Special Publication No. 05-01

Run Forecasts and Harvest Projections for 2005 Alaska Salmon Fisheries and Review of the 2004 Season

by

Doug Eggers

ERRATA:

There are two corrections to the original version of this report. The corrections appear on pages 1 and 77.

February 2005

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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by

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Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau

February 2005

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The Division of Sport Fish Special Publications series was established in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and other documents that do not fit in another publication series of the Division of Sport Fish. Since 2004, the Division of Commercial Fisheries has also used the same Special Publication series. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone editorial and peer review.

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EXECUTIVE SUMMARY

The Alaska Department of Fish and Game is expecting an increase in commercial salmon catches in 2005. The pink salmon (*Oncorhynchus gorbuscha*) harvest is expected to be higher than 2004, the expected sockeye salmon (*O. nerka*) and chum salmon (*O. keta*) harvests are expected to be slightly higher than 2004. The 2005 commercial catch all-species projection of 181 million is distributed as 765 thousand Chinook salmon (*O. tshawytscha*), 42.8 million sockeye salmon, 5.1 million coho salmon (*O. kisutch*), 114 million pink salmon, and 17.6 million chum salmon. Table 1 shows specific projection numbers by species and fishing area. Catch projections generally reflect potential harvests for most of the major sockeye salmon fisheries as well as for large hatchery runs including pink, sockeye, and chum salmon to the Southeast Alaska, Kodiak, and Prince William Sound areas. These projections are based on quantitative projections of next year's salmon run, using information on previous spawning levels, smolt outmigrations, returns of sibling age classes, and recent survival rates observed for hatchery releases. However, for other fisheries, including the wild pink salmon fisheries in Southeast Alaska, Prince William Sound, Kodiak, and the South Alaska Peninsula areas, the catch projections are based on averages of recent catch levels that are affected, to some extent, by recent levels of fishing effort. Recent levels of catch have been constrained in many areas by low fishing effort, thus catch levels are affected by both market conditions and size of salmon runs. Harvest projections for these fisheries may not be indicative of potential harvest levels. With the exception of the Southeast Alaska Chinook salmon fisheries, Alaskan salmon management will be based on actual observed salmon run strength. Alaska managers have the primary goal of maintaining spawning population sizes—not of reaching preseason catch projections.

At this time last year, department biologists were expecting an all-species commercial catch of 196 million for the 2004 season. As it turned out, the all-species catch reached 167 million. In 2004, the overall catch of pink salmon was 99.6 million compared to the preseason projection of 119 million. The overall chum salmon catch was 16.4 million compared to the preseason projection of 21 million. Table 2 shows 2004 harvest numbers by salmon species and fishing area, in units of fish harvested, and Table 3 provides this information in units of pounds harvested.

The 2004 exvessel value of the commercial harvest showed a marked increase over the 2003 season. The preliminary estimate for the total value of Alaska's 2004 harvest is $257 million, above the $195 million for 2003, but down from $275 million in 2000, and the $370 million for 1999, $261 million for 1998, $297 million for 1997, $378 million for 1996, $487 million for 1995, and $489 million for 1994.

Look for inseason harvest information, postseason statistics, and other information about salmon in Alaska on the World Wide Web at http://www.cf.adfg.state.ak.us/.

Table 1.–Projections of 2005 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Region Total	415 [b]	1,527 [a]	2,816 [a]	49,000	10,600 [d]	64,358
Prince William Sound						
Natural Production	52 [a]	1,644	363 [e]	4,290	469	6,818
Hatchery Production	0	1,398 [f]	221 [g]	30,889 [g]	2,545 [g]	35,053
Upper Cook Inlet	15 [a]	4,100	202 [a]	68 [c]	143 [a]	4,528
Lower Cook Inlet	1	297	14	3,433	35 [a]	3,780
Bristol Bay	162	25,600	36 [c]	0 [c]	673 [a]	26,471
Central Region Total	231	33,039	835	38,680	3,865	76,650
Kodiak Area	20	2,235	526	17,900	1,177	21,858
Chignik	3	1,792	119	785	137	2,836
South Peninsula	5	2,150	200	8,000	1,000	11,355
North Peninsula	7	1,960	50	20	75	2,112
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	35	8,137	895	26,705	2,389	38,161
AYK Region Total	84	103	545	1	770	1,502
Statewide Total	765	42,805	5,092	114,386	17,623	180,671

Columns and rows may not total exactly due to rounding.

[a] Average harvest for the 5-year, 2000–2004, period.

[b] Average harvest for 3 year, 2002–2004, period.

[c] 5-year average of odd-year harvests.

[d] Projection of southeast Alaska hatchery chum salmon return of 8.6 million less broodstock (0.5 million) plus projected wild stock catch of 2.5 million. Hatchery projections made by SRAA, NSRAA, and DIPAC.

[e] Average harvest for the 10-year, 1995–2004, period.

[f] Includes the harvest of Gulkana sockeye and preliminary forecasted return of Main Bay hatchery sockeye less broodstock requirements. Forecasts made by PWSAC.

[g] Preliminary forecasted returns to PWSAC and VFDA hatcheries less broodstock requirements. Forecasts made by PWSAC and VFDA.

Table 2.–Preliminary 2004 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Region Total	471 [a]	2,038	3,085	45,019	11,324	61,936
Prince William Sound	39	1,893	620	23,531	2,002	28,085
Upper Cook Inlet	27	4,931	311	358	146	5,773
Lower Cook Inlet	2	130	12	2,518	207	2,869
Bristol Bay	115	26,265	73	52	732	27,237
Central Region Total	183	33,219	1,016	26,459	3,085	63,956
Kodiak Area	29	4,170	490	21,441	1,122	27,252
Chignik	3	705	0	2	0	710
South Peninsula & Aleutians	7	2,206	236	6,681	795	9,925
North Peninsula	10	2,438	34	16	15	2,513
Westward Region Total	50	9,519	760	28,140	1,932	40,401
AYK Region Total	87	66	602	0	51	806
Total Alaska	791	44,842	5,463	99,618	16,392	167,099

Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.

Columns may not total exactly due to rounding.

[a] Total commercial harvest of chinook salmon for the October 1, 2003 to September 30, 2004 catch accounting period.

Table 3.–Preliminary 2004 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Region Total	7,250	12,025	21,742	164,767	92,124	297,908
Prince William Sound	879	10,977	5,595	87,449	15,047	119,947
Upper Cook Inlet	676	29,882	2,078	1,317	1,079	35,032
Lower Cook Inlet	21	649	94	8,757	1,693	11,214
Bristol Bay	1,730	151,695	501	217	4,662	158,805
Central Region Total	3,306	193,203	8,268	97,740	22,481	324,998
Kodiak Area	328	22,061	3,768	78,082	8,596	112,835
Chignik	47	4,510	0	8	4	4,569
South Peninsula & Aleutians	120	12,535	1,509	21,949	5,202	41,315
North Peninsula	159	14,091	289	52	107	14,698
Westward Region Total	654	53,197	5,566	100,091	13,909	173,417
AYK Region Total	1,527	433	4,133	0	987	7,080
Total Alaska	12,700	258,900	39,700	362,600	129,500	803,400

Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.
Columns may not total exactly due to rounding.

INTRODUCTION

The Alaska Department of Fish and Game's (ADF&G) four major fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) are shown in Figure 1. These regions supersede any references to the department's former statistical regions.

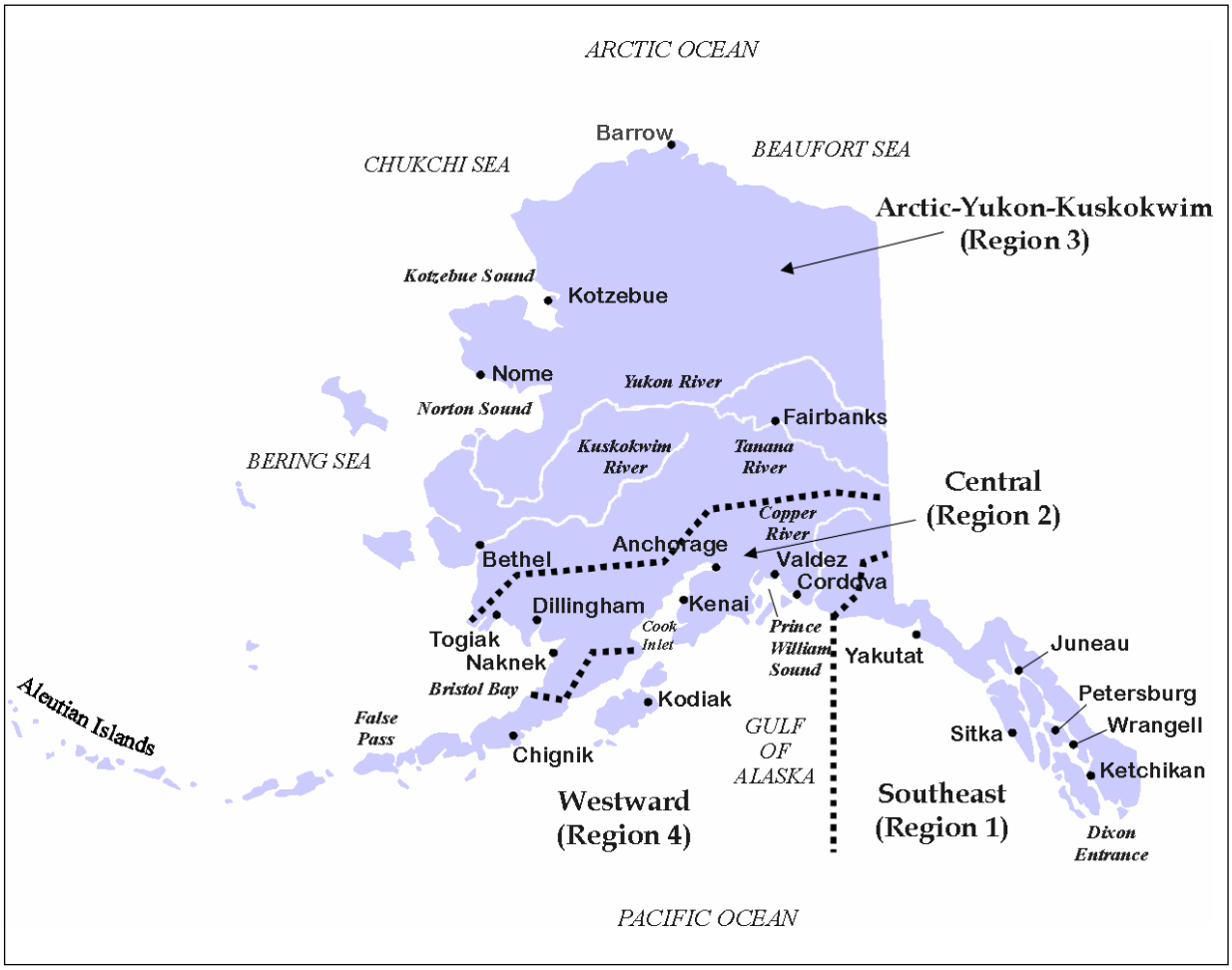

Figure 1.–The four fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Alaska Department of Fish and Game, Division of Commercial Fisheries.

Forecasts of runs (catch+escapement) for major salmon fisheries and projections of the statewide commercial salmon harvest have been published every year by ADF&G since 1969 (ADF&G 1969–1973, 1975–1983; Eggers 1985, 1986; Eggers and Dean 1987, 1988; Geiger and Savikko, 1989–1993; Geiger and Simpson 1994, 1995; and Geiger and Frenette 1996–1997; Geiger et. al. 1997; Hart et. al. 1998; Geiger and Hart 1999; Scott and Geiger 2000; Geiger and McNair 2001, Eggers 2002, Eggers 2003, Plotnick and Eggers 2004). Though the department does not produce formal run size forecasts for all salmon runs in the state, local salmon biologists prepare harvest projections or harvest outlooks for all areas. Projections are based on formal forecasts when available. When the formal forecasts are not available, local biologists use average historical catches and local knowledge of recent events to develop these outlooks. Projections for the 2004 Alaska commercial salmon harvest, by species and area, are found in

Table 1. Harvest outlooks for the Arctic-Yukon-Kuskokwim Region are developed as ranges; these ranges are listed in Appendix B. Trends in total statewide salmon harvests and catch projections in numbers of fish, by species, are found in Figures 2–6 (pages 40–44). Tables 2–7 provide detailed information on the 2004 harvest.

This report contains a detailed review of Alaska's 2004 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Board of Fisheries, the fishing industry, and the public.

Predominant ages and brood years for 2004 salmon runs, by species, are as follows:

	Age of Returning Salmon in Years				
Species	2	3	4	5	6
Pink	2003				
Chum		2002	2001	2000	
Coho		2002	2001		
Sockeye			2001	2000	1999
Chinook			2001	2000	1999

The common and scientific names for Alaska's Pacific salmon species are as follows:

Common (and Vernacular) Names	Scientific Name
Chinook (king)	*Oncorhynchus tshawytscha*
sockeye (red)	*Oncorhynchus nerka*
coho (silver)	*Oncorhynchus kisutch*
pink (humpy, humpback)	*Oncorhynchus gorbuscha*
chum (dog)	*Oncorhynchus keta*

DEFINITIONS OF TERMS

Biological escapement goal	The number of salmon in a particular stock that ADF&G has determined should be allowed to escape the fishery to spawn to achieve the maximum yield (human use). This determination is based on biological information about the fish stock in question. (Also see *optimum escapement goal*.)
Commercial harvest	Harvests of fish that are used for commercial purposes. This includes fish caught by the commercial common property fishery (see below) and by hatchery operators for cost recovery; it excludes sport, subsistence, and personal use harvests.
Commercial common property harvest	Harvests taken by traditional, competitive commercial fisheries (gillnet, purse seine, and troll), as opposed to commercial harvests resulting from hatchery cost recovery, fishing derbies, and sale of confiscated fish.
Common property harvest	Harvests taken by the commercial common property fisheries (see above), as well as the sport, subsistence, and personal use fisheries. This category excludes hatchery cost recovery harvests.
Cost recovery harvest	Harvests of salmon by hatchery operators in specially designated areas to fund the operation of hatcheries and other enhancement activities.
Enhancement of runs	Hatcheries and other means of artificial propagation to create salmon runs or make existing salmon runs larger. Enhancement includes remote fish stocking, fertilization of lakes, and other techniques.
Escapement, spawning population, or brood stock	The portion of a salmon run that is not harvested and survives to reach the spawning grounds or hatchery.
Harvest projections or harvest outlooks	Harvest outlooks are the best available estimates of upcoming harvest levels. Prepared by local biologists, outlooks are based on formal run forecasts, when available. At other times outlooks are based on historical average catches, subjectively adjusted based on recent trends and local knowledge.
Optimum escapement goal	The number of salmon in a particular stock that should be allowed to spawn to achieve sustainable runs based on biological needs of the stock, as well as consideration of social and allocative needs.
Run forecast	Forecasts of a run (harvest + escapement) are estimates of the fish that will return in a given year based on such information as parent-year escapements, subsequent fry abundance, and spring seawater temperatures. Run forecasts are generally thought to be more reliable than harvest outlooks, but run forecasts are provided only for selected areas.
Salmon run	The total number of mature salmon returning in a given year from ocean-rearing areas to coastal waters.

PRELIMINARY REVIEW OF THE 2004 ALASKA COMMERCIAL SALMON FISHERIES

SOUTHEAST ALASKA AND YAKUTAT

The Region I cumulative commercial salmon harvest by all gear types, including hatchery cost recovery, totaled approximately 61.9 million fish in 2004 (Tables 2 and 4). From the previous year's harvest, Chinook increased 16 percent, sockeye increased 34 percent, coho increased 23 percent, pink decreased 13 percent, and chum salmon increased 2 percent. The Region I total commercial salmon harvest proportion consisted of Chinook (< 1 percent), sockeye (3 percent), coho (5 percent), pink (73 percent), and chum salmon (18 percent). The 2004 combined Chinook harvest of 484 thousand fish is the highest Chinook salmon harvest on record since statehood and almost twice the 10-year average. The sockeye salmon harvest of 2.0 million ranks forth highest in the past 10 years and eighth highest since statehood. The coho harvest of 3.0 million fish ranks sixth in the past 10-years and ninth since statehood. The pink harvest of 45.0 million fish ranks seventh in the past 10 years and thirteenth since 1960. The chum salmon harvest of 11.3 million ranks sixth in the past 10 years and fifth since statehood (Table 2). This trend in reduced fishing effort is affecting the ability of the commercial fleet to harvest the available fish in some areas, and the harvest of some species would have been higher had there been more demand for the product.

The exvessel value (wholesale fish ticket value) of the 2004 Southeast Alaska/Yakutat Region commercial salmon harvest was estimated at $73.8 million, a 40 percent increase from the prior year. The exvessel estimate is considered conservative because it is based on the price reported on fish tickets and does not include subsequent price adjustments. The actual exvessel value, possibly 10 to 20 percent higher, will not be known until final processor reports are received and analyzed by the Commercial Fisheries Entry Commission (CFEC). The exvessel value by gear was highest for troll ($27.9 million), followed by purse seine ($24.0 million), hatchery cost recovery ($8.3 million), drift gillnet ($11.1 million), set gillnet gear ($1.6 million), and Annette Island/Miscellaneous ($0.8 million). The total regional harvest of salmon was valued as follows: Chinook $14.4 million, sockeye $10.0 million, coho $18.7 million, pink $11.3 million, and chum salmon $19.3 million.

Salmon landed by purse seiners accounted for 80 percent of the total salmon harvest, followed by hatchery cost recovery (7 percent), drift gillnetters (6 percent) and trollers (4 percent). Trollers (hand and power) accounted for 73 percent of the regional landings of Chinook and 62 percent of the coho salmon harvest. Purse seiners harvested 95 percent of the pink, 44 percent of the sockeye and 50 percent of the chum salmon harvest. Drift gillnetters accounted for 39 percent of the sockeye and 16 percent of the chum salmon harvested. The set gillnet harvest of sockeye salmon represent 4 percent of the regional harvest. Approximately 13 percent of the Chinook and 31 percent of the chum salmon harvest was taken in the hatchery cost recovery fisheries.

In general, escapements were excellent through the Southeast Region. The region-wide estimate of Chinook salmon escapement was the second highest on record, primarily due to a record high escapement to the Stikine River. The preliminary estimate of escapement to the Stikine alone, based on an expansion of the Little Tahltan River weir count, is over 84 thousand Chinook, about 3 times the upper limit of the escapement goal range. Escapement to Andrew Creek in the lower Stikine was also a record high.

Table 4.–Preliminary 2004 Southeast Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishery	Chinook	Sockeye	Coho	Pink	Chum	Total [e f]
Southern Seine[a] Total	30.4	577.1	232.5	19,526.4	1,585.5	21,952
Northern Seine[b] Total	9.6	323.5	166.7	23,070.5	4,099.0	27,669
Drift Gillnet						
Tree Point	2.0	142.4	30.9	407.4	291.7	874
Prince of Wales	2.7	116.3	138.6	245.2	110.5	613
Stikine	7.4	103.4	26.6	20.4	38.0	196
Taku-Snettisham	2.3	241.1	45.3	150.3	130.8	570
Lynn Canal	0.8	143.6	51.9	88.6	581.2	866
Hatchery Terminal	4.9	51.2	22.9	32.4	677.9	789
Set Gillnet	2.7	88.3	196.9	23.2	1.6	313
Hand Troll [c]						
Traditional	13.0	0.1	108.5	2.4	0.9	125
Hatchery Terminal	0.3	0.0	0.0	0.0	0.0	0.3
Experimental	4.8	0.0	0.1	0.0	0.0	5
Power Troll [c]						
Traditional	272.1	4.6	1,801.9	54.5	158.4	2,292
Hatchery Terminal	1.3	0.0	1.6	0.0	1.8	5
Experimental	50.4	0.2	2.8	0.2	10.1	64
Total Annette Isl. Res.						
Seine	0.3	16.1	5.9	543.1	20.8	586
Drift Gillnet	1.5	14.7	23.3	172.5	76.9	289
Total Annette Is. Troll [c]	0.1	0.0	1.7	0.1	0.0	2
Hand Troll	0.0	0.0	0.0	0.0	0.0	0
Power Troll	0.1	0.0	1.7	0.1	0.0	2
Trap	0.0	0.0	0.0	0.0	0.0	0
Hatchery Cost Recovery	61.7	210.7	220.6	619.1	3,507.9	4,620
Miscellaneous [d]	2.2	4.4	4.7	62.3	30.9	104
Southeast Region Total	471	2,038	3,085	45,019	11,324	61,936

[a] Districts 101-108.
[b] Districts 109-114.
[c] Catch accounting period for the 2004 chinook salmon season goes from October 1, 2003 through September 30, 2004.
[d] Includes salmon that were confiscated, caught in sportfish derbies, or commercial test fisheries, and sold.
[e] Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.
[f] Columns may not total exactly due to rounding error.

Sockeye salmon escapements across the region were fairly normal, but higher than last year's values for many areas (e.g., Hugh Smith Lake, Taku River, Chilkoot River, Chilkat River, and several others). The Hugh Smith Lake adult sockeye salmon escapement was just under 20 thousand, and exceeded the upper end of the recently established biological escapement goal range of 8 thousand to 18 thousand adults. This stock was formally adopted as a stock of concern at the 2003 Board of Fish meetings. The escapement of sockeye salmon into McDonald Lake was estimated to be 21 thousand, based on the expanded foot survey index. This is the lowest escapement at the lake since 1979. The sockeye salmon run at the lake has been below the escapement goal of 65 thousand to 85 thousand in 3 of the past 4 years.

Coho salmon escapements in monitored systems were good to excellent throughout Southeast Alaska in 2004. The total pink salmon escapement index of 15.8 million ranked eighth highest since 1960. This was slightly below the 2002 parent year index of 17.4 million, and 15 percent below the recent 10-year average of 18.2 million. Biological escapement goals were met for all 3 subregions. Escapement indices were met for 40 of 44 Southeast Alaska pink salmon stock

groups. Four stock groups had escapement indices below the lower bound of the management target: Moira in District 2, Burnett in District 6, Southeast Baranof in District 9, and North Chichagof in District 14. Escapements of chum salmon appeared to be just about at the 21-year 1982–2003 average based on the sum of peak survey estimates of 82 index streams in Districts 1 to 15. The escapement of chum salmon into Fish Creek at the head of Portland Canal was estimated to be 91 thousand. This is among the largest escapements for Fish Creek, and well above the long-term average of 24 thousand.

PRINCE WILLIAM SOUND

The 2004 Prince William Sound Area commercial salmon harvest of 28.1 million fish (Table 2 and 5) was comprised of 23.6 million pink, 1.9 million sockeye, 2 million chum, 620 thousand coho, and 39 thousand Chinook salmon (Table 5). Fifty five percent of the catch (15.4 million) was common property harvest and 12.6 million was sold for hatchery cost recovery, exclusive of post egg-take roe sales.

The estimated value of the combined commercial salmon harvest is $36.2 million, including hatchery sales. This estimate is based on the price reported on fish tickets and does not include post-season price adjustments. Therefore, the final exvessel value, possibly 10 to 20 percent higher than the current estimate, will not be known until final processor reports are received and analyzed by the Commercial Fisheries Entry Commission.

The 2004 harvest forecast for the Copper River District was 50.8 thousand Chinook, 885 thousand sockeye, and 315 thousand coho salmon. The Gulkana Hatchery located north of Paxson Lake was expected to contribute approximately 80 thousand sockeye salmon to the commercial harvest. The actual 2004 sockeye salmon harvest of 1.1 million ranked as the eighth largest on record since 1985 and was below the recent 10-year average harvest of 1.5 million. The harvest of 38 thousand Chinook salmon was below the projected harvest and ranked as the seventh largest Chinook salmon harvest on record since 1985. The coho salmon harvest of 468 thousand ranked as the fifth largest commercial harvest since 1985. The 2004 inriver goal for salmon passing the Miles Lake sonar site was set at 551.7 thousand to 751.7 thousand salmon, which included 11.2 thousand hatchery surplus salmon. The 2004 actual sonar escapement was 669.6 thousand salmon on July 31, at which time the sonar was removed. While not finalized, it appears the estimated Chinook salmon escapement into upper Copper River drainages will be above the minimum escapement objective. A final Chinook salmon spawning escapement estimate will be made once all upriver harvests have been quantified. The sockeye salmon escapement index in the lower Copper River in 2004 was above the lower end of the escapement range. The actual escapement index of 69.4 thousand fish was 18 percent below the mid-point index goal of 84.6 thousand, but within the 55 thousand to 130 thousand sustainable escapement goal range. Lower river coho salmon escapement in 2004 was above the mid-point goal of 50 thousand with a peak index count of 100 thousand fish.

Opening in early June, the Bering River District is managed concurrently with the Copper River District. The 2004 harvest of 13 thousand sockeye salmon from the Bering River District was near the recent 10-year average of 14.4 thousand. The coho salmon harvest of 96 thousand fell near the 10-year average of 88.4 thousand coho salmon. Sockeye salmon escapement into Bering River District streams was below the lower end of the escapement range of 26 thousand with an index estimate of 23.3 thousand. The coho salmon escapement goal was achieved for the Bering River District with a peak spawning count of 30.2 thousand versus an anticipated mid-point count of 23 thousand.

Table 5.–Preliminary 2004 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Purse Seine						
Eastern	0	14	30	9,513	102	9,659
Northern	0	0	0	45	0	45
Coghill	0	0	0	24	386	410
Southwestern	0	2	3	1,628	0	1,633
Montague	0	1	1	102	343	447
Southeastern	0	0	0	261	50	311
Unakwik	0	0	0	0	0	0
Drift Gillnet						
Bering River	0	13	96	0	0	109
Copper River	38	1,048	468	5	3	1,562
Unakwik	0	8	0	0	0	8
Coghill	0	216	10	20	535	781
Eshamy	0	216	1	56	43	316
Set Gillnet						
Eshamy	0	92	1	52	10	155
Hatchery [a]	0	283	10	11,825	529	12,647
Misc. PWS [b]	1	0	0	0	0	1
Prince William Sound Total [c]	39	1,893	620	23,531	2,001	28,084
Southern District	2	51	1	2,462	1	2,517
Kamishak District	0	52	5	13	177	247
Outer District	0	11	0	43	28	82
Eastern District	0	17	0	0	0	17
Lower Cook Inlet Total	2	131	12	2,518	206	2,863
Central District	25	4,903	266	356	144	5,694
Northern District	2	27	45	2	2	78
Upper Cook Inlet Total	27	4,930	311	358	146	5,772
Naknek-Kvichak District	1	4,717	2	8	30	4,758
Nushagak District	97	6,105	48	26	459	6,735
Egegik District	2	10,210	3	0	75	10,290
Ugashik District	1	3,139	5	0	49	3,194
Togiak District	9	437	15	18	94	573
General District	5	1,657	0	0	25	1,687
Bristol Bay Total	115	26,265	73	52	732	27,237
Central Region Total	183	33,219	1,016	26,459	3,085	63,956

[a] Hatchery sales for operating expenses. Includes meal production/roe salvage sales, processor discards. Excludes post egg-take roe sales at hatcheries.

[b] Does not include salmon taken for home use as reported on fish tickets.

[c] Some of these fish were donations.

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.

Columns may not total exactly due to rounding

Gillnet fisheries in Prince William Sound primarily targeted enhanced and wild sockeye and chum salmon. In the Coghill District, the common property harvest totaled 921 thousand chum salmon, with 535 thousand and 386 thousand chum salmon harvested by drift gillnet and purse seine gear respectively. Prince William Sound Aquaculture Corporation harvested 529 thousand chum salmon for hatchery sales. The sockeye salmon escapement to Coghill Lake of 30.6 thousand was within the escapement goal of 20 thousand to 40 thousand sockeye salmon. The total sockeye salmon harvest by the common property fishery was 216 thousand. The run of

sockeye salmon to the Coghill District allowed a regular schedule of fishing periods for the drift gillnet fleet when coupled with moderate fishing effort. PWSAC did not achieve the chum salmon portion of their revenue goal for the 2004 season. There was no postseason unharvested surplus.

The preseason forecast for the Eshamy District indicated a run of 98 thousand wild stock sockeye salmon to Eshamy Lake and 1.3 million enhanced sockeye returning to Main Bay Hatchery. PWSAC failed to achieve their sockeye salmon revenue goal from the Main Bay Hatchery run, harvesting 283 thousand sockeye salmon, which was 79 percent of their harvest goal. A total of 308 thousand sockeye salmon were harvested by the drift and set gillnet fleets in the Eshamy District. The escapement goal of 20 thousand to 40 thousand fish at Eshamy Lake was not met with only 13.4 thousand sockeye salmon passing through the weir by August 31, when the weir was removed. It is likely that some unknown additional escapement occurred after the removal of the weir as water levels increased with post season rainfall. Eshamy stock sockeye salmon has a protracted run timing from mid-July into October.

The 2004 preseason outlook projected normal even-year enhanced and wild pink salmon returns to Prince William Sound. The 2004 pink salmon forecast for Prince William Sound was 40.7 million fish. This estimate includes 4.6 million wild-stock fish, 11.6 million Valdez Fisheries Development Association fish, and 24.5 million Prince William Sound Aquaculture Corporation hatchery fish. Prince William Sound Aquaculture Corporation and Valdez Fisheries Development Association based their forecasts on the release of approximately 603 million pink salmon fry in 2003, the sixth largest in Prince William Sound history. Approximately 16.05 million (45 percent) of the projected 36.1 million enhanced pink salmon returning were needed for cost recovery. Valdez Fisheries Development Association anticipated a cost recovery harvest of 4.19 million pink salmon. Prince William Sound Aquaculture Corporation anticipated a pink salmon cost recovery harvest of 11.9 million fish, composed of 3.9 million from Wally Norenberg Hatchery, 3.7 million from Crooked Creek Hatchery, and 4.3 million from Armin F. Koernig hatchery. The remaining 20.0 million fish would be available for commercial common property harvest. A total of 2.6 million wild stock pink salmon were projected to be available for harvest leaving 2.0 million fish for the escapement.

An estimated 23.5 million pink salmon were harvested in Prince William Sound in 2004, composed of 11.7 million common property fish and 11.8 million cost recovery fish. Approximately 40 percent (105 permit holders) of the Area E salmon purse seine permit holders made at least one delivery during the 2004 season. Contribution estimates of wild and hatchery fish are not available at this time. Pink salmon harvest management was based on aerial survey escapement data, test fishing in the Southwestern District, catch rates and terminal area run entry.

Aerial surveys to assess early chum and pink salmon escapements in the Eastern and Northern Districts began in mid-June. In July, surveys began in all other purse seine districts. Specific escapement estimates are not available at this time. Eastern and Southeastern districts' escapement appeared to be within or above the escapement goal ranges. The remaining districts escapements are uncertain because of extreme low water conditions. The 2004 summer was extremely dry with many streams having little or no flow for much of July, August, and September. During aerial surveys pink salmon were staged at stream-mouths for extended periods, unable to enter streams because of low flow conditions, and some die-offs were documented. Significant rainfall occurred in late September; however, weather conditions at this

time prevented aerial surveys for 2–3 weeks. By the time weather permitted survey flights again (October 5) the pink salmon run was nearly finished. Low water conditions complicated wild stock management as pink and chum salmon accumulated at stream mouths but were unable to enter the streams. As weekly escapement goals were met or exceeded, taking into consideration all fish that had escaped the fishery (stream and stream mouth counts), commercial common property fisheries were allowed in some areas outside the hatchery subdistricts.

In 2004, Prince William Sound Aquaculture Corporation did not complete their pink salmon cost recovery goal. Enhanced pink salmon returns for the Wally Norenberg Hatchery, Armin F. Koernig hatchery and Crooked Creek Hatchery were significantly less than Prince William Sound Aquaculture Corporation's preseason projections. Prince William Sound Aquaculture Corporation harvested approximately 4.1 million fish at Armin F. Koernig hatchery, 2.3 million fish at Crooked Creek Hatchery, and 2.3 million fish at Wally Norenberg Hatchery. Test fishing in the Southwestern District by the R/V *Solstice* provided crucial pink salmon stock composition and sex ratio data. Initially the pink salmon stock was composed of 55 percent hatchery fish but by July 29 that increased to 78 percent and remained at that level or higher for the remainder of the test fishery. Daily bay estimates and harvest of pink salmon at all 3 Prince William Sound Aquaculture Corporation hatcheries remained low. Pink salmon run entry remained depressed as the female sex ratio in the test fishery and cost recovery harvests climbed from 30 percent to 40 percent. In late July, it was apparent that the enhanced pink salmon return was weaker than Prince William Sound Aquaculture Corporation had projected. Prince William Sound Aquaculture Corporation stated that they would like to achieve 50 percent of its revenue goal before any targeted commercial fisheries. All pink salmon hatchery subdistricts remained closed to Common Property Fishery until very late in the 2004 season.

Valdez Fisheries Development Association's anticipated 2004 adult return of pink salmon to the Solomon Gulch Hatchery was 11.6 million fish, assuming a 5.6 percent marine survival from the 2002 fry release of 206.2 million. It was anticipated that 323 thousand salmon were needed to meet egg take objectives at the hatchery. The 2004 sales harvest revenue goal was $2.6 million as outlined in the Valdez Fisheries Development Association FY 2004 Income and Expense Statement. Cost recovery began on June 23. Valdez Fisheries Development Association achieved the cost recovery goal with a harvest of 3.4 million pink salmon. The first commercial common property period occurred on July 3 with a harvest of 1.3 million pink salmon. Processing capacity was able to keep pace with run entry and at no time was there a buildup of pink salmon at the head of Port Valdez. Valdez Fisheries Development Association cost recovery and common property fisheries were well balanced in 2004 maximizing harvest efficiency and maintaining high quality. By July 25, purse seine effort was beginning to shift to the Prince William Sound Aquaculture Corporation pink salmon returns. In 2004, Eastern District wild pink salmon stocks remained above anticipated counts and escapement goals throughout most of the district. Due to adequate wild stock escapement most of the Eastern District was open 2–3 times per week to common property fisheries from July 19 until September 2. The peak purse seine effort occurred on July 12 when 160 deliveries accounted for 1.4 million pink salmon.

The 2004 chum salmon forecast return in Prince William Sound was 4.6 million fish. The majority (88 percent) was anticipated to be the result of Prince William Sound Aquaculture Corporation hatchery production. Approximately 997 thousand enhanced chum salmon were expected to return to Port Chalmers. All of the Port Chalmers chum salmon were intended to be harvested in the purse seine fishery. Prince William Sound Aquaculture Corporation anticipated

harvesting 2.1 million (67 percent) of the projected 3.1 million Wally Norenberg Hatchery enhanced chum salmon for cost recovery. Based on the department's wild chum salmon forecast of 568 thousand fish, a potential common property harvest of 393 thousand wild chum salmon would be possible. In 2004, the purse seine fleet was allowed to fish the Esther Subdistrict as a consequence of the 2003 exvessel value allocation. This was the first season in which the buffer zone was implemented in the management of the Coghill District fisheries.

The enhanced chum salmon runs were significantly less than Prince William Sound Aquaculture Corporation's forecast. Prince William Sound Aquaculture Corporation harvested 529 thousand of the required 2.08 million chum salmon and did not meet the 2004 Wally Norenberg Hatchery chum salmon cost recovery goal. The combined common property and cost recovery harvest of 2 million fish was approximately 65 percent of Prince William Sound Aquaculture Corporation's projected Wally Norenberg Hatchery return of 3.1 million chum salmon. Six commercial fishing periods (3 each for drift gillnet and purse seine) were prosecuted before extremely poor chum salmon returns closed the Esther Subdistrict to protect cost recovery and broodstock collection. The purse seine fleet harvested 386 thousand chum salmon in the Coghill District while the gillnet fleet took 535 thousand chum salmon. The Montague District total common property chum salmon harvest was 343 thousand fish, only 33 percent of Prince William Sound Aquaculture Corporation's projected Port Chalmers return of 997 thousand. A fishing schedule of 7 consecutive 156-hour periods was initiated in the Montague District on May 31 through July 18 to harvest Port Chalmers enhanced chum salmon. Wild stock chum salmon escapement is not available at this time.

COOK INLET

Upper Cook Inlet

The 2004 Upper Cook Inlet commercial harvest of 5.8 million salmon represents the highest harvest in UCI for the past 10 years and was also approximately 47 percent greater than the average annual harvest from 1954–2003. The estimated exvessel value of $20.6 million is somewhat poor by recent exvessel standards, which has ranged as high as 120 million dollars. As is the case statewide, prices paid for all salmon, and sockeye salmon in particular, remain depressed, thereby detrimentally affecting exvessel values, even for strong runs. Sockeye salmon escapement goals to the 5 monitored systems in Upper Cook Inlet (Westerman & Willette 2004) were met or exceeded in all systems other than the Yentna River where the lower end of the goal was not achieved.

The preseason forecast for the 2004 season projected a run of 5.2 million sockeye salmon, with a harvest estimate (sport, personal use & commercial) of 3.7 million fish. The total run to the Kenai River was forecasted to be 3.2 million sockeye salmon. The actual return to the Kenai River was 4.9 million, resulting in an in-river goal range of 850 thousand to 1.1 million sockeye. The actual in-river count was 1.386 million sockeye salmon. The Upper Cook Inlet commercial harvest of 4.9 million sockeye salmon was 32 percent above the preseason forecast. The total run of sockeye salmon to Upper Cook Inlet (Tobias and Willette 2004) was 50 percent more than the preseason forecast. Returns to all systems in Upper Cook Inlet with the exception of the Susitna River were stronger than expected in 2004, with the Kenai River sockeye salmon run approximately 52 percent greater than the preseason forecast. The Kasilof River sockeye salmon run was approximately 133 percent greater than the preseason forecast. The total run to the Susitna River was 39 percent lower than the forecast. Roughly half of this Susitna total run is bound for the Yentna River where the escapement is monitored. Roughly 800 thousand

sockeye are estimated to have returned from unmonitored systems. Sockeye salmon prices at the beginning of the season averaged $0.60 to $0.65 per pound. Typically this price is adjusted upwards by the end of the season, but for the past few years prices have not changed dramatically from the beginning of the year to the end of the season. The total exvessel value in Upper Cook Inlet for sockeye salmon was $19.4 million, which was 94 percent of the total Upper Cook Inlet exvessel value for salmon.

The 2004 coho salmon harvest of 311 thousand was approximately 20 percent above the recent 10-year average harvest and about equal to the 50-year long-term average coho harvest. The coho run in 2004 was judged to be above average. Commercial coho salmon harvests in Upper Cook Inlet during the 1980s and early 1990s were much higher than the long term average, due to high coho salmon production, and strong sockeye salmon returns to Upper Cook Inlet, which resulted in more fishing time in the Central District. Since 1996, Board of Fisheries regulations have reduced the fishing time of the drift fleet in the Central District and eliminated additional fishing time directed at coho salmon surpluses in the Northern District and in the Kalgin Island and Upper Subdistricts of the Central District, which has resulted in marked reductions in the commercial exploitation rate. For systems with escapement goals escapement objectives were met or exceeded. The exvessel value of coho salmon to the commercial fishery was approximately $400 thousand.

The 2004 harvest of 358 thousand pink salmon is slightly lower than the recent even-year average harvest of 448 thousand. It is much lower than the long term average harvest because of restrictions to fisheries to protect other stocks and low prices paid for pink salmon. The low prices have resulted in commercial fishers avoiding pink salmon, especially when sockeye salmon are present in large numbers. Pink salmon escapements are not monitored in Upper Cook Inlet to an appreciable degree; however, it appears that escapements to most river systems were very good. Prices paid for pink salmon were $.03 to $.07 per pound, resulting in an exvessel value for this species of $65 thousand.

The 2004 harvest of 146 thousand chum salmon was below the long-term average harvest of approximately 528 thousand. The 2004 chum salmon run was approximately 25 percent less than the recent 10-year average harvest. Much of this reduction in harvest has been the result of reduced fishing time in traditional areas, primarily by the drift fleet. Since the flood of 1986, chum salmon production in much of south central Alaska has been poor, with recent harvests well below the long-term average harvest of 500 thousand. Since 1995–1996, small improvements have occurred each year, and chum salmon runs to most of Cook Inlet in 2004 were very good. The exvessel value of chum salmon to the commercial fishery was approximately $125 thousand.

The 2004 harvest of 27 thousand Chinook salmon is well above the long-term average harvest by approximately 8 thousand Chinook salmon. The 2 fisheries where Chinook salmon are harvested in appreciable numbers in Upper Cook Inlet are in the Northern District and in the Upper Subdistrict of the Central District. After experiencing a significant downturn in the early to mid 1990s, Northern District Chinook salmon stocks continue to trend sharply upward and most escapement goals are being met or exceeded. Harvests in the Northern District Chinook salmon fishery remain low due to reduced participation and regulatory closures of the highest producing sites north of the Theodore River. Late-run Kenai River Chinook salmon runs have been relatively stable and escapement objectives have been consistently achieved or exceeded. In 2004 the commercial harvest in the Upper Subdistrict set gillnet fishery of 21.6 thousand

Chinook salmon was the highest harvest since 1996, according to available records. In 2004, the exvessel value for Chinook salmon was valued at $674 thousand, which is approximately 3.3 percent of the total exvessel value.

Lower Cook Inlet

The 2004 Lower Cook Inlet all-species salmon harvest of 2.9 million fish was the third highest during the past decade, exceeding the recent 10-year average of 1.8 million fish by over 50 percent. Although the overall harvest failed to achieve the cumulative preseason forecast of 3.2 million fish, the Lower Cook Inlet chum catch of nearly 206 thousand fish was easily the highest since 1988. Prices paid for salmon this season yielded an estimated Lower Cook Inlet exvessel value of just over $1.3 million, making the value of the 2004 harvest about 38 percent less than the recent 10-year average and the second lowest during that time period.

As has been the case for many years, Lower Cook Inlet commercial salmon harvests in 2004 were once again dominated by hatchery and enhanced fish production. Over one half of the sockeye salmon harvest in numbers of fish was attributed to lake stocking and fertilization projects, most of which were originally begun by the ADF&G but are currently maintained by Cook Inlet Aquaculture Association. These projects were conducted at Leisure and Hazel Lakes in the Southern District, Kirschner Lake in the Kamishak Bay District, and Bear Lake in the Eastern District. Another traditional sockeye salmon enhancement project, conducted by the Nanwalek Salmon Enhancement Project in conjunction with Chugach Regional Resources Commission at English Bay Lakes in the Southern District, contributed only a very minor number of sockeyes to commercial set gillnet harvests this season. Pink salmon production from Tutka Hatchery, operated by Cook Inlet Aquaculture Association, was considerably better than recent seasons, with an overall estimated return of 1.2 million fish, nearly doubling the preseason projection. The pink salmon return to Port Graham Hatchery was also strong, with an estimated total return of over 1.3 million fish. However, as is typically the case since hatchery programs were taken over by private non-profit agencies in Lower Cook Inlet, a significant portion of the salmon harvest was taken and utilized for hatchery cost recovery. An estimated 87 percent of the total salmon catch was taken by Cook Inlet Aquaculture Association and Port Graham Hatchery Corporation as hatchery cost recovery to support the sockeye lake stocking programs and Tutka and Port Graham Hatchery operations, equating to approximately 27 percent of the exvessel value of the 2004 Lower Cook Inlet salmon fishery.

The 2004 sockeye catch of 131 thousand sockeyes accounted for only about 5 percent of the Lower Cook Inlet commercial salmon harvest in total numbers of fish, which is considerably less than the traditional proportion for that species, yet still provided 40 percent of the exvessel value of the entire salmon fishery this season. The 2004 Lower Cook Inlet commercial sockeye harvest was characterized by weak returns to virtually all systems, especially enhanced systems, primarily due to low stocking levels in 2001. Natural sockeye returns to all systems within the management area were considered relatively good, with all 4 systems achieving their respective sustainable escapement goals, while the 2 systems with both natural and enhanced production also attained their desired in-river returns. One of the highlights of the season was the sockeye return to Chenik Lake, located in the Kamishak Bay District on the west side of Lower Cook Inlet. Stocking of this formerly enhanced system was discontinued after the 1996 season, thus all present production is considered natural, and the 2004 return to the system was estimated at over 50 thousand sockeyes. The commercial harvest of over 33 thousand sockeyes marked the first such directed harvest of fish destined for this system in over a decade.

Returns of pink salmon, usually the dominant species in numbers of commercially harvested salmon in Lower Cook Inlet, were considered only fair this year, even though the overall catch of over 2.5 million fish misleadingly suggests otherwise. This number represents the third highest commercial harvest during the last 20 years, and was more than double the average catch during that time period. The vast majority of the catch this season was taken in the Southern District as a direct result of Tutka and Port Graham Hatcheries production, but essentially this entire district's total, or about 2.46 million fish, was utilized for hatchery cost recovery by the 2 facilities in an unsuccessful effort to achieve their established revenue goals. An additional 70 thousand pinks, not accounted for in commercial catch totals, were taken for hatchery brood stock purposes by the Port Graham Hatchery facility. In an important development regarding hatcheries in Lower Cook Inlet, Cook Inlet Aquaculture Association announced prior to the season that it was ceasing operations at Tutka Hatchery, and the 2005 season would mark the last salmon return to the facility for the foreseeable future.

Naturally produced pinks contributed only about 2 percent of the area-wide harvest of that species this season, with all taken as incidental catch in fisheries directed at other species. Nonetheless, pink salmon sustainable escapement goals were achieved at nearly all systems throughout Lower Cook Inlet.

Returns of chum salmon were undoubtedly the bright spot in Lower Cook Inlet this past season. The 2004 commercial chum salmon harvest of 206 thousand fish, which was over 7 times the recent 10-year average and was the highest catch since 1988, continued a 5-year trend of relatively strong catches in Lower Cook Inlet. The harvest was not surprising based on the recent pattern of comparatively strong returns and concurrently good escapements, especially to systems in Kamishak Bay. The majority of the Kamishak District harvest, totaling 177 thousand chums this season, was taken in the northern end of the district by effort targeting another exceptionally strong Cottonwood Creek return. Additionally, a commercial opening directed at chum salmon in the Outer District was allowed in Port Dick this season for the first time in well over a decade, resulting in a harvest of almost 28 thousand fish. Nearly all chum salmon sustainable escapement goals were achieved in Lower Cook Inlet as a result of the reasonable returns, with the exception of McNeil River in the Kamishak Bay District, which failed to attain its escapement goal.

The 2004 commercial harvest of 12 thousand coho salmon was the highest Lower Cook Inlet total for this species since 1998, slightly exceeding the average catch during the past 10 years. As is typical, about 45 percent of the harvest came as a combination of hatchery cost recovery operations at Bear Lake and entries into the Seward Silver Salmon Derby, both in Resurrection Bay of the Eastern District. The remainder was uncharacteristically split between seiners (45 percent, primarily in the Kamishak Bay District) and set gillnetters in the Southern District (10 percent), with the proportions reversed from those traditionally experienced with these 2 gear groups. Because the coho resource in Lower Cook Inlet and its assessment is limited, commercial coho harvests can sometimes be used to gauge coho run strength. However, market conditions in recent years have discouraged directed effort, making the incidental commercial harvest of this species an unreliable indicator. Sport and personal use harvests generally provide the best indicators of run strength. The reasonably good commercial catches in 2004 suggested that coho returns were average to slightly better than average. One aerial survey was flown for coho salmon assessment at the head of Kachemak Bay, indicating good escapement into Clearwater Slough, the major index stream.

The harvest of Chinook salmon, not normally a commercially important species in Lower Cook Inlet, was the third highest catch for this species over the past decade at 1.7 thousand fish, exceeding the 20-year average of 1.4 thousand. Virtually the entire catch came from the Southern District and can be primarily attributed to enhanced production at Halibut Cove Lagoon and Seldovia Bay. Even though these Chinook enhancement projects are intended to primarily benefit recreational fishermen, adult fish returning to the stocking sites are incidentally taken in the commercial fishery. Set gillnetters accounted for about 85 percent of the Lower Cook Inlet Chinook catch, similar to the historical proportion for that gear group, with purse seiners taking the remaining 15 percent.

BRISTOL BAY

The 2004 harvest of all salmon species in Bristol Bay totaled approximately 27.2 million fish. To derive a preliminary estimate of the exvessel value of the fishery, the figures listed in the following table were used. These figures represent a rough estimate since the contribution of future price adjustments, loyalty bonuses, and differential prices for refrigerated versus non-refrigerated fish are not included. The calculated exvessel value of the 2004 Bristol Bay salmon fisheries totaled approximately $77 million, which is the sixth lowest exvessel value in over 20 years. It was 36 percent below the recent 20-year average value of $121 million.

The 2004 season was the seventh year of managing for a sockeye salmon harvest allocation between drift and set gillnet gear groups in 4 of the 5 districts in Bristol Bay. Togiak District is excluded from the allocation plan. Strategies used to achieve allocation percentages between gear groups included varying the amount of fishing time and giving separate gear group openings.

The 2004 inshore sockeye salmon run of 43.5 million fish was 3.1 million fish less than the forecast of 46.6 million. Sockeye runs to every district except Nushagak were less than their forecasts. The Bay's total run was approximately 7 percent less than forecast. Togiak District had the largest forecasting error, with a run that was 30 percent under forecast. Escapements to the Egegik, Ugashik, Nushagak, and Togiak Rivers fell within their biological escapement goal ranges. The Wood River escapement of 1.5 million exceeded the upper end of its biological escapement goal range by 3 percent. The Naknek River escapement of 1.9 million was within its optimum escapement goal range of 800 thousand to 2 million. The Kvichak River escapement fell short of the lower end of its biological escapement goal range by 500 thousand fish. However, the Alagnak River set a new record escapement tower count of 5.4 million sockeye salmon, which was 1.7 million above its previous high count in 2003 of 3.7 million, and well above the aerial count escapement goal of 185 thousand.

The Naknek-Kvichak District sockeye harvest of approximately 4.7 million fish was the eighth smallest harvest for this system since 1984 and well below the average of 8.3 million. The Egegik District sockeye harvest of 10.2 million fish was the seventh largest catch in the last 20 years and 24 percent above the 20-year average 8.2 million fish. The Ugashik District sockeye harvest of approximately 3.1 million sockeye salmon was the ninth largest since 1984 and 11 percent above its 20-year average of 2.8 million fish. The Nushagak District harvest of 6.1 million sockeye was the tenth largest harvest on record for the district, and 60 percent above the 20-year average. The Togiak District sockeye harvest of approximately 437 thousand fish was the tenth largest in 20 years and slightly below the 20-year average of 442 thousand. In addition, there was approximately 1.7 million sockeye salmon harvested in a General District, bringing the total 2004 Bristol Bay harvest to 26.3 million sockeye salmon.

The 2004 Kvichak forecast of 13.2 million sockeye included a fair amount of surplus salmon for harvest and consequently it was thought that the Naknek River Special Harvest Area might not have to be used this season. The predicted Kvichak surplus also gave support to the idea of harvesting sockeye early in a General District. Unfortunately, the Naknek River Special Harvest Area and Egegik River Special Harvest Area could not be avoided again this year, and by July 6, reduced fishing areas were established in both districts. The Naknek/Kvichak and Egegik Districts stayed at their reduced areas until July 19.

The first commercial opening in the Nushagak District occurred on June 14. On the Eastside, the first commercial deliveries were made on June 7. Sockeye salmon catches including the General District harvest totaled about 2.9 million through June 23. The eastside of Bristol Bay dominated the catch with approximately 73 percent of the harvest. The Egegik District lead the way with a 10.2 million catch. The Nushagak District was second in production with a 6.1 million harvest.

The Chinook salmon harvests in Bristol Bay districts were below average in every district except the Nushagak. There were 2 directed Chinook fishing periods in the Nushagak District resulting in approximately 21 thousand Chinook salmon landed. The Nushagak harvest of 97 thousand Chinook salmon was well above its 1984–2003 average catch of 53 thousand. Other Chinook catches were primarily incidental to targeting sockeye salmon. An additional 4.6 thousand Chinook were harvested in the General District fishery. The Portage Creek sonar count of 116 thousand Chinook salmon was 55 percent above the 75 thousand fish Nushagak goal.

The total Bristol Bay chum salmon harvest of approximately 732 thousand fish was 25 percent below the recent 20-year average of 971 thousand. All of the districts except Nushagak, produced harvests below their 1984–2003 average catch. The Nushagak harvest of 459 thousand chum salmon was 14 percent above its 20-year average of 403 thousand. Escapement counts ranged from above average in the Nushagak and Ugashik systems to below average in the Egegik system. The 2004 run produced a reported commercial harvest of 52 thousand pink salmon, most of which, 44 thousand, came from the Nushagak and Togiak Districts. An escapement count of 556 thousand pink salmon was recorded at the Nushagak sonar. No other escapement counts for pink salmon were conducted this season.

The total Bay-wide coho salmon harvest of approximately 73 thousand fish was 45 percent below the recent 20-year average of 133 thousand. All of the districts, except Nushagak, produced catches below their 1984–2003 average harvests. The Nushagak District harvest of 48 thousand fish was 23 percent above its 20-year average of 39 thousand. The Nushagak sonar escapement count of 153 thousand coho salmon was about twice the average escapement count. Coho escapement data in other areas are still being compiled.

KUSKOKWIM AREA

The 2004 Kuskokwim Area Chinook, sockeye, chum and coho salmon runs returned in greater strength than anticipated. The Kuskokwim River salmon fisheries were managed according to the Kuskokwim River Salmon Rebuilding Management Plan with Chinook and chum salmon stocks identified as stocks of yield concern. Amounts of salmon necessary for subsistence use were achieved throughout the Area.

There were 4 chum and sockeye salmon directed commercial openings in the Kuskokwim River in late June and the first week of July. These 4 openings represent the first chum salmon

directed commercial fishery in the Kuskokwim River since 2000. A directed commercial coho fishery was implemented in the Kuskokwim River in August. Kuskokwim Bay commercial salmon fisheries were managed according to their associated management plans and regulations. A total of 688 thousand salmon were commercially harvested from the Kuskokwim Area. A total of 467 permit holders participated in the Area fishery with the exvessel value estimated at $1.5 million. Limited processor capacity, low prices, and low fishing effort dominated the season; however, a modest increase in effort was observed in comparison to the previous 2 years.

A total of 390 individual entry permit holders recorded landings during the 2004 season in District 1. This level of fishing effort was 21.6 percent below the recent 10-year average of 497 fishers, but represents the second consecutive year of increasing participation since the record low number of 318 permits in 2002. The Chinook, chum, and sockeye salmon harvests of 2.3 thousand, 20.4 thousand, and 9.7 thousand fish, respectively, were below the recent 10-year averages. The coho salmon harvest of 433.8 thousand fish was above the recent 10-year average and was the highest coho salmon harvest since 1996. The total value of the Kuskokwim River fishery to fishers was $942.6 thousand, which was 70 percent of the recent 10-year average value and a 2-fold increase in comparative value over 2003. This increase in value is primarily attributed to the comparatively large coho salmon harvest in 2004.

Kuskokwim River Chinook salmon escapement information indicates Chinook salmon escapements during 2004 were above average. The upper end of the sustainable escapement goal for Kogrukluk River Chinook salmon was exceeded in 2004 with the passage of 19.7 thousand fish, the second highest escapement on record. The aerial survey Chinook salmon escapement index was the highest on record.

Kuskokwim River chum salmon escapements were average to above average for the 2004 season. The upper end of the sustainable escapement goal for Aniak River chum salmon was exceeded in 2004 with a total fish estimate of 673.4 thousand, the second highest estimate on record. The passage of 24.2 thousand chum salmon at the Kogrukluk River was within the sustainable escapement goal range.

Coho salmon escapements were below average to above average with passage at the Kogrukluk River weir coming at the upper end of the sustainable escapement goal range at 27 thousand fish. Sockeye salmon escapements were average to below average.

The northern boundary of District 4 Kuskokwim Bay was extended approximately 3 miles in 2004 from Oyak Creek to Weelung Creek. The fishery started June 15 with 12-hour fishing periods established on Tuesdays and Thursdays. Chinook salmon catches were below average and catch rates were above average for the first 2 commercial openings. This trend remained constant through early July, when three 12-hour periods per week were established to target first sockeye and then coho salmon.

District 4 harvest in 2004 was 25.5 thousand Chinook, 34.6 thousand sockeye, 25.8 thousand chum, and 82.4 thousand coho salmon. Fishing effort in 2004 was similar to the increased effort seen in 2003, but remained well below the high effort seen from the mid-1980s through the mid-1990s. Chinook and coho salmon harvests were above the recent 10-year averages and sockeye and chum salmon harvests were below the recent 10-year averages. The total value of the fishery was estimated at $405 thousand, which is 84 percent of the recent 10-year average value. This represents the highest value of the District 4 commercial fishery since 2000. As a result of

limited processing capacity, a 2 thousand pound limit per fisher was imposed during the first week in July.

Salmon escapement counts at the Kanektok River weir were 19.5 thousand Chinook, 102.7 thousand sockeye, 87.8 thousand coho, and 46.3 thousand chum salmon. No escapement goals have been established for the weir. A total of 28.4 thousand Chinook and 78.4 thousand sockeye salmon were observed by aerial survey. This represents the highest Chinook salmon aerial survey count on record. The Chinook and sockeye salmon aerial survey counts exceeded the upper end of their respective sustainable escapement goal ranges.

District 5 is made up of waters within and adjacent to Goodnews Bay. The western boundary of District 5 was extended in 2004 to a line between points approximately 2 miles along the outside shoreline of the north and south spits at the entrance to Goodnews Bay.

District 5 commercial harvests in 2004 were 2.6 thousand Chinook, 20.9 thousand sockeye, 6 thousand chum, and 23.7 thousand coho salmon. Fishing effort in 2004 was similar to 2003, but remained well below the high effort seen from the mid-1980s through the mid-1990s. Chinook and coho salmon harvests were above the recent 10-year averages and sockeye and chum salmon harvests were below the recent 10-year averages. The total value of the fishery was estimated at $135.2 thousand which is 68 percent of the recent 10 year average value and similar to the fishery value in 2003. As a result of limited processing capacity, a 2 thousand pound limit per fisher was imposed during the first week in July.

Salmon escapement counts at the Middle Fork Goodnews River weir were 4.3 thousand Chinook, 56.5 thousand sockeye, 47.9 thousand coho, and 31.2 thousand chum salmon. Chinook and sockeye salmon counts achieved the upper end of their respective sustainable escapement goal ranges. Chum and coho salmon counts exceeded their sustainable escapement goal thresholds. A total of 7.5 thousand Chinook and 31.7 thousand sockeye salmon were observed on the mainstem Goodnews River by aerial survey, which exceeded the upper end of their respective sustainable escapement goal ranges.

YUKON AREA

The 2004 Yukon River commercial salmon harvest of 108.7 thousand fish was 85 percent of the historical average since statehood (1961–2003). The total estimated commercial harvest including the estimated harvest to produce roe sold was 56.2 thousand Chinook, 26.4 thousand summer chum, 4.1 thousand fall chum, and 22 thousand coho salmon for the Alaskan portion of the Yukon River drainage.

No salmon roe was sold from Chinook or summer chum salmon. While the 2004 Chinook salmon harvest was the best since 1997 and about 16 thousand fish more than the 2003 harvest, it was still 33 percent below the 1994–2003 average commercial harvest of 83 thousand Chinook salmon. The summer chum salmon harvest was 90 percent below the 1994–2003 average harvest of 259 thousand fish. Due to the lack of markets, the summer chum salmon harvest was taken incidental to fishing directed at Chinook salmon, except in District 6 where a limited chum salmon directed commercial fishery occurred.

A total of 579 permit holders participated in the Chinook and summer chum salmon fishery during 2004, which was 16 percent below the 1994–2003 average of 675 permit holders. The Lower Yukon Area (Districts 1–3) and Upper Yukon Area (Districts 4–6) are separate Commercial Fisheries Entry Commission permit areas. A total of 550 permit holders fished the

summer season in the Lower Yukon Area in 2004, which was 10 percent below the 1994–2003 average of 613 permit holders. In the Upper Yukon Area, 20 permit holders fished, which was 71 percent below the 1994–2003 average of 70 permit holders.

Yukon River fishers in Alaska received an estimated $3.1 million for their chinook and summer chum salmon harvest in 2004, approximately 23 percent below the 1994–2003 summer season average of $4 million.

Lower Yukon River fishers received an estimated average price per pound of $2.80 for Chinook and $0.05 for summer chum salmon. The average price paid for Chinook salmon in the Lower Yukon Area was 7 percent above the 1994–2003 average of $2.63 per pound. The exvessel value of the Lower Yukon Area fishery of $3.1 million is the largest since 1999 and near the 1994–2003 average of $3.6 million. The average income for Lower Yukon Area fishers that participated in the 2004 fishery was $5.6 thousand.

Upper Yukon Area fishers received an estimated average price per pound of $0.77 for Chinook and $0.27 for summer chum salmon. The average price paid for Chinook salmon in the Upper Yukon Area was 14 percent below the 1994–2003 average of $0.90 per pound. The average price per pound for summer chum salmon of $0.27 was 50 percent above the 1994–2003 average of $0.18 per pound. The exvessel value of the Upper Yukon Area summer season fishery of $47.9 thousand is 88 percent below the 10-year average (1994–2003) of $382.3 thousand. The average income for Upper Yukon Area fishers that participated in the 2004 fishery was $2.4 thousand.

In 2004, the Chinook salmon run was stronger than the 2001 and 2002 runs and possibly as strong, or stronger than the 2003 run. Two of our main assessment projects underestimated the run strength because of high water, debris, and an abnormal entry pattern. Chinook salmon escapement goals throughout the drainage were either met or exceeded. The East Fork Andreafsky River weir escapement count was slightly below 7.9 thousand, a record for the project. The upper end of the Chinook salmon escapement goal was exceeded by approximately 4 thousand in the Chena River and by more than 9 thousand fish in the Salcha River. The Canadian escapement objective of 28 thousand was exceeded with an estimated escapement of 39 thousand fish.

The 2004 summer chum salmon run was improved over the last several years. Summer chum salmon escapement appeared to be adequate when using Pilot Station sonar passage estimate of 1.3 million fish to assess the run. However, Anvik River escapement was approximately 365 thousand slightly above the lower end of the escapement goal range of 350 thousand to 750 thousand, and East Fork Andreafsky escapement was slightly below the lower end of the goal range of 65 thousand to 135 thousand.

Commercial fishing for fall chum and coho salmon has become sporadic with commercial fishing occurring in 6 of the past 10 years, because of very poor runs. The 2004 commercial season was managed conservatively based on the trend of low fall chum salmon abundance, which resulted in a late developing fishery.

The Yukon Area estimated commercial harvest for fall chum and coho salmon was approximately 92 percent below the 1994–2003 average of 48.6 thousand fall chum salmon and 29 percent above the 10-year average of 17 thousand coho salmon. In addition, market conditions and limited buying capacity accounted for the low harvest of fall chum and coho salmon throughout the drainage.

The preliminary 2004 commercial fall chum and coho salmon season value for the Yukon Area was $11.1 thousand ($3.9 thousand for the Lower Yukon Area, $7.2 thousand for the upper Yukon Area). The previous 10-year commercial fall chum and coho salmon seasons combined values for the Yukon Area averaged $91.3 thousand ($64.1 thousand for the Lower Yukon Area, $27.2 thousand for the Upper Yukon Area).

Yukon River fishers received an average price of $0.25 per pound for fall chum salmon in the Lower Yukon Area and $0.05 per pound in the Upper Yukon Area. This compares to the 1994–2003 average of $0.17 per pound and $0.15 per pound, respectively. For coho salmon, fishers in 2004 received an average price of $0.25 per pound and $0.05 per pound in the Lower and Upper Yukon Areas compared to the recent 10-year average price of $0.29 and $0.19 per pound, respectively.

In the previous 10 fall seasons, an average of 136 permit holders fished the fall chum and coho salmon fishery (125 for the Lower Yukon Area, 11 for the Upper Yukon Area), compared to 32 fishers who participated in 2003 (26 for the Lower Yukon Area, 6 for the Upper Yukon Area).

The 2004 fall commercial fishery developed late in the season due to an unexpected late pulse of fall chum that provided the surplus of fish required outlined in the Yukon River Drainage Fall Chum Salmon Management Plan. Once commercial surpluses were identified, limited markets became a factor in prosecuting the fishery. Late management actions included extending the season and increasing fishing period time in an effort to harvest both fall chum and coho salmon.

Even though the overall 2004 fall chum salmon return was below average, it was significantly improved over the parent years and demonstrated near normal production. The fall chum salmon drainage wide escapement goal range was attained in 2004 as well as in 4 of 6 monitored systems. The distribution of the fall chum salmon run left the Porcupine River system weak, however the remaining escapement goals were met. In particular, the Canadian Yukon River mainstem interim escapement goal of > 65 thousand was achieved along with the Agreement goal of > 80 thousand fall chum salmon.

The 2004 coho salmon run strength in the Yukon Area was second only to the record run in 2003 as indicated by Pilot Station Sonar passage estimates since 1995. The opening of the commercial fishery was delayed in an effort to protect the overlapping fall chum salmon run, which resulted in a low commercial harvest of coho salmon. The Delta-Clearwater River coho salmon escapement of 38 thousand was well above the sustainable escapement goal range of 5.2 thousand to 17 thousand. The Andreafsky River weir also estimated the second highest coho salmon escapement on record since the project began in 1995.

NORTON SOUND AREA

The 2004 Norton Sound commercial salmon fishery was a great improvement over recent years. A well above average coho salmon run allowed for the normal commercial fishing schedule of 2 48-hour periods per week, from late July until early September in the Shaktoolik and Unalakleet Subdistricts. The commercial coho harvest for those subdistricts was the third highest in 10 years. Chinook salmon runs in Norton Sound have been consistently weak since 1999 and were poor again this year. The Unalakleet and Shaktoolik Chinook salmon stock was classified as a yield concern by the Board of Fisheries in January 2004. The chum run was average based on a late push into the Shaktoolik and Unalakleet Subdistricts, but there has been little interest in

commercial chum salmon fishing. The pink salmon run was a record, but there has been no buyer interest in pink salmon the last 4 seasons.

The first commercial opening occurred in the Moses Point Subdistrict for Chinook salmon in early July, but there was no commercial fishing effort. Elsewhere in Norton Sound the Chinook salmon run was too weak to allow for commercial fishing. The commercial coho season opened the week of July 26 after the Unalakleet River test net had the best catches for July in the 20-year project history.

The combined commercial harvest of all salmon species ranked fifth in the last 10 years in Norton Sound. The coho salmon harvest of 42 thousand was 120 percent above the recent 5-year average, and 12 percent above the recent 10-year average. There were no chum salmon directed periods and harvest of chum salmon was incidental during the coho fishery. The chum salmon run to eastern Norton Sound was average, and much better than the chum salmon run in northern Norton Sound. The tail end of the chum salmon run showed surprising strength in both the commercial fishery in eastern Norton Sound and the Unalakleet River test net, as catches for both were well above average in August. The chum salmon commercial harvest of 6.3 thousand was 7 percent above the 5-year average, but 58 percent below the 10-year average.

Only 36 permit holders participated in the commercial fishery, and only 2003 and 2002 had a lower participation when 30 permit holders fished in 2003 and 12 permit holders fished in 2002. The previous 5-year average was 46 permits fished and the previous 10-year average was 73 permits fished.

The 2004 fishery value to the fishers of $122.7 thousand was 75 percent above the 5-year average of $70.1 thousand, but 52 percent below the 10-year average of $254 thousand. The average price paid for sockeye salmon was $.40 per pound, $.39 per pound for coho, and $.14 per pound for chum salmon.

KOTZEBUE AREA

The Kotzebue Sound commercial salmon fishery opened on July 12 and closed by regulation after August 31. The last fish sold were on August 20 when the major buyer ceased operations.

In 2004 the Kotzebue Sound commercial fishery had an onsite buyer for the first time since 2001. Because fish were processed locally and not immediately shipped in the round as in previous years, the buyer was limited in the amount of salmon that could be purchased. The department opened the fishery continuously beginning on July 12 and let the buyer determine the fishing time for the fleet. There were 44 permit holders including one catcher-seller that sold fish in 2004. The chum salmon harvest of 51.1 thousand was 53 percent below the recent 5-year average, and 60 percent below the recent 10-year average. In addition, 128 Chinook salmon, 124 Dolly Varden and 3 sockeye salmon were harvested. The overall chum salmon run to Kotzebue Sound in 2004 was estimated to be below average in abundance based on the low commercial harvest rates, subsistence fishers reporting lower catches than normal, and the Kobuk test fish index being below average.

A total of 419.1 thousand pounds of chum salmon (average weight 8.2 pounds) were sold at an average of $0.15 per pound. A total of 1.3 thousand pounds of Chinook salmon (average weight 11.4 pounds) were sold at an average of $0.72 per pound. A total of 22 pounds of sockeye salmon (average weight 7.3 pounds) were sold at an average of $0.50 per pound. A total of 846 pounds of Dolly Varden (average weight 7.1 pounds) were sold at an average of $0.26 per

pound. The total exvessel value was $64.4 thousand to Kotzebue area fishers with the chum salmon value at $63.2 thousand. The average value for participating permit holders was $1.5 thousand. The total exvessel value represents 10 percent of the $630.3 thousand historical average.

Table 6.–Preliminary 2004 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total [b c]
Kuskokwim River	2	10	434	0	20	466
Kuskokwim Bay	28	56	106	0	32	222
Kuskokwim Area Total	30	66	540	0	52	688
Lower Yukon River	53	0	2	0	21	76
Upper Yukon River [a]	4	0	19	0	10	32
Yukon River Total [a]	57	0	20	0	31	108
Norton Sound	0	0	42	0	6	48
Kotzebue Area	0	0	0	0	51	51
AYK Region Total	87	66	602	0	140	895

[a] The Upper Yukon River catch includes the estimated harvest to produce roe sold.
[b] Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
[c] Columns and rows may not total exactly due to rounding error.

KODIAK MANAGEMENT AREA

The 2004 Kodiak Management Area commercial salmon fishery began on June 5 and the last commercial landing occurred on September 20, 2004. Commercial fishing effort was low for the seventh consecutive year, though slightly higher than the record low participation in 2002. Of the 593 eligible Kodiak commercial salmon permits, only 305 made commercial landings. Ninety one permits were not renewed for the 2004 season. By gear type, a total of 164 set gillnet and 141 purse seine permit holders fished; there was no participation by beach seiners again in 2004. The number of permits actually fished varied during the season, with the highest participation in any single week at 123 purse seine and 133 gillnet permit holders fishing (week 3 of the season, June 21–27).

Approximately 27.2 million salmon were harvested in the Kodiak Management Area by commercial gear, which is above the previous 10-year (1994–2003) average of 20.8 million salmon (Tables 2 and 3). Of the total salmon harvested in 2004, ADF&G commercial test fisheries took under a thousand salmon (702), and just over 3.6 thousand salmon were retained from commercial catches for the permit holder's own use (taken but not sold). Subsistence or sport fishery salmon harvests will not be known until late spring of 2005, after permits and questionnaires are returned to the department.

The 2004 Kodiak Management Area Chinook salmon harvest was over 10 thousand fish more than the previous 10-year average. The sockeye salmon harvest was over 700 thousand fish more than the 10-year average, and almost twice the point forecast, though within the forecast range (approximately 950 thousand to 4.76 million sockeye salmon). The coho salmon harvest was similar to the 1994–2003 average and close to forecast. Overall, the pink salmon commercial harvest was approximately 5 million fish more than the 10-year average and over 9 million fish more than the recent even numbered year harvest average (even years 1994–2002; 12.4 million). The pink salmon harvest was also more than the point forecast, and within the

forecast range (15.9 to 23 million pink salmon). The chum salmon harvest was about 260 thousand fish greater than average though about 98 thousand fish less than forecast.

The estimated total exvessel value of the 2004 fishery was approximately $19.9 million, below the 1994 to 2003 average exvessel value of $26.9 million. The estimated exvessel value is based on inseason price estimates and will increase as final processor reports become available. The inseason values may not reflect additional payments made to fishermen for dock deliveries, refrigerated seawater, iced fish, or other settlements. Additional post-season payments may add over $3 million to the Kodiak Management Area exvessel value. Purse seine fishermen accounted for 83.2 percent of the total number of salmon harvested and averaged approximately $97.4 thousand per fished permit. This is an increase from the 2003 estimated exvessel value, and is more than the previous 10-year average exvessel value for purse seiners of $85.8 thousand. Set gillnet fishermen accounted for 16.8 percent of the total number of salmon harvested and averaged approximately $37.6 thousand per fished permit. This was an increase from last year, but still less than the 1994 to 2003 set gillnetter exvessel average of $43.3 thousand.

Fish counting weirs were operated on 10 systems this year. In addition, 3 different observers flew 20 aerial surveys, and 5 observers made foot and skiff survey escapement estimates.

Market conditions or a lack of fishing effort/success led to larger than projected escapements for most species in most areas. Budget constraints limited aerial surveys and reduced late season operation of fish counting weirs. In many cases, this reduced the department's ability to accurately estimate the index total escapement. Particularly deficient are late season chum and coho salmon escapement estimates and Mainland District estimates for all species.

The total Chinook salmon escapement was much greater than the aggregate escapement objective, and nearly 8 thousand fish greater than the previous 10-year (1994–2003) average. The overall sockeye salmon escapement met the objectives and nearly matched the 10-year average. Documented coho salmon escapement met the aggregated objectives, but was less than half the 1994–2003 average. Overall, the pink salmon escapement exceeded the objectives, and was nearly 3 million more than the 1994–2002 even-year average. The overall chum salmon escapement was within objectives, and was near the 1994–2003 average.

The Karluk and Ayakulik River systems support the largest Chinook salmon populations in the Kodiak Management Area. Commercial harvest occurs during targeted sockeye salmon fisheries; there are no directed Chinook salmon commercial fisheries in the Kodiak Management Area. The 2004 Kodiak Management Area Chinook salmon harvest was above the previous 10-year average and above forecast. The average weight of commercially harvested Chinook salmon was 11.4 pounds. Approximately 82.2 percent of the 2004 commercial harvest of Chinook salmon occurred along the westside of Afognak and Kodiak Islands, during directed early-run Karluk sockeye fisheries. Commercial fisheries in the Inner and Outer Karluk Section (the near terminal and terminal sections nearest to the Karluk River) accounted for 2.5 thousand Chinook salmon, or about 8.9 percent of the total Chinook salmon commercial harvest. Chinook Salmon harvested near the Ayakulik River (the near terminal and terminal sections nearest to the Ayakulik River) accounted for 160 Chinook salmon.

The total Chinook salmon escapement was above the aggregated objectives (8.4 thousand to 16.9 thousand), and was above the previous 10-year average. Escapement objectives have been developed for these 2 major Chinook salmon producing river systems and the escapements are

estimated using fish counting weirs. Chinook salmon escapement through the Ayakulik weir (24.8 thousand) exceeded the established upper range of the objective (4.8 thousand to 9.6 thousand). The Chinook escapement through the Karluk weir (7.5 thousand) also exceeded the upper range of the established objective (3.6 thousand to 7.3 thousand).

The Kodiak Management Area sockeye salmon commercial harvest was above the 10-year average and well above the point forecast, though within the forecast range. The average sockeye salmon weight for the commercial harvest was 5.3 pounds. Run strength and timing was extremely variable. Some of the sockeye salmon runs were early and strong, while others were weak. The overall sockeye salmon escapement was above average and above the aggregated escapement objectives.

Karluk early-run (through July 15) sockeye salmon was again strong and came in early. Earlier migration timing has occurred for the past 4 years and, in an attempt to slow early escapement, the initial commercial fishing period was June 5, 4 days earlier than the "traditional" opening date (June 9). However, sockeye salmon escapement met the early-run escapement objective (150 thousand to 250 thousand) on June 5, and exceeded the lower objective by June 6. The upper objective was exceeded by June 11. Continuous fishing was allowed along the westside of Kodiak in the Outer and Inner Karluk Sections through early July, when the management focus turned to pink salmon. The Karluk early-run sockeye salmon escapement was 389 thousand fish. Approximately 1.3 million sockeye salmon were harvested in early-season westside fisheries, well above the early-run sockeye salmon point forecast (510 thousand).

The Karluk late-run sockeye salmon escapement was approximately 330.7 thousand fish. Approximately 836.8 thousand sockeye salmon were harvested in late-season westside fisheries, well above the late-run sockeye salmon point forecast (481 thousand).

The Ayakulik was expected to have a small surplus of sockeye salmon available to commercial fishing in 2004. Escapements began relatively strong with interim escapement objectives being surpassed early in the season. The lower escapement objective was exceeded by June 22. The first period targeting Ayakulik sockeye salmon began on June 30 with the Outer Ayakulik Section opening to commercial salmon fishing. The Outer Ayakulik Section remained opened until July 10. Further fishing periods occurred in early August in both the Inner and Outer Ayakulik Sections. The Ayakulik sockeye salmon escapement was 275.2 thousand, near the upper end of the escapement objective range (200 thousand to 300 thousand). Over 260.3 thousand sockeye salmon were harvested in the Ayakulik Sections, which exceeded the 2004 point forecast (111 thousand).

The 2004 forecast for the Frazer system estimated a run of 244 thousand sockeye salmon (range 66 thousand to 706 thousand), with a harvestable surplus of approximately 104 thousand sockeye salmon. The forecast for the early run to the Upper Station system was 163 thousand sockeye salmon (range 101 thousand to 238 thousand), with a harvestable surplus of approximately 138 thousand sockeye salmon. Early Upper Station sockeye salmon are taken incidentally during fisheries primarily targeting Frazer system sockeye salmon or in directed fisheries in upper Olga Bay.

The department tentatively scheduled a commercial salmon fishing period for June 5 in the Alitak Bay District if certain criteria were met prior to June 3. Generally, the Upper Station early-run sockeye salmon have an earlier run timing than the Frazer system. The intent of the early opening was to allow an opportunity to harvest Upper Station early-run sockeye salmon

prior to the Frazer system sockeye salmon peak run timing. Sockeye salmon escapement to Upper Station began earlier than average with well above average escapement counts by June 3. The Upper Station sustainable objective (25 thousand) was exceeded on June 2 and it was evident that the minimum escapement objective (50 thousand) would be met. Test fish results also indicated a strong push of sockeye salmon traveling into Olga Bay. Criteria being met, the department prosecuted a 33-hour test fishery on June 5. By June 6, the minimum escapement objective for Upper Station was met and Frazer sockeye salmon escapement (34.7 thousand) was well ahead of interim escapements objectives. The department then prosecuted a series of extensions up to the maximum fishing time allowed (7.4 days) by the Alitak Bay District Management Plan followed by the mandatory 2.6 day closure.

Escapements into the Upper Station System continued to be strong following the closure and another fishing period was announced for June 16. Concerns of overescapement led the department to open the terminal harvest areas of Inner and Outer Upper Station on June 18 until further notice. By June 17 the Upper Station escapement objectives (50 thousand to 75 thousand) were surpassed (76.7 thousand) and the Frazer system escapement (82.7 thousand) was well ahead of interim escapement objectives. The Alitak Bay District opened until further notice on June 22 as directed in the its management plan (5 AAC 18.361)

The Alitak Bay District remained open to commercial salmon fishing until July 2. At that time it became evident that although the escapement at Dog Salmon had been good, fish were not entering the Frazer fishpass. The fish must travel through the pass in order to enter the Frazer Lake system to spawn. The escapement count at the fishpass was only 30.9 thousand sockeye salmon on June 29. The diversion weir to the fishpass was rebuilt this spring, and it had been reported that some fish may have bypassed the weir and could not enter the fishpass. Therefore, a closure was allowed in order to allow additional escapement into the system and return to the pulse fishery schedule in the regulatory management plan. The Inner and Outer Upper Station Sections remained open to harvest early-run Upper Station sockeye salmon in excess of escapement needs until July 13.

Problems with the diversion weir at the Frazer fishpass were resolved, and escapement counts at the fishpass increased. The Alitak Bay District opened again to commercial salmon fishing on July 6 and remained open through July 13.

The Alitak Bay District early-run sockeye salmon commercial harvest was approximately 642.8 thousand, well above the point forecast (138 thousand).

Late-run Upper Station sockeye salmon were expected to be strong. With the strong late escapement into Frazer Lake and a strong pink salmon return, fishing time was allowed for the Alitak Bay District beginning July 16. Even with the commercial fisheries, the Upper Station sockeye salmon escapement counts continued at a good rate, meeting and exceeding interim objectives near the end of August. The late-run Upper Station escapement was 177.1 thousand sockeye salmon, meeting the established objective (150 thousand to 200 thousand). Effort during late July and August was similar to June and early July, with 67 gillnet and 23 seine permits operating in the District, and the last delivery occurring on September 16. Harvests from late Alitak fisheries include about 514.2 thousand sockeye salmon.

Terminal harvest fisheries accounted for approximately 1 percent of the total ABD sockeye salmon harvest in the Alitak Bay District. Nineteen gillnet permit holders harvested a total of 12

thousand sockeye salmon in the Dog Salmon Flats (257-42) and the Inner and Outer Upper Station Sections (257-30).

The relative percentages of the sockeye salmon harvest in traditional fishing sections, Cape Alitak, Alitak Bay, Moser Bay, and Olga Bay did not fall within the Board of Fisheries allocative guidelines in 2004. The Cape Alitak Section harvested 36.8 percent of the total sockeye salmon (allocative guideline 38 percent to 44 percent) The Alitak Bay Section harvested 26 percent of the sockeye salmon (allocative guideline 18 percent to 24 percent). The Moser Bay Section finished the season with 25 percent of the harvest (allocative guideline 16 percent to 22 percent); while the Olga Bay Section harvested 12.2 percent (allocative guideline 16 percent to 22 percent).

The Afognak Lake (Litnik) sockeye salmon run was very weak, for the fourth consecutive year. No commercial or sport fisheries were allowed. From June 12 to August 1, the subsistence fishery in the adjacent marine waters was closed by joint emergency action of state and federal subsistence managers. Despite the fishery closures, only 15.2 thousand sockeye salmon escaped into Afognak Lake, well below the escapement objective (40 thousand to 60 thousand).

Laura Lake (Pauls Bay) sockeye salmon began with a large push of escapement on June 6, and escapement soon exceeded interim objectives. Though the weir was removed earlier than in previous years (approximately 2 months), the sockeye salmon escapement (29.3 thousand) had met the escapement objective (20 thousand to 40 thousand). Commercial fishing was allowed on June 21 and was extended until July 10. Approximately 5 thousand sockeye salmon were harvested commercially, above the point forecast (2.7 thousand) and above the harvest forecast range (2.2 thousand to 3.2 thousand) of the supplemental portion (from rehabilitation efforts) of the total production.

Malina Lake sockeye salmon escapement was monitored by weir counts and aerial surveys in 2004. Escapements were weaker than expected with only 9.6 thousand counted through the weir. However the Malina weir was in place for approximately 35 days and subsequent aerial surveys counted a larger escapement (20 thousand), which did meet, desired objectives.

Commercial salmon fishing was allowed in the Malina Creek Terminal Harvest Area beginning June 5. The entire Southwest Afognak Section opened June 9 and remained open through early July due to the strong Karluk sockeye salmon run. Commercial fishermen in the terminal harvest area harvested approximately 2.4 thousand sockeye salmon prior to the beginning of fisheries in the Southwest Afognak Section. This is above the point estimate of 1.3 thousand, and above range estimates (1 thousand to 1.6 thousand). Additional Malina-bound sockeye salmon were likely harvested in adjacent areas (catches from adjacent areas cannot be separated from other Kodiak stocks moving through those areas). The Malina Terminal Harvest Area closed to commercial salmon fishing on July 10 due to weak sockeye salmon escapements through the weir.

The Saltery Lake weir was not operated for the 2004 season. Budget constraints forced Kodiak Management Area management staff to prioritize existing funds and the Saltery Lake weir project was cut. However aerial surveys were conducted and the Saltery Lake sockeye salmon run proved again to be strong. The sockeye salmon escapement (54.8 thousand) exceeded the established objective (15 thousand to 30 thousand) despite liberal fishing opportunities. This system has a mid to late season timing. Fishing was allowed June 14–15, and continuous fishing was allowed beginning June 21 with closed waters reduced to the stream terminus for much of the

time. The commercial harvest from the Inner Ugak Bay Section included approximately 5.5 thousand sockeye salmon. No forecast was made for the Saltery sockeye salmon run or harvest.

Some fisheries are located in restricted areas where salmon enhancement projects create surplus production.

There was no reported commercial harvest of sockeye salmon in the Settler Cove terminal harvest area. Sockeye salmon returning to this system are taken in commercial fisheries in adjacent sections however no stock separation studies are available. Additionally, a local subsistence fishery harvests a significant portion of this enhanced run. While no estimate of the subsistence harvest is currently available, reports from Port Lions subsistence fishermen indicate that this run was fair.

Approximately 23.4 thousand sockeye salmon (forecast 38.4 thousand; range 25 thousand to 72.2 thousand) were harvested in the Waterfall terminal harvest area (Little Waterfall Lake).

Approximately 19.7 thousand sockeye salmon (forecast 32.2 thousand; range 13.4 thousand to 72.3 thousand) were harvested in the Foul Bay terminal harvest area (Hidden Lake):

Approximately 2.4 thousand sockeye salmon (forecast 1.3 thousand; range 1 thousand to 1.6 thousand) were harvested in the Malina terminal harvest area. Approximately 75 thousand sockeye salmon were harvested in the Spiridon terminal harvest area (Telrod Cove): The Spiridon terminal harvest area represents about 41 percent of the total harvest of Spiridon enhancement fish; the other 59 percent are harvested in traditional net fisheries along the westside of the Kodiak Management Area. If expanded the total Spiridon sockeye salmon commercial harvest is estimated at approximately 184.8 thousand (forecast 337 thousand; range 178 thousand to 521 thousand). In 2004 there was reduced commercial fishing effort in the Kodiak Management Area, including the westside fisheries, so the relationship between terminal harvest area catch (41 percent) and outside catches (59 percent) may not be the same as in prior years.

Approximately 38.2 thousand sockeye salmon (run forecast 8.8 thousand; range 5.9 thousand to 11.7 thousand) were harvested at Kitoi Bay Hatchery: This is the commercial harvest from the Inner and Outer Kitoi Bay, Duck Bay and Izhut Bay Sections only. Additional sockeye salmon were harvested in adjacent sections, but stock separation studies are not available.

The Cape Igvak management plan (5 AAC 18.360) allocates up to 15 percent of the total Chignik-bound sockeye salmon harvest to KMA fishermen in the Cape Igvak Section. Based on regulations, 90 percent of all sockeye salmon caught prior to July 25 in the Cape Igvak Section are considered to be Chignik-bound. Allocative and biological criteria of the management plan were met in 2004 and commercial fisheries were allowed in the Cape Igvak Section with 9 days of fishing allowed in June during the early run to Chignik. However, the late run Chignik sockeye salmon run was very weak. The criteria were not met and there were no further fishing allowed in the Igvak Section until after July 25. Through July 25, the Cape Igvak harvest of sockeye salmon considered to be Chignik bound (90 percent) was approximately 160.7 thousand. This Cape Igvak sockeye salmon harvest represents 17.9 percent of the total Chignik sockeye salmon harvest. Overall, the total sockeye salmon harvest in the Cape Igvak Section through July 25 was 178.5 thousand, well below the point forecast (258.6 thousand).

The North Shelikof fisheries are targeting local pink salmon runs and the fishing periods are based on the projected pink salmon run strength. If it appears that the sockeye salmon harvest

will meet or exceed limits set by the Board of Fisheries, then fisheries are to be restricted to inshore waters only, and offshore "Seaward Zones" are closed. In 2004, a department biologist was present on the grounds to determine the sockeye salmon catch, and facilitate orderly, short-notice closure if the harvest limits were met. A Seaward Zone closure was required in the North Shelikof Unit (mid to north Mainland and northwest Afognak/Shuyak Islands). Soon after the July 12 commercial fishing period, the department biologists estimated that the harvest would meet the North Shelikof sockeye salmon harvest cap (15 thousand). The Seaward Zone of North Shelikof Unit was closed at 5:00 PM July 13. At the closure, the harvest in this area was estimated to include approximately 16 thousand sockeye salmon. The total July 6–25 harvest in the North Shelikof Unit included about 53.3 thousand sockeye salmon, which includes the Shoreward Zone harvests during the normal fishing periods and the Seaward Zone harvests prior to the closure. There was no closure to the Seaward Zone in the Southwest Afognak Unit. The harvest cap of 50 thousand sockeye salmon was not met. The July 6–25 harvest in the Southwest Afognak Unit included about 24.5 thousand sockeye salmon

The Kodiak Management Area commercial coho salmon harvest (489.8 thousand) was slightly below forecast (495.2 thousand) but very near the 1994–2003 average (348.6 thousand). The average weight was 7.7 pounds. The Kitoi Bay Hatchery coho salmon commercial harvest was approximately 128.3 thousand which was below forecast (159 thousand). The hatchery coho salmon average weight was 7.9 pounds. Coho salmon escapements, where measured, were fair. Overall, coho salmon escapement (71.5 thousand) met established objectives (55.3 thousand to 94.3 thousand) but were below the previous 10-year (1994–2003) average (188 thousand). Coho salmon escapement estimates are a minimum number; more coho salmon entered Kodiak Management Area systems after the end of the weir and aerial survey projects. Many weirs were not operated as late as in past years. On systems with weirs, coho salmon escapement met or exceeded established interim escapement objectives. Aerial surveys were not conducted past August 31, while it is known that fresh coho salmon were still migrating into area streams into late October.

Overall, the Kodiak Management Area pink salmon harvest (21.4 million) was within the harvest forecast (15.9 to 23 million) and above the past 5 even-year (1994–2003) average harvest (12.4 million). The average weight was 3.6 pounds. Wild stock pink salmon harvests were fair to good. Over 17.5 million wild stock pink salmon were harvested (forecast 10 million to 14 million). Westside fisheries (Southwest Afognak to Ayakulik), accounted for 12.6 million pink salmon (forecast 7.3 to 9.5 million). The Kitoi Bay Hatchery pink salmon return was weaker than expected. In those sections near the hatchery about 4 million pink salmon were harvested (forecast 5.9 to 9.0 million). The average weight of hatchery pink salmon was 3.6 pounds. Additional Kitoi-bound pink salmon were likely taken along the west side of Kodiak and Afognak Islands. There was a cost recovery fishery near the hatchery, with Kitoi pink salmon harvested and sold by the Kodiak Regional Aquaculture Association. Due to reduced commercial fishing effort and poor market conditions, there was less directed fishing for Kodiak Management Area wild stock pink salmon in 2004 and this led to increased escapements. Overall, pink salmon escapement (8.8 million) was above established objectives (2.4 million to 6 million), and exceeded the 1994–2002 even-year average (5.5 million). Escapement objectives were exceeded for the Northwest, Southwest, Alitak, Eastside, and Northeast Districts and were met in the Afognak and Mainland District.

The KMA chum salmon harvest (1.1 million) was near the forecast (1.2 million) and above the 1994–2003 average (860.6 thousand). The average weight was 7.7 pounds. The commercial

catch from the Westside District (516.7 thousand; forecast 371.9 thousand) was greater than expected, while the Mainland (149.4 thousand; forecast 206.6 thousand), and Eastside (102.8 thousand; forecast 165.3 thousand) Districts were less than forecast. Kitoi Bay Hatchery chum salmon production was weaker than expected. The Kitoi Bay Hatchery chum salmon harvest (239.6 thousand) was below the hatchery forecast (393 thousand). The average weight of the hatchery chum salmon was 7.7 pounds. The overall chum salmon escapement (533.1 thousand) met the established objective (273 thousand to 819 thousand) but fell slightly below the 1994–2003 average (550 thousand). District objectives were below the established objectives in some cases, but limited aerial surveys led to incomplete escapement estimation for some systems.

CHIGNIK MANAGEMENT AREA

The 2004 Chignik Management Area harvest of all species was less than the 2002–2003 average (the cooperative management plan years), and the prior 10-and 20-year averages. The Chinook salmon harvest was approximately equal to the harvest of the prior 2 years under the cooperative management plan, and about half of the prior 10- and 20-year averages. The early run sockeye salmon harvest (before July 5) was similar to prior year's average early run harvest, but the late run harvest was well below the recent averages. The 2004 coho salmon harvest was exceptionally small because there was no commercial salmon fishing effort after early August. The pink and chum salmon harvests were also well below recent averages, likely because of the lack of commercial fishing effort outside of Chignik Lagoon, where the majority of the pink and chum salmon have historically been caught.

In 2004, the cooperative fleet was allocated 87 percent and the competitive fleet was allocated 13 percent of the within- Chignik Management Area commercial sockeye salmon harvest. The cooperative fleet harvested a total (including home pack) of 605.3 thousand sockeye salmon, or 86.6 percent of the Chignik Management Area commercial sockeye salmon harvest. The competitive fleet harvested a total (including home pack) of 93.5 thousand sockeye salmon, or 13.4 percent of the Chignik Management Area commercial sockeye salmon harvest. Chignik-bound sockeye salmon are allocated to the Cape Igvak fishery in the Kodiak Management Area (Area K) and to the Southeastern District Mainland fishery in the Alaska Peninsula-Aleutian Islands Management Area (Area M) through July 25. Area K (Cape Igvak) fishermen harvested approximately 17.9 percent of the total Chignik sockeye salmon catch at Cape Igvak, which was approximately 31 thousand sockeye salmon above the allocation of 15.0 percent. Alaska Peninsula Management Area fishermen harvested about 6.2 percent of the total Chignik sockeye salmon catch in the Southeastern District Mainland fishery, which was about 1 thousand sockeye salmon over their allocation of 6.0 percent.

The exvessel value of the 2004 Chignik Management Area salmon harvest was about $3.6 million (approximately $36 thousand per permit holder), which was the lowest value since 1975. The vast majority of the value was from the sale of sockeye salmon, with Chinook salmon being the second most valuable species. On average, the harvest of coho, pink, and chum salmon provided less than $10 each per individual permit holder.

The 2004 Chignik River Chinook salmon escapement of 7.8 thousand was the largest on record, significantly exceeding the Chignik River Chinook escapement goal of 1.3 thousand to 2.7 thousand fish. The early-run escapement goal of 350 thousand to 400 thousand sockeye salmon through July 4 was achieved with an estimated escapement of 363.8 thousand. The late-run (post-July 4) escapement goal of 200 thousand to 250 thousand sockeye salmon was met

with an estimated escapement of 214.5 thousand sockeye salmon. Sockeye salmon escapements into other Chignik Management Area streams were relatively minor. The Chignik River watershed total early run of 1.1 million sockeye salmon was approximately equal to the average total early run from 2002–2003 (the cooperative years) and about 500 thousand sockeye salmon fewer than the prior 10- and 20-year average runs. The total late run of 406.9 thousand sockeye salmon was approximately 500 thousand sockeye salmon less than the average total late run from 2002–2003 and about 800 thousand sockeye salmon fewer than the prior 10- and 20-year average runs. The total for both runs combined was 1.5 million sockeye salmon, which was approximately 400 thousand sockeye salmon less than the average combined runs from 2002–2003 and about 1.3 million sockeye salmon less than the prior 10- and 20-year average combined runs. Both runs materialized under the preseason forecasts; the early run was over-forecast by 13 percent and the late run was over-forecast by 62 percent.

The 2004 Chignik River pink salmon escapement was 2.2 thousand salmon. Pink salmon escapement to other Chignik Management Area streams was estimated via aerial survey and summarized by district. All of the district sustainable escapement goals were exceeded in 2004. The sustainable escapement goal of all districts combined (660 thousand salmon) was exceeded with an estimated overall escapement of 1.1 million pink salmon. The 2004 Chignik River chum salmon escapement was 276 salmon. Chum salmon escapement to other Chignik Management Area streams were estimated via aerial survey and summarized by district. The Eastern District sustainable escapement goal of 93.7 thousand chum salmon was met, but the chum salmon escapement goals to the other districts were not met; however, the overall Chignik Management Area chum salmon escapement of 349,518 exceeded the sum of the district sustainable escapement goals of 206.7 thousand chum salmon. Coho salmon began to enter Chignik Management Area drainages in mid-August and continued through at least November. Therefore, coho salmon escapement estimates are incomplete because department staff leaves the Chignik Area in mid-September. The 2004 Chignik River coho salmon escapement estimate through September 4 was 18.8 thousand.

ALASKA PENINSULA-ALEUTIAN ISLANDS

South Alaska Peninsula Area

The 2004 total commercial harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amlia Islands Management Areas was 17.5 thousand Chinook, 4.6 million sockeye, 270 thousand coho, 6.7 million pink, and 806.9 thousand chum salmon. The harvests of Chinook, sockeye, and pink salmon were above the most recent 10-year average (1994–2003). The number of permit holders participating in the fishery was well below average. The total exvessel value of the harvest ($15.3 million) was 64 percent of the 1994–2003 average value of approximately $24.1 million.

South Alaska Peninsula June Fishery

In February 2004, the Alaska Board of Fisheries made changes to the South Unimak and Shumagin Islands June Salmon Management Plan. These changes included: (1) Opened the season on June 7 (previously June 10). (2) Established fishing periods that start at 6:00 AM and run for 88 hours until 10:00 PM three days later. The fishing periods are separated by 32-hour closures with the fishery ending at 10:00 PM June 29. (3) The South Unimak fishery was expanded to include the entire Southwestern District and the West Pavlof Bay and East Pavlof Bay Sections of the South Central District.

The total June salmon harvests in numbers of fish for the South Unimak and Shumagin Islands fisheries were approximately 4.4 thousand Chinook, 1.3 million sockeye, 621 coho, 360 thousand pink, and 482 thousand chum salmon. The South Unimak harvest was approximately 666 Chinook, 532 thousand sockeye, 159 coho, 79 thousand pink, and 131 thousand chum salmon. The Shumagin Islands harvest was approximately 3.7 thousand Chinook, 816 thousand sockeye, 281 thousand pink, 462 coho, and 352 thousand chum salmon.

The South Peninsula June fisheries sockeye salmon harvest was 214.7 thousand fish more than the 1994–2003 average of 1.1 million fish and 825.9 thousand fish above the 2002–2003 average of 522.1 thousand fish. The Shumagin Islands sockeye salmon harvest was the largest since statehood. The total exvessel value ($4.3 million) was below the 1994–2003 average of $6.4 million but over three times the 2002–2003 average of $1.4 million. Fishing effort by all gear types continued to be well below average largely because of low prices. The number of purse seine permit holders participating in the 2004 South Unimak and Shumagin Islands June fisheries was 38 as compared to 40 in 2003. The number of drift gillnet permit holders was 95 in 2004 as compared to 84 in 2003, while the number set gillnet permit holders was 57 in 2004 as opposed to 53 in 2003.

The harvest from the expanded area of the South Unimak fishery (Poperechnoi Island, north side of Dolgoi Island, West Pavlof Bay Section, and East Pavlof Bay Section) was 123 Chinook, 114.9 thousand sockeye, 74 coho, 10.6 thousand pink, and 3.4 thousand chum salmon. In the South Unimak fishery, this represented 18.5 percent of the Chinook salmon harvest, 21.6 percent of the sockeye salmon harvest, 48.7 percent of the coho salmon harvest, 13.5 percent of the pink salmon harvest, and 2.6 percent of the chum salmon harvest. The expanded area of the South Unimak fishery is only open to seine and set gillnet gear and accounted for 65 percent of the purse seine and 77 percent of the set gillnet South Unimak sockeye salmon harvest.

Southeastern District Mainland Fishery

Based on the Chignik Management Area sockeye salmon harvest, the Southeastern District Mainland opened to commercial salmon fishing for 24 hours at 8:00 PM on June 15. Between June 15 and July 25, there were three 24-hour periods in the entire Southeastern District Mainland and one 24-hour period outside the Northwest Stepovak Section. The estimated Southeastern District Mainland sockeye salmon harvest, considered Chignik bound through July 25, was 55.4 thousand fish. This constituted 6.2 percent (6 percent allocation) of the total Chignik bound sockeye salmon harvest through July 25.

Beginning July 1, the Northwest Stepovak Section of the Southeastern District Mainland was managed on the basis of a strong Orzinski Lake sockeye salmon run and a sockeye salmon harvest in the Chignik Management Area of at least 600 thousand fish. Fourteen fishing days (4 days per week) were allowed in the Northwest Stepovak Section through July 25. Orzinski Bay was open continuously from July 1 through July 25. The sockeye salmon harvest in the Northwest Stepovak Section from July 1–25 was 141.4 thousand fish. The Orzinski Lake sockeye salmon escapement exceeded interim escapement goals throughout the season. A total of 65.3 thousand adult sockeye salmon passed the weir prior to August 1, surpassing the 20 thousand adult salmon season escapement goal.

South Peninsula Post-June Fishery

Prior to the South Peninsula Post-June fishery, ADF&G conducted a test fishery to determine immature salmon abundance in the Shumagin Islands. From July 2–6 no test fishing occurred because the department was unable to charter a seine vessel. The Shumagin Island fishery was opened to set gillnet gear only on July 6. Test fishery results on July 7–8 indicated that the number of immature salmon was below the regulatory threshold (100 per set) at 44 and 43 immature salmon per set respectively. The Shumagin Islands fishery was opened to seine and gillnet gear on July 8. Inseason monitoring of the seine fishery showed that the harvest of immature salmon was below the threshold for the entire fishery.

Fishing effort continued to be well below normal during the Post-June fishery. Fishermen did not generally fish pink and chum salmon aggressively because of low prices. Because of adequate salmon run strength, low effort levels, and limited processor interest in purchasing pink salmon, fishing time in non-terminal areas (Figure 2) through July 21 was the maximum allowed under the management plan.

During July 6–21, extensive fishing time was allowed in Canoe Bay despite a relatively weak chum salmon run because little fishing effort occurred. Most of the chum salmon run escaped resulting in more than adequate escapement. Pink salmon runs appeared both early and strong in the upper end of Pavlof Bay, justifying extensive fishing time in these areas too. During July 22–31, extensions of fishing time in northern Pavlof Bay and the Canoe Bay, Mino Creek-Little Coal Bay, Belkofski Bay, and Deer Island Sections between the general South Peninsula openings (5 AAC 09.366) provided uninterrupted harvest opportunity. Additional fishing area was also allowed at Thin Point Cove and Morzhovoi Bay to provide opportunity to harvest sockeye salmon in excess of escapement needs. The South Peninsula reopened for commercial fishing on September 1. The entire September harvest was from set gillnet permit holders in the Southeastern District. Fishing time in the Southeastern District was based on coho salmon harvest. Although highly variable, coho harvest rates were generally average to above average. The South Peninsula Post-June harvests of Chinook, sockeye, and pink salmon were above the most recent 10-year average (1994–2003). The chum salmon harvest was 44 percent of the 1994–2003 average of 697.4 thousand fish.

The South Peninsula preliminary indexed sockeye salmon escapement of 220.9 thousand fish was the highest on record, far above the escapement objective of 62.3 thousand to 115.2 thousand fish. The South Peninsula indexed total pink salmon escapement of 8.3 million was the largest on record. The South Peninsula indexed total chum salmon escapement of 732.4 thousand was over the escapement objective of 330.4 thousand to 660.8 thousand fish. A total of 132.8 thousand coho salmon were documented in 66 South Peninsula streams. Some of the major coho salmon systems were not surveyed or surveyed during off-peak times due to inclement fall weather.

North Alaska Peninsula

In 2004, 144 Area M permit holders and 1 Area T permit holder participated in commercial salmon fisheries along the North Peninsula. This was slightly above the 2003 level when 135 Area M and 4 Area T permit holders fished, but far below effort levels during the 1990s. The North Peninsula fishery is predominantly a sockeye salmon fishery, although depending on market conditions directed Chinook, chum, and coho fisheries occur in some locations. During

even-numbered years, pink salmon may be targeted in select locations if abundance is high and market conditions are favorable

The Chinook salmon harvest of 10.4 thousand fish was slightly more than twice the 5 thousand fish harvest projection. The sockeye salmon harvest of 2.4 million fish was approximately 39 percent above the 1.8 thousand fish harvest projection. The coho harvest of 33.9 thousand fish was well under the 2004 projection of 50 thousand fish, mostly due to a lack of interest by processors and fishermen and not run strength. The pink salmon harvest of 15.8 thousand fish was the lowest even-year harvest since 1982 and was far below the 30 thousand fish harvest projection. The chum salmon harvest of only 14.9 thousand fish was far below the projected level of 75 thousand fish. The Chinook and coho salmon harvests would have been substantially larger had market conditions been strong while the low pink salmon and chum salmon harvests were caused by a combination of mediocre runs and a lack of interest by the industry.

In 2004, the total North Peninsula harvests of Chinook and sockeye salmon were above the previous 10-year (1994–2003) average while the harvests of coho, pink and chum salmon were below the 1994–2003 average.

The North Peninsula indexed total Chinook salmon escapement was 30.9 thousand fish. The Nelson (Sapsuk) River escapement (mostly a weir count) was 7 thousand fish, which was above the goal (2.4 thousand to 4.4 thousand fish). The respective Black Hills Creek and Steelhead Creek Chinook salmon escapements were 1 thousand and 2 thousand fish. The indexed total escapement objectives for both Black Hills and Steelhead Creeks is 600 to 1.2 thousand Chinook salmon. Sandy River had an excellent Chinook escapement of approximately 5.5 thousand fish. The North Peninsula sockeye salmon escapement was an estimated 1.4 million fish. All sockeye salmon system escapement goals were met or exceeded except for Sandy River. The weired systems (Bear, Sandy, Nelson, and Ilnik Rivers) accounted for 72.5 percent of North Peninsula sockeye salmon escapement. The total North Peninsula escapement goal range is 523.4 thousand to 933.8 thousand sockeye salmon. The North Peninsula coho salmon run strength was strong. Most of the run escaped due to low exvessel prices and a lack of processor interest in purchasing coho salmon. The Nelson (Sapsuk) River escapement was about 52.5 thousand fish compared to the sustainable escapement goal of 18 thousand fish. Other major streams surveyed were: Meshik River, 135 thousand fish, Mud Creek, 21.5 thousand fish, Cinder River, 27.5 thousand fish, and the Ilnik Lagoon system, 40 thousand fish Christianson Lagoon system, 30 thousand fish, Swanson Lagoon, 12.7 thousand fish, and the Joshua Green River, 122 thousand fish. In all, approximately 519.4 thousand coho salmon were documented in 35 North Peninsula streams during 2004. This escapement estimate is conservative because some streams were not surveyed. Only part of Unangashak River, where 8 thousand coho salmon were observed, was surveyable and salmon were still entering several systems, including the Meshik River, Cinder River, and Christiansen Lagoon, while final surveys were being conducted. The North Peninsula pink salmon escapement was at least 121 thousand fish, which is 11 percent below the 1984–2002 even-year average of 136.5 thousand fish. The North Peninsula is normally a minor pink salmon producer. The Bechevin Bay Section's pink salmon escapement was 84.3 thousand fish as compared to the sustainable escapement goal of 31 thousand fish. The North Peninsula indexed total chum salmon escapement was 435 thousand fish, which was within the 219.6 thousand to 454.2 thousand goal. Due to low prices, there was little fishing effort directed toward North Peninsula chum salmon. The locations with the largest chum salmon indexed total escapements

were: Izembek-Moffet Bay (252 thousand fish), Herendeen-Moller Bay (73 thousand fish), and Bechevin Bay (41 thousand fish).

ALEUTIAN ISLANDS AND ATKA-AMLIA ISLANDS AREAS

In 2004, no commercial harvests were reported from the Aleutian Islands and the Atka-Amlia Islands Management Areas. No buyers were available for pink salmon on Unalaska Island and South Alaska Peninsula pink salmon runs were so strong that there was no need for the permit holders to travel to Unalaska. However, analysis of the limited data available indicates that escapements were good.

The U. S. Fish and Wildlife Service operated a weir at McLees Lake on Unalaska Island. During 2004, the weir passed a total of 40.3 thousand sockeye salmon through July 26. This was the fourth year the weir operated and counted a very large sockeye escapement, although the 2004 escapement was less than half as large as the 2002 and 2003 escapements.

Table 7.–Preliminary 2004 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Kodiak	29	4,170	490	21,441	1,122	27,252
Chignik	3	705	0	2	1	711
South Peninsula and Aleutian Islands	7	2,206	236	6,681	795	9,925
North Peninsula	10	2,438	34	16	15	2,513
Alaska Peninsula Total	18	4,644	270	6,697	809	12,438
Aleutian Islands	0	0	0	0	0	0
Westward Region Total	50	9,519	760	28,140	1,932	40,401

Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
Columns may not total exactly due to rounding.

PRELIMINARY FORECASTS OF 2005 SALMON RUNS TO SELECTED ALASKA FISHERIES

ADF&G prepares forecasts for salmon runs that affect major fisheries around the state. Salmon runs to be forecasted are selected using several criteria, including economic importance, feasibility, compatibility with existing programs, and management needs. For the 2005 fishing year, forecast fisheries are as follows:

Southeast	—	pink salmon
Prince William Sound	—	pink, chum, and sockeye salmon
Copper River/ Copper River Delta	—	sockeye salmon
Upper Cook Inlet	—	sockeye salmon
Lower Cook Inlet	—	pink salmon
Kodiak	—	pink salmon
Upper Station (early and late)	—	sockeye salmon
Frazer Lake	—	sockeye salmon
Ayakulik River	—	sockeye salmon
Spiridon Lake	—	sockeye salmon
Karluk Lake (early and late)	—	sockeye salmon
Chignik	—	sockeye salmon
Bristol Bay	—	sockeye and Chinook salmon
Alaska Peninsula, Bear Lake (late run)	—	sockeye salmon
Alaska Peninsula, Nelson River	—	sockeye salmon

A variety of information was used to make salmon run forecasts. In most cases the principal indicator of future abundance is the escapement magnitudes of parental stocks. Other information that might have been considered includes spawning stock distribution, smolt outmigration levels, returns to date from sibling age classes of the projected return, and environmental conditions. A range of run possibilities are predicted for each forecasted fishery. In general, based on past experience, the actual run can be expected to fall within the range (between the lower and upper limits) less than half the time. Please see the appendices for further details.

Catch projections based on quantitative forecasts of salmon runs generally reflect potential harvests, and are made for most of major sockeye salmon fisheries as well as for large hatchery runs including pink, sockeye, and chum salmon hatchery runs to the Southeast Alaska, Kodiak, and Prince William Sound areas. However, for other fisheries, including the wild pink salmon fisheries in Southeast Alaska, Prince William Sound, Kodiak, and the South Alaska Peninsula areas, the catch projections are made based on recent catch levels and are reflective of recent levels of fishing effort. Recent harvest levels have been constrained in many areas by historically low fishing effort, thus recent catch levels are reflective of both market conditions and recent levels of salmon runs. Harvest projections for these fisheries may not be indicative of potential harvest levels.

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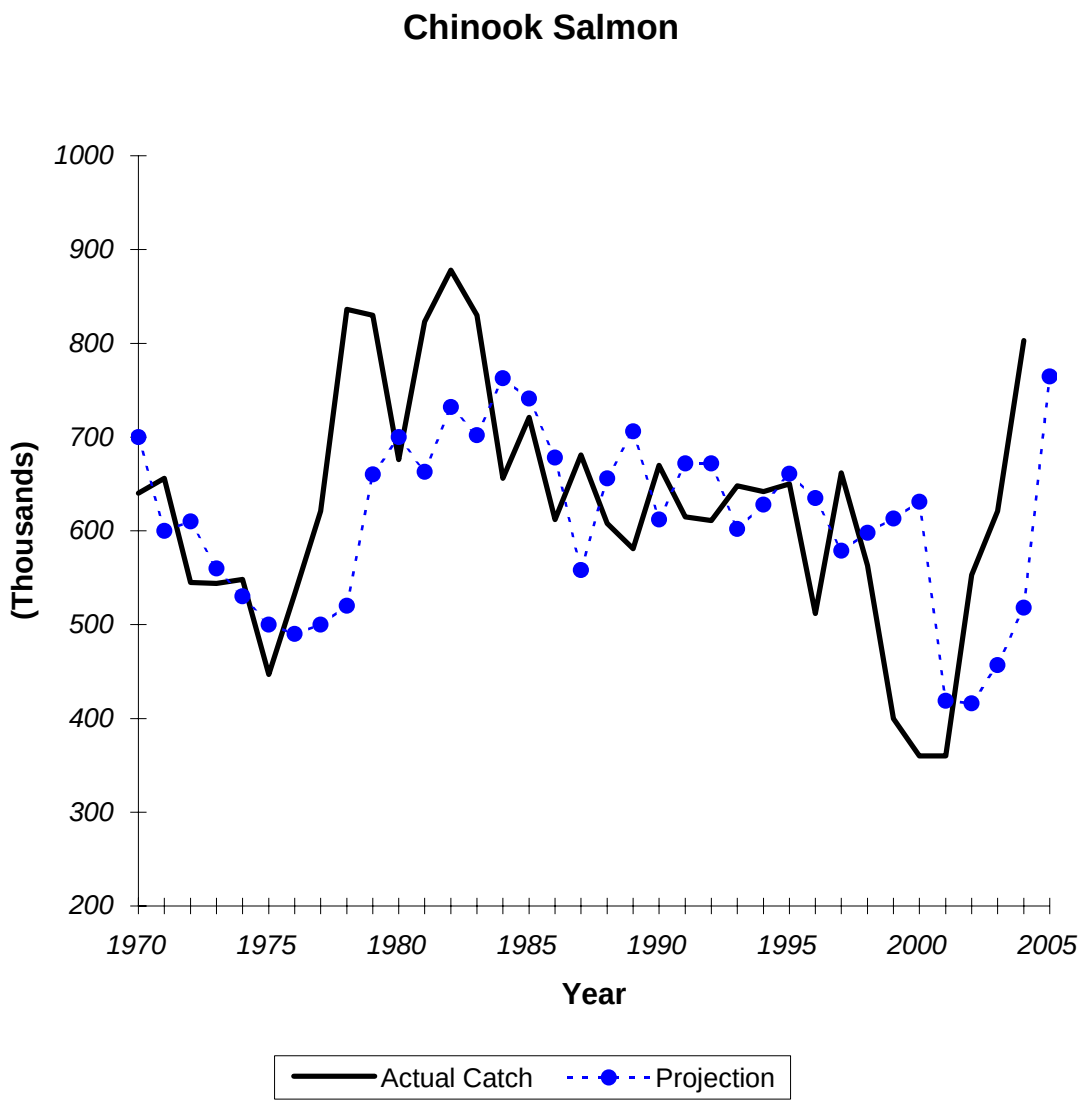

Figure 2.–Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970–2004, with the 2005 projection.

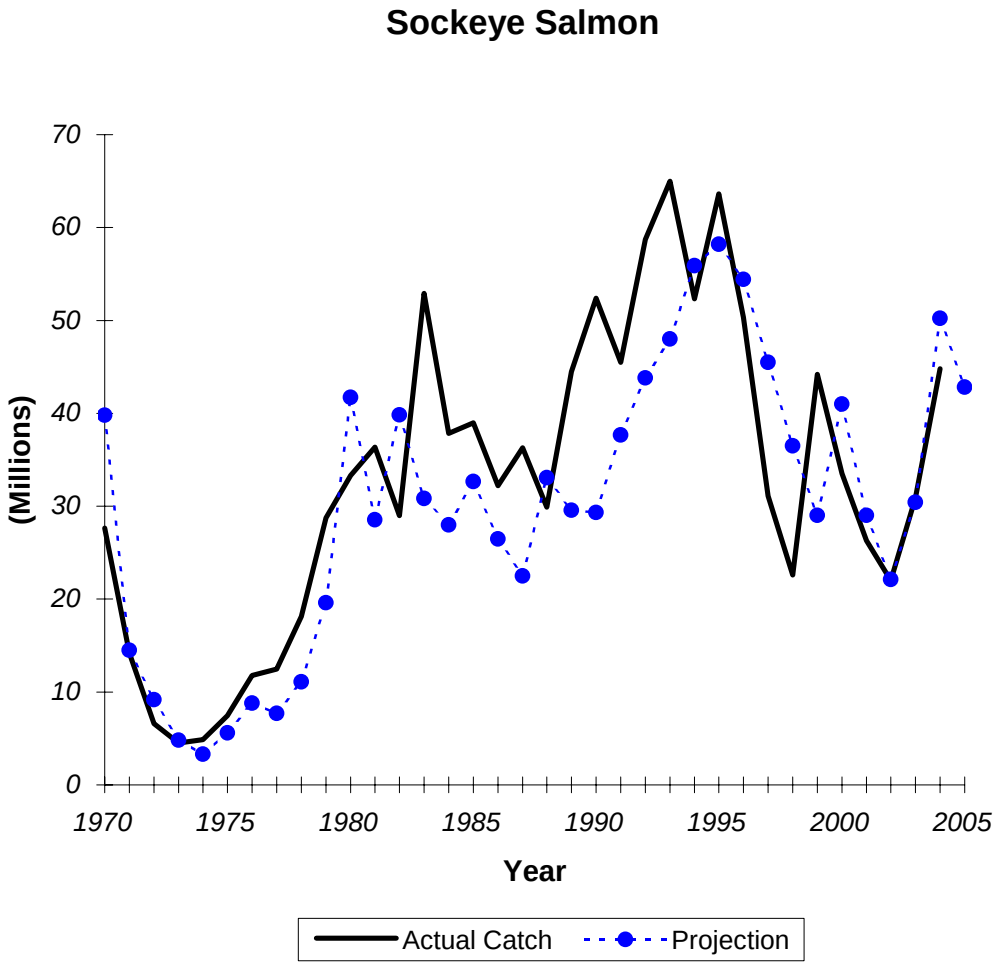

Figure 3.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan sockeye salmon fisheries from 1970–2004, with the 2005 projection.

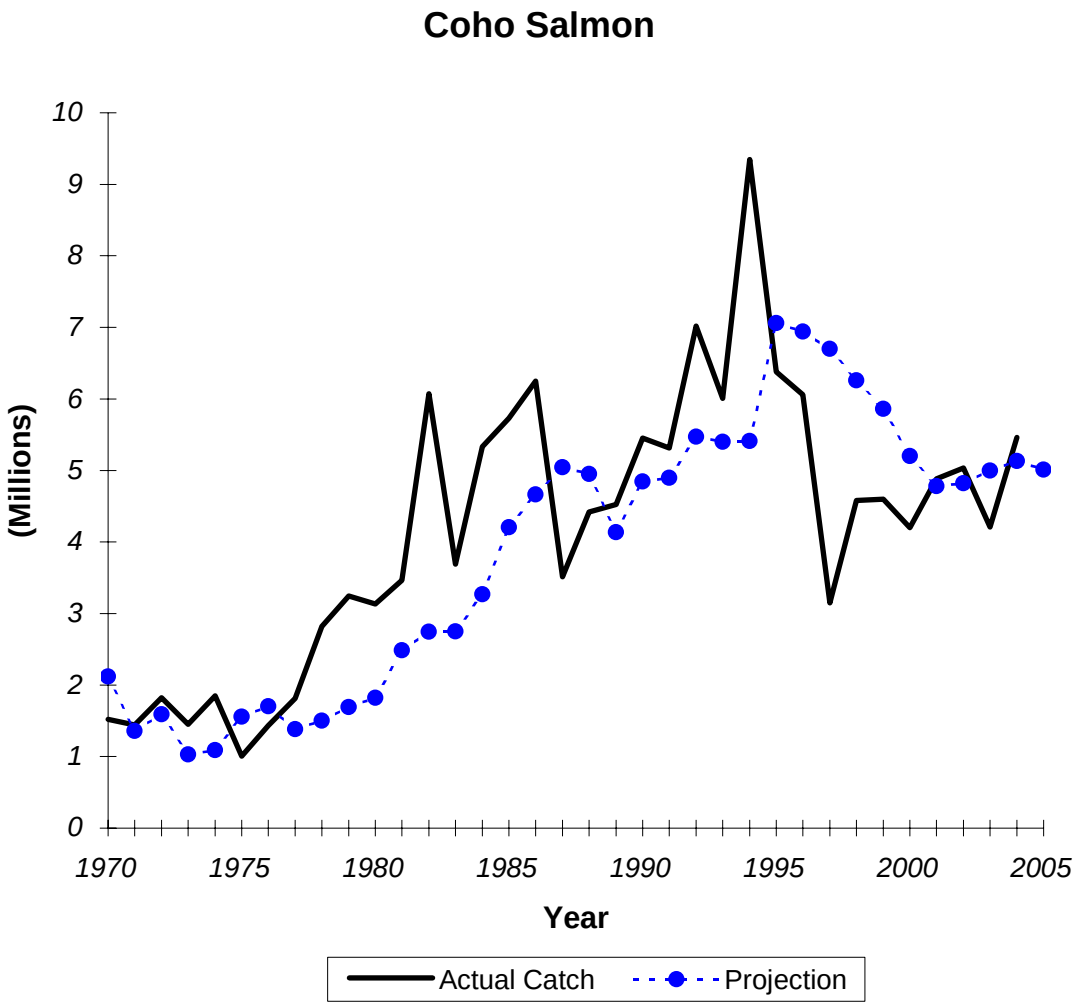

Figure 4.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan coho salmon fisheries from 1970–2004, with the 2005 projection.

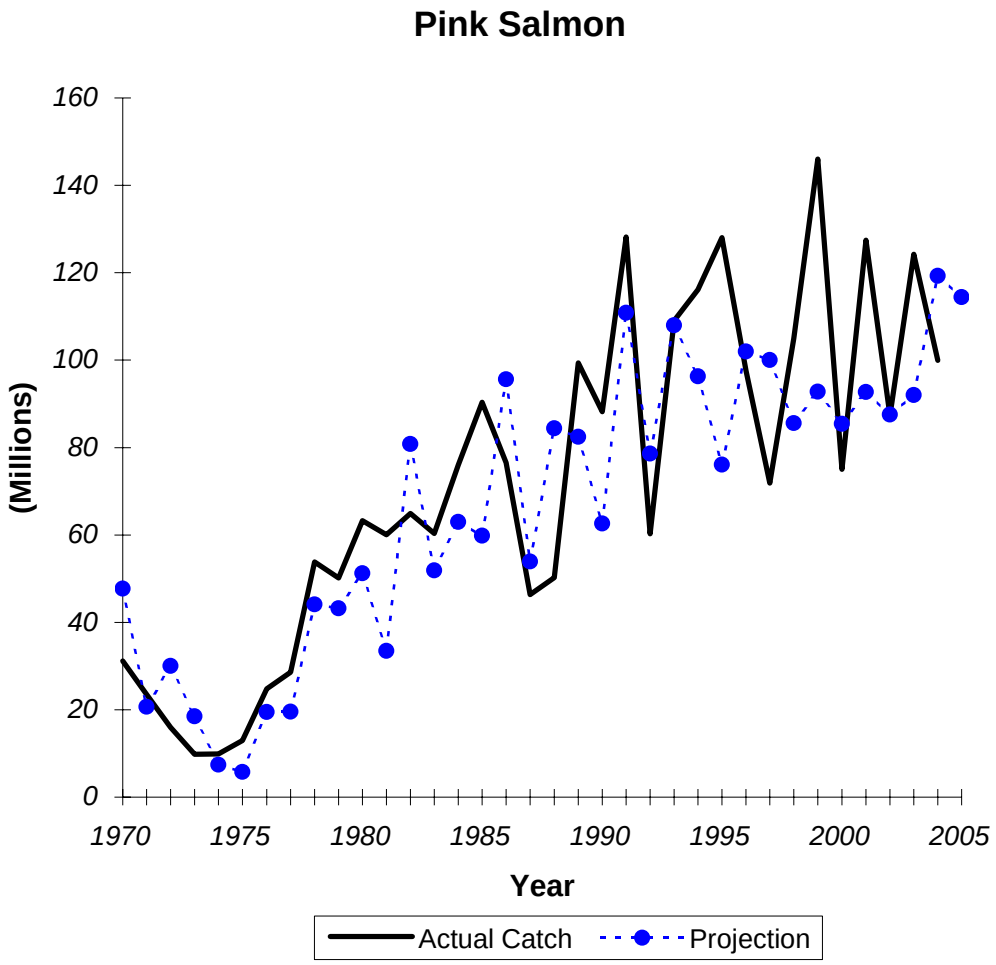

Figure 5.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan pink salmon fisheries from 1970–2004, with the 2005 projection.

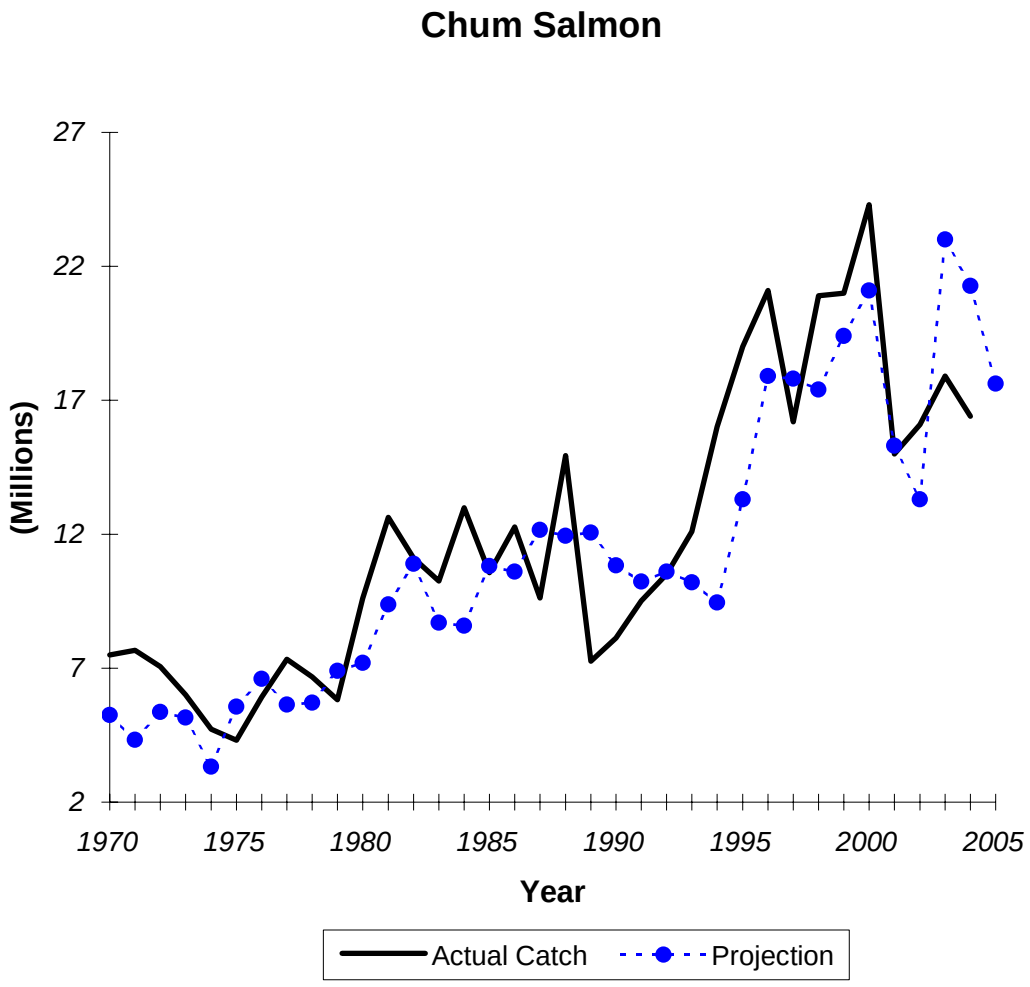

Figure 6.–Relationship between actual catch and projected catch in millions, for Alaskan chum salmon fisheries from 1970–2004, with the 2005 projection.

APPENDIX

Appendix A. 1.– Southeast Alaska

Forecast Area: Southeast Alaska
Species: Pink Salmon

The following categories of pink salmon harvest in Southeast Alaska were obtained by calculating the 20th, 40th, 60th, and 80th percentiles of historical harvest during the 40-year period 1962 to 2001:

Category	Range (millions)	Percentile
Disaster	Less than 10	Less than 20th
Weak	10 to 17	21st to 40th
Average	17 to 30	41st to 60th
Strong	30 to 53	61st to 80th
Excellent	Greater than 53	Greater than 80th

The pink salmon return in 2005 is predicted to be *Strong* to *Excellent*, with a potential total Southeast Alaska harvest of 49 million fish, with a range of 25 to 72 million fish. The Strong category represents harvests between the 61st and 80th percentiles of the historical Southeast Alaska pink salmon harvest from 1960 to 2004.

Forecast Methods

The forecast of the potential pink salmon harvest in Southeast Alaska in 2005 was based on a time-series technique called *exponential smoothing*. This technique is similar to a running average, except that all harvests since 1960 were used in the analysis (Figure 1). Recent harvest observations were given more weight in the analysis, while past harvest observations were increasingly down-weighted with time; i.e., the older the data, the less influence it has on the forecast. If x_t, x_{t-1}, ... denotes the observed harvests in year t, t-1, and so on, then the forecast in year t+1 is given by,

$$\hat{x}_{t+1} = cx_t + (1-c)\hat{x}_t \ .$$

The forecast for year t, that is $\hat{x}_t$, is also a weighted average of the observed catch in year t-1, and the forecast in year t-2. This is a kind of recursive equation that contains all of the data in the series. In this case, we choose a value of c to be approximately 0.27, based on minimizing the sum of past squared errors. The forecast range is an 80 percent confidence interval, calculated by estimating the forecast error in the exponential smoothing technique over the recent 15 year period of high production (Figure 1).

The parent year escapement appears to have been ample to provide a Strong to Excellent total return in 2005. Brood year escapement indices in 2003 were the third highest on record for the region (21.3 million), and well above the recently established biological escapement goals. In addition, pink salmon runs in Southeast Alaska have tended to be stronger in odd years, with an average harvest of 55 million in the last 5 odd years since 1995.

Appendix A. 1. Southeast Alaska (continued)

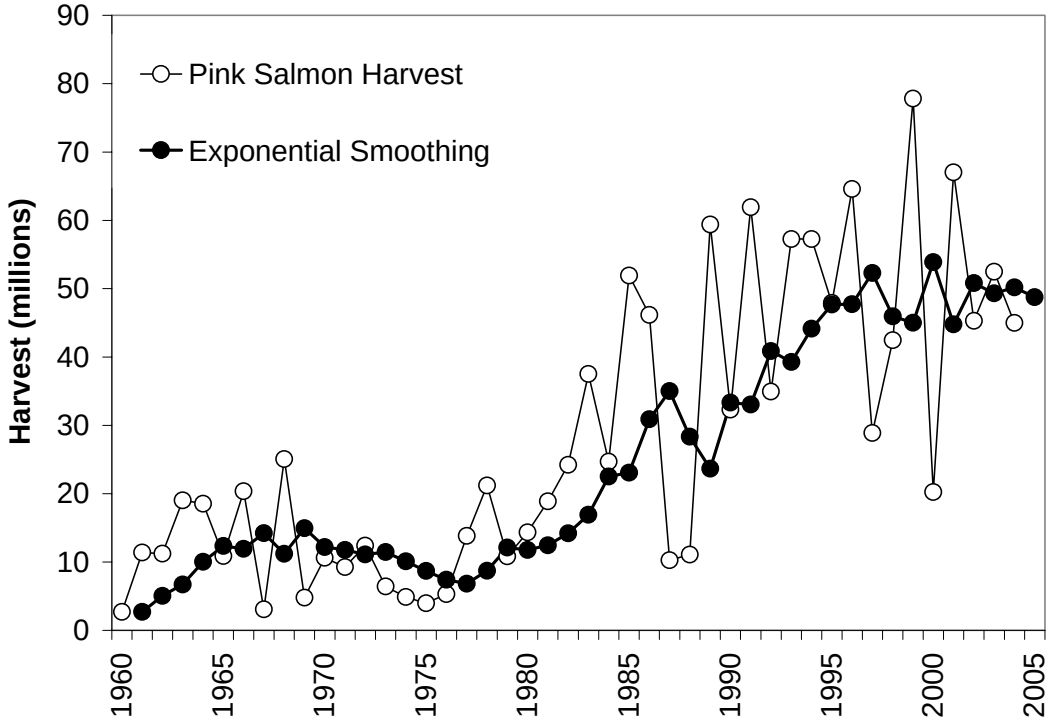

Figure 7.– Comparison of annual harvest of pink salmon in Southeast Alaska, and smoothed values of the harvest used in the 2005 forecast model.

Forecast Discussion

ADF&G programs designed specifically for collecting data useful for predicting returns of pink salmon in Southeast Alaska were eliminated in 1992. Our ability to forecast the pink salmon harvest is further complicated by recent large-scale changes in the fishing industry. Researchers cannot predict future management actions, fishing conditions, processing capacity, or product demand that drives the harvest each year. These factors have affected recent harvest levels, and in some recent years, our escapement measures indicated that there could have been considerable additional harvest had there been demand for the product.

Given these facts, we believe a simple, easily explained procedure that tracks the overall trend in harvest will produce a better forecast than complicated analyses based on questionable assumptions or based on spurious correlations. The current forecast does not rely on estimates of total escapement or total run size, as did prior forecasts, because accurate measures of these variables are not currently available. Because it is strictly based on historical harvests, this new method of forecasting does not directly forecast the amount of fish that might be available for harvest.

The department will manage fisheries *inseason* based on the strength of salmon runs. Aerial escapement surveys and fishery performance data will continue, as always, to be essential in making inseason management decisions.

Steve Heinl, Pink and Chum Salmon Project Leader, Ketchikan
Xinxian Zhang, Biometrician, Douglas
Hal Geiger, Fishery Biologist, Douglas

Appendix A. 2.–Prince William Sound

Forecast Area: Prince William Sound
Species: Pink Salmon

Pink Salmon

Preliminary Forecast of the 2005 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Prince William Sound General Districts		
Total Run	6,290	2,540 - 10,040
Escapement Goal [a]	2,000	
Harvest Estimate	4,290	540 - 8,040

[a] The escapement goal of 2.0 million pink salmon is the midpoint of the sustainable escapement goal range (1.25 - 2.75 million).

Forecast Methods

The predicted natural run of pink salmon is the average total run for the odd years 1995–2003. The total run by year was estimated as the total natural contribution to commercial harvests combined with the escapement index calculated as the area under the curve of weekly aerial escapement surveys. The natural pink salmon contributions were estimated by subtraction of hatchery stock estimates from the Commercial Common Property Fishery harvests based on thermal marked otolith recoveries (1997–2004), coded wire tag recoveries (1985–1996), or average fry-to-adult survival estimates times fry releases. The prediction procedure differs from the 1997–1999 method that used linear regressions of adult production versus the brood year escapement index. Prior to 1997, forecast methods employed surveys of preemergent fry; however, surveys of preemergent fry have not been conducted since 1995. The forecast range is the 80 percent prediction interval about the mean.

Forecast Discussion

Beginning in 2004, the department no longer produces hatchery pink salmon forecasts. Forecast methods examined for the 2005 natural run included the linear regression of log-transformed total Prince William Sound escapement versus log-transformed total Prince William Sound return; using the previous odd brood year total run to predict the future year total run (most naïve forecast method), and total run averages using from 2 to 20 years of data. These methods were only moderately successful when tested against the estimated actual total runs. The forecast from the 1995–2003 odd-brood year average run was used because it had the lowest mean absolute percent error.

The brood year 2003 escapement index (2.9 million) was the second largest observed escapement since 1971. If this total run forecast is realized, it will be the eighth largest among odd brood years 1961–2003.

With assistance from the Exxon Valdez Oil Spill Trustee Council and Prince William Sound Fisheries Research Application and Planning group, future enhancements to forecasting accuracy may come from examining early marine survival; zooplankton abundance and distribution; and juvenile pink salmon migration corridors. Other research examining pristine levels in blue mussels and juvenile pink salmon size and abundance during their early marine life stage may provide a more accurate preseason total run forecast in the future.

Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

Appendix A. 2.–Prince William Sound (continued)

Forecast Area: Prince William Sound
Species: Chum Salmon

Chum salmon

Preliminary Forecast of the 2005 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Prince William Sound General Districts		
Total Run	644	511 - 777
Escapement Goal [a]	175	
Harvest Estimate	469	336 - 602

[a] The escapement goal of 175,000 chum salmon is the midpoint of the sustainable escapement goal range (100,000-249,000).

Forecast Methods

The forecast of the total natural chum salmon run was calculated as the average of all runs from 2000 to 2004. The total natural run by year was estimated as the total commercial harvest combined with the escapement index calculated as the area under the curve of weekly aerial escapement surveys. The common property fishery harvest contributions of natural stock chum salmon were estimated using thermally marked otolith estimates by period for Coghill, Eshamy, and Montague districts. The forecast range is the 80 percent prediction interval about the mean run size.

Forecast Discussion

Beginning in 2004, the department no longer produces hatchery chum salmon forecasts. Our ability to accurately forecast natural chum salmon stocks is limited by the small amount of data available. Estimates of natural stock contributions to the common property fishery were unavailable prior to 2003. In 2003 and 2004, natural chum salmon contribution estimates based on thermally marked otoliths were available for the Coghill and Montague Districts and for the Eshamy District in 2004. Historical age data from escapements and CPF harvests are unavailable for most districts of PWS. If this total run is realized it will be the 17th largest since 1970.

Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

Appendix A. 2.–Prince William Sound (continued)

Forecast Area: Prince William Sound
Species: Sockeye Salmon

Sockeye Salmon

Preliminary Forecast of the 2005 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Prince William Sound - Coghill Lake		
Total Run	246	96 - 637
Escapement Goal [a]	30	
Harvest Estimate	216	66 - 607
Prince William Sound - Eshamy Lake		
Total Run	77	25 - 128
Escapement Goal [a]	30	
Harvest Estimate	47	0 - 98
TOTAL PRODUCTION:		
Run Estimate	323	99 - 650
Escapement Goal	60	
Common Property Harvest	263	39 - 590

[a] The escapement goal of 30 thousand sockeye salmon for both Coghill and Eshamy Lakes is the midpoint of the biological escapement goal range. The biological escapement goal range for both systems is 20-40 thousand sockeye salmon.

Forecast Methods

The forecast of the natural sockeye salmon run to Coghill Lake is the total of estimates for 5 age classes. Linear regression models using log-transformed data were used to predict runs of age-1.2 and -1.3 sockeye salmon. The run of these 2 age classes was predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year. For example, the model to predict the run of age-1.2 sockeye salmon in 2005 used the run of age-1.1 fish in 2004 as the input parameter. The predicted runs of age-1.1, -2.2, and -2.3 sockeye salmon were calculated as the mean return of that age class in past years. Although catch and escapement numbers, as well as age composition data, are available for Coghill Lake sockeye salmon runs since 1962, escapement numbers prior to installation of a full weir in 1974 are considered unreliable. Therefore, only data collected since 1974 were used to estimate model parameters, calculate individual age class forecasts, and generate 80 percent prediction intervals. The 80 percent prediction intervals were calculated using the mean square error of past forecasts.

The forecast of the natural run to Eshamy Lake is the mean of the runs from the year after the peak year in the 4-year cycle. Eshamy Lake escapements have been enumerated at a weir since 1950 except 1987 and 1998. Commercial harvest data are available for the same period, but age composition data are available only for some years since 1962. Only data collected since 1970, excluding 1987 and 1998, were used to calculate the forecast and the 80 percent prediction interval.

The total Prince William Sound run and common property harvest forecasts were calculated as the sum of the Coghill and Eshamy Lakes midpoint forecasts. The 80 percent prediction intervals were calculated as the square root of the sum of the squared 80 percent prediction intervals for Coghill and Eshamy Lakes.

Forecast Discussion

The forecast of the natural sockeye salmon run to Coghill Lake is the total of estimates for 5 age classes. Linear regression models using log-transformed data were used to predict runs of age-1.2 and -1.3 sockeye salmon. The run of these 2 age classes was predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year. For example, the model to predict the run of age-1.2 sockeye salmon in 2005 used the run of age-1.1 fish in 2004 as the input parameter. The predicted runs of age-1.1, -2.2, and -2.3 sockeye salmon were calculated as the mean return of that age class in past years. Although catch and escapement numbers, as well as age composition data, are available for Coghill Lake sockeye salmon runs since 1962, escapement numbers prior to installation of a full weir in 1974 are considered unreliable. Therefore, only data collected since 1974 were used to estimate model parameters, calculate individual age class forecasts, and generate 80 percent prediction intervals. The 80 percent prediction intervals were calculated using the mean square error of past forecasts.

The forecast of the natural run to Eshamy Lake is the mean of the runs from the year after the peak year in the 4-year cycle. Eshamy Lake escapements have been enumerated at a weir since 1950 except 1987 and 1998. Commercial harvest data are available for the same period, but age composition data are available only for some years since 1962. Only data collected since 1970, excluding 1987 and 1998, were used to calculate the forecast and the 80 percent prediction interval.

The total Prince William Sound run and common property harvest forecasts were calculated as the sum of the Coghill and Eshamy Lakes midpoint forecasts. The 80 percent prediction intervals were calculated as the square root of the sum of the squared 80 percent prediction intervals for Coghill and Eshamy Lakes.

Rick Merizon, Fisheries Biologist II, PWS Research Biologist, Cordova

Appendix A. 3.–Copper River

Forecast Area: Copper River/Copper River Delta
Species: Sockeye Salmon

Copper River Sockeye Salmon

Preliminary Forecast of the 2005 Run:	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Total Run	1,911	1,092 - 2,730
Escapement Goal [a]	530	
Common Property Harvest [b]	1,381	627 - 2,135
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
Prince William Sound Aquaculture Corp. - Gulkana Hatchery		
Hatchery Run	243	139 - 347
Broodstock Needs	20	
Supplemental Escapement [c]	48	
Common Property Harvest [b]	175	79 - 270
TOTAL PRODUCTION:		
Run Estimate	2,154	1,290 - 3,018
Natural Escapement Goal	530	
Broodstock Needs	20	
Supplemental Escapement [c]	48	
Common Property Harvest [d]	1,556	922 - 2,190

[a] The escapement goal of 530,000 sockeye salmon is the historical average spawning escapement (361,000) of the upper Copper River (spawning escapement range: 300,000 - 500,00) combined with the historical average Copper River delta aerial survey peak count times two (spawning escapement range 55,000 - 130,000). The average Copper River delta peak count of 84,500 is multiplied by two to adjust for surveyor efficiency, i.e., we assume surveyors count 50% of the total fish. No adjustment is made for freshwater residence time.

[b] Includes the harvests from commercial, subsistence, personal use, and sport fisheries.

[c] Hatchery production that will not be harvested to ensure that natural escapement to the upper Copper River is achieved, because natural stocks cannot sustain the higher exploitation levels of hatchery stocks.

[d] Includes the harvests from commercial, subsistence, personal use, and sport fisheries. The commercial common property harvest is estimated to be ~1,351thousand sockeye salmon.

Forecast Methods

The forecast of natural run sockeye salmon to the Copper River is the total of estimates for 6 age classes. Linear regression models using log-transformed data were used to predict runs for age-1.2, -1.3, -2.2 sockeye salmon. The run for these three age classes was predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year. For example, the model to predict the run of age-1.3 sockeye salmon in 2005 used the run of age-1.2 fish in 2004 as the input parameter. Finally, predicted runs of age-1.1, -0.3, and -2.3 sockeye salmon were calculated as the mean return of those age classes since 1961. The 80 percent prediction bounds for the run and harvest forecasts were calculated using the mean square error of the 1984–2004 run or harvest forecasts.

Forecast methods for 2005 are similar to forecast methods since 1998, but differ substantially from earlier methods. Prior to 1998, forecasts were calculated as the product of historical mean return-per-spawner and parent year escapements weighted by age class. Mean return-per-spawner values were estimated from linear regressions of adult production on brood year escapements.

Supplemental production from Gulkana Hatchery remote releases to Crosswind and Summit Lakes was predicted using age-specific smolt-to-adult survival estimates from brood years 1995–1998. The survival estimates were calculated using coded wire tag recoveries in harvests and enumerated adult escapements. The forecast of supplemental production from Gulkana I and Gulkana II Hatcheries was estimated from the total fry release and a fry to adult survival of 0.8 percent. The return was then apportioned using a maturity schedule of 13 percent age 4 and 87 percent age 5. The average estimated exploitation rate (72 percent) for 1996–2004 was used to estimate the total harvest of Gulkana Hatchery stocks in 2005. The 80 percent prediction interval for the forecast of supplemental production was calculated using mean square error estimates calculated for total runs.

Forecast Discussion

Forecasts prior to 1998 relied on the relationship between number of spawners and subsequent returns, using return-per-spawner values for parent year abundance similar to the dominant age class (age 5) of the forecast year. Because average return-per-spawner values do not reflect recent increased production, and because returns are still incomplete from the most recent brood years, linear regressions of brood-year sibling returns were used to produce forecasts since 1998. Additionally, reliable estimates of survival and contributions from supplemental production for individual brood years and release locations became available through coded wire tag recoveries in harvest and escapements only recently.

Historical estimates of Gulkana Hatchery production are considered imprecise. Improved contribution estimates for brood years 1995–1998 indicate large contributions from supplemental production and smolt-to-adult survival estimates for Crosswind Lake releases that averaged ~ 20 percent. Returns from fish marked with strontium chloride (Sr) began in 2003 (age-4 fish) and the majority of the adult run (age-4 and age-5 fish) was marked in 2004. All fish from all release locations (Gulkana I and Gulkana II sites; Crosswind and Summit Lakes) are now marked, but all fish now have the same mark. Therefore, estimates of smolt-to-adult or fry-to-adult survival for individual locations are no longer possible. We can now estimate the total contribution of enhanced fish to all Gulkana Hatchery releases combined, but unless different marks for individual releases can be used in the future, forecasts will be limited to total enhanced production.

The 2005 run will be composed primarily of returns from brood years 2000 and 2001. Five-year-old sockeye salmon (brood year 2000) are expected to predominate Copper River delta and upper Copper River runs. Production from the early portion of the natural run may be weak because of low inriver escapements prior to mid-June in brood year 2000. The inriver sonar estimate on 10 June 2000 was only 40 percent of the 1990–1998 average.

The total common property harvest range was calculated by subtracting the broodstock and escapement goal from the lower and upper bounds of the total run. The 2005 total run forecast is ~ 0.07 million above the twenty year average (1985–2004 = 2.08 million). If realized, the 2005 forecast total run would rank eighth largest since 1978 and just below the 2002 total run. The 1.91 million natural run would be slightly above the recent twenty year average (1985–2004 = 1.85 million), and a 0.24 million Gulkana Hatchery run would be about 0.14 million below the 1995–2004 average (0.38 million)

Steve Moffitt, Fisheries Biologist III, PWS Research Project Leader, Cordova

Appendix A. 4.–Upper and Lower Cook Inlet

Forecast Area: Upper Cook Inlet
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION		
Total Run	5.6	2.2–8.9
Escapement Goal	1.5	
Harvest Estimate	4.1	

Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet are the Kenai, Kasilof, Susitna and Crescent Rivers, and Fish Creek. Spawner, sibling, fry, and smolt data, if available, were examined for each system. Four models were used to forecast the return of sockeye salmon to Upper Cook Inlet in 2005: (1) the relationship between adult returns and spawners, (2) the relationship between adult returns and fry, (3) the relationship between adult returns and smolts, and (4) the relationship between adult returns and siblings. In most cases, sibling relationships were used. The return of age-1.3 sockeye salmon to the Kenai River in 2005 was forecast using the fry model. The fry-model prediction was based on the abundance of sockeye salmon fry rearing in Skilak and Kenai lakes in the fall of 2001. The abundance of smolts emigrating from Tustemena Lake (estimated by the Cook Inlet Aquaculture Association) was used to forecast returns of sockeye salmon to the Kasilof River in 2005. This is the fourth time this model has been used. An approximate eighty percent confidence interval for the total forecasted run was calculated using the squared deviations between past forecasts and actual runs as the forecast variance (mean square error).

Forecast Discussion

In 2004, the commercial harvest of sockeye salmon in Upper Cook Inlet was 4.9 million, while the preseason forecast was 3.7 million. The higher than expected commercial harvest in 2004 was largely due to a stronger than expected return of 5-year old sockeye salmon to the Kenai River and 2-ocean age sockeye salmon to the Kasilof River. In 2004, the total return of sockeye salmon was 4.9 million to the Kenai River, 1.7 million to the Kasilof River, 279 thousand to the Susitna River, 170 thousand to the Crescent River, and 41 thousand to Fish Creek. The forecast return of sockeye salmon in 2004 was 3.2 million to the Kenai River, 727 thousand to the Kasilof River, 464 thousand to the Susitna River, 136 thousand to the Crescent River, and 33 thousand to Fish Creek.

A run of 5.6 million sockeye salmon is forecasted to return to Upper Cook Inlet in 2005 with a harvest by all user groups of 4.1 million sockeye salmon. The forecasted harvest in 2005 is about 0.2 million fish above the 20-year average harvest. A fry model was used to forecast the return of age-1.3 sockeye salmon to the Kenai River. The fry model predicted a return of 2.2 million age-1.3 sockeye salmon to the Kenai River, which is about equal to the 20-year average return for this age class. The fry model has provided more accurate forecasts of age-1.3 sockeye salmon to the Kenai River than the sibling model in 4 of the past 8 years, but this year the sibling model forecast of 2.1 million fish was very similar to the fry model forecast. The forecast return to the Kasilof River is slightly above the 20-year average return of 894 thousand. Smolt models were

used to forecast the returns of sockeye salmon to Kasilof River in 2005. Smolt models for Kasilof River salmon have provided more accurate forecasts than other models over the past 9 years. Age-1.2 and -1.3 sockeye salmon typically comprise about 69 percent of the run to the Kasilof River. These fish emigrated from Tustemena Lake as smolts in 2002 and 2003. Smolt population estimates were below the 20-year average in 2002 and above the 20-year average in 2003. The forecast return to Fish Creek is much lower than the 20-year average return of 185 thousand. Age-1.2 sockeye salmon typically comprise 58 percent of the run to this system. Only 17.3 thousand age-1.2 sockeye salmon are forecast to return to Fish Creek in 2005. This forecast is based upon a count of only 117 thousand sockeye salmon smolts emigrating from this system in 2003.

Forecast runs to individual freshwater systems of Upper Cook Inlet are as follows:

System	Run	In River Goal
Crescent River	160,000	25,000–50,000
Fish Creek	27,000	20,000–70,000
Kasilof River	911,000	150,000–250,000
Kenai River	3,319,000	750,000–950,000
Susitna River	432,000	90,000–160,000
Minor System	727,000	N/A

Mark Willette, Research Project Leader, Upper Cook Inlet

Forecast Area: Lower Cook Inlet
Species: Pink Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION		
Total Run	2,107	578–8,358
Escapement	370	129–604
Commercial Harvest	1,738	444–7,753
SUPPLEMENTAL PRODUCTION		
Total Run	1,856	1,116–2,341
Broodstock and Escapement	160	160
Commercial Harvest	1,696	956–2,181
TOTAL AREA PRODUCTION		
Total Run	3,963	1,694–10,699
Broodstock and Escapement	530	293–764
Commercial Harvest	3,433	1,400–9,934

Columns may not total exactly due to rounding to the nearest thousand fish.

Escapement values include an escapement goal shortfall of 2 thousand fish for systems with a forecast in 2005.

Commercial Harvest = Total Run - Escapement/Broodstock.

Commercial harvests of supplemental production include both common property and cost recovery harvests.

Additional harvests may be expected from systems not included in the forecast.

Forecast Methods

The forecast of wild pink salmon returns to 11 harvest areas in the Lower Cook Inlet Management area was based on log-log regression of total return on escapement from 36 to 44 years of observations. An 80 percent confidence range about the forecast of natural production was developed using cross-validation methods. Projected harvest from natural production was obtained by subtracting the escapement goal from the forecasted run for each of our 11 index areas and then summing the resulting values. Forecasts of supplemental production by the Tutka Bay and Port Graham hatcheries was based on marine survival rates of 2.1 and 2.3 percent, respectively. Projected harvest from supplemental production was obtained by subtracting broodstock goals from the supplemental production forecast.

Forecast Discussion

The natural production forecast model was tested using cross-validation methods. The model has correctly predicted 37 out of 43 changes in direction of annual run size. In 2003, the last odd-numbered year, 9 of 11 systems forecasted had runs within the forecast range. The 2005 forecast for natural production of 2.1 million pink salmon has an 80 percent confidence interval of 578 thousand to 8.6 million fish. Strong parent-year escapement and fairly good marine survival in 2003–2004, as indicated by hatchery returns, suggests there is a strong likelihood of reaching at least the mid-point estimate of this forecast. If realized, a natural run of 2.1 million pink salmon would be over 4 times the median run size of 504 thousand fish for odd-year returns between 1961 and 2003. The pink salmon escapement goal is 370 thousand fish (range 135 thousand to 604 thousand) for systems with a forecast. If the run comes in as forecast, the upper end of the escapement goal range should be met. If the lower end of the forecast range is realized, a combined escapement shortfall of 2 thousand fish is expected for Seldovia and Bruin Bays. The resulting escapement forecast would then be 133 thousand pink salmon.

The harvestable surplus of naturally produced pink salmon in the Southern District is projected to be 86.7 thousand fish, 59 thousand of which is expected to come from Humpy Creek. Harvests of 19.1 and 8.7 thousand fish are expected for Seldovia Bay and Port Graham, respectively. Supplemental production of pink salmon in the Southern District has contributed from 24 percent to 90 percent of the total Lower Cook Inlet commercial harvest in recent years. The Tutka Hatchery released nearly 58 million fry in 2004, before ceasing operations for the foreseeable future. The winter of 2003–2004 contradicted the recent trend by producing fairly good ocean survival rates for Tutka Bay and Port Graham Hatchery pink salmon. Given an estimated ocean survival rate of 2.1 percent, about 1 million pink salmon are expected to return to Tutka Bay and Lagoon in 2005 (personal communication with G. Fandrei, Cook Inlet Aquaculture Association). This will be the final return to the Tutka Hatchery facility. The Port Graham Hatchery released 36.3 million fry in 2004. That facility is assuming a marine survival rate of 2.3 percent and is expecting nearly 835 thousand pink salmon to return to Port Graham Bay in 2005 (personal communication with G. McMullen, Port Graham Hatchery). The 2005 brood stock goal for the Port Graham Hatchery is 160 thousand fish. Because cost recovery requirements are dependent upon inseason fish prices, the allocation of hatchery-produced salmon returns between common property and cost recovery fisheries cannot be determined at this time.

In the Outer District, the number of naturally produced pink salmon available for harvest is projected to be 936 thousand fish, with over 51 percent (482 thousand fish) of the harvest expected to occur in the Port Dick subdistrict. If realized, the Port Dick harvest would be the highest odd-year catch since 1981. Harvests ranging from 30 to 229 thousand fish are anticipated from Port Chatham, Nuka Island, Windy Bay, and Rocky Bay.

Edward O. Otis, LCI Research Biologist, Homer
Lee F. Hammarstrom, Area Finfish Management Biologist, Homer

Appendix A. 5.–Kodiak

Forecast Area: Kodiak
Species: Pink Salmon

Preliminary Forecast of the 2005 Harvest	Harvest Forecast (millions)
Wild Stock Production: Average	6.0–10.0
Kitoi Bay Hatchery Production	7.9–11.9
2005 Total KMA Pink Salmon Harvest	13.9–21.9
Wild Stock Production by District:	
AFOGNAK	0.5–0.9
WESTSIDE	2.4–4.0
ALITAK	1.5–2.5
EASTSIDE	1.2–2.0
MAINLAND	0.4–0.6

Forecast Methods

The 2005 Kodiak Management Area wild stock pink salmon forecast was prepared by evaluating Ricker spawner-recruit models, and comparing the 2003 brood year escapement indices for the entire Kodiak Management Area and individual fishing districts to past escapements, subsequent returns, and escapement and harvest averages. An anticipated harvest range for the 2005 wild stock pink salmon return was determined by selecting one of 5 different harvest magnitude categories.

Harvest categories were delimited by melding harvest quintiles with the forecast categories previously used by management biologists to determine the length of initial fishing periods. This forecasting method has been used since 1999. Categories are shown below.

Harvest Category	Range (millions)
Very Weak	Less than 3
Weak	3 to 6
Average	6 to 10
Strong	10 to 14
Excellent	Greater than 14

The Kitoi Bay Hatchery pink salmon forecast was developed by applying the average fry-to-adult survival rates to the number of fry released in 2004. The average fry-to-adult survival rate was based on the last 12 stocking years (fish returning from 1993 to 2004) when releases were in excess of 100 million fry. The low range estimate was based on the lowest survival rate, and the high range estimate was based on the average survival rate of the past 2 odd-year returns (2001 and 2003).

Forecast Discussion

Several Ricker spawner-recruit models were developed to examine the relationship of 1979 to 2001 odd-year escapements to total return or harvest. Kodiak Management Area pink salmon exhibit odd-numbered or even-numbered year dominance; currently even-year runs tend to be larger than odd-year runs. The harvest projections fell within the *average* (6 million to 10 million) category. Models were also developed for each district and the sum of the district estimates was similar to the area-wide prediction.

The effects of climate on pink salmon spawning, egg-to-fry survival, outmigration, and nearshore survival is unquantified. However, no conditions were experienced during the last 2 years that would lead us to believe that the estimate produced from the Ricker spawner-recruit models should be modified.

Recent odd-year pink salmon returns have declined from record numbers produced in 1993 and 1995. The 2003 (brood year) pink salmon escapement (5.1 million) was above established goals (1.0 to 3.0 million), and just above the 1991 to 2001 odd-year average (5.0 million). Escapement goals were met in each district in the Kodiak Management Area, with high escapements in the Eastside/Northend area and Mainland District (1.9 million and 1.0 million respectively).

The 2005 pink salmon wild production harvest will likely be *average* (6 to 10 million), with the statistical modeling suggesting that the high end of the range may be achieved.

For the Kitoi Bay Hatchery pink salmon return, approximately 145 million fry were fed and released into Kitoi Bay in 2003. All fry are released on the same date each year (May 24); single day releases saturate the area with fry, increasing the survival. Survival is also positively correlated with the size of the fry on release. The average Kitoi Bay Hatchery pink salmon fry size upon release was 0.76 grams, above the recent 5-year average (0.70 grams). Kitoi Bay Hatchery pink salmon returns appear to be odd-year dominant, exhibiting much higher survival rates than even-year returns (5.3 percent vs. 2.7 percent). Additionally, a cyclic increase in survival has been noted, with every other odd-year return being consistently strong. The 2005 return should be one of these higher than average return years.

Combining the 2005 pink salmon wild and hatchery production suggests that the total Kodiak Management Area pink salmon harvest will likely be *excellent* (greater than 14 million). This forecast level will allow an initial weekly fishing period of 105 hours (4.5 days) for most of the Kodiak Management Area during the initial general pink salmon fishery (beginning July 6, 2005). By the fourth week of July, fishing time may be extended or restricted, by section or district, as true run strengths become known.

Ivan Vining, Biometrician, Kodiak
Jeff Wadle, Assistant Area Management Biologist, Kodiak
Kevin Brennan, Area Management Biologist, Kodiak
Drew Aro, Kitoi Bay Hatchery Manager, Kodiak

Forecast Area: Kodiak, Spiridon Lake
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	104	61–145
Escapement Goal	0	
Harvest Estimate	104	61–145

Forecast Methods

The 2005 Spiridon Lake forecast estimate was based on the 2002 to 2004 smolt outmigration estimates, average smolt-to-adult survival rates, and the average ocean age of adult returns to the Spiridon Lake Terminal Harvest Area from the 1991 to 1999 fry stocking years.

Sockeye salmon smolt outmigrating from Spiridon Lake each spring (May–June) were trapped, enumerated, and a portion of each day's outmigration was sampled for age (scales) and size data. Age composition estimates were used to assign ages to the seasonal outmigration. The 2002 smolt outmigration was composed of approximately 442 thousand age-1. smolt and 92 thousand age-2. smolt. In 2003, approximately 229 thousand age-1. smolt and 35 thousand age-2. smolt outmigrated from Spiridon Lake, and approximately 540 thousand age-1. and 37 thousand age-2. smolt outmigrated in 2004.

Dividing the average total adult return by the average number of smolt outmigrating from Spiridon Lake resulted in an average smolt-to-adult survival of 31.1 percent (with a lower range of 18.4 percent and upper range of 43.4 percent survival) for sockeye salmon stocked from 1991 to 1999. The 2002 to 2004 annual smolt outmigration estimates by age were multiplied by the average smolt-to-adult survival to calculate the freshwater age of adult sockeye salmon returns, while the range was generated using the lowest and highest smolt-to-adult survival rates observed for these stocking years.

Spiridon Lake sockeye salmon stocked from 1991 to 1999 returned to the Spiridon Lake Terminal Harvest Area, on average, as 1-ocean (3.3 percent), 2-ocean (74.4 percent) and 3-ocean (22.2 percent) fish. These average age-at-return percentages were multiplied by the calculated number and range of adult returns by freshwater age to generate an estimate and range of returning fish by ocean age (and year). The results for each age class were summed to calculate a forecast estimate and forecast range for the 2005 run.

Forecast Discussion

Barrier falls in the outlet creek (Telrod Creek) flowing from Spiridon Lake to Telrod Cove prevent adult sockeye salmon from returning to Spiridon Lake. Therefore, all returning adult sockeye salmon will be available for harvest in the traditional fishing areas and in the Spiridon Lake Terminal Harvest Area, which is located at Telrod Cove. The 2005 run is predicted to be approximately 191 thousand fish less than the 11-year average run of 295 thousand (1994 to 2004), and approximately 82 thousand fish less than the 2004 run (186 thousand). The predominant age classes in the run are expected to be ages 1.2 (51 percent) and 1.3 (29 percent). Spiridon Lake sockeye salmon are expected to return in late June to early July, peaking in mid to

late July and ending by mid August. This run timing parallels the Saltery Lake sockeye stock, which was used as the brood source for the Spiridon Lake sockeye salmon returning in 2005.

Steve Schrof, Finfish Research Biologist, Kodiak

Appendix A. 5.–Kodiak (continued)

Forecast Area: Kodiak, Ayakulik River
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	392	100–705
Escapement Goal	250	200–300
Harvest Estimate	142	

Forecast Methods

The 2005 Ayakulik sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1988 to 2002) ocean age class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ocean age 2 (2-ocean) sockeye salmon were predicted from prior year 1-ocean returns ($P = 9.9\times10^{-5}$), while 3-ocean sockeye were predicted from prior year 2-ocean returns ($P = 4.1\times10^{-3}$). Estimates of variance were calculated from each regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the 10^{th} and 90^{th} percentiles of the returns. The variances associated with individual regression estimates by age class were summed to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Ayakulik sockeye salmon run for 2005; 80 percent prediction intervals for the total run were calculated by combining the regression and median prediction intervals.

Forecast Discussion

The 2005 forecast is 31 thousand fish greater than the 2004 forecast (361 thousand) and about 54 thousand fish less than the actual 2004 run estimate of 446 thousand fish. The 2005 run should be composed of approximately 61 percent 3-ocean fish and 35 percent 2-ocean fish. If realized, this run will be 300 thousand fish less than the recent 10-year average (1995 to 2004) run of 692 thousand fish. The healthy 2004 Ayakulik River sockeye run suggests a rebound from the extremely weak runs in 2002 and 2003 (the lowest consecutive runs since 1974 and 1975). Overall, the confidence in the 2005 Ayakulik forecast is good, due to the relatively strong relationships in the recent year data. The projected harvest of 142 thousand fish is based on achievement of the midpoint (250 thousand) of the escapement goal range.

M. B. Foster, Finfish Research Biologist, Kodiak

Appendix A. 5.–Kodiak (continued)

Forecast Area: Kodiak, Karluk Lake (Early Run)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	554	383–728
Escapement Goal	150	150–250
Harvest Estimate	404	

Forecast Methods

The 2005 Karluk Lake early-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent brood year (1979 to 2000) sibling relationships for three age classes. Linear regression models were also used to investigate the relationship between ocean age one (1-ocean) and ocean age 2 (2-ocean) sockeye salmon. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ages 1.3, 2.3, and 3.3 were predicted from age-1.2, -2.2, and -3.2 siblings respectively. Two-ocean fish (ages 1.2, 2.2, and 3.2) were predicted from 1-ocean fish (ages 1.1, 2.1, and 3.1). All other age classes were estimated by summing 13 minor age class run estimates (0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 4.1, 2.4, 4.2, 3.4, 4.3 and 4.4) by year (1995 to 2004) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When the median return by age class was used, the 80 percent prediction intervals were estimated by calculating the 10^{th} and 90^{th} percentiles of the data. The variances associated with individual regression age class estimates were summed to calculate 80 percent prediction intervals. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2005 forecast is about 106 thousand fish less than the 2004 forecast (660 thousand) and about 236 thousand fish less than the actual 2004 run estimate of 790 thousand fish. The 2005 run should be composed of approximately 52 percent 2-ocean fish and 44 percent 3-ocean fish. If realized, this run will be 51 thousand fish less than the recent 10-year average (1995 to 2004) run of 605 thousand fish.

The projected harvest of 404 thousand fish is based on achievement of the low point of the escapement goal range (150 thousand fish). Age 2.2 has been the predominant age class in each of the past 7 seasons. The 2003 age-2. smolt outmigration estimate was larger than the 2002 estimate; however, the age-2.1 siblings that returned in 2004 were well below average. The smolt outmigration information conflicts with the sibling relationship information; therefore, our confidence in this forecast is fair.

Mark Witteveen, Finfish Research Biologist, Kodiak

Forecast Area: Kodiak, Karluk Lake (Late Run)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	856	390–1,488
Escapement Goal	400	400–550
Harvest Estimate	456	

Forecast Methods

The 2005 Karluk Lake late-run sockeye salmon forecast was prepared by investigating simple linear regression models utilizing recent brood year (1980 to 1999) alternative sibling relationships for one age class, an ocean temperature relationship for one age class, and estimating median runs for 4 individual age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). A significant alternative sibling regression model was employed to estimate the age-3.2 component of the run from 2004 returns of age-2.2 sockeye salmon. A significant regression model was employed to estimate the age-2.2 component of the run from sea surface temperatures that occurred in the summer of the first year of ocean residence. Following non-significant regression results, the median return by age class was used to estimate the age-1.2, -1.3, -2.3, and -3.3 components of the run. All other age classes were estimated by summing 12 minor age class run estimates (0.1, 0.2, 1.1, 0.3, 2.1, 0.4, 3.1, 1.4, 2.4, 4.2, 3.4, and 4.3) by year (1995 to 2004) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and pooled age class estimates. When the median return by age class was used, 80 percent prediction intervals were estimated by calculating the 10^{th} and 90^{th} percentiles of the data. The variances associated with individual regression age class estimates were summed to calculate 80 percent prediction intervals. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2005 forecast is about 25 thousand fish less than the 2004 forecast (881 thousand) and about 197 thousand fish greater than the actual 2004 run estimate of 659 thousand fish. Median estimates were used for most age classes due to relatively poor sibling relationships. The 2005 run should be composed of approximately 56 percent 5-year-old fish and 39 percent 6-year-old fish. If realized, this run will be 41 thousand fish greater than the recent 10-year average (1995–2004) of 815 thousand fish.

The projected harvest of 456 thousand fish is based on achievement of the lower bound of the escapement goal range (400 thousand fish). The predominant age classes in the run should be ages 2.2 (55 percent), 3.2 (21 percent), and 2.3 (18 percent). Age 2.2 has been the predominant age class in 6 of the past 7 seasons. Smolt outmigration estimates indicate that a larger number of age-2. smolt outmigrated in 2003 than in 2002, suggesting that a higher number of age-2.2 sockeye will return in 2005 than in 2004. The smolt outmigration information suggests that the run may fall in the upper end of the forecast range. Climate indices have not been used before in forecasting Karluk late-run sockeye salmon. This coupled with the relatively poor sibling relationships limit our confidence in this forecast, which we would categorize as poor to fair.

Mark Witteveen, Finfish Research Biologist, Kodiak

Forecast Area: Kodiak, Frazer Lake (Dog Salmon Creek)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	384	178–622
Escapement Goal	140	140–200
Harvest Estimate	244	

Forecast Methods

The 2005 Frazer Lake (Dog Salmon Creek) sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1970 to 2002) ocean age class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ocean age three (3-ocean) sockeye salmon were predicted from prior year 2-ocean returns ($P = 7.3\times10^{-3}$). The 2-ocean sockeye were predicted from prior year 1-ocean returns ($P = 5.6\times10^{-4}$) using only recent year (post 1993) data, based on trends in the residual. Estimates of variance were calculated from each regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return (since 1988) and prediction intervals were calculated using the 10^{th} and 90^{th} percentiles of the returns. The variances associated with individual regression estimates by age class were summed to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Frazer Lake sockeye salmon run for 2005; 80 percent prediction intervals for the total run were calculated by combining the regression and median prediction intervals.

Forecast Discussion

The 2005 forecast is 140 thousand fish greater than the 2004 forecast (244 thousand) and about 328 thousand fish less than the actual 2004 run estimate of 712 thousand fish. The 2005 run should be composed of approximately 66 percent 3-ocean fish and 26 percent 2-ocean fish. If realized, this run will be 113 thousand fish less than the recent 10-year average (1995 to 2004) run of 497 thousand fish. The strong 2004 Frazer Lake sockeye run suggests a rebound from the extremely weak runs in 2002 and 2003 (the lowest consecutive runs since 1986 and 1987). Overall, the confidence in the 2005 Frazer Lake forecast is fair, due to the low abundance of the ocean age-1 predictor age class. The 2005 return of 2-ocean sockeye represents the greatest source of uncertainty. The large 2003 estimated smolt outmigration (that will yield the 2-ocean sockeye for 2005) suggests a strong return of 2-ocean fish. The projected harvest of 244 thousand fish is based on achievement of the lower end (140 thousand) of the escapement goal range.

M.B. Foster, Finfish Research Biologist, Kodiak

Appendix A. 5.–Kodiak (continued)

Forecast Area: Kodiak, Upper Station (Olga Lakes, Early Run)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	170	113–231
Escapement Goal	50	25–75
Harvest Estimate	120	

Forecast Methods

The 2005 Upper Station early-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1973 to 2002) ocean age class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ocean age three (3-ocean) sockeye salmon were predicted from prior year 2-ocean returns ($P=2.2\times10^{-5}$). The 2-ocean sockeye were predicted from prior year 1-ocean returns ($P = 1.1\times10^{-3}$) using only recent year (post 1988) data, based on trends in the residuals. Estimates of variance were calculated from each regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the 10^{th} and 90^{th} percentiles of the returns. The variances associated with individual regression estimates by age class were summed to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Upper Station early sockeye salmon run for 2005; 80 percent prediction intervals for the total early run were calculated by combining the regression and median prediction intervals.

Forecast Discussion

The 2005 forecast is 7 thousand fish greater than the 2004 forecast (163 thousand) and about 99 thousand fish less than the actual 2004 run estimate of 269 thousand fish. The 2005 run should be composed of approximately 59 percent 3-ocean fish and 40 percent 2-ocean fish. If realized, this run will be 30 thousand fish greater than the recent 10-year average (1995 to 2004) run of 140 thousand fish. The 2004 early run of sockeye at Upper Station was the strongest in recent history (at least 30 years). Overall, the confidence in the 2005 Upper Station early-run forecast is fair; regression relationships were strong but there was an unprecedented abundance of 2-ocean sockeye used to predict 3-ocean sockeye returning in 2005. Therefore, return of 3-ocean sockeye represents the greatest source of uncertainty in this forecast. The projected harvest of 120 thousand fish is based on achievement of the midpoint of the escapement goal range (50 thousand fish).

M. B. Foster, Finfish Research Biologist, Kodiak

Appendix A. 5.–Kodiak (continued)

Forecast Area: Kodiak, Upper Station (Olga Lakes, Late Run)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	592	384–813
Escapement Goal	175	150–200
Harvest Estimate	417	

Forecast Methods

The 2005 Upper Station late-run sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing outmigration year (1974 to 2002) ocean class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). Ocean age three (3-ocean) sockeye salmon were predicted from prior year 2-ocean returns ($P = 1.1\times10^{-4}$). The 2-ocean portion of the run was predicted from a temperature index ($P = 2.1\times10^{-3}$) using only recent year (post 1986) data, based on trends in the residuals. The temperature index was calculated by summing the 2-year average winter (October–May) Kodiak air temperature prior to outmigration and the average sea surface temperature (in the Gulf of Alaska 88 nmi south of Kodiak) for the first summer following outmigration. Estimates of variance were calculated from each regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the 10^{th} and 90^{th} percentiles of the returns. The variances associated with individual regression estimates by age class were summed to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Upper Station late sockeye salmon run for 2005; 80 percent prediction intervals for the total run were calculated by combining the regression and median prediction intervals.

Forecast Discussion

The 2005 forecast is 54 thousand fish greater than the 2004 forecast (538 thousand) and about 78 thousand fish greater than the actual 2004 run estimate of 514 thousand fish. The 2005 run should be composed of approximately 74 percent 2-ocean fish and 24 percent 3-ocean fish. If realized, this run will be 145 thousand fish greater than the recent 10-year average (1995 to 2004) run of 447 thousand fish. The 2004 late run of sockeye at Upper Station was the strongest in recent history (at least 30 years). Overall, the confidence in the 2005 Upper Station late-run forecast is fair to good, due to the strong regression relationships and hence relatively small confidence intervals. The 2005 return of 2-ocean sockeye represents the greatest source of uncertainty. The projected harvest of 417 thousand fish is based on achievement of the midpoint of the escapement goal range (175 thousand fish).

M. B. Foster, Finfish Research Biologist, Kodiak

Appendix A. 6.–Chignik

Forecast Area: Chignik
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run		Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION			
Early Run (Black Lake)	Total Run Estimate	1,840	1,060–2,760
	Escapement Goal	350	350–400
	Harvest Estimate[a]	1,490	
Late Run (Chignik Lake)	Total Run Estimate	552	285–1,086
	Escapement Objective[b]	250	250–300
	Harvest Estimate	302	
Total Chignik System	Total Run Estimate	2,390	
	Escapement Objective[b]	600	1,350–3,850
	Harvest Estimate[a]	1,790	600–700

[a] These figures include harvests of Chignik-bound sockeye salmon from the Southeastern District Mainland and the Cape Igvak fisheries; approximately 1,430 thousand sockeye salmon are projected to be harvested in the Chignik Management Area.

[b] The Chignik Lake late run escapement goal is 200,000 sockeye salmon, resulting in an escapement goal for the entire run of 550,000. However, managers try to achieve an additional escapement objective of 50,000 sockeye salmon in August and September.

Forecast Methods

The forecasts for the 2005 early and late Chignik sockeye salmon runs were based on available data from 1977 to the present. Simple linear regressions were modeled using sibling, outmigration year, escapement age class, temperature data and year class return relationships. Each regression model was assessed with standard regression diagnostic procedures. Regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The variance of each estimate was calculated from the error structure of the regression. Prediction intervals were estimated at a coverage probability of 80 percent. Median estimators were used to estimate production of age classes where regression relationships were not significant.

The predicted early-run age-1.3 and -2.3 returns were estimated based on the abundance of their sibling returns (1.2 and 2.2) in 2004. Following non-significant regression results, the median brood year return by total age was used to estimate all other early-run age class components (i.e., ages 0.2, 1.1, 0.3, 1.2, 2.1, 2.2, 1.4, 3.2, 2.4, 3.2).

Ocean age class relationships and temperature indices were analyzed for the late run. Ocean age 2 (2-ocean) sockeye salmon were predicted from prior year 1-ocean returns and a temperature index, using multiple linear regression, ($P = 3.5\times10^{-5}$). Ocean age three (3-ocean sockeye) were predicted by regressing the ratio between 2- and 3-ocean fish (same outmigration year) on a temperature index (P = 0.01). The temperature index was constructed using the average winter temperature (October through May) prior to sockeye salmon outmigration and the average summer temperature (June through September) after outmigration. Temperature data were obtained from the Cold Bay Airport climate database. Estimates of variance were calculated from each regression. Both 1-ocean and 4-ocean sockeye salmon were predicted by calculating the median return and prediction intervals were calculated using the 10^{th} and 90^{th} percentiles of the returns. The variances associated with individual regression estimates by age class were

summed to calculate 80 percent prediction intervals. Regression and median estimates were summed to estimate the total Chignik watershed sockeye salmon run for 2005; 80 percent prediction intervals for the total run were calculated by combining the regression and median prediction intervals.

The total early- and late-run forecasts were calculated by summing individual and pooled age class estimates. When the median returns by age class were used, the 10^{th} and 90^{th} percentiles of the data were used to describe the range of the data. The variances associated with individual estimates were summed to estimate 80 percent prediction intervals, which were then added to the percentile estimates to calculate the forecast ranges.

Forecast Discussion

The 2005 sockeye salmon run to the Chignik River is expected to be approximately 2.4 million fish. The early run is expected to be approximately 1.8 million fish. The late run is expected to be approximately 552 thousand fish. The 2005 sockeye salmon run to Chignik is expected to be approximately 111 thousand fish less than the recent 10-year average run (2.5 million) and 900 thousand fish greater than the 2004 run (1.5 million).

Approximately 88 percent of the 2005 early run was estimated using sibling relationships. Using similar methods, the 2004 early run was overestimated by approximately 14 percent. Approximately 98 percent of the 2005 late run was estimated using simple linear and multiple regression relationships incorporating temperature indices. Climate indices have not been used before in forecasting the Chignik late run. Rather, in the past, median estimators have typically been used due to poor sibling relationships.

Available smolt data were analyzed and significant multiple regression relationships were found between the total number of outmigrating age-1. and -2. smolt and subsequent 2- and 3-ocean returns (about 98 percent of the run). This estimate was then expanded proportionally to account for other ocean ages not calculated by the multiple regressions. In 2003, returns predicted by simple regression underestimated the total run by about 9 percent. In 2004, a similar simple regression method overestimated the total run to Chignik by 1.6 million fish. The smolt-based forecast of the 2005 Chignik total sockeye salmon run is 1.3 million sockeye salmon, which is substantially lower (1.1 million) than that predicted from sibling relationships and median estimates.

The disparity between the smolt forecast and the sibling forecast suggest the actual run may fall in the lower half of the forecast range. Given this ancillary information, our confidence in this forecast is fair.

The projected harvest estimate for the early run of 1.5 million fish is based on achievement of the lower end of the early run escapement goal range of 350 thousand fish. The projected late-run harvest estimate of 302 thousand is based on the achievement of the lower end of the late run escapement objective range of 250 thousand fish through September 15. Harvest estimates for both the early- and late-run include Chignik bound sockeye salmon harvested in the Cape Igvak Section of the Kodiak Management Area and the Southeastern District Mainland of the Alaska Peninsula Management Area.

Heather Finkle, Finfish Research Biologist, Alaska Peninsula
M .B. Foster, Finfish Research Biologist, Kodiak

Appendix A. 7.–Bristol Bay

Forecast Area: Bristol Bay
Species: Sockeye Salmon

Forecast of the 2005 Return	Forecast Estimate (millions)	Forecast Range (millions)
TOTAL PRODUCTION		
Total Run	32.9	28–38
Escapement Goal	7.3	
Commercial Common Property Harvest	25.6[a]	

Forecasted sockeye harvests for inshore Bristol Bay fishing districts are as follows:

Naknek-Kvichak	7.8 million[a]
Egegik	9.3 million
Ugashik	2.8 million
Nushagak	5.6 million
Togiak	0.2 million

[a] It is unlikely that the Naknek Kvichak District catch will be this large. The large surplus return (4.8 million) forecasted for the Alagnak River system will likely not be harvested given the reduced fishing opportunity in the full Naknek-Kvichak District expected in face of the low surplus return (0.4 million) forecasted for the Kvichak River system.

Forecast Methods

The forecast for the sockeye salmon run to Bristol Bay in 2005 is the sum of individual predictions for nine river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak-Mulchatna, and Togiak) and 4 age classes (ages 1.2, 1.3, 2.2, and 2.3, plus ages 0.3 and 1.4 for Nushagak). Adult escapement and return data from brood years 1973–2001 were used in the analyses.

Predictions for each age class returning to a river system were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. Tested models included simple linear regression, multiple regression, and 5-year averages. In addition, univariate and multivariate time series analysis models were examined. The models chosen were those with statistically significant parameters having the greatest past reliability (accuracy and precision) based on mean absolute deviation, mean absolute percent error, and mean percent error between forecasts and actual returns for the years 2002 through 2004.

The forecast range was the upper and lower values of the 80 percent confidence bounds for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published run predictions for the 2000 through 2004 runs.

A total of 32.9 million sockeye salmon are expected to return to Bristol Bay in 2005. This prediction is 5 percent lower than the previous 10-year mean (34.7 million) of runs. All systems are expected to exceed their minimum spawning escapement goals. A run of 32.9 million sockeye salmon can potentially produce a total harvest of 25.6 million fish if all escapement goals are met at their mid range and industry is capable of taking the surplus fish. A harvest of this size would be about 17 percent higher than the previous 10-year mean (21.9 million) harvests (range is 11 million to 46 million). Note that if the Kvichak run develops as forecasted and the Naknek-Kvichak District remains closed outside of the Naknek River Special Harvest Area, Alagnak fish excess to the escapement goal may not be available for harvest.

Forecast Discussion

We excluded some historical escapement and return data to prepare the 2005 forecast. Beginning with the 1973 brood year (>1979 return year), the number of returning adults produced from each spawner in Bristol Bay showed a dramatic increase across most stocks. As a result, recent Bristol Bay sockeye salmon forecasts have been based on data from this more productive period in order to more accurately predict returns. Poor sockeye salmon returns to Bristol Bay in 1996 (4 year-old fish only), 1997, and 1998 (offspring from brood years 1992–1994) suggested we might be entering a period of productivity more similar to the pre-1978 period. However, the fish from the 1996–1998 return years reared in the ocean when temperatures were above average, whereas cooler-than-average ocean temperatures characterized the pre-1978 period. In addition, there has been no consistent statewide signal in salmon productivity despite recent anomalous returns. Recent ocean temperature data and the runs to Bristol Bay in 1999 to 2004 suggest that runs in 2005 may be more characteristic of the period 1978–1995. Hence, we used these data to prepare our forecast.

The greatest source of uncertainty in the 2005 forecast is in predicting the returns of 2-ocean fish (ages 1.2 and 2.2). The weak presence of jacks in the 2004 return (1-ocean fish, the siblings of the age-1.2 and age-2.2 fish returning in 2005) suggests a poor return of age-1.2 and age-2.2 fish in 2005 but with great uncertainty. The greatest sources of potential error in actual numbers of fish are the forecasts of age-1.2 fish for Alagnak and Wood Rivers, and the age-2.3 forecast of Alagnak River because the predictor (age-2.2 return from 2004) is far outside of the existing data set.

In general, a weak return of 2-ocean fish is expected in 2005 based on the poor return of 1-ocean jacks in 2004. However, the large returns of 2-ocean fish in 2004 suggest a large return of 3-ocean fish in 2005. We do not know why the Bristol Bay sockeye salmon runs in 1996–1998 were poor. The 2000–2004 runs to Bristol Bay on a baywide scale were similar to expected suggesting that the poor runs in 1996–1998 were anomalies. We are actively working with scientists inside and outside the Department to better understand the reasons for these population trends and develop better techniques for forecasting sockeye salmon runs to Bristol Bay.

Lowell Fair, Bristol Bay Research Project Leader, Anchorage

Forecast Area: Bristol Bay
Species: Chinook Salmon

Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL RUN	243	182–304
Inriver Run Goal[1]	75	
Additional Sport and Subsistence Harvest	6	
Commercial Common Property Harvest	162	

[a] The Nushagak inriver goal is 75 thousand chinook salmon, which provides for a biological escapement goal of 65 thousand spawners and a harvest of 10 thousand chinook salmon by upriver subsistence and sport fisheries.

Forecast Methods

The 2005 Nushagak District Chinook salmon forecast is the sum of individual predictions of 5 age classes (age-1.1, -1.2, -1.3, -1.4, and -1.5). For each age class, up to 10 models were evaluated for use in forecasting abundance. Predictions for each age class were calculated from models based on the relationship between adult returns and spawners or siblings from previous years. Tested models included simple linear regression, multiple regression, and averages. In addition, univariate and multivariate time series analysis models were examined. The models chosen were those with statistically significant parameters having the greatest past reliability (accuracy and precision) based on mean absolute deviation, mean absolute percent error, and mean percent error between forecasts and actual returns for the years 2002 through 2004. Data sets in the analyses included adult escapement and return data from brood years 1978–2002.

A simple average of recent returns was used to forecast age-1.1 abundance. The best age-1.2, age-1.3, and age-1.4 models were based on the relationship between sibling returns in succeeding years (e.g., age-1.2 returns for 2005 based on age-1.1 returns in 2004). The top model for age-1.5 abundance used age-1.4 returns and spawning escapements as predictors.

The forecast range is the upper and lower values of the 80 percent confidence bounds for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published run predictions for the 2000 through 2004 returns.

Forecast Discussion

Age composition of the forecasted total run is <1 percent (<1 thousand) age 1.1, 10 percent (25 thousand) age 1.2, 35 percent (84 thousand) age 1.3, 53 percent (129 thousand) age 1.4, and 2 percent (4 thousand) age 1.5. The 2005 forecasted total run of 243 thousand Chinook salmon is more than 1.6 times greater than the previous 10- and 20-year mean total run of more than 140 thousand. The projected commercial harvest of 162 thousand Chinook salmon is about 3 times greater than the 10- and 20-year mean harvest of around 50 thousand.

Lowell Fair, Bristol Bay Research Project Leader, Anchorage

Appendix A. 8.–Alaska Peninsula

Forecast Area: Alaska Peninsula, Bear Lake (Late Run)
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	448	100–863
Escapement Goal	108	81–135
Harvest Estimate	340	

Forecast Methods

The 2005 Bear River late-run sockeye salmon forecast was prepared by investigating simple linear regression models utilizing recent brood year (1980 to 1999) sibling relationships for one age class. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction estimates from regression models were used only in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The age-2.3 fish were predicted from their age-2.2 siblings. All other age classes were estimated by summing 16 age class run estimates (0.1, 0.2, 1.1, 0.3, 1.2, 2.1, 2.2, 0.4, 1.3, 3.1, 1.4, 3.2, 1.5, 2.4, 3.3, and 3.4) by total age, calculating the median contribution of each pooled age class, and summing the pooled medians. The total run forecast was calculated by summing the individual regression and pooled age class estimates. When a regression relationship was used to predict an individual age class, the variance of the estimate was calculated from the error structure of the regression and used to calculate 80 percent prediction intervals. When the median returns by total age were used, the 80 percent prediction intervals were estimated by calculating the 10^{th} and 90^{th} percentiles of the data. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2005 forecast for the Bear Lake late run is about 183 thousand fish less than the 2004 forecast (631 thousand), and about 359 thousand fish greater than the actual 2004 run of 89 thousand fish. The 2005 run should be composed of approximately 85 percent 5-year-old fish and 10 percent 4-year-old fish. If realized, this run will be 110 thousand fish less than the recent (1995 to 2004) 10-year average (558 thousand).

The projected harvest of 340 thousand fish is based on the achievement of the midpoint of the escapement goal range (108 thousand fish). Ages 2.2 and 2.3 have been the predominant age classes during most seasons. Approximately 4 percent of the 2005 run estimate was based on a sibling relationship. Age-2.2 and -2.3 returns during 2004, with average to large parent year escapements, were well below average. The reason for the poor 2004 returns of the predominant age classes is unknown. The 2005 expected returns of age-2.2 and -2.3 fish are from parent years of low to average parent year escapement levels. Because of the uncertainty associated with the variable predictive capabilities of the sibling data, our confidence in this forecast is poor.

Heather Finkle, Finfish Research Biologist, Alaska Peninsula

Forecast Area: Alaska Peninsula, Nelson River
Species: Sockeye Salmon

Preliminary Forecast of the 2005 Run	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION		
Total Run Estimate	497	277–740
Escapement Goal	158	97–219
Harvest Estimate	339	

Forecast Methods

The 2005 Nelson River sockeye salmon forecast was prepared primarily by investigating simple linear regression models of ocean age class relationships. In constructing and evaluating each of the regression models, standard regression diagnostics were used. Prediction estimates from regression models were only used in cases where the slope of the regression was significantly different from zero ($P < 0.25$). The 2-ocean returns were predicted from the 1-ocean returns using data from the last 11 years. The 3-ocean return was estimated by calculating the median return separately from the other age classes as it generally comprises 40 percent of the total return. All other age classes were estimated by summing 8 minor age class run estimates (0.1, 1.1, 2.1, 0.4, 3.1, 1.4, 1.5, and 2.4) by total age, calculating the median contribution of each pooled age, and summing the pooled medians. The total run forecast was calculated by summing individual regression and pooled age class estimates. When the median return by age was used, the 80 percent prediction intervals were estimated by calculating the 10^{th} and 90^{th} percentiles of the data. The variance associated with the regression estimate was used to estimate 80 percent prediction intervals. The median and regression prediction intervals were summed to estimate an overall prediction interval.

Forecast Discussion

The 2005 forecast is about 8 thousand fish greater than the 2004 forecast (489 thousand) and about 510 thousand less fish than the actual 2004 run estimate of 1 million sockeye salmon. The 2005 run should be composed of approximately 58 percent 2-ocean fish and 40 percent 3-ocean fish. If realized, this run will be 59 thousand fish less than the recent 10-year average (1995 to 2004) of 552 thousand sockeye salmon.

The projected harvest of 339 thousand fish is based on the achievement of the midpoint of the escapement goal range (158 thousand fish). Historically, 2-ocean sockeye salmon comprised about 58 percent of the Nelson River run. The regression model used to predict 2-ocean fish exhibited relatively low variance and a highly significant slope ($P = 0.0008$). Because of these qualities, our confidence in this forecast is fair.

Heather Finkle, Finfish Research Biologist, Alaska Peninsula

Appendix A. 9.–Arctic-Yukon Kuskokwim

Forecast Area: Arctic-Yukon-Kuskokwim
Species: All Salmon

The Alaska Department of Fish and Game does not produce formal run forecasts for any salmon runs in the Arctic-Yukon-Kuskokwim Region. Salmon run outlooks in the Arctic-Yukon-Kuskokwim Region are qualitative in nature because of the lack of adequate information with which to develop more rigorous forecasts. Consequently, the commercial harvest outlooks for the Arctic-Yukon-Kuskokwim region are typically based upon available parent year spawning escapement indicators, age composition information, recent year trends and the likely level of commercial harvest that can be expected to be available from such indicators, given the fishery management plans in place. While the commercial harvest outlooks provide for a general level of expectation, the fisheries are managed based upon inseason assessments of the actual runs.

In the Arctic-Yukon-Kuskokwim region, as in some other areas of the state, salmon production notably decreased for many stocks from 1998–2002. Chinook salmon stocks in the Yukon and Kuskokwim Rivers and Eastern Norton Sound have been classified as stocks of concern under the guidelines established in the Sustainable Salmon Fisheries Policy for the State of Alaska. Similarly, chum salmon from the Kuskokwim, Yukon (summer and fall), and Nome Areas have also been classified as stocks of concern. Causes for the loss of productivity have been the subject of much interest and concern, but to date unknown. In 2003 and 2004, there was increased abundance of Chinook, fall chum and coho salmon in the Yukon River and Chinook, chum and coho salmon in the Kuskokwim River. Salmon production appeared to be good. Additionally, the Bering Sea trawl bycatch and Bering-Aleutian Salmon International Survey (BASIS) study indicated the presence of large numbers of salmon in the Bering Sea in the summers of 2003 and 2004. A larger than normal proportion of three-year-old chum salmon returned to the AYK Region streams in 2004.

The commercial harvest outlooks for the year 2004 qualitatively take recent abundance trends into account. Additionally, declining salmon markets, particularly for chum salmon flesh since 1994 and salmon roe in 1997, have had a major impact on the commercial fisheries in the AYK Region. A continuation of these market trends in the year 2004 could reduce potential harvests in some areas, and lower exvessel value. In most cases, market conditions have not been accounted for in the harvest outlooks.

The commercial harvest outlook for the year 2005 can be found in the following Table.

Commercial salmon harvest outlook for the AYK Region, year 2005, in thousands of fish:

	Species					
Management Area	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim River	5–20	20–50	300–500	0–1	150–300	
Kuskokwim Bay	22–39	50–85	40–105	0–1	29– 50	
Kuskokwim Total	27–59	70–135	340–604	0–2	179–350	
Yukon	20–60		10–75		100–500	20–150
Norton Sound	0–1	0	20–40	0	15–25	
Kotzebue Sound					75–125	