Special Publication 11-03

Run Forecasts and Harvest Projections for 2011 Alaska Salmon Fisheries and Review of the 2010 Season

Edited by

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and

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February 2011

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

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Weights and measures (metric)

centimeter	cm
deciliter	dL
fathom *spell out*	
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm
metric ton mt (*spell out)*	

Weights and measures (English)

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

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	©
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.
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
United States Code	U.S.C.
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour (*spell out for 24-hour time of day*)	h
minute	min
second	s
week	*spell out*
year	*spell out*

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
chi-square	χ^2
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

SPECIAL PUBLICATION 11-03

RUN FORECASTS AND HARVEST PROJECTIONS FOR 2011 ALASKA SALMON FISHERIES AND REVIEW OF THE 2010 SEASON

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DEFINITION 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 provide the greatest potential for maximum sustained 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	Run refers to the total number of mature fish returning in a given year from ocean-rearing areas to spawn.
Sustainable escapement goal	A level of escapement indicated by an index or an escapement estimate that is known to provide for sustained yield over a 5 to 10 year period. The sustainable escapement goal will be stated as a range or a lower bound.
Return	Return refers to an aggregation of salmon over several or more years that represent the surviving adult offspring from a single brood year.

NAMES FOR ALASKA'S PACIFIC SALMON SPECIES

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

ABSTRACT

This report contains a detailed review of Alaska's 2010 commercial salmon season as well as run forecasts and harvest projections for 2011. The Alaska all-species salmon harvest for 2010 totaled 171.2 million, which was about 33.9 million greater than the preseason forecast of 137.3 million. This combined harvest was composed of 378,000 Chinook salmon *Oncorhynchus tshawytscha*, 40.8 million sockeye salmon *O. nerka*, 4 million coho salmon *O. kisutch*, 107.6 million pink salmon *O. gorbuscha*, and 18.5 million chum salmon *O. keta*. Alaska Department of Fish and Game is expecting an increase in commercial salmon catches in 2011 due to the projected increase in pink salmon *Oncorhynchus gorbuscha* harvests. The 2011 total commercial salmon catch (all species) projection of 203.4 million is expected to include 122,000 Chinook salmon in areas outside Southeast Alaska, 44.7 million sockeye salmon, 4.6 million coho salmon, 133.5 million pink salmon, and 19.5 million chum salmon. The projected pink salmon harvest is about 25% higher than the harvest experienced in 2010 (107.6 million). The projected sockeye salmon harvest is about 11% higher than the harvest in 2010. The projected chum salmon harvest is expected to be slightly higher than the harvest in 2010.

When the appropriate data were available, harvest projections were arrived at through quantitative projections based on information on previous spawning levels, smolt outmigrations, returns of sibling age classes, and recent survival rates observed for hatchery releases. Other projections were based on averages of recent catch levels. Fishing effort influences average catch levels, and effort is partly determined by market conditions in addition to the size of salmon runs. Therefore these projections may not be indicative of potential harvest levels.

Key words: pink salmon, *Oncorhynchus gorbuscha*, sockeye salmon, *O. nerka*, chum salmon, *O. keta*, Chinook salmon, *O. tshawytscha*, coho salmon, *O. kisutch*, catch projection, run forecast, harvest projection, smolt outmigrations, sibling age classes, hatchery releases, fishing effort, exvessel value, salmon management

INTRODUCTION

This report contains salmon run forecasts and harvest projections for 2011 as well as a detailed review of Alaska's 2010 commercial salmon season. Salmon escapement and harvest estimates reported in this document were summarized from the Alaska Department of Fish and Game (ADF&G) escapement and fish ticket databases. Data provided in this report are preliminary and supersede any data previously published.

ADF&G is expecting an increase in commercial salmon catches in 2011 due to the projected increase in pink salmon *Oncorhynchus gorbuscha* harvests. The 2011 total commercial salmon catch (all species) projection of 203.4 million is expected to include 122,000 Chinook salmon in areas outside Southeast Alaska, 44.7 million sockeye salmon, 4.6 million coho salmon, 133.5 million pink salmon, and 19.5 million chum salmon. The projected pink salmon harvest is about 25% higher than the harvest experienced in 2010 (107.6 million). The projected sockeye salmon harvest is about 11% higher than the harvest in 2010. The projected chum salmon harvest is expected to be slightly higher than the harvest in 2010.

Table 1 shows specific harvest projection numbers by species and fishing area. These projections 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. Fishing effort influences average catch levels, and effort is partly determined by market conditions and the size of salmon runs. Therefore these projections may not be indicative of potential harvest levels. With the exception of the Southeast Alaska Chinook salmon fisheries and the South Peninsula June fisheries, Alaska salmon management will be based on in season estimates of salmon run strength. Alaska managers have the primary goal of maintaining spawning population sizes—not of reaching preseason catch projections.

Table 1.–Projections of 2011 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Alaska						
Natural Production		1,241	2,435	55,000	2,021	60,697
Hatchery Production[a]					8,083	8,083
Southeast Region Total	[b]	1,241 [c]	2,435 [c]	55,000	10,104	68,780
Prince William Sound						
Natural Production	14	1,339 [e]	346 [f]	3,550	200	5,448
Hatchery Production[g]		1,045	543	34,403	3,550	39,541
Upper Cook Inlet	14 [c]	4,600	179 [c]	106 [d]	101 [c]	5,000
Lower Cook Inlet						
Natural Production	1 [c]	66 [c]	10 [c]	600	50 [c]	727
Hatchery Production		208 [h]				208
Bristol Bay	41	28,520	83 [c]	2 [c]	1,554 [c]	30,200
Central Region Total	70	35,778	1,161	38,660	5,455	81,124
Kodiak						
Natural Production	15 [c]	1,810 [i]	217 [c]	21,900 [j]	729 [c]	24,672
Hatchery Production[k]		243	156	7,400	411	8,210
Chignik[l]	4 [c]	1,402	109	1,338	237	3,090
South AK Peninsula and Aleutians	6 [c]	1,907 [c]	191 [c]	10,081 [s]	1,031 [c]	13,216
North Alaska Peninsula[n]	5 [c]	2,206 [n]	84 [c]	90 [d]	171 [c]	2,555
Westward Region Total	29	7,569	756	40,809	2,580	51,743
Arctic-Yukon-Kuskokwim Region Total	22	145	260	75	1,340	1,842
Statewide Total	122	44,734	4,612	134,544	19,478	203,490

Note: Columns and rows may not total exactly due to rounding.

[a] Hatchery projections made by Southern Southeast Regional Aquaculture Association, Northern Southeast Regional Aquaculture Association, Douglas Island Pink and Chum , Armstrong-Keta, Inc., Kake Nonprofit Fisheries Corporation, and Metlakatla Indian Community less broodstock (500,000). Wild chum catch estimated as 20% of total catch.

[b] Southeast Chinook treaty forecast not available. The allowable catch of Chinook salmon in Southeast Alaska is determined by the Pacific Salmon Commission and the Commission has not published the quota for 2011. Release of the 2010 Chinook salmon quota for Southeast Alaska is expected in late March or early April.

[c] Average harvest for the 5-year, 2006–2010, period.

[d] Average previous 5 odd-year harvests, 2001–2009 period.

[e] Includes harvest estimates for Coghill and Eshamy lakes, Unakwik District and Copper River sockeye salmon.

[f] 10-year average harvest (2001–2010) in the Copper River and Bering River districts.

[g] Hatchery projections made by Prince William Sound Aquaculture Corporation and Valdez Fisheries Development Association.

[h] Includes common property plus cost recovery harvests.

[i] Total Kodiak harvest of 1.810 million natural run sockeye includes projected harvests from formally forecasted systems, projected Chignik harvest at Cape Igvak, and projected harvest from additional minor systems totaling 571,000 fish.

[j] See formal pink forecast.

[k] Hatchery projections made by Kodiak Regional Aquaculture Association (150,000); enhanced Spiridon sockeye run harvest forecast (133,000) was developed by department staff.

[l] Chignik Chinook, coho, pink, and chum salmon harvests based on 5-year (2006–2010) average harvests (postcooperative fishery) Chignik sockeye based on a formal forecast with projected harvest at Igvak and Southeastern District Mainland excluded.

[m] Based on South Peninsula formal forecast and the Aleutian Islands average previous 5 odd-year harvests, 2001–2009 period

[n] 10-year average (2001–2010); sockeye includes formal forecasts for Bear late run (345,000), Nelson stocks (334,000), and projected Chignik harvests at Southeastern District Mainland fishery.

The Alaska all-species salmon harvest for 2010 totaled 171.2 million, which was about 33.9 million greater than the preseason forecast of 137.3 million. This combined harvest was composed of 378,000 Chinook *Oncorhynchus tshawytscha*, 40.8 million sockeye *O. nerka*, 4 million coho *O. kisutch*, 107.6 million pink *O. gorbuscha*, and 18.5 million chum salmon *O. keta*. Table 2 shows 2010 harvest numbers by salmon species and fishing area, in units of fish harvested, and Table 3 provides this information in units of pounds harvested. Tables 4–7 provide detailed information on the 2010 harvest by species and area.

Table 2.–Preliminary 2010 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	262	718	2,581	24,207	9,472	37,239
Prince William Sound	10	1,995	357	71,178	4,349	77,889
Upper Cook Inlet	10	2,828	207	293	229	3,567
Lower Cook Inlet	0	93	2	278	95	468
Bristol Bay	31	28,595	104	1,340	1,091	31,161
Central Region Total	52	33,511	671	73,089	5,763	113,085
Kodiak Area	15	1,437	266	8,865	735	11,317
Chignik	10	1,372	159	490	581	2,613
South Peninsula & Aleutians	8	1,280	166	859	795	3,108
North Peninsula	3	2,230	62	8	259	2,562
Westward Region Total	35	6,326	654	10,222	2,370	19,608
AYK Region Total	29	202	142	32	850	1,255
Total Alaska	378	40,756	4,048	107,550	18,455	171,187

Note: Missing data indicates no harvest, and zeros indicate harvest activity but <1,000.
Note: Columns may not total exactly due to rounding.
[a] Total commercial harvest of Chinook salmon for the October 1, 2009–September 30, 2010 catch accounting period.

Table 3.–Preliminary 2010 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	3,599	4,570	19,020	102,619	81,670	211,477
Prince William Sound	200	12,513	2,963	256,264	29,423	301,363
Upper Cook Inlet	205	17,461	1,362	1,245	1,546	21,819
Lower Cook Inlet	1	417	15	1,008	795	2,235
Bristol Bay	461	155,949	931	4,320	6,989	168,650
Central Region Total	866	186,340	5,270	262,837	38,753	494,066
Kodiak Area	116	7,691	2,006	32,176	5,339	47,329
Chignik	103	8,940	1,138	1,663	4,437	16,281
South Peninsula & Aleutians	100	7,183	1,117	2,551	5,679	16,630
North Peninsula	47	12,924	495	24	1,817	15,308
Westward Region Total	366	36,739	4,756	36,416	17,271	95,548
AYK Region Total	375	1,376	1,037	88	5,975	8,851
Total Alaska	5,200	229,000	30,100	402,000	143,700	810,000

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

Look for inseason harvest information, postseason statistics, and other information about salmon in Alaska on the World Wide Web at http://www.Fishing.adfg.alaska.gov.

ADF&G's 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.

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.

This report contains a detailed review of Alaska's 2010 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Alaska Board of Fisheries, the fishing industry, and the public.

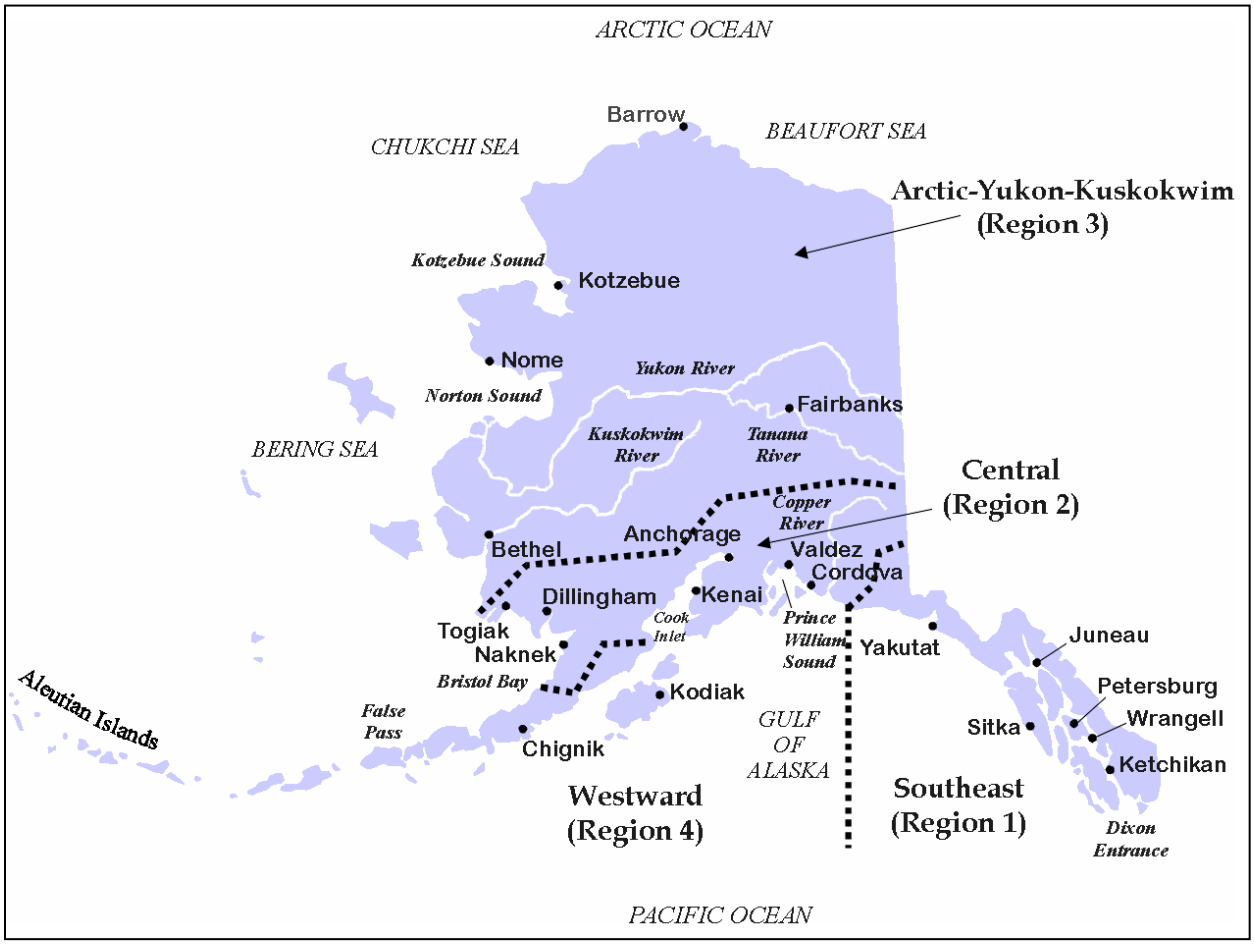

Figure 1.–The four ADF&G fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Division of Commercial Fisheries.

Table 4.–Preliminary 2010 Southeast Region commercial salmon harvests, by fishing area and species in thousands of fish.

Fishery	Chinook[a]	Sockeye	Coho	Pink	Chum	Total [b, c]
Purse Seine						
Southern Purse Seine Traditional	1	115	127	11,343	1,002	12,588
Northern Purse Seine Traditional	0	27	43	8,958	470	9,499
Hatchery Terminal	16	10	22	272	1,761	2,080
Total Purse Seine	17	151	193	20,573	3,233	24,167
Drift Gillnet						
Tree Point	1	63	88	570	325	1,047
Prince of Wales	2	112	226	310	98	748
Stikine	2	33	43	59	51	187
Taku-Snettisham	2	62	62	132	489	747
Lynn Canal	1	90	65	133	587	875
Drift Gillnet Hatchery Terminal	11	29	20	112	670	842
Total Drift Gillnet	20	388	504	1,316	2,220	4,447
Set Gillnet (Yakutat)	1	122	161	160	1	446
Troll						
Hand Troll						
Traditional	8	0	88	5	7	108
Hatchery Terminal	0	0	0	0	3	3
Spring Areas	4	0	1	01	0.24	6
Total Hand Troll	13	0	89	6	10	117
Power Troll [d]						
Traditional	157	2	1,246	72	263	1,741
Hatchery Terminal	1	0	1	1	93	97
Spring Areas	24	0	7	8	28	67
Total Power Troll	182	2	1,254	82	385	1,905
Total Troll	195	2	1,343	88	395	2,023
Annette Island Reservation						
Seine	0	5	11	858	72	946
Drift Gillnet	1	10	74	469	242	796
Troll	0		0	0		0
Hand Troll	0		0	0		0
Power Troll						
Trap						
Total Annette Island Reservation	1	15	85	1,327	314	1,742
Hatchery Cost Recovery	28	38	295	713	3,299	4,374
Miscellaneous [e]	1	1	0	30	10	42
Southeast Region Total	262	718	2,581	24,207	9,472	37,239

[a] Chinook adults and jacks are totaled.
[b] Missing data indicates no harvest, and zeros indicate harvest activity but <500.
[c] Columns may not total exactly due to rounding error.
[d] Catch accounting period for the 2010 Chinook salmon season goes from October 1, 2009 to September 30, 2010.
[e] Includes salmon that were confiscated or caught in sport fish derbies or commercial test fisheries and sold.

SOUTHEAST ALASKA AND YAKUTAT REGION

Region I salmon harvests totaled 37.2 million at an estimated 211 million pounds in 2010 (Tables 2–4). The initial estimate of exvessel value based on prices reported on fish tickets is $131 million; however, this estimate is expected to increase following the Commercial Fisheries Entry Commission analysis after Commercial Annual Operator Reports are submitted by fish buyers. The total harvest in 2010 was below the recent 10-year average harvest of 54.7 million, and just below the long-term average harvest since 1962 of 38.6 million. The total harvest decreased from 58.6 million in 2009—consistent with a recent cycle of weaker even year pink salmon returns—but the 2010 harvest was a substantial increase compared with the previous even year harvest of 28.1 million in 2008. Due to larger average weights of pink, chum, and coho, the total poundage of 211 million was similar to the 2009 poundage of 217 million despite lower numbers harvested. Total harvests included 262,000 Chinook, 718,000 sockeye, 2.6 million coho, 24.2 million pink, and 9.5 million chum salmon. The proportional harvest composition by species included <1% Chinook, 2% sockeye, 7% coho, 65% pink, and 25% chum salmon. The exvessel value increased by 32% from $99 million in 2009 to $131 million in 2010, and was the highest consumer-price-index-adjusted value in 16 years since 1994. A total of 1,871 limited entry permit holders participated in the 2010 salmon fisheries, down 2% from the previous season.

Chinook Salmon

The regional Chinook salmon harvest included 262,000 (including both adults and jacks) for the October 1, 2009 to September 30, 2010 catch accounting year. This harvest was below both the long-term average harvest of 299,000 and the recent 10-year average harvest of 343,000. In 2010 the all-gear treaty Chinook quota for Southeast Alaska was 221,800, based on the coastwide Chinook model under the newly renegotiated Pacific Salmon Treaty. Quota allocations of treaty fish included 163,864 to troll fisheries, 9,537 to purse seine fisheries, 7,432 to drift and set gillnet fisheries, and 40,966 to sport fisheries. There were no directed fisheries on the Taku or Stikine River in 2010 due to low forecasts and returns. In addition to Chinook harvests managed to target coastwide stocks under the Pacific Salmon Treaty spring troll fisheries are managed throughout the region to harvest Alaska hatchery-produced Chinook along with treaty fish. The total Chinook harvest of 261,500 fish apportioned by commercial fisheries included 76% to troll gear, 11% to hatchery cost recovery, 6% to purse seine, and 6% to drift gillnet. The initial exvessel value of the total Chinook salmon harvest is estimated at $14.6 million based on harvests of 3.6 million pounds and an average price of $4.05/lb. Troll harvests of 194,700 included 42,500 during the winter season, 28,600 during the spring season, and 123,500 during the summer season. Troll price for winter-caught Chinook salmon averaged $7.85/lb.

Sockeye Salmon

The sockeye salmon harvest of 718,000 was just over half of both the long-term and recent 10-year average harvest of 1.4 million. Sockeye salmon have generally contributed only 3% in numbers of fish to regional harvests over the past 10-year period. Regional harvests included 151,000 (21%) from the purse seine fisheries, 388,000 (54%) from the drift gillnet fisheries, and 122,000 (17%) from the Yakutat set gillnet fisheries. Sockeye escapement goals were met for 12 out of 13 stocks that have escapement goals. Sockeye salmon contributed an estimated $6.9 million to the regional exvessel value based on a harvest of 4.6 million pounds and an average price of $1.64/lb. Notable for 2010 was that McDonald Lake sockeye salmon, designated a *stock*

of management concern in 2009 by the Alaska Board of Fisheries, reached its escapement goal in 2010 for the first time in five years.

Coho Salmon

The regional harvest of coho salmon was 2.6 million in 2010. This harvest was 124% of the long-term average harvest of 2.1 million and equal to the recent 10-year average harvest. Troll fisheries harvested 1.3 million coho salmon (52%), followed by drift gillnet (20%), hatchery cost recovery (11%), purse seine (7%), and Yakutat set gillnet (6%). All coho salmon escapement goals in the region were either met or exceeded in 2010. The initial fish ticket value for the coho salmon harvest was $22 million based on harvests of 19.0 million pounds and an average price of $1.19/lb. Troll fisheries received an average price of $1.55/lb. for summer coho, and coho accounted for 49% of the seasonal troll fishery exvessel value of $29 million.

Pink Salmon

The 2010 pink salmon harvest of 24.2 million was below the long-term average of 29.5 million (1962–2009) and the recent 10-year average harvest of 40.0 million (2000–2009). The pre-season ADF&G harvest forecast for 2010 was 19.0 million with a range of 11.0 to 32.0 million. Pink salmon are predominantly harvested by the purse seine fishery. The Southeast purse seine fishery accounted for 85% of the regional pink salmon harvest, the drift gillnet fishery 5%, and Annette Island Reservation fishermen an additional 5% of the harvest. The remaining 5% of the harvest included the hand troll, power troll, and hatchery cost recovery fisheries, along with salmon confiscated or caught in sport fish derbies or commercial test fisheries. Pink salmon average weights were around 4.2 lb. Based on an average price of around $0.30/lb and 103 million pounds harvested the initial exvessel value was $31 million. Seine harvest distribution included 11.3 million in southern districts and 8.9 million in northern districts. Seine harvests and returns were variable by district and included harvests of 6.3 million in District 1, 3.7 million in District 13, 2.4 million in District 10, 2.2 million in District 9, and 2.0 million in District 2. Escapements in the region rebounded from low returns overall in 2008, and especially in the Northern Southeastern Inside subregion. The three subregion biological escapement goals were met, escapement targets were met in 11 of 15 districts, and 38 of 46 stock group escapement targets were met or exceeded.

Chum Salmon

The total commercial chum salmon harvest was 9.5 million in 2010. The harvest was well above the long-term average harvest of 5.3 million (1962–2009) and 92% of the recent 10-year average harvest (10.3 million). The major harvests included 3.2 million (34%) from purse seine fisheries, 3.3 million (35%) from hatchery cost recovery harvests, and 2.2 million (23%) from drift gillnet fisheries. A total of 62% of chum salmon harvests took place in terminal areas in either cost recovery or common property terminal area fisheries. A large portion of chum salmon harvests in the region resulted from hatchery production, including harvest outside of terminal areas as hatchery returns pass through traditional fisheries. The regional chum salmon harvest of 9.5 million was near the projected return of around 9.4 million based on forecasts by the three major hatchery operators plus an allowance for expected wild production. Total enhanced chum salmon harvests were 7.6 million to the three major enhancement organizations: 2.4 million to Southern Southeast Regional Aquaculture Association release sites, 2.5 million to Northern Southeast Regional Aquaculture Association release sites, and 2.7 million to Douglas Island Pink and Chum release locations. Wild summer chum salmon escapements, based on three recently

established sustainable escapement goal thresholds, were below goal in Southern Southeast and Northern Southeast Inside areas, but reached the goal for the Northern Southeast Outside area. Fall chum salmon escapements were good in most systems monitored. The chum salmon harvest, based on 82 million pounds landed and an average price $0.72/lb, were worth $56.0 million exvessel. Chum salmon were the most valuable species for the Southeast Alaska region in 2010 and contributed 43% to the overall salmon value.

CENTRAL REGION

PRELIMINARY 2010 PRINCE WILLIAM SOUND SALMON SEASON SUMMARY

The 2010 Prince William Sound (PWS) area commercial salmon harvest was 77.9 million fish. The harvest was composed of 71.2 million pink, 2.0 million sockeye, 4.3 million chum, 357,000 coho, and 10,400 Chinook salmon. The 2010 harvest was composed of 71.6 million commercial common property fishery (CPF) (92%), and 6.3 million (8%) hatchery cost recovery fish.

Gillnet Fisheries

Copper River District

The 2010 preseason commercial harvest forecast for the Copper River District was 17,000 Chinook, 1.3 million sockeye, and 302,900 coho salmon. Gulkana Hatchery was expected to contribute 315,000 sockeye salmon to the 2010 CPF harvest. The commercial salmon fishing season in the Copper River District began on Thursday, May 13. The 2010 sockeye salmon harvest of 635,968 was below the previous 10-year harvest average of 1.2 million. The preliminary harvest composition was 414,394 (65.16%) wild, 208,704 (32.82%) Gulkana Hatchery, and 12,870 (2.02%) Main Bay Hatchery (MBH) sockeye salmon. The CPF harvest of 9,654 Chinook salmon was below the previous 10-year average harvest of 32,032. The coho salmon commercial harvest of 210,624 was below the previous 10-year average harvest of 300,000. The 2010 inriver goal for salmon passing the Miles Lake sonar site was set at 667,590 to 867,590. The 2010 sonar escapement estimate was 924,156. Spawning escapement to Copper River delta systems based on aerial survey indices was 83,905 sockeye salmon, and was within the sustainable escapement goal (SEG) range (55,000–130,000). Coho salmon spawning escapement to the Copper River Delta based on aerial survey indices was 41,077 and was within the SEG range (32,000–67,000).

Bering River District

The Bering River District in 2010 was initially closed to commercial sockeye salmon harvest due to aerial survey counts from 2006 to 2009 that were below the SEG range (23,000–35,000). Inseason aerial survey counts below weekly anticipated goals led to continued closure of the district for sockeye salmon fishing. The 2010 aerial escapement index of 5,771 was below the SEG range. The coho salmon commercial harvest of 80,560 was above the previous 10-year harvest average of 51,759. Aerial surveys of coho salmon produced an escapement index of 21,311 that was within the SEG range (13,000–33,000).

Coghill District (Drift Gillnet)

The CPF harvest of chum salmon in the Coghill District was 2.6 million, 2.5 million by drift gillnet gear and 38,100 by purse seine gear. Prince William Sound Aquaculture Corporation (PWSAC) harvested 749,763 chum salmon for corporate cost recovery. The Coghill River weir

passed 24,312 sockeye salmon—well within the SEG range (20,000–40,000). The total CPF harvest of sockeye salmon in the Coghill District was 95,938, of which 78,600 were of enhanced stock (predominately MBH) origin and 1,700 were of wild stock origin. The majority of the sockeye salmon, 87,463, were harvested by the drift gillnet fleet. The coho salmon harvest of 11,456 was above the PWSAC forecast of 8,100 enhanced fish. The majority, 6,333, were harvested by the drift gillnet fleet. A portion of the Coghill District coho salmon harvest was likely of wild stock origin.

Eshamy District

The department's preseason forecast for Eshamy Lake was 46,900 wild sockeye salmon and PWSAC forecasted a run of 884,000 MBH-enhanced sockeye salmon. The CPF harvest of sockeye salmon in the Eshamy District was 1,195,772 to 278,668 by set gillnet permit holders and 917,104 by drift gillnet permit holders. Enhanced sockeye salmon contribution to the Eshamy District CPF harvest was 96%. Additionally, MBH sockeye salmon were harvested in the Copper River (12,900) and Coghill (78,600) districts. Sockeye salmon escapement to Eshamy Lake was 16,291 when the weir was removed on August 30. This was within the new biological escapement goal (BEG) range (13,000–28,000) adopted in 2008.

Unakwik District

The department's preseason harvest forecast for the Unakwik District was 6,700 sockeye salmon. The Unakwik District CPF harvest was less than 100. The harvest was below the 10-year average of 6,800.

Montague District, Port Chalmers Subdistrict

PWSAC forecasted a run of 863,000 chum salmon to the Port Chalmers remote release site. The drift gillnet harvest was 242,526. This was the second year that drift gillnet gear was given access to the Port Chalmers Subdistrict under the Prince William Sound Management and Salmon Enhancement Plan. The harvest was below the 5-year CPF average of 666,000. Approximately 1.7% of the chum salmon harvested in the Port Chalmers Subdistrict were of wild stock origin.

Purse Seine Fisheries

Coho Salmon

The 2010 Valdez Fisheries Development Association (VFDA) coho salmon run was anticipated to be 178,000. VFDA's broodstock objective was 1,000. VFDA harvested 27,600 coho salmon, of which 1,400 were utilized for broodstock and 26,200 were sold. In 2010 the purse seine fleet harvested 30,500 coho salmon in the Southwestern (15,600), Coghill (5,100), Northern (4,000), and Eastern (5,900) districts. The majority of coho salmon harvested in the Eastern and Coghill districts are assumed to be of enhanced stock origin.

Pink Salmon

The 2010 pink salmon total run forecast for PWS was 30.6 million. This estimate included 2.8 million wild stock fish, 10.6 million VFDA hatchery fish, and 17.2 million PWSAC hatchery fish. Approximately 3.3 million (19%) of the 17.2 million pink salmon run forecast to the PWSAC hatcheries were projected for cost recovery and broodstock. The remaining 13.9 (81%)

million PWSAC fish would be available for CPF harvest. Approximately 6.1 million (57%) of the projected 10.6 million pink salmon run forecast to VFDA's Solomon Gulch Hatchery were projected for cost recovery and broodstock. The remaining 4.5 million (43%) VFDA fish would be available for CPF harvest. A total harvest of 803,000 wild stock pink salmon was forecasted for CPF, leaving 2.0 million for escapement.

The 2010 harvest of 71.2 million pink salmon, composed of approximately 3% wild and 97% hatchery fish, was the highest PWS pink salmon harvest on record, exceeding the previous record of 63.5 million pink salmon harvested in 2007. Overall harvest by gear type was 62.1 million by purse seine, 17,000 by set gillnet, 3.5 million by drift gillnet, and 5.5 million (2.4 million VFDA and 3.2 million PWSAC) for hatchery cost recovery and broodstock. Enhanced pink salmon contributions by aquaculture associations to total harvest were 25% VFDA and 71% PWSAC. VFDA cost recovery and broodstock harvest represented approximately 13% of the total pink salmon run to Solomon Gulch Hatchery. PWSAC cost recovery and broodstock harvest was approximately 6% of the total pink salmon run to PWSAC hatcheries.

Through targeting fishing effort on enhanced pink salmon, inseason pink salmon aerial survey escapement estimates moved above minimum anticipated escapement thresholds by mid-September in all districts but Montague District. The area-under-the-curve estimate of pink salmon escapement used for direct comparison with the SEG range is not yet available, but considering that inseason pink salmon escapement indices ended up above anticipated aerial survey counts, overall escapement was likely well within the even-year SEG range (1.25–2.75 million). The preliminary PWS wild stock pink salmon harvest of 2.3 million was the 14th lowest wild stock harvest by number in the last 50 years; average annual harvest over this same time frame was 5.4 million.

Chum Salmon

The 2010 chum salmon total run forecast for PWS was 3.4 million. The majority of the forecast, 3.0 million (90%), were of PWSAC hatchery origin. PWSAC forecasted a run of 1.8 million to Wally Noerenberg Hatchery, 863,000 to Port Chalmers, and 344,000 to Armin F. Koernig Hatchery. Approximately 639,000 chum salmon (35%) of the forecast 1.8 million Wally Noerenberg Hatchery run were designated for corporate cost recovery and broodstock. All Port Chalmers and Armin F. Koernig chum salmon were available for harvest in the CPF. Based on the department's wild chum salmon forecast of 355,000, there was a potential CPF harvest of 155,000 wild chum salmon.

The CPF harvest in PWS was 3.6 million, which was 1.2 million above the CPF preseason forecast. The 2010 purse seine CPF harvest (231,000) was composed of approximately 9% wild and 91% hatchery fish. The purse seine chum salmon harvest was predominantly from the Armin F. Koernig hatchery terminal harvest area (THA) and special harvest area (SHA) and was composed of 3% wild and 97% enhanced chum salmon. Coghill District had a purse seine harvest of 38,000 and a drift gillnet harvest of 2.5 million. The 2010 total PWS wild stock chum salmon escapement lagged behind anticipated aerial survey indices early in the season, with escapement ahead of anticipated in all but the Eastern District by the end of the season.

COOK INLET

Lower Cook Inlet

The 2010 Lower Cook Inlet (LCI) all-species commercial salmon harvest of 468,000 fell far short of both the recent 10- and 20-year averages, representing the lowest cumulative total in the management area since 1976. The overall harvest was less than half of the revised preseason forecast of 1.02 million. A third consecutive season of strong prices for all species allowed the estimated exvessel value to reach $1.78 million, which was the sixth highest in the past decade but well below the recent 10- and 20-year averages.

With the shutdown of Tutka Bay Hatchery after the 2004 season, and no active programs at Port Graham Hatchery, 2010 LCI commercial pink salmon harvests were once again completely the result of natural production. On the other hand, an estimated three-fourths of the sockeye salmon catch was attributed to Cook Inlet Aquaculture Association (CIAA) lake stocking/fertilization projects at Bear Lake in the Eastern District, Leisure and Hazel Lakes in the Southern District, a remote saltwater release project at Tutka Bay Lagoon in the Southern District, and Kirschner Lake in the Kamishak Bay District. For the second consecutive season, all these fish were taken by CIAA for hatchery cost recovery and broodstock requirements. Private nonprofit agencies normally harvest a significant portion of the LCI salmon returns for hatchery cost recovery, and this season was no exception. An estimated 15% of the total all-species salmon catch was taken by CIAA as hatchery cost recovery to support the stocking programs and hatchery operations. However, because of the high proportion of the sockeye catch that was utilized for hatchery cost recovery, this volume equated to just over one-third of the entire exvessel value of the 2010 LCI salmon fishery.

Runs of naturally produced sockeye salmon in LCI were not especially strong, but SEGs were attained at five of six major systems in the management area. The sixth sockeye salmon system fell just short of its SEG as assessed by aerial surveys, but these surveys were hampered by poor weather all season, and actual escapement was felt to be greater than documented and believed to be within the SEG range. The run to one sockeye salmon system with a combination of natural and enhanced production also achieved its established goal. Natural returns of pink salmon in LCI were generally weak, although systems in Port Dick (Outer District) experienced sufficiently strong runs to allow commercial fishing. Nonetheless, most of the monitored pink salmon systems in the in the management area met or exceeded their SEGs. Chum salmon runs and resultant harvests were reasonably strong throughout the management area, and chum salmon SEGs were achieved or exceeded at 9 of 12 monitored systems. LCI commercial chum salmon harvests totaled approximately 95,000, surpassing the recent 10-year average of 87,000 for this species. The LCI chum salmon harvest in 2010 represented the 10th year of good catches during the past 11 seasons. Chinook salmon catches in LCI were the lowest since the 1960s, while coho salmon catches in LCI represented the lowest total for the management area in over 30 years.

Chinook Salmon

The 2010 harvest of Chinook salmon, not generally a commercially important species in LCI, totaled fewer than 50, less than 5% of the average during the last decade and the lowest catch since 1965. All but 10 came from the Southern District, where the catch was entirely taken by commercial set gillnetters. The majority of the Southern District Chinook salmon were harvested from Tutka Bay Subdistrict.

Sockeye Salmon

For the second straight season, the Trail Lakes Hatchery Sockeye Salmon Management Plan (5 AAC 21.373) heavily influenced commercial salmon fishery management and harvest in LCI. This plan directs the department to manage all CIAA hatchery SHAs associated with Trail Lakes Hatchery sockeye enhancement programs to achieve hatchery financial and broodstock objectives. With a preseason sockeye salmon revenue goal established at $1.434 million, CIAA projected that not all sockeye salmon returning to their various LCI enhancement sites in 2010 would be required for cost recovery to achieve the goal, and that opportunity for directed common property harvest of these returns was likely. Unfortunately, sockeye salmon runs to two of four CIAA enhancement sites in LCI were far below preseason expectations, and all hatchery-produced fish were ultimately required for hatchery cost recovery and broodstock purposes.

The 2010 LCI sockeye salmon catch of 93,100 was the lowest for the management area since 1980, which is roughly the time when sockeye salmon enhancement first began in the management area. As mentioned previously, however, the high proportion of sockeye salmon required for hatchery cost recovery this season resulted in nearly 75% of that species' exvessel value utilized in pursuit of facility revenue goals, while only 25% of the sockeye salmon value went to the common property fishery. The 2010 LCI commercial sockeye harvest was characterized by dismal runs to key enhanced systems at Bear Lake (Eastern District) and Leisure and Hazel Lakes (Southern District), and a weaker-than-anticipated enhanced run to Kirschner Lake (Kamishak Bay District). The sockeye salmon run to Tutka Bay Lagoon remote release site was the only one of CIAA's four LCI projects that met expectations in 2010. Natural sockeye salmon returns within the management area were considered fair to poor, but four of five major systems achieved their respective SEGs, while the fifth system is believed to have achieved its goal since aerial surveys showed an escapement under the SEG range, but surveys were continuously hampered by poor weather all season. English Bay Lakes, a system in the Southern District with both natural and enhanced production (though the latter has been inconsistent in recent years), also attained its respective desired inriver return. Of particular note regarding LCI lakes was the formerly enhanced system of Chenik Lake, located in the Kamishak Bay District on the west side of LCI, where stocking was discontinued after the 1996 season and all present production is considered natural. The sockeye run to Chenik Lake this season was reasonably good for an eighth consecutive season, but the resulting 2010 commercial catch in nearby waters totaled only 5,500, down considerably from the previous 5-year average harvest of over 91,000. This season's cumulative run to Chenik Lake was estimated at approximately 23,000.

Coho Salmon

The coho salmon resource is not extensive in the LCI management area, and as a result this species rarely attains commercial prominence. The commercial harvest of approximately 2,100 coho salmon in 2010 was only about one-fifth of the average catch during the past 10 years and was the lowest since 1977. The Eastern District, which frequently produces the bulk of the LCI coho catches because of the Seward Silver Salmon Derby, and CIAA hatchery cost recovery at Bear Lake, accounted for around 64% of the area wide coho harvest. The remainder of the LCI commercial coho catch was primarily taken by seiners in Kamishak Bay District (27%), followed by set gillnetters in the Southern District (8%). The limited number of aerial surveys flown specifically for coho salmon assessment in 2010 showed good escapement at Clearwater Slough in the Northshore Subdistrict of the Southern District.

Pink Salmon

Natural returns of pink salmon, usually the dominant species in numbers of commercially harvested salmon in LCI, were weak this year. For the third consecutive season, LCI catches of pink salmon were entirely the result of natural production. Openings to target natural stocks of pink salmon this season were not as numerous or liberal as in recent years, resulting in overall catches totaling only 278,000, which was less than one-fourth of the most recent 10-year average and represented the lowest catch of this species since 1987. However, note that the 10- and 20-year average pink salmon harvests in LCI include years when supplementary hatchery production contributed significant numbers of fish to commercial harvests. Despite the weak runs in LCI this season, pink salmon SEGs were achieved at 14 of 17 monitored systems in the management area.

Chum Salmon

For the 10th year out of the past 11 seasons, LCI chum salmon returns were relatively strong, producing a harvest of almost 95,000 in 2010 and exceeding the average harvest over the past 10 years by about 9%. The majority of the chum catch was taken by common property seiners in Kamishak Bay District (70,800), followed by that same gear group in the Outer District (22,500). Escapements into most LCI chum salmon systems were sufficient to achieve goals, with the exception of McNeil River in Kamishak Bay District and Island Creek in the Outer District.

Upper Cook Inlet

The 2010 Upper Cook Inlet (UCI) commercial harvest of 3.6 million salmon was about equal to the last 10-year average harvest in UCI. The 2010 UCI commercial exvessel value of approximately $32.4 million was 70% above the recent 10-year average of $18.6 million. While all five species of Pacific salmon are present in UCI, sockeye salmon are the most valuable, accounting for approximately 77% of the exvessel value in the commercial fishery since 1960 and more than 92% of the total value during the past 20 years. Sockeye salmon escapement goals have historically been monitored in six systems in UCI. Prior to the 2009 season, the Yentna River sonar goal was discontinued because of its unreliability and replaced with weir goals (SEGs) monitored on three lake systems within the Susitna River, Judd and Chelatna Lakes in the Yentna River drainage, and Larson Lake in the mainstem Susitna River drainage. The video monitor on Packers Creek failed in 2010 so there is no estimate for that system. For the 2010 season, two of seven sockeye salmon goals were met, falling within the established goal range, while four exceeded and one fell below the goal objective.

Chinook Salmon

Approximately 9,901 Chinook salmon were harvested in 2010, which was about 70% of the long-term average harvest of 15,900. The two fisheries where Chinook salmon are harvested in appreciable numbers in UCI are the Northern District and Upper Subdistrict set gillnet fisheries. The Deshka River is the only system in Northern Cook Inlet where Chinook salmon escapement is monitored inseason with a weir. In 2008 and 2009, the Deshka River Chinook salmon run, which is the generally the largest run in the region, was below average, failing to meet its escapement goal. The 2010 Deshka River forecast predicted a total run of 31,000, 10,000 more than the 2009 forecast. However, on June 12 the sport fishery was restricted to no bait in order to aid in achieving the Deshka River escapement goal. The commercial fishery in the Northern District was then restricted from a 12-hour period to a 6-hour period by emergency order. The

no-bait restriction was rescinded on June 19 because restrictions were no longer necessary. The 2010 Deshka River escapement of 18,600 was within the escapement range (13,000–28,000). The first emergency order of the season closed commercial salmon fishing in the portion of the Northern District of Upper Cook Inlet from an ADF&G regulatory marker (located 1 mile south of the Chuitna River) to the Susitna River for all of the fishing periods scheduled for the 2010 Chinook salmon fishing season. This was done to aid in achieving the escapement goals to the Chuitna, Theodore, and Lewis rivers. The Northern District harvest (1,631) is about half of the long-term average harvest (3,294).

Late-run Kenai River Chinook salmon runs have been relatively stable and escapement objectives have been consistently achieved or exceeded. Beginning in 1999, a 24-hour closed period per week was mandated for the set gillnet fishery in the Upper Subdistrict. Since that time, longer closed periods of 48-hours or two shorter closed periods each week, a 24- and a 36-hour closed period, have also been adopted into regulation. The stated purpose of these closed periods is to pass fish into the inriver recreational fishery for the weekends. However, when large numbers of sockeye salmon enter the Kenai and Kasilof Rivers during closed windows, additional fishing time is necessary to keep sockeye salmon escapements within their goal ranges. The Upper Subdistrict set gillnet harvest of 6,835 Chinook salmon is approximately 70% of the average. Both early and late run Kenai River escapement goals were achieved. In 2010, the exvessel value for Chinook salmon was $264,000 which is approximately 0.8% of the total exvessel value.

Sockeye Salmon

The preseason sockeye salmon forecast for the 2010 season projected a run of 3.6 million, with a harvest estimate (sport, personal use and commercial) of 2.3 million. The total run to the Kenai River, generally the largest producer in UCI, was forecast to be 1.7 million. This resulted in managing for an inriver sonar goal range in the Kenai River (650,000–850,000). Two regularly scheduled 12-hour fishing periods per week, plus up to 24 hours of additional fishing time in the Upper Subdistrict set gillnet fishery were allowed under this run size.

While the fishing season opens in most of UCI in mid- to late June, participation and harvests remain fairly low until early July. In 2010, sockeye salmon harvests in the Central District were relatively low until the July 5 regular fishing period when the drift fleet harvest began to rise sharply. Unlike other years however, the set gillnet harvest in the Kasilof Section remained relatively poor by recent standards despite fairly liberal fishing time. A smaller Kasilof run and strong northeast winds, which blew for a 10-day period in early July, likely contributed to this harvest disparity, preventing Kasilof stocks from moving to the east side as they normally do in early July. The drift CPUE for the July 8, regular period was 750 which is very good and by July 12 the drift gillnet CPUE was over 1,240 which was the highest CPUE ever for the drift fishery. Although the drift gillnet CPUE was high, the harvest by the drift fleet on July 12 was much smaller than normal during this period as nearly half of the drift fleet did not fish during this period because it was a religious holiday. The commercial harvest up to July 13 was 993,000, which was becoming a little disconcerting for a forecast run of 3.6 million; however, to date the escapement to all rivers were not remarkably different than expected. The drift CPUE returned to more normal levels on July 15 (831) and July 19 (530). Beginning July 20, indications from the offshore test fish program, coupled with commercial harvest data and escapements to date, began to indicate the sockeye return was stronger than forecast. After harvest figures from the regular fishing period on July 22 and offshore test fish program data were evaluated, the total run

estimate continued to indicate a return more than the preseason forecast and a Kenai run of over 2 million. The total return to the Kenai River of over 2 million sockeye salmon triggered a higher inriver goal (750,000–950,000). Management parameters also changed with this new assessment to 51 hours of additional fishing time but two windows were now required each week, including a 36-hour Friday window.

The total sockeye salmon run to UCI in 2010 was estimated to be 5.7 million, which was 58.5% more than forecast (Table 5). Based on offshore test fish program data, the run was one day early. Runs to Fish Creek, the Kenai River and minor systems were better than forecast, while sockeye salmon runs to the Susitna River, Kasilof River and Crescent River were below forecast. The UCI commercial harvest of 2.83 million sockeye salmon was 67% above the preseason forecast harvest estimate of 1.7 million and 100,000 below the long-term average harvest in UCI. Since 1999, only 1 of the 12 years was managed in the correct tier for the entire season.

Sockeye salmon prices during the season were in the range of $1.75/lb. The total exvessel value in UCI for sockeye salmon was approximately $30.4 million, which was 92.4% of the total UCI exvessel value.

Coho Salmon

The 2010 coho salmon harvest estimate (207,256) was approximately 11% above the recent 10-year average harvest (185,500) and 35% below the long-term (1966–2009) average coho salmon harvest (309,000). Reduced commercial harvests of coho salmon in 2010 were likely due to restrictions in fishing area put in regulation by the Board of Fisheries to reduce the drift fleet coho salmon harvest, as well as several regular fishing period restrictions in the Northern District set gillnet fishery in compliance with the Susitna River Action Plan. The coho salmon run in 2010 was judged to be average. The only significant coho salmon return to UCI that is monitored with an escapement goal is the Little Susitna River. In 2010, the final escapement count of 9,200 was slightly below the 2009 escapement and also below the lower end of the escapement goal range of 10,000. The exvessel value of coho salmon to the commercial fishery was approximately $1 million, or 3.2 % of the total exvessel value in Upper Cook Inlet.

Pink Salmon

The estimated 2010 commercial harvest of pink salmon in UCI was 292,672, slightly below the recent even-year pink salmon harvest since 2000 (302,000). Pink salmon escapements are not monitored in UCI to an appreciable degree. Anecdotal information does indicate that escapements to most river systems were not as good as in recent years. Prices paid for pink salmon were approximately $0.25/lb, resulting in an exvessel value for this species of $290,000, approximately 1% of the total exvessel value.

Chum Salmon

The 2010 harvest of 228,670 chum salmon was about twice the average harvest since 2000 (112,000) but half of long-term average harvest of approximately 451,000. There is only one chum salmon escapement goal in UCI, which is an SEG in Chinitna Bay on Clearwater Creek, and the upper range of that goal was exceeded in 2010. The exvessel value of chum salmon to the commercial fishery was approximately $875,200, or 2.7% of the total exvessel value.

BRISTOL BAY

The 2010 inshore Bristol Bay sockeye salmon run of approximately 40.19 million was the 17th largest since statehood, and the preliminary catch of 29 million sockeye rank was the 11th largest since statehood. This year's total inshore run was 6% above the 20-year average (1990–2009) of 37.97 million and was 1% higher than the preseason forecast of 39.77 million. Two of five districts attained harvests above preseason expectations; the Naknek–Kvichak District harvest (10.66 million) was 28% above forecast and the Ugashik District harvest (4.05 million) was 15% above forecast. The Nushagak District harvest of (8.3 million) was the second largest in the history of the district. The total Nushagak run was 11.1 million sockeye salmon—about 5% above the preseason forecast. The Togiak District was 21% below forecast, and Egegik District was 45% below forecast. The commercial harvest of sockeye salmon was 5% below the 30.53 million preseason forecast. Total Bristol Bay escapement was 11.5 million sockeye salmon.

Approximately 31,400 Chinook salmon were harvested in Bristol Bay in 2010. This is 48% of the average harvest for the last 20 years. Chum salmon harvest (1.09 million) was 15% above the 20-year average (946,000). Coho salmon harvest of approximately 104,000 was 7% above the 20-year average (93,000). Pink salmon harvest was approximately 1.34 million. There was significant market interest in pink salmon in the Nushagak District, resulting in a bay-wide pink salmon harvest almost 800% higher than the even-year average over the last 20 years.

The 2010 harvest of all salmon species in Bristol Bay was approximately 31 million. The calculated preliminary exvessel value of the 2010 Bristol Bay salmon fishery is approximately $153.12 million, which is 35% above the 20-year average, and ranks seventh over that same period. This figure represents an estimate since the contribution of future price adjustments, loyalty bonuses, and differential prices for refrigerated versus nonrefrigerated fish were not included.

Chinook Salmon

Chinook salmon harvests in Bristol Bay districts were below average in every district. There were three directed Chinook fishing periods in the Nushagak District with a total harvest of approximately 1,100. After the third directed Chinook salmon opening, escapement into the Nushagak River started to fall below expected daily levels and failed to reach several trigger points in the management plan. Over the course of the season, sport fishing was restricted to catch and release and the use of bait was prohibited. Ultimately, the sport fishery was closed completely and subsistence fishing was reduced to three days per week in the Nushagak drainage for the conservation of Chinook salmon. The total Chinook salmon escapement into the Nushagak River was 36,625. This is the first time since enumeration began in 1980 that the minimum escapement goal of 40,000 was not achieved for Nushagak Chinook salmon. The total Nushagak District Chinook salmon harvest was 25,581.

Sockeye Salmon

The 2010 inshore sockeye salmon run of 40.19 million was 1% higher than the preseason forecast (39.77 million). Escapements into the Igushik, Wood and Naknek Rivers were above established ranges. All other systems were within established ranges.

Potential processing capacity was the only major preseason concern entering the 2010 Bristol Bay salmon season. In a pattern similar to the last four years, the winter of 2009 to 2010 was colder than the historic average, suggesting that run timing might be delayed by a few days.

Given the projected harvest (30.53 million), the department planned to allow more fishing time early in the run. At the December 2009 Alaska Board of Fisheries meeting the board also changed regulations with the goal of encouraging early season fishing. The board adopted regulations allowing fishermen to fish eastside districts prior to June 25 without having to register their permit or vessel. Although this new regulation did seem to increase the number of participants fishing in eastside districts prior to June 25, the run timing in 2010 seemed a little later and the total harvest through June 25 was only 1.2 million. With recent improvements in total processing capacity and staggered run timing of individual river systems, no catch limits were imposed in 2010. The total harvest was 6% below forecast and total inshore run was 1% above forecast. Also of significance in 2010, the Naknek River SHA was not opened for the third season since 1995. The Wood River SHA was opened for the conservation of Nushagak sockeye salmon for five tides beginning on July 6. By July 8, the Nushagak sockeye salmon escapement was back to appropriate levels and fishing was reopened in the Nushagak Section of the Nushagak District. The Wood River SHA stayed open under new regulations passed at the December 2009 Alaska Board of Fisheries meeting. This regulation allows fishing in the Wood River SHA if the escapement exceeds 1.1 million and is projected to exceed 1.4 million.

Coho Salmon

The bay-wide harvest of approximately 104,000 was 7% above the recent 20-year average of 97,000. The majority of the coho harvest was in the Nushagak District, where most fish were caught from mid-July to mid-August. The primary fishery in the Nushagak District after the sockeye salmon season was for pink salmon with coho salmon harvested incidentally, although there was some directed coho salmon harvest.

Pink Salmon

Pink salmon runs are strong during even years in Bristol Bay. For the first time since 1984, there was a significant directed pink salmon fishery in Bristol Bay, especially within the Nushagak District. The department worked with stakeholders over the winter to devise and implement a plan to provide harvest opportunity for pink salmon while protecting pink and coho salmon stocks. The plan allowed fishing six days a week for 15 hours a day. Three days were limited to pink gear only and three days were unlimited in mesh size to provide some opportunity to harvest coho salmon while mostly targeting pink salmon. The daily fishing time could be reduced if effort increased above expected levels. The fishery was very successful with over 1.2 million pink salmon harvested in the Nushagak District and 1.3 million harvested Bay-wide.

Chum Salmon

The 2010 total Bristol Bay chum salmon harvest was approximately 1.09 million. Naknek-Kvichak and Nushagak Districts produced harvests above their 20-year averages while Egegik, Ugashik and Togiak Districts produced less chum salmon than their 20-year averages. The Nushagak District was the largest producer of chum salmon, where over 509,000 were harvested.

Table 5.–Preliminary 2010 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 District	0	1	6	16,386	14	16,408
Northern Dist.	0	1	4	17,914	2	17,921
Coghill Dist.	0	8	5	10,873	38	10,924
Northwestern Dist.	0	0	0	0	0	0
Southwestern Dist.	0	60	16	16,954	176	17,206
Southeastern Dist.	0	0	0	19	0	19
Unakwik Dist.	0	0	0	0	0	0
Drift Gillnet						
Bering River District	0	0	81	0	0	81
Copper River Dist.	10	636	211	21	16	893
Coghill Dist.	0	87	6	3,329	2,514	5,937
Eshamy Dist.	0	917	1	114	510	1,542
Montague Dist.	0	6	0	16	243	264
Unakwik Dist.	0	0	0	0	0	0
Set Gillnet						
Eshamy Dist.	0	279	0	17	80	375
Hatchery [a]	0	0	28	5,535	755	6,318
Prince William Sound Total	10	1,995	357	71,178	4,349	77,889
Southern District	0	54	0	3	2	59
Kamishak District	0	14	1	2	71	88
Outer District	0	3	0	272	22	298
Eastern District	0	22	1	0	0	23
Lower Cook Inlet Total	0	93	2	278	95	468
Central District	2	40	38	4	4	87
Northern District	8	2,788	169	289	225	3,479
Upper Cook Inlet Total	10	2,828	207	293	229	3,567
Naknek-Kvichak District	0	10,659	1	8	330	10,669
Nushagak District	26	8,309	69	1,290	510	10,204
Egegik District	0	4,963	10	2	59	5,034
Ugashik District	0	3,993	0	0	69	4,062
Togiak District	5	670	24	40	124	862
Bristol Bay Total	31	28,595	104	1,340	1,091	31,161
Central Region Total	52	33,511	671	73,089	5,763	113,085

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

Note: Columns may not total exactly due to rounding.

[a] Hatchery sales for operating expenses and broodstock harvests.

ARCTIC-YUKON-KUSKOKWIM REGION

Arctic-Yukon-Kuskokwim (AYK) Region salmon harvests totaled 1.26 million salmon and 8.85 million pounds in 2010 (Tables 2, 3, and 6). The exvessel value was estimated to be $6.5 million. Cumulative all-gear commercial harvest included 29,000 Chinook, 202,000 sockeye, 142,000 coho, 850,000 chum, and 32,000 pink salmon. Chinook and coho salmon harvests were considerably below average while chum and sockeye harvests were above average. Poor pink salmon markets resulted in a substantially lower harvest than available surplus. Landings were made by 1,187 limited entry permit holders in 2010.

KUSKOKWIM AREA

The Kuskokwim Area commercial salmon harvest in 2010 was 18,713 Chinook, 201,864 sockeye, 76,621 coho, 226,672 chum, and 5 pink salmon for a total of 523,875 fish. A total of 530 permit holders participated and the exvessel value was estimated to be $2,894,589.

Overall, Chinook and chum salmon harvests where similar to what was expected, sockeye salmon harvest was above what was anticipated, and coho salmon was below the expected harvest range in the Kuskokwim Area in 2010. Escapement was adequate for all species at monitored locations except for Chinook salmon, which only met two of nine escapement goals. Amounts necessary for subsistence use is expected to have been met. In general, run timing throughout Kuskokwim area for Chinook and sockeye salmon was characterized as late, chum salmon was considered normal, while coho salmon were considered to be early**.**

KUSKOKWIM RIVER

Subsistence fishing in the Kuskokwim River was allowed seven days a week throughout the season with the exception of closed periods associated with commercial fishing periods. Subsistence harvests, as indicated by inseason surveys, were primarily described as *normal* for Chinook salmon, and *normal* to *good* for sockeye and chum salmon. Amounts necessary for subsistence use is expected to have been achieved.

There were 16 commercial fishing periods in District 1 between June 25 and August 12. Two registered buyers purchased fish in Kuskokwim Area in 2010. Processing capacity limited all commercial openings to one subdistrict per period. Therefore, the department alternated commercial fishing periods between Subdistricts 1-A and 1-B. Processing capacity did allow for four 2-hour extensions of fishing time in the Lower Section of Subdistrict 1-B. Due to limited processing capacity, one period was limited to the Upper Section of Subdistrict 1-B. Chinook salmon catch rates from late June through early July were below average. Chum and sockeye salmon catch rates from late June through mid-July were mostly average to above average. Sockeye salmon run timing was the latest on record for the Bethel Test Fishery. Coho salmon catch rates from late July through August 12 were below average. The coho salmon commercial fishing season ended early due to concerns for abundance. Commercial salmon harvests in District 1 were 2,731 Chinook, 22,428 sockeye, 93,148 chum, 58,031 coho, and 5 pink salmon, for a total of 176,343 fish. The total number of permit holders participating was 433 and the ex-vessel value of the fishery was estimated to be $765,607.

Inseason indicators suggested Chinook salmon abundance in 2010 was comparable to 1999 and 2000. Chinook salmon escapements were evaluated through aerial surveys on seven index streams throughout the drainage and by weirs on six tributary streams. Only one of seven

escapement goals was estimated to have been achieved. Sport fishing was closed and subsistence fishing was restricted by U.S. Fish and Wildlife Service in the Tuluksak and Kwetheluk rivers to increase Chinook salmon spawning escapement.

Sockeye salmon escapements were monitored at each of the seven tributary weir projects, although sockeye are not a prominent species in many of these systems. Kogrukluk and Kwethluk rivers have the largest sockeye salmon escapements and were characterized as above average in 2010. The one established escapement goal in the Kuskokwim Area was met. A new weir that was established in 2010 to monitor sockeye salmon escapements at the outlet of Telaquana Lake passed 71,598 sockeye salmon.

Chum salmon escapements were monitored at six tributary weirs and one tributary sonar project. All projects observed average to above average escapements. Of the two established SEGs, one was within the escapement goal range and one exceeded the escapement goal range.

Coho salmon escapements were monitored at five tributary weirs. Escapement at the Kogrukluk River weir was within the escapement goal range. At the other monitored locations escapements were characterized as average to below average.

Kuskokwim Bay (Quinhagak) and District 5 (Goodnews Bay)

Subsistence fishing in Kuskokwim Bay area was allowed seven days per week throughout the season with the exception of closed periods associated with commercial fishing. Subsistence harvests in 2010 were described as adequate and amounts necessary for subsistence use is expected to have been achieved.

The District 4 commercial salmon fishing season opened June 15. Initially, the District 4 fishery is directed towards Chinook salmon with two commercial fishing periods per week, provided abundance and processing capacity were adequate. Because of late Chinook salmon run timing and abundance concerns, commercial fishing opportunity was reduced in District 4 during the first week of the commercial fishing season. District 5 opened on June 28, which is about one week later than normal, due to concerns for Chinook salmon abundance. Chinook salmon harvests and catch rates were below average to average throughout the season in both districts. By July 2, the sockeye salmon harvest in both districts had exceeded the Chinook salmon harvest and, by regulation, management was directed towards sockeye salmon. Under sockeye salmon management, three commercial fishing periods per week are allowed, provided abundance and processing capacity are adequate. Because of high sockeye salmon abundance, additional fishing time was provided in both districts between July 7 and 17. District 4 sockeye and chum salmon harvests in 2010 were the highest on record, and District 5 sockeye and chum salmon harvests were above average. Coho salmon harvest exceeded sockeye salmon harvest in District 4 on August 2, and August 6 in District 5. On those dates, each district shifted to coho salmon management, which allows three commercial periods a week provided abundance is adequate. From August 2 to the last commercial fishing period on August 18, fishing opportunity was reduced in both districts to two periods per week due to concerns for coho salmon abundance. Coho salmon harvests and catch rates were below average throughout the season in both districts.

In 2010, 241 individual permit holders recorded landings during 24 commercial periods in District 4. The total commercial harvest (272,892) was composed of 14,230 Chinook, 138,362 sockeye, 106,610 chum, and 13,690 coho salmon. The exvessel value of the District 4

commercial fishery was estimated to be $1.66 million. Fishing effort was the highest since 1997, and exvessel value was the highest since 1988.

A total of 48 individual permit holders recorded landings in District 5 during 22 commercial periods. The District 5 total commercial harvest (74,640) was composed of 1,752 Chinook, 41,074 sockeye, 26,914 chum, and 4,900 coho salmon. The exvessel value of the District 5 commercial fishery was estimated to be $473,661. Fishing effort was the highest since 1999, and exvessel value was the highest since 1994.

Kanektok River drainage is the primary salmon producing drainage in District 4. Fish passage through the Kanektok River weir during its operation from June 28 through August 5 was 5,800 Chinook, 202,643 sockeye, 62,567 chum, 344 coho, and 114,074 pink salmon. Escapement estimates for coho and pink salmon are incomplete because the project does not operate through the entire coho and pink salmon runs. No formal escapement goals for any species have been established at the weir. An aerial survey rated as fair for survey conditions was conducted on August 2 to estimate Chinook and sockeye salmon escapements. The estimate of 1,228 Chinook salmon was below the established SEG (3,500–8,000). The estimate of 16,950 sockeye salmon was within the established SEG (14,000–34,000).

The Goodnews River drainage is the primary salmon-producing drainage in District 5. Fish passage through the Middle Fork Goodnews River included 2,244 Chinook, 35,762 sockeye, 26,687 chum, 23,839 coho, and 3,444 pink salmon. The weir was operational from June 25 through September 18 except for two inoperable periods caused by high water from July 29 to August 4 and from August 14 to 26. Chinook and sockeye salmon escapements achieved the lower end of their escapement goal ranges, and chum and coho salmon lower bound escapement goals were achieved. Because of high water and poor weather, no aerial enumeration surveys were conducted.

Yukon Area

The 2010 Yukon River total commercial harvest was 9,897 Chinook, 232,888 summer chum, 2,550 fall chum, and 3,750 coho salmon for the Alaskan portion of the drainage. A total of 9,897 Chinook, 183,215 summer chum, 815 fall chum, and 2,050 coho salmon were harvested in the Lower Yukon River (Districts 1–3) and 0 Chinook, 49,673 summer chum, 1,735 fall chum, and 1,700 coho salmon were harvested in the Upper Yukon River (Districts 4–6). All salmon were sold as whole fish; however the District 6 fall season (fall chum and coho salmon) fishery selectively purchased males for higher flesh quality. A total of 475 permit holders sold fish in 2010 and the exvessel value was approximately $1.55 million.

The 2010 Yukon River Chinook salmon run was projected to be below average to average. Before the 2010 season, ADF&G developed a preseason management strategy with input from U.S. Fish and Wildlife Service, fishermen, tribal council representatives, and other stakeholders. According to the resulting preseason strategy, initial management would be based on preseason projections, a directed Chinook salmon commercial fishery in 2010 would be unlikely on the mainstem river, and managers would consider implementing conservation measures if the run developed below expectations.

Through the month of June, the Chinook salmon run was assessed to be large enough to provide for escapement and subsistence uses based upon the preseason outlook and late run timing. The regulatory “windowed” subsistence salmon fishing schedule was initiated on June 7 in District 1,

and was implemented chronologically upriver as the run progressed upstream. Persistent wet and cold weather conditions around the Yukon Delta, resulting in poor processing conditions, led many subsistence fishermen to abstain from harvesting the first pulse of Chinook salmon. Throughout the drainage there were episodes of high water events with heavy debris loads, which preempted subsistence fishing.

When it became evident that the Chinook salmon run would fall short of the U.S./Canada Yukon River Treaty obligation, the run had reached Subdistrict 5-D. Fishermen were asked to consider conservation measures such as voluntary harvest reductions, shifting harvest to other species, spreading harvest out over the duration of the run, reducing extended sharing, and keeping fish harvested within the village or local area. It was understood that fishing had been difficult this year due to high water conditions and debris. Imposing fishing restriction at the time would have increased hardships. The hope was to provide fishermen the flexibility to work around their own unique fishing conditions to effectively conserve Chinook salmon where they could.

ADF&G delayed summer chum salmon-directed commercial periods until the third quarter point in the Chinook salmon run at the Lower Yukon Test Fishery. This strategy allowed for the majority of Chinook salmon to pass prior to commercial fishing, and the last quarter of the Chinook run is predominantly of Alaskan origin. The department scheduled eight commercial summer chum salmon fishing periods in District 1 and seven in District 2. The cumulative harvest for Districts 1 and 2 combined was 183,215, 181% above the 2000 to 2009 average harvest (65,143). Because of low effort during the first four 12-hour Subdistrict 4-A commercial fishing periods, commercial fishing was allowed to continue for 21 days until the end of the summer fishing season. The cumulative harvest in 4-A was 44,207. The department scheduled seven summer chum salmon commercial fishing periods in District 6 and the preliminary cumulative harvest was 5,466.

A total of 450 permit holders participated in the summer chum salmon fishery, which was approximately 17% below the 2000 to 2009 average of 544. 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 440 permit holders fished in the Lower Yukon Area in 2010, which was approximately 16% below the 2000 to 2009 average of 527. In the Upper Yukon Area, 10 permit holders fished, which was approximately 50% below the 2000 to 2009 average of 20. Yukon River fishermen in Alaska received an estimated $1.5 million for their Chinook and summer chum salmon harvest in 2010, approximately 16% below the 2000 to 2009 average of $1.8 million.

The actual 2010 Chinook salmon run was much weaker than the preseason projection and early inseason assessment projects indicated. Consequently, most escapement results were disappointing. Chinook salmon escapement goals for the East Fork Andreafsky, West Fork Andreafsky, and Salcha rivers were achieved. The Anvik and Chena river escapement goals were not achieved. Preliminary Chinook salmon passage at Eagle sonar was 35,128, yielding a border passage of approximately 33,500, which was below the escapement goal (42,500–55,000). These numbers are preliminary, however, and subject to change.

Summer chum salmon escapements were variable, but most tributaries experienced good escapements. East Fork Andreafsky SEG and Anvik BEG were achieved. Salcha River escapement, however, was approximately 7,000 less than expected for this project.

The fall season began, by regulation, on July 16. Fall chum salmon management was based on the preseason outlook of 600,000. It was anticipated that level of abundance would be adequate to meet escapement needs and provide for normal subsistence harvests. At the beginning of the fall season, subsistence fishing in Districts 1, 2, 3, and Subdistrict 5-D were open 7 days a week, 24 hours a day, while District 4 and Subdistricts 5-A, 5-B, and 5-C were on a 5-days-a-week schedule. Early in the fall season, high water level and debris load hindered subsistence fishing efforts in Districts 4 and 5. The department liberalized the subsistence fishing schedule in Districts 4 and Subdistricts 5-A, 5-B, and 5-C to 7 days a week, 24 hours a day, to provide more opportunity to offset the difficulties incurred by subsistence fishermen.

Around mid-August, the historical midpoint of the run past Pilot Station Sonar, management of fall chum salmon shifted from using the preseason outlook to inseason assessment. At that point, two pulses of fall chum salmon had passed Pilot Station and inseason assessment indicated that the fall chum salmon run was weaker than anticipated, with projections less than 400,000. At that abundance level, based on the fall chum salmon management plan, commercial fishing is not allowed, and restrictions to subsistence fishing are possible. The department placed the mainriver districts on the regulatory windowed schedule. The third and largest of the four fall chum salmon pulses passed Pilot Station on August 16. Inseason projections continued to show fall chum salmon abundance to be less than 400,000. In addition, the department began to have concerns about fall chum salmon meeting the lower end of the Canadian border escapement goal of 80,000. In response, the department cancelled one subsistence fishing period in the mainriver districts, excluding Subdistricts 5-A and 5-D. It became apparent in early September, based on passage information from Eagle sonar, that the lower end of the Canadian border passage goal was going to be met. As a result, the department determined that no subsistence restrictions were needed in Subdistrict 5-D. In addition, subsistence schedules in the mainriver districts were liberalized. The last, and smallest of the four fall chum salmon pulses, passed Pilot Station on August 31.

The 2010 coho salmon run was late, had three pulses past Pilot Station, with the last and largest occurring on August 30. A coho salmon directed commercial fishery in Districts 1 and 2 was allowed under the guidelines of the modified Yukon River Coho Salmon Management Plan (5 AAC 05.36.). In addition, a limited salmon directed commercial fishery was prosecuted in District 6 under the guidelines of Tanana River Salmon Management Plan (5AAC 05.367.).

There were two commercial periods in District 1, one period in District 2, and three periods in District 6. The 2010 total commercial harvest for the Yukon River fall season in the Alaskan portion of the drainage was 2,550 fall chum and 3,750 coho salmon. Both harvests were well below their respective recent 5- and 10-year averages and among the lowest on record. All salmon were sold in the round and no salmon roe was sold separately. However, in District 6, male salmon were selectively purchased. The exvessel value of the total harvest was $29,000, $8,000 for fall chum and $21,000 for coho salmon. All exvessel values were below their respective most recent 10-year averages. A total of 94 individual permit holders participated in the 2010 fall chum and coho salmon fishery, 90 for Districts 1 and 2 combined, and four in District 6. Participation in all districts was below historical averages.

The preliminary 2010 fall chum salmon run size was estimated to be approximately 450,000 to 500,000, which is below the preseason projection (552,000–828,000), and below the run size provided by the summer to fall chum salmon relationship (600,000). Drainage-wide escapement is estimated to be near 400,000 fall chum salmon for 2010, which is within the BEG range

(300,000–600,000). The distribution of tributary stock escapements was not uniform and some goals and management objects were not achieved, particularly within the Porcupine River drainage including the Sheenjek and Fishing Branch river systems, while goals for Chandalar River, Canadian Yukon River Mainstem, Delta and Tanana rivers were achieved.

There are few coho salmon spawning escapement assessment projects in the Yukon River drainage because of funding limitations. The sonar at Pilot Station was operated a week longer than usual, through September 7 (as in 2008 and 2009), with an estimated passage of 141,000, which is below the historical average (151,000). There was a small pulse of coho salmon that entered during the extension. This passage resulted in slightly later run timing of coho salmon with an average of three days late based on the six monitoring projects. The Subdistrict 5-A test fish wheel indicated the coho salmon run was 35% above average while the Nenana test fish wheel indicated the run was average in relative abundance. The lower end of the SEG range (5,200–17,000) at Delta Clearwater River, was the only established escapement goal for coho salmon achieved.

NORTON SOUND AREA

Highlights of the 2010 Norton Sound District commercial salmon fishery included the best chum salmon harvest since 1986, a record Subdistrict 2 (Golovin) and 3 (Elim) coho salmon harvest, a record $1.22 million in salmon sales by permit holders, and the highest average value of salmon catch per permit holder on record (without adjusting for inflation). Disappointments in 2010 were the poor runs of Chinook and sockeye salmon as forecasted preseason.

Commercial salmon fishing began with a 48-hour opening on June 30, in Subdistrict 2 and Subdistrict 3, directed at chum salmon. This June start date was the earliest commercial chum salmon fishing start date in over a decade. Counts at the Kwiniuk River tower in Subdistrict 3 began on June 25, and after four days of counting the escapement goal range (11,500–23,000) was projected to be easily exceeded. The department notified the buyer that commercial chum salmon fishing could begin any time they were ready to purchase fish. Commercial catches were above average for the first period so two 48-hour fishing periods per week were allowed for the remainder of July.

Subdistrict 4 (Norton Bay) first opened on July 4 with one 24-hour fishing period and later went to two 48-hour fishing periods a week, targeting chum salmon. In Subdistrict 5 (Shaktoolik) commercial fishing began on July 3 with one 24-hour fishing period, and in Subdistrict 6 (Unalakleet) commercial fishing began on July 2 with one 24-hour fishing period. Both the Subdistrict 5 and 6 fishing periods targeted chum salmon with gillnets restricted to 6-inch or less mesh size. Fishing periods for the remainder of July in Subdistricts 5 and 6 ranged from 24 to 54 hours, as the buyer attempted to keep up with Norton Sound's best chum salmon run in 25 years.

In late July in Subdistricts 2 and 3 and in early August in Subdistricts 4, 5, and 6, the department switched to coho salmon management. During the second week of August the department expanded fishing times in Subdistricts 2, 3, and 4 to two 72-hour fishing periods a week because of an above average coho salmon run. In Subdsitricts 5 and 6, except for one 72-hour fishing period in mid-August, only two 48-hour fishing periods per week were allowed because of an average run of coho salmon. Commercial fishing was extended for one week into September in Subdistricts 2 and 3 because of record coho salmon catches. In Subdistricts 4, 5, and 6 commercial fishing regulations allow for fishing through the first week of September. A final 120-hour commercial

fishing period was allowed in Subdistricts 2 through 6 beginning on September 2, and fishing closed for the season on September 7.

Commercial chum salmon catches in Norton Sound were the best since 1986. Subdistricts 2–5 had the highest chum salmon harvest in each subdistrict in over 20 years and Subdistrict 6 had the highest chum salmon harvest in 18 years. The department's longest operational salmon escapement monitoring project in Norton Sound at Kwiniuk River had the highest chum salmon escapement (71,388) in the 46-year history of the counting tower project. The department's Unalakleet River test fishery had the highest chum salmon catch index in its 26-year project history.

After five consecutive years of top-10 coho salmon catches, the 2010 Norton Sound coho salmon catch slipped to 12th highest. The coho salmon run to northern Norton Sound was above average and there were record commercial catches in Subdistrict 2 (5,586) and Subdistrict 3 (10,180). However, the coho salmon run to southern Norton Sound was average and commercial harvests averaged approximately one-third of the record harvests from 2006 to 2008 in Subdistricts 5 and 6.

The Norton Sound District combined commercial harvest of all salmon species was best since 2000. The number of commercial permits fished (115) was the highest since 1994. The 2010 fishery value to permit holders was a record $1,220,487 and the average value per permit holder of $10,613 was the highest on record.

The average price paid was $2.25/lbfor Chinook salmon, $0.63/lb for sockeye salmon, $1.47/lb for coho salmon, $0.32/lb for pink salmon, and $0.62/lb for chum salmon.

KOTZEBUE SOUND AREA

The overall chum salmon run to Kotzebue Sound in 2010 was estimated to be above average to well above average based on the commercial harvest rates, subsistence fishermen reports, and the Kobuk test fish index being the fifth best in the 18-year project history. The commercial harvest of 270,343 chum salmon was the highest since 1995. Also, harvested during the commercial fishery and kept for personal use were 13 Chinook salmon, 6 sockeye salmon, 557 pink salmon, 7 coho salmon, 1,323 Dolly Varden, and 302 sheefish. There were likely some additional fish kept for personal use that did not get reported on fish tickets.

The department opened the commercial fishery on July 12 and the schedule allowed for fishing from 12:00 p.m. to 8:00 p.m. on Monday and from 6:00 a.m. to 2:00 p.m. on Tuesday through Saturday. Beginning with the July 26 fishing period, the buyer began to shorten fishing time for their fleet because of capacity concerns. Complaints from fishermen that some permit holders were ignoring the shorter fishing hours requested by the buyer resulted in the department setting daily fishing times by emergency order beginning with the August 6 fishing period. This resulted in a more orderly fishery because there was no longer the temptation to fish longer than the buyer requested, and enforcement officers were able to issue citations for those fishing before or after the scheduled openings that were set by emergency order.

There were 67 permit holders who sold fish to the buyer, including one catcher–seller who sold fish to the buyer and also sold some of his catch to Kotzebue area residents. This was the highest number of permit holders to fish since 1997. Since 2004, when a commercial buyer returned to Kotzebue, the number of permit holders that fished had been in the 40s, except the last two years, which were in the 60s. Still the number of permit holders that fished the last two years was less than half the number of permit holders that fished in the 1990s, and well below the nearly 200 permit holders that fished in the 1980s.

A total of 2,160,264 pounds of chum salmon (average weight 8.0 lb) were sold at an average of $0.40/lb. The total exvessel value was $860,125 to Kotzebue Sound fishermen. The average value for each participating permit holder was $12,837, the highest since 1988. The total exvessel value represents 148% of the $580,893 historical average.

Note: Table 6 was corrected on May 17, 2011.

Table 6.–Preliminary 2010 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 [a b]
Kuskokwim River	3	22	58	0	93	176
Kuskokwim Bay	16	179	19	0	134	348
Kuskokwim Area Total	19	202	77	0	227	524
Lower Yukon River	10	0	2	0	184	196
Upper Yukon River	0	0	2	0	51	53
Yukon River Total	10	0	4	0	235	249
Norton Sound	0	0	62	32	118	212
Kotzebue Area	0	0	0	0	270	270
AYK Region Total	29	202	142	32	850	1,255

[a] Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
[b] Columns and rows may not total exactly due to rounding error.

WESTWARD REGION

KODIAK MANAGEMENT AREA

The 2010 Kodiak Management Area (KMA) commercial salmon fishery began on June 9 and the last commercial landing occurred on September 30. Harvests by fishing area and species is summarized in Table 7.

Table 7.– Preliminary 2010 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing Area	Chinook	Sockeye	Coho	Pink	Chum	Total[a,b]
Kodiak	15	1,437	266	8,865	735	11,317
Chignik	10	1,380	159	490	581	2,620
South Peninsula and Aleutians	8	1,280	166	859	795	3,108
North Peninsula	3	2,230	62	8	259	2,562
Alaska Peninsula Total	11	3,510	228	867	1,054	5,670
Westward Region Total	35	6,326	654	10,222	2,370	19,608

[a] Missing data indicates no harvest and zeros indicate harvest activity but <1,000.
[b] Columns and rows may not total exactly due to rounding error.

Commercial fishing effort was low during the 2010 commercial salmon season although it was an increase from 2009. Of the 593 eligible commercial salmon permits, only 315 (53%) made commercial landings.

By gear type, a total of 158 set gillnet, 155 purse seine and 2 beach seine permit holder(s) fished in 2010. Both purse seine and set gillnet permit holder participation was above the previous 10-year average. During 2010 both set gillnet and purse seine permit holder participation was higher than in 2009. The number of permits actually fished at any given time varied throughout the season.

The 2010 commercial harvest sold by fishermen in the KMA was 14,550 Chinook, 1,436,606 sockeye, 266,431 coho, 8,864,796 pink and 734,806 chum salmon (Table 7) for a total of approximately 11.3 million, which is below the previous 10-year (2000–2009) average of 24.5 million.

The estimated total exvessel value of the 2010 fishery was approximately $24.2 million, which was above the 10-year average exvessel value ($22.3 million).

Seine fishermen accounted for 87% of the total number of salmon harvested and averaged $130,490 per fished permit. The exvessel value decreased from the 2009 season, but was higher than the previous 10-year average ($114,313) for purse seine permit holders.

Set gillnet fishermen accounted for 13% of the total number of salmon harvested. Earnings averaged approximately $25,720 per fished permit, which was a decrease from 2009, and below the previous 10-year average permit holder earnings ($35,617).

2010 Commercial Harvest Summary

Chinook Salmon

There are no directed Chinook salmon commercial fisheries in the KMA but incidental commercial harvest occurs during targeted sockeye salmon fisheries. The Ayakulik and Karluk river systems support the largest Chinook salmon populations in the KMA. Although no commercial openings were allowed in the Inner Karluk and Outer Karluk sections in June or July, nonretention of Chinook salmon was implemented during the fishing periods allowed in the Inner and Outer Ayakulik sections. The 2010 commercial harvest of Chinook salmon in the KMA totaled 14,550 which was lower than the previous 10-year average (17,911) and below the 2010 forecast (20,000).

Sockeye Salmon

The 2010 commercial harvest of sockeye salmon in the KMA totaled 1.433 million. The harvest was below the recent 10-year average (2,578,734) and below the forecast (2.492 million).

Early season management for much of the westside and northend of Kodiak Island is driven by the Karluk early-run sockeye salmon (through July 15). Due to poor returns, minimal fishing time was allowed targeting Karluk early-run sockeye salmon. Approximately 122,660 were harvested in early-season (through July 15) westside fisheries, which was above the forecast (55,000). Approximately 219,501 were harvested in the late-season westside fishery which was below the Karluk late-run point forecast (440,000).

The Ayakulik River was forecasted to have a surplus of sockeye salmon (420,000) available to commercial fishing in 2010. Directed sockeye salmon fisheries were allowed in the Inner and Outer Ayakulik sections from June through the end of the season. Approximately 155,836 fish were harvested in the Inner and Outer Ayakulik sections during the 2010 season.

The department tentatively scheduled a commercial salmon fishing period for June 9 in the Alitak District if certain criteria were met prior to June 7. Generally, the early-run sockeye salmon appear in Upper Station earlier than they do in 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 Lake sockeye salmon peak run timing. The Upper Station sockeye salmon early-run came in as expected, and a commercial salmon fishery was prosecuted on June 9 as a 33 hour test fishery. The resulting sockeye salmon harvest indicated a weak run. As the season progressed, it became evident that the early-run sockeye salmon to Upper Station was fair. The 2010 forecast for Frazer Lake was estimated at 258,000 with a harvestable surplus of approximately 133,000. The Frazer Lake run came in weaker than expected. On July 14, the lower sockeye salmon goal was achieved through the Dog Salmon weir. The Alitak District early-run sockeye salmon commercial harvest was only 30,691, well below the projected harvest of 176,000.

The late-run sockeye salmon forecast for Upper Station predicted a total return of 399,000 with 213,000 available for harvest. Escapements were sufficient to allow several commercial fishing openings in the Alitak District. The total late-run sockeye salmon harvest (85,247) was well below forecast (213,000).

Cape Igvak Salmon Management Plan

This regulatory management plan (5 AAC 18.360) allocates up to 15% of the total Chignik-bound sockeye salmon harvest to KMA fishermen in the Cape Igvak Section. Based on regulations, 90% 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 2010 and commercial fisheries were allowed in the Cape Igvak Section with four days of fishing allowed in June during the early run to Chignik. The late-run Chignik sockeye salmon run forecast came in as expected and a further eight days of fishing was allowed through July 25.

Through July 25, the Cape Igvak harvest of sockeye salmon considered to be Chignik-bound (90%) was approximately 185,193. This Cape Igvak harvest represents 13.1% of the total Chignik sockeye salmon harvest (15% allocation). Overall, the total sockeye salmon harvest in the Cape Igvak Section through July 25 was 105,770, which was slightly below the point forecast (205,940).

North Shelikof Sockeye Salmon Management Plan

From July 6 to 25, this regulatory management plan (5 AAC 18.363) places harvest limits on two areas of the KMA bordering northern Shelikof Strait to limit interception of sockeye salmon that are considered Cook Inlet-bound. During the period that this management plan is in effect, KMA 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 Shoreward Zones only, and offshore Seaward Zones are closed. In 2010, a department biologist was present on the grounds to determine the sockeye salmon catch and facilitate orderly, short notice closures if the harvest limits were met.

A Seaward Zone closure was implemented in the North Shelikof Unit at 1:00 p.m. July 8 when it was estimated that the cumulative sockeye salmon had approached the 15,000 limit. The total July 6 to 25 harvests in the North Shelikof Unit was 18,920, which includes both the Shoreward Zone and Seaward Zone harvests. A Seaward Zone closure was not required in the Southwest Afognak Section as the harvest cap (50,000) was not met. The July 6 to 25 harvest in the Southwest Afognak Section was 26,023.

Terminal and Special Harvest Areas

Some fisheries occur in areas where salmon enhancement projects create surplus production. Sockeye salmon harvests occurred as follows.

There was above average effort and harvest in the both Waterfall and Foul Bay SHAs with a total of 45,589 harvested in both SHAs.

In the Spiridon SHA (Telrod Cove), 100,727 sockeye salmon were harvested. The harvest in the Spiridon SHA represents only a portion of the total harvest of Spiridon enhancement fish; the remainder is harvested in traditional net fisheries along the westside of the KMA. The total Spiridon commercial harvest has not been estimated at this time.

The Kitoi Bay Hatchery harvest was an estimated 91,124 sockeye salmon, and was above the point forecast of 71,244. This includes the commercial harvest of both enhanced and wild salmon from the Inner Kitoi Bay, Outer Kitoi Bay, Duck Bay, and Izhut Bay sections. Additional

enhanced sockeye salmon may have been harvested in adjacent sections, but stock separation data are not available.

Coho Salmon

The commercial coho salmon harvest of 266,431 was below forecast (413,108) and below the 2000 to 2009 average (396,148).

The largest portion of the coho salmon commercial harvest occurred in those sections associated with Kitoi Bay Hatchery (Inner Kitoi Bay, Outer Kitoi Bay, Duck Bay, and Izhut Bay sections), with a total harvest of 113,909,which was below the projected harvest (155,108).

Pink Salmon

Overall, the 2010 pink salmon harvest of 8.86 million was below the harvest forecast (11.4 million), and well below the past five even-year (2000–2008) average harvest (18.0 million), and also the previous 10-year average harvest (20.57 million).

Wild stock pink salmon harvests were slightly below forecast (5.7 million) with 5.64 million pink salmon harvested in the KMA. Westside fisheries (Southwest Afognak to Ayakulik), accounted for 2.65 million and the eastside and the north end of Kodiak Island had a harvest of 682,887.

The Kitoi Bay Hatchery pink salmon return was weaker than expected. In those sections near the hatchery 3.25 million fish were harvested compared to a projected harvest of 5.7 million. There was a cost recovery fishery near the hatchery, with Kitoi pink, coho, chum and sockeye salmon harvested and sold by the Kodiak Regional Aquaculture Association.

Chum Salmon

The chum salmon harvest (734,806) was well below the forecast (1.02 million) and below the 2000 to 2009 average (932,402). The eastside and the north end of Kodiak Island accounted for 136,434 chum salmon. Kitoi Bay Hatchery chum salmon production was weaker than expected, with 191,284 harvested, below the 2010 forecast (273,668).

2010 Escapement Summary

During the 2010, KMA commercial salmon season fish counting weirs were operated on eight systems, including the Karluk, Ayakulik, Litnik, Upper Station, Frazer, Buskin, Saltery and Big Bay (Shuyak Island) systems. Continued erosion of funding has reduced the number of weirs from 12 in 2000. In addition, four observers flew over 35 aerial surveys, and several observers conducted foot and skiff survey escapement estimates. Foot surveys are still being conducted on road system streams, primarily by the Division of Sport Fish.

Chinook Salmon

The total Chinook salmon escapement (8,569) was well below the previous 10-year average (16,608). Escapement goals for Chinook salmon have been developed for the Karluk and Ayakulik rivers and the escapements are estimated using fish counting weirs.

Due to a relatively weak sockeye salmon run, there was no commercial fishing allowed in the Inner Karluk Section. Furthermore, there was no commercial salmon fishing in the Outer Karluk Section until September, and there was reduced fishing time in the other management units of the

Westside Kodiak fishery. In addition, both subsistence and sport fish fisheries were closed to the harvest of Chinook salmon in the Karluk system. Despite the reduced incidental catch of Chinook in these fisheries, the Chinook salmon count through the Karluk weir (2,917) was below the established escapement goal range (3,600–7,300). However, Chinook salmon escapement through the Ayakulik weir (5,291) was within the established escapement goal range (4,800–9,600).

Sockeye Salmon

The 2010 sockeye salmon returns to systems in the KMA were varied. Only the Karluk early-run, escapement did not meet established minimum escapement goal. Pasagshak, Buskin, Little River, Malina, Upper Station early and late runs, the Frazer, Afognak, Uganik, Saltery, Ayakulik, and the Karluk late-run had sockeye salmon escapements that were within established escapement goal ranges. The entire KMA estimated sockeye salmon escapement (1.1 million) was below the previous 10-year average (1.46 million).

Coho Salmon

The only established coho salmon escapement goals occur in the Northeast Kodiak and Eastside Kodiak districts in the following rivers; American (400–900), Olds (1,000–2,200), Buskin (3,20–7,200) and the Pasagshak rivers (1,200–3,300). The escapement goals were met for the Buskin (3,307), and the Pasagshak (1,971). However, both the Olds and American Rivers did not reach their minimum escapement goals.

For the entire KMA, the estimated coho salmon escapement is incomplete and it is expected that more coho salmon enter KMA systems throughout the fall after the conclusion of aerial surveys and removal of weirs. At this time the KMA has very little coho salmon monitoring, (the last aerial surveys were conducted in mid-September) and the lack of stock status information will further hamper the management of coho salmon in the KMA.

Pink Salmon

Overall KMA pink salmon escapement (3.64 million) was well below the previous even year average of 6.14 million and below the previous 10-year average (5.09 million). Pink salmon escapement goals have been established as an aggregate goal for the entire Kodiak Archipelago and the Mainland District. The escapement goal range (2.0–5.0 million) was met for the Kodiak Archipelago (3.378 million). The Mainland District pink salmon escapement of 265,650 was within the established escapement goal range (250,000–750,000).

Chum Salmon

Overall chum salmon escapement (300,285) was below the recent 10-year average (473,392). Escapement goals have been established in Kodiak Archipelago and the Mainland. The escapement in the Kodiak Archipelago was above the escapement goal (151,000) with an estimate of 155,570 and the Mainland District escapement of 144,715 was also above the escapement goal (104,000).

CHIGNIK MANAGEMENT AREA SEASON SUMMARY

The Chignik River watershed supports two distinct sockeye salmon runs which traditionally provide the majority of directed harvest opportunities within the Chignik Management Area (CMA). In 2010, the combined early- and late-run sockeye salmon harvest was above recent

averages. Additionally, there are several streams within the CMA that support large runs of pink, chum, and coho salmon. In 2010, the CMA was open to commercial salmon fishing for 73 days (June 16–September 7) and a total of 66 permits—including the department's test fishery permit—were fished.

Escapement Summary

Escapement through the Chignik River weir was monitored using underwater digital video equipment. Two underwater gates in the weir were open to provide uninterrupted escapement. The numbers of fish passing the weir were counted by species for the first 10 minutes of each hour. The counts were expanded to obtain hourly escapement estimates, and then summed to provide an estimate of daily fish passage. A digital video archive was kept of each 10-minute counting period. The first count of the 2010 season occurred on May 27 when weir installation was complete, and the last weir count of the season took place on September 2, after which the weir was removed.

Aerial surveys were flown throughout the season to monitor escapement into CMA streams. Peak aerial survey counts, by index stream and species, were summed and compared to available escapement goals established by Witteveen et al. (2007). Pink and chum salmon escapements were measured against established area wide SEGs, which were apportioned into district-wide management objectives.

Chinook Salmon

The Chignik River is the only Chinook salmon-producing stream within the CMA and one of the largest Chinook salmon streams on the South Alaska Peninsula. The BEG for Chinook salmon in the Chignik River watershed is 1,300 to 2,700 (Witteveen et al. 2005). The 2010 Chignik River Chinook escapement, through the weir (3,679) was well above the previous 5- and 10-year averages. Subsistence and sport fishery harvest of Chinook salmon above the weir will not be known until after permits and questionnaires are returned and tabulated by the fall of 2010.

Sockeye Salmon

Sockeye salmon escapement to the Chignik River is managed based on separate interim escapement objectives for both early- and late-run sockeye salmon. The early-run SEG (350,000–400,000) through July 4 was exceeded with an estimated escapement (432,535).

The late-run objectives include an additional 50,000 which are incorporated into the late-run SEG to provide for additional freshwater subsistence fishing opportunity. The late-run (post-July 4) SEG (250,000–400,000) was met with an estimated escapement of 311,291. Post-weir sockeye salmon escapement estimates were produced for the September 3–15 (20,539) and the September 16–30 (6,491) periods, which were included in the total late-run escapement estimate.

Early run escapement was above the prior 5- and 10-year average escapement. The late run sockeye salmon escapement was similar to prior 5- and 10-year averages. Sockeye salmon escapements into other CMA streams were relatively minor.

Coho Salmon

Coho salmon begin to enter CMA drainages in mid-August and continue through November. The coho salmon run is generally building when the weir is removed; therefore, coho salmon escapement estimates are considered incomplete. The 2010 Chignik River coho salmon escapement estimate through Sept 2 was 5,152. This was below prior 5- and 10-year average

escapements. Although no coho salmon escapement goals have been established for the CMA (Witteveen et al. 2005), coho salmon escapement throughout the CMA appears to be consistent with past years and sustainable at this level.

Pink Salmon

Coho salmon begin to enter CMA drainages in mid-July continue through August. The 2010 Chignik River pink salmon escapement estimate through Sept 2 was 3,670. This was below prior 5- and 10-year average escapements. Pink salmon escapements to other CMA streams were estimated via aerial survey and summarized by district. The 2010 overall combined escapement for CMA streams was approximately 330,570, which was within the areawide aggregate even-year SEG range (200,000–600,000).

Chum Salmon

The 2010 Chignik River chum salmon escapement was 95, which was below average for the Chignik River. Chum salmon escapements to other CMA streams were estimated via aerial survey and summarized by district. The SEG of all districts combined (57,400; Witteveen et al. 2007) was exceeded with an estimated total peak escapement (177,220).

Commercial Fishery Summary

The CMA was open to commercial salmon fishing for 73 days during the 2010 commercial salmon season. The first fishing period occurred on June 16 and the CMA closed to commercial salmon fishing shortly after the local processor ceased operations on September 5. In 2010, 66 permit holders (including the department's test fishery permit) made a total of 2,532 landings.

Harvest Summary

Chinook Salmon

A total of 10,262 Chinook salmon were commercially harvested (excluding home pack and the department's test fishery) in 2010, which was well above recent average harvests (Table 3). The majority of the 2010 CMA Chinook salmon harvest occurred in the Western District, with much of the remainder harvested in the Chignik Bay and Central districts. Most of the Chinook salmon harvest occurred from late June until the end of July.

Sockeye Salmon

A total of 1.380 million sockeye salmon were commercially harvested (excluding home pack and the department's test fishery) in the CMA during 2010, which was above the prior 10-year average harvest and approximately 377,000 (38%) more than the prior 5-year average harvest. The majority of the 2010 CMA sockeye salmon harvest came from the Chignik Bay District, although substantial harvests also occurred in Central and Western districts (Table 7).

In 2010, the Southeastern District Mainland (SEDM) and Cape Igvak opened to commercial salmon fishing for the first time on June 18. A total of 106,584 (85,267 considered Chignik-bound) sockeye salmon were harvested in the SEDM through the end of the allocation period, on July 25. Cape Igvak fisherman harvested 205,770 (185,193 considered Chignik-bound) during the allocation period.

Coho Salmon

A total of 159,198 coho salmon were commercially harvested in 2010, which was greater than the prior 5- and 10-year average harvests. The majority of the coho salmon harvest in 2010 took place during July and August in the Western District.

Pink Salmon

A total of 489,774 pink salmon were commercially harvested in 2010, which was well below the prior 5- and 10-year average harvests. The largest portion of the CMA pink salmon harvest came from the Western District, although the Central district also yielded a substantial portion of the catch (Table 1). Most pink salmon were harvested between late June and mid-August.

Chum Salmon

A total of 581,329 chum salmon were commercially harvested in 2010, which was the highest catch since accurate harvest records began in 1954. The majority of the chum salmon harvest in 2010 took place in the Central District, although the Western and Eastern districts also yielded substantial catches (Table 1). Most chum salmon were harvested between late June and mid-August.

Economic Value Summary

The exvessel value of the 2010 CMA commercial salmon fishery was about $14.3 million, approximately $220,599 per active permit holder. A majority of the value was from the sale of sockeye salmon (79%), while chum salmon harvest contributed a much larger proportion (12%) of the fishery value than in previous years, contributing roughly $27,300 per active permit holder. The harvest provided (per active permit holder) approximately $8,711 (coho), $8,707 (pink), and $2,463 (Chinook).

Department Test Fishery Summary

The department conducted test fisheries on three occasions in 2010. Data from these test fisheries were used to assess the early season buildup of sockeye salmon in Chignik Lagoon. An estimated 6,545 sockeye salmon were harvested, which provided approximately $31,000 that was used to offset the cost of vessel charters and operating the Chignik weir.

Subsistence Summary

At this writing subsistence harvest numbers for 2010 have not been finalized.

ALASKA PENINSULA, ALEUTIAN ISLANDS, AND ATKA-AMLIA ISLANDS MANAGEMENT AREAS SALMON SEASON SUMMARY

Total harvest presented from the 2010 commercial salmon fishing season should closely approximate final harvest numbers for all species. The 2010 commercial salmon harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amlia Islands Management Areas totaled 10,625 Chinook, 3.510 million sockeye, 228.374 coho, 867,290 pink, and 1.054 million chum salmon. Subsistence salmon harvest will be reported in the 2010 annual management report. Data reported in this report are considered preliminary. Preliminary exvessel value of salmon harvested in Area M totaled $22.56 million. Value information was generated from fish tickets and does not include postseason adjustments paid to fishermen.

South Unimak and Shumagin Islands June Fisheries

The South Unimak and Shumagin Islands fishing season began at 6:00 a.m. on June 7 with an 88-hour fishing period for all gear types (purse seine, drift gillnet, and set gillnet gear). During the June fishery, there were four 88-hour periods and one 64-hour fishing period. The commercial salmon harvest for the June fishery consisted of 3,118 Chinook, 818,865 sockeye, 27 coho, 332,435 pink, and 271,700 chum salmon.

Southeastern District Mainland

Beginning July 1, the Northwest Stepovak Section of the Southeastern District SEDM is managed on the strength of the Orzinski Lake sockeye salmon run. The return of sockeye salmon to Orzinski Lake was adequate to allow limited commercial harvest opportunity in the Northwest Stepovak Section. From July 1 to 25, there were 9 Chinook, 61,172 sockeye, 122 coho, 773 pink, and 6,417 chum salmon harvested in the Northwest Stepovak Section. The cumulative sockeye salmon escapement (18,039), through the Orzinski Lake weir, was within the sustainable escapement goal (15,000–20,000).

Due to a strong commercial salmon harvest in the CMA, the SEDM opened to commercial salmon fishing on June 18. During the SEDM allocation openings 873 Chinook, 106,584 sockeye, 2,793 coho, 13,832 pink, and 67,744 chum salmon were harvested.

From July 26 to August 31, the SEDM is managed based on the abundance of local salmon stocks. Due to poor pink and chum salmon escapements, no commercial salmon fishing opportunity was allowed during this time.

From September 1 to 30 the SEDM is open concurrently with the remainder of the Southeastern District based on the abundance of coho salmon stocks. In September, 3 Chinook, 4,286 sockeye, 1,587 coho, 0 pink, and 149 chum salmon were harvested in the SEDM.

South Peninsula post-June fishery

Prior to the South Peninsula post-June fishery, the department conducts a test fishery to determine immature salmon abundance in the Shumagin Islands. Test fishing resulted in 41 (July 2), 23 (July 3), and 7 (July 5) immature salmon per set, which are all below the threshold of 100 immature salmon per set.

From July 6 to 21, there were six fishing periods, each consisting of a 24-hour opening followed by a 48-hour closure. From July 22 to 31, there were three fishing periods that consisted of a 36-hour opening followed by a 48-hour closure. During August, the post-June fishery is managed based on the abundance of local stocks. In September and October, management focuses on coho salmon returns, though the status of local pink and chum salmon returns may also be taken into consideration.

The total commercial harvest for the South Peninsula post-June fishery (excluding the SEDM) was 3,848 Chinook, 287,491 sockeye, 161,698 coho, 486,748 pink, and 444,245 chum salmon. A total of 140 permit holders participated in the 2010 South Peninsula Post-June salmon fishery. Participation consisted of 57 purse seine, 28 drift gillnet, and 55 set gillnet permits.

Commercial salmon fishing did not take place from August 4 through September 14 in the South Alaska Peninsula due to low escapements of both pink and chum salmon. There were two

commercial salmon fishing periods during September (September 14–16; September 21–23) in the Southeastern District in order to assess the abundance of coho salmon.

Aleutian Islands Fishery

The department opened the Aleutian Islands Area to commercial salmon fishing by seine gear on August 4. Commercial harvest of salmon occurred in Unalaska and Makushin bays, with a total harvest of 2 Chinook, 1,263 sockeye, 0 coho, 25,668 pink, and 4,862 chum salmon. Currently there is no escapement goal for pink salmon in the Aleutian Islands area. No salmon escapement surveys were conducted in the Aleutian Islands during 2010.

South Peninsula Escapement

The South Peninsula indexed sockeye salmon escapement (38,039) was below the lower end of the management objective range (48,200–86,400). Pink salmon total escapement (742,912) was well below the lower end of the even-year goal range (1.865–3.729 million). Chum salmon indexed total escapement (291,912) was below the escapement goal range (330,400–660,800). A total of 260 coho salmon were documented in South Peninsula streams. Some of the major coho salmon systems are typically not surveyed, or surveyed during off-peak times. There are few escapement goals on the South Peninsula for coho salmon due to their late-run timing. A lack of escapement information for coho salmon is due to the departure of management staff from the South Peninsula region prior to peak coho salmon runs, and poor weather conditions during the peak coho salmon runs preventing aerial surveys from being conducted.

North Alaska Peninsula

The total commercial harvest for the North Alaska Peninsula fishery was 2,771 Chinook, 3.51 million sockeye, 62,147 coho, 7,833 pink and 259,063 chum salmon. In 2010, 173 Area M permit holders participated in commercial salmon fisheries along the North Alaska Peninsula. There was no effort by Area T permit holders. The numbers of Area M and Area T permit holders participating in 2010 were far below the historic numbers observed during the 1990s.

The North Alaska Peninsula fishery is predominantly a sockeye salmon fishery, although depending on market conditions, directed Chinook, coho, and chum salmon fisheries occur in some locations. During even-numbered years, depending on market conditions, pink salmon runs are frequently targeted in the Northwestern District.

In 2010, the North Alaska Peninsula harvest of sockeye and chum salmon was above the previous 10-year (2000–2009) averages, while the harvest of Chinook, coho and pink salmon was below the previous 10-year average. The harvests of Chinook, sockeye, coho and pink salmon were below projected levels, while chum salmon was above projected levels.

Northwestern District

In the 2010 Northwestern District commercial salmon fishery a total of 54,805 sockeye, 525 coho, 6,450 pink, and 139,070 chum salmon were harvested. A total of 23 permit holders participated in the fishery, consisting of 6 purse seiners, 15 drift gillnetters, and 2 set gillnetters. The commercial fishery in Urilia Bay harvested a total of 28,040 sockeye salmon in 2010.

In the Northwestern District, chum salmon escapement totaled 144,100. The Northwestern District chum salmon escapement goal (100,000–215,000) was met, with a majority of the escapement occurring in the Izembek-Moffet Bay Section. The Urilia Bay Section had an

escapement of 34,700 sockeye salmon, and 13,600 pink salmon escaped into Bechevin Bay. Bechevin Bay is the only North Peninsula location with a pink salmon escapement objective (31,000 during even-numbered years); the objective was not met in 2010.

Nelson Lagoon Section

The total run of 250,715 sockeye salmon (includes harvest and escapement) from the Nelson Lagoon Section was well below the estimated forecast (492,000). From the total run, 93,715 sockeye salmon were harvested in Nelson Lagoon and 157,000 escaped, of which 108,000 returned to the Nelson (Sapsuk) River, and 49,000 were observed in other tributaries of Nelson River such as David's (29,000) and Caribou (20,000) rivers. The sockeye salmon escapement into Nelson River met the BEG (97,000 to 219,000).

Bear River and Three Hills Sections

By regulation, the Bear River Section opens to commercial salmon fishing on May 1 and the Three Hills Section opens June 25. Both areas are managed based on the sockeye salmon run strengths into Bear and Sandy rivers. In 2010 a portion of the Bear River Section and all of the Three Hills Section were closed to commercial salmon fishing to protect Sandy River sockeye salmon, which struggled to meet the interim escapement objectives throughout the season. The Bear River early-run (through July 31) sockeye salmon escapement (226,534) was within the escapement goal (176,000–293,000).

The Bear River sockeye salmon late-run (after July 31) escapement of 142,966 met the escapement goal (117,000–195,000). Although the late run met its season-ending escapement goal, the run was just below the 10-year average (148,647). The total Bear River late-run (catch plus escapement) sockeye salmon run was 387,349, which was below the forecast estimate (423,000). To ensure the late-run met the season-ending escapement objective, a portion of the Bear River Section was closed to commercial salmon fishing during part of the late-run.

In 2010, the Port Moller Bight, Bear River, Three Hills, and Ilnik sections were closed from July 30 to August 9. During this time period the Bear River early-run ends and the late-run begins. A test fishery was conducted to assess the run strength on August 4 and August 8. The August 4 test fishery did not show a substantial buildup of sockeye salmon in the vicinity of Bear River. Due to uncertainty of the sockeye salmon buildup, a second test fishery was conducted on August 8 which showed a far greater buildup of sockeye salmon near Bear River. On August 10, the commercial salmon fishery was re-opened in the Port Moller Bight, Bear River, Three Hills and Ilnik sections. To protect milling fish destined for Bear River, commercial fishing was restricted in the vicinity of Bear River. Typically the late run peaks between August 15 and 20. Due to the steady daily escapement into Bear River, commercial fishing in the immediate vicinity of Bear River remained restricted until August 20, when management staff was assured the late run would meet the season-ending escapement objective.

The final 2010 Sandy River sockeye salmon escapement (37,000) was below the 10-year average (49,990); however, it did meet the season ending escapement goal range (34,000–74,000). For most of the season the sockeye salmon escapement into Sandy River did not meet the interim escapement objectives. To protect Sandy River fish and ensure the escapement objectives would be met, the Three Hills section was not open to commercial salmon fishing until July 19. A large portion of the Bear River Section was also closed to commercial salmon fishing until July 19, when it was assured that Sandy River would meet the season ending escapement objective.

Ilnik Section

Since 2005, the Ocean River, normally a tributary of the Ilnik River, has emptied directly into the Bering Sea and bypassed the Ilnik River weir. Prior to 2005, the Ocean River had not emptied directly into the Bering Sea since 1987. To account for Ocean River-bound sockeye salmon that bypassed the weir, the Ilnik River weir escapement goal was decreased by 20%. In 2009 a new channel had connected Willie Creek (a major spawning tributary to Ilnik River) with Ocean River. This development potentially allowed fish destined for Ilnik River and Willie Creek to bypass the weir. Foot and aerial surveys confirmed that sockeye salmon were bypassing the weir using the new channel and accessing Willie Creek and possibly the upper Ilnik River. The Ocean River sockeye salmon escapement estimate (16,000), based on aerial surveys, exceeded the season ending escapement goal (8,000–12,000). The total Ilnik River system escapement which included fish through the weir and aerial surveys of Ocean River was 59,000. The number through the weir (43,000) met the season-ending escapement goal for the Ilnik River.

By regulation the Ilnik Section can open to commercial salmon fishing on June 20, but because of low escapement rates into Ilnik River, the area did not open until June 28. Based on the 10-year escapement average, by June 23 the Ilnik River weir has typically passed roughly half the total escapement for the year. In 2010, about 29,000 sockeye salmon had passed the weir through June 29. Harvest in the Ilnik Section from June 28 to June 30 averaged about 70,000 sockeye salmon per day. After the peak harvest, the harvest decreased throughout the month of July.

In 2010, a total of 125 permit holders harvested 660,074 sockeye salmon in the Ilnik Section from June 28 until September 4. Within the Ilnik Section, about 25% of this commercial harvest occurred southwest of Unangashak Bluffs (163,533), and 75% was harvested between Unangashak Bluffs and Strogonof Point (496,541). The peak daily catch in the southern portion of the Ilnik Section was on July 17 when 17,773 salmon were harvested, and the largest daily harvest occurred June 29, in the northern portion of the Ilnik Section when 71,643 salmon were harvested.

Beginning August 15, Ilnik Section is managed for coho salmon runs into Ilnik Lagoon. No directed coho salmon fisheries occurred in the Ilnik Section during 2010. Commercial fisheries in the Ilnik Section continued targeting sockeye salmon while coho salmon were harvested incidentally in the sockeye salmon fisheries.

Inner and Outer Port Heiden Sections

Aerial escapement surveys began on the Meshik River on June 18 and were conducted about once per week throughout the fishery. On June 30, 18,000 sockeye salmon were observed in-river. A peak survey conducted on July 15 documented 43,000 sockeye salmon in the Meshik River, meeting the season-ending escapement goal (25,000–100,000). The final escapement in the Inner Port Heiden Section (including Meshik River, Red Bluff and Yellow Bluff creeks and tributaries) was 63,700.

Fishing time in the Outer Port Heiden Section is based on Meshik River sockeye salmon abundance unless management actions are taken for the conservation of Ugashik River sockeye salmon in the Egegik District. By regulation, the Outer Port Heiden Section can open to commercial salmon fishing from June 20 to July 31. The weekly fishing periods in the Outer Port Heiden Section are scheduled from 6:00 a.m. Monday to 6:00 p.m. Wednesday. The Outer Port

Heiden Section opened on June 24 and had consistent openings of 2.5 days per week throughout July until the section closed for the season on July 28. In 2010, a total of 112 permit holders harvested 786,025 sockeye salmon from the Outer Port Heiden Section. The peak daily catch was on July 8 when 88,231 sockeye salmon were harvested. A small harvest occurred in the Inner Port Heiden Section in 2010 when less than three permit holders participated in the fishery.

Cinder River Section

There was no harvest reported in the Cinder River Section in 2010.

PRELIMINARY FORECASTS OF 2011 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 2010 fishing year, forecast fisheries are as follows:

Southeast	pink salmon
Prince William Sound	Wild chum, sockeye, and pink salmon
Copper River/ Copper River Delta	Chinook and sockeye salmon
Upper Cook Inlet	sockeye salmon
Lower Cook Inlet	pink salmon
Kodiak	pink salmon
Spiridon Lake	sockeye salmon
Ayakulik River	sockeye salmon
Karluk Lake (Early and Late Runs)	sockeye salmon
Alitak District, Frazer and Upper Station	sockeye salmon
Chignik (Early and Late Runs)	sockeye salmon
Bristol Bay	sockeye salmon
Nushagak District	Chinook salmon
Alaska Peninsula	pink salmon
Bear River (late run)	sockeye salmon
Nelson River	sockeye salmon
Arctic-Yukon-Kuskokwim	Chinook, sockeye, coho, pink, and chum salmon
Yukon Area	Fall chum salmon

A variety of information is used to forecast salmon runs. 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, outmigrating smolt numbers, 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 and pink salmon fisheries in Southeast Alaska, Kodiak, PWS, and Alaska Peninsula. Forecasts for large hatchery runs including pink, sockeye, and chum salmon runs to the Southeast Alaska, Kodiak, and PWS areas are provided by private nonprofit operators. Other fisheries, 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.

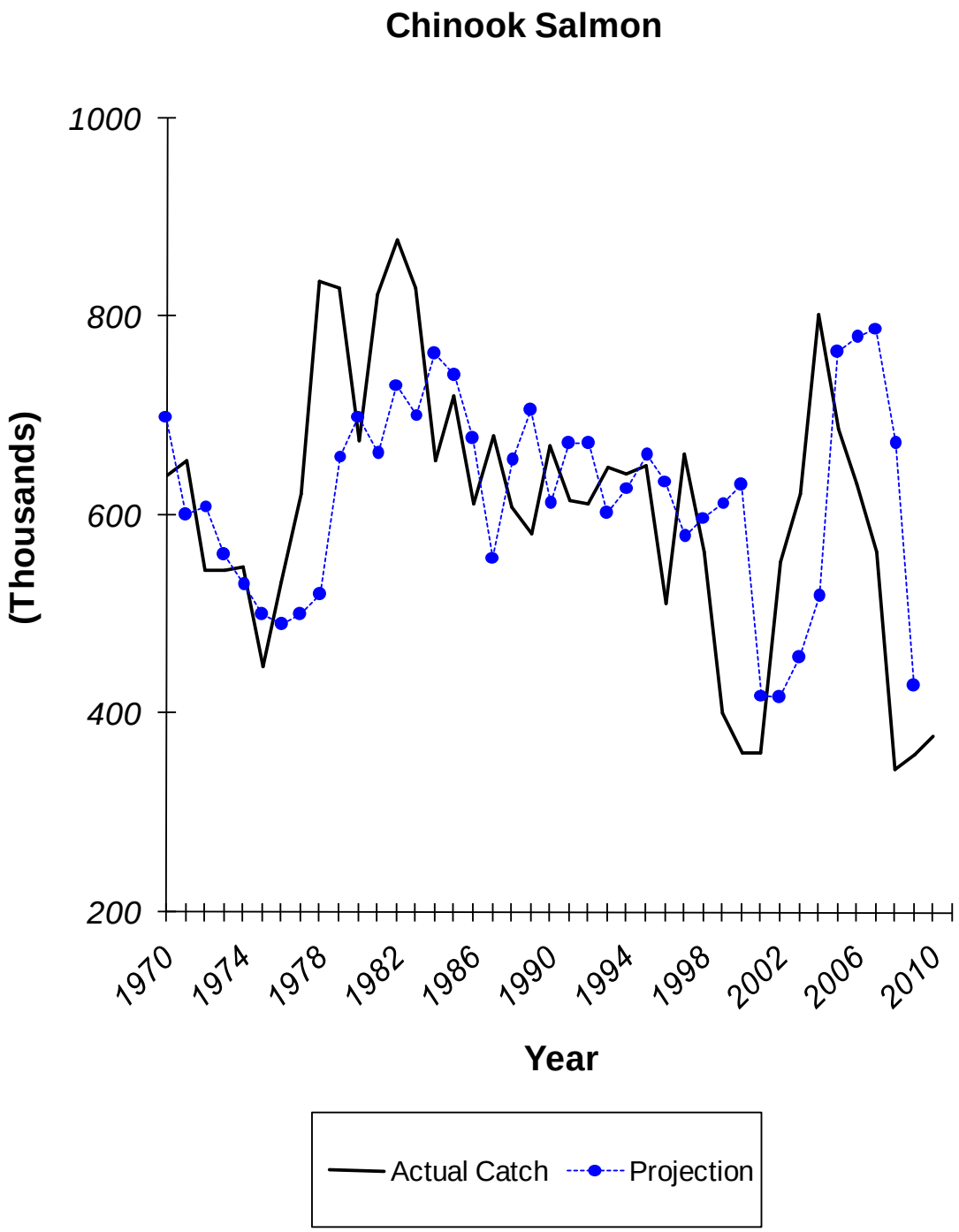

Figure 2.–Relationship between actual catch and projected catch in thousands, for Alaskan Chinook salmon fisheries from 1970 to 2010, 2010–2011 projection not available.

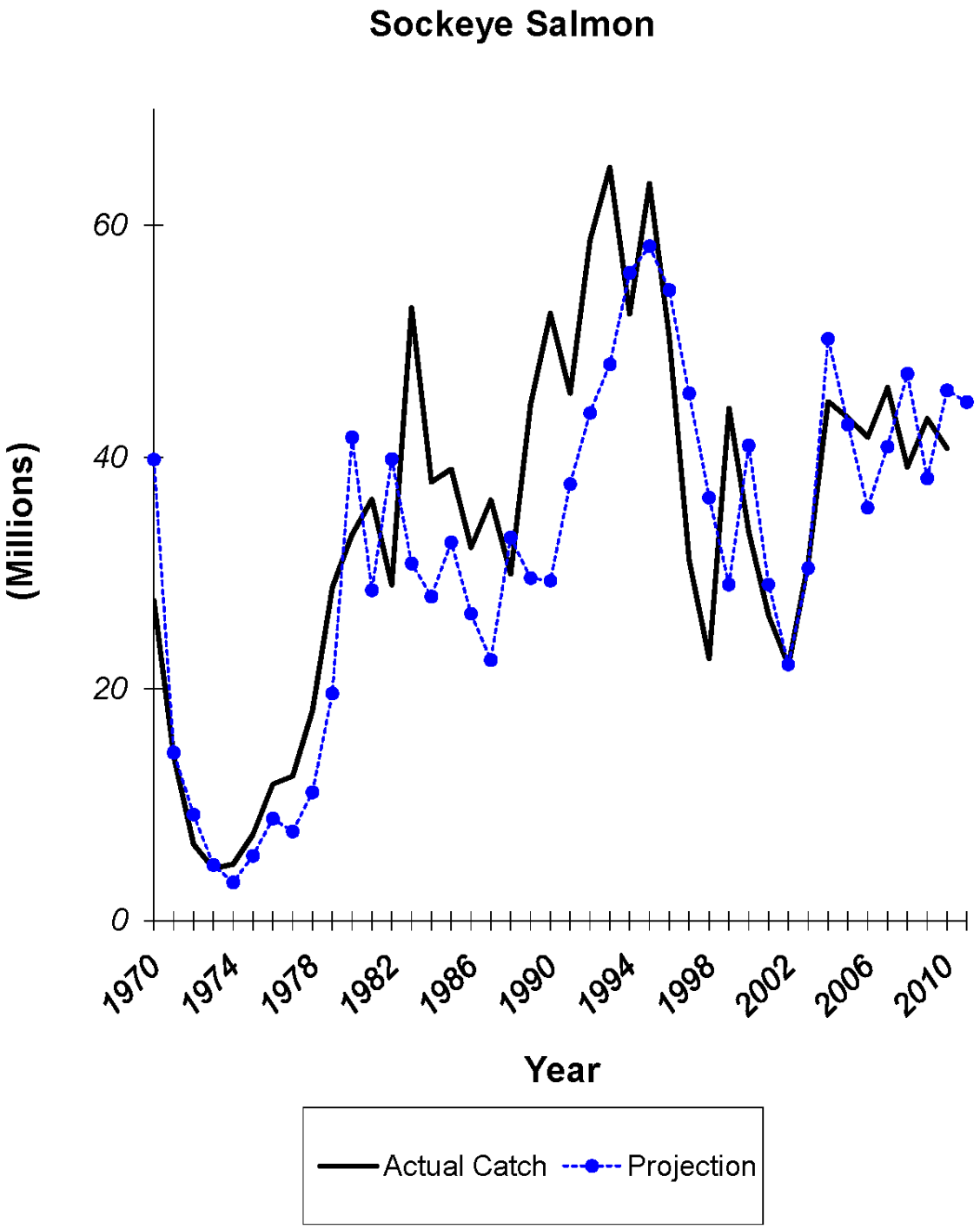

Figure 3.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan sockeye salmon fisheries from 1970 to 2010, with the 2011 projection.

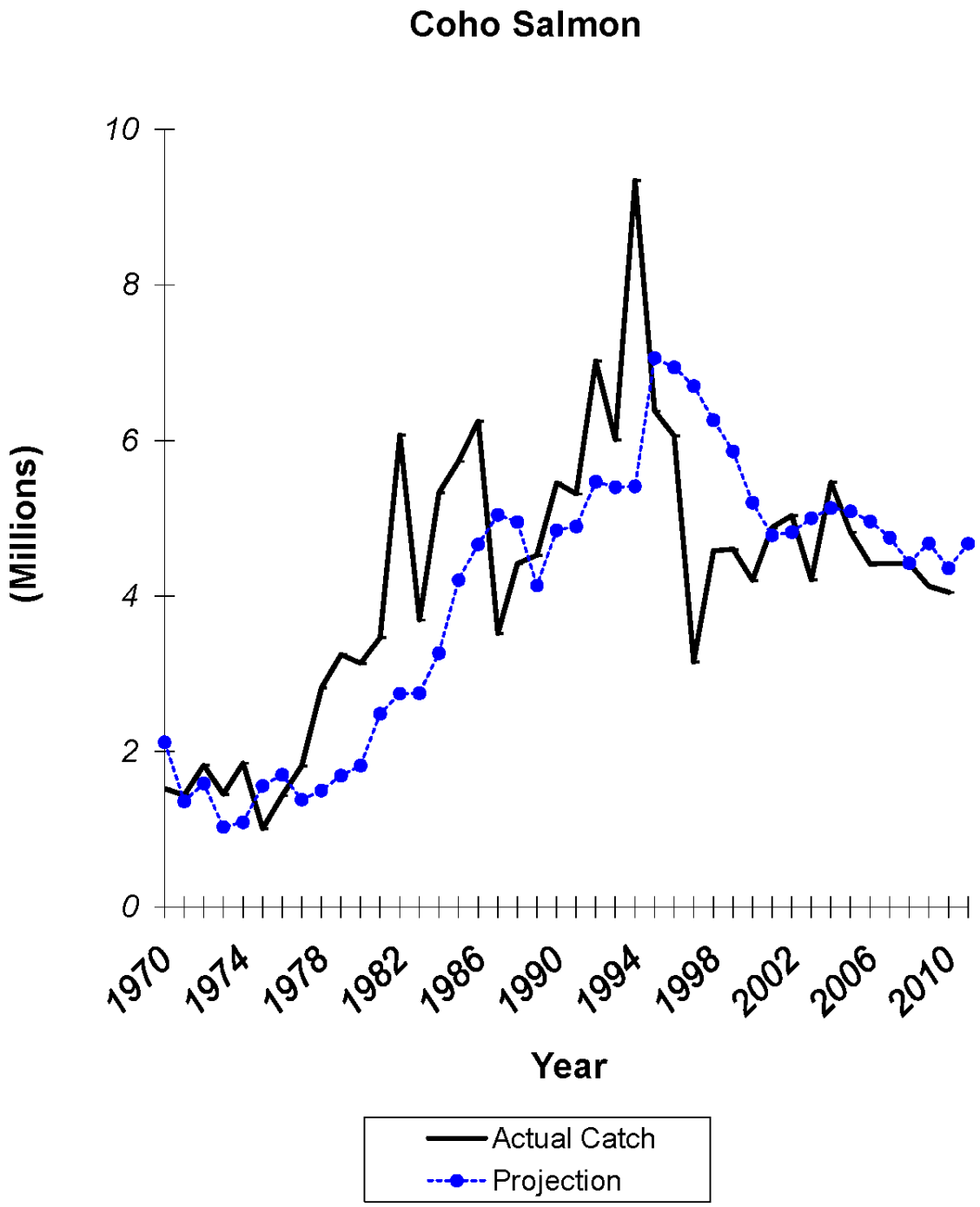

Figure 4.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan coho salmon fisheries from 1970 to 2010, with the 2011 projection.

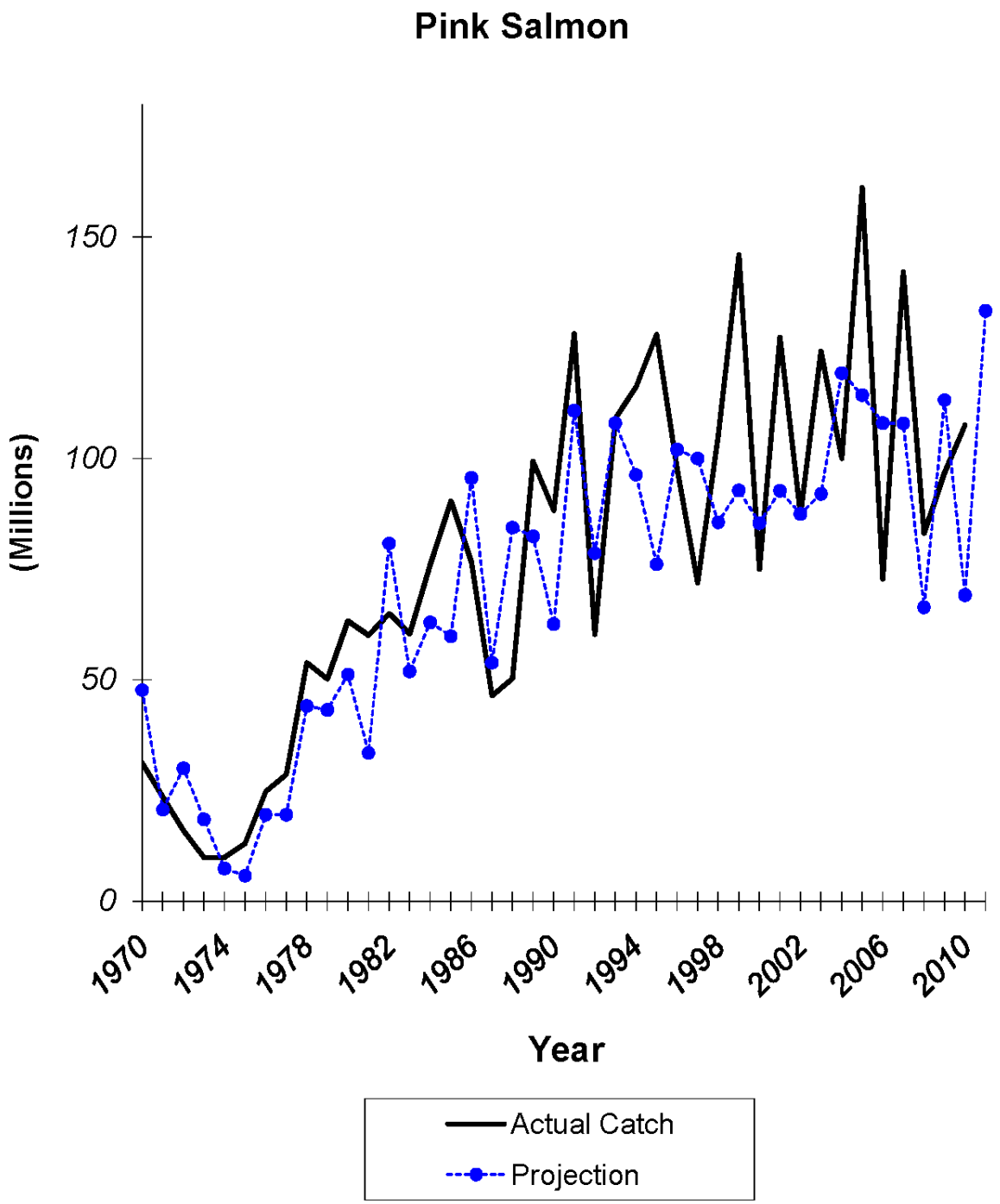

Figure 5.–Relationship between actual catch (millions) and projected catch (millions) for Alaskan pink salmon fisheries from 1970 to 2010, with the 2011 projection.

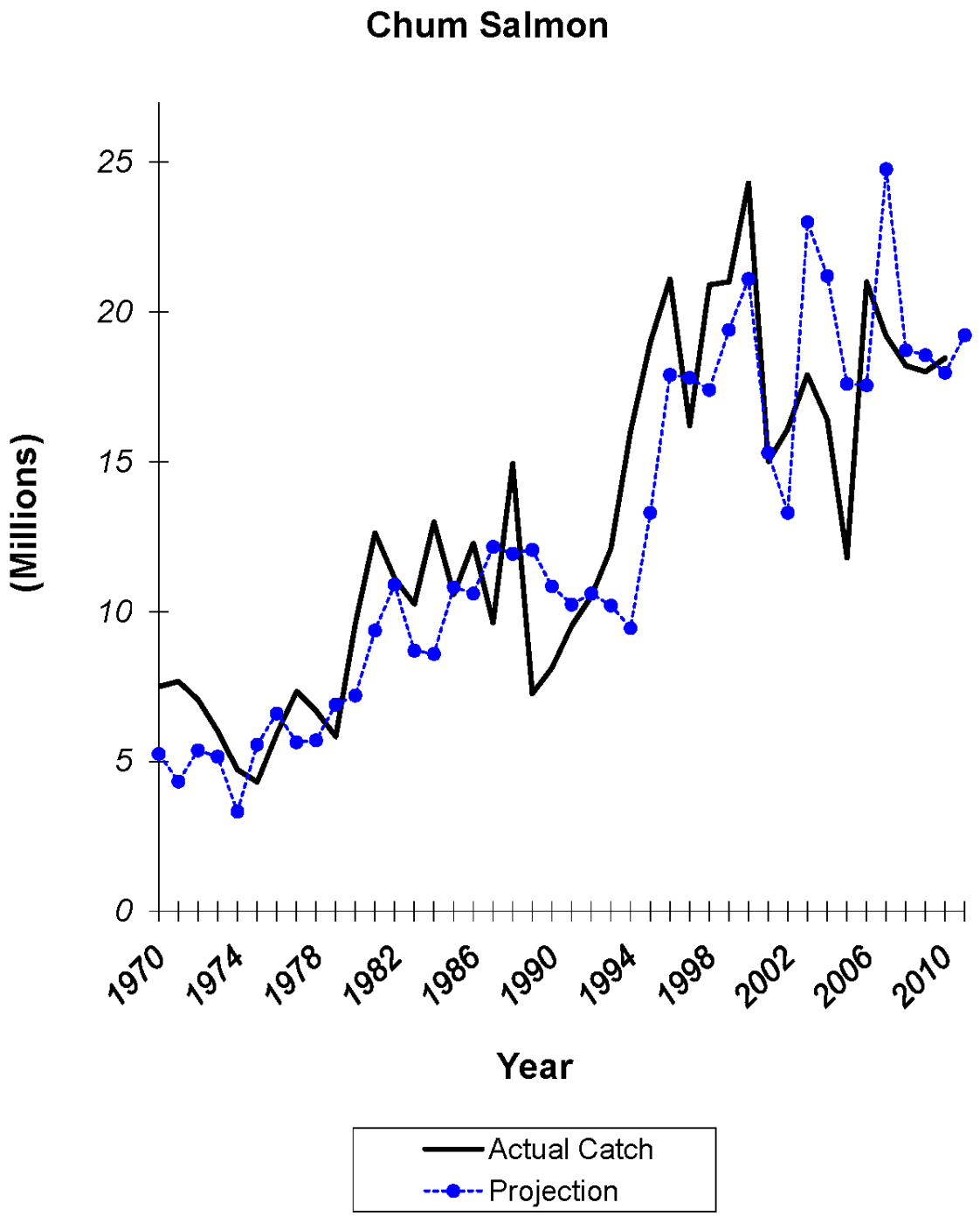

Figure 6.–Relationship between actual catch and projected catch in millions, for Alaskan chum salmon fisheries from 1970 to 2010, with the 2011 projection.

APPENDICES

Forecast Area: Southeast Alaska
Species: Pink Salmon

The Southeast Alaska pink salmon harvest in 2011 is predicted to be in the excellent range, with a point estimate of 55 million (80% confidence interval: 43–67 million). The categorical ranges of pink salmon harvest in Southeast Alaska were formulated from the 20th, 40th, 60th, and 80th percentiles of historical harvest from 1960 to 2010.

Category	Range (millions)	Percentile
Poor	Less than 11	Less than 20th
Weak	11 to 16	20th to 40th
Average	16 to 28	40th to 60th
Strong	28 to 50	60th to 80th
Excellent	Greater than 50	Greater than 80th

Forecast Methods

The 2011 forecast was produced in two steps: (1) a forecast of the trend in the harvest, and (2) the forecast trend adjusted using 2010 juvenile pink salmon abundance data. The forecast of the trend in pink salmon harvests 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 forecast estimate. 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 datum, 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,

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

We estimated a value of c to be approximately 0.46, based on minimizing the sum of past squared errors in the entire data set (odd and even years combined).The forecast for year t, that is $\hat{x}_t$, is also a weighted average of the forecast made for year t-1 and the actual harvest in year t-1. This is a kind of recursive equation that contains all of the data in the series. Because the recent harvest series has developed an odd-year and even-year cycle, we let t be 2009, the parent year for the 2011 return. Since the formula used to calculate the forecast is a weighted average of the 2009 harvest and its associated forecast, which was also based on the associated parent year harvest and forecast, this forecast is based entirely on odd-year data. That is, we used all of the odd-year harvest data up to 2009, assuming that the 2009 parent year and other odd years in the series will better predict the 2011 return. This analysis produced a forecast of 46 million pink salmon (Figure A1).

We adjusted the forecast using peak June/ July juvenile pink salmon CPUE statistics provided by the NOAA Fisheries, Alaska Fisheries Science Center, Auke Bay Laboratories (Joe Orsi, Auke Bay Laboratories, personal communication). These data were obtained from systematic surveys conducted annually in upper Chatham and Icy straits in conjunction with NOAA's Southeast Coastal Monitoring Project and are highly correlated with the harvest of adult pink salmon in the

following year (see Orsi et al. 2006[a]). We developed a simple equation to predict the forecast error in the exponential smooth by regressing the forecast error proportions from 1998 to 2010 on the corresponding NOAA CPUE data from 1997 to 2009 (Figure A2). The forecast error proportion was simply the forecast error (the exponential smooth forecast subtracted from the actual harvest) divided by the forecast point estimate. We predicted the 2011 forecast error and adjusted the exponential-smooth forecast upward, from 46 million to 55 million pink salmon (Figure A3). The forecast range (43–67 million) is based on an 80% confidence interval, calculated by cross-validation estimates of the forecast error.

Forecast Discussion

The 2011 forecast of 55 million pink salmon is well above the recent 10-year average harvest of 40 million, and is near the average harvest for the past five odd years. The parent-year escapement index in 2009 of 12.7 million ranked 14th since 1960 and was 76% of the prior 10-year average of 16.6 million. Although the overall escapement index was below the prior 10-year average, BEGs were met for all three subregions in Southeast Alaska and escapements appeared to be well distributed across the region. Management targets for pink salmon were met for all 15 districts with management targets and, at a finer scale, for 41 of the 46 pink salmon stock groups. In addition, the NOAA Auke Bay Lab's 2010 peak June/July juvenile pink salmon CPUE statistic from upper Chatham and Icy straits in northern Southeast Alaska ranked in the top third out of the 13 previous years that NOAA has collected that information, which indicates good freshwater and early marine survival for pink salmon set to return in 2011. Pink salmon harvests associated with the top third of indices in their data set ranged between 45 and 78 million.

The NOAA Auke Bay Lab continues to conduct research that has greatly improved our ability to forecast pink salmon harvests in Southeast Alaska. ADF&G forecasts that were adjusted using NOAA's juvenile pink salmon data were much improved over previous forecasts (Figure A4). Hindcasts of past harvests (1998–2006) using this forecast method also exhibited fair to good performance in predicting the direction of forecast error (Figure A3). Even if these hindcast values were not always precise (e.g., in 2006), the ability to predict if the harvest will be greater than average or less than average is an immense improvement over past ADF&G forecasts. For these reasons, we are using this method to forecast the pink salmon harvest for a fifth straight year.

The department will manage the commercial purse seine 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.

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[a] We gratefully acknowledge the assistance and advice of Joe Orsi and Alex Wertheimer (retired) and their colleagues at the NOAA Auke Bay Lab. However, we accept responsibility for this forecast, and we accept sole responsibility for this use of their data. For a detailed description of these NOAA research activities see: Orsi, J. A., E. A. Fergusson, M. V. Sturdevant, B. L. Wing, A. C. Wertheimer, and W. R. Heard. 2006. Annual survey of juvenile salmon and ecologically related species and environmental factors in the marine waters of Southeastern Alaska, May–August 2005 (NPAFC Doc. 955) Auke Bay Lab., Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA. http://www.npafc.org/new/pub_documents.html

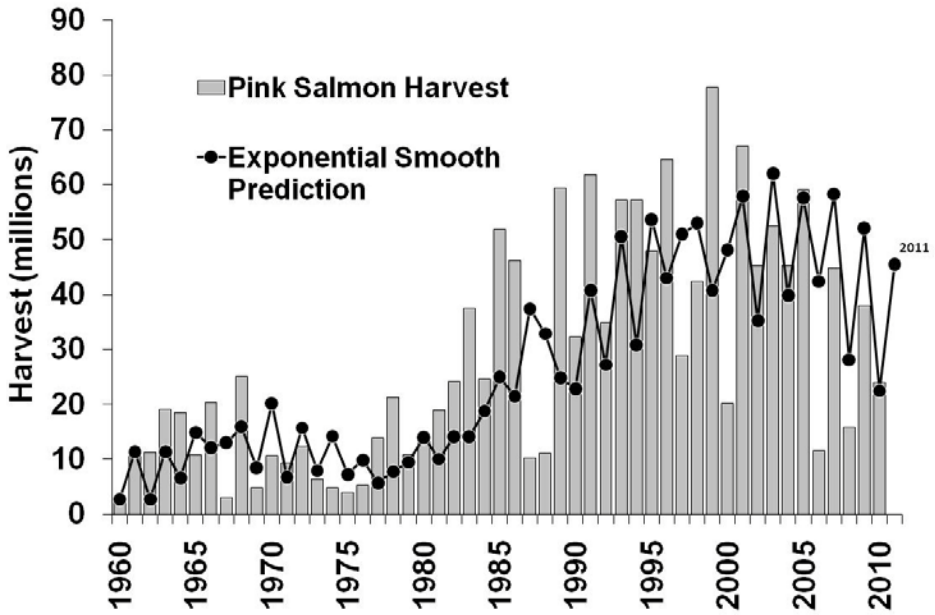

Figure A1.– Comparison of the annual harvest of pink salmon in Southeast Alaska, and exponential smoothed hindcast values of the harvest used in the 2010 forecast model. This method produced a 2010 harvest forecast of 22 million pink salmon.

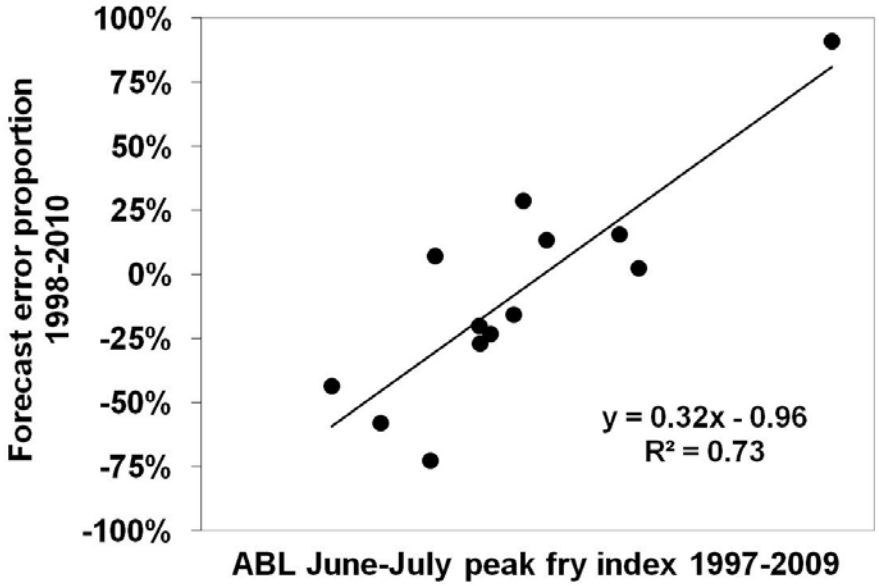

Figure A2.–Regression of ADF&G forecast error proportion on the peak June–July juvenile pink salmon index from Icy Strait one year prior. The forecast error is a proportion calculated by dividing the forecast error (the annual ADF&G forecast subtracted from the actual harvest) by the forecast point estimate.

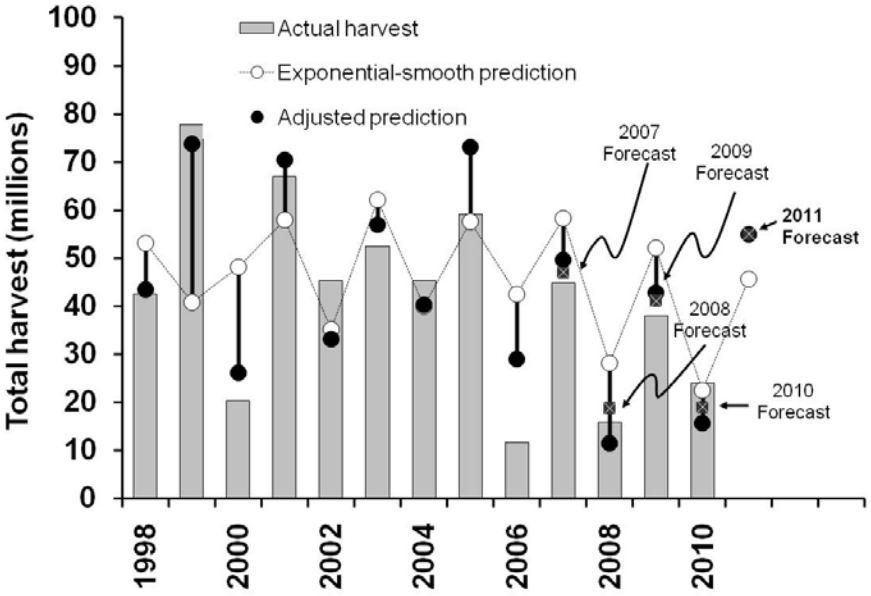

Figure A3.–Annual harvest of pink salmon in Southeast Alaska, 1998–2010, compared to the exponential smoothed hindcast predictions of the harvest adjusted using NOAA Auke Bay Laboratory juvenile pink salmon data. The 2007–2010 ADF&G harvest forecasts were very close to the actual harvests in those years.

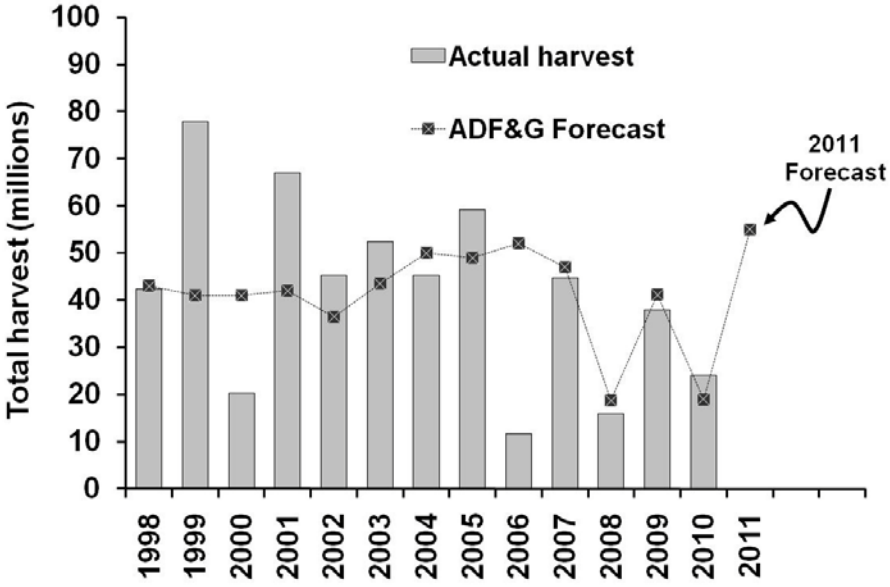

Figure A4.–Annual harvest of pink salmon in Southeast Alaska compared to the ADF&G preseason harvest forecast, 1998–2010. The 2007–2010 ADF&G harvest forecasts were adjusted using NOAA's juvenile pink salmon data.

Andy Piston, Fishery Biologist, Ketchikan
Steve Heinl, Salmon Research Supervisor, Ketchikan

Forecast Area: Prince William Sound
Species: Pink Salmon (Wild Only)

Preliminary Forecast of the 2011 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	5,550	2,900–8,200
Escapement Goal [a]	2,000	
Harvest Estimate [b]	3,550	900–6,200

[a] The escapement goal of 2.0 million pink salmon is the midpoint of the SEG range (1.25–2.75 million).
[b] Includes the harvests from commercial, subsistence, and sport fisheries.

Forecast Methods

The predicted natural total run of pink salmon in 2011 is estimated from an exponential smoothing model. Exponential smoothing is a time series model where each annual forecast is a weighted average of the previous total run estimate ( ) and the previous smoothing forecast ( ). If y_t, y_{t-1}, … represent the observed total natural run in years t and t-1, …, the forecast in year t+1 is estimated as,

The smoothing factor or constant in the model is c ($0 < c < 1$). We estimated c at 0.71 by minimizing the mean absolute percentage error (MAPE) of model forecasts for the odd cycle years 1965–2009. The exponential smoothing is a recursive function as each forecast for year t (is a weighted average of the total run estimate in year t-1 and the forecast in year t-2. The total natural run by year was estimated as the total natural (nonhatchery) contribution to commercial harvests combined with the stream escapement index. The stream escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. No adjustments to the escapement index were made for aerial observer efficiency (~44%), the proportion of the total escapement represented by the index streams (~80%) or the number of hatchery strays in streams. The natural pink salmon contributions to the CPF were estimated by subtracting hatchery contributions from the CPF total. Hatchery contributions were determined by thermal marked otolith recoveries (1997–2010), coded wire tag recoveries (1985–1996), or average fry-to-adult survival estimates multiplied by fry release numbers and estimated exploitation rates. The 2011 prediction procedure differs from the 2000–2010 methods that used averages of previous total runs and the 1997–1999 method that used linear regressions of adult production versus brood year escapement index. Prior to 1997, forecast methods employed surveys of pre-emergent fry; however, these surveys have not been conducted since 1995. An approximate 80% prediction interval for the total run forecast was calculated using the squared deviations between 2006–2010 forecasts and actual run sizes as the forecast variance (mean squared error):

$$\hat{y} \pm t_{\alpha/2,n-1} \times MSE$$

Where is the forecast prediction from the exponential smoothing model described above, *t* is the critical value, *n* is the sample size and *MSE* is the mean squared error.

Forecast Discussion

Beginning in 2004, the department stopped producing hatchery pink salmon forecasts because the hatchery operators were already producing forecasts for their releases. Forecast methods examined for the 2011 natural run included: (1) the previous odd-brood-year total run (most naïve forecast method), (2) total run averages with 2 to 10 years of data, and (3) linear regression of log-transformed total PWS escapement versus log-transformed total PWS return by brood line, (4) exponential smoothing models using all years or just odd brood years, (5) exponential smoothing forecasts corrected with juvenile survey CPUE,(6) juvenile survey CPUE vs. total run, and (7) the inclusion of Pacific Decadal Oscillation (http://jisao.washington.edu/pdo/) and GAK1 water temperature data (http://www.ims.uaf.edu/gak1/) in the regression models. The 2011 forecast was generated with the lag-1 exponential smoothing model because the model forecasts (2006–2010) had the lowest MAPE (76%) and the lowest standard deviation of the MAPE (102%). The exponential smoothing model tracks the long-term trends in total run, but does predict surprise events, such as the 2008 and 2009 pink salmon runs.

The brood year 2009 escapement index (1.8 million) was within the SEG range (1.25 million to 2.75 million) and ranked 10th of the observed odd year escapements since 1960. If the 2011 total run forecast is realized, it will be the 14th largest among the 25 odd brood year returns since 1960. Environmental factors, which likely play a role in determining pink salmon returns in PWS, have been quite dynamic during the past four to five years. A warm regime, coinciding with generally high productivity of salmon, began in approximately 1977. Beginning in 2007, ocean temperatures at GAK1 along the Seward line were well below average (http://www.ims.uaf.edu/gak1/). The last few years have also been one of the longest periods of cold conditions, as measured by Pacific Decadal Oscillation index values, since the 1970s (http://jisao.washington.edu/pdo/). However, an El Nino event that spanned from 2009 to 2010 corresponded to a period of positive Pacific Decadal Oscillation index values (http://www.elnino.noaa.gov/index.html) and the pink salmon returning to PWS in 2010 spent much of their ocean lives in warmer El Nino conditions. With the passing of the 2009 to 2010 El Nino event, Pacific Decadal Oscillation values again became negative in June of 2010 and remain negative through November 2010. The developing La Nina event (http://www.elnino.noaa.gov/lanina.html) will likely keep ocean temperatures colder than normal in the northern Pacific through at least the spring of 2011. It will not be known for several more years if the recent period of relatively cold ocean conditions signals the beginning of a new cold regime.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

Forecast Area: Prince William Sound
Species: Chum Salmon (Wild Only)

Preliminary Forecast of the 2011 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound General Districts		
Total Run	400	390–410
Escapement Goal [a]	200	
Harvest Estimate	200	190–210

[a] The escapement goal of 91,000 chum salmon is the minimum threshold of the SEG range. It is the intention of ADF&G to manage for the long-term escapement mean of 200,000 among all districts with an existing SEG.

Forecast Methods

The forecast of the total natural chum salmon run was calculated as the 5-year (2006–2010) average. The total natural run by year was estimated as the total commercial harvest contribution combined with the escapement index. The escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. No adjustments to the escapement index were made for aerial observer efficiency, the proportion of the total escapement represented by the index streams, or the number of hatchery strays in streams. The CPF harvest contributions of natural stock chum salmon were estimated using pre-hatchery average wild runs (2002 and 2003) or thermally marked otolith estimates (2004–2010) for each district in PWS. The forecast range is the 80% prediction interval about the 5-year mean run size. The prediction interval was calculated as:

$$\tilde{y} \pm t_{\alpha/2,n-1} \times s\sqrt{1+\frac{1}{n}}$$

Where $\tilde{y}$ is the average total run of the five previous years (2006–2010), t is the critical value, s is the standard deviation and n is the sample size.

Forecast Discussion

Beginning in 2004, the department stopped producing hatchery chum salmon forecasts because the hatchery operators were already producing forecasts for their releases. Our ability to accurately forecast natural chum salmon stocks is limited by the small amount of data available. Estimates of natural stock contributions to CPF were unavailable prior to 2003. From 2003 to 2010 natural chum salmon contribution estimates based on thermally marked otoliths were available for the Coghill and Montague districts. Contribution estimates from thermal marked otoliths in other districts have been available since 2004. Historical chum salmon age data from escapements and CPF harvests are unavailable for most districts of PWS. If the 2011 wild chum salmon forecast of 400,000 is realized, it would be the 28th largest of the 42 years since 1970. For comparison, the estimated total run size was well over 1.3 million from 1981 to 1988, but has not surpassed 1 million since 1988.

The cold ocean temperatures and negative Pacific Decadal Oscillation index values discussed previously for pink salmon may also negatively affect the run of chum salmon in 2011. However, chum salmon, which spend multiple years in the ocean may benefit from the 2009 to 2010 El Nino event.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

Forecast Area: Prince William Sound
Species: Sockeye Salmon (Wild Only)

Preliminary Forecast of the 2011 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Prince William Sound, Coghill Lake		
Total Run	170	140–200
Escapement Goal[a]	30	
Harvest Estimate[b]	140	110–170
Prince William Sound, Eshamy Lake		
Total Run	35	10–60
Escapement Goal[c]	21	
Harvest Estimate	15	0–40
Total Production		
Run Estimate	205	170–240
Escapement Goal	51	
All Harvest[b,d]	155	120–1,901

[a] The escapement goal of 30,000 for Coghill Lake is the midpoint of the escapement goal range (20,000–40,000).
[b] Includes harvest from commercial, subsistence, and sport fisheries.
[c] The escapement goal of 20,500 for Eshamy Lake is the midpoint of the escapement goal range (13,000–28,000).
[d] The total PWS harvest estimate does not include the average annual Unakwik District commercial harvest of approximately 6,600.

Forecast Methods

The natural sockeye salmon run forecast to Coghill Lake is the total of estimates for five age classes. A linear regression model with natural log-transformed data was used to predict returns of age-1.3 sockeye salmon. This linear regression model was parameterized using the historical relationship between returns of age-1.3 fish and returns of the age-1.2 fish one year previous, which are from the same brood year. For example, the model to predict the return of age-1.3 sockeye salmon in 2011 used the return of age-1.2 fish in 2010 as the input parameter. We generally use a similar regression model to predict the total return of age-1.2 sockeye salmon returning to Coghill Lake. However, the number and percentage of age-1.1 (jack) sockeye salmon returning to the Coghill Lake weir in 2010 were the highest ever observed for this system, and we did not feel comfortable forecasting returns of age-1.2 sockeye salmon given that the input parameter (number of age-1.1 sockeye salmon) was well outside the bounds of any previous observation. Therefore, we used the 1974 to 2010 mean annual returns of age-1.2 sockeye salmon to Coghill Lake (34,000) rather than the regression model prediction (62,800) in the 2011 forecast. Predicted returns of age-1.1, -2.2, and -2.3 sockeye salmon were also calculated as the 1974 to 2010 mean return of that age class. Although harvest, escapement numbers, and age composition data have been available for Coghill Lake sockeye salmon runs since 1962, escapement numbers prior to the 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% prediction intervals. An approximate 80% prediction interval for the total run forecast was calculated using the squared deviations between the 2006 to 2010 forecasts and actual runs as the forecast variance:

$$\tilde{y} \pm t_{\alpha/2,n-1} \times MSE$$

Where $\tilde{y}$ is the forecast prediction from the linear regression model described above, *t* is the critical value, *n* is the sample size and *MSE* is the mean squared error. Historically, sibling model estimates of age-1.3 returns to Coghill Lake have a much lower MAPE (~35%) than the sibling model used to predict returns of age-1.2 fish (~135%).

The forecast of the natural run to Eshamy Lake is the mean of the runs from the fourth year in the 4-year cycle. Eshamy Lake escapement has 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 for only some years after 1962. Data collected since 1970, excluding 1987 and 1998, were used to calculate the forecast. The 80% prediction interval was calculated using the equation described for wild chum salmon.

PWS total run and common property harvest forecasts were calculated from the sum of Coghill and Eshamy lakes midpoint forecasts. The 80% prediction intervals were calculated as the sum of the point estimates plus/minus the square root of the sum of the squared differences between the individual point estimates and 80% prediction intervals for Coghill and Eshamy lakes.

Forecast Discussion

Beginning in 2004, the department stopped forecasting hatchery runs of sockeye salmon to MBH because hatchery operators were already producing forecasts. Coghill Lake has very dynamic limnological characteristics that significantly impact the sockeye salmon population. Studies conducted in the mid 1980s and early 1990s indicated the lake may be zooplankton limited. As a result, the BEG midpoint was lowered in 1992 (from 40,000 to 25,000) to allow zooplankton populations to recover. Fertilizers were added to the lake (1993–1996) in a cooperative project with the U.S. Forest Service to improve the forage base for rearing sockeye salmon juveniles. In 2005, current data were reviewed and the midpoint escapement goal remained unchanged while the goal type was changed from a BEG to an SEG. Also, in 2002 the department began collecting limnological data to monitor basic lake characteristics. The Coghill Lake natural run escapement has been within or above the escapement goal range every year since 1995. If achieved, the 2011 total run forecast midpoint (172,100) would rank as the fourth largest run since 1988. The majority (126,700 of 172,100) of the overall Coghill Lake wild sockeye salmon forecast is predicted to come from age-1.3 fish from the 2006 brood year. It is unknown how floods in 2006 will impact the 2011 run. It is possible that some redds were washed away during these flooding events, but the return of age-1.2 sockeye salmon in 2010 was slightly larger than the historical average. Other factors that may influence the Coghill Lake wild sockeye salmon run in 2011 are the 2009–2010 El Nino event (http://www.elnino.noaa.gov/index.html) and the trend towards cooler ocean temperatures since 2007 (http://jisao.washington.edu/pdo/).

The Eshamy Lake natural stock appears to exhibit a 4-year cycle. The 2011 run is the fourth year in the cycle. Historically, the Eshamy Lake natural stock was the largest natural stock contributor to CPF harvests of sockeye salmon in PWS outside of the Coghill District, and contributed to a substantial incidental harvest by the purse seine fishery in the Southwestern District. Although escapements into Eshamy River have been counted at a weir for 50 years, only periodic collection

of age, sex, and size data has occurred for the Eshamy and Southwestern districts CPF harvests because of inconsistent harvest and delivery locations outside of Cordova. Contributions to CPF harvests in western PWS of sockeye salmon produced by the MBH have been estimated by recovery of coded wire tags and thermally marked otoliths. However, not all harvests can be adequately sampled, increasing the uncertainty of total run estimates for all natural and enhanced sockeye salmon stocks in western PWS. Age composition data and weir counts were not collected in 1987 and 1998 because of budget reductions. The ongoing Eshamy River weir operation and thermal otolith marking of MBH sockeye salmon should produce more accurate estimates of total Eshamy Lake natural runs.

The escapement goal for Eshamy Lake was reviewed in 2008 and the range was changed. The new BEG range is 13,000 to 28,000 (midpoint 20,500). The old range was 20,000 to 40,000.

Steve Moffitt, Area Finfish Research Biologist, Cordova
Rich Brenner, Finfish Research Biologist, Cordova

Forecast Area: Copper River
Species: Chinook Salmon

Preliminary Forecast of the 2011 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	39	11–65
Escapement Goal[a]	24 or greater	
Harvest Estimate[b]	14	0–41

[a] The spawning escapement goal of 24,000 is the minimum threshold of the SEG range. ADF&G intends to manage for the estimated long-term average escapement of 26,000.

[b] The maximum harvest by all fisheries (subsistence, personal use, sport, and commercial). Given the recent 5-year average exploitation rate, the commercial harvest would be about 9,200.

Forecast Methods

Forecast methods examined for the Chinook salmon forecast included: (1) a pseudo-sibling model using commercial harvest age data and inriver abundance estimated as the Miles Lake sonar count multiplied by the proportion of Chinook salmon in the Chitina Subdistrict personal use fishery (brood years 1977–2005), (2) a pseudo-sibling model using commercial harvest age data and inriver abundance data from the mark–recapture program (brood years 1993–2005), (3) the previous year's run size (most naïve method), and (4) mean total run size estimates (2-, 3-, 4-, and 5-year averages). The first pseudo-sibling model using log transformed data produced reasonable model fits for age 1.2 to predict age 1.3 ($p < 0.01$), but marginal fits for the model using age 1.3 to predict age 1.4 ($p = 0.08$). Additionally, retrospective forecasts using the pseudo-sibling models had MAPE greater than those from any of the mean run size models. Retrospective forecasts using a 2-year total run average had a smaller MAPE (28%) and a smaller standard deviation of the MAPE (26%) than the other mean total run forecasts except the most naïve forecast (the previous year's run size). Therefore, the forecast for 2011 is the previous 2-year (2009–2010) total run average.

The 80% prediction interval was calculated using the equation described for wild chum salmon runs. The harvest forecast is the total run estimate minus the lower bound SEG of 24,000. Therefore, the harvest estimate is the maximum harvest estimate.

Forecast Discussion

The department did not generate a formal Chinook salmon total run forecast between 1998 and 2007 because of inadequate number of inriver abundance or spawning escapement estimates. Forecasts made prior to 1998 used aerial survey indices adjusted to approximate the total escapement. These forecasts performed poorly, especially after the number of aerial surveys was significantly reduced in 1994. In 1999, ADF&G's Division of Sport Fish began a mark–recapture program to estimate the inriver abundance of Chinook salmon. The Native Village of Eyak became a collaborator on the project and eventually took the lead in its operation. There are currently 12 years (1999–2010) of inriver abundance estimates; however the 2010 estimate has not been finalized.

The 2011 total run forecast point estimate (38,000) is ~35,000 below the 10-year average (2001–2010 average = 73,000). The age-5 component of this forecast could be reduced from two significant flood events in August and October of 2006 and the generally cooler ocean conditions measured in the north Pacific since 2007. If realized, the 2011 forecast total run would be the second smallest since 1999 and only slightly larger than the estimated total run for 2010 (32,000).

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Forecast Area: Copper River
Species: Sockeye Salmon

Preliminary Forecast of the 2010 Run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	1,690	980–2,400
Escapement Goal[a]		
Upper Copper River	361	
Copper River Delta	169	
All Harvest[b]	1,160	510–1,810
Hatchery And Supplemental Production		
PWSAC - Gulkana Hatchery		
Hatchery Run	320	190–450
Broodstock Needs	20	
Supplemental Escapement[c]	100	
All Harvest[b]	200	150–480
Total Production		
Run Estimate	2,010	1,170–2,850
Natural Escapement Goal	530	
Broodstock Needs	20	
Supplemental Escapement[c]	100	
All Harvest[d,f]	1,360	700–2,020

[a] The escapement goal of 530,000 is the historical average spawning escapement (361,000) of the upper Copper River (spawning escapement goal range 300,000–500,00) combined with the historical average Copper River delta aerial survey peak count multiplied by 2 (spawning escapement goal range 55,000–130,000). The average Copper River delta peak count of 84,500 is multiplied by 2 to adjust for surveyor efficiency, i.e., we assume surveyors count 50% of the total fish. No adjustment is made for freshwater residence time. Therefore, the escapement goal is 361,000 (upriver) + 84,500 × 2 (delta) = 530,000.

[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] The Upper Copper inriver goal categories include spawning escapement (sockeye and other salmon); sport, subsistence, and personal use fishery harvests; and hatchery broodstock and supplemental escapement per 5 AAC24360(b). The inriver goal estimate is preliminary until upriver harvests estimates for 2010 are available.

[e] The common property harvest midpoint estimate is 1.18 million sockeye salmon and the 80% probability of capture is 520,000–1.84 million. The point estimate is calculated as the total run estimate minus the sockeye salmon portion of the inriver goal and the Copper River Delta escapement goal.

Forecast Methods

Forecast methods for 2011 are similar to those used since 1998. The forecast of natural sockeye salmon to the Copper River is the total of estimates for six age classes. Linear regression models with log-transformed data were used to predict returns for age-1.2, -1.3, and -2.2 sockeye salmon. These three age classes were predicted from the relationship between returns of that age class and returns of the age class one year younger from the same brood year (sibling model). The predicted return of age-1.1, -0.3, and -2.3 sockeye salmon were calculated as the 5-year (2006–2010) mean return of those age classes. The total common property harvest forecast was

calculated by subtracting the Gulkana Hatchery broodstock, hatchery surplus, and wild stock escapement goal needs (upriver and delta) from the total run forecast. The commercial common property estimate was calculated by subtracting from the total run a preliminary estimate the inriver goal categories (5 AAC 24.360(b)) and the Copper River Delta spawning escapement goal. The 80% prediction bounds for the total run and harvest forecast were calculated using the method described previously for Coghill Lake sockeye salmon except only the years 1983 to 2010 were used in the calculation of mean squared error.

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 to 1998. The survival estimates were calculated using coded wire tag recoveries in harvests and enumerated adult escapements. Supplemental production from Gulkana I and Gulkana II hatcheries was estimated from fry releases and a fry-to-adult survival of 1% percent. The run was apportioned to brood year using a maturity schedule of 13% age 4 and 87% age 5. The average estimated exploitation rate (62%) for 2000 to 2009 was used to project the total harvest of Gulkana Hatchery stocks in 2011. The 80% prediction interval for the forecast of supplemental production was calculated using the mean square error estimate of the total run described above for Coghill Lake sockeye salmon.

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 from 1995 to 1998. The survival estimates were calculated using coded wire tag recoveries in harvests and enumerated adult escapements. Supplemental production from Gulkana I and Gulkana II hatcheries was estimated from fry releases and a fry-to-adult survival of 1%. The run was apportioned to brood year using a maturity schedule of 13% age 4 and 87% age 5.

The average estimated exploitation rate (67%) for 2000 to 2009 was used to project the total harvest of Gulkana Hatchery stocks in 2010. The 80% prediction interval for the forecast of supplemental production was calculated using the mean square error estimate of the total run described above.

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. Because average return-per-spawner values do not reflect recent production trends, and because returns are still incomplete from the most recent brood years, linear regressions of brood-year sibling returns were used to produce forecasts beginning in 1998. Additionally, more precise estimates of survival and contributions from supplemental production for individual brood years and release locations were available through coded wire tag recoveries in harvests and escapements for brood years 1995 to 1998.

Historical estimates of Gulkana Hatchery production prior to 1995 are considered imprecise. Improved contribution estimates for brood years from 1995 to 1998 indicate large contributions from supplemental production and smolt-to-adult survival estimates for Crosswind Lake releases that averaged about 20%. Fish marked with strontium chloride (Sr) began returning in 2003 (age 4) and the majority of the adult run (age 4 and age 5) was marked beginning in 2004. Fish from all release locations (Gulkana I and Gulkana II hatchery sites and Crosswind and Summit lakes)

are now marked, but all fish have the same mark. We can estimate the total contribution of enhanced fish from all Gulkana Hatchery releases, but unless different marks for individual releases can be developed, future forecasts will be limited to using fry-to-adult survival estimates and estimated maturity schedules to forecast total enhanced production.

The 2010 run will be composed primarily of returns from brood years 2005 and 2006. Five-year-old fish (brood year 2005) are expected to predominate the Copper River delta and upper Copper River runs. The Miles Lake cumulative sonar counts for 2005 were above the minimum objective all season and totaled 854,268. The cumulative sonar count in 2006 (959,706) exceeded the maximum inriver objective by the end of the season; however, the cumulative count did not reach the minimum cumulative objective until June 2. The Copper River delta escapement index for 2005 (58,406) was well below the 1999 to 2008 average (80,128); however, the 2006 (98,896) index was well above the 1999 to 2008 average.

The Gulkana Hatchery run will include 5-year-old fish from the largest Crosswind Lake smolt outmigration (approximately 2.5 million) and 4-year-old fish from the fifth largest smolt outmigration between 1989 and 2008. The run will also include 4-year-old fish from the 10th largest Summit Lake smolt outmigration and 4-year-old fish from the third largest smolt outmigration.

The 2010 total run forecast is about 50,000 above the recent 5-year average (2.13 million). If realized, the 2009 forecast total run would be the 10th largest since 1980 and only slightly smaller than the 2005 total run. The 1.7 million natural run would be about 270,000 below the recent 20-year average (1990–2009) of 1.97 million, and a 470,000 Gulkana Hatchery run would be almost 3 times the 5-year (2005–2009) average of 170,000. The large natural forecast is driven by the large number of 4-year-old (age-1.2) fish in 2009 and the subsequent prediction for a large number of 5-year-old (age-1.3) fish in 2010. The large enhanced run forecast is driven by the large smolt outmigration from Crosswind Lake in 2007 (~2.5 million).

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Forecast Area: Upper Cook Inlet
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (millions)	Forecast Range (millions)
Total Run	6.4	4.1–10.3
Escapement	1.6–2.0	
Harvest Estimate	4.4–4.8	

Forecast Methods

The major sockeye salmon systems in UCI are the Kenai, Kasilof, Susitna, and Crescent Rivers, and Fish Creek. Spawner, return, sibling, fry, and smolt data, if available, were examined for each system. Four models were used to forecast the run of sockeye salmon to UCI in 2011: (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 sibling adult returns. Several forecast models were evaluated for each stock and age class. Models providing the smallest MAPE between the forecasts and actual runs over the past 10 years were generally used. In most cases, these were sibling models. Forecast model predictions based on spawners, fry, smolt or siblings were compared to evaluate uncertainty.

The returns of age-1.3, -2.2, and -2.3 sockeye salmon to the Kenai River in 2011 were forecast using sibling models. For example, the sibling-model prediction of the return of age-1.3 sockeye salmon was based on the abundance of age-1.2 sockeye salmon in 2010. A spawner-recruit model prediction of the age-1.2 sockeye salmon return was based upon spawner abundance in 2007. Smolt models were used to forecast the returns of age-1.2, -1.3, -2.2, and -2.3 sockeye salmon to the Kasilof River. The smolt model used to forecast the return of age-2.2 sockeye salmon to Kasilof River included smolt weight as a covariate.

The total escapement of sockeye salmon to the Susitna River was forecasted using the recent 5-year average aggregate escapement into Judd, Shell, Chelatna, and Larson lakes expanded to the entire Susitna River watershed using mark–recapture abundance estimates from 2006 to 2009. The total run of Susitna River sockeye salmon to UCI was forecasted using the escapement and the mean harvest rate estimated from genetic stock composition of the commercial harvest from 2007 to 2009.

The sockeye salmon forecast for unmonitored systems in UCI was estimated as 15% of the aggregate forecast for the five major stocks. The fraction of the total run destined for unmonitored systems was estimated using genetic estimates of the stock composition of offshore test fishery harvests.

An aggregate range of sockeye salmon escapements was calculated for this forecast due to uncertainty regarding actions that may be taken at the upcoming Alaska Board of Fisheries meeting. Aggregate escapements were estimated from the sum of the midpoints of the escapement goal ranges for each of the major sockeye salmon producing systems in UCI and the

escapement into unmonitored systems (estimated as 15% of the aggregate escapement into monitored systems). Beginning in 2011, ADF&G will be counting sockeye salmon escapements on the Kenai and Kasilof rivers using new dual-frequency identification sonar (DIDSON). ADF&G has established new escapement goals for Kenai late-run sockeye salmon (700,000–1,200,000) and Kasilof sockeye salmon (160,000–340,000) based upon this new sonar system. The lower aggregate bound of sockeye salmon escapements was calculated using the midpoint (850,000) of the current Kenai late-run sockeye salmon inriver escapement goal (750,000–950,000) given the 2011 Kenai sockeye salmon forecast (3.9 million). The upper aggregate bound of escapements was calculated by applying the mean expansion factor (1.4) between historical Kenai Bendix and DIDSON sonar counts to the midpoint of the inriver goal (850,000). The total harvest by all user groups was estimated by subtracting the lower and upper bounds of the aggregate escapement range from the total run forecast for all stocks. The estimated sport harvest upstream of the sonar at river mile 19 on the Kenai River was subtracted from the aggregate escapement into monitored systems. The total run forecast range was calculated by multiplying the forecast times the upper and lower values of the percent error of the actual runs from published forecast runs from 2001 through 2010.

Forecast Discussion

In 2010, the harvest of sockeye salmon by all user groups in UCI was 3.6 million, while the preseason forecast was 2.3 million. The higher-than-expected harvest in 2010 was largely due to an above forecast run to the Kenai River. In 2010, the total run was 3.3 million to the Kenai River, 847,000 to the Kasilof River, 256,000 to the Susitna River, 131,000 to the Crescent River, and 209,000 to Fish Creek. The 2010 run forecast was 1.7 million to the Kenai River, 901,000 to the Kasilof River, 542,000 to the Susitna River, 148,000 to the Crescent River, and 142,000 to Fish Creek.

A run of 6.4 million sockeye salmon is forecasted to return to UCI in 2011 with a harvest by all user groups of 4.4 to 4.8 million. The forecasted harvest in 2011 (600,000–1.0 million) is above the 20-year average harvest by all user groups (3.8 million). The run forecast for the Kenai River is 3.9 million, which is 9% greater than the 20-year average run (3.6 million). Age-1.3 sockeye salmon typically comprise about 64% of the run to the Kenai River. A sibling model based upon the return of age-1.2 sockeye salmon in 2010 (663,000; 20-year average = 373,000) predicted a return of 3.0 million age-1.3 sockeye salmon. A fry model based upon the abundance of age-0 fry rearing in Skilak and Kenai lakes in the fall of 2007 (9.1 million; 20-year average = 17.8 million) predicted a return of 1.4 million age-1.3 sockeye salmon. The sibling model was used for this forecast, because the 10-year MAPE was lower for the sibling model (25%) than the fry model (62%). Age-2.3 sockeye salmon typically comprise about 17% of the run to the Kenai River. A sibling model based upon the return of age-2.2 sockeye salmon in 2010 (171,000; 20-year average = 248,000) predicted a return of 275,000 age-2.3 sockeye salmon in 2011. A fry model based upon the abundance of age-1 fry rearing in Skilak and Kenai lakes in the fall of 2007 (8.9 million; 20-year average = 1.6 million) predicted a return of 1.6 million age-2.3 sockeye salmon. The sibling model was used for this forecast because the 10-year MAPE was lower for the sibling model (28%) than the fry model (115%). The forecasted age-2.3 return is 56% less than the 20-year average return for this age class. The predominant age classes in the 2011 run should be age 1.3 (75%), age 1.2 (9%), and age 2.3 (7%). The 10-year MAPE for the set of models used for the 2011 Kenai sockeye salmon run forecast was 29%.

The sockeye salmon run forecast for the Kasilof River is 929,000, which is 3% greater than the 20-year average run (902,000). Age-1.3 sockeye salmon typically comprise about 35% of the run to the Kasilof River. The forecast for age-1.3 sockeye salmon is 325,000, which is 3% greater than the 20-year average return (315,000) for this age class. A smolt model based upon the abundance of age-1 sockeye salmon smolts in 2008 was used to forecast the return of age-1.3 sockeye salmon in 2011. The abundance of age-1 smolts in 2008 was 4.3 million, which is equal to the 20-year average abundance for this age class. A sibling model predicted a return of 316,000 age-1.3 sockeye salmon. The smolt model was used for this forecast because the 10-year MAPE was lower for the smolt model (23%) than the sibling model (27%). Age-1.2 sockeye salmon typically comprise about 30% of the run. The forecast for age-1.2 sockeye salmon is 242,000, which is 12% less than the 20-year average return (274,000) for this age class. A smolt model based upon the abundance of age-1 smolts (2.1 million) in 2009 was used to forecast the return of age-1.2 sockeye salmon in 2011. A sibling model forecasted a return of 309,000 age-1.2 sockeye salmon. The smolt model was used for this forecast because the 10-year MAPE was lower for the smolt model (39%) than the sibling model (50%). Age-2.2 sockeye salmon typically comprise about 24% of the run. The forecast for age-2.2 sockeye salmon is 286,000, which is 34% greater than the 20-year average return (213,000) for this age class. A smolt model based upon the abundance and mean weight of age-2 smolts in 2009 was used to forecast the return of age-2.2 sockeye salmon in 2011. The abundance of age-2 smolts in 2009 was 1.5 million, which is 9% less than the 20-year average abundance (1.7 million) for this age class. The mean weight of age-2 smolts in 2009 (6.8 g) was 22% greater than the 20-year average smolt weight (5.5 g). The predominant age classes in the 2011 run should be age 1.2 (26%), age 1.3 (35%), and age 2.2 (31%). The 10-year MAPE for the set of models used for the 2011 Kasilof sockeye salmon run forecast was 27%.

The sockeye salmon run forecast for the Susitna River (463,000) is 61% less than the 20-year average run (780,000). This forecast was derived from historical aggregate weir counts rather than sonar and age composition catch allocation models, because recent mark–recapture studies have shown that the Yentna sonar project underestimated sockeye salmon escapement causing estimates of adult returns to also be underestimated. Since this is only the second year a weir-based method has been used, no MAPE can be estimated. However, the 2010 forecast was 112% greater than the estimated actual run. The 20-year average run was calculated by expanding sonar abundance estimates using mark–recapture and genetic stock composition estimates.

The sockeye salmon run forecast for Fish Creek is 105,000, which is 10% less than the 20-year average run (116,000). Age-1.2 and -1.3 sockeye salmon typically comprise 78% of the run to Fish Creek. A fry model based upon the estimated abundance of age-0 fry entering Big Lake in 2008 (7.1 million; 15-year average = 13.7 million) predicted a return of 45,000 age-1.2 sockeye salmon. A sibling model based upon the abundance of age-1.2 sockeye salmon returning in 2010 predicted a return of 37,000 age-1.3 sockeye salmon in 2011. The age-1.2 forecast is 26% less than the 20-year average return (61,000) for this age class, while the age-1.3 forecast is 23% greater than the 20-year average return (30,000). The predominant age classes in the 2011 run should be age 1.2 (43%), age 1.3 (35%), and age 2.2 (12%).

The sockeye salmon run forecast for Crescent River is 131,000, which is 26% greater than the 20-year average run (104,000). Age-1.3 and -2.3 sockeye salmon typically comprise 75% of the run to Crescent River. Sibling models based upon returns of age-1.2 and -2.2 sockeye salmon in 2010 were used to forecast returns of age-1.3 (75,000) and -2.3 (31,000) sockeye salmon in 2011. The predominant age classes in the 2011 run should be age 1.3 (58%) and age 2.3 (24%). Run forecasts to individual freshwater systems are as follows.

System	Run	Inriver Goals
Crescent River	131,000	30,000–70,000
Fish Creek	105,000	20,000–70,000
Kasilof River	929,000	160,000–340,000
Kenai River[a]	3,941,000	
Susitna River	463,000	
Larson Lake	NA	15,000–50,000
Chelatna Lake	NA	20,000–65,000
Judd Lake	NA	20,000–55,000
Unmonitored Systems	835,000	NA
Total	6,404,000	

[a] See methods section for explanation of Kenai late-run sockeye salmon goals.

Mark Willette, Research Project Leader, Upper Cook Inlet

Forecast Area: Upper Cook Inlet
Species: Other Salmon Species

Preliminary Forecast of the 2011 Commercial Harvest

Natural Production	Forecast Estimate (thousands)
Pink Salmon	106
Chum Salmon	101
Coho Salmon	179
Chinook Salmon	14

Forecast Methods

The recent 5-year average commercial harvest was used to forecast the harvest of chum, coho, and Chinook salmon in 2011. The forecast for pink salmon was based upon the average harvest during the past 5 odd-numbered years.

Forecast Discussion

The recent 5-year average commercial harvest was used in the forecast, because regulatory changes have substantially restricted harvests of these species in recent years.

Mark Willette, Research Project Leader, Upper Cook Inlet

Forecast Area: Lower Cook Inlet
Species: Pink Salmon

Preliminary forecast of the 2011 run

Natural Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run	865	528–1,496
Escapement	266	105–424
Commercial Harvest	600	423–1,072

Note: Columns may not total exactly due to rounding to the nearest thousand fish.
Note: Commercial Harvest is Total Run – Escapement.
Note: Additional harvests may be expected from systems not included in the forecast.

Forecast Methods

The forecast of wild pink salmon runs to 10 harvest areas in the LCI Management area was based on a logarithmic regression of total run and escapement from 38 to 45 years of observations. The total run forecast for LCI natural production was the sum of the 10 individual harvest area forecasts. Upper and lower bounds around the total run forecast, however, were derived by multiplying the forecast times the upper and lower values of the percent error ([actual return – forecast return]/actual return) observed during the previous 10 years (excluding 2004). Forecasted commercial harvest ranges were obtained by subtracting corresponding escapement goals from the upper and lower bounds of the forecast range. The forecasted aggregate escapement was the sum of midpoints from the individual escapement goals. The total forecasted commercial harvest was the total run minus the aggregated escapement.

Forecast Discussion

Because pink salmon exhibit a 2-year life cycle, comparisons of run size are typically stratified by odd and even years to account for dominance of one line over the other. In LCI, dominance of one line is typically short lived, lasting two to six generations, before the opposing line becomes dominant. Despite the relative parity between odd and even year pink salmon returns in LCI over broad time scales, we continue to stratify run size comparisons by odd and even years to account for the short term dominance cycles.

In 2009, the last odd-numbered year, 7 of 10 forecasted systems had runs within the forecast range. The 2011 forecast for natural production of 865,000 pink salmon has a forecast range of 528,000 to 1.496 million. Variable strength parent-year escapements in 2009 and modest spawner-return ratios in recent years suggest there is only a fair likelihood of reaching the point estimate of this forecast range. If realized, a natural run of 865,000 pink salmon would be 4% lower than the mean run size (898,000) for odd-year returns between 1963 and 2009. The pink salmon cumulative escapement goal is 346,000 (range 127,000–565,000) for systems with a forecast. If the total run comes in as forecasted, the midpoint of the cumulative escapement goal range should be met for all index streams except Humpy Creek (42,000) and Bruin Bay River (38,000) which will fall short of their goals. The resulting accumulative escapement forecast would then be 266,000 pink salmon.

Four districts make up the LCI management area. The harvestable surplus of naturally produced pink salmon in Southern District is projected to be 8,000, with 7,000 coming from Port Graham River, and the balance from Seldovia Bay. Pink salmon are no longer produced by hatcheries in LCI. Consequently, no supplemental harvest of enhanced pink salmon will occur in 2011.

In Outer District, the number of naturally produced pink salmon available for harvest is projected to be 491,000, with over 60% (239,000) of the harvest expected to occur in Port Dick Subdistrict. If realized, the Port Dick harvest would be slightly more than the mean odd-year catch since 1963. The next largest harvest is projected to occur in Rocky Bay (127,000), while smaller harvests ranging from 20,000 to 84,000 are anticipated from Port Chatham, Nuka Island, and Windy Bay.

No pink salmon harvest is expected from the Eastern District in 2011. Commercial fishing specifically directed at pink salmon has not been allowed in Eastern District in recent years due to a combination of low production and potential conflicts with the Resurrection Bay Salmon Management Plan, which limits commercial interference with the sport coho salmon fishery.

In Kamishak Bay District, the number of naturally produced pink salmon available for harvest is projected to be 100,000, all of which is expected to occur in Ursus and Rocky Cove Subdistricts. If realized, the Ursus/Rocky Cove harvest of 100,000 would become the third highest for this index area. Although low market value and lack of tender service and available buyers have limited the incentive to harvest pink salmon in the Kamishak District over most of the previous decade, this trend could change based on significantly higher prices paid for pink salmon in LCI during the past three seasons.

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

Forecast Area: Kodiak
Species: Pink Salmon

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (millions)	Forecast Range (millions)
KMA Wild Stock Total Run	27.9	21.9–35.6
KMA Escapement Goal [a]	6.0	2.3–6.0
KMA Wild Stock Harvest	21.9	15.9–29.6
Kitoi Bay Hatchery Harvest [b]	7.4	4.9–9.8
Total KMA Pink Salmon Harvest	29.3	20.8–39.3

Note: Column numbers may not total or correspond exactly with numbers in text due to rounding.

[a] The 2011 escapement goal forecast combines Kodiak Archipelago odd-year aggregate (2.0 to 5.0 million) and the Mainland District aggregate (250,000 to 1.0 million), based on escapement goal recommendations for 2011.

[b] This figure is the total expected return (7.7 million) minus the broodstock collection goal of 350,000; the Kitoi Bay Hatchery cost recovery harvest is expected to be roughly 1.0 to 2.0 million.

The 2011 KMA predicted pink salmon harvest is expected to be in the Excellent category with a point estimate of 29.3 million (20.8 to 39.3 million) pink salmon combined from the wild stock and Kitoi Bay Hatchery harvests. Harvest categories were delimited from the 20th, 40th, 60th, and 80th percentiles of historical commercial harvest in the KMA from 1978 to 2010 and will be used to determine the length of initial fishing periods.

Total KMA Harvest Category	Range (millions)	Percentile
Poor	Less than 7.6	Less than 20th
Weak	7.6 to 10.7	21st to 40th
Average	10.7 to 14.4	41st to 60th
Strong	14.4 to 21.8	61st to 80th
Excellent	Greater than 21.8	81st to 100th

Forecast Methods

The KMA wild stock pink salmon harvest forecast is derived from a total run forecast minus the upper end (6.0 million) of the combined aggregate escapement goal ranges for the Kodiak Archipelago and Mainland ADF&G in 2010. Total run estimates were derived from a combination of weir counts on the Karluk and Ayakulik rivers, aerial survey indices, and harvest estimates. For the 2011 KMA wild stock pink salmon forecast, a generalized Ricker model was fit to the odd-year KMA returns from 1979 to 2009, utilizing KMA pink salmon indexed escapement for the spawner index. Four additional terms were included in this generalized Ricker model: (1) Karluk and Ayakulik rivers pink salmon weir counts, (2) average air temperature in March, (3) average precipitation in April and May, and (4) average air temperature in April and May.

The generalized model assumes that these environmental conditions affect survival at early life history stages of pink salmon and were lagged correspondingly. All environmental conditions were estimated from Kodiak Airport climate observations. In constructing and evaluating the regression model, standard regression diagnostic procedures were used. Based on the generalized Ricker model, 80% prediction intervals were estimated.

The 2011 KBH pink salmon forecast was prepared by evaluating pink salmon survivals from even brood years 1991 through 2009, when releases from KBH exceeded 100 million fry. Brood years 1996 through 2009 were particularly important to the forecasting model because all pink fry were released on the same day to saturate the release area with fry (predator satiation), a strategy shown to significantly improve fry to adult survival. The pink salmon return to KBH is odd-year dominant and has had exceptional marine survival every fourth year dating back to the first releases in 1977 (except 1997). The primary forecasting consideration for 2011 is this 4-year cycle, which should be above average in 2011 but weaker than 2009. The midpoint estimate of 7.7 million reflects a marine survival of 5.3%.

Forecast Discussion

The 2011 KMA wild stock pink salmon total run (27.9 million) will be well above average and the highest odd-year total since 1995. Confidence in the 2011 forecast estimate is fair based on the regression model and relatively large confidence intervals. Historically, odd-year returns are significantly harder to predict than even-year. Environmental conditions explored and used in the model affecting the early life survival of the 2011 pink salmon run were generally much better than average, but also hard to quantify because they were outside the ranges often observed. The effects of an unusually large flood in October of 2009 is uncertain; staff review of available literature found no conclusive effects of such flooding on other pink salmon populations. The 2009 indexed escapement estimate of 5.1 million pink salmon is above average.

The predicted wild stock total run is corroborated by ancillary information provided by the pink salmon fry abundance index estimated in Kodiak area harbors in 2010. This index was estimated using the methods of Arnie Shaul, an ADF&G area management biologist on the Alaska Peninsula from 1973 until 2005 who often predicted pink salmon abundance based on prior-year pink fry indices in nearshore waters.

The 2011 KBH pink salmon production is expected to be 7.7 million. The brood stock collection goal is 350,000, yielding a total hatchery harvest projection of 7.4 million. Cost recovery goals for 2011 have not yet been set, but are an estimated 1.0 to 2.0 million will be harvested in the cost recovery fishery. In 2010, 144.4 million fry were released, which was an average amount of juveniles. Average weight of pink salmon fry was 0.70 grams, which was slightly above average and likely due to warm conditions in late April and May.

This forecast level will allow an initial weekly fishing period length of 105 hours (4½ days) for most of the KMA during the initial general pink salmon fisheries (beginning July 6, 2011). By the third week of July, fishing time will likely be extended, by section or district, as true run strengths become known.

M. Birch Foster, Finfish Research Biologist, Kodiak
Drew Aro, Kitoi Bay Hatchery Manager, Afognak

Forecast Area: Kodiak, Spiridon Lake
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	133	45–222
Escapement Goal	0	
Harvest Estimate	133	45–222

Forecast Methods

The 2011 Spiridon Lake sockeye salmon forecast was prepared by investigating simple linear regression models using 1992 to 2008 outmigration-to-return relationships for three age classes. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Age-1.2, -2.2, and -1.3 fish were predicted from smolt outmigration estimates. All other age classes were estimated by summing the age classes (0.1, 0.2, 1.1, 0.3, 2.1, 3.1, 1.4, 2.3 and 3.2) by return year (1996–2010) and calculating the pooled median contribution. The total run forecast was calculated by summing individual and median age class estimates. When the median return by age class was used, prediction intervals were estimated by calculating the 10th and 90th percentiles of the data. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

Sockeye salmon are prevented from returning to Spiridon Lake because barrier falls block upstream migrations in the outlet creek (Telrod Creek). Therefore, all returning adult sockeye salmon are available for harvest, primarily in the Central Section of the Northwest Kodiak District and in the Spiridon Bay Special Harvest Area in Telrod Cove. The 2011 forecast of 133,000 is 43,000 less than the 2010 forecast (176,000) and 41,000 less than the actual 2010 run estimate (174,000). The 2011 run should be mainly age-1.2 (40%) and age-2.2 (34%). Confidence in this forecast is good due to the strength of the regression models. If realized, this run will be about 111,000 less than the recent 10-year average (2001 to 2010) run of 244,000. Peak run timing of Spiridon Lake sockeye salmon through the Westside fishery will be during the month of July.

M. Birch Foster and Mark J. Witteveen, Finfish Research Biologists, Kodiak

Forecast Area: Kodiak, Ayakulik River
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	713	491–934
Escapement Goal	300	200–400
Harvest Estimate	413	

[a] The escapement estimate and range are the midpoint and range of the combined escapement goals for the early (140,000–280,000) and late runs (60,000–120,000) in 2011.

Forecast Methods

The 2011 Ayakulik River sockeye salmon forecast was prepared primarily by investigating simple linear regression models that use saltwater age class relationships from recent outmigration years. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Age-.2 sockeye salmon were predicted from age-.1 returns using only recent outmigration years (1992 to 2008). The age-.3 sockeye salmon were predicted from age-.1 returns using outmigration years from 1992 to 2007. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. Both age-.1 and -.4 sockeye salmon were predicted by calculating the median return (outmigration years 1992 to present) and prediction intervals were calculated using the 10th and 90th percentiles of the returns. Regression and median estimates were summed to estimate the total Ayakulik River sockeye salmon run for 2011. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% confidence intervals for each age class forecasted.

Forecast Discussion

The 2011 Ayakulik River forecast of 713,000 is 43,000 more than the 2010 forecast (670,000) and about 194,000 more than the actual estimated run of 518,000 in 2010. The 2011 run should be mainly age-.2 (65%) and age-.3 (33%) fish, and would be 370,000 more than the recent 10-year average (2001–2010) and the largest run since 1999. Confidence in the 2011 forecast is good, due to strong regression relationships. The projected harvest (413,000) is based on achieving the midpoint (300,000) for the combined escapement goal ranges of the early and late runs. Escapement goals used are those recommended for 2011, based on a review by ADF&G in 2010.

M. Birch Foster, Finfish Research Biologist, Kodiak

Forecast Area: Kodiak, Karluk River
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

Total Production		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Run	Total Run Estimate	250	110–390
	Escapement Goal [a]	150	110–250
	Harvest Estimate	100	
Late Run	Total Run Estimate	410	315–505
	Escapement Objective [a]	270	170–380
	Harvest Estimate	140	
Total Karluk River System	Total Run Estimate	660	425–895
	Escapement Objective [a]	420	280–630
	Harvest Estimate	240	

[a] The escapement estimates and ranges are the approximate midpoints and the total ranges of escapement goals for the early (110,000–250,000), late (170,000–380,000), and total combined runs in 2011.

Forecast Methods

The forecasts for the 2011 early and late Karluk River sockeye salmon runs were based on available data from 1982 to the present. Simple linear and multiple regressions and Ricker curve relationships were modeled using outmigration year ocean age class relationships, sibling relationships, recent escapements, and zooplankton biomass in Karluk Lake. Each model was assessed with standard diagnostic procedures. Estimates were only used in cases where the model was significant. The minor age classes that could not be estimated with one of these models were estimated using pooled medians. The error structure of each model was used to calculate an 80% prediction interval and the 10th and 90th percentiles of the data were used to calculate the prediction interval of the median estimates.

The number of early run age-.2 sockeye salmon returning in 2011 was predicted based on the prior year return of age-.1 sockeye salmon and the average biomass of zooplankton in Karluk Lake during the two summers prior to outmigration, using a multiple regression relationship. Age-1.3 fish were predicted from their age-1.2 siblings using a simple linear regression relationship. Age-2.3 and -3.3 fish were predicted from their respective age-2.2 and -3.2 siblings using Ricker relationships. The remaining age classes were calculated using their pooled medians.

The number of late-run age-.2 sockeye salmon returning in 2011 was predicted using a multiple regression relationship from the average biomass of zooplankton in Karluk Lake during the two summers prior to outmigration and the average Karluk Lake escapement for the three years prior to outmigration. The age-.3 run was predicted from the prior year run of age-2.2 fish from both

the early and late runs using a Ricker relationship. The rest of the late run was calculated using the pooled medians of age-.1 fish and the pooled medians of all other remaining age classes.

The overall run estimates were calculated by summing each age class estimate. The overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The total 2011 sockeye salmon run to the Karluk River is expected to be approximately 660,000. The early run is expected to be approximately 250,000, which is about 218,000 below the recent 10-year average (468,000) and 169,000 above the 2010 run (81,000). The late run is expected to be approximately 410,000, which is 305,000 below the recent 10-year average (714,000) and 94,000 more than the 2010 run (316,000).

The projected harvest estimate for the early run (100,000) is based on achieving the midpoint of the early-run escapement goal range (150,000). The projected harvest estimate for the late run (140,000) is based on achievement of the midpoint of the late-run escapement goal range (270,000). Escapement goals used are those recommended for 2011, based on a review by ADF&G in 2010. The majority of both runs is expected to be age-.2 fish. Our confidence in the forecast is fair.

Mark Witteveen, Finfish Research Biologist, Kodiak

Forecast Area: Kodiak, Alaiak District, Frazer and Upper Station Rivers
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

TOTAL PRODUCTION		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Upper Station River	Total Run Estimate	56	16–97
	Escapement Goal [a]	43	43–93
	Harvest Estimate [c]	13	
Late Upper Station River	Total Run Estimate	348	235–461
	Escapement Goal [b]	186	120–265
	Harvest Estimate [c]	162	
Frazer Lake	Total Run Estimate	329	214–445
	Escapement Goal [d]	148	105–200
	Harvest Estimate [c]	181	
Total Alitak District	Total Run Estimate	734	465–1,003
	Harvest Estimate	357	

[a] The escapement estimate and range for the Upper Station early run are the lower bound and total range of the escapement goal range (43,000–93,000) in 2011; the Alaska Board of Fisheries instituted an optimal escapement goal of 25,000 in 1998.
[b] The escapement estimate and range for the Upper Station late run are the S_{MSY} estimate and range of the escapement goal (120,000–265,000) in 2011.
[c] The harvest of Upper Station bound sockeye salmon is concurrent with the harvest of Frazer Lake bound sockeye salmon and predominantly occurs within the Alitak Bay District.
[d] The escapement estimate is the S_{MSY} (118,000) and escapement goal range (75,000–170,000), plus an additional 30,000 that typically do not ascend the fish pass to Frazer Lake.

Forecast Methods

The 2011 sockeye salmon run to the Alitak District was forecasted with simple linear regression models using saltwater age class relationships by system from recent outmigration years (1998 to 2008). In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Returns of age-.2 sockeye salmon to the Frazer and Upper Station River early runs were predicted from prior year age-.1 returns; for the Upper Station late run, age-.2 returns were predicted based on prior year age-2.1 returns to the nearby Frazer Lake system. For both rivers (all three runs), returns of age-.3 sockeye salmon were predicted from prior age-.2 returns. Prediction intervals of 80% for the regression estimates were calculated using the variances of the regression models. For both rivers (all three runs), age-.1 and age-.4 sockeye salmon were predicted by calculating the median return (post-1998 outmigration year)

and prediction intervals were calculated using the 10th and 90th percentiles of the returns. Regression and median estimates were summed to estimate the total sockeye salmon run for 2011. Overall 80% prediction intervals were calculated as the square root of the sum of squared 80 percent confidence intervals for each age class forecasted.

Forecast Discussion

The 2011 sockeye salmon run to Alitak District is expected to be approximately 734,000, which is approximately 19,000 less than the recent 10-year average run (753,000) and 328,000 more than the 2010 run (425,000). The Upper Station River early run is expected to be approximately 56,000, well below the recent 10-year average (102,000). The Upper Station River late run is expected to be approximately 348,000, above the recent 10-year average (289,000). The Frazer Lake run is expected to be approximately 329,000, just below the recent 10-year average (361,000). The 2011 Alitak District sockeye salmon run should be predominantly age-.2 fish (~85%). Overall, our confidence in the forecast is fair, based on the regression models and the large confidence interval.

The projected harvest estimate of 357,000 is based on achievement of the lower end of the Upper Station early run and mid-point of the Upper Station late run and Frazer Lake escapement goal ranges.

M. Birch Foster, Finfish Research Biologist, Kodiak

Forecast Area: Chignik
Species: Sockeye Salmon

Preliminary Forecast of the 2011 Run

TOTAL PRODUCTION		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Run (Black Lake)	Total Run Estimate	1,299	608–1,989
	Escapement Goal	350	350–400
	Harvest Estimate [a]	949	
Late Run (Chignik Lake)	Total Run Estimate	1,024	738–1,309
	Escapement Objective [b]	250	250–400
	Harvest Estimate [a]	774	
Total Chignik System	Total Run Estimate	2,323	1,347–3,298
	Escapement Objective [b]	600	600–800
	Harvest Estimate		
	Chignik Area	1,402	
	SDML Area	92	
	Igvak Area	229	

Note: Column numbers may not total or correspond exactly with numbers in text due to rounding.

[a] The forecast escapement for the Chignik River early run in 2011 is the lower end and range of the SEG (350,000–400,000) recommended for 2011.

[b] The Chignik Lake late-run escapement goal is 200,000–400,000, resulting in an escapement goal of 550,000–800,000 for both runs combined. However, managers try to achieve an additional inriver goal of 50,000 in August and September.

Forecast Methods

Forecasts of 2011 early and late Chignik sockeye salmon runs were based on available data from 1977 to the present. Simple and multiple linear regressions were modeled using recent ocean age class relationships and smolt outmigration data. Each regression model was assessed with standard regression diagnostic procedures. The variance of each estimate was calculated from the error structure of the regression. Regression analyses were examined for serial autocorrelation.

The number of early run age-.3 sockeye salmon in 2011 was estimated based on the abundance of age-.2 sockeye salmon in 2010. Following nonsignificant regression results, the early-run age-.1, -.2, and -.4 components were predicted by calculating median returns since the 1981 outmigration year.

The number of late run sockeye salmon returning in 2011 was estimated using ocean age class relationships and smolt outmigration estimates. The age-.2 sockeye salmon were predicted from prior year's age-.1 returns using simple linear regression. Returns of age-.3 sockeye salmon were predicted by regressing the estimated age-1 and age-2 smolt from the same outmigration year. The age-.1 and -.4 sockeye salmon age classes were predicted by calculating the median returns.

The variances associated with individual regression estimates by age class were used to calculate 80% prediction intervals for those estimates. Prediction intervals for median estimates were calculated using the 10th and 90th percentiles of the data. For each run (early and late), the overall 80% prediction intervals were calculated as the square root of the sum of the squared 80% prediction intervals for each forecasted age class. The early- and late-run regression and median estimates were summed to estimate the total Chignik watershed sockeye salmon run for 2011. The combined early- and late-run 80% prediction interval was calculated by summing the lower prediction bounds and upper prediction bounds of the two runs.

Forecast Discussion

The 2011 sockeye salmon run to the Chignik River is expected to be approximately 2.32 million. The early run is expected to be approximately 1.30 million. The late run is expected to be approximately 1.02 million. The 2011 Chignik sockeye salmon run is expected to be approximately 350,000 more than the recent 10-year average run (1.97 million) and 71,000 less than the 2010 run (2.39 million).

The projected early-run harvest estimate (949,000) is based on achieving the lower end of the early-run escapement goal range (350,000). The projected late-run harvest estimate (774,000) is based on achieving the lower end of the late-run inriver run goal range through September 15 (250,000). Harvest estimates for both runs 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.

Available smolt data were analyzed with simple linear regression, using the number of outmigrating age-2 smolt to predict the subsequent age-.3 adult returns (about 83% of the run). This estimate was then expanded proportionally to account for other ages (age-.1. -.2, and -.4). The smolt-based forecast of the 2011 Chignik total sockeye salmon run is 1.86 million, which is less (465,000) than that predicted from ocean-age relationships and median estimates (2.32 million).

Time series analysis using 30 years of Chignik sockeye salmon return data, as well as the smolt forecast, approximate the median and ocean age class forecasts. Given this ancillary information, our confidence in this forecast is fair.

Mary Loewen, Finfish Research Biologist, Alaska Peninsula

Forecast Area: Bristol Bay
Species: Sockeye Salmon

Forecast of the 2011 Run

Total Production	Forecast (millions)	Forecast Range (millions)
Total Run	38.50	29.17–47.82
Escapement	8.83	
Commercial Common Property Harvest	29.67	
Bristol Bay Harvest	28.52	
South Peninsula Harvest	1.15	

Forecast Methods

The forecast for the sockeye salmon run to Bristol Bay in 2011 is the sum of individual predictions for nine river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak-Mulchatna, and Togiak rivers) and four age classes (ages 1.2, 1.3, 2.2, and 2.3, plus ages 0.3 and 1.4 for Nushagak River). Adult escapement and return data from brood years 1976 to 2007 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 also included simple linear regression and recent year averages. All models were evaluated for time series trends. 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 2008 through 2010.

The forecast range was the upper and lower values of the 80% confidence bounds for the total run forecast. The confidence bounds were calculated using deviations of actual runs from published predictions from 2001 through 2010.

Forecast Results

A total of 38.50 million sockeye salmon are expected to return to Bristol Bay in 2011. This prediction is 5% higher than the previous 10-year mean of total runs (36.68 million; range of 17.83–46.04 million). The forecast range is from 29.17 to 47.82 million. All systems are expected to exceed their minimum spawning escapement goals.

A run of 38.50 million can potentially produce a total harvest of 29.67 million if escapement goals are met for managed stocks and industry is capable of taking the surplus fish. The projected harvest includes 28.52 million in Bristol Bay and 1.15 million in the South Peninsula fisheries. A Bristol Bay harvest of 29.67 million would be 26% higher than the previous 10-year mean harvest (23.55 million; range of 10.66–30.89 million).

The run forecast to each district and river system is as follows: 14.38 million to Naknek-Kvichak District (5.68 million to Kvichak River; 1.77 million to Alagnak River; 6.93 million to Naknek River); 8.74 million to Egegik District; 5.03 million to Ugashik District; 9.50 million to Nushagak District (6.51 million to Wood River; 1.64 million to Nushagak River; 1.35 million to Igushik River); and 860,000 to Togiak District (Table 1).

The total run forecast of 38.50 million is expected to be comprised of 14.47 million age-1.3 fish (38%) followed by 9.72 million age-2.2 fish (25%), 9.09 million age-1.2 fish (24%), 4.92 million age-2.3 fish (13%), 85,000 age-0.3 fish (<1%), and 214,000 age-1.4 fish (<1%) (Table G1).

Forecast Discussion

Similar methods have been used to produce the Bristol Bay sockeye salmon forecast since 2001. These forecast methods have performed fairly well when looking at the overall Bay-wide forecast. There has been a tendency for the forecasts and projected harvests to be biased low in recent years. The forecast in 2010 was 3% below the total run. The forecasts since 2001 have averaged 10% below the actual total run. The run forecast differences have ranged from 26% below actual run in 2007 to 9% above actual run in 2001. The expected harvests have averaged 3% below actual harvest since 2001. The expected harvest differences have ranged from 22% below actual harvest in 2009 to 33% above actual harvest in 2004.

There is a much greater amount of uncertainty in our forecasts of returns to individual rivers. Since 2001, we have underforecast the returns to the Alagnak (-36%), Togiak (-19%), Nushagak (-18%), Naknek (-9%), and Wood (-9%) rivers and over-forecast returns to Igushik (24%), Egegik (23%), and Kvichak (18%) rivers. An example of the large variability can be observed in the forecasts to the Kvichak. We overforecast the returns to Kvichak by an average of 97% from 2001 through 2004 during an unusually unproductive period and underforecast the returns to the Kvichak by an average of -32% from 2005 through 2010 during a higher period of productivity. In large part, an individual river's forecast error is reflective of its current production as it relates to average historical production.

Even though there is large amount of variability around the forecasts to the individual rivers, the overall Baywide forecasts have been fairly accurate since 2001. This appears to have been the result of overforecasting returns to some rivers and underforecasting returns to other rivers. The forecasts to individual rivers have been offsetting each other such that the overall Baywide forecast has been more accurate than the individual forecasts.

We anticipate the 2011 run will be dominated by age-1.3 (38%), followed by age-2.2 (25%), age-1.2 (24%), and age-2.3 (13%) sockeye salmon. There is always some uncertainty in our forecast of returns by age class. However, we expect the overall uncertainty in 2011 to be similar to what occurred in 2010. Our forecasts were close for age-1.2 (29% forecast compared to 28% observed) and age-1.3 (39% compared to 36% observed) sockeye. We underforecast age-2.2 (16% forecast compared to 25% observed) and overforecast age-2.3 (15% forecast compared to 9% observed) sockeye in 2010.

The 2011 forecast of 38.50 million is not unexpected. Recent total runs to Bristol Bay have been fairly productive and stable. Since 2004, total runs have averaged 42.8 million and ranged from 39.3 million (2005) to 46.0 million (2007). We are not sure if this recent trend of productivity and stability will continue. Historically, total runs to Bristol Bay have been highly variable. If the 2011 forecast is accurate, it would be the eighth consecutive year where total run is close to or exceeds 40 million.

Tim Baker, Fred West, and Greg Buck, Bristol Bay Fishery Research Staff, Anchorage

Table G1.–Forecast of total run, escapement, and harvest of major age classes of sockeye salmon returning to Bristol Bay river systems in 2011.

DISTRICT	Millions of Sockeye Salmon							
	Forecasted Production by Age Class					Forecasted		South
River	1.2	2.2	1.3	2.3	Total	Escapement	Harvest	Peninsula [a]
NAKNEK-KVICHAK								
Kvichak	1.85	1.75	1.40	0.68	5.68	2.84	2.67	0.17
Alagnak	0.54	0.20	0.96	0.07	1.77	0.88 [b]	0.83	0.05
Naknek	1.61	0.86	3.28	1.18	6.93	1.10	5.62	0.21
Total	3.99	2.81	5.64	1.93	14.38	4.82	9.12	0.43
EGEGIK	0.49	4.64	1.23	2.38	8.74	1.10	7.37	0.26
UGASHIK	0.96	1.94	1.69	0.45	5.03	0.85	4.03	0.15
NUSHAGAK [c]								
Wood	3.05	0.25	3.17	0.04	6.51	1.10	5.21	0.20
Igushik	0.22	0.02	1.08	0.04	1.35	0.23	1.08	0.04
Nushagak	0.19	0.01	1.11	0.03	1.64 [d]	0.55	1.04	0.05
Total	3.46	0.28	5.35	0.11	9.50	1.88	7.34	0.28
TOGIAK [e]	0.20	0.05	0.55	0.07	0.86	0.18	0.66	0.03
BRISTOL BAY	9.09	9.72	14.47	4.92	38.50	8.83	28.52	1.15
	24%	25%	38%	13%	100%			

Note: This table summarizes the forecast of sockeye salmon in millions of fish. Any differences in addition are due to rounding.

[a] The projected harvest accounts for the harvest of Bristol Bay sockeye salmon in the South Peninsula commercial salmon fisheries. The South Peninsula harvest has averaged 3.0% of the total Bristol Bay sockeye salmon production during the last 5 years.

[b] The projected escapement to the Alagnak River was estimated based on exploiting the Alagnak River at the same exploitation rate as the Kvichak River.

[c] Forecast for Snake River system was not included (1971–1991 average escapement was 18,000).

[d] Nushagak River forecast includes age-0.3 (85,000) and age-1.4 (214,000) fish.

[e] Forecasts for Kulukak, Kanik, Osviak, and Matogak river systems were not included. These systems contribute approximately 50,000 to Togiak District harvest each year.

Forecast Area: Bristol Bay, Nushagak District
Species: Chinook Salmon

Forecast of the 2011 Run

Total Production	Forecast (thousands)	Forecast Range (thousands)
Commercial Common Property Harvest	41	29–52

Forecast Methods

The anticipated commercial harvest of Nushagak River Chinook salmon in 2011 is 41,000 and projected to range between 29,000 and 52,000. These projections are based on the most recent 5-year average and the observed mean percent error of 28% during that same time period. The actual harvest has ranged between 12,000 (in 2001) and 101,000 (in 2004) during the most recent 10-year period (Table 1).

Previously, it has been our practice to forecast Chinook salmon total run and from that, the projected harvest. However, our total run forecast models have not performed well in recent years.

Various factors account for our inability to accurately forecast future Chinook runs to the Nushagak River. One of the most likely factors may be in our assessment of the escapement portion of the total run. We believe that the sonar project provides a fairly good estimate of returning sockeye salmon which migrate close to shore. However, Chinook, and to a lesser extent, chum salmon migrate further offshore. The sonar project was set up to count returning salmon primarily in the nearshore areas of the river and does not reach across the entire river. We know that some portion of the returning Chinook salmon migrate up the middle of the river. Our assumption has been that we count a consistent proportion of the returning Chinook salmon and that this index provides a basis from which to forecast. However, the low return of Chinook salmon in recent years and the recent poor performance of the forecast have cast doubt on that assumption. Additional concerns include recent changes we made to the sonar equipment and the methods we use to apportion counts to salmon species with gillnets. New research beginning in 2011 will attempt to address some of the uncertainties associated with estimating Chinook salmon abundance. We hope these studies will eventually improve our ability to reliably forecast total run so we can return to producing them.

Tim Baker, Fred West, and Greg Buck, Bristol Bay Fishery Research Staff, Anchorage

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

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	462	174–751
Escapement Goal	117	117–195
Harvest Estimate	345	

[a] The forecast escapement for the Bear Lake late run in 2011 is the lower end and range of the BEG (117,000–195,000).

Forecast Methods

The 2011 forecast of the Bear Lake late-run sockeye salmon run was prepared using regression and median estimates and investigating multiple linear regression models of saltwater age class relationships with environmental data and sockeye salmon returns by age class from the past 21 years. In constructing and evaluating the regression models, standard regression diagnostics were used. Age-.3 sockeye salmon returns were predicted from previous year age-.2 returns using simple linear regression. Returns of age-.2 sockeye salmon were predicted using multiple regression analysis of average winter (October–April) air temperatures and precipitation. This index encompasses the temperatures from year of outmigration and the three years prior to the outmigration as well as total inches of October precipitation in the year preceding outmigration. Air temperature and precipitation data were obtained from the Cold Bay airport climate database. Estimates of variance were calculated from the regressions and used to calculate 80% prediction intervals for the regression model. The returns of age-.1 and -.4 sockeye salmon were predicted from median estimates for each of the age class run estimates using data from the last 21 years, and 80% prediction intervals were estimated by calculating 10th and 90th percentiles of the data. Total run forecast was calculated by summing individual regression and median age class estimates. The overall 80% prediction interval was calculated as the square root of the sum of squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The 2011 Bear Lake late-run forecast of 462,000 sockeye salmon is about 39,000 more than the 2010 forecast (423,000) and about 19,000 more than the estimated 2010 run (443,000). On average, the Bear Lake late run is composed age-.2 (63%) and age-.3 (34%) sockeye salmon. Consistent with historical age structures, the 2011 run should be composed of approximately 59% age-.2 fish and 37% age-.3 fish. If realized, this run will be 59,000 less than the recent (2001 to 2010) 10-year average (521,000). The projected harvest of 345,000 is based on achieving the lower bound of the escapement goal range (117,000). Based on uncertainty associated with the variable predictive capabilities of the sibling data, our confidence in this forecast is fair .

Mary Loewen, Finfish Research Biologist, Alaska Peninsula

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

Preliminary Forecast of the 2011 Run

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	484	323–645
Escapement Goal	150	97–219
Harvest Estimate	334	

Forecast Methods

The 2011 Nelson River sockeye salmon run was forecast using simple linear regression models of saltwater age class relationships and temperature data from the past 24 years. Average annual summer (May through September) air temperatures indices were constructed from Cold Bay airport data for corresponding outmigration years, starting in 1986. Standard regression diagnostics were used to construct and evaluate each of the regression models. Age-.2 sockeye salmon returns were positively correlated with the annual percentage of Nelson River age-.1 returns in the aggregate age-.1 returns from Bear and Nelson rivers (number of Nelson age-.1 fish/number of Nelson age-.1 fish + Bear age-.1 fish). The age-.3 sockeye returns were predicted by linear regression of the ratio between age-.3 and age-.2 fish (same outmigration year) on the annual average summer air temperature index. The age-.3 returns were negatively correlated with average summer air temperature. Estimates of variance were calculated from each regression. The returns of age-.1 and age-.4 fish were calculated from the median estimates for each of the age class run estimates using data from 1989 to the present. The total run forecast was calculated by summing individual regression and pooled age class estimates. When median return by age was used, 80% prediction intervals were estimated by calculating 10th and 90th percentiles of the data. Prediction intervals of 80% for the regression estimates were calculated using variances of the regression models. Overall 80% prediction intervals were calculated as the square root of the sum of squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The 2011 Nelson River forecast (484,000) is about 8,000 less than the 2010 forecast (492,000) and about 281,000 more than the estimated 2010 run (200,000). The 2011 Nelson River sockeye salmon run is expected to be about 41,000 less than the recent 10-year average run (523,000). The 2011 run should be composed mainly of age-.2 (64%) and age-.3 (14%) fish. Because the regression relationships predicting age-.2 and age-.3 sockeye salmon are significant and represent a vast majority of the run, the confidence in this forecast is fair. The projected harvest of 334,000 is based on the achieving the approximate midpoint of the escapement goal range (150,000).

Heather Finkle, Finfish Research Biologist, Alaska Peninsula

Forecast Area: Alaska Peninsula, South Alaska Peninsula Aggregate
Species: Pink Salmon

Preliminary Forecast of the 2011 Run

TOTAL PRODUCTION	Forecast Estimate(millions)	Forecast Range (millions)
South Peninsula Total Run	12.5	10.6–14.3
South Peninsula Escapement	3.3	1.6–3.3
South Peninsula Harvest	9.2	7.4–11.6

The 2011 South Alaska Peninsula predicted pink salmon harvest is expected to be in the *Strong* to *Excellent* category, with a point estimate of 9.2 million (8.0–10.5 million). Harvest categories were delimited from the 20th, 40th, 60th, and 80th percentiles of historical commercial harvest on the South Alaska Peninsula from 1978 to 2010.

S. Alaska Peninsula Pink Harvest Category	Range (millions)	Percentile
Poor	Less than 3.2	Less than 20th
Weak	3.2 to 4.9	21st to 40th
Average	4.9 to 7.3	41st to 60th
Strong	7.3 to 9.3	61st to 80th
Excellent	Greater than 9.3	81st to 100th

Forecast Methods

The South Alaska Peninsula pink salmon harvest forecast is derived from a total run forecast, minus the upper end (3.3 million) of the odd-year South Alaska Peninsula escapement goal range. Total run estimates were derived from a combination of aerial survey indices and harvest estimates. For the 2011 South Alaska Peninsula pink salmon forecast, a multiple linear regression model was fit to South Alaska Peninsula pink salmon returns from 2000 to 2010 using three independent (predictor) variables: (1) South Alaska Peninsula total pink salmon harvest lagged two years to brood year of return, (2) Winter (November to April) total precipitation measured at St. Paul Airport, and (3) Winter (November to April) total precipitation divided by the variance (analogous to the Sharpe ratio) measured at the Kodiak Airport. This model operates under the assumption that climate indices approximate environmental conditions that affect survival at early life history stages of pink salmon, and thus were lagged accordingly. Prediction intervals of 80% were estimated using the regression's estimated standard error of the prediction.

Forecast Discussion

The South Alaska Peninsula pink salmon total run is predicted to be 12.5 million in 2011, an above-average return and the highest since 2008. Environmental conditions used in the model suggest early life survival was above average for pink salmon returning as adults in 2011. The 2009 indexed pink salmon escapement (brood year escapement for the 2011 return) of 3.1 million was strong.

M. Birch Foster, Finfish Research Biologist, Kodiak

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

ADF&G does not produce formal run forecasts for most salmon runs in the AYK Region. The salmon run outlooks presented in this report are qualitative in nature because of a lack of information with which to develop more rigorous forecasts. Consequently, these commercial harvest outlooks 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 commercial harvest outlooks provide for a general level of expectation, fisheries management is based on inseason run assessment. A formal forecast of Yukon River fall chum salmon is provided. A Canadian-origin Yukon River Chinook salmon forecast is made prior to the meeting of U.S./Canada Yukon River Panel in the spring of 2011.

In the AYK Region, as in some other areas of the state, salmon production notably decreased for many stocks from 1998 to 2002, rebuilt rapidly beginning in 2003 with record and near record runs in 2005 and 2006, and has shown a general decline again since 2007. Chinook salmon in particular have shown declining abundance since 2007. Currently, Yukon River and Eastern Norton Sound Chinook salmon stocks and Northern Norton Sound chum salmon stocks are classified as stocks of yield concern under the Sustainable Salmon Fisheries Policy.

The high seas Bering Arctic Subarctic Integrated Surveys (BASIS) study indicated a decline in the presence of juvenile Chinook salmon in 2005 and 2006, but an increase in 2007. The BASIS study also observed a decline in chum salmon in 2004 and 2005, but 2006 and 2007 results showed an increase. No surveys were conducted in 2008. Chum salmon collected in the BASIS study in 2007 would correspond to the age-5 returns in 2011(age-4, the other primary returning age class, would have been present in 2008). Age-6 and age-5 Chinook salmon, the primary returning age classes, would correspond to BASIS study collections in 2006 and 2007, respectively. A collaborative effort between ADF&G and NOAA is in progress to test the applicability of BASIS juvenile salmon indices for run size forecasting.

In general, processing capacity and management for anticipated low Chinook salmon abundance may result in chum and sockeye salmon harvests that are lower than the outlook projections, in the AYK region.

	Salmon Species					
Management Area	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim River	2–10	20–30	60–150	0	200–300	
Kuskokwim Bay	10–17	80–160	20–60	0	90–140	
Kuskokwim Area Total	12–27	100–190	80–210	0	290–440	
Yukon	0–5	0	10–70	0	300–600	50–300
Norton Sound	0	0	60–90	50–100	90–120	
Kotzebue Sound					230–260	

Forecast Area: Yukon Area
Species: Fall Chum Salmon

Preliminary Forecast of the 2010 Run

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	737	605–870
Escapement Goal		300–600
Harvest Estimate		50–300

Forecast Methods

The forecast for the 2011 Yukon Area fall chum salmon run is based on run reconstruction of five river systems (Tanana, Chandalar, Sheenjek, Fishing Branch and the mainstem Yukon River in Canada) and four age classes age-3 through age-6, with age-4 fish dominating followed by age-5 fish. Adult escapement and return data was used from the complete brood years 1974 to 2004, production from incomplete brood years 2005 and 2006 was estimated based on return per spawner from brood year returns, and an auto-regressive Ricker model was used to predict returns from the 2007 and 2008 parent years.

Predicted returns were multiplied by corresponding average maturity schedules for odd and even-numbered parent years to estimate 2011 run size, and rounded to the nearest thousand fish. The even/odd maturity schedule from 1984 to 2004 was used to estimate the 2011 return, since current production is reduced from the pre-1984 level. The forecast range is the upper and lower values of the 80% confidence bounds for the total run forecast. Confidence bounds are calculated using deviation of the run projection point estimates and the observed returns from 1987 to 2010.

The 2011 projected run size of fall chum salmon for the Yukon Area is approximately 737,000. This projection is below average for odd-numbered runs; however, recent runs have fluctuated more widely and have produced runs as low as 400,000 in 2001 to as high as 2.3 million in 2005. The 80% confidence bounds for the 2011 forecast range from 605,000 to 870,000 fall chum salmon. If the run materializes as projected, abundance would be sufficient to meet escapement goals, including Canadian border passage and harvest sharing obligations, provide an average subsistence harvest, and may provide opportunity for a limited commercial harvest.

Drainagewide escapements between 300,000 and 600,000 provide a mean yield of 520,000. The mean subsistence harvest from 1974 to 2009 for Alaskan subsistence and Canadian aboriginal harvests is 145,000. Commercial harvests are prosecuted on the amount above 500,000 based on inseason assessments of run size. Due to drastic fluctuations of pulses of fish entering the Yukon River mouth, fishery management is challenging. ADF&G anticipates a subsistence harvest of about 100,000 and commercial harvest to be between 50,000 and 300,000 depending on inseason assessment of run size and application to the 5 AAC 01.249 *Yukon River Drainage Fall Chum Salmon Management Plan.*

The forecasted total run of 737,000 fall chum salmon is expected to be composed of 72% age-4 and 25% age-5 fish. The age-4 component of fall chum salmon runs has varied widely, ranging from 37% (1992) to 94% (2005). Fall chum salmon also exhibit a strong even-odd abundance cycle (averaging 1.0 million in odd-numbered years and 687,000 in even-numbered years) that was fairly regular between 1974 and 1992. Since 1993 the odd-even abundance relationship has severely deteriorated with wide swings in production that are primarily thought to be due to conditions in the marine environment, although some density dependence may have occurred in 2005. The effect of the odd-even cycle was restricted between 1993 and 2002 during which most years' (1993 and 1997–2002) stocks were severely depressed, with peaks of high production occurring in 1995 and 2005. Age-4 fish contributed greater than 90% (record levels) during the recent runs in 2003 and 2005. However, based on preliminary analysis, the extremely large escapement observed in 2005 is only producing an estimated 0.23 returns per spawner.

Forecast Discussion

Point projections for expected returns have been developed since 1987 for fall chum salmon in the Yukon River drainage. Forecast methods were changed to provide ranges around the point estimates beginning in 1999. Additionally, in attempts to reflect poor runs and improvements in some runs, adjustments to the point estimates were made by reducing the projection of run size by the average ratio of observed to predicted returns through 2005. From 2006 through 2011 the ranges were developed around the point estimate, based on the 80% confidence bounds, using the standard deviation between the annual point estimates and observed returns. High and low cycles in production have changed approximately 27-fold (based on 31 brood year returns) with the most drastic fluctuations occurring between brood years 1995 and 2001; therefore, projections of run size remain extremely difficult to predict.

Since projection ranges were established in 1999, 42% of the observed runs were within the projected run size range, 41% were below, and 17% were above the range. Returns of age-4 fish in odd-numbered years are typically 20% greater than even-numbered years. Although sibling relationships for this stock are weak, a strong showing of age-3 fish in 2010 (second highest in three decades and sixth highest in 34 years) may support stronger age-4 return in 2011. The age-4 component is returning from a relatively large escapement in 2007, and is anticipated to carry the run. The 2011 point estimate of 737,000 fall chum salmon is largely reliant on the age-4 component returning at a higher production level (0.83 returns per spawner) than observed in both the 2006 (0.63) and 2005 (0.23) parent years. This run size would provide for a commercial harvest of approximately 200,000.

Bonnie Borba, Yukon Area Fall Season Research Project Leader, Fairbanks

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