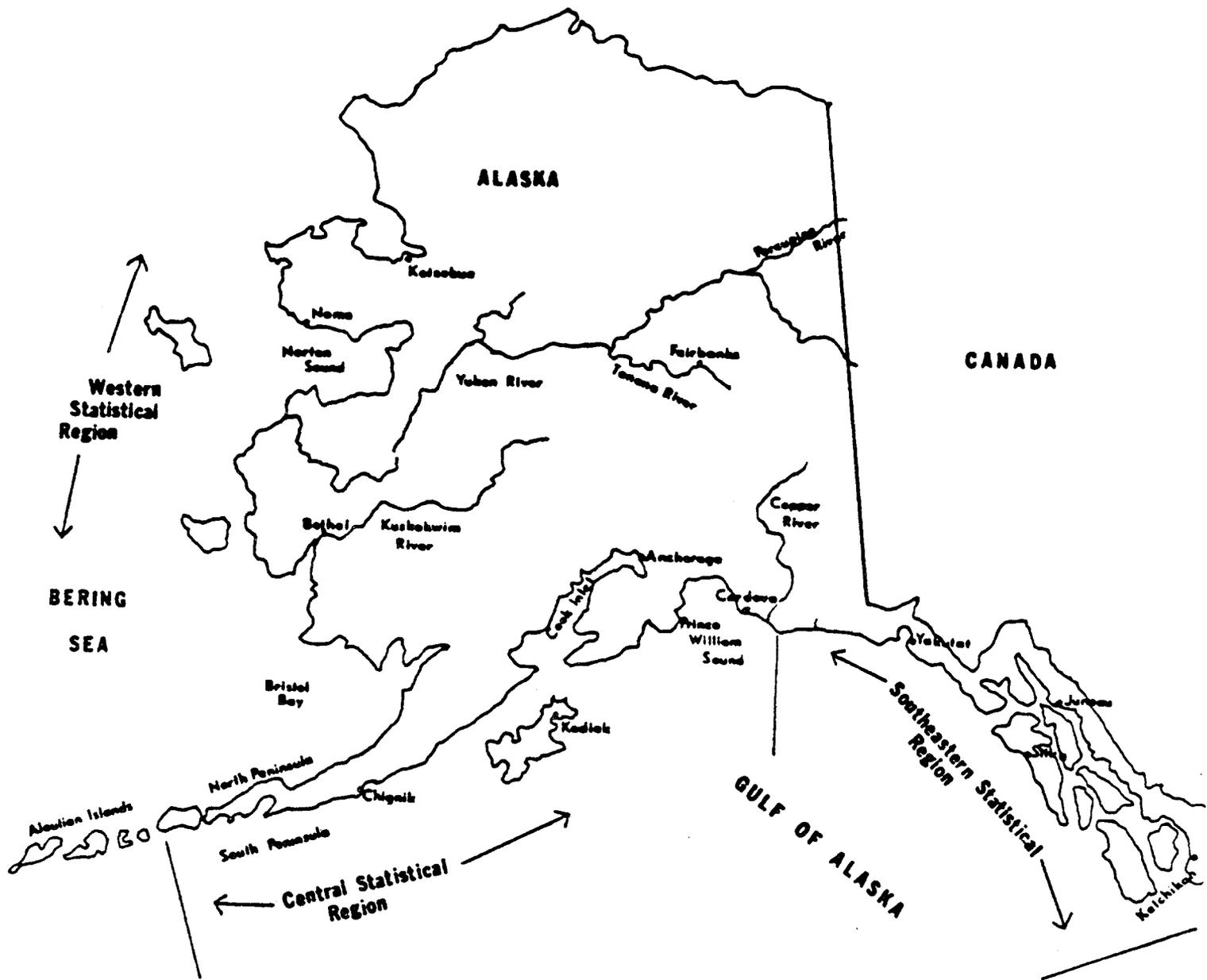


Figure 3. Alaska Department of Fish and Game Commercial Fisheries Statistical Regions.

REVIEW OF THE 1985 ALASKA COMMERCIAL SALMON FISHERY

The 1985 Alaska commercial salmon season is estimated to be the largest harvest in history with a commercial catch of 144.6 million salmon (Figure 4) and produced an ex-vessel value of over \$370.0 million to fishermen. This is the sixth consecutive year Alaskan salmon harvests have exceeded 100 million fish.

The 1985 harvest composition of salmon species taken were 62% pink or 89.3 million, 26% sockeye or 38.3 million, 7% chum or 10.6 million, about 4% coho or 5.6 million, and less than 1% or 0.7 million chinook salmon.

The 1985 salmon harvest of 144.6 million fish exceeded the pre-season midpoint harvest estimate of 109.2 million fish (Table 2) by a large margin. Principal factors contributed to this season's record harvest were the following: (1) the largest recorded statewide pink salmon harvest, 89.3 million; (2) landings of over 23.4 million sockeye salmon in Bristol Bay; (3) the contribution of supplemental production from state and private hatcheries; and (4) a generally strong return of coho salmon to areas of the state.

Preliminary catch estimates by fishing area and statistical region are summarized in Table 3. These estimates are presented in more detail by management region in Tables 4 through 7.

Southeastern Region

Overall, it was a very good salmon fishing season throughout most of the region. The Southeastern pink salmon harvest will probably exceed 51.0 million fish when all fish tickets are tabulated. Only the 1941 harvest of 60.0 million pink salmon will exceed this year's harvest. Northern Southeastern produced a harvest of 20.5 million pink salmon, almost three times the pre-season harvest estimate of 7.3 million fish. The southern Southeastern areas harvested 30.4 million pinks which was slightly larger than the pre-season harvest estimate of 24.8 million pink salmon. Pink salmon spawning escapement ranged from adequate to excellent depending on area.

The sockeye salmon catch of 1.8 million fish was the best since 1939. Prince of Wales, Lynn Canal, and the East River of the Yakutat area produced excellent sockeye harvests as did the southern district purse seine fisheries.

The total coho salmon catch of approximately 2.5 million fish is considered one of the best on record, and continues a recent trend of increased returns for this species. The troll fishery harvested an estimated 1.6 million coho salmon.

Southeastern landings of chum salmon were 3.2 million fish which is considered good for recent years. Lynn Canal produced new weekly landing records of late fall chum salmon this season. The hatchery at Hidden Falls on Baranof Island produced an estimated harvest of over 335,000 chum salmon, contributing substantially to the overall region chum harvest.

The commercial harvest of chinook salmon was estimated to be 255,000 fish. Provisions of the 1985 U.S./Canada Salmon Treaty limited the season's commercial

Alaska Commercial Salmon Harvest

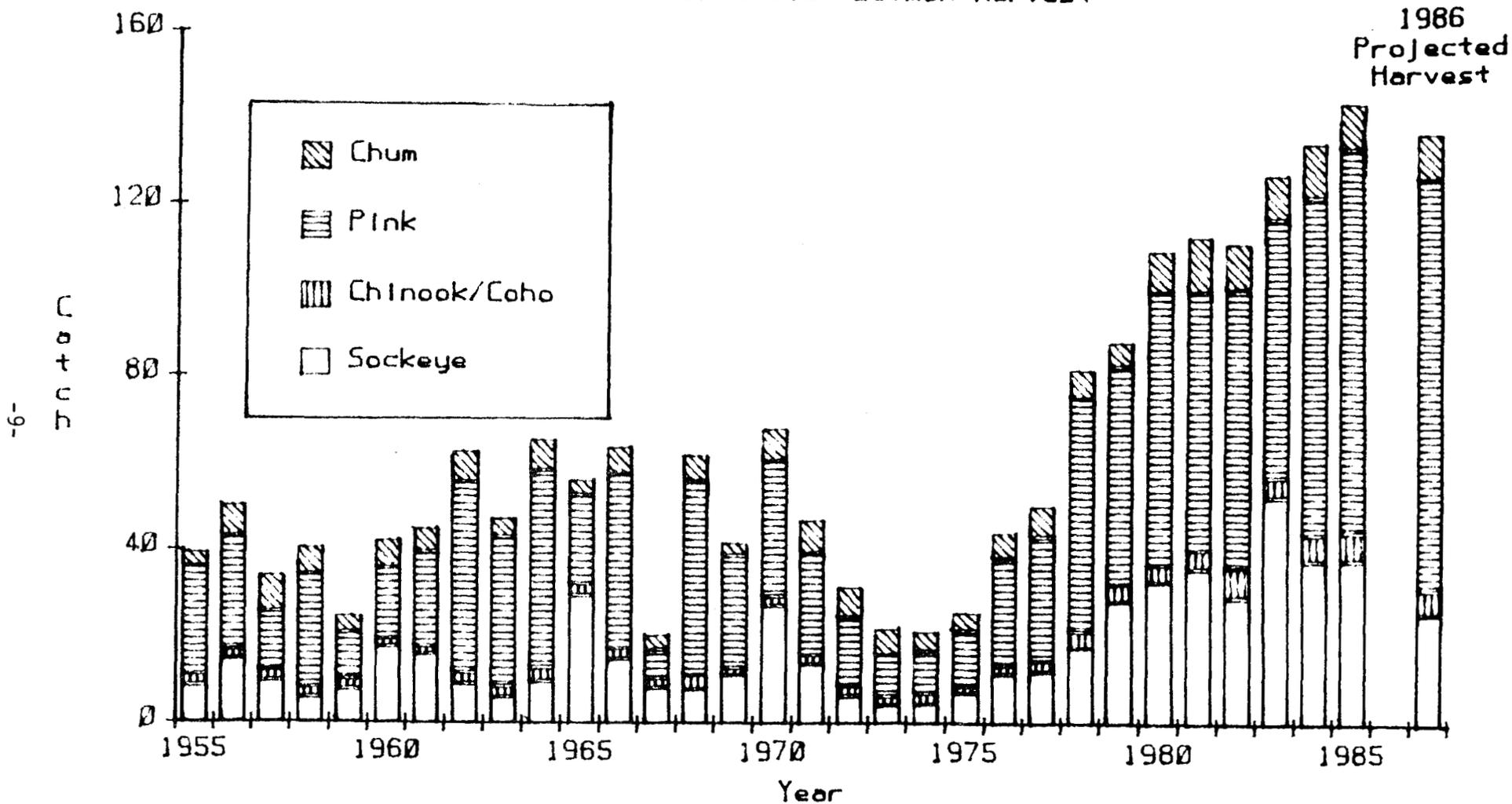


Figure 4. Alaska commercial salmon harvests by species, 1955-1985, and the 1986 projected harvest.

Table 2. Comparison of actual and forecast 1985 salmon returns, with errors and relative errors, for some major Alaska salmon fisheries.

		Thousands of Fish					
Area	Species	(1) Harvest	(2) Escapement ¹	(3) Return (1) + (2)	(4) Forecasted Return	(5) Error (4) - (3)	(6) Relative Error (5)/(3) x 100%
Southern Southeastern	pink	30473	12000	42473	30800	-11673	-27%
Northern Southeastern	pink	20516	8000	28516	11900	-16616	-58%
Southeastern total	pink	50988	20000	70988	42700	-28288	-40%
Prince William Sound	pink	25057	2715	27771	21500	-6271	-23%
	chum	1280	191	1471	2109	638	43%
PWS Coghill District	sockeye	350	147	497	220	-277	-56%
Copper River	sockeye	928	631	1559	1780	221	14%
	chinook	46	4	50	45	-6	-11%
Lower Cook Inlet- Southern and Outer Districts	pink	1137	316	1453	1217	-236	-16%
Upper Cook Inlet	sockeye	3852	1362	5214	4400	-814	-16%
Kodiak	pink	7340	2600	9940	6780	-3160	-32%
Chignik ²	sockeye ²	1110	717	1826	2490	664	36%
	pink	175	355	530	500	-30	-6%
South Peninsula ³	pink	4396	1600	5996	5000	-996	-17%
Bristol Bay ⁴	sockeye	23474	13154	36628	34700	-1928	-5%
Bristol Bay, Nushagak ⁴ District	chinook	67	125	192	188	-4	-2%
TOTAL		120199	43916	164115	123629	-40487	-25%

¹ Preliminary data compiled 1 November 1985.

² The harvest includes estimated interceptions of Chignik bound sockeye taken at Cape Igvak, Stepovak Bay, Aniakchak, and Hook Pass fisheries.

³ The harvest does not include June catches of migrating pink salmon bound for other areas.

⁴ Inshore harvest only.

Table 3. Preliminary 1985 Alaska commercial salmon harvest by species and fishing area¹.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southern Southeastern	76.7	1111.7	1198.4	30472.7	1300.6	34160.2
Northern Southeastern	178.6	737.4	1341.1	20515.5	1966.2	24738.8
Southeastern Statistical Region Total	255.3	1849.2	2539.4	50988.2	3266.8	58899.0
Cordova Area	43.5	1441.6	1033.5	25074.6	1294.2	28887.4
Cook Inlet Area	24.3	4130.8	629.4	1313.2	744.8	6842.6
Kodiak Area	5.0	1842.8	283.2	7335.0	431.0	9897.0
Chignik	1.9	943.8	203.7	175.0	26.1	1350.6
South Peninsula	6.0	2062.0	161.0	4396.0	1341.0	7966.0
Central Statistical Region Total	80.7	10421.0	2310.8	38293.8	3837.1	54943.5
Aleutian Islands	0.0	2.0	0.0	0.3	14.0	16.3
North Peninsula	23.0	2518.0	170.0	4.0	698.0	3413.0
Bristol Bay Area	122.0	23472.0	161.0	0.0	864.0	24619.0
Kuskokwim Area	74.1	121.2	382.1	0.0	224.7	802.1
Yukon Area	146.2	0.0	57.7	0.0	1033.3	1237.2
Norton Sound	19.5	0.2	22.0	3.6	134.9	180.2
Kotzebue Area	0.0	0.0	0.0	0.0	521.4	521.4
Western Statistical Region Total	384.8	26113.4	792.8	7.9	3490.3	30789.2
ALASKA TOTAL	720.8	38383.6	5643.1	89290.0	10594.2	144631.6

¹ Compiled 1 December 1985, catches in thousands of fish.

Table 4. Preliminary 1985 Southeastern Alaska commercial salmon harvest by species and management area¹.

Management Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southern Southeastern						
Portland Canal gill net	2.8	167.0	46.9	649.7	218.2	1084.7
Annette Island gill net	0.3	49.8	14.0	394.3	34.8	493.2
Annette Island trap	0.4	10.9	3.5	497.8	1.5	514.0
Prince of Wales Is. gill net	1.7	265.3	91.1	584.9	69.6	1012.7
Stikine River gill net	.0	1.1	1.9	5.3	1.9	10.2
Southern hatcheries	2.0	0.1	45.8	9.7	288.0	345.6
Southern districts seine	15.0	616.3	326.3	28232.9	680.4	29870.9
Southern districts troll	54.6	1.3	668.9	98.0	6.2	829.0
Southern Southeastern total	76.7	1111.7	1198.4	30472.7	1300.6	34160.2
Northern Southeastern						
Taku-Snettisham gill net	3.0	87.1	52.3	312.8	107.9	563.0
Lynn Canal gill net	3.4	337.2	109.1	260.3	803.6	1513.5
Yakutat gill net	1.0	233.4	193.5	16.1	12.3	456.3
Northern hatcheries	0.0	.0	6.2	462.1	342.8	811.1
Northern districts seine	7.5	73.3	60.3	18594.0	653.6	19388.7
Northern districts troll	163.7	6.4	919.7	870.2	46.0	2006.1
Northern Southeastern total	178.6	737.4	1341.1	20515.5	1966.2	24738.8
SOUTHEASTERN REGION TOTAL	255.3	1849.2	2539.4	50988.2	3266.8	58899.0

¹ Compiled 1 December 1985, catches in thousands of fish.

Table 5. Preliminary 1985 Central Region Alaska commercial salmon harvest by species and management area¹.

Management Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Cordova Area						
Bering River	0.2	20.5	415.8	0.1	8.3	444.9
Copper River	42.2	927.8	598.0	17.8	5.8	1591.5
Prince William Sound						
Hatcheries				1274.0	3.8	1277.8
Coghill District	0.5	350.0	1.2	521.0	266.0	1138.7
Unakwik District	.0	26.9	.0	37.4	8.0	72.4
Eshamy District	.0	2.2	0.1	100.9	1.4	104.6
General purse seine	0.6	114.1	18.4	23123.5	1000.9	24257.5
Prince William Sound total	1.1	493.3	19.7	25056.7	1280.1	26851.0
Cordova Area total	43.5	1441.6	1033.5	25074.6	1294.2	28887.4
Cook Inlet Area						
Lower Cook Inlet						
Outer District	.0	92.0	3.2	618.2	11.8	725.3
Southern District	1.0	84.1	4.3	518.9	5.5	613.8
Kamishak District	.0	78.3	2.0	0.2	8.1	88.6
Eastern District	.0	24.3	.0	92.4	5.1	121.9
Lower Cook Inlet total	1.0	278.7	9.5	1229.7	30.6	1549.5
Upper Cook Inlet						
Central District	21.4	3689.1	540.7	57.0	682.9	4991.2
Northern District	1.9	163.0	79.2	26.5	31.2	301.8
Upper Cook Inlet total	23.3	3852.1	619.9	83.5	714.1	5293.0
Cook Inlet Area total	24.3	4130.8	629.4	1313.2	744.8	6842.6
Bristol Bay						
Egegik District	4.0	7457.0	33.0	0.0	110.0	7604.0
Ugashik District	7.0	6346.0	61.0	0.0	119.0	6533.0
Naknek-Kvichak District	6.0	8136.0	8.0	0.0	176.0	8326.0
Nushagak District	68.0	1323.0	20.0	0.0	253.0	1664.0
Togiak District	37.0	210.0	39.0	0.0	206.0	492.0
Bristol Bay total	122.0	23472.0	161.0	0.0	864.0	24619.0
CENTRAL REGION TOTAL	189.8	29044.4	1823.9	26387.8	2903.0	60349.0

¹ Compiled 1 November 1985, catches in thousands of fish.

Table 6. Preliminary 1985 Westward Region Alaska commercial salmon harvest by species and management area¹.

Management Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kodiak Area	5.0	1842.8	283.2	7335.0	431.0	9897.0
Chignik Area	1.9	943.8	203.7	175.0	26.1	1350.6
Alaska Peninsula and Aleutians						
South Peninsula	6.0	2062.0	161.0	4396.0	1341.0	7966.0
North Peninsula	23.0	2518.0	170.0	4.0	698.0	3413.0
Aleutian Islands	0.0	2.0	0.0	0.3	14.0	16.3
Alaska Penin. Aleut. total	29.0	4582.0	331.0	4400.3	2053.0	11395.3
WESTWARD REGION TOTAL	35.9	7368.6	817.9	11910.3	2510.1	22642.8

¹ Compiled 1 November 1985, catches in thousands of fish.

Table 7. Preliminary 1985 Arctic-Yukon-Kuskokwim Region Alaska commercial salmon harvest by species and management area¹.

Management Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kuskokwim Area						
Kuskokwim River	37.9	106.6	335.6	0.0	199.5	679.6
Kuskokwim Bay	36.2	14.6	46.5	0.0	25.2	122.5
Kuskokwim Area total	74.1	121.2	382.1	0.0	224.7	802.1
Yukon River						
Lower Yukon River	141.0	0.0	45.0	0.0	613.0	799.0
Upper Yukon River	5.2	0.0	12.7	0.0	420.3	438.2
Yukon River total	146.2	0.0	57.7	0.0	1033.3	1237.2
Norton Sound	19.5	0.2	22.0	3.6	134.9	180.2
Kotzebue Area	0.0	0.0	0.0	0.0	521.4	521.4
ARCTIC-YUKON-KUSKOKWIM REGION TOTAL	239.8	121.4	461.8	3.6	1914.3	2740.9

¹ Compiled 1 November 1985, catches in thousands of fish.

harvest of chinook salmon. The troll fishery landed about 216,000 chinook salmon which included 23,000 during the winter troll season, 1 October - 14 April. The summer season chinook fishery was open 3-12 June, 1-22 July, and for a 39-hour fishing period 25-26 August.

Net catches of chinook salmon (33,000) were higher than normal due to the increased availability of chinook salmon and extensive open fishing time needed to harvest other salmon species. A non-retention of chinook salmon regulation was implemented in the purse seine fishery as an experiment to hold chinook salmon catch to the agreed treaty level numbers.

Central Region

Bristol Bay:

The Bristol Bay inshore sockeye catch of 23.4 million fish was the ninth largest in the 93-year history of the fishery. All time harvest records were set in the Egegik District (7.4 million) and the Ugashik District (6.3 million). The total sockeye salmon return to Bristol Bay was 36.6 million fish, near the pre-season pooled forecast of 35.0 million fish. Chinook, chum, and coho salmon returns were below recent year run totals.

The total salmon harvested in the 1986 Bristol Bay fisheries was estimated to be 24.6 million fish worth \$115 million in ex-vessel value.

Estimated average weights and prices per pound were:

Sockeye	5.83 lbs - \$.81	Chinook	18.67 lbs - \$.98
Chum	6.73 lbs - \$.32	Coho	7.63 lbs - \$.69

Spawning escapement goals were achieved for all species and river systems, except for the Kvichak River sockeye salmon.

Prince William Sound:

The areawide commercial harvest of all salmon species was estimated to be 28.8 million fish and establishes a new all time record harvest of all species of salmon in Prince William Sound. Approximately 1.8 million salmon were from supplemental salmon production and taken in the common property fisheries as well as cost recovery programs from hatcheries.

Pink salmon harvests set a new record with the purse seine fishery taking 23.1 million pink salmon.

The sockeye salmon harvest of 1.4 million fish was above the long-term average harvests but slightly below pre-season expectations. The Copper River sockeye fishery took 0.9 million sockeye salmon, but experienced a later than normal return of fish due to lake breakup and cold water temperatures. Sockeye salmon catches in the Coghill District were near record levels this season producing a harvest of close to 350,000 sockeye salmon.

The areawide harvests of 1.2 million chum salmon was slightly below the pre-season expectations although well above long-term harvest averages.

The 1.0 million coho salmon harvests established an all time record with the Copper and Bering Rivers setting district catch records. The catch of about 415,000 coho from the Bering River is almost double the previous historic high.

The estimated ex-vessel value to the fishermen was \$45.8 million for this season's harvest.

Upper Cook Inlet:

The total salmon returns to Upper Cook Inlet were generally excellent, although considerable variations in run strength among stocks and species were evident. The total catch of 5.2 million salmon ranks fourth among historic harvest levels (1954-1985). The sockeye salmon harvest was the major contributor, totaling 3.9 million fish and was the second best catch on record for this species. The coho salmon catch of 620,000 also was the second highest catch on record. The chum salmon harvest of 714,000 was only slightly above the long-term average while the pink salmon harvest of 84,000 was well below the odd-year average. The chinook salmon harvest of 23,000 was the highest observed under the present regulatory structure.

Prices paid per pound were generally higher than in the recent past with sockeye and chinook salmon selling for \$1.20/lb, coho salmon for \$.70, chum salmon for \$.45, and pink salmon for \$.20. The estimated ex-vessel value of the catch was \$33.8 million, second highest on record.

Lower Cook Inlet:

The Lower Cook Inlet total salmon harvest of 1.5 million fish was 63% above the 30-year average harvests.

The sockeye salmon harvests were outstanding in all districts and the area harvest of 278,700 sockeye set a new record, exceeding the 1984 record by 3% and was 4-1/2 times greater than the 30-year average sockeye harvests.

The total pink salmon return to the Southern and Outer Districts was 22% above forecast with the Tutka Bay Hatchery return coming in 4% below the midpoint of the forecasted range. The primary reason for the larger than anticipated pink salmon return was the large (600,000 fish) harvest in the Port Dick and Nuka Bay areas.

The chum salmon harvests were poorer than expected with most chums taken incidentally during directed coho or pink salmon fisheries. The chum harvest was only 24% of the 30-year average harvest with escapements generally poor and below desired levels.

The coho salmon harvest was 27% above average and due primarily to a record harvest occurring in Nuka Bay of the Outer District.

Fishing effort was reduced this season with only 51 seine and 34 set gill net permits being fished. The estimated ex-vessel value of the fishery of \$2.8 million is considered to be economically good.

Average weights and prices per pound were:

Chinook	28.0 lbs - \$1.60	Sockeye	4.7 lbs - \$1.25
Pink	3.5 lbs - \$.22	Coho	9.8 lbs - \$.85
Chum	8.2 lbs - \$.25		

Arctic-Yukon-Kuskokwim Region

Yukon River:

The Yukon River area commercial salmon fishery harvested a total of 1.2 million salmon. The catch was composed of 146,200 chinook, 1,033,300 chum and 57,700 coho salmon.

The total salmon catch and the chum catch were below the recent 5-year harvest average (1980-1984). The chinook salmon catch was the fourth largest, while the coho salmon catch was the second highest in history.

Yukon River fishermen received an estimated \$7,157,000 for their catch in 1985.

Kuskokwim Area:

The commercial salmon fishery was opened on 20 June in District W-1 and W-2 for an initial 6-hour period and in W-4 and W-5 for a 12-hour period.

The District 1 and 2 catch of 37,800 chinook salmon was below the previous 5-year average of 39,300 chinook. The chinook harvest in District 5 was considered average while District 4 produced the third largest recorded chinook harvest. Escapements into the Kuskokwim River were below the desired escapement objectives for the third consecutive year.

The chum salmon harvest of 199,200 fish from District 1 and 2 were the lowest since 1976. Despite extended fishing closures, escapements of chum salmon were very low. Due to the very poor returns of sockeye and chum salmon, fishing was closed in Districts 4 and 5 on 15 July.

The coho salmon fishery reopened on 1 August to 6 September in Districts 4 and 5. However, severe weather hampered fishing effort and escapement enumeration. The catch of 335,600 coho salmon from the Kuskokwim River was the third largest recorded with escapement appearing to be above average.

A record 781 fishermen participated in the area fishery this year. The fishery was estimated to be worth \$3,253,600 or \$4,165 per fishermen which was down from the record high \$7,500 per fishermen in 1984. Although a considerable variation between districts exist, average weights and prices per pound were:

Chinook	17.0 lbs - \$.71	Sockeye	7.0 lbs - \$.59
Coho	7.5 lbs - \$.51	Chum	7.1 lbs - \$.25

Norton Sound:

The Norton Sound commercial salmon season opening was delayed for the second consecutive year due to late ice breakup and late run timing of salmon returns.

Most districts had their initial opening on 27 June, with the Nome subdistrict opening on 4 July.

The 1985 Norton Sound commercial salmon harvest totaled 180,200 fish which was comprised of 19,500 chinook, 3,600 pink, 134,900 chum, 22,000 coho, and 200 sockeye salmon.

The chinook salmon harvest was the highest on record while the chum, pink, and coho salmon harvests were 33% and 98%, and 60% below recent year harvest averages. A total of 155 out of 196 renewed Commercial Fisheries Entry Commission permits were actually fished this season.

In addition to domestic processor, a joint venture between KEG (Koyak-Elim-Golovin) fisheries and the North Pacific Longline Gillnet Association operated during the 1985 season. Under a permit issued by the Governor, four Japanese freezer ships were allowed to buy Norton Sound salmon directly from domestic fishermen.

Commercial fishermen received approximately \$822,000 for their catch this year which was the fourth highest dollar value on record. Average weights and prices per pound paid to fishermen were:

Chinook	21.5 lbs - \$1.08	Sockeye	7.0 lbs - \$.63
Pink	3.1 lbs - \$.20	Coho	7.7 lbs - \$.48
Chum	7.0 lbs - \$.31		

Kotzebue:

The 1985 Kotzebue fishing season was open 11 July to 31 August, fifteen fishing periods occurred for a total of 612 hours of fishing time. A total of 521,400 chum salmon, 63 chinook, and 454 Arctic char were taken by 189 fishermen and sold to four processing companies.

The 1985 salmon season produced the fourth largest chum salmon harvest since initiation of this fishery in 1962. When compared to the last six years, this season produced the second highest commercial catch and fishery value. The total ex-vessel value to fishermen for the 1985 season was estimated to be worth \$2,137,400.

Westward Region

Kodiak:

The 1985 commercial salmon harvest of over 9,897,000 salmon consisted of 7,335,000 pink, 1,842,800 sockeye, 431,000 chum, 283,200 coho, and 4,970 chinook salmon.

The harvest of 7.3 million pink salmon was 2.7 million fish more than the 4.6 million salmon midpoint forecasted harvest. Returns of pink salmon to the Kitoi Bay Hatchery were more than triple the forecast return and contributed over 3.5 million fish to the commercial salmon harvest of the area.

The chum salmon harvest of 431,000 fish taken incidentally to the pink salmon fishery, was below the long-term odd-year harvest average of 655,000 fish.

The sockeye salmon harvest of 1,842,800 fish ranks second to harvests of the last 40 years. This season's sockeye harvest came mainly from local Kodiak Island stocks and was the largest harvest of these local stocks since statehood. Only 125,000 Chignik-bound sockeye salmon were taken in the Cape Igvak fishery resulting in a 14.5% harvest level.

Escapements were excellent to all major sockeye salmon systems. The escapement goal for the Karluk River was achieved for the first time since statehood and received the best escapement into that system since 1938.

The harvest of 4,970 chinook salmon taken incidentally during the June sockeye fisheries is the highest catch since 1941. The escapement of 13,500 chinook salmon was well above average.

The coho salmon harvest of 283,200 fish represents the second highest coho salmon harvest on record and was double the pre-season projections. Coho salmon escapements of over 170,000 can be considered above average with good distribution.

The 1985 commercial salmon season was estimated to produce an ex-vessel value of over \$20.5 million to the fishermen of the Kodiak area.

Chignik:

The Chignik sockeye salmon fishery was opened on 12 June, for a 24-hour fishing period that was extended for continuous fishing until 18 June because of good early weir escapement counts and strong early sockeye harvests. However, the return of the early fun and late run sockeye salmon to the Chignik area did not materialize as expected. Restricted fishing periods and closures were implemented to achieve the escapement goals of both sockeye runs.

The total sockeye harvest was only 943,800 fish, well below both the pre-season midpoint harvest estimate of 1.8 million fish and the 10-year average harvests.

The catch of 203,700 coho salmon was the second largest on record and helped offset the weak sockeye harvest.

Returns of pink and chum salmon were generally weak as expected, with poor returns in the Eastern District and good returns in portions of the Western District.

Alaska Peninsula and Aleutian:

During June of 1985 a total of 105 seiners, 151 drift gillnetters, and 73 set gillnetters fished in that portion of the area west of Port Heiden.

The 1985 total salmon catch for the entire area was 11.4 million fish and estimated to be worth \$36.0 million to the fishermen.

South Peninsula:

During 1985, openings in South Unimak and Shumagin Islands June fisheries were generally 16 hours long. An exception was the 12-hour opening on 14 June for the Shumagin Districts. Fishing periods occurred in both fisheries on 3, 5, 7, 12, 14, 19, and 21 June. Fishing was restricted to South Unimak on 9 and 23 June, and to the Shumagins on 26 and 28 June.

A total of 1,383,000 sockeye salmon were harvested at South Unimak, very close to the guideline harvest level of 1,380,000. The Shumagin sockeye salmon harvest was 323,000 with a guideline harvest level of 305,000.

A total of 107,000 and 321,000 chum salmon were harvested incidental to sockeye salmon in the Shumagin Islands and South Unimak fisheries, respectively during 1985. The Shumagin's June chum harvests averaged 113,000 and ranged from 54,000 to 169,000 during the period 1980-1984. South Unimak chum salmon catches have averaged 551,000 and ranged from 228,000 to 934,000 during the period 1980-1984.

The Southeast Mainland fishery includes the Beaver Bay, Balboa Bay, West Stepovak, and East Stepovak sections. During 1985, four days of fishing were allowed during June to harvest Chignik-destined sockeye. An estimated 44,000 Chignik sockeye were intercepted and represents 10.1% of the Chignik return through 16 June. The fishery was closed until 25 July. The 25 July catch was much lower than anticipated, consequently only 5.25% was taken by the Southeast Mainland fishery through 25 July.

The 1985 South Peninsula pink salmon catch was 4.4 million fish with an escapement of 1.6 million fish. With a few exceptions, all odd-year pink salmon systems received good to excellent escapements during 1985.

The July-August catch of South Peninsula chums was 909,000, the fourth largest since 1962. The chum salmon escapement was estimated to be 500,000 and on the whole was well distributed.

The 1985 South Peninsula coho salmon catch was approximately 161,000. Most of the coho salmon catch was taken during the July-August pink and chum salmon fisheries.

North Peninsula:

The North Peninsula chinook salmon catch was 23,000 fish, higher than the average of 16,000 for the previous 10 years. The chinook salmon escapement was estimated to be 13,000. Chinook escapements were mediocre in the vicinity of Port Moller and Nelson Lagoon. It is believed that more of the chinook return was intercepted in the directed sockeye fishery, which was unusually intense due to record sockeye returns. The problem was exacerbated due to late the chinook return that overlapped to a greater extent with the sockeye return.

The North Peninsula sockeye salmon catch was a record 2.5 million fish. Nelson Lagoon accounted for 686,000 (also a record) with 71,000 being taken in the Northwestern District. The balance of the sockeye catch was taken from the area east of Port Moller.

The North Peninsula sockeye salmon escapement was 450,000 to Bear River and 315,000 to Nelson Lagoon and were larger than escapement goals of 200-250,000 and 100-150,000, respectively.

The North Peninsula chum catch of 698,000 was the fourth highest on record (100,000 below the 1984 record year). The estimated escapement of 344,000 was not evenly distributed, with heavy escapements occurring in the Izemnek-Moffet Bay section and part of Herendeen Bay, and poor to fair escapements occurring in the remainder of the area.

The 1985 North Peninsula coho catch of 170,000 was the third highest on record behind 1982 and 1984. Total coho escapement appeared fair to excellent.

Aleutian Islands:

The Aleutians experienced a dismal pink salmon year. The fishery was not opened during the July-August emergency order period and the total pink salmon catch was well under 1,000. However, the escapements in traditional fishing areas was (with a couple of exceptions) similar to the disastrous 1983 parent year escapements.

PRELIMINARY FORECASTS OF 1986 SALMON RETURNS TO
SELECTED ALASKA FISHERIES

The Department's salmon management program includes a number of salmon return forecast projects. Forecast fisheries are selected using several criteria, including economic importance, feasibility, compatibility with existing programs, and management needs. Forecast fisheries are:

- Southern Southeastern - pink salmon
- Northern Southeastern - pink salmon
- Prince William Sound - pink, chum, and Coghill District sockeye salmon
- Prince William Sound/
Copper River - sockeye and chinook salmon
- Lower Cook Inlet: Southern
and Outer Districts - pink salmon
- Upper Cook Inlet - sockeye salmon
- Kodiak - pink salmon
- Chignik - pink and sockeye salmon
- South Peninsula - pink salmon
- Bristol Bay - pink, sockeye, and chinook salmon

In 1985 83% of the total statewide harvest was taken in these fisheries (Table 1).

A variety of information is used to make salmon return forecasts, including escapement magnitudes and distribution, egg deposition, survival to intermediate life stages, high seas abundance, environmental conditions, and population age composition. The return, with upper and lower limits, is predicted for each forecast fishery. In general, based on past experience, the actual return can be expected to fall within the range (between the lower and upper limits) somewhat less than half the time. In 1985, seven of fourteen return forecasts were outside their respective ranges. The 1986 forecasts and ranges are summarized in Table 8.

Forecast abstracts are given below; the reader is referred to the Appendix for further details.

Southeastern Alaska Pink Salmon

The total Southeastern pink salmon harvest is expected to be 38.4 million, a decrease from the near record 1985 harvest of 51 million. A return of 37.9 million pink salmon is expected to southern Southeastern districts in 1986,

Table 8. Preliminary forecasts of salmon returns and commercial harvests for some major Alaska fisheries in 1986.

Thousands of Fish									
Area	Species	Forecast Return	Escapement Goal	Estimated Harvest	Forecasted Return ¹ Range		Estimated Harvest Range		
Southern Southeastern	pink	37900	6000	31900	30600 -	45300	24600 -	39300	
Northern Southeastern	pink	11100	4600	6500	6900 -	15300	2300 -	10700	
Southeastern total	pink	49000	10600	38400	40600 -	57500	30000 -	46900	
Prince William Sound ²	pink	27600	4200	23400	22070 -	33130	17870 -	28930	
	chum	1266	383	882	971 -	1562	587 -	1178	
PWS Coghill District	sockeye	552	40	512	386 -	718	346 -	678	
Copper River	sockeye	1559	704	854	1247 -	1870	685 -	1024	
	chinook	45	15	30	36 -	54	25 -	35	
Lower Cook Inlet- ² Southern and Outer Districts	pink	2269	270	1999	1123 -	3414	853 -	3144	
Upper Cook Inlet	sockeye	5200	1000	4200	4200 -	6200	3200 -	5200	
Kodiak ²	pink	19730	4050	15680	17640 -	21930	13590 -	17880	
Chignik ³	sockeye	2811	650	2161	2569 -	3053	1919 -	2403	
	pink	2640	700	1940	1300 -	3960	600 -	3260	
South Peninsula ⁴	pink	8400	2000	6400	5000 -	11800	3500 -	9300	
Bristol Bay ⁵	sockeye	22000	9700	12300	8600 -	35400	2200 -	25700	
Bristol Bay, Nushagak District	chinook	183	75	108	77 -	297	2 -	222	
	pink	4100	1000	3100	1400 -	7300	400 -	6300	
Bristol Bay, Togiak District	chinook	39	15	24	10 -	71	0 -	56	
		147392	35403	111990	129834 -	165095	94431 -	129692	

¹ Compiled 1 November 1985. The forecast return and harvest ranges were estimated by several techniques. Based on past experience, somewhat less than half of the sockeye returns and harvests can be expected to fall within their respective ranges.

² Includes supplemental production, PWS pink escapement goal includes 2.3 million hatchery harvest, PWS chum escapement includes 205 thousand hatchery harvest.

³ Includes estimated interceptions of Chignik bound sockeye at Cape Igvak and Stepovak Bay.

⁴ Does not include pink salmon taken during June near False Pass, South Unimak, and Shumagin Islands, which are returning to other areas.

⁵ Inshore harvests only.

with an expected harvest of 31.9 million. The parent escapement for 1984 was the second largest on record, temperatures were above average, and high CPUE during the later parts of the run were high indicating favorable sex ratios for the parent escapement. A return of 11.1 million pink salmon is expected to return to northern Southeastern districts, with the 1986 harvest expected to be 6.5 million. Parent escapements and temperatures for the northern Southeastern districts were above average and pre-emergent fry indices were down from the previous year but well above recent 20-year averages.

Prince William Sound Pink, Chum, and Coghill River Sockeye Salmon

The 1986 Prince William Sound harvest of pink salmon is expected to be 23.4 million salmon (including 2.3 million hatchery harvest) and represents a slight decrease from the 1985 harvest. The return is expected to consist of 60% natural and 40% hatchery stocks. The expected 1986 chum harvest is 882 thousand down from the 1985 harvest. The expected 1986 harvest of Coghill sockeye is 512 thousand up substantially from the 1985 harvest.

Prince William Sound/Copper River Sockeye and Chinook Salmon

A harvest of 854 thousand sockeye and 30 thousand chinook salmon is expected for the Copper and Bering Rivers, both of these are down from the 1985 harvests.

Lower Cook Inlet (Southern and Outer Districts) Pink Salmon

The total expected 1986 pink salmon harvest is expected to be 2 million fish. Approximately 25% of these fish is expected to come from Tutka Lagoon hatchery fish.

Upper Cook Inlet Sockeye Salmon

A harvest of 4.2 million sockeye salmon is expected in 1986. The return is expected to be comparable to 1985 levels.

Kodiak Pink Salmon

The 1986 Kodiak pink salmon return forecast is 19.7 million, with an expected catch of 17.7 million. This is substantially greater than the 1985 harvest. The pre-emergent fry index was one of the largest on record, indicating excellent survival of 1984 escapement. Cold temperatures during the outmigration of fry may buffer the high survival indicated by fry index and has moderated 1986 return expectations.

Chignik Pink and Sockeye Salmon

The return of pink salmon to Chignik in 1986 is expected to be 2.6 million with a harvest expected of 2 million. This is up substantially from the 1985 harvest. The 1986 return of Chignik sockeye salmon is expected to be 2.8 million with a harvest expected of 2.2 million, up from the 1985 harvest.

South Peninsula Pink Salmon

The 1986 return of pink salmon to South Peninsula is expected to be 8.4 million

with a harvest of 6.4 million expected. This is up substantially from 1985 and would be the fourth largest harvest on record.

Bristol Bay Sockeye and Chinook Salmon

The 1986 return of sockeye salmon to Bristol Bay is expected to be 22 million with a harvest of 12.3 million expected. The Standard ADF&G forecast (21.3 million) was consistent with the forecast made based on Japanese Research Catches (23.1 million). The return to the Kvichak River system is expected to be below or near escapement goals. The 1986 catch is expected to be substantially below the 1985 level. The 1986 return of Nushagak and Togiak chinook salmon is expected to be 193 and 39 thousand with a catch of 108 and 24 thousand, respectively. This is the first year that a forecast of Togiak chinook salmon has been made.

PROJECTED 1986 ALASKA COMMERCIAL SALMON HARVESTS

Projections of the 1986 Alaska commercial salmon harvest by statistical region and species are presented in Table 9. Table 10 gives the projections by management region and species. These projections are composed of forecast harvests, and harvest projections (recent harvest averages, sometimes modified if additional information is available) for fisheries without formal forecasts. Coho returns are not forecast in any region. Forecasts of chum salmon returns are available only for Prince William Sound. Several smaller pink salmon runs are not forecast. Major sockeye runs in the Central and Western statistical regions are forecast; an important exception is the sockeye fisheries in Kodiak. Despite these gaps, 83% of the 1985 salmon harvest of 144 million fish came from fisheries where formal forecasts are made

The 1986 statewide total commercial harvest projection is 138.0 million fish.

Species Outlook

Pink Salmon

69% of the 1986 statewide total harvest projection, or 96 million fish.

62% of the 1985 statewide total harvest, or 89 million fish.

A moderate increase, from the 89 million pink salmon harvested in 1985 to 96 million in 1986 is expected. The 1986 pink salmon catch is expected to decrease slightly in Prince William Sound, decrease in Southeastern Alaska, and to increase significantly in Western Alaska and Kodiak.

Sockeye Salmon

19% of the 1986 statewide total harvest projection, or 26 million fish.

26.5% of the 1985 statewide total harvest, or 38 million fish.

The 1986 catch of sockeye is expected to decrease from the large 1985 catch. The 1986 sockeye harvest is expected to be substantially lower in Bristol Bay.

Chum Salmon

7.7% of the 1986 statewide total harvest project, or 10.6 million fish.

7.3% of the 1985 statewide total harvest, or 10.6 million fish.

Coho Salmon

3.4% of the 1986 statewide total harvest projection, or 4.7 million fish.

3.9% of the 1985 statewide total harvest, or 5.6 million fish.

Table 9. Preliminary projections of 1986 Alaska commercial salmon harvests by statistical region and species¹.

STATISTICAL REGION ²	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeastern	261	1500	2300	38400	3000	45461
Central	62	10596	1570	51769	4147	68144
Western	355	14385	795	5420	3455	24410
TOTAL ALASKA	678	26481	4665	95589	10602	138015

¹ Compiled 1 November 1985, catches in thousands of fish. The projected 1986 harvest were obtained by summing harvest forecasts (Table 8) and harvest projections for remaining fisheries. The latter based on recent catches.

² See Figure 3 for definition of statistical areas.

Table 10. Preliminary projections of 1986 Alaska commercial salmon harvests by management region and species¹.

Management Region	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeastern	261	1500	2300	38400	3000	45461
Central	156	18101	1520	29849	2897	52523
Arctic-Yukon-Kuskokwim	223	80	145	220	1750	2418
Westward	38	6800	700	27120	2955	37613
TOTAL ALASKA	678	26481	4665	95589	10602	138015

¹ Compiled 1 November 1985, catches in thousands of fish. The projected 1986 harvests were obtained by summing harvest forecasts (Table 8) and harvest projections for remaining fisheries. The latter was based on averages of catches in recent years.

² See Tables 4, 5, 6, and 7 for definition of management regions.

APPENDIX. FORECAST METHODS AND DISCUSSIONS

FORECAST AREA: Southeastern Alaska

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

Southern Southeastern:	<u>Point</u>	<u>Range</u>
Return Estimate:	37.9 million	30.6 million - 45.3 million
Escapement Goal:	6.0 million	
Harvest Estimate:	31.9 million	24.6 million - 39.3 million
Northern Southeastern:		
Return Estimate:	11.1 million	6.9 million - 15.3 million
Escapement Goal:	4.6 million	
Harvest Estimate:	6.5 million	2.3 million - 10.7 million
Total Southeastern:		
Return Estimate:	49.0 million	40.6 million - 57.5 million
Escapement Goal:	10.6 million	
Harvest Estimate:	38.4 million	30.0 million - 46.9 million

FORECAST METHODS

Returns to the southern and northern areas of Southeastern Alaska are forecasted separately because of differences in migration routes and run timing. The southern Southeastern forecast was based on multiple linear regression analysis using 19 years of data (1967 through 1985). The variables included in the regression analysis were: escapement index, average winter air temperatures at several stations throughout the area, and average catch per unit effort (CPUE) of the last two weeks of the districts 103 and 104 seine fishery. The latter variable is a measure of the quantity of females in the escapement. The northern Southeastern forecast was prepared using the pre-emergent fry index average regional air temperatures during the year the fry emerge and outmigrate.

DISCUSSION OF THE 1986 FORECAST

Southern Southeastern: The 1986 pink salmon return to southern Southeastern Alaska is expected to continue exhibiting the strength it has

in recent years. The point prediction of 37.9 was the largest ever made in this program which dates back to 1967. One of the primary factors responsible for this optimistic outlook was the excellent parent year escapement index of 8.9 million, the second largest since statehood, being surpassed only by the 1983 index of 9.1 million.

The average winter air temperature of 34.3°F was slightly above the study period average although it was 1.5 degrees below the temperature which influenced the near record return in 1985.

The last independent variable CPUE during the last two weeks of the parent year fishery exhibited the highest partial correlation with return. Its influence is believed to be a reflection of improved sex ratios in the escapement. Recent studies have documented sex ratios of only 30% females in the catch early in the season increasing to almost 70% females late in the season. The CPUE for 1984 was almost twice as high as any previously observed. This resulted in an unrealistically high prediction. Since it is believed there is a point above which increasing CPUE's at the end of the fishery will not further improve escapement sex ratios, the highest CPUE which had occurred through 1983 (1985 return) was used for the 1986 prediction.

One of the biggest unknowns in this year's prediction is the influence of unusually high concentrations of immature black cod in the area during the 1985 outmigration period. The last time this was observed was in 1978; the 1979 return per index spawner was only 1.98 to 1. It is not believed their influence this year was near as extreme because they arrived about 3 weeks later than in 1979, thus giving the fry additional time to develop their escapement behavior skills.

The distribution of the return should be similar to that which occurred in 1985 with at least half of the overall catch occurring off the west coast of Prince of Wales in District 103 and 104. Observations made during the early marine program indicated the return to District 101 will be very similar to last year, while District 102 should show more strength than 1985. The fishing effort required to harvest excess fish returning to District 101 through 104 will most likely harvest fish returning to Districts 105 through 108 leaving few excess fish available for harvest in those districts.

Northern Southeastern: The point estimate of 11.1 million represents a return per spawner of 2.92 which is just over average for the recent 19 years. Winter temperatures in the northern areas were above average but about a degree below the temperatures that produced the 1985 near record harvest. The pre-emergent fry index was down from last year's index but well above recent 20-year average. Escapements in the parent year were well above average but 800 thousand short of the levels that produced the 1985 return.

District 109 had the third best escapement since 1960 and the raw fry index was the second highest ever at 306.1 fry per meter. Escapements to the Sitka portions of this district (Section 9A) were strong and the

fry index in the Sitka area was the best ever recorded. The Petersburg portions of this district had very strong escapements and the pre-emergent fry index was correspondingly strong indicating good potential for harvestable surpluses.

The escapements to District 110 and 114 were generally well below desired levels and while pre-emergent values were fairly good little harvest is generally expected from most of the stocks in these areas.

District 111 had an escapement of 443 thousand excluding the Taku River area and a very good pre-emergent index indicating good overwinter survival. The escapements to the Taku River area were strong again and should produce some harvestable surpluses in 1986.

Escapements in District 112 were the lowest since 1976 and the fry index was about average. Early marine studies in the Tenakee Inlet area recorded reduced levels of pink salmon fry and with the late spring early marine conditions were not as favorable as those that produced last years return. Some harvest is expected from localized stocks in this district, however.

District 113 had the best even-year escapement since 1960 which coupled with the strong pre-emergent fry index indicates very good potential for harvestable surpluses. The Peril Straits streams had a combined escapement index that was the second best since 1960 and the pre-emergent fry index was the best ever recorded. The outside areas of the district also have very strong escapements and good pre-emergent fry values indicating a very good potential for harvest.

Jesse D. Jones
Fishery Biologist
Juneau

Karl T. Hofmeister
Fishery Biologist
Ketchikan

FORECAST AREA: Prince William Sound

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	16.7 million	12.0 million - 21.4 million
Harvest Estimate:	15.2 million	10.5 million - 19.9 million
Escapement Goal:	1.5 million	
SUPPLEMENTAL PRODUCTION		
Cannery Creek Hatchery		
Return Estimate:	1.5 million	1.1 million - 1.9 million
Common Property Harvest Estimate:	1.4 million	1.0 million - 1.8 million
Brood Stock and Stream Escapement:	0.1 million	
Main Bay Hatchery		
Return Estimate:	0.7 million	0.5 million - 0.9 million
Common Property Harvest Estimate:	0.6 million	0.0 million - 0.8 million
Brood Stock:	0.1 million	
Valdez Fisheries Development Association		
Return Estimate:	3.1 million	2.1 million - 4.1 million
Common Property Harvest Estimate:	2.0 million	1.0 million - 3.0 million
Brood Stock:	0.2 million	
Hatchery Harvest:	0.9 million	
Prince William Sound Aquaculture Corporation, A.F.K. Hatchery		
Return Estimate:	5.6 million	2.9 million - 8.3 million
Common Property Harvest Estimate:	4.2 million	1.5 million - 6.9 million
Brood Stock:	0.2 million	
Hatchery Harvest:	1.2 million	
TOTAL SUPPLEMENTAL PRODUCTION		
Return Estimate:	10.9 million	

	<u>Point</u>	<u>Range</u>
Common Property		
Harvest Estimate:	8.0 million	
Escapement and Brood		
Stock:	0.6 million	
Hatchery Harvest:	2.3 million	
Total Harvest:	10.3 million	
 TOTAL PRODUCTION		
Return Estimate:	27.6 million	22.1 million - 33.1 million
Harvest Estimate:	23.2 million	17.9 million - 28.9 million
Escapement, Brood		
Stock, and Hatchery		
Harvest:	4.2 million	

FORECAST METHODS

Natural Production: The 1986 forecast was based on a multiple linear regression of even-numbered brood year returns on pre-emergent fry indices and March-April temperature regimes of the year following brood year spawning for the respective brood years. Data were from 1964 through 1984 brood years.

This estimated 1986 return was based on a pre-emergent fry index of 379 fry per square meter. This index was the product of a record estimated escapement of 4.1 million fish but represented a lower than average index for the recent high return year. The lower survival is expected to be balanced by the high air temperatures observed during March-April 1985.

Supplemental Production: The 1986 forecasted hatchery return was based on a total hatchery release of 220.6 million fed and unfed fry. Returns to individual hatcheries were based on estimated fry to adult survival rates as calculated from common property fishery catch contributions and actual returns to the hatchery itself.

DISCUSSION OF THE 1986 FORECAST

Natural Production: As previously stated the 1984 estimated escapement of 4.1 million fish represents the highest on record. All districts far exceeded the upper range of desired escapement and all districts had good spawner distribution.

Harvestable surpluses will be available throughout the commercial fishing season and, barring any unforeseen stock failures, should be available in all districts of the Sound throughout the season.

Supplemental Production: As with the Sound's wild stocks the hatchery releases for the last four years have experienced phenomenally high survival rates. If predictions are close for the 1986 season the hatchery returns could compose nearly 40% of the total pink salmon return.

FORECAST AREA: Prince William Sound

SPECIES: Chum Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	927,000	649,000 to 1,205,000
Harvest Estimate:	677,000	399,000 to 955,000
Escapement Goal:	250,000	

SUPPLEMENTAL PRODUCTION

Valdez Fisheries Development Association

Return Estimate:	12,800	6,400 to 25,600
Common Property		
Harvest Estimate:	0	0 0
Brood Stock:	12,800	

Main Bay Hatchery

Return Estimate:	140,400	98,000 to 184,000
Common Property		
Harvest Estimate:	65,400	23,000 to 109,000
Brood Stock:	75,000	

Prince William Sound Aquaculture Corporation
Armin F. Koernig Hatchery

Return Estimate:	181,000	90,400 to 271,300
Common Property		
Harvest Estimate:	136,000	0 to 135,300
Brood Stock:	45,000	
Hatchery Harvest:	0	

Esther Lake Hatchery

Return Estimate:	4,500	2,200 to 6,700
Common Property		
Harvest Estimate:	4,000	0 to 1,700
Brood Stock:	500	
Hatchery Harvest:	0	

TOTAL SUPPLEMENTAL PRODUCTION

Return Estimate:	338,700	
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	<u>Point</u>	<u>Range</u>
Common Property Harvest Estimate:	205,400	
Brood Stock:	133,300	
Hatchery Harvest:	0	
Total Harvest:	205,400	
TOTAL PRODUCTION		
Return Estimate:	1,265,700	970,500 - 1,561,500
Harvest Estimate:	882,400	587,200 - 1,178,200
Escapement, Brood Stock, and Hatchery Harvest:	383,300	

FORECAST METHODS

Natural Production: The 1986 forecast was based on linear regression analysis of brood year production relationships of 3-year-old to 4-year-old fish and 4-year-old to 5-year-old fish. In 1986 the 1982 brood year is expected to produce 552,000 4-year-old fish and the 1981 brood year is expected to contribute 205,000 5-year-old fish.

For the first time a forecast was made of 3-year-old returns. After investigating many different statistical relationships the best relationship was pre-emergent fry indices versus March-April air temperatures in the year of emergence and subsequent 3-year-old returns. A return of 133,000 3-year-olds was made based on this method.

The total forecast of 3-, 4-, and 5-year-old fish was 890,000 fish and account for 96% of annual returns. Therefore the total expected return for 1986 is 927,000 fish (890,000 divided by .96).

Supplemental Production: The fry released from brood years contributing to the 1986 chum salmon return was in excess of 40 million. The total expected return of 338,700 fish was based on average fry to adult survival rates and average contribution of age classes to annual returns. To date 4-year-old fish average 75% of annual returns and therefore should be the major portion of the 1986 return.

DISCUSSION OF THE 1986 FORECAST

Natural Production: Both 3-year-old and 4-year-old production was lower than expected in 1985 while 5-year-old production was higher than expected. This trend indicated that production rates for brood years 1981 and 1982 could be lower than anticipated; the reason for the lower productivity rate is not known. Previous brood years that produced over 200,000 3-year-old fish produced in excess of 1.4 million 4-year-olds (brood year 1977 produced 1.8 million and brood year 1978 produced 1.5 million 4-year-olds). The 1986 predicted return of 552,000 4-year-olds was less than half of the

average 4-year-old returns that have been occurring since 1981. To a lesser degree lower production of 3- and 5-year-olds is also expected in 1986.

Overall the 1986 expected returns are projected to be below returns that have been occurring since 1981.

Supplemental Production: If hatchery returns come back as predicted they will represent the largest to date for Prince William Sound. The returns to the Main Bay and Esther Island facilities will be the easiest to monitor for success as their timing is early; this timing makes their success easier to monitor as it is not expected that the General districts purse seine fishery will be opened prior to their return with the result that interceptions will not occur on these stocks.

Michael L. McCurdy
Research Project Leader
Cordova

FORECAST AREA: Prince William Sound

SPECIES: Sockeye Salmon, Coghill River

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	552,000	386,000 to 718,000
Harvest Estimate:	512,000	346,000 to 678,000
Escapement Goal:	40,000	

FORECAST METHODS

The forecast was made based on historical return by age class for 1968 to 1982 brood years. A forecast of each of the major age classes (4_2 's, 5_2 's, 5_3 's, and 6_3 's) was made based on returns of respective sibling age classes in 1985. Relationships of 1-ocean to 2-ocean and 2-ocean to 3-ocean returns by freshwater age groups from the same brood year were estimated by linear regression.

DISCUSSION OF 1986 FORECAST

Brood year production has continued to be greater than expected for brood years 1980 and 1981; these years had escapements of 142,000 and 156,000 fish respectively. These escapements are the third and fourth highest recorded since statehood. The increased production, to date, is particularly true for the 2-freshwater, 2- and 3-ocean age groups. If this continues the 2-freshwater age groups will be contributing a larger percentage of annual returns through 1988.

The expected 1986 return of 552,000 fish is better than twice the average for brood years 1968 to 1979.

Michael L. McCurdy
Research Project Leader
Cordova

FORECAST AREA: Prince William Sound/Copper River

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	1,476,300	1,181,100 to 1,771,500
Harvest Estimate:	805,000	645,000 to 965,000
Escapement Goal:	671,300	

SUPPLEMENTAL PRODUCTION

Gulkana Hatchery

Return Estimate:	82,300	65,800 to 98,800
Harvest Estimate:	49,400	39,600 to 59,200
Brood Stock and Stream Escapement:	32,900	

TOTAL PRODUCTION

Return Estimate:	1,558,600	1,246,900 to 1,870,300
Harvest Estimate:	854,400	684,600 to 1,024,200
Escapement and Brood Stock:	704,200	

FORECAST METHODS

Natural Production: The 1986 sockeye salmon forecast utilized historical return per spawner data from the five most similar spawning populations and parent year escapement weighted age class (4-, 5-, and 6-year-olds) for the Copper River Delta and Upper Copper River independently. The 1986 predicted return was influenced heavily by the 1981 and 1982 brood years for the Copper River Delta and the Upper Copper River.

Supplemental Production: The 1986 supplemental return will be the result of production from Gulkana Hatchery. Brood years 1981 and 1982 using F.R.E.D. Division standard survival assumptions should produce an adult return of 82,256. A harvest level of 60% would contribute 49,354 salmon to the catch.

DISCUSSION OF THE 1986 FORECAST

Escapements for the contributing brood years (1980-1982) were above historical average for both Copper River Delta streams and for the Upper Copper River. There could be negative effects of high spawner density

on the 1986 return but these are expected to be buffered by mild winter conditions during the freshwater phase, producing an average return.

SPECIES: Chinook Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	44,475	35,500 to 53,500
Harvest Estimate:	29,475	24,500 to 34,500
Escapement Goal:	15,000	

FORECAST METHODS:

The 1986 chinook salmon forecast utilizes historical indices of escapement made with aerial surveys and age composition of the returns. A single estimate of escapement was derived as the average of the escapement indices observed for the 1979-1983 brood years weighted by the average proportion of the 7-, 6-, 5-, and 4-year-old fish in the historical returns, respectively. The escapement estimate was then multiplied by an average return-per-spawner to give the expected 1986 return. Climate conditions or spawner distribution were not considered in the forecast.

DISCUSSION OF THE 1986 FORECAST

During the past 8-10 years, chinook salmon catches as well as escapements to the Copper River have been consistently above average. Only a failure of the 1980 brood year or significant extra production of the 1979, 1981, or 1982 brood years could seriously affect the forecasted return. No climate condition or other event is believed to have impacted any of the brood years involved. A chinook salmon harvest of the 29,500 is expected.

Kenneth Roberson
Research Biologist
Glennallen

FORECAST AREA: Lower Cook Inlet, Southern and Outer Districts

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Southern and Outer Districts	1,547,500	587,200 - 2,507,800
Resurrection Bay	171,100	0 - 648,000
Total Forecasted Return:	1,718,600	587,200 - 3,155,800
Escapement Goal:	228,000	
Harvest Estimate:	1,490,600	359,200 - 2,927,800
SUPPLEMENTAL PRODUCTION		
Return Estimate (Tutka)	549,900	371,300 - 728,500
Required Brood Stock:	42,000	
Harvest Estimate:	507,900	329,300 - 686,500
TOTAL PRODUCTION		
Return Estimate:	2,268,500	1,123,000 - 3,414,000
Escapement and Brood Stock:	270,000	
Harvest Estimate:	1,998,500	853,000 - 3,143,000

FORECAST METHODS

The 1986 pink salmon forecasts for the Southern and Outer Districts and Resurrection Bay were derived based on linear regression of adult returns and indices of alevin densities in major spawning streams. The indices of alevin abundance was the average of the individual stream indices weighted by the average escapement for that stream. This weighting procedure has not been incorporated into the Resurrection Bay forecast using the total alevin index.

The Tutka Lagoon pink salmon hatchery has provided 35-90% of the entire Southern District pink harvest since 1978. The hatchery released 23.5 million fry in 1985, 9.4 of which were short term reared. Past survival rates used for forecasting returns are 2-4% for reared fry and 0.8-2% for direct released fry. A major chum salmon fry release occurred from the Tutka hatchery in 1982 and a return rate of 2% has been used to forecast the return from 1.14 million fry.

The sockeye return to Leisure Lake is also forecasted annually. Recent return rates for the various year and age classes of sockeye have been used to forecast the 1986 return. The majority of the return continues to be comprised of 2-ocean adults and the 1984 outmigration of smolt was only 229,000.

DISCUSSION OF THE 1986 FORECAST

The primary question is whether the LCI pink salmon returns are going to shift to an even-year dominance. Since 1971, the odd-year return has dominated regardless of alevin densities observed in the spawning streams. There are indications that this shift may occur in 1986.

The 1984 brood year alevin densities were the highest even-year levels observed since 1968, but must still be tempered by the complete lack of pink salmon in many Outer District streams and the lack of upstream spawning in Port Dick, the major producing stream during even-years. Average return per spawner data suggested a return of 1,250,000 and may be more realistic than the 1.72 million estimates by the above procedure. The 1984 return to Resurrection Bay was forecasted to be 143,400 and came in at 159,400. Alevin densities in three major spawning systems were lower in 1984 and the 1986 return will in all likelihood be lower than the 1984 returns.

If the even-year shift occurs, the Tutka hatchery return may exceed 1.0 million fish. The 1985 return of 528,371 came from 4.0 million fewer fry that were not reared prior to release. Better return per release should be expected for the 1986 returns because of the 1985 releases of reared fry.

Sockeye returns of predominantly 4-year-old fish should be strong due to excellent escapements in 1982. Coho salmon escapements were excellent to rivers in the Kamishak District and given the mild weather in recent years, a strong return is expected to this area. The projected harvest of 20,000 could easily be exceeded in this district alone as the parent year harvest was over 38,000.

Chum salmon returns should be above average due to excellent escapements in 1981 and 1982. However, no harvestable returns of 4-year-old fish from the 1981 spawning escapement occurred in 1985 and may be an indication of poor survival by that year class. This again refers back to the "El Nino" current effects in the northern Pacific.

Thomas R. Schroeder
Area Management Biologist
Homer

FORECAST AREA: Upper Cook Inlet

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	5.2 million	4.2 million to 6.2 million
Escapement Goal:	1.0 million	
Harvest Estimate:	4.2 million	3.2 million to 5.2 million

FORECAST METHODS

The major sockeye salmon systems in Upper Cook Inlet are the Kenai, Kasilof, Susitna, Crescent, Chakachatna/McArthur, and Big Rivers. Fish Creek is also significant in some years.

Historical data on total sockeye salmon return are available for the first four systems noted and these data form the basis of the forecast. Escapement-return relationships by system provided estimates of total production from each brood year escapement. Average marine maturity schedules were then applied to estimate the numbers of adult salmon returning each year.

DISCUSSION OF THE 1986 FORECAST

The total return of sockeye salmon to Upper Cook Inlet is estimated to be 5.2 million in 1986. Desired escapement levels to the four major river systems total one million, providing an anticipated harvestable surplus of 4.2 million fish. Estimated returns to the Kenai River are 2.4 million, to the Kasilof River are 1.5 million, to the Susitna River are 1.2 million, and to the Crescent River are 111,000.

The 1986 forecast represents the third attempt at forecasting sockeye salmon returns to Upper Cook Inlet. In 1984, the first attempt, the forecast was for a total return of 3.2 million fish with a harvest of 2.2 million fish. The actual return was estimated to be 3.3 million fish (103% of forecast) with a harvest of 2.0 million fish (91% of forecast). The second year forecast (1985) was for a harvest of 3.6 million fish. The actual harvest was 3.8 million sockeye salmon (106% of forecast).

Therefore, this forecast method for all of Upper Cook Inlet appears to give a fairly accurate figure. However, the data by individual river system probably does not reflect actual returns by system as minor system production was assigned to the four major systems for analysis. This has tended to bias high the estimate by individual system.

Kenneth E. Tarbox
Research Project Leader
Upper Cook Inlet

FORECAST AREA: Kodiak

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

NATURAL PRODUCTION	<u>Point</u>	<u>Range</u>
Return Estimate:	18.6 million	16.6 million - 20.7 million
Escapement:	3.9 million	
Harvest Estimate:	14.7 million	12.7 million - 16.8 million
SUPPLEMENTAL PRODUCTION ¹		
Return Estimate:	1.13 million	0.49 million - 1.80 million
Required Brood Stock:	0.15 million	
Harvest Estimate:	0.98 million	0.34 million - 1.15 million
TOTAL PRODUCTION		
Return Estimate:	19.73 million	17.64 million - 21.93 million
Escapement and Brood Stock:	4.05 million	
Harvest Estimate:	15.68 million	13.59 million - 17.88 million

FORECAST METHODS

The 1986 pink salmon forecast return to the Kodiak Management Area was determined as follows. A point estimate for the total management area return was calculated from a multiple linear regression analysis of the past 20 years pre-emergent data. Variables used in the analysis were the indexed live fry densities and the departure from the norm of the average April ambient air temperatures taken in Kodiak. The upper and lower range estimates are the 80% confidence intervals.

DISCUSSION OF THE 1986 FORECAST

Pre-emergent fry sampling this spring (1985) indicated excellent over-winter survival from the brood year escapement of 4.5 million pink salmon.

¹ Hatchery production forecast is for Kitoi Bay Hatchery and was prepared by Roger Blackett. See Afognak District for additional discussion. All numerical values represent numbers of fish.

Sampling resulted in an unweighted live fry index of 252.06 live fry/m². This fry index is one of the highest on record.

Distribution of the brood year escapement resulted in 86% of the fish entering the pre-emergent index streams. Freezing weather conditions slowed sampling. Streams on the mainland were not sampled due to the extended cold weather. The natural fry outmigration appeared to peak later than normal because of the continued cold weather in March through mid-April. The cold April temperature is the main reason the forecasted pink salmon return in 1986 is lower than the excellent live fry indexes would indicate.

A breakdown of the expected return by major geographical districts is summarized below. All district harvest projections assume desired escapement goals will be met.

Afognak District: The pre-emergent fry index was very similar to that of the 1984 return. Dead fry from freezing accounted for the lower indexes on Perenosa Creek. Malina and Marka Creeks were not sampled due to freezing weather. A total of 744,000 pinks are expected to return. The desired escapement level is 250,000 pinks leaving 494,000 pinks available for harvesting.

Afognak District Supplemental Production: Kitoi Bay Hatchery total return point estimate is 1,129,000 pinks from a release of 75.1 million fry. 150,000 pinks are required for escapement and brood stock leaving 979,000 pinks available for harvesting. Once again the lower estimated return is based on the cold April temperatures in 1985.

Westside District: Overall live fry densities for the district are some of the highest on record. Little River was the only stream not sampled in the district. 14,508,000 pinks are expected to return. The desired escapement goal is 2,250,000 pinks, leaving an estimated 12,258,000 pinks available for harvesting.

Alitak District: The live fry index for this district is above average. Early spawning on the upper portion of Deadman River appeared to have suffered from scouring during the heavy flooding which occurred in August 1984. 1.3 million pink salmon are expected to return to the district. 500,000 pinks are needed to meet the desired escapement goals, leaving approximately 800,000 pinks available for harvesting.

General District: The overall live fry index for the district is one of the highest on record. Once again cold spring temperatures are the main reason for the lower expected return. 1.49 million pinks are expected to return to the district. The desired escapement level is 500,000 pinks, leaving approximately 990,000 pinks available for harvesting.

Mainland District: No streams were sampled because of the late freezing weather conditions. Based on the brood year escapements and the over-winter success of pink fry on Kodiak and Afognak Islands, 558,000 pinks are expected to return. The escapement goal is 400,000 pinks, leaving

approximately 158,000 pinks available for harvesting.

David Prokopowich
Assistant Area Management Biologist
Kodiak Management Area

FORECAST AREA: Chignik

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF THE 1986 RETURN:

	<u>Point</u>	<u>Range</u>
Return Estimate:	2.64 million	1.30 million - 3.97 million
Escapement Goal:	700,000	
Harvest Estimate:	1.49 million	0.60 million - 3.27 million

FORECAST METHODS

The 1986 Chignik forecast was determined using the last 20 years of return per spawner rates for the Western, Perryville, Central, and Eastern Districts.

DISCUSSION OF THE 1986 FORECAST

The 1986 forecast was derived using return per spawner rates instead of using the pre-emergent fry sampling data due to the limited spawning effort during the spring of 1985 in the Chignik area. The pre-emergent fry sampling studies that were conducted did indicate that stream conditions were fair to good with little evidence for scouring as was the case in past years.

The parent year escapement for the 1986 return was very good at 686,920 for the Western and Perryville Districts and 472,460 for the Central and Eastern Districts. Return per spawner rates have been variable throughout the years as have been the returns. The mean return per spawner for the past 20 years in the Western and Perryville Districts is 3.71. The streams in these districts are reasonably stable and coupled with the parent year escapement should produce a return of about 1.10 million pinks in 1986. The less stable streams of the Central and Eastern Districts produced a return per spawner rate for the last 20 odd years of 2.46 and should produce about 1.4 million pinks based on the parent escapement of 580,580. The estimated return of both areas was 2.60 million fish with a range of 1.30 million - 3.97 million.

Spring environmental conditions in 1985 were very cold. Cold weather may have contributed to cold sea water temperatures which in turn would prevent adequate plankton blooms. Early emerged pink salmon fry could have encountered an inadequate food supply resulting in poor overall marine survival of early emerged pink salmon fry. This may push the actual return down to the lower end of the prediction range of the forecast.

Pete Probasco
Area Management Biologist
Chignik Area

FORECAST AREA: Chignik

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

EARLY RUN (Black Lake Stock)	<u>Point</u>	<u>Range</u>
Return Estimate:	1.90 million	1.70 million - 2.10 million
Escapement Goal:	400,000	
Harvest Estimate:	1.50 million	1.30 million - 1.70 million
LATE RUN (Chignik Lake Stock)		
Return Estimate:	911,000	778,000 - 1.05 million
Escapement Goal:	250,000	
Harvest Estimate:	661,700	528,000 - 800,000
TOTAL CHIGNIK		
Return Estimate:	2.81 million	2.57 million - 3.05 million
Escapement Goal:	650,000	
Harvest Estimate:	2.16 million	1.92 million - 2.40 million

FORECAST METHODS

Point estimates given above are sums of the predicted returns of 3-ocean and 2-ocean age sockeye in the respective runs.

A multiple linear regression equation was used to predict the return of 3-ocean age fish in the early run from data on the return of 1.2 age fish in the previous year, mean length of 1.2 males in the previous year, and size of the early run escapement 5 years earlier. The expected return of 2-ocean age fish in the early run was taken to be the geometric mean of 2-ocean returns since 1965, excluding 1969 and 1975. The late run forecast was derived by using the average return per spawner based on the past 26 years of observed late run returns.

DISCUSSION OF THE 1986 FORECAST

Early Run: The 1986 early run (Black Lake stock) forecast estimates a total return of 1.9 million (mid-point estimate). The prediction was based mainly on a good 1985 return of 1.2 age fish. The 1.2 aged sockeye made up 15% of the total early run return. The return estimate of 1.9 million for the returning Black Lake stock falls well within the range

of past year's runs. The 20-year average return for the early run was 1,080,816 with a range of 312,918 to the high return of 3,819,354¹ experienced in 1984.

Performance of the early run forecast model expressed as a percentage of the observed run for 15 years tested since 1983 has been 16.8%.

Late Run: The 1986 preliminary forecast was developed by using average return/spawner based on the past 26 years of observed returns. This method of forecasting much like the former method has produced a lot of variability between the forecast and the actual return. The 1986 forecast estimate of 911,740 is slightly above average (831,364) of the historical returns.

Pete Probasco
Area Management Biologist
Chignik Area

¹ Includes Cape Igvak and Stepovak commercial catches of early run sockeye intercepted in these areas.

FORECAST AREA: South Peninsula

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

	<u>Point</u>	<u>Range</u>
Return Estimate:	8.4 million	5.0 million - 11.8 million
Escapement Goal:	2.0 million	
Harvest Estimate:	6.4 million	3.5 million - 9.3 million

FORECAST METHODS

In past years forecasts were developed using linear regressions that described the relationship between pre-emergent fry density and following returns. This method does not take into account ocean survival of fry after they leave fresh water. The 1986 forecast was based on a multiple regression which relates fry density as well as sea surface temperatures to subsequent returns.

DISCUSSION OF THE 1986 FORECAST

The forecast was based on the pre-emergent pink salmon fry sampling program conducted each March in key index streams. This method appears accurate in determining the overwinter fry survival and yields a value which relates yearly returns to fry density. However, another critical time period in the survival of pink salmon is immediately after outmigration from fresh water streams. Food availability is very important to fry survival. Water temperatures during April and May influence the amount of plankton available. There was a high correlation between water temperatures and ocean survival, as expressed by a ratio of return to fry density suggested that during years with higher April and May temperatures, ocean survival is better. Seven years of temperature and fry density data were used to develop the multiple regression model used to forecast the 1986 return. This method may prove to be more accurate than past forecasts because it takes into account early ocean survival as well as overwintering survival.

The point estimate for the 1986 return is 8.4 million pink salmon. This would be the 4th largest return in the past 22 years. At an 80% confidence level, the return is expected to be between 5 and 11.8 million fish.

The forecast does not include the incidental pink salmon harvested during the June fishery.

Len J. Schwarz
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Peninsula/Aleutians Area

FORECAST AREA: Bristol Bay

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

	<u>Point</u>	<u>Range</u>
Total Return:	22.0 million	8.6 million - 35.4 million
Escapement Goal:	9.7 million	
Projected Harvest:	12.3 million	2.2 million to 25.7 million

Please note, since the total projected harvest was based on the sum of estimated system harvests (i.e., total system return minus system escapement goal), the sum of the total escapement goal and total projected harvest may not necessarily equal the total return (i.e., total returns to some systems may be less than escapement goals).

FORECAST METHODS

The 1986 Bristol Bay sockeye salmon forecast was derived from the following two independent methods:

- 1) Standard ADF&G (based upon spawner-recruit relationships, sibling age class returns, and smolt production-survival estimates for individual age classes and river-lake systems); and
- 2) Japanese Research Catches (based upon geometric mean catch per unit of effort of sockeye salmon collected by Japanese research vessels fishing south of the Aleutian Islands during summer months).

These two methods produced the following results (in millions of sockeye salmon):

<u>Forecast Method</u>	<u>Estimate</u>	<u>Standard Error</u>	<u>Range</u>
Standard ADF&G	21.3	9.1	9.0 to 33.6
Japanese Research Catches	23.1	11.2	7.9 to 38.3

Standard errors and 80% confidence limits for each of the two estimates were calculated using standard linear regression analysis to describe the relationship between past forecasts and actual returns. A total of 13 years of data were used to test the accuracy of the Standard ADF&G and Japanese Research Catches methods. The 1986 forecast was the sum of the weighted averages for the 2-ocean and 3-ocean age class estimates obtained from the Standard ADF&G and Japanese Research Catches methods.

The inverse of the squared standard deviation of each estimate was used as a weighting factor to calculate the estimate for each ocean age class.

Information on mean lengths of immature sockeye in Japanese research catches is not yet available, but will be included in final forecast calculations, which will be available prior to the fishing season.

DISCUSSION OF THE 1986 FORECAST

Returns are expected to exceed spawning escapement goals for all systems except the Kvichak River. All data used for the 1986 forecast indicate that the total return to Kvichak system will be less than 6.0 million (Standard ADF&G component results: smolt-to-adult, 5.6 million; combination of sibling age classes and spawner-recruit, 3.1 million). The 1986 escapement goal for the Kvichak system is 4 to 6 million depending on the actual size of the 1986 Kvichak return. Available information suggests that escapements over about 5.0 million are required to produce optimal returns. A goal of 5.0 million was used to calculate the preliminary 1986 projected harvest.

The Standard ADF&G and Japanese Research Catches methods both produced similar predictions for total Bristol Bay sockeye salmon returns, although they did differ in ocean age proportions. The Standard ADF&G prediction for 2-ocean returns (10.5 million, 49% of total run) was much less than the Japanese Research Catches prediction (17.2 million, 75% of the total run). If there is a greater return of 2-ocean sockeye salmon to Bristol Bay in 1986 than was predicted by the Standard ADF&G method, total returns to Kvichak system may approach 6.0 million, as was indicated by the smolt-to-adult component of the Standard ADF&G method.

Henry J. Yuen
and
Stephen M. Fried
Research Biologists
Anchorage

FORECAST AREA: Bristol Bay, Togiak District

SPECIES: Chinook Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

	<u>Point</u>	<u>Range</u>
Return Estimate:	39,000	10,000 - 71,000
Escapement Goal:	15,000	
Projected Harvest:	24,000	0 - 56,000

FORECAST METHODS

The 1986 Togiak District chinook salmon forecast was based upon the relationship between returns of sibling age classes (i.e., age classes produced from the same spawning escapement). Standard linear regression techniques were used to estimate returns and 80% confidence intervals (ranges) for each major age class. These results were summed to provide the total return estimate.

DISCUSSION OF THE 1986 FORECAST

The 1986 chinook salmon forecasted return to the Togiak District of 39,000 is 27% less than average returns for recent years (1976-1984). At this magnitude commercial harvests are only expected to reach the 24,000 level which is down from the average 31,000 fish caught per year since 1976.

Age 5₂ (38%) are expected to dominate the Togiak District return while the 6₂ age class is expected to contribute 31%. The remainder of the return will be comprised primarily of 4₂ (21%) and 7₂ (10%) fish.

R. Eric Minard
Research Biologist
Dillingham

FORECAST AREA: Bristol Bay, Nushagak District

SPECIES: Chinook Salmon

PRELIMINARY FORECAST OF 1986 RETURN:

	<u>Point</u>	<u>Range</u>
Return Estimate:	183,000	77,000 to 297,000
Escapement Goal:	75,000	
Projected Harvest:	108,000	2,000 to 222,000

FORECAST METHODS

The 1986 Nushagak District chinook salmon forecast was based upon the relationship between returns of sibling age classes (i.e., age classes produced from the same spawning escapement). Standard linear regression techniques were used to estimate returns and 80% confidence intervals (ranges) for each major age class. These results were summed to provide the total return estimate.

DISCUSSION OF THE 1986 FORECAST

The 1986 forecasted chinook salmon return to the Nushagak District of 183,000 is 6% greater than the long term (19 year) average but is 23% less than recent year (1976-84) average returns. Commercial harvests are expected to approach the 108,000 mark which is slightly less than the recent year (1976-1984) average harvests of 119,500. Age 6₂ and 5₂ fish are expected to dominate the 1986 return, contributing 40% and 38%, respectively. The remainder will be comprised of age 4₂ (17%) and 7₂ (4%) fish.

After record returns observed in the early 1980's it appears the Nushagak chinook stocks have returned to a level that is still relatively strong in comparison to the long term historical averages.

R. Eric Minard
Research Biologist
Dillingham

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