

Special Publication 19-07

**Run Forecasts and Harvest Projections for 2019
Alaska Salmon Fisheries and Review of the 2018
Season**

Edited by

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March 2019

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	Alaska Administrative Code	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	alternate hypothesis	H_A
gram	g			base of natural logarithm	e
hectare	ha			catch per unit effort	CPUE
kilogram	kg	all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.	coefficient of variation	CV
kilometer	km			common test statistics	(F, t, χ^2 , etc.)
liter	L	at	@	confidence interval	CI
meter	m	compass directions:		correlation coefficient (multiple)	R
milliliter	mL	east	E	correlation coefficient (simple)	r
millimeter	mm	north	N	covariance	cov
		south	S	degree (angular)	$^\circ$
		west	W	degrees of freedom	df
Weights and measures (English)		copyright	©	expected value	E
cubic feet per second	ft ³ /s	corporate suffixes:		greater than	>
foot	ft	Company	Co.	greater than or equal to	≥
gallon	gal	Corporation	Corp.	harvest per unit effort	HPUE
inch	in	Incorporated	Inc.	less than	<
mile	mi	Limited	Ltd.	less than or equal to	≤
nautical mile	nmi	District of Columbia	D.C.	logarithm (natural)	ln
ounce	oz	et alii (and others)	et al.	logarithm (base 10)	log
pound	lb	et cetera (and so forth)	etc.	logarithm (specify base)	log ₂ etc.
quart	qt	exempli gratia (for example)	e.g.	minute (angular)	'
yard	yd	Federal Information Code	FIC	not significant	NS
		id est (that is)	i.e.	null hypothesis	H_0
Time and temperature		latitude or longitude	lat or long	percent	%
day	d	monetary symbols (U.S.)	\$, ¢	probability	P
degrees Celsius	°C	months (tables and figures): first three letters	Jan, ..., Dec	probability of a type I error (rejection of the null hypothesis when true)	α
degrees Fahrenheit	°F	registered trademark	®	probability of a type II error (acceptance of the null hypothesis when false)	β
degrees kelvin	K	trademark	™	second (angular)	"
hour	h	United States (adjective)	U.S.	standard deviation	SD
minute	min	United States of America (noun)	USA	standard error	SE
second	s	U.S.C.	United States Code	variance	
		U.S. state	use two-letter abbreviations (e.g., AK, WA)	population	Var
Physics and chemistry				sample	var
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				

SPECIAL PUBLICATION 19-07

**RUN FORECASTS AND HARVEST PROJECTIONS FOR 2019 ALASKA
SALMON FISHERIES AND REVIEW OF THE 2018 SEASON**

Edited by

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Division of Sport Fish, Research and Technical Services
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DEFINITION OF TERMS

Biological escapement goal	The number of salmon in a particular stock that the Alaska Department of Fish and Game has determined should be allowed to escape the fishery to spawn to achieve the maximum yield (human use). This determination is based on biological information about the fish stock in question. (Also see <i>optimum escapement goal</i> .)
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 broodstock	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 both achieve sustainable runs based on biological needs of the stock, and meet 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	Sustainable escapement goal is defined as a level of escapement, indicated by an index or a range of escapement estimates that is known to have provided for sustained yield over a 5- to 10-year period. A sustainable escapement goal is used in situations where a biological escapement goal cannot be estimated due to the absence of a stock-specific catch estimate.
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	<i>Oncorhynchus tshawytscha</i>
sockeye	red	<i>Oncorhynchus nerka</i>
coho	silver	<i>Oncorhynchus kisutch</i>
pink	humpy, humpback	<i>Oncorhynchus gorbuscha</i>
chum	dog	<i>Oncorhynchus keta</i>

ABSTRACT

This report contains a detailed review of Alaska's 2018 commercial salmon season and harvest forecasts for 2019. The Alaska all-species salmon harvest for 2018 totaled 115.7 million, about 31.6 million less than the preseason forecast of 147.3 million. This combined harvest was composed of 241,000 Chinook salmon *Oncorhynchus tshawytscha*, 50.5 million sockeye salmon *O. nerka*, 3.7 million coho salmon *O. kisutch*, 40.9 million pink salmon *O. gorbuscha*, and 20.3 million chum salmon *O. keta*. The Alaska Department of Fish and Game is expecting an increase in commercial salmon harvests in 2019. The 2019 total commercial salmon harvest (all species) projection of 213.2 million is expected to include 112,000 Chinook salmon in areas outside Southeast Alaska, 41.7 million sockeye salmon, 4.6 million coho salmon, 137.8 million pink salmon, and 29.0 million chum salmon. Compared to 2018 commercial harvests, the projected 2019 commercial harvests are expected to be as follows: pink salmon, 96.9 million more; sockeye salmon, 8.9 million fewer; coho salmon, 900,000 more; and chum salmon, 8.7 million more.

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, salmon management

INTRODUCTION

This report contains salmon run forecasts and harvest projections for 2019 as well as a detailed review of Alaska's 2018 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 harvest in 2019, mostly due to increases in pink and chum salmon harvests compared to 2018. The 2019 total commercial salmon harvest (all species) projection of 213.2 million is expected to include 112,000 Chinook salmon in areas outside Southeast Alaska, 41.7 million sockeye, 4.6 million coho, 137.8 million pink, and 29.0 million chum salmon (Table 1). Compared to 2018 commercial harvests (Table 2), the projected 2019 commercial harvests are expected to be as follows: pink salmon, 96.9 million more; sockeye salmon, 8.9 million fewer; coho salmon, 900,000 more; and chum salmon, 8.7 million more. If realized, the projected commercial chum salmon harvest would be the largest on record for Alaska. We note that—except for Southeast Alaska—pink salmon forecasts are generally based on average returns from previous brood years. The pink salmon run forecast for 2019 is partly an artifact of this method; there is a great deal of uncertainty in predicting pink salmon returns.

Table 1 shows specific harvest projection numbers by species and fishing area. When the appropriate data were available, harvest forecasts were arrived at through quantitative projections based on information of previous spawning levels, smolt outmigrations, returns of sibling age classes, and survival rates for hatchery releases. Other projections were based on averages of recent harvests. Fishing effort influences harvests, and effort is partly determined by market conditions in addition to the size of salmon runs. Therefore, these projections may not be indicative of actual harvests.

Except for the Southeast Alaska Chinook salmon fisheries and the South Peninsula June fisheries, Alaska salmon management will be based on inseason estimates of salmon run strength. Alaska managers have the primary goal of maintaining spawning population sizes—not of reaching preseason harvest projections.

Table 1.—Projections of 2019 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

Region & Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Alaska						
Natural Production		1,011	1,788	18,000	3,086	23,885
Hatchery Production ^a		218	767	1,395	17,485	19,864
Southeast Region Total	^b	1,229 ^c	2,555 ^c	19,395	20,571	43,749
Prince William Sound						
Natural Production	28	1,146 ^d	372 ^e	22,439	392	24,377
Hatchery Production ^f		1,387	228	42,357	2,391	46,362
Lower Cook Inlet						
Natural Production	1 ^c	126 ^c	14 ^c	2,404	85 ^c	2,629
Hatchery Production		131 ^g		944		1,076
Upper Cook Inlet	7 ^c	3,000	207 ^c	103 ^c	175 ^c	3,492
Bristol Bay	37 ^c	26,110	163 ^c	8 ^h	1,142 ^c	27,460
Central Region Total	73	31,900	984	68,255	4,184	105,396
Kodiak						
Natural Production	7 ^c	2,086 ⁱ	285 ^c	20,400	674 ^c	23,452
Hatchery Production		250 ^j	25	6,600 ^g	128	7,003
Chignik	9 ^c	1,001 ^k	107 ^c	2,448 ^h	177 ^c	3,742
South Peninsula & Aleutians	20 ^c	2,332 ^c	271 ^c	20,600	908 ^c	24,131
North Alaska Peninsula	2 ^c	2,885 ^l	71 ^c	83 ^h	130 ^c	3,170
Westward Region Total	38	8,553	759	50,131	2,017	61,498
Arctic-Yukon-Kuskokwim	1	4	330	50	2,190	2,575
Total						
Statewide Total	112	41,686	4,628	137,830	28,962	213,218

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

^a Hatchery chum salmon 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 salmon catch estimated as 20% of total catch. All other hatchery projections are 5-year average harvest (2014–2018), or, for pink salmon, average harvest from past 5 odd years.

^b Southeast Chinook salmon treaty forecast not available. The allowable catch of Chinook salmon in Southeast Alaska is determined by the Pacific Salmon Commission, which has not published the quota for 2019. Release of the 2019 Chinook salmon quota for Southeast Alaska is expected in late March or early April.

^c Average harvest of the previous 5 years (2014–2018).

^d Includes harvest estimates for Coghill and Copper River sockeye salmon.

^e Five-year average harvest (2009–2018) in the Prince William Sound area.

^f Hatchery projections made by Prince William Sound Aquaculture Corporation and Valdez Fisheries Development Association. Gulkana Hatchery projection made by ADF&G.

^g Includes common property plus cost-recovery harvests.

^h Average of previous 5 odd-year harvests (2009–2017).

ⁱ Total Kodiak harvest of 2.086 million natural run sockeye salmon includes projected harvests from formally forecasted systems, projected Chignik harvest at Cape Igvak, and projected harvest from additional minor systems (743,000 fish).

^j Hatchery projections made by Kodiak Regional Aquaculture Association. Sockeye salmon hatchery projections include enhanced Spiridon Lake sockeye salmon run harvest forecast and other Kodiak Regional Aquaculture Association projections (250,000 total).

^k Chignik sockeye salmon harvest estimate based on a formal forecast with projected harvest at Igvak and Southeastern District Mainland excluded.

^l Five-year average harvest (2014–2018); includes formal forecasts for Bear River late run (253,000) and Nelson River (212,000) sockeye salmon stocks.

The Alaska all-species salmon harvest for 2018 totaled 115.7 million, about 31.6 million less than the preseason forecast of 147.3 million. This combined harvest was composed of 241,000 Chinook salmon *Oncorhynchus tshawytscha*, 50.5 million sockeye salmon *O. nerka*, 3.7 million coho salmon *O. kisutch*, 40.9 million pink salmon *O. gorbuscha*, and 20.3 million chum salmon *O. keta*. Table 2 shows 2018 harvest numbers by salmon species and fishing area, in units of thousands of fish harvested, and Table 3 provides this information in units of thousands of pounds harvested. Tables 4–7 provide detailed information on the 2018 harvest by species and area.

Table 2.—Preliminary 2018 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total ^a	160	637	1,603	8,096	11,472	21,968
Prince William Sound	8	1,312	523	24,063	3,468	29,374
Lower Cook Inlet ^b	0	370	15	1,564	49	1,999
Upper Cook Inlet	3	818	232	127	115	1,296
Bristol Bay	45	41,937	162	244	1,637	44,025
Central Region Total	57	44,437	932	25,998	5,269	76,694
Kodiak Area	4	1,772	441	5,944	464	8,625
Chignik	0	0	0	0	1	1
South Peninsula and Aleutians	18	1,330	260	762	997	3,366
North Peninsula	2	2,366	108	32	157	2,666
Westward Region Total	24	5,469	809	6,739	1,619	14,659
Arctic-Yukon-Kuskokwim Region Total	1	4	371	80	1,898	2,353
Total Alaska	241	50,546	3,715	40,912	20,257	115,673

Note: Missing data indicates no harvest, and zeros indicate harvest activity but <500 fish.

Note: Columns may not total exactly due to rounding.

^a Total commercial harvest of Chinook salmon for the October 1, 2017, to September 30, 2018, catch accounting period.

^b Commercial harvest in Lower Cook Inlet includes commercial common property and hatchery cost-recovery harvest, hatchery-donated fish, and homepack; but not broodstock, hatchery carcasses sold, or sportfish derby caught/commercially sold fish.

Table 3.—Preliminary 2018 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Southeast Region Total ^a	2,002	3,380	11,984	31,096	96,479	144,941
Prince William Sound	134	5,961	4,512	91,047	28,764	130,418
Lower Cook Inlet ^b	3	1,484	125	5,767	409	7,787
Upper Cook Inlet	47	4,290	1,470	477	959	7,243
Bristol Bay	470	215,788	872	244	10,325	227,700
Central Region Total	654	227,523	6,979	97,535	40,458	373,148
Kodiak Area	27	9,018	3,598	22,878	3,726	39,247
Chignik	0	1	0	0	7	8
South Peninsula and Aleutians	147	6,678	1,791	2,494	7,799	18,909
North Peninsula	25	12,630	694	100	331	13,781
Westward Region Total	199	28,326	6,084	25,472	11,863	71,944
Arctic-Yukon-Kuskokwim Region Total	3	19	2,546	223	13,648	16,439
Total Alaska	2,859	259,248	27,593	154,325	162,448	606,472

Note: Columns may not total exactly due to rounding and zeros indicate that less than 500 pounds were harvested.

^a Total commercial harvest of Chinook salmon for the October 1, 2017, to September 30, 2018, catch accounting period.

^b Commercial harvest in Lower Cook Inlet includes commercial common property and hatchery cost-recovery harvest, but not homepack, broodstock, or hatchery donated fish.

Inseason harvest information, postseason statistics, and other information about salmon in Alaska can be found online on at <http://www.Fishing.adfg.alaska.gov>.

ADF&G's 4 major commercial fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) are shown in Figure 1. These regions supersede any references to ADF&G's former statistical regions.

Although ADF&G 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 2018 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 4 ADF&G fishery management regions (Southeast, Central, Arctic-Yukon-Kuskokwim, and Westward) of the Division of Commercial Fisheries.

PRELIMINARY REVIEW OF THE 2018 ALASKA COMMERCIAL SALMON FISHERIES

SOUTHEAST REGION

SOUTHEAST ALASKA AND YAKUTAT AREAS

The 2018 Region I cumulative commercial salmon harvest by all harvest categories, including hatchery cost recovery, was 22.0 million fish (Table 4). Total common property commercial harvest was 17.6 million (80% of total harvest). Overall harvest in numbers of salmon in 2018 was 44% of 2017. The 2018 harvests by species compared with 2017 were as follows: Chinook 92%, sockeye 79%, coho 56%, pink 23%, and chum salmon 100%. The Region I total commercial salmon harvest proportions by species were Chinook 1%, sockeye 3%, coho 7%, pink 37%, and chum salmon 52%. The 2018 combined-gear, large Chinook salmon harvest of 160,000 was 55% of the most recent 10-year average and 53% of the long-term average. The sockeye salmon harvest of 637,000 was 59% of the recent 10-year average and 48% of the long-term average. The coho salmon harvest of 1.6 million was 59% of the 10-year average and 74% of the long-term average. The pink salmon harvest of 8.1 million was 21% of the 10-year average and 26% of the long-term average. The chum salmon harvest of 11.5 million was 112% of the 10-year average and 189% of the long-term average. The all species total harvest was 42% of the recent 10-year average and 54% of the long-term average harvest.

Chinook Salmon

Harvest Summary

The Chinook salmon harvest of 160,000 in 2018 was below both the recent 10-year and long-term averages and ranks lowest over the previous 57 years. The average total Chinook salmon harvest since 1962 is approximately 300,000. Preliminary harvests of coastwide Chinook salmon accountable under the Pacific Salmon Treaty included 100,000 by troll gear, 1,000 by purse seine gear, and 4,000 by gillnet gear. Total commercial harvests of Alaska hatchery-origin Chinook salmon were 36,000, (23% of total Chinook salmon harvests), and 20,000 Chinook salmon were harvested in private hatchery cost-recovery fisheries.

Sockeye Salmon

Harvest Summary

The harvest of sockeye salmon was 637,000 fish in 2018. This harvest was below both the recent 10-year average of 1.2 million and the long-term average of 1.3 million. The 2018 sockeye salmon harvest ranks 53rd over the previous 57 years since 1962. The Southeast Alaska Area purse seine fishery harvest of 231,000 was below the recent and long-term averages and accounted for 36% of the regional total harvest. The drift gillnet fishery harvest of 227,000 was below the recent and long-term averages and accounted for 36% of the regional total harvest. The set gillnet fishery harvest of 7,000 was below the recent and long-term averages and accounted for 1% of the regional total harvest.

Coho Salmon

Harvest Summary

The 2018 coho salmon harvest was 1.6 million. This harvest was less than the long-term and recent averages. The 2018 coho salmon harvest ranks 36th over the 57 years since 1962. The coho salmon harvest in the troll fishery was 900,000, less than the long-term and recent averages, and accounted for 59% of the harvest. Purse seine, drift, and set gillnet harvests of coho salmon were below long-term and recent averages.

Pink Salmon

Harvest Summary

The 2018 pink salmon harvest was 8.1 million, 37% of the total region salmon harvest. The purse seine pink salmon harvest was 6.9 million, 85% of the total pink salmon harvest. The 2018 pink salmon harvest was below the recent and long-term averages, ranking 51st over the 57 years since 1962.

Chum Salmon

Harvest Summary

The 2018 chum salmon harvest of 11.5 million is the 10th largest harvest since statehood and was above the recent average of 10.3 million. Most chum salmon harvest in the region is attributable to hatchery production. Before hatchery chum salmon production became significant in 1984, the 1962–1983 regional average chum salmon harvest was 1.6 million.

Table 4.–Preliminary 2018 Southeast Region commercial salmon harvests, by fishing area and species in thousands of fish.

Fishery	Species					Total
	Chinook ^a	Sockeye	Coho	Pink	Chum	
Purse Seine						
Southern Purse Seine Traditional	0	195	103	4,567	1,050	5,915
Northern Purse Seine Traditional	0	23	17	2,092	301	2,432
Hatchery Terminal	16	14	35	192	3,634	3,891
Total Purse Seine	17	231	154	6,851	4,985	12,238
Drift Gillnet						
Tree Point	2	20	35	113	188	358
Prince of Wales	3	25	112	348	176	665
Stikine	3	6	9	16	134	167
Taku-Snettisham	1	68	36	23	517	645
Lynn Canal	1	73	45	16	704	839
Drift Gillnet Hatchery Terminal	12	35	22	40	807	915
Total Drift Gillnet	21	227	259	556	2,526	3,589
Set Gillnet (Yakutat)	0	7	96	28	0	131
Troll						
Hand Troll						
Traditional	2	0	37	2	4	46
Hatchery Terminal	0	0	1	0	1	2
Spring Areas	1	0	0	0	0	1
Total Hand Troll	3	0	38	2	6	49
Power Troll						
Traditional	89	5	899	42	411	1,446
Hatchery Terminal	1	0	1	10	110	122
Spring Areas	6	0	0	0	4	11
Total Power Troll	97	5	901	51	525	1,578
Total Troll	100	5	938	54	531	1,627
Annette Island Reservation						
Seine	0	4	3	170	59	236
Drift Gillnet	1	2	14	126	152	296
Troll	0	0	0	0	0	0
Hand Troll	0	0	0	0	0	0
Power Troll	0	0	0	0	0	0
Trap						
Total Annette Island Reservation	2	6	17	296	211	533
Hatchery Cost Recovery	20	159	137	294	3,202	3,811
Miscellaneous ^b	0	2	3	17	16	38
Southeast Region Total	160	637	1,603	8,096	11,472	21,968

Note: Missing data indicates no harvest, and zeros indicate harvest activity but <500 fish.

Note: Columns may not total exactly due to rounding.

^a Chinook salmon adults and jacks are totaled. Catch accounting period for the 2018 Chinook salmon season goes from October 1, 2017, to September 30, 2018.

^b Includes salmon that were confiscated or caught in sport fish derbies or commercial test fisheries and sold.

CENTRAL REGION

PRINCE WILLIAM SOUND AREA

The 2018 Prince William Sound (PWS) Area commercial salmon harvest was 29.37 million (Table 5). Harvest was composed of 8,000 Chinook, 1.30 million sockeye, 523,000 coho, 24.06 million pink, and 3.47 million chum salmon—including 456,000 for Wally Noerenberg Hatchery (WNH) broodstock and cost recovery. The 2018 harvest included 24.99 million (85%) commercial common property fishery (CCPF), and 4.38 million (15%) hatchery cost-recovery and broodstock fish.

Chinook Salmon

Run and Escapement Summary

The 2018 preseason commercial harvest forecast for the Copper River District was 13,000 Chinook salmon.

Harvest Summary

Over 99% of CCPF harvest of 8,000 Chinook salmon occurred in the first 3 fishing periods of the season. Season total harvest was the lowest since statehood.

Sockeye Salmon

Run and Escapement Summary

The 2018 preseason commercial harvest forecast for the Copper River District was 942,000 sockeye salmon. Gulkana Hatchery was projected to contribute 71,000 to the CCPF harvest.

Spawning escapement to Copper River Delta index systems based on aerial survey peak counts was 58,500 sockeye salmon, within the sustainable escapement goal (SEG) range of 55,000–130,000.

The aerial escapement index of 14,600 sockeye salmon was below the SEG range of 15,000–33,000.

Prince William Sound Aquaculture Corporation (PWSAC) forecast a run of 763,000 Main Bay Hatchery enhanced sockeye salmon in 2018.

The 2018 Coghill Lake sockeye salmon total run forecast was 183,000. The Coghill River weir passed 30,954 sockeye salmon; this is within the SEG range of 20,000–60,000. The weir washed out during 2 separate flood events, resulting in no passage estimates for the periods of June 17–29 and July 9–27. The historical peak passage period was enumerated, but passage during the time period without weir coverage likely represents enough fish to place actual escapement near the upper end of the goal.

Harvest Summary

The Copper River drift gillnet sockeye salmon harvest of 47,000 was 97% less than the recent 10-year harvest average of 1.29 million and the second lowest harvest in the last 100 years. The number of wild sockeye salmon harvested in the CCPF Copper River District drift gillnet fishery was 41,100 (87%), whereas the Gulkana Hatchery contribution to the sockeye salmon commercial harvest was 5,900 (13%).

The CCPF drift gillnet harvest of sockeye salmon in the Coghill District was 187,000, 29% above the recent 10-year average (2008–2017). The proportion of wild sockeye salmon in this Coghill District CCPF harvest was 54%.

The CCPF harvest of sockeye salmon in the Eshamy District gillnet (drift and set) fishery was 1.0 million, 31% above the forecast. The proportion of wild sockeye salmon in the Eshamy District CCPF harvest was 9% (88,800). PWSAC harvested approximately 10,200 sockeye salmon for broodstock and culled 2,500 jack sockeye salmon.

Unakwik District CCPF drift gillnet harvest was 4,000 sockeye salmon—more than double the 10-year average of 1,500 sockeye salmon.

Coho Salmon

Run and Escapement Summary

The 2018 preseason commercial harvest forecast for the Copper River District was 226,000 coho salmon. Copper River Delta coho salmon peak escapement counts are within the SEG range of 32,000–67,000. Bering River District coho salmon spawning escapement monitoring is ongoing, but peak escapement counts are within the SEG range of 13,000–33,000.

PWSAC forecast a 2018 run of 87,000 coho salmon to WNH and required 2,700 (3%) for cost recovery and broodstock.

The Valdez Fisheries Development Association (VFDA) coho salmon run was forecast to be 85,000. Total CCPF harvest of coho salmon in PWS (excluding Copper River and Bering River districts) was 78,800.

Harvest Summary

The total purse seine CCPF harvest of coho salmon in PWS (excluding Copper River and Bering River districts) was 81,000.

The season total drift gillnet coho salmon commercial harvest in the Copper River District of 304,000 was well above the recent 10-year harvest average of 225,000.

The recent 10-year average CCPF harvest for the Bering River District drift gillnet fishery is 59,000 coho salmon. The commercial harvest of 121,000 was double the previous 10-year harvest average. Commercial fishing effort in the coho salmon fishery was high due in part to the poor sockeye salmon fishery.

The CCPF drift gillnet harvest of coho salmon in the Coghill District was 4,000.

Pink Salmon

Run and Escapement Summary

The 2018 pink salmon total run forecast for PWS was 34.35 million, of which 28.31 million were estimated to be available for CCPF harvest. This estimate included 16.93 million VFDA enhanced fish, 15.40 million PWSAC enhanced fish, and a CCPF forecast of 2.02 million wild fish. Approximately 3.03 million (18%) of the projected 16.93 million pink salmon run to VFDA's Solomon Gulch Hatchery were needed for cost recovery and broodstock, leaving 13.90 million for CCPF. Approximately 3.01 million (20%) of the projected 15.40 million pink salmon run to the PWSAC hatcheries were needed for cost recovery and broodstock. The remaining 12.39 million PWSAC fish are expected to be available for CCPF harvest.

Inseason pink salmon escapement estimates were below thresholds in most districts during the early part of the 2018 season, but developed quickly midseason and escapements were met in most districts. This allowed for expanded time and area for fishing effort targeting surplus wild pink salmon. The area-under-the-curve estimate of pink salmon escapement is not yet available, but considering inseason escapement indices were above projected counts, overall escapements were likely within or above the even-year SEG ranges for all districts.

Harvest Summary

Pink salmon CCPF drift gillnet harvest in the Coghill District was 286,000, 25% of the recent 10-year average. The proportion of wild pink salmon in the Coghill District CCPF harvest was 32%.

In the Eshamy District, 326,000 pink salmon were harvested in the CCPF gillnet (drift and set) fishery. The proportion of wild pink salmon in the Eshamy District CCPF harvest was 63%.

The CCPF harvest of 20.16 million pink salmon was 14.26 million less than the 5-year even-year average, and 29% below the preseason forecast. Total pink salmon harvest was 24.06 million, including 3.9 million for hatchery cost recovery, broodstock, and raceway sales (2.25 million for PWSAC and 1.58 million for VFDA). Pink salmon otolith contributions estimate CCPF harvest contributions of 9.9 million Solomon Gulch Hatchery fish, 9.03 million PWSAC fish, and 5 million wild fish. The wild pink salmon CCPF harvest of 5 million was the second largest even-year harvest since 1998.

Chum Salmon

Run and Escapement Summary

PWSAC forecast a 2018 run of 3.12 million chum salmon to WNH and required 656,000 (21%) for cost recovery and broodstock. The total chum salmon return to WNH was 2.39 million and was 23% below forecast.

The 2018 chum salmon total run forecast was 3.45 million, with 3.06 million (89%) projected to be of PWSAC origin and a wild chum salmon CCPF forecast of 391,000. Of these, 450,000 chum salmon were expected to be harvested at Armin F. Koernig Hatchery and 150,000 were expected to be harvested at Port Chalmers by the purse seine fleet.

Harvest Summary

The CCPF drift gillnet harvest of chum salmon in the Coghill District was 1.80 million. The proportion of wild chum salmon in the Coghill District CCPF harvest was 2%. PWSAC harvested 456,000 chum salmon for cost recovery and broodstock.

The CCPF harvest of chum salmon in the Eshamy District gillnet (drift and set) fishery was 141,000. The proportion of wild chum salmon in the Eshamy District CCPF harvest was 9%.

The purse seine CCPF harvest of 1.05 million chum salmon was above the recent 10-year harvest average of 691,000. Purse seine chum salmon harvest in PWS was predominantly from the Southwestern, Montague, and Eastern districts. Chum salmon commercial harvest in the Southwestern District was 356,000, of which 108,000 (31%) were of WNH origin. Montague District chum salmon commercial harvest was 453,000, of which 345,000 (78%) were of Port Chalmers origin. Eastern District chum salmon commercial harvest was 197,000, of which 176,000 (90%) were of wild stock origin.

COOK INLET AREA

Lower Cook Inlet

The 2018 Lower Cook Inlet Area commercial salmon harvest was 2.0 million (Table 5). The harvest was composed of 381 Chinook, 370,460 sockeye, 15,387 coho, 1.6 million pink, and 48,729 chum salmon, of which 758,117 (37.9%) were CCPF harvest and 1.2 million (62.1%) were hatchery cost recovery.

Chinook Salmon

Harvest Summary

The 2018 purse seine harvest for the Southern District was 131 Chinook salmon. This compares to a previous 10-year average harvest of 67 Chinook salmon. The set gillnet harvest for the Southern District was 185 Chinook salmon. The previous 10-year average harvest for set gillnet gear was 292 Chinook salmon.

Sockeye Salmon

Run and Escapement Summary

Cook Inlet Aquaculture Association (CIAA) forecasted a run of 44,600 sockeye salmon to the Kirschner Lake remote release site. CIAA also forecasted a total run of 199,727 sockeye salmon to Resurrection Bay facilities with all but 52,500 of these fish intended for broodstock or cost-recovery purposes.

Preliminary passage estimate at the English Bay River weir was 18,083 sockeye salmon; this exceeded the SEG of 6,000–13,500 for this system.

Sockeye salmon escapement was within SEG ranges for all systems in the Kamishak Bay District.

Sockeye salmon escapement to Delight Lake was above the SEG range for that lake, and within the range for Desire Lake. Escapement levels for salmon in the Outer District may have been underestimated due to poor weather conditions that prevented regular aerial and ground surveys of this area.

Due to small runs in the previous 10 years, no sockeye salmon wild stocks were forecast to be available for commercial harvest from the Eastern District in 2018. Escapement of 12,779 sockeye salmon through the weir at Bear Creek was within the desired inriver passage goal of 5,620–13,220. This goal is the combination of the SEG (700–8,300) as well as the estimated 4,920 sockeye salmon required for broodstock for the CIAA Resurrection Bay sockeye salmon program at the Trail Lakes Hatchery. The only other index system in the Eastern District is Aialik Lake sockeye salmon, where the final escapement was below the SEG range of 3,200–5,400.

Harvest Summary

The 2018 purse seine harvest for the Southern District was 55,246 sockeye salmon. This compares to a previous 10-year average harvest of 40,818. The set gillnet harvest for the Southern District was 15,157. The previous 10-year average harvest for set gillnet gear was 27,617. In addition, 68,979 sockeye salmon were harvested by CIAA from special harvest areas (SHAs) in this district for cost-recovery purposes.

The Kamishak Bay District commercial harvest was approximately 34,000 sockeye salmon. This compares to a previous 10-year average annual harvest of 56,416 from the Kamishak Bay District

commercial fishery. In addition, 11,536 sockeye salmon were harvested by CIAA from the Kirschner Lake SHA for cost-recovery purposes.

The Outer District harvest was 1,409 sockeye salmon. This harvest compares to the previous 10-year average annual harvest of 7,641.

Total cost-recovery harvest from the Eastern District was 158,427 sockeye salmon. In addition, 2,924 were donated at the weir to members of the public.

Portions of Resurrection Bay were open for commercial harvest from June 18 through July 13. During this time, 5 permit holders reported harvesting 22,310 sockeye salmon.

Coho Salmon

Harvest Summary

The 2018 purse seine harvest for the Southern District was 1,747 coho salmon. This compares to a previous 10-year average harvest of 994. The set gillnet harvest for the Southern District was 3,067. The previous 10-year average harvest for set gillnet gear was 1,888.

The Kamishak Bay District harvest was 9,077 coho salmon. This compares to a previous 10-year average annual harvest of 136 from the Kamishak Bay District commercial fishery.

In 2018, 1,277 coho salmon were donated at the weir to members of the public.

Pink Salmon

Run and Escapement Summary

In the Southern District, China Poot Creek did not achieve its pink salmon SEG, and 2 streams, Tutka Creek and Seldovia River, exceeded the upper end of their respective pink salmon SEG ranges.

Pink salmon escapement was within the SEG in the Bruin River in the Kamishak Bay District. The pink salmon escapement was below the SEG range at Sunday Creek and Brown's Peak Creek (Kamishak Bay District). Escapement levels for salmon in the Kamishak District may have been underestimated due to poor weather conditions that prevented regular aerial surveys of that area.

In the Outer District, preliminary estimates show that pink salmon escapement was below the SEG range for 3 stocks, within the range for 3 stocks, and above the range for 3 stocks. Escapement levels for salmon in the Outer District may have been underestimated due to poor weather conditions that prevented regular aerial and ground surveys of this area.

Due to small runs in the previous 10 years, no pink salmon wild stocks were forecast to be available for commercial harvest from the Eastern District in 2018.

Harvest Summary

The 2018 purse seine harvest for the Southern District was 472,204 pink salmon. This compares to a previous 10-year average harvest of 83,523. The set gillnet harvest for the Southern District was 56,638. The previous 10-year average harvest for set gillnet gear was 11,861. In addition, 997,518 were harvested by CIAA from SHAs in this district for cost-recovery purposes.

The Kamishak Bay District harvest was approximately 5,000 pink salmon. This compares to a previous 10-year average annual harvest of 49,542 from the Kamishak Bay District commercial

fishery. The Outer District harvest was 32,326. This harvest compares to the previous 10-year average annual harvest of 954,505.

Chum Salmon

Run and Escapement Summary

The chum salmon SEG was exceeded at the Bruin River in the Kamishak Bay District. Escapement levels for salmon in the Kamishak District may have been underestimated due to poor weather conditions that prevented regular aerial surveys of that area.

Chum salmon escapement in the Outer District was below the SEG at Island Creek and Port Dick Creek, within the SEG range at Dogfish Bay, and above the SEG range in the Rocky River. Escapement levels for salmon in the Outer District may have been underestimated due to poor weather conditions that prevented regular aerial and ground surveys of this area.

Harvest Summary

The 2018 purse seine harvest for the Southern District was 1,166 chum salmon. This compares to a previous 10-year average harvest of 994. The set gillnet harvest for the Southern District was 4,232. The previous 10-year average harvest for this set gillnet gear was 3,760.

The Kamishak Bay District commercial fishery harvest was 8,298 chum salmon. This compares to a previous 10-year average annual harvest of 23,953.

The Outer District harvest was 34,857 chum salmon. This harvest compares to the previous 10-year average annual harvest of 65,438.

Upper Cook Inlet

The overall harvest of the 2018 commercial salmon fishery of Upper Cook Inlet (UCI) was poor. The 2018 UCI commercial harvest of approximately 1.3 million salmon (Table 5) was 61% less than the recent 10-year average annual harvest of 3.4 million.

Chinook Salmon

Run and Escapement Summary

Moderate increases have been seen in Chinook salmon numbers for the past 4 years, but runs were expected to be below average in Southcentral Alaska for the 2018 season. The 2018 Chinook salmon return turned out to be significantly below average and lower than the preseason forecasts, leading to inseason conservation measures in all fisheries in order to reduce the harvest of Chinook salmon stocks.

The 2018 preseason run forecast for Deshka River Chinook salmon was approximately 12,800 fish. The Deshka River SEG is 13,000–28,000. Based on this forecast, the 2018 run to the Deshka River would not be large enough to achieve the SEG, even with no harvest. The preseason outlook for all other Northern Cook Inlet Chinook salmon stocks in 2018 was poor. This followed 2017 when weak Chinook salmon production also occurred in northern streams resulting in 12 of the 14 monitored Chinook salmon stocks not achieving their escapement goals, including all 7 Chinook salmon *stocks of concern*. The estimated final 2018 escapement of Chinook salmon in the Deshka River was approximately 8,544; this was below the lower end of the SEG. Additionally, the Alaska Board of Fisheries adopted a new Chinook salmon SEG of 2,100–4,300 for the Little Susitna River at its 2017 UCI finfish meeting. The Little Susitna River weir count in 2018 was only 549 Chinook

salmon; this meant that, although the weir was submerged for considerable time due to high rainfall, the SEG was not achieved.

Kenai River late-run Chinook salmon are managed to meet an SEG of 13,500–27,000 large (>75 cm mid eye to tail fork) fish. If restrictions are implemented in the sport fishery to achieve the SEG (from July 1–31), restrictive paired actions are also required in the Upper Subdistrict set gillnet (ESSN) fishery. The 2018 preseason forecast was for a total run of 21,503 large Kenai River late-run Chinook salmon. Based on low preseason abundance estimate for late-run Chinook salmon and low abundance of the early-run Chinook salmon stock, the 2018 late-run sport fishery in the Kenai River was restricted to no bait on July 1 and further restricted to no retention on July 16. As a result of the sport fishery being restricted to no bait, beginning July 1 the ESSN commercial fishery was restricted to fishing no more than 48 hours per week with a 36-hour Friday no-fishing window per week. When the sport fishery was further restricted to no retention, the ESSN fishery was limited to fishing no more than 24 hours per week, with no mandatory closures. At the 2017 Alaska Board of Fisheries meeting, the East Foreland Section (statistical area 244-42) was exempted from these paired restrictive provisions due to very low Chinook salmon harvest in this area. However, due to low Kenai sockeye salmon run, entry extra hours for the East Foreland Section were limited. Beginning August 1, after the Kenai River Chinook salmon sport fishery is closed, the paired restrictive provisions are no longer in effect, but the ESSN fishery is still managed to meet both Chinook and sockeye salmon escapement goals. Low abundance of sockeye salmon in the Kenai River resulted in the entire ESSN fishery outside of the Kenai River SHA being closed from July 30 to the end of the season on August 15.

Late-run Chinook salmon passage in the Kenai River was counted at the River Mile 14 sonar site from July 1 through August 20. The final 2018 sonar count of large late-run Kenai River Chinook salmon was 16,957, with an escapement estimate of 17,343 to account for fish spawning below the sonar site. Thus, the large fish SEG of 13,500-27,000 for Kenai River late-run Chinook salmon was achieved.

Harvest Summary

In UCI, most Chinook salmon are harvested from 2 commercial fisheries: The Northern District set gillnet fishery and the set gillnet fishery in the Upper Subdistrict of the Central District. Late-run Chinook salmon returning to the Kenai and Kasilof rivers are the primary Chinook salmon stocks harvested in UCI commercial fisheries.

The directed Chinook salmon set gillnet fishery in the Northern District was closed for the entire 2018 season to reduce the harvest of Northern Cook Inlet Chinook salmon. In addition, the initial June 25 set gillnet fishing period for sockeye salmon in the Northern District was closed to conserve Chinook salmon. Only 143 Chinook salmon were harvested in the regular fishery in the Northern District, 93% less than the average total Chinook salmon harvest of 1,986 from this district when the directed fishery is open.

The 2018 year-end Chinook salmon harvest in all UCI commercial fisheries was 3,392; this was 60% less than the previous 10-year (2008–2017) average annual harvest of 8,430. Of this total, the ESSN fishery harvested 2,273 Chinook salmon, or 67% of the harvest. Of the 2,273 Chinook salmon harvested in the ESSN fishery, an estimated 590, or 26%, were large Chinook salmon, and a total of 409, or 18%, were large Kenai River late-run origin fish. The drift fishery harvested 503 Chinook salmon of all sizes and all stocks.

Sockeye Salmon

Run and Escapement Summary

The 2018 total run of sockeye salmon to UCI—including estimates of commercial, sport, personal use, educational, subsistence harvests, and escapement of approximately 3.1 million—was 32% less than the preseason forecast. The sockeye salmon run forecast to the Kenai River in 2018 was 2.5 million; this meant that management of the drift and set gillnet fisheries fell in the middle run-size tier under provisions for Kenai River sockeye salmon runs between 2.3 and 4.6 million.

Fish Creek fell short of the forecast by 120,000 sockeye salmon, and the number returning to the Susitna River and all other systems (minor systems) were also considerably less than forecast in 2018. The Kenai River run fell short of the forecast by approximately 1.1 million.

A similar pattern of sockeye salmon passage in the Kenai River was observed in 2018 as was seen in 2015 through 2017. For the fourth year in a row, the peak day of sockeye salmon passage in the Kenai River was significantly less than peak count days of recent years (2018 = 54% less). In 2018, the peak day of passage occurred on July 21, with 62,623 sockeye salmon, whereas the 2008–2017 average was 135,000. The 2018 figure represented the second lowest peak day of passage in the past 10 years. This is further exemplified by the fact that commercial fishing on this stock had been closed for the previous 6 days to increase daily passage into the Kenai River. In the previous 10 years, the average date where 50% of sockeye salmon passage has occurred in the Kenai River is July 23. In 2018, 50% of the final passage estimate did not occur until August 3–11 days later than average. The late run timing and smaller peak count complicated management in 2018 as management plans with specific dates and triggers were developed in relation to average run entry timing and magnitude.

The Kasilof River sockeye salmon total run estimate was 167,000 fewer than forecast. In 2018, sockeye salmon passage in the Kasilof River through midnight on June 24 was only 23,477. Kasilof River sockeye salmon passage is typically about 64% complete through July 19, and the 2018 total passage estimate of 188,345 for that date suggested that the biological escapement goal (BEG) of 160,000–340,000 could be met, even with a reduction in harvest of this stock.

A remote video system was deployed at Packers Creek to monitor sockeye salmon escapement into Packers Lake. A review of the video data midseason did not support any additional fishing periods beyond Monday and Thursday regular periods in the Kalgin Island Subdistrict in 2018, but the lower end of the escapement goal was achieved by the end of the season.

Harvest Summary

The 2018 UCI commercial harvest of 818,000 sockeye salmon was approximately 71% less than the 2008–2017 average annual harvest of 2.8 million. The 2018 sockeye salmon harvest was the seventh smallest on record and the smallest harvest since 1975.

Total sockeye salmon harvest in 2018 in the Upper Subdistrict setnet fisheries was 289,841. From June 25 through August 15, the Kasilof Section set gillnet fishery inclusive of Kenai River SHA was open on 20 different days, harvesting approximately 222,086 sockeye salmon. The average annual sockeye salmon harvest in the Kasilof Section during the previous 10 years (excluding 2012 due to significant restrictions to the fishery for Chinook salmon conservation) was 646,000. The Kasilof River SHA was opened on 5 days in 2018 and 11,410 sockeye salmon were harvested. From July 10 through August 14, the Kenai and East Foreland sections were open on 6 different

days, producing a total harvest of 67,775. This was only 15% of the previous 10-year (excluding 2012) average annual harvest of 443,000 for those sections.

The total UCI drift gillnet harvest in 2018 was approximately 400,000 sockeye salmon; this was about 75% less than the average annual harvest of 1.6 million from the previous 10 years. The peak day of harvest in the drift fleet occurred on Thursday, July 12, where 313 vessels harvested approximately 89,602, or 313 fish/boat. The average peak harvest per boat was 919 for the previous 10 years. The drift harvest of 400,285 was 58% of the total harvest between the 2 gillnet gear types; the previous 10-year average was 56% (2012 was excluded). The ESSN fishery harvested approximately 42% of the total harvest (289,841 fish) compared to their previous 10-year average of 44%.

Approximately 3,000 sockeye salmon were harvested in the Kustatan Subdistrict in 2018, with 1,310 of these harvested during the Big River fishery. The 2018 sockeye salmon harvest was approximately 8% less than the recent 10-year (2008–2017) average annual harvest of 3,268.

In 2018, approximately 36,000 sockeye salmon were harvested from the Kalgin Island Subdistrict, with nearly 3,554 (10%) of those fish taken during the Big River sockeye salmon fishery. The average annual sockeye salmon harvest during the previous 10 years was approximately 54,889, with roughly 11,500 of those harvested during the early season Big River fishery.

In 2018, approximately 50,000 sockeye salmon were harvested in the Northern District. This harvest was 29% greater than the 2008–2017 average annual harvest of 38,734, and approximately 43% less than the 1966–2017 average of nearly 87,000.

Coho Salmon

Run and Escapement Summary

In UCI, there are 4 coho salmon systems with escapement goals that are monitored inseason with weirs, and 1 monitored with a foot survey. Fish Creek, Little Susitna, and Deshka rivers have weirs, and McRoberts Creek is counted with foot surveys. The goal at Fish Creek is an SEG of 1,200–4,400. Coho salmon counts at the Fish Creek weir occurred from July 20 to September 24 and produced a final estimate of 5,022, exceeding the upper end of the SEG. The Little Susitna River has a coho salmon SEG of 10,100–17,700. Coho salmon escapement was counted at the Little Susitna weir from July 6 through August 8, when the weir integrity was lost due to high water, and the total passage estimate was at 7,583. A new SEG of 10,200–24,100 was adopted at the 2017 UCI Board of Fisheries meeting for Deshka River coho salmon. In the second year of assessing coho salmon escapement in this drainage as it related to the SEG, 12,933 fish were counted through the weir by August 29. Finally, there is a coho salmon foot survey SEG of 450–1,400 at McRoberts Creek that drains into Jim Creek of the Knik River drainage. In 2018, the foot survey was conducted on September 21 and produced a count of 758, so the SEG was achieved for this system.

Harvest Summary

The 2018 harvest estimate of approximately 232,290 coho salmon in all commercial fisheries in UCI was 29% greater than the recent 10-year (2008–2017) average annual harvest of approximately 180,000. The 2018 drift gillnet harvest of 108,906 coho salmon was very close to the recent 10-year average of approximately 107,000. The Northern District set gillnet harvest of 67,000 coho salmon in 2018 was the largest harvest since 2000 and was approximately 86% greater than recent 10-year (2008–2017) average annual harvest of 36,000.

Pink Salmon

Harvest Summary

Pink salmon runs in UCI are even-year dominant, with odd-year average annual harvests typically less than one-sixth of even-year harvests. The 2018 UCI commercial pink salmon harvest was estimated to be approximately 126,923; this was 68% lower than the average annual harvest of nearly 386,413 from the previous 10 years of even-year harvests.

Chum Salmon

Run and Escapement Summary

There is only 1 chum salmon escapement goal in UCI, the SEG of 3,800–8,000 in Chinitna River/Clearwater Creek, the major tributary that drains into Chinitna Bay. Two aerial surveys of chum salmon escapement were conducted in Chinitna Bay (Chinitna River/Clearwater Creek) in 2018. Only 2,300 chum salmon were observed in this watershed during aerial survey flights, indicating the minimum SEG was not achieved. As such, Chinitna Bay was not opened to drift gillnetting until August 31, after the chum salmon run, to focus on coho salmon.

Harvest Summary

The 2018 harvest of 115,366 chum salmon was approximately 31% lower than the previous 10-year average annual harvest of 165,000.

BRISTOL BAY

The commercial harvest of 41.3 million sockeye salmon (Table 5) was 10% above the 37.6 million preseason forecast and is the second largest harvest on record. The preliminary harvests for other species are 41,696 Chinook salmon; 1,868,308 chum salmon; 138,466 coho salmon; and 218,998 pink salmon.

Chinook Salmon

Run and Escapement Summary

Chinook salmon escapement into the Nushagak River was 97,239 and within the escapement goal range of 55,000–120,000. The Chinook salmon escapement into the Alagnak River was 998 based on aerial surveys and was below the escapement goal of 2,700.

Harvest Summary

Except in the Ugashik District, the 2018 Chinook salmon harvests in Bristol Bay were below average. No directed Chinook salmon fishing periods occurred in the Nushagak District in 2018. Chinook salmon were incidentally caught during directed sockeye salmon periods in all commercial districts and a preliminary total of 45,000 Chinook salmon were harvested, 13% below the 20-year average of 48,161.

Sockeye Salmon

Run and Escapement Summary

The 2018 inshore Bristol Bay sockeye salmon run of 62.3 million is the largest on record dating back to 1893 and was 69% above the 36.9 million average run for the latest 20-year time period. It was the fourth consecutive year that inshore sockeye salmon runs exceeded 50 million. The 2018

Bristol Bay sockeye salmon run was 21% above the preseason inshore forecast of 51.3 million. Runs to all districts, except Egegik, were larger than the preseason forecast.

Naknek-Kvichak, Egegik, and Ugashik districts (east side) observed the latest run timing on record and because of the disparity in run timing between the Nushagak and the east side districts, the processing sector was able to keep pace with the run. The Bristol Bay sockeye salmon run was dominated by fish with 1 year of freshwater residence (ages 1.2 and 1.3). Fish with 2 years of freshwater residence (age 2.2 and 2.3) were below preseason expectations, particularly in the Egegik and Kvichak rivers.

All sockeye salmon escapement goals were met or exceeded, with a total baywide escapement of 21.0 million.

Harvest Summary

The 2018 commercial harvest of 41.2 million was 69% higher than the recent 20-year average for all districts. The Nushagak District sockeye salmon harvest of 24.2 million was the largest single Bristol Bay district harvest on record.

Coho Salmon

Harvest Summary

The 2018 commercial coho salmon harvest was 162,000. Typically, the Nushagak District is the largest coho salmon producer and accounted for 84,000 this year (above the 20-year average).

Pink Salmon

Harvest Summary

Pink salmon return to Bristol Bay in even years. The 2018 harvest was 244,000; this is 55% below the 20-year average (for even years only) of 488,383 pink salmon. Most pink salmon returning to Bristol Bay are harvested in the Togiak and Nushagak districts.

Chum Salmon

Harvest Summary

The 2018 commercial harvest of Bristol Bay chum salmon was 1,637,000, higher than the latest 20-year average (1998–2017) of 983,118. Nushagak District was the largest producer of chum salmon (1,192,060 were harvested).

ACKNOWLEDGMENTS

ADF&G would like to thank the Bristol Bay Fisheries Collaborative (BBFC) for funding assistance in 2018. The BBFC began in 2016 and is an agreement between ADF&G and the Bristol Bay Science and Research Institute (BBSRI) to work together with stakeholders to restore a world-class fisheries management system and raise funds to support and maintain it. This agreement is supported by ADF&G, drift and set gillnet fishermen, processors, municipalities, villages, support industries, and other stakeholders. A list of organizations that committed financial support to the BBFC in 2018, as well as additional information about this agreement can be found at <https://www.bbsri.org/bbfc>.

In 2018, BBFC funding and resources were responsible for the deployment of a second boat in the Port Moller Test Fishery. The use of a second test fishing vessel provided the opportunity to

document the migratory path of Bristol Bay sockeye salmon well beyond the historically fished locations.

Table 5.–Preliminary 2018 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Purse Seine						
Eastern District	0	6	24	10,290	197	10,516
Northern District	0	3	3	2,627	9	2,641
Coghill District	0	2	6	687	4	700
Northwestern District	0	4	1	184	8	197
Southwestern District	0	49	44	4,912	356	5,360
Montague District	0	6	2	395	453	856
Southeastern District	0	0	1	443	28	472
Unakwik District	0	0	0	0	0	0
Drift Gillnet						
Bering River District	0	0	121	0	0	121
Copper River District	8	47	304	11	3	372
Coghill District	0	187	4	286	1,802	2,280
Eshamy District	0	823	3	303	131	1,260
Montague District	0	0	0	0	0	0
Unakwik District	0	4	0	0	0	4
Set Gillnet						
Eshamy District	0	182	0	23	10	215
Hatchery ^a	0	0	10	3,902	467	4,379
Prince William Sound Total	8	1,312	523	24,063	3,468	29,374
Southern District						
Southern District	0	71	5	529	5	611
Kamishak District	0	34	9	5	8	56
Outer District	0	1	0	32	35	69
Eastern District	0	22	0	0	0	22
Hatchery ^b	0	242	1	998	0	1,241
Lower Cook Inlet Total^c	0	370	15	1,564	49	1,999
Central District						
Central District	3	765	165	114	111	1,159
Northern District	0	53	67	13	4	137
Upper Cook Inlet Total	3	818	232	127	115	1,296
Naknek-Kvichak District						
Naknek-Kvichak District	2	8,918	12	31	311	9,273
Nushagak District						
Nushagak District	36	24,230	84	142	1,020	25,513
Egegik District						
Egegik District	2	5,150	21	3	76	5,251
Ugashik District						
Ugashik District	1	2,772	2	1	72	2,848
Togiak District						
Togiak District	3	868	43	68	158	1,141
Bristol Bay Total	45	41,937	162	244	1,637	44,025
Central Region Total	57	44,437	932	25,998	5,269	76,694

Note: Missing data indicates no harvest and zeros indicate harvest activity but <500.

Note: Columns may not total exactly due to rounding.

^a Hatchery sales for operating expenses and broodstock harvests.

^b LCI hatchery harvest includes hatchery cost recovery and hatchery donated fish but not broodstock.

^c LCI total includes commercially harvested fish retained for homepack.

ARCTIC-YUKON-KUSKOKWIM REGION

Arctic-Yukon-Kuskokwim (AYK) Region 2018 harvests totaled 2,353,000 salmon (Table 6). Cumulative all-gear commercial harvest included 919 Chinook, 4,000 sockeye, 371,000 coho, 1,898,000 chum, and 80,000 pink salmon. Commercial salmon harvests for sockeye, chum, and pink salmon—which comigrate with Chinook salmon—were limited by conservation measures to protect Chinook salmon. Chum salmon abundance was variable throughout the region, with large abundance occurring in the Yukon River and Kotzebue. Sockeye and coho salmon abundance were generally strong throughout the region in locations where they occur.

KUSKOKWIM AREA

The 2018 fishing season was the third consecutive year since statehood that there were no large-scale commercial salmon buyer/processors in the Kuskokwim Area. This resulted in very little opportunity for fishermen in District 1 and no opportunity for fishermen in District 4 (Quinhagak) and District 5 (Goodnews Bay).

Preseason management actions including early season subsistence fishing closures, tributary closures, time and area restrictions, gillnet mesh size and length restrictions, and live release requirements were jointly recommended by the Alaska Department of Fish and Game (ADF&G) and the US Fish and Wildlife Service to achieve escapement goals. The Kuskokwim River Salmon Management Working Group and the Kuskokwim River Inter-Tribal Fish Commission voted to support the management actions.

Early season subsistence fishing closures were initiated in various locations in the Kuskokwim Area. With these closures came additional restrictions, including tributary closures and live release of Chinook salmon requirements. During the front-end closure there were 2 gillnet opportunities with 4-inch or less mesh to allow subsistence fishers time to harvest nonsalmon species. Various gear restrictions were made on the mainstem and tributaries throughout the 2018 season. The tributary restrictions were kept in place beyond the mainstem restrictions for the purpose of conservation while Chinook salmon were on their spawning grounds.

Beginning June 12, the Federal Subsistence Board adopted a Special Action to close the Kuskokwim Chinook salmon fishery to non-Federally qualified users within the boundary of the Yukon Delta National Wildlife Refuge. The US Fish and Wildlife Service managed the subsistence fishery within the Yukon Delta National Wildlife Refuge through July 6, and then ADF&G resumed management of the entire Kuskokwim River.

Chinook Salmon

Run and Escapement Summary

The preliminary Kuskokwim River total run estimate is approximately 140,891 Chinook salmon (95% CI: 113,093–175,521). The Kuskokwim River drainagewide escapement goal was likely achieved but will not be fully assessed until after all data has been analyzed this winter.

Due to the early season subsistence fishery closures, Bethel Test Fish (BTF) was limited as an indicator of Chinook salmon run timing. Subsistence harvest is historically weighted towards the beginning of the run, and the lack of this early season fishery resulted in the evaluation of a larger proportion of the early run than other years on record. Run timing was average based on BTF.

Preliminary Chinook salmon escapement at KogrukluK River weir is 5,757; this is within the established SEG range of 4,800–8,800. Preliminary Chinook Salmon escapement of 3,421 to the George River weir exceeded the established SEG range of 1,800–3,300. Escapement at Kwethluk River weir was not assessed due to the project being inoperable for the majority of the Chinook salmon migration. Seven tributaries have aerial survey SEGs and all 7 tributaries were within the respective SEG ranges.

The Kanektok River weir did not operate in 2018 due to a lack of funding. The Chinook salmon aerial survey for the Kanektok River SEG of 3,500–8,000 was achieved with an estimate of 4,246.

Harvest Summary

Postseason subsistence harvest surveys are presently being conducted. An assessment of subsistence salmon harvest in 2018 will not be available until after postseason harvest surveys have been completed, data have been analyzed, and preliminary harvest estimates are produced. Average subsistence Chinook salmon harvest on the Kuskokwim River is 84,000.

Sockeye Salmon

Run and Escapement Summary

Based on BTF, sockeye salmon run timing was late. Overall, sockeye salmon escapement was well above average across the drainage. The preliminary KogrukluK River weir escapement of 18,934 exceeded the established SEG range of 4,400–17,000. The Telaquana weir observed the highest escapement of sockeye salmon since the project was established in 2010 with a count of 197,324.

The Kanektok River weir did not operate in 2018 due to a lack of funding. The sockeye salmon aerial survey SEG for the Kanektok River of 14,000–34,000 was exceeded with an estimate of 326,200; this is the second highest escapement estimate on record.

Coho Salmon

Run and Escapement Summary

Coho salmon run timing was only partially assessed at BTF due to project operational dates. This season the project ended operations a week early due to a boating accident involving the BTF vessel. All run strength indicators point to a below average coho salmon run. Coho salmon passage at the Kwethluk River weir was below average with a count of 5,589; this is below the established SEG threshold (>19,000). The preliminary KogrukluK River weir coho salmon escapement did not achieve the lower bound of the SEG range of 13,000–28,000, with a season count of 7,700.

Harvest Summary

Due to the lack of a large-scale commercial buyer/processor, only a few short commercial fishing opportunities directed at coho salmon were provided in the Kuskokwim River in early to mid-August resulting in well below average harvests. Participants included those commercial fishermen who had registered with ADF&G as catcher/sellers and had secured their own markets. Due to the small number of participants during these commercial fishing periods State of Alaska confidentially requirements prohibit release of the harvest.

Chum Salmon

Run and Escapement Summary

Chum salmon run timing at BTF was late and escapement projects showed an average run. The preliminary escapement count of 45,230 at the Kogruklu River weir achieved the established SEG range of 15,000–49,000.

YUKON AREA

The 2018 Yukon River total commercial harvest was 576,700 summer chum, 387,785 fall chum, 111,000 coho, and 39,000 pink salmon for the Alaska portion of the drainage. A total of 446,381 summer chum, 369,595 fall chum, 106,000 coho, and 39,000 pink salmon were harvested in the lower Yukon River (Districts 1–3) and 130,319 summer chum, 18,190 fall chum, and 4,000 coho salmon were harvested in the upper Yukon River (Districts 4–6). The commercial harvests of fall chum and coho salmon combined in 2018 were the fourth largest on record since 1961.

Chinook Salmon

Run and Escapement Summary

The 2018 preseason Chinook salmon outlook was a range of 173,000–251,000.

The 2018 Chinook salmon run appears to have been 2 days later than average based on the midpoint at the sonar project near Pilot Station. The first 2 pulses were weaker than expected based on preseason forecast; this triggered restrictive management actions to reduce harvest, but the later part of the run came in stronger and thus gave management confidence to relax some subsistence restrictions. Escapement assessment for Chinook salmon was hampered by high water conditions for tower counting projects. Sonar estimates of passage were collected at Chena and Salcha rivers; preliminary sonar estimates indicate goals were met. The SEG at the East Fork Andreafsky River Weir was met with a passage of 4,114 Chinook salmon. Preliminary Chinook salmon passage at the border sonar project near Eagle was approximately 57,893; this is likely sufficient passage to meet the border objectives of providing a Canadian harvest share for Chinook salmon and meeting the Interim Management Escapement Goal (42,500–55,000).

Harvest Summary

As with previous years, restrictions to the summer season Chinook salmon-directed subsistence fishing were taken in response to poor Chinook salmon runs in recent years. For the 11th consecutive year, summer season Chinook salmon-directed commercial fishing was not allowed.

Because Chinook salmon are encountered incidentally in the commercial summer chum salmon fishery, a suite of strategies was used to conservatively manage the fishery in order to minimize the impact to the Chinook salmon run. Chinook salmon are required to be released alive from these selective gear types. Once commercial fishing was allowed with gillnets, all Chinook salmon could be released alive or kept for subsistence use.

The sale of incidentally caught Chinook salmon was prohibited by emergency order during the entire summer and fall commercial fishing. Fishermen were required to report any Chinook salmon released alive or caught but not sold on fish tickets. An estimated 11,928 Chinook salmon were reported released alive, and 3,042 Chinook salmon were kept for personal use in Districts 1 and 2 during the summer season commercial fishery. A total of 286 Chinook salmon were encountered

and released alive in District 4. In District 6, fishermen retained 143 incidentally caught Chinook salmon for personal use.

Coho Salmon

Run and Escapement Summary

The estimated passage of 136,300 coho salmon past Pilot Station sonar was below the historical median of 160,000. However, preliminary run reconstruction indicates a run size of 239,000; this is above historical median of 217,000. The Delta Clearwater River has the only established escapement goal for coho salmon in the Yukon Area, an SEG range of 5,200–17,000. A boat survey conducted in the Delta Clearwater River in early November observed 2,884 coho salmon; this was below the escapement objective. Escapement estimates for coho salmon were conducted by aerial surveys in the Nenana River drainage, where 3 out of 4 escapements were below the 1974–2017 average.

Pink Salmon

Harvest Summary

The majority of the pink salmon harvest was from the summer season with a total of 39,000.

Chum Salmon

Run and Escapement Summary

The 2018 preseason summer chum salmon outlook was for approximately 2.5 million.

The drainagewide escapement goal of 500,000–1,200,000 summer chum salmon was exceeded with an estimated escapement of over 1.6 million; however, goals on the East Fork Andreafsky and Anvik rivers were not met. This is not entirely unexpected based on the recent trend of lower river stocks not performing as well as upriver stocks. The summer chum salmon tower counts were considered incomplete for the Chena and Salcha rivers for the 2018 season due to unfavorable water conditions; however, summer chum passage was considered about average and preliminary sonar counts indicate goals were met.

The preliminary 2018 fall chum salmon run size is estimated to be 1,100,000; this was below the lower end of the preseason forecast range of 1,600,000–1,800,000. As this was a record high forecast, more weight was put on the preseason projection of 700,000–900,000 and managed through the season based on inseason projections. The preliminary drainagewide escapement estimate for fall chum salmon was 643,000; this exceeded the upper end of the SEG range of 300,000–600,000. Most fall chum salmon escapement goals were exceeded (drainagewide, Mainstem Yukon, Chandalar, Tanana and Delta rivers). The exception was the Fishing Branch River (Porcupine River drainage), which has failed to achieve the lower end of its Interim Management Escapement Goal range of 22,000–49,000 for 3 of the last 5 years despite other Yukon River stocks meeting or exceeding their escapement goals or objectives.

Harvest Summary

Commercial fishing opportunity was provided to target summer chum salmon in Districts 1, 2, 4, and 6.

Selective fishing for summer chum salmon using dip nets and beach seines began June 9 in District 1. The combined harvest in Districts 1 and 2 with selective gear types was 243,881 summer

chum salmon. The use of gillnets in the summer chum commercial fishery was delayed until well after the midpoint of the Chinook salmon run when the passage estimate at Pilot Station sonar was around 139,000 Chinook salmon.

The District 4 summer chum salmon harvest of 126,892 was 7% above the recent 5-year average of 118,241 and was the second largest harvest since 1996.

The 2018 District 6 commercial harvest of 3,437 summer chum salmon was 34% below the recent 5-year average of 5,188.

The Lower Yukon Area harvest of 446,381 summer chum salmon was 8% above the 2013–2017 average harvest of 415,117. The Upper Yukon Area harvest of 130,319 summer chum was nearly 6% above the 2013–2017 average of 123,319. The total 2018 summer season commercial harvest for the entire Yukon Area was 576,700 summer chum salmon; this was 17% above the 2013–2017 average harvest of 491,249 and was the largest on record since 1996.

The fall chum salmon directed commercial fishery ended by regulation after August 31. Coho salmon-directed commercial fisheries occurred in District 1 during September 1–10, and in District 6 as a terminal harvest area during October 1–28. The total commercial harvest for the Yukon River in the Alaska portion of the drainage was 387,785 fall chum salmon. The 2013–2017 5-year average commercial harvests of fall chum salmon (300,044) have been well above the 2008–2017 10-year average.

NORTON SOUND AREA

The commercial fishery harvest of coho and chum salmon in the Norton Sound Area was a record, with the chum salmon harvest being the second highest on record and the best since 1983. Although a small portion of the overall salmon harvest was attributed to sockeye salmon, the sockeye salmon harvest was the second highest in history at approximately 4,000. Despite high pink salmon returns, pink salmon were harvested as an incidental catch only. Restrictions were taken in the subsistence fishery in southern Norton Sound to protect Chinook salmon, and escapements were higher than in recent years. Escapement goal ranges were exceeded for all salmon species, except for Chinook salmon. One of 2 Chinook salmon escapement goals were reached.

Chinook Salmon

Harvest Summary

Commercial Chinook salmon harvest for the Norton Sound Area was 906.

Sockeye Salmon

Harvest Summary

Commercial sockeye salmon harvest for the Norton Sound Area was approximately 4,000.

Coho Salmon

Run and Escapement Summary

The 2018 coho salmon harvest easily exceeded the forecast of 170,000–220,000 and obliterated the previous record of 191,254 coho salmon harvested last year.

Harvest Summary

Commercial coho salmon harvest for the Norton Sound Area was 260,471. The 2018 coho salmon harvest easily exceeded the forecast and surpassed the 2017 harvest record of 191,254.

Pink Salmon

Run and Escapement Summary

The pink salmon run was also much stronger than expected, but there was little interest by the buyer and there were no directed pink salmon commercial fishing periods. The pink salmon harvest was an incidental catch during chum and coho salmon directed fishing periods and the harvest was within the forecast range of 25,000–75,000.

Harvest Summary

Commercial pink salmon harvest for the Norton Sound Area was 40,449. The pink salmon run was also much stronger than expected, but there was little interest by buyers and there were no directed pink salmon commercial fishing periods. The pink salmon harvest was an incidental catch during chum and coho salmon-directed fishing periods.

Chum Salmon

Run and Escapement Summary

The 2018 forecasted commercial chum salmon harvest range was 150,000–200,000. The harvest was over the forecast even though fishing time was limited early in the season in southern Norton Sound to protect Chinook salmon, and the buyer restricted fishing time because of capacity concerns.

Harvest Summary

Commercial chum salmon harvest for the Norton Sound Area was 238,030.

KOTZEBUE SOUND AREA

Chinook Salmon

Harvest Summary

Buyers purchased 13 Chinook salmon in 2018. Permit holders also retained 214 Chinook salmon for personal use.

Sockeye Salmon

Harvest Summary

Buyers purchased 15 sockeye salmon in 2018. Permit holders also retained 47 sockeye salmon for personal use.

Coho Salmon

Harvest Summary

Permit holders retained 17 coho salmon for personal use in 2018.

Pink Salmon

Harvest Summary

Permit holders retained 1,174 pink salmon for personal use in 2018.

Chum Salmon

Run and Escapement Summary

No aerial surveys were flown in 2018; however, the Kobuk River test fish chum salmon catch index ranked fifth highest in the last 26 years.

Harvest Summary

The Kotzebue Sound chum salmon harvest in 2018 was a record harvest of 695,153. The harvest was above the forecast of 400,000–600,000, and ADF&G noted in the 2018 management plan that there was the possibility of record harvest of nearly 700,000 if the market could accept that level of harvest. There was increased commercial fishing time when a floating processor arrived in late July because the fishery was no longer restricted by airplane cargo capacity. A total of 5,642,859 pounds of chum salmon were sold by commercial vessels during 2018.

Table 6.–Preliminary 2018 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total ^a
	Chinook	Sockeye	Coho	Pink	Chum	
Kuskokwim River	0	0	0	0	0	0
Kuskokwim Bay	0	0	0	0	0	0
Kuskokwim Area Total	0	0	0	0	0	0
Lower Yukon River	0	0	106	39	816	961
Upper Yukon River	0	0	4	0	149	153
Yukon River Total	0	0	111	39	964	1,114
Norton Sound	1	4	260	40	238	543
Kotzebue Sound	0	0	0	0	695	695
AYK Region Total	1	4	371	80	1,898	2,353

Note: Zeros indicates no harvest or fewer than 500 fish harvested. Columns and rows may not total exactly due to rounding error.

^a Confidential information not included.

WESTWARD REGION

KODIAK AREA

The commercial fishing effort in 2018 was below average compared to recent years. Participation rates for purse seine, beach seine, and set gillnet permits were all below the previous 10-year averages.

The 2018 commercial harvest (not including personal use or ADF&G test fishery) in the Kodiak Management Area (KMA) was approximately 4,000 Chinook, 1,772,000 sockeye, 441,000 coho, 5,944,000 pink, and 464,000 chum salmon (Table 7). The total KMA harvest (including Kodiak Regional Aquaculture Association cost recovery) of 8,668,580 was well below the 2018 forecast as well as the previous 10-year average of approximately 21,563,216.

Chinook Salmon

Run and Escapement Summary

The total Chinook salmon escapement (5,378) was below the previous 10-year average. Escapement goals for Chinook salmon have been developed for the Karluk and Ayakulik rivers, and escapements are estimated using fish counting weirs.

The Chinook salmon escapement through the Karluk River weir (3,155) was within the BEG range of 3,000–6,000. Chinook salmon escapement through the Ayakulik River weir (2,149) was below the BEG range of 4,800–8,400; however, the Ayakulik River weir was out due to high water during much of the Chinook salmon run.

Harvest Summary

There are no directed Chinook salmon commercial fisheries in the KMA, but incidental commercial harvest occurs during targeted sockeye and pink salmon fisheries. The 2018 commercial harvest of Chinook salmon in the KMA totaled 4,000; this was below the previous 10-year average (13,726) and below the 2018 forecast (8,000).

Sockeye Salmon

Run and Escapement Summary

Sockeye salmon runs in many systems in the KMA were average. The major sockeye salmon systems of the KMA met their established escapement goals although several smaller systems (Buskin, Malina, Pasagshak, and Afognak) did not achieve their escapement goals. The entire KMA estimated sockeye salmon escapement of (1,501,385) was above the previous 10-year average of 1,275,371.

Harvest Summary

The 2018 commercial harvest of sockeye salmon totaled 1,772,000. The harvest was below the recent 10-year average (2,295,184) and the preseason forecast (2,609,500).

Early season management for much of the Westside of Kodiak Island is driven by Karluk early-run sockeye salmon. Periodic fishing time was allowed along much of the Westside of Kodiak until the management focus turned to pink salmon. A total of 167,652 sockeye salmon were harvested in early-season Westside areas opened based on Karluk early-run sockeye salmon.

Westside sockeye salmon numbers include an estimated contribution of 57,792 from the enhanced Spiridon Lake sockeye salmon run.

Late-season management for much of the Westside of Kodiak is driven by the Kodiak Island pink salmon fishery and Karluk late-run sockeye salmon. A total of 1,107,852 sockeye salmon were commercially harvested in late-season Westside areas opened based on local pink and chum salmon as well as Karluk late-run sockeye salmon. Westside sockeye salmon numbers include an estimated contribution of 90,831 from the enhanced Spiridon Lake sockeye salmon run.

The Ayakulik sockeye salmon run was moderate, allowing for 3 fishing periods during early-run sockeye salmon management. A total of 98,796 sockeye salmon were harvested in areas managed based on Ayakulik early-run sockeye salmon. The strength of the Ayakulik late-run sockeye salmon was also moderate. Approximately 19,299 sockeye salmon were harvested in areas managed based on Ayakulik late-run sockeye salmon. A total of 118,095 sockeye salmon were harvested from Westside sections opened based on Ayakulik returns; this was below the 2018 forecast of 193,500.

Frazer Lake and Upper Station early-run sockeye salmon runs were adequate to allow for commercial salmon openings in the traditional fishing areas (i.e., seine and gillnet sections of the Alitak District). The Alitak District early-run sockeye salmon harvest was approximately 81,002; this was below the projected harvest of 116,000.

Upper Station late-run sockeye salmon run came in stronger than expected and liberal fishing time was permitted. The total harvest of the Alitak District late-run sockeye salmon was approximately 196,526; this was above the forecasted harvest of 107,000.

The Cape Igvak Salmon 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 Chignik-bound. Both Chignik sockeye salmon runs were extremely weak and the allocative and biological criteria were never met to allow fishing in the Cape Igvak Section. No sockeye salmon were harvested in the Cape Igvak Section through July 25; the preseason forecast was approximately 67,500.

From July 6 to July 25, the North Shelikof Sockeye Salmon Management Plan (5 AAC 18.363) places harvest limits on areas along the 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 managed based on local pink and chum salmon runs. If it appears that the sockeye salmon harvest will meet or exceed limits set by the management plan, then fisheries are to be restricted to inshore Shoreward Zones only, and offshore Seaward Zones are closed.

An ADF&G biologist was present on the grounds to determine the sockeye salmon catch and to facilitate orderly and short notice closures if the harvest limits are met. A Seaward Zone closure was implemented in the North Shelikof Unit at 8:00 p.m., July 25, when it was estimated that the cumulative sockeye salmon harvest had approached the 15,000 limit. The total July 6–25 harvest in the North Shelikof Unit was 16,066 sockeye salmon; this included both the Shoreward and Seaward Zone harvests. A Seaward Zone closure did not take place in the Southwest Afognak Section and the harvest cap of 50,000 was never exceeded. A total of 831 sockeye salmon were harvested in the Southwest Afognak Section between July 6 and July 25.

Some fisheries occur in areas where salmon enhancement projects create surplus production. There was below average effort and harvest in the Foul Bay Special Harvest Area (SHA) with 5,626 sockeye salmon harvested.

In the Spiridon Bay SHA (Telrod Cove), and the Spiridon Bay Section, 75,420 sockeye salmon were harvested. This includes cost-recovery fish harvested by Kodiak Regional Aquaculture Association. The harvest in the Spiridon Bay SHA and the Spiridon Bay Section represents only a portion of the total harvest of Spiridon enhancement fish, the remainder is harvested in traditional fisheries along the Westside of Kodiak. It is estimated that approximately 73,203 Spiridon enhancement fish were harvested outside of Telrod Cove and the Spiridon Bay Section, bringing the total Spiridon enhancement sockeye salmon harvest to 148,623; this was well below the forecast of 274,000.

The Kitoi Bay Hatchery harvest was 25,381 sockeye salmon; this was below the forecast of 49,000. 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

Run and Escapement Summary

The only established coho salmon escapement goals occur in the Northeast Kodiak and Eastside Kodiak districts for the following systems: American (400), Olds (1,000), Buskin (4,700–9,600) and the Pasagshak (1,200) rivers. At the time of this report the final estimated escapement numbers have not been calculated.

Coho salmon enter systems in the fall after most of the weirs have been removed. From limited foot surveys on streams conducted near the city of Kodiak and the Islands of Afognak and Shuyak, coho salmon escapement was well above average. However, due to warm and dry weather conditions in September many of the runs were later than usual.

Harvest Summary

The commercial coho salmon harvest of approximately 441,000 was similar to the forecast (400,200) and above the previous 10-year average (296,287). The majority of the coho salmon were caught in the Westside Kodiak and Kitoi Bay fisheries.

Pink Salmon

Run and Escapement Summary

The KMA pink salmon escapement of 5,154,242 was above the previous 10-year average of 4,207,128. Pink salmon escapement goals have been established as aggregate goals for the entire Kodiak Archipelago and the Mainland District. The escapement for the Kodiak Archipelago (4,873,842) was near the upper end of the escapement goal range of 2.0–5.0 million; however, 47% of the total archipelago's pink salmon escapement (2,275,207) returned to just the Karluk River. The Mainland District pink salmon escapement of 280,400 was below average but within the established escapement goal range (250,000–1,000,000).

Harvest Summary

The 2018 pink salmon harvest of 5,944,000 was below the forecast (8,700,000) and well below the previous 10-year average harvest of 18,109,553.

The wild stock pink salmon harvest was approximately 2,762,720 in the KMA (5,916,000 forecast). Most of the pink salmon were harvested in the Westside and Alitak Districts. Westside pink salmon fisheries (Raspberry Cape to Ayakulik) harvested approximately 1,659,000 and the Alitak District harvested approximately 780,000.

The Kitoi Bay Hatchery pink salmon run was stronger than expected with approximately 3,200,000 pink salmon harvested in sections near the hatchery (2,100,000 forecast). Kitoi-bound pink salmon were likely harvested along the west and east sides of Kodiak and Afognak islands. Likewise, additional wild stock salmon were likely harvested in areas associated with Kitoi Bay Hatchery. However, ADF&G does not have a stock separation program for pink salmon and is unable to differentiate stocks. There was no cost-recovery fishery near the hatchery in 2018.

Chum Salmon

Run and Escapement Summary

The overall KMA chum salmon escapement of 342,745 was below the previous 10-year average (363,734). A peak indexed escapement goal based on 17 streams in on the Kodiak Archipelago has been established. The 2018 peak indexed escapement of 126,300 was above the goal of 101,000.

Harvest Summary

Most of the KMA wild chum salmon are harvested during the directed pink and chum salmon fisheries in July. Due to the weak pink salmon returns and the extended closures, the 2018 KMA chum salmon harvest of 464,000 was well below the 2018 forecast (1,017,000). Additionally, the Kitoi Bay Hatchery chum salmon harvest of 166,041 chum salmon was below the forecast of 263,000, but above the 10-year average of approximately 134,000.

CHIGNIK AREA

The Chignik River watershed supports 2 genetically distinct sockeye salmon runs that traditionally provide the majority of directed harvest opportunities within the Chignik Management Area (CMA). The 2018 overall sockeye salmon run of 539,825 (escapement and harvest) was the poorest return on record since statehood. As a result, the early- and late-run Chignik River sockeye salmon combined total run was well below all recent averages. There was no commercial fishing targeting sockeye salmon in 2018. Two 48-hour fishing periods did occur in select inner bays of the CMA; the first in July to target early opportunity on pink and chum salmon, and the second in September to target coho salmon. Very little effort occurred in either fishing period.

In June, commercial salmon fishing is based on the strength of the Chignik River early-run sockeye salmon. The first commercial fishing period, established by emergency order, is typically based on escapement monitored at the weir. Future fishing periods are determined by daily escapement as well as harvest information. In late June through July, the CMA is managed largely to achieve adequate escapement of the Chignik River early- and late-run sockeye salmon, as well as local pink and chum salmon stocks. Beginning in early July, opportunity to target early pink and chum salmon may occur in select bays of the Central, Western, Eastern, and Perryville districts. In August, and for the remainder of the season, management of the CMA is based on achieving the Chignik River late-run sockeye salmon goals and on ADF&G's evaluation of local stocks of pink, chum, and coho salmon. If the Chignik River late sockeye salmon run is not meeting the escapement goal objectives and a harvestable surplus of pink, chum, or coho salmon is available,

ADF&G may restrict fishing to certain areas in the CMA to minimize the harvest of sockeye salmon.

ADF&G did not conduct test fisheries in the CMA during the 2018 season.

Escapement through the Chignik River weir was monitored using underwater digital video equipment from June 1 to August 18. Two underwater gates in the weir were open to provide uninterrupted escapement. 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.

Two DIDSON (Dual Identification Sonar) acoustic units were also installed in the Chignik River simultaneous to weir operations from August 1 to August 18 (when the weir was removed early due to a high-water event). From August 19 to September 6, the DIDSON units were the sole method used to record fish passage. The numbers of fish passing upstream of the DIDSONs were counted for the first 10 minutes of each hour. The counts were then expanded to obtain hourly escapement estimates. Species apportionment was determined by fishing with a seine net every couple of days. This project is funded by an Alaska Sustainable Salmon Fund grant with the purpose of providing a direct comparison between weir and DIDSON operations in order to develop a correction factor between the 2 methods. This was the last year of the 3-year Alaska Sustainable Salmon Fund grant. Currently, ADF&G is still analyzing the 2016–2018 seasons. Data in this report does not include preliminary DIDSON information for 2016 and 2017. However, the Chignik River weir was removed much earlier than normal in 2018 and DIDSON estimates will be used for this season since they are the only estimates available for a portion of August and September.

Aerial surveys were flown throughout the season to monitor escapement into other CMA streams. Peak aerial survey counts, by index stream and species, were summed and compared to available escapement goals established by Schaberg et al. (2015). Pink and chum salmon escapements were measured against established areawide SEGs.

Chinook Salmon

Run and Escapement Summary

The Chignik River is the only major 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 into the Chignik River watershed is 1,300–2,700. The 2018 Chignik River Chinook salmon escapement, above the weir, was very poor (825) and did not meet the escapement goal. State subsistence fishing and sport fishing for Chignik River Chinook salmon closed on July 13 in order to protect the run and allow as many spawning fish to escape as possible. State subsistence and sport fishery harvest of Chinook salmon prior to the closure will not be known until permits and questionnaires are returned and tabulated by the spring of 2019.

Harvest Summary

No Chinook salmon were commercially harvested in the CMA during 2018.

Sockeye Salmon

Run and Escapement Summary

The Chignik River sockeye salmon run in 2018 was extremely poor and well below all recent averages. Through July 31, a total of 359,646 sockeye salmon passed the weir, slightly more than half of the 10-year average total escapement for this time of year (617,000). The final estimated escapement (including weir, DIDSON, and postweir estimates) through September 30 of 539,697 was the lowest final estimated escapement for the Chignik River sockeye salmon run since 1969 (485,144). The total 2018 estimated escapement to the Chignik River was approximately 70% of the 10-year average escapement.

The Chignik River sockeye salmon early and late runs overlap in run timing from approximately mid-June through July. Each run is managed based on separate escapement objectives (early-run BEG of 350,000–450,000; late run SEG of 275,000–400,000). In order to estimate the early- and late-run fish passing the weir in season, ADF&G applied an average stock proportion curve developed from genetic data collected during the 2010–2017 seasons. The model from which the curve was developed assumes that early-run fish escape upriver through July 31. Late-run sockeye salmon begin escaping in mid-June and all fish passing the weir beginning August 1 are considered late run. Through July 31, the early run was estimated to be approximately 192,000, well below the final early-run goal. The late-run sockeye salmon escapement was estimated to be approximately 168,000 through July 31 and was tracking slightly above the minimum escapement objectives for that time of year.

In 2018, genetic samples were again taken at the weir to determine the final proportion of early- to late-run fish during the peak of the overlap period (late June through late July). The samples were collected every 4 or 5 days from approximately June 26 to July 27. The samples were sent to the ADF&G genetics lab in Anchorage and analyzed after the final sampling period. The transition between runs was estimated by fitting the stock proportion data to a common logistic equation adapted from Quinn and Deriso (1999).

Once the samples were analyzed, the new model was applied to the 2018 escapement and the daily proportions for early- and late-run sockeye salmon from June 1 through July 31 were readjusted. The estimated Chignik River early-run sockeye salmon escapement was adjusted to 263,979, still well below the final escapement goal and all recent averages. The late-run sockeye salmon estimated escapement through July 31 was adjusted to 95,667, dropping the estimated escapement well below escapement objectives. The late-run escapement lagged behind escapement objectives most of the season; however, it did begin meeting the lower bound objectives at the end of August. The final Chignik River late run sockeye salmon estimated escapement through September met the lower bound of the SEG with 275,718.

The Chignik River also has an inriver run goal (IRRG) of 75,000 sockeye salmon (25,000 in August and 50,000 in September) to provide for additional freshwater subsistence fishing opportunity. The IRRG requires that 25,000 sockeye salmon escape in August in addition to the minimum escapement needs for the month (73,000) so that a total of 98,000 sockeye salmon escape in August. In 2018, the estimated August escapement was approximately 145,136, meeting minimum escapement requirements for the month as well as the August IRRG component of 25,000. Approximately 34,915 sockeye salmon were estimated during September 1–30 from DIDSON estimates and a postweir/DIDSON analysis based on the rate of decay of the run. September escapement did not meet the September IRRG component of 50,000.

Harvest Summary

A total of 128 sockeye salmon were incidentally harvested during the commercial fishing period targeting pink and chum salmon in the CMA during 2018. Sockeye salmon harvest was the lowest on record since statehood and below all recent averages.

The Southeastern District Mainland (SEDM) and Cape Igvak fisheries were not opened during the allocation period as the Chignik Area harvest did not exceed the required 600,000 sockeye salmon by July 25.

Coho Salmon

Run and Escapement Summary

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. The 2018 Chignik River coho salmon escapement was 64,214; this was above the most recent 5- and 10-year average escapement estimates.

Harvest Summary

One coho salmon was commercially harvested in 2018. The most recent 10-year average for coho salmon harvest in the CMA is approximately 111,000.

Pink Salmon

Run and Escapement Summary

An estimated 3,222 pink salmon passed the Chignik River weir in 2018; this was below previous even 5- and 10-year average escapements. Pink salmon escapements into other CMA streams were estimated via aerial surveys. A new even-year pink salmon SEG (170,000–280,000) was adopted at the 2016 Alaska Board of Fisheries meeting for 4 of the 5 districts combined, and is based on 8 index streams within the districts. Aerial surveys indicated that local pink salmon stocks were late arriving in the CMA and overall escapement was weak in 2018. Pink salmon estimated total peak escapement was 41,900 for all index streams, well below recent even-year averages.

Harvest Summary

A total of 6 pink salmon were commercially harvested in the CMA in 2018. The most recent 10-year average harvest (even years only) for pink salmon in the CMA is approximately 702,000.

Chum Salmon

Run and Escapement Summary

The 2018 Chignik River chum salmon escapement was 54; this was below average for the Chignik River. Chum salmon escapements to other CMA streams were estimated via aerial surveys. A new chum salmon SEG (45,000–110,000) was adopted at the 2016 Alaska Board of Fisheries meeting based on escapement into 6 index streams within 4 of the 5 districts. The 2018 estimated total peak chum salmon escapement of 33,400 for all index streams did not meet the minimum escapement goal. It should be noted however, that aerial surveys in late July and August were extremely limited due to inclement weather and poor visibility in 2018. Surveys early in the season indicated local chum salmon stocks were arriving as expected and it is likely that the escapement goal would have been met if there had been better survey conditions.

Harvest Summary

A total of 924 chum salmon were commercially harvested in 2018. The recent 10-year average harvest for chum salmon in the CMA is approximately 253,000.

ALASKA PENINSULA, ALEUTIAN ISLANDS, AND ATKA-AMLIA ISLANDS AREAS

The 2018 commercial salmon harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amlia Islands Management areas totaled approximately 20,000 Chinook, 3,696,000 sockeye, 368,000 coho, 794,000 pink, and 1,154,000 chum salmon.

In 2018, the harvest of sockeye and Chinook salmon on the North Alaska Peninsula were both below projected harvest levels, whereas the harvest of coho, pink, and chum salmon were above projected harvest levels. The North Alaska Peninsula harvests of sockeye and coho salmon were above the previous 10-year (2008–2017) averages for each species, whereas the harvest of Chinook, pink, and chum salmon were below the 10-year averages.

Chinook Salmon

Run and Escapement Summary

Nelson River is the only river in Area M with a Chinook salmon escapement goal. At the Nelson River weir, a total of 5,022 Chinook salmon escaped, exceeding the escapement goal of 2,400–4,400. The total Northern District Chinook salmon escapement of 15,909 was above the most recent 10-year average of 12,667.

Harvest Summary

The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 4,158 Chinook salmon. The total commercial harvest for the South Peninsula Post-June fishery (including the SEDM from July 26 to October 31) was 13,146 Chinook salmon. During 2018 in the Northwestern District commercial salmon fishery, a total of 3 Chinook salmon were harvested.

Sockeye Salmon

Run and Escapement Summary

The Orzinski Lake sockeye salmon record low escapement of 2,817 was well below the SEG of 15,000–20,000 sockeye salmon.

The South Peninsula sockeye salmon escapement of 12,017 was well below the management objective range of 48,200–86,400. Escapement into Mortensens Lagoon (1,200) was well below its SEG range of 3,200–6,400. Escapement into Thin Point Lagoon (1,000) was well below the SEG range of 14,000–28,000. Reports of later-than-average subsistence harvest of sockeye salmon suggest that some sockeye salmon escapement may have occurred after the peak surveys were completed and sockeye salmon escapement is likely slightly higher than was observed.

The sockeye salmon escapement for 2018 in the Northwestern District was below the escapement objective range of 52,600–106,000, with a total escapement of 45,750.

The 2018 North Creek salmon escapement of 8,300 sockeye salmon met the escapement goal of 4,400–8,800.

The Nelson Lagoon Section was opened for all weekly fishing periods along with many extensions in fishing time in 2018. The Nelson (Sapsuk) River total run of 386,303 sockeye salmon (includes harvest and escapement) was below the estimated forecast of 428,000. From the total run, 165,303 were harvested in Nelson Lagoon and 221,000 escaped in the Nelson River. The 2018 escapement into Nelson River exceeded the BEG of 97,000–219,000.

The Bear River early-run (through July 31) sockeye salmon escapement of 324,093 exceeded the escapement goal of 176,000–293,000. The Bear River late-run (after July 31) sockeye salmon escapement of 232,907 exceeded the escapement goal of 117,000–195,000. The Bear River season sockeye salmon escapement was 557,000, surpassing the combined early- and late-run sockeye salmon escapement goal of 293,000–488,000.

The 2018 Sandy River sockeye salmon escapement of 35,000 met the season ending escapement goal range of 34,000–74,000.

In 2018 the Ilnik River system sockeye salmon escapement through the weir was 81,000, exceeding the Ilnik River escapement goal of 40,000–60,000.

Aerial escapement surveys of the Meshik River began on June 18. Subsequent surveys occurred throughout the season and the final sockeye salmon escapement into the Meshik River system was 134,100, exceeding the escapement goal of 48,000–86,000. This includes escapement into the Meshik River and tributaries, as well as Red Bluff and Yellow Bluff creeks.

The total Cinder River (including Mud Creek) sockeye salmon escapement estimate of 191,300 exceeded the escapement goal of 36,000–94,000.

Harvest Summary

The South Unimak and Shumagin Islands commercial sockeye salmon harvest for the June fishery was 822,102. There were two 96-hour openings in the SEDM that resulted in the harvest of 1,491 sockeye salmon. The total commercial harvest for the South Peninsula Post-June fishery (including the SEDM from July 26–October 31) was 514,396. In the 2018 commercial sockeye salmon fishery 7,181 were harvested in the Northwestern District; 2,318 were harvested in the Black Hills Section; 165,303 were harvested in Nelson Lagoon, and 221,000 escaped in the Nelson River; 405,703 were harvested in the Bear River Section; 361,790 were harvested in the Three Hills Section; and 1.1 million were harvested in the Ilnik Section (above historical averages). A small amount of commercial fishing effort occurred inside the Ilnik Lagoon in 2018, the harvest was negligible, and confidentiality rules prohibit reporting. In 2018, a total of 356,014 sockeye salmon were harvested from the Outer Port Heiden Section (below the 10-year average harvest of 519,132).

Coho Salmon

Run and Escapement Summary

There were no coho salmon surveys flown on the South Peninsula streams. A lack of escapement information for coho salmon is due to the departure of ADF&G management staff from the South Peninsula region prior to peak coho salmon runs, and poor weather conditions preventing aerial surveys from being conducted during peak coho salmon runs.

In 2018, a total of 44,000 coho salmon were observed in Nelson River, exceeding the Nelson River SEG threshold of 18,000.

Coho salmon surveys were done on all Northern District streams in early September before the peak of the coho salmon run. Budgetary and logistical constraints do not permit coho salmon surveys to take place later in the fall. Coho salmon runs continue through September and October, so escapements tabulated from aerial surveys are considered minimum estimates. The total coho salmon escapement in the Northern District during 2018 was 343,300—indicating a strong coho salmon run. Both the Nelson and Ilnik rivers have coho salmon lower bound escapement goals in the Northern District. The Nelson River escapement of 44,000 coho salmon exceeded the lower bound escapement goal of 18,000. A total of 122,000 coho salmon were observed during early September in the Ilnik River in 2018; this exceeded the lower bound escapement goal of 9,000. It is expected that more coho salmon entered the Ilnik and Nelson river systems during September and October. The coho salmon escapement into the Cinder River was 66,000, and 63,000 escaped into the Meshik River system (Meshik River and Landlocked Creek) as observed by aerial survey.

Harvest Summary

The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 51 coho salmon. There were two 96-hour openings in the SEDM that resulted in the harvest of 1,007 coho salmon. The total commercial harvest for the South Peninsula Post-June fishery (including the SEDM from July 26–October 31) was 271,259 coho salmon. During the 2018 commercial coho salmon fishery, 9,683 coho salmon were harvested in the Northwestern District; 31,000 coho salmon were harvested in the Nelson Lagoon Section (comparable to the recent 10-year average of 33,000); and 33,000 coho salmon were harvested in the Ilnik Section.

Pink Salmon

Run and Escapement Summary

The South Peninsula pink salmon total indexed escapement of 732,422 was well below the SEG range of 1,750,000–4,000,000.

There are no escapement goals for pink salmon in the Northern District. In some years, depending on market conditions, a directed pink salmon fishery may occur, however this did not happen in 2018. A total of 39,943 pink salmon were observed in the Northern District during 2018.

Harvest Summary

The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 345,255 pink salmon. There were two 96-hour openings in the SEDM that resulted in the harvest of 4 pink salmon. The total commercial harvest for the South Peninsula Post-June fishery (including the SEDM from July 26–October 31) was 428,143. During 2018 in the Northwestern District commercial pink salmon fishery, the harvest was 2,509.

Chum Salmon

Run and Escapement Summary

The South Peninsula Chum salmon indexed total escapement of 344,830 was within the cumulative district escapement goal range of 330,400–660,800. This escapement estimate represents a minimum; the actual escapement was likely greater but unable to be seen due to exceptionally bad weather in 2018 that limited surveys on the South Alaska Peninsula.

In the Northwestern District, the chum salmon escapement of 90,705 was below the SEG of 100,000–215,000. This escapement estimate represents a minimum; the actual escapement was

likely greater due to poor survey conditions in 1 of the major chum salmon producing streams in the Northwestern District.

The Northern District has a districtwide chum salmon escapement goal of 119,600–239,200. This goal was met with an escapement of 236,109; this is above the most recent 10-year average of 179,396. The bulk of the chum salmon escapement occurred in the Herendeen–Moller Bay Section (85,000) and the Cinder River Section (79,000).

Harvest Summary

The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 537,424 chum salmon. There were two 96-hour openings in the SEDM that resulted in the harvest of 277 chum salmon. The total commercial harvest for the South Peninsula Post-June fishery (including the SEDM from July 26–October 31) was 428,143. During 2018 commercial chum salmon fishery, a total of 105,705 were harvested in the Northwestern District, and 1,101 were harvested in the Black Hills Section.

Table 7.–Preliminary 2018 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing Area	Species					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kodiak	4	1,772	441	5,944	464	8,625
Chignik	0	0	0	0	1	1
South Peninsula and Aleutians Islands ^a	18	1,330	260	762	997	3,366
North Peninsula ^a	2	2,366	108	32	157	2,666
Alaska Peninsula Total	20	3,696	368	794	1,154	6,032
Westward Region Total	24	5,469	809	6,739	1,619	14,659

Note: Columns and rows may not total exactly due to rounding error; zeros correspond to fewer than 500 fish harvested.

^a Catches include test fishery catch.

PRELIMINARY FORECASTS OF 2019 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 2019 fishing year, forecast fisheries are as follows:

Southeast	pink salmon
Prince William Sound & Copper River	wild Chinook, sockeye, chum, and pink salmon
Upper Cook Inlet	sockeye salmon
Lower Cook Inlet	pink salmon
Kodiak	
Kodiak Management Area	pink salmon
Ayakulik River	sockeye salmon
Karluk River	sockeye salmon (early and late runs)
Alitak District (Frazer Lake and Upper Station)	sockeye salmon
Chignik Management Area	
Chignik River	sockeye salmon (early and late runs)
Bristol Bay	sockeye salmon
Alaska Peninsula	
South Alaska Peninsula	pink salmon
Bear River	sockeye salmon (late run)
Nelson River	sockeye salmon
Arctic-Yukon-Kuskokwim	
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, PWS, Cook Inlet, Kodiak, and the Alaska Peninsula. Forecasts for large hatchery runs including sockeye, pink, and chum salmon runs to the Southeast Alaska, PWS, and Kodiak areas are provided by private nonprofit operators. For 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.

SALMON SPECIES CATCH AND PROJECTIONS

Figures 2–6 show actual catch and projected catch for Chinook, sockeye, coho, pink, and chum salmon.

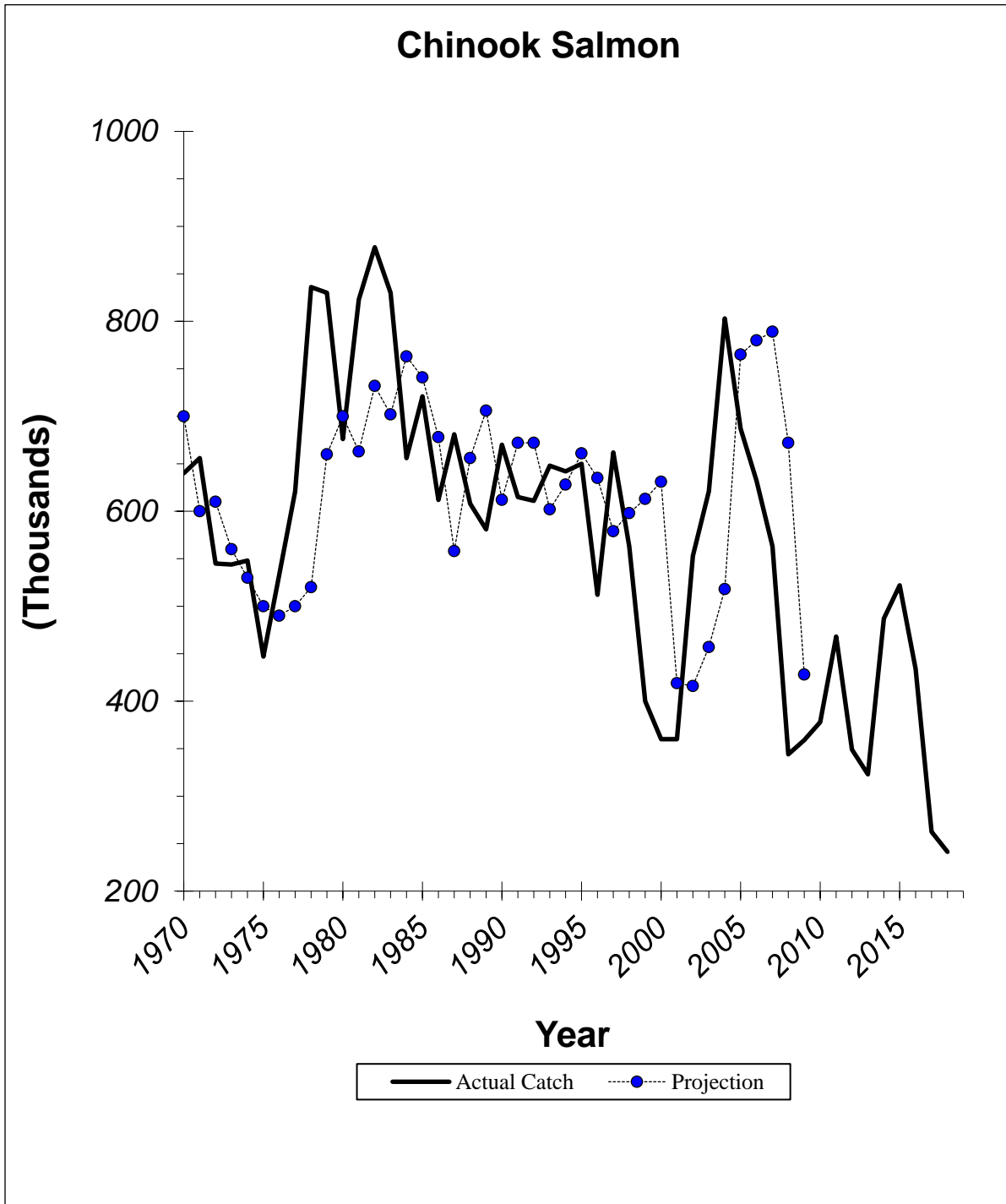


Figure 2.—Relationship between actual catch and projected catch in thousands, for Alaska Chinook salmon fisheries from 1970 to 2018; 2010–2019 projections are not available.

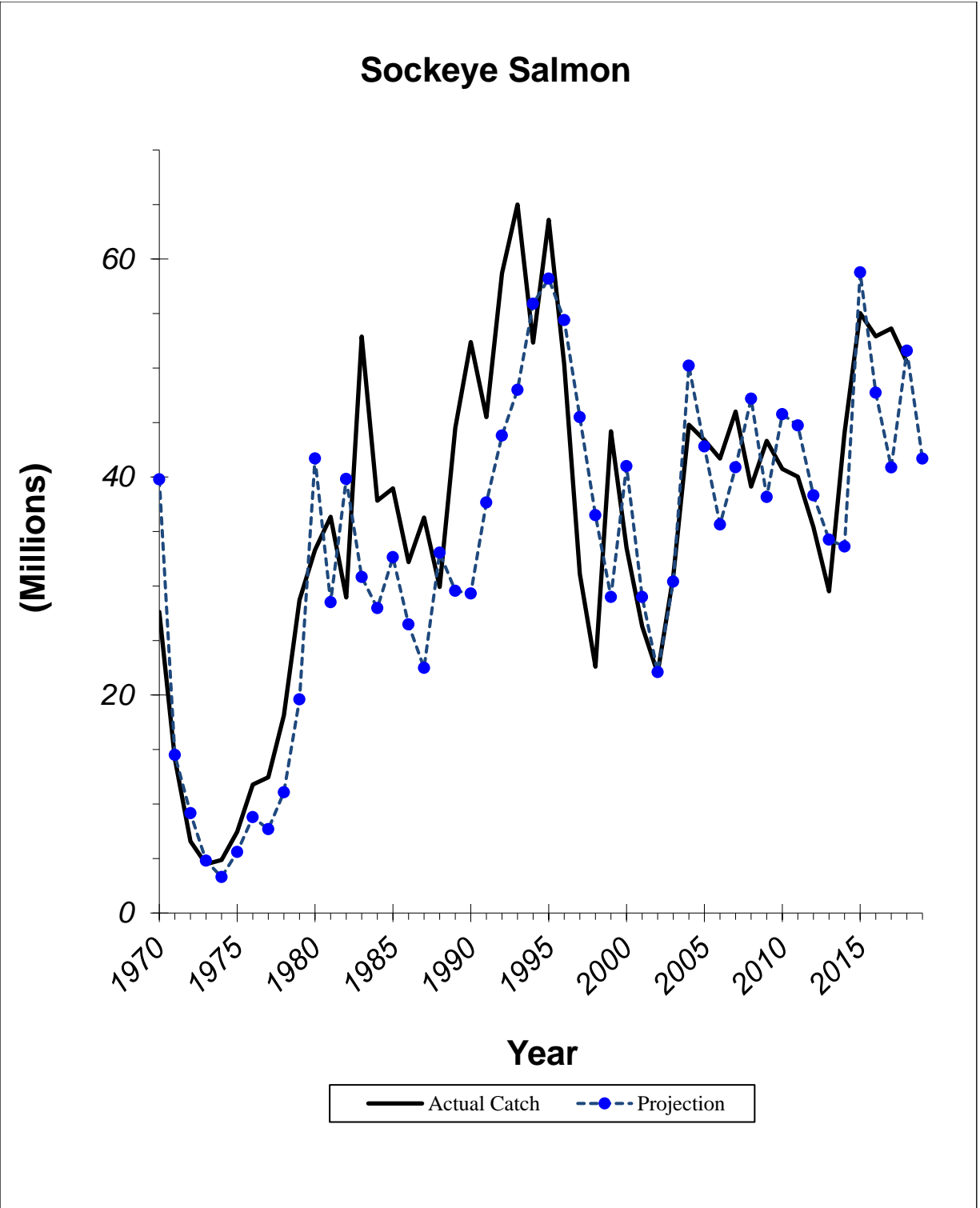


Figure 3.—Relationship between actual catch and projected catch in millions, for Alaska sockeye salmon fisheries from 1970 to 2018, with the 2019 projection.

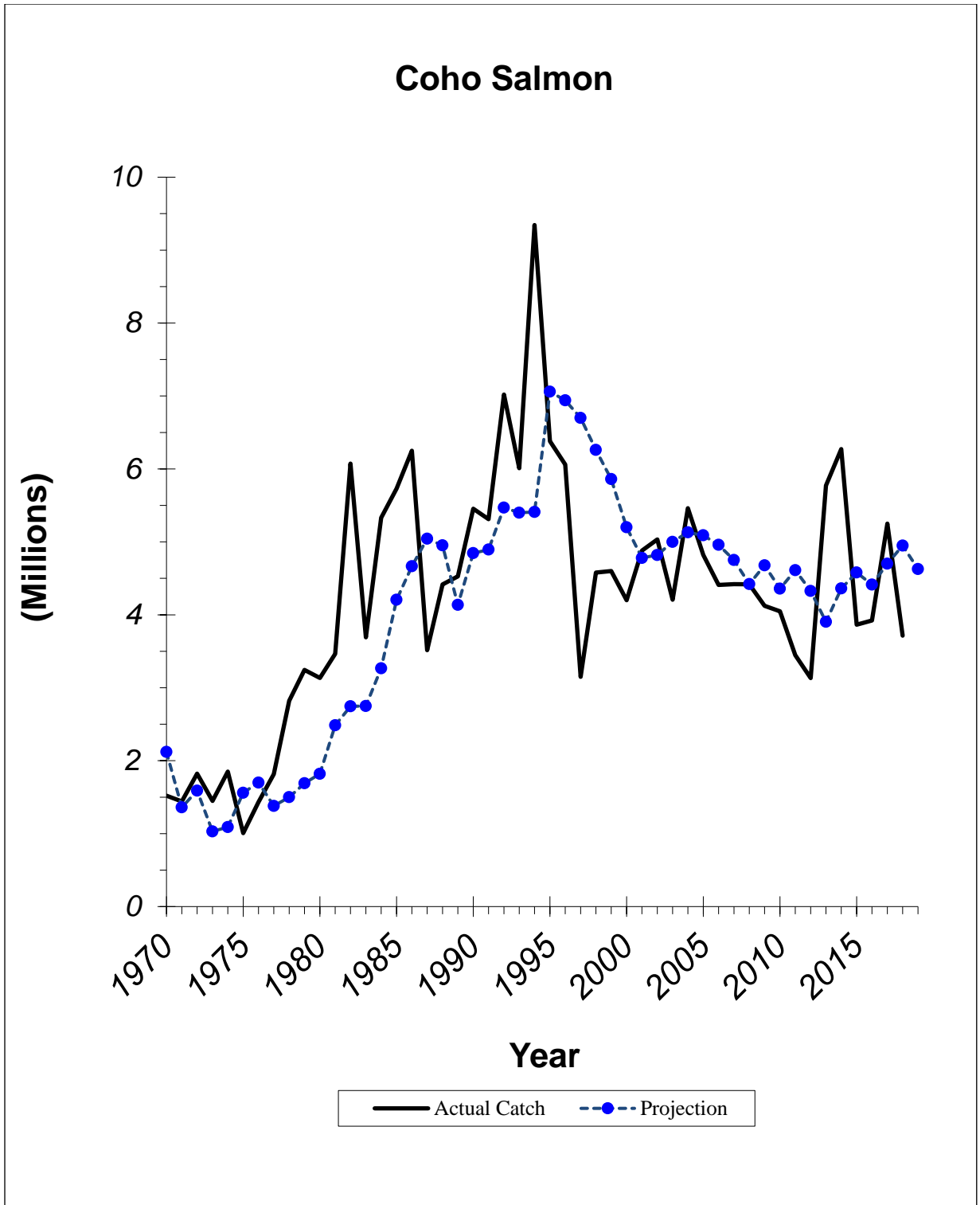


Figure 4.—Relationship between actual catch and projected catch in millions, for Alaska coho salmon fisheries from 1970 to 2018, with the 2019 projection.

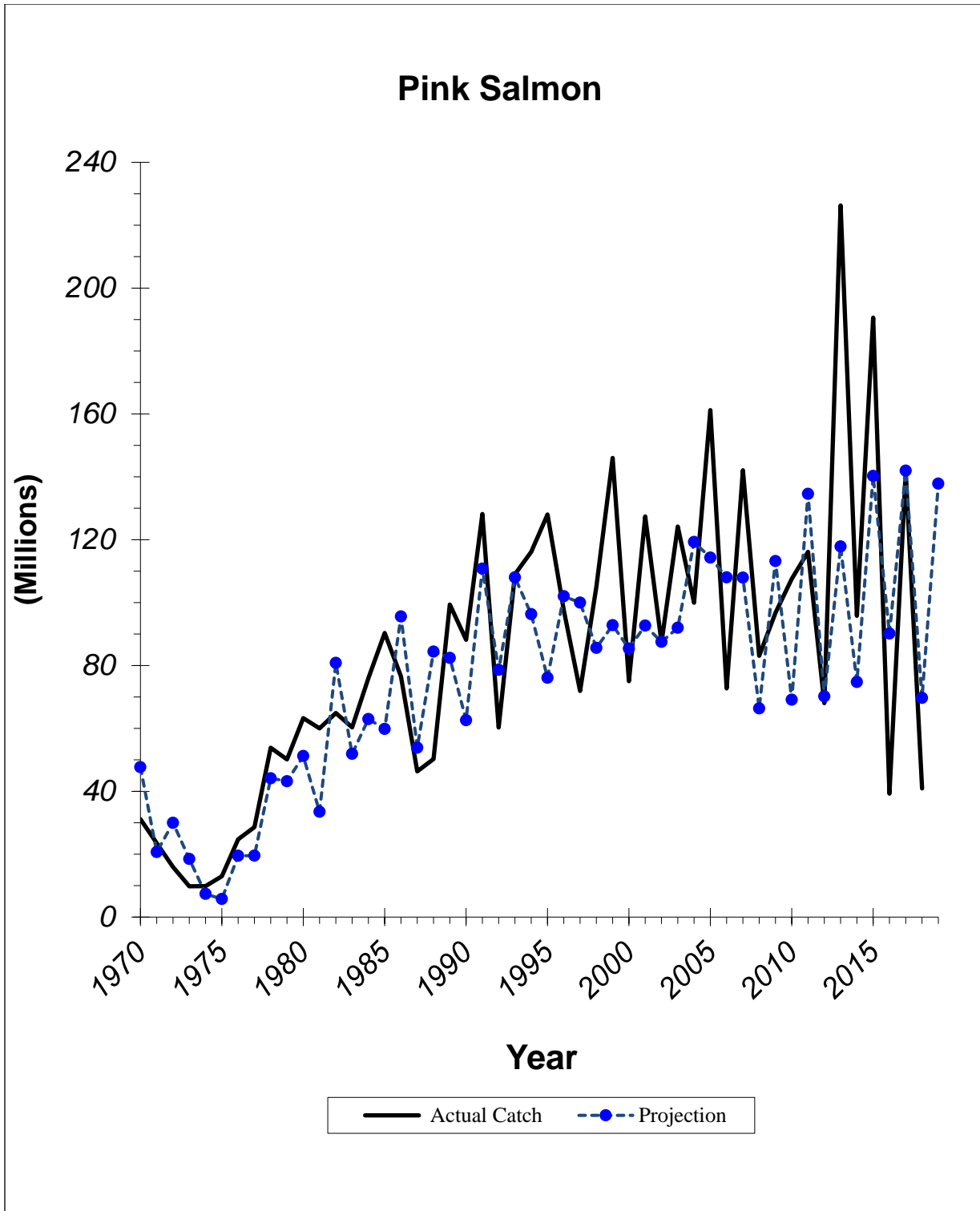


Figure 5.—Relationship between actual catch and projected catch in millions, for Alaska pink salmon fisheries from 1970 to 2018, with the 2019 projection.

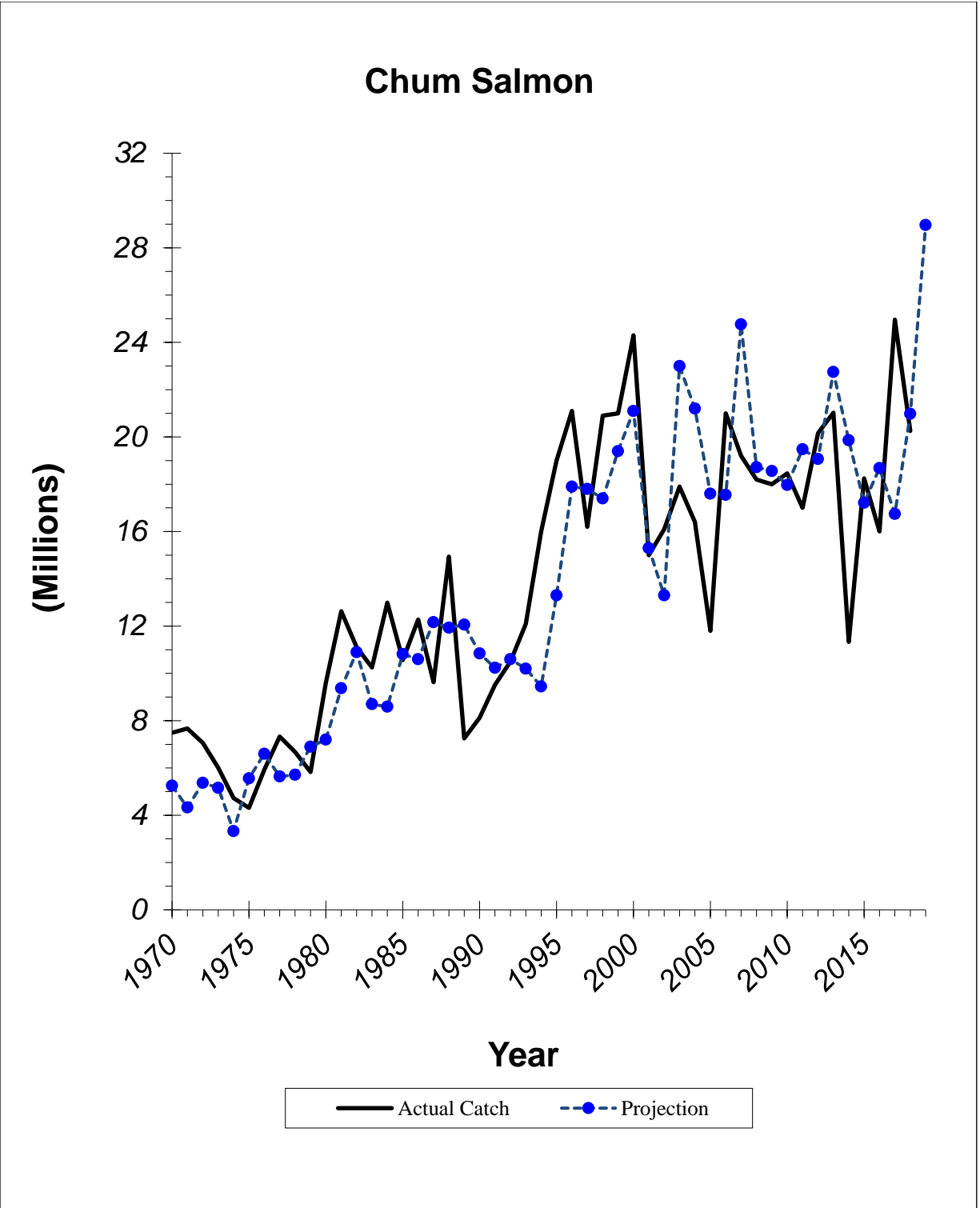


Figure 6.—Relationship between actual catch and projected catch in millions, for Alaska chum salmon fisheries from 1970 to 2018, with the 2019 projection.

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APPENDIX A: SOUTHEAST ALASKA

Forecast Area: Southeast Alaska
Species: Pink Salmon

The Southeast Alaska (SEAK) pink salmon harvest in 2019 is predicted to be in the *weak* range with a point estimate of 18 million (80% confidence interval: 15–26 million). The categorical ranges of pink salmon harvest in SEAK were formulated from the 20th, 40th, 60th, and 80th percentiles of historical harvest over the 59-year period of 1960–2018.

Category	Range (millions)	Percentile
Poor	Less than 11	Less than 20th
Weak	11 to 19	20th to 40th
Average	19 to 34	40th to 60th
Strong	34 to 50	60th to 80th
Excellent	Greater than 50	Greater than 80th

Forecast Methods

In past years, National Oceanic and Atmospheric Administration (NOAA) Fisheries, Alaska Fisheries Science Center, Auke Bay Laboratories (NOAA); and Alaska Department of Fish and Game (ADF&G) produced separate pink salmon harvest forecasts for Southeast Alaska. The 2 agencies are increasing collaboration in support of NOAA’s long-term Southeast Coastal Monitoring Project (SECM) and are combining efforts to produce a joint forecast for 2019. The ADF&G R/V *Medeia* was used to conduct the 2018 SECM surveys and ADF&G biologists provided more direct assistance to the sampling effort during the June, July, and August surveys. In the future, we plan to work towards increased coordination between the 2 agencies and will continue to look for ways to focus and expand the SECM survey to provide a wide variety of information of value to the fishing industry.

The 2019 SEAK pink salmon harvest forecast (Figures A1 and A2) was primarily based on juvenile pink salmon abundance indices collected by the SECM project in northern SEAK inside waters during June and July. These data were obtained from systematic surveys conducted annually in upper Chatham and Icy straits and are highly correlated with the harvest of adult pink salmon in the following year (Wertheimer et al. 2011). The juvenile pink salmon abundance index of 1.23 in 2018 was the third lowest in the 22 years of SECM surveys.

Forecasts were developed using an approach described in Wertheimer et al. (2011). A linear multiple regression model was developed, using monthly peak juvenile CPUE (standardized catch based on 20-minute trawl sets) for the June and July surveys and associated environmental parameters. The model used is $\ln(\text{harvest}) = \alpha + \beta(\ln(\text{CPUE}+1)) + \gamma_1 X_1 + \dots + \gamma_n X_n + \varepsilon$,

where γ is the coefficient for environmental covariates X_i (e.g., water temperatures, climate indices, fish size and condition) and ε represents the normally distributed error term. Backward/forward stepwise regression were used for environmental covariate selection and models were ranked via Akaike Information Criterion (AIC) and small sample AIC (AICc). Leave-one-out cross validation (hindcast) and model performance metrics such as Mean and Median Absolute Percentage Error (MAPE, MEAPE) were then used to evaluate forecast accuracy of alternative models.

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Forecast confidence intervals were developed using a bootstrap approach to sampling the historical series of trawl hauls (sampling with replacement) to estimate annual Peak $\ln(\text{CPUE}+1)$ for each bootstrap run, and the trawl hauls for the predictor value for each bootstrap run, to generate a series of 10,000 forecast estimates.

Forecast Discussion

The 2019 harvest forecast of 18 million pink salmon is approximately half of the recent 10-year average harvest of 36 million. A harvest near this forecast would be the lowest odd-year harvest since 1987. The 2018 peak June–July juvenile pink salmon index value (1.23) ranked 20th out of the 22 years that SECM information has been collected, and pink salmon harvests associated with juvenile indices below a value of 2.0 have ranged from 8 to 37 million (mean = 20 million).

The extremely low juvenile abundance index in 2018 was unexpected given that pink salmon escapements in 2017 were generally good and escapement goals were met in all 3 subregions of SEAK. This indicates that brood year 2017 pink salmon likely experienced poor freshwater and/or early marine survival. The Auke Creek Research Station in Juneau, Alaska, contains a permanent fish counting structure that allows for near-complete sampling of upstream and downstream migrating salmon, including pink salmon adults and fry. The escapement of 10,711 pink salmon at Auke Creek in 2017 produced only 31,540 outmigrating fry in spring 2018. The fry-per-spawner ratio of 2.94 was the second lowest on record and well below the long-term average for the odd-year brood at 13.42 fry per spawner. In addition, the midpoint date of pink salmon fry outmigration at Auke Creek in 2018 (April 20) was 4 days later than the historical average (April 16) and 9 days later than the average migration midpoint date of the last 5 odd-year brood fry (April 11). The overall midpoint date of pink salmon fry outmigration at Auke Creek has shifted earlier over time at a rate of almost a half day per year, but this year's later timing likely reflects below average temperatures in the Juneau area from February through March. The juvenile pink salmon caught in the 2018 SECM survey trawls were also the smallest (in length) in the 22-year time series; this may be related to the later emergence timing and possibly poor nearshore marine conditions in the spring.

One potential source of uncertainty regarding the 2019 pink salmon return is the anomalously warm sea surface temperatures in the Gulf of Alaska. The warm temperatures that persisted throughout the Gulf of Alaska from fall 2013 through much of 2016 (Bond et al. 2015; Di Lorenzo and Mantua 2016) have returned in 2018. Pink salmon that went to sea from 2014 to 2016 returned in numbers below expectation and below recent odd- and even-year averages. Although sea surface temperatures moderated in the Gulf of Alaska in 2017, effects on the Gulf ecosystem likely persisted and pink salmon that went to sea in 2017 and returned in 2018 also experienced reduced survival. The return of anomalously warm sea surface temperatures in the Gulf of Alaska may have a negative impact on the survival of pink salmon. Although the weak harvest forecast in 2019 is consistent with poor survival, the impact of Gulf of Alaska temperatures is unknown and adds uncertainty to the forecast.

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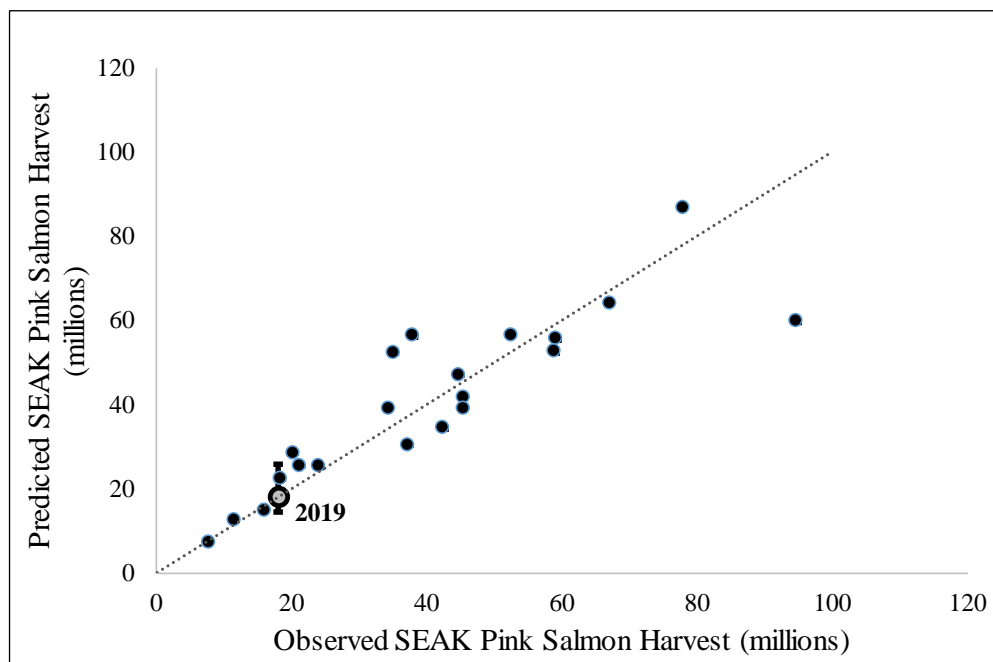


Figure A1.–Forecast model fit (hindcasts) for total Southeast Alaska (SEAK) pink salmon harvest, 1998–2018. The 2019 forecast is shown as a gray circle and the 80% forecast range is shown as a black bar. The dotted line represents a one-to-one line and circles above the line represent hindcasts that would have been over the actual harvest and circles below the line represent hindcasts that would have been below the actual harvest.

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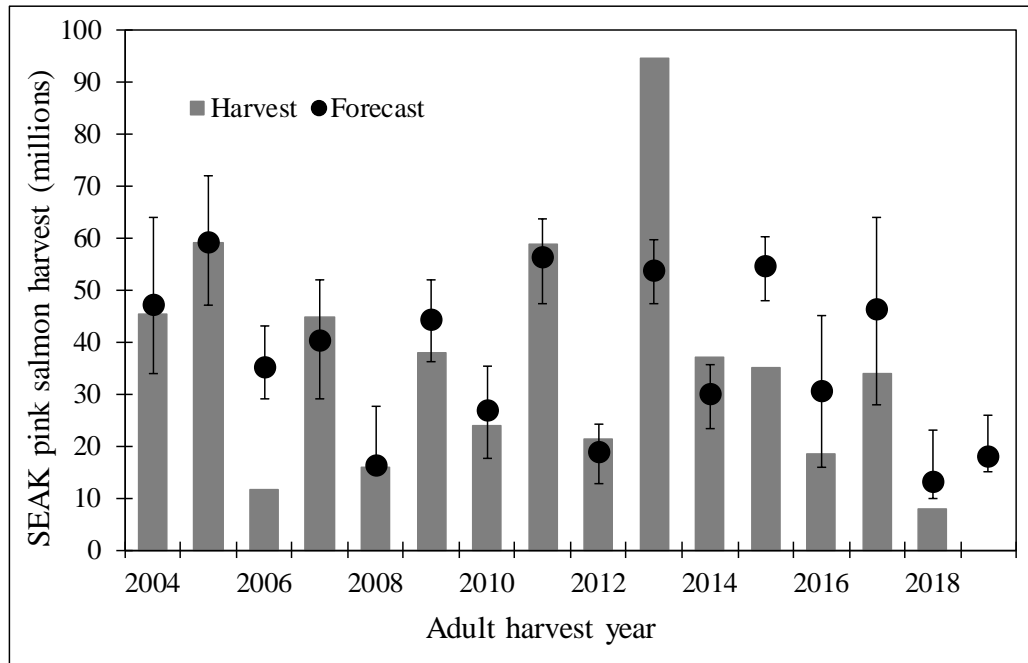


Figure A2.–Annual harvests of pink salmon in SEAK compared to the actual preseason harvest forecasts, 2004–2019. The error bars represent the 80% confidence intervals of the forecasts.

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APPENDIX B: PRINCE WILLIAM SOUND AND COPPER RIVER

Forecast Area: Prince William Sound (PWS) and Copper River

Forecasts of total run were calculated for Copper River Chinook and sockeye salmon, Gulkana Hatchery sockeye salmon, Coghill Lake sockeye salmon, and for wild Prince William Sound (PWS) pink and chum salmon. Prince William Sound Aquaculture Corporation (PWSAC) and Valdez Fisheries Development Association (VFDA) provide additional forecasts for hatchery-specific stocks. In addition to forecasts, a summary of recent 10-year averages (2009–2018) of commercial common croppery fishery (CCPF) harvest for most wild stocks and Gulkana Hatchery production are also included. Salmon forecasts are inherently uncertain and are primarily used to gauge the magnitude of expected runs and set early-season harvest management strategy. In 2019, ADF&G will continue to manage PWS Area commercial salmon fisheries *inseason* based on the strength of salmon abundance indices including sonar counts, weir passage, aerial escapement surveys, and fishery performance data.

Table B1.–2019 Prince William Sound Area formal salmon forecast summary (thousands of fish).

Area/Production Type	Species	Forecast Type	Forecast Point	Forecast Range	% Above/Below 10-yr Average
Copper River					
<i>Wild Production</i>	Chinook salmon	Total Run	55	33–77	19.6% Above
<i>Wild Production</i>	Sockeye salmon	Total Run	1,416	1,031–1,801	30.9% Below
<i>Gulkana Hatchery Production</i>	Sockeye salmon	Total Run	98	71–125	69.3% Below
<i>Total Production</i>	Sockeye salmon	Total Run	1,514	1,021–2,007	
Coghill Lake					
<i>Wild Production</i>	Sockeye salmon	Total Run	473	280–666	193.8% Above
Prince William Sound					
<i>Wild Production</i>	Pink salmon	Total Run	23,560	13,920–33,200	67.7% Above
<i>Wild Production</i>	Chum salmon	Total Run	527	275–779	10.0% Above

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Table B2.–Prince William Sound Area recent 10-year (2009–2018) average CCPF salmon harvest by species (thousands of fish).

Area/Production Type	Chinook	Sockeye	Coho	Pink	Chum	Total
Bering River						
<i>Wild Production</i>	0	2	67	0	0	69
Copper River						
<i>Wild Production</i>	12	1,043	235	37	10	1,337
<i>Hatchery Production</i>	0	204	0	0	0	204
<i>Total Production</i>	12	1,247	235	37	10	1,541
Prince William Sound						
<i>Wild Production</i>	1	176	N/A ^a	10,920 ^b	236	11,333
Area Totals						
<i>Wild Production</i>	13	1,221	302	10,957	246	12,739

^a Estimates of wild coho salmon harvests in are not available due to limited samples of thermally marked coho salmon otoliths from the commercial harvest.

^b Recent 10 odd-year CCPF harvest (1999–2017).

Forecast Area: Copper River
Species: Chinook Salmon

The 2019 Copper River Chinook salmon total run point estimate is 55,000 (80% confidence interval: 33,000–77,000). The recent 10-year average (2009–2018) Copper River Chinook salmon total run is 46,000. Subtracting the lower bound sustainable escapement goal of 24,000 from the total run forecast results in a common property harvest point estimate (all fisheries) of 31,000 (range: 9,000–53,000).

Forecast Methods

Several forecast methods were examined for the 2019 Copper River Chinook salmon total run forecast including exponential smoothing, and 2-, 3-, and 5-year running averages of total run. Total run size was calculated as the sum of commercial and subsistence harvests of Chinook salmon below Miles Lake and the mark–recapture point estimate of Chinook salmon inriver abundance. There are currently 20 years (1999–2018) of inriver abundance estimates available for this analysis. Following a 2018 biometric review of PWS Area salmon forecast methods, ADF&G concluded that running average models consistently outperformed more complex sibling models to forecast Copper River Chinook salmon.

For 2019, exponential smoothing and moving average models all produced similar forecast results in the 48,000–58,000 range. Exponential smoothing and 2-year running average forecasts had similar performance and outperformed 3- and 5-year running average models when compared retrospectively. The exponential smoothing forecast was selected for 2019 because it marginally outperformed the 2-year running average forecast by having a slightly lower mean absolute percentage error (MAPE) and mean squared error (MSE), whereas the 2-year running average had the lowest mean percent error. The exponential smoothing technique is similar to a running average except that all observations of total run since 1999 were used in the forecast estimate. Recent observations of total run were weighted more heavily in the analysis, whereas past total run observations were increasingly down-weighted with time, resulting in older total run observations having less influence on the forecast than more recent observations. The 80% confidence intervals were calculated from the mean squared error of the retrospective forecast predictions.

Forecast Area: Copper River
Species: Sockeye Salmon

The 2019 wild Copper River sockeye salmon total run point estimate is 1,416,000 (80% prediction interval: 1,031,000–1,801,000). The recent 10-year average (2009–2018) Copper River wild sockeye salmon total run is 2,049,000. Gulkana Hatchery sockeye salmon total run is predicted to be 98,000 (80% prediction interval: 71,000–125,000) for a total Copper River sockeye salmon run (wild + hatchery production) of 1,514,000 (80% prediction interval: 1,021,000–2,007,000). Total Copper River sockeye salmon common property harvest (all fisheries) is predicted to be 955,000 (80% prediction interval: 550,000–1,360,000) with a CCPF harvest of 756,000 (80% prediction interval: 351,000–1,161,000).

Forecast Methods

Forecast models examined for wild Copper River sockeye salmon for 2019 included mean total run size estimates (2-, 3-, 4-, 5-, 10-, and all-year averages), mean return of individual age classes, and regression models of sibling relationships. Historically, sibling relationship models outperform more simplistic average run models for Copper River sockeye salmon. The forecast of wild sockeye salmon to the Copper River is the total of estimates for 6 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 3 age classes were predicted from the relationship between returns of each age class and returns of the age class 1 year younger from the same brood year (sibling model). Predicted return of age-1.1, -0.3, and -2.3 sockeye salmon were calculated as the 5-year (2014–2018) mean return of those age classes. The 2019 run to Gulkana Hatchery was estimated as the recent 3-year average fry-to-adult survival estimate (0.61%) from all Gulkana I and Gulkana II hatcheries releases combined (onsite and remote). The run was apportioned to brood year using a maturity schedule of 17% age-4 and 83% age-5.

The total common property (all fisheries) harvest forecast was calculated by subtracting the Gulkana Hatchery broodstock, hatchery surplus, and wild stock escapement goal needs (upriver and Copper River Delta) from the total run forecast. The CCPF harvest estimate was calculated by subtracting inriver goal categories (5 AAC 24.360(b)) and the Copper River Delta spawning escapement goal from the total run forecast. An estimated exploitation rate of 70% was used to project the total harvest of Gulkana Hatchery stocks in 2019. There are currently 54 years (1965–2018) of harvest, escapement, and age composition data available for this analysis. Total run 80% prediction intervals were calculated as the sum of the individual age class forecast point estimates plus/minus the square root of the sum of the squared differences between the age class forecast point estimates and age class forecast 80% prediction intervals.

Historically, the forecast of Copper River sockeye salmon runs has been the most accurate forecast produced for any salmon species in the PWS area. However, the 2018 Copper River sockeye salmon forecast of 1.88 million, produced using methods as described above, resulted in an overforecast in excess of 1 million. This forecast is uncertain and should be interpreted with caution as poor runs of many Gulf of Alaska sockeye salmon stocks in 2018 suggest there is considerable likelihood of overforecasting in 2019.

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Forecast Area: Prince William Sound
Species: Sockeye Salmon (Coghill Lake)

The 2019 Coghill Lake sockeye salmon total run point estimate is 473,000 (80% prediction interval: 280,000–666,000). Subtracting the escapement target of 30,000 from the total run forecast results in a common property harvest point estimate (all fisheries) of 443,000 (range: 250,000–636,000). The recent 10-year average (2009–2018) Coghill Lake sockeye salmon total run is 161,000.

Forecast Methods

The sockeye salmon run forecast to Coghill Lake is the total of estimates for 5 age classes. Total run by year was estimated as the total commercial harvest contribution combined with the Coghill River weir escapement count. A linear regression model with 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 and age-1.2 sockeye salmon 1 year previous (sibling model), which are from the same brood year. For example, the model to predict the return of age-1.3 sockeye salmon in 2019 used the return of age-1.2 sockeye salmon in 2018 as the input parameter. Predicted returns of age-1.1, -1.2, -2.2, and -2.3 sockeye salmon were calculated as the 2009–2018 mean return of that age class.

Harvest, escapement, and age composition data are available for Coghill Lake sockeye salmon runs back to 1962; however, inclusion of escapements prior to the installation of a full weir in 1974 reduced forecast reliability. Therefore, only data collected since 1974 were used. The 80% prediction intervals for the Coghill Lake sockeye salmon total run were calculated using the squared deviations between the 2014–2018 forecasts and actual runs as the forecast variance. Historically, sibling model estimates of age-1.3 returns to Coghill Lake have a much lower MAPE (32%) than the sibling model used to predict age-1.2 returns (79%). Over the previous 10-year period (2009–2018) Coghill Lake sockeye forecasts have an average error of 43% for total run predictions and 15% for commercial harvest predictions, indicating a tendency to overforecast. The proportion of age-1.2 sampled at the Coghill River weir in 2018 was exceptionally high, resulting in a large forecast of age-1.3 for 2019. The large forecast of age-1.3 fish in 2019 is the primary driver for the large 2019 total run forecast. Poor temporal coverage of age composition sampling in 2018 due to multiple washouts of the Coghill River weir, as well as poor runs to many Gulf of Alaska sockeye salmon stocks in 2018, add considerable uncertainty to the 2019 forecast.

Forecast Area: Prince William Sound
Species: Pink Salmon (natural run only)

The 2019 PWS wild pink salmon total run point estimate is 23,560,000 (80% confidence interval: 13,920,000–33,200,000). The recent 10 odd-year average (1999–2017) PWS wild pink salmon total run is 14,050,000.

Forecast Methods

Total wild run of pink salmon by year was estimated as the total wild (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. Beginning in 2015, the number of index streams surveyed was reduced from 214 to 134 streams, and escapement goals were adjusted in 2017 to match the reduced set of index streams. Because of this, estimates of historical total run used in this analysis, as well as forecast estimates of total run, are slightly lower than pre-2017 levels. 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. Wild pink salmon contributions to the CCPF were estimated by subtracting hatchery contributions from the CCPF total. Hatchery contributions were determined from thermal marked otolith recoveries (1997–2017), coded wire tag recoveries (1985–1996), or average fry-to-adult survival estimates multiplied by fry release numbers and estimated exploitation rates (1977–1984).

Several models were examined for the 2019 PWS wild pink total run forecast including exponential smoothing and 2-, 3-, and 5-year running averages of past odd-year total runs. Exponential smoothing and moving average models produced similar forecast results in the 18–26 million range. Exponential smoothing and 2-year running average forecasts had very similar performance and outperformed 3- and 5-year running average models when compared retrospectively. The exponential smoothing forecast was selected for 2019 because it marginally outperformed the 2-year running average forecast by having less bias to over- or underforecast and lower MSE, whereas the 2-year running average had lower MAPE. The exponential smoothing technique is similar to a running average except that all observations of odd-year total run since 1961 were used in the forecast estimate. Recent observations of total run were weighted more heavily in the analysis, whereas past total run observations were increasingly down-weighted with time, resulting in older total run observations having less influence on the forecast than more recent observations. The 80% confidence intervals were calculated from the mean squared error of the retrospective forecast predictions. The large 2019 forecast of PWS odd-year pink salmon is primarily driven by record runs in 2015 and 2017.

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Forecast Area: Prince William Sound

Species: Chum Salmon (natural run only)

The 2019 PWS wild chum total run point estimate is 527,000 (80% confidence interval: 275,000–779,000). The recent 10-year average (2009–2018) PWS wild chum salmon total run is 479,000.

Forecast Methods

Total natural run by year was estimated as the total wild (nonhatchery) contribution to commercial harvests combined with the stream escapement index. See pink salmon forecast methods for details on recent changes to assessment and forecast methods. Several models were examined for the 2019 PWS wild chum total run forecast including exponential smoothing and 2-, 3-, and 5-year running averages of past total runs. For 2019, 3-year running average outperformed the other models. Our ability to accurately forecast wild chum salmon stocks is limited by the lack of data available on the wild component of commercial harvest before 2004. CCPF harvest contributions of wild stock chum salmon were estimated using pre-hatchery average natural runs (1998–2003) or thermally marked otolith estimates (2004–2018) for each district in PWS. The 80% confidence intervals were calculated from the mean squared error of the retrospective forecast predictions.

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APPENDIX C: UPPER AND LOWER COOK INLET

Forecast Area: Upper Cook Inlet
Species: Sockeye Salmon

The forecasts of the 2019 Upper Cook Inlet sockeye salmon run and harvests are as follows:

	Forecast Estimate (millions)	Forecast Range (millions)
TOTAL PRODUCTION:		
Total Run	6.0	4.8–7.3
Escapement	2.0	
UCI Commercial Harvest	3.0	
Other UCI Harvests	1.0	

Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet (UCI) are the Kenai, Kasilof, and Susitna rivers, and Fish Creek. Available escapement (spawner abundance), return, sibling, fry, and smolt data were examined for each system. To forecast the total return of sockeye salmon to UCI in 2019, up to 4 models were used to evaluate each stock and major age class: (1) the relationship between adult returns and spawners, (2) the relationship between adult returns and fall fry, (3) the relationship between adult returns and emigrating smolt, and (4) the relationship between sibling adult returns. Several forecast models were evaluated for each stock and age class. Models providing the smallest mean absolute percent error (MAPE) between the forecast and actual runs over the past 10 years were selected. Forecast model predictions were compared to evaluate uncertainty.

The return of age-1.3 Kenai River sockeye salmon in 2019 was forecasted using a fry model. The fry-model prediction of the return of age-1.3 salmon is based on the abundance estimates of age-0 sockeye salmon fry that reared in Kenai and Skilak lakes in 2015. A spawner-recruit model was used to predict the age-1.2 salmon return based upon the spawning escapement in 2015. The Kenai River return of age-2.2 salmon was forecasted using a sibling model based upon the abundance of age-2.1 salmon that returned in 2018, and the return of age-2.3 salmon was forecasted using a sibling model based upon the abundance of age-2.2 salmon that returned in 2018.

The returns of age-1.2, -1.3, -2.2, and -2.3 Kasilof River sockeye salmon in 2019 were all forecasted using sibling models based upon returns of age-1.1, -1.2, -2.1, and -2.2 salmon in 2018.

The returns of age-0.3, -1.2, -1.3, -2.2 and -2.3 Susitna River sockeye salmon were forecasted using mean return per spawner by age class for brood years 2006–2015. Mark–recapture estimates of inriver run and genetic estimates of commercial harvest were available for these brood years.

The sockeye salmon forecast for unmonitored systems in UCI was estimated as 17% of the aggregate forecast for the 4 monitored stocks. Unmonitored stocks include Crescent River, Big River, McArthur River, Chilligan River, Coal Creek, Cottonwood Creek, Wasilla Creek, Eagle River, and many other smaller systems in the area. The fraction of the total run destined for unmonitored systems was estimated using genetic estimates of the stock composition of offshore test fishery harvests.

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The total potential harvest by all user groups was estimated by subtracting the aggregate escapement from the total run forecast for all stocks. Aggregate escapement was estimated from the sum of the midpoints of the escapement goal ranges for each of the monitored sockeye salmon-producing systems and the escapement into unmonitored systems (estimated as 17% of the escapement into monitored systems). Commercial harvest was estimated from the average fraction (2011–2015) of total harvest taken in the commercial fishery. The harvest by all other user groups (sport, personal use, and subsistence) was estimated by subtracting commercial harvest from total harvest.

The 2019 total UCI run forecast range was calculated by multiplying the forecast by the MAPE of the actual UCI runs from published UCI run forecasts from 2009–2018. The run forecast ranges for Kenai, Kasilof, and Susitna rivers and Fish Creek were calculated by multiplying each system’s forecast by the 10-year (2009–2018) MAPE for that watershed (Table C1).

Forecast Discussion

In 2019, a total run of approximately 6.0 million sockeye salmon (range 4.8–7.3 million) is forecast to return to UCI with a potential commercial harvest of 3.0 million. The forecasted commercial harvest in 2019 is 200,000 more than the 20-year average harvest.

The run forecast for the Kenai River is approximately 3.8 million sockeye salmon (range 3.1–4.5 million); this is approximately 200,000 greater than the 20-year average run of 3.6 million. A fry model based upon the age-0 fry rearing in Kenai and Skilak lakes in 2015 (22.2 million compared to the 20-year average of 18.2 million) and the average weight of age-0 fall fry rearing in Skilak Lake (1.0 grams compared to the 20-year average of 1.1 grams) predicts a return of 2.7 million age-1.3 salmon in 2019. In contrast, a sibling model from the return of age-1.2 salmon in 2018 predicted a return of 3.1 million age-1.3 salmon. The fry-model was selected for this forecast because the 10-year MAPE was lower for the fry model (27%) compared to the sibling model (29%). A sibling model based upon the return of age-2.2 salmon in 2018 (202,000 vs. 20-year average of 247,000) predicted a return of 442,000 age-2.3 fish. A fry model based upon the abundance of age-1 fry rearing in Skilak and Kenai lakes in the fall of 2015 (996,000 vs. 20-year average of 2.1 million) predicted a return of 345,000 age-2.3 fish. The sibling model was selected for the forecast because the 10-year MAPE was lower for this method (82%) compared to the fry model (124%). The predominant age classes in the 2019 run forecast are age-1.2 (10%), age-1.3 (71%) and age-2.3 (12%). The 10-year MAPE for the set of models used for the 2019 Kenai sockeye salmon run forecast is 19%.

The Kasilof River sockeye salmon run forecast is approximately 873,000 (range 0.7–1.0 million); this is 11% less than the 20-year average of 979,000. A sibling model based upon the return of age-1.2 salmon in 2018 (355,000 vs. 20-year average of 321,000) was used to forecast a return of 320,000 age-1.3 salmon in 2019 with a corresponding MAPE of 56%. A sibling model based upon the return of age-1.1 salmon in 2018 was selected to forecast a return of 237,000 age-1.2 salmon in 2019; in contrast, a spawner-recruit model based upon spawner abundance in 2015 forecasted a return of 329,000 age-1.2 salmon in 2019. The sibling model was selected for this forecast because the 10-year MAPE was lower for the sibling (44%) than the spawner-recruit model (61%). A sibling model based upon the return of age-2.1 salmon in 2018 was used to forecast a return of

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200,000 age-2.2 salmon in 2019. A spawner-recruit model forecast for age-2.2 salmon was 255,000. The sibling model was selected for this forecast, because the 10-year MAPE was lower for the sibling model (14%) compared to the spawner-recruit model (20%). The predominant age classes in the 2019 run forecast are age 1.2 (27%), age 1.3 (37%), and age 2.2 (30%). The 10-year MAPE for the set of models used for the 2019 Kasilof sockeye salmon run forecast is 19%.

The Susitna River sockeye salmon run forecast is approximately 343,000 (range 233,000–422,000); this is 16% less than the 20-year average of 409,000. This forecast was derived using mean return per spawner by age class and mark–recapture estimates of spawner abundance for brood years 2006–2014. The 10-year MAPE for this forecast method is 32%. The predominant age classes in the 2019 Susitna sockeye salmon run forecast are age-1.2 (45%) and age-1.3 (40%).

The Fish Creek sockeye salmon run forecast is 124,000 (range 38,000–210,000); this is 50% greater than the 20-year average run of 83,000. A sibling model based upon the return of age-1.1 salmon in 2018 (4,000 vs. 20-year average of 3,000) was used to forecast a return of 72,000 age-1.2 salmon. A spawner-recruit model forecasted a return of 98,000 age-1.2 salmon. The sibling model was used for this forecast, because the 10-year MAPE was lower for the sibling (64%) than the spawner-recruit model (106%). Sibling models were also used to forecast the returns of age-1.3, -2.2 and -2.3 salmon. The predominant age classes in the 2019 Fish Creek run forecast are age 1.2 (57%) and age 1.3 (30%). The 10-year MAPE for the Fish Creek sockeye salmon run forecast is 69%.

Table C1.–Sockeye salmon run forecasts, 20-year average runs and escapement goals (in thousands of fish) to individual freshwater systems in Upper Cook Inlet.

System		Major age classes				Total	Total	Escapement
		1.2	1.3	2.2	2.3	run ^a	run range	goals ^b
Kenai River	Forecast	382	2,691	231	442	3,814	3,089 – 4,539	1,000 – 1,300 ^c
	20-yr average	402	2,064	247	759	3,545		
Kasilof River	Forecast	237	320	200	97	873	707 – 1,039	160 – 340
	20-yr average	321	308	250	81	979		
Susitna River	Forecast	154	137	17	19	343	233 – 422	Lake goals ^d
	20-yr average	91	179	26	37	377		
Fish Creek	Forecast	72	27	11	2	124	38 – 210	15 – 45
	20-yr average	47	19	6	2	83		
Unmonitored	Forecast	144	543	79	96	881		No goal
	20-yr average	147	439	90	150	852		
Total run	Forecast	989	3,718	538	656	6,035		
	20-yr average	1,008	3,009	619	1,029	5,821		

^a Total run includes all age classes.

^b Goals listed here are as follows: Kenai River, Inriver; Kasilof River, BEG; Susitna River, SEG (weir goals); and Fish Creek, SEG.

^c This is the inriver sockeye salmon goal for runs between 2.3 and 4.6 million measured using sonar at river mile 19 on the Kenai River.

^d Susitna sockeye salmon are managed to achieve escapement goals at Larson, Chelatna, and Judd lakes. Current escapement goals for these lakes are as follows: Larson (15,000–35,000), Chelatna (20,000–45,000), and Judd (15,000–40,000).

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Other Salmon Species

The forecast of the 2019 commercial harvest of other salmon species is as follows:

Species	Commercial harvest forecasts
Pink salmon	103,000
Chum salmon	175,000
Coho salmon	207,000
Chinook salmon	7,300

Forecast Methods

The recent 5-year average commercial harvest was used to forecast the harvest of chum, coho, and Chinook salmon in 2019. The forecast for pink salmon is based upon the average harvest during the previous 5 odd-numbered years.

Forecast Discussion

The recent 5-year average commercial harvest was used in the forecast, because harvests in these years likely best represent harvests under current regulations.

For more information, contact Bob DeCino or Brian Marston at the Soldotna ADF&G office at (907) 262-9368.

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Forecast Area: Lower Cook Inlet
Species: Pink Salmon

Preliminary forecast of the 2019 run:

	Forecast Estimate (thousands)	Forecast Range (thousands)
Commercial Common Property Harvest (CCPF)	2,404	892–3,915

Note: CCPF harvest refers to fish available for harvest outside of hatchery special harvest areas (SHAs); no prediction of fishing effort is made. Additional CCPF and hatchery cost-recovery harvests may be expected from hatchery returns in and around SHAs. Lower Cook Inlet hatchery forecasts are available from Cook Inlet Aquaculture Association (CIAA): <http://www.ciaa.net.org>

Forecast Methods

A naïve forecast based on historical odd-year pink salmon harvests (1961–2017) was used to predict the CCPF harvest in LCI. Similar to methods used in PWS and SEAK, several trend forecast models were evaluated to determine which best fit the data, including exponential smoothing and 2-, 3-, and 5-year running averages of past odd-year CCPF harvests. Exponential smoothing and moving average models using log-transformed data inputs produced a wide range of point forecasts (427,100–2,861,500). The exponential smoothing model using odd-year data inputs (nontransformed) outperformed the other models based on comparison of several performance metrics (e.g., bias, mean square error [MSE], root mean square error [RMSE], and mean absolute scaled error [MASE]). The 80% confidence intervals were calculated from the MSE of the retrospective forecast predictions.

Forecast Discussion

Prior to this forecast, the odd-year LCI pink salmon forecast consisted of a wild stock total run forecast based on a logarithmic regression of total run and escapement from over 50 years of observations on 10 index streams, and a hatchery/supplemental production forecast provided by Cook Inlet Aquaculture Association (CIAA). However, preliminary results from otolith sampling in LCI during 2014–2018 suggest high proportions of hatchery-marked fish in the harvest and escapement samples collected from some index streams may confound the viability of spawner-recruit based run forecasts. Because of this, the decision was made to produce a CCPF harvest forecast in lieu of the total run forecast.

Because pink salmon exhibit a 2-year life cycle, comparisons of run size are 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 2–6 generations before the opposing line becomes dominant. Despite the relative parity between odd and even year pink salmon runs 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. Currently, the odd-year brood line is dominant in LCI.

In 2017, the parent year for the upcoming 2019 return, LCI experienced strong escapements to most (~89%) pink salmon index streams, with only 2 minor stocks failing to achieve their respective escapement goals. The 2019 CCPF harvest forecast of 2.4 million pink salmon has a forecast range of 892,200–3.9 million. If realized, a CCPF harvest of 2.4 million pink salmon would be approximately 25% higher than the recent 5-year average CCPF harvest of 1.92 million for odd-year returns between 2009 and 2017.

Other Salmon Species

The forecast of the 2019 CCPF harvest of other, less abundant salmon species in LCI is as follows:

	CCPF Harvest Forecasts	Model	Dataset
Sockeye Salmon ^a	125,800	Exponential Smoothing	Log-Transformed
Chum Salmon	84,800	Exponential Smoothing	Non-logged
Coho Salmon	13,700	2-Year Running Average	Non-logged
Chinook Salmon	452	Exponential Smoothing	Log-Transformed

^a Additional CCPF and hatchery cost-recovery harvests of sockeye salmon may be expected from hatchery returns in and around SHAs. Lower Cook Inlet hatchery forecasts are available from Cook Inlet Aquaculture Association (CIAA): <http://www.ciaa.net.org>

Forecast Methods

Naïve forecasts based on historical harvests (1960–2018) were used to predict the 2019 CCPF harvest of other, less abundant salmon species in LCI. Similar to methods used in PWS and SEAK, several trend forecast models were evaluated to determine which best fit the data, including exponential smoothing and 2-, 3-, and 5-year running averages of past CCPF harvests. Log-transformed and nonlogged historical harvest datasets were evaluated with each model and the final forecast was selected based on comparison of several performance metrics (e.g., bias, mean square error [MSE], root mean square error [RMSE], Mean Percentage Error [MPE], Mean Absolute Percentage Error [MAPE], and mean absolute scaled error [MASE]).

Forecast Discussion

Prior to this year, the recent 5-year average harvest was used to forecast the LCI sockeye, chum, coho, and Chinook salmon CCPF harvest for the coming year. Beginning this year, for consistency, we transitioned to the same trend forecast methods we used for LCI pink salmon.

Edward O. Otis, Area Finfish Research Biologist, Homer
Glenn J. Hollowell, Area Finfish Management Biologist, Homer

APPENDIX D: KODIAK

Forecast Area: Kodiak
Species: Pink Salmon

Preliminary forecast of the 2019 run:

Total Production	Forecast Estimate (millions)	Forecast Range (millions)
KMA Wild Stock Total Run	25.4	13.2–37.5
KMA Escapement Goal ^a	5.0	
KMA Wild Stock Harvest	20.4	8.2–32.5
Kitoi Bay Hatchery Harvest ^b	6.6	4.9–8.4
Total KMA Pink Salmon Harvest	27.0	13.1–40.9

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

^a The 2019 estimated escapement is within the range of the odd-year aggregate escapement goals for the Kodiak Archipelago (2.0–5.0 million) and the Mainland District (0.25–1.0 million).

^b This figure is the total expected return (7.1 million) minus the broodstock collection goal of 0.43 million; the Kitoi Bay Hatchery cost-recovery harvest is expected to be roughly 2.0 to 3.0 million.

The 2019 Kodiak Management Area (KMA) predicted pink salmon harvest is expected to be in the *Excellent* category with a point estimate of 27.0 million combining the wild stock and Kitoi Bay Hatchery harvest estimates. Harvest categories were delimited from the 20th, 40th, 60th, and 80th percentiles of historical commercial harvest in the KMA from 1978 to 2018.

KMA Harvest Category	Range (millions)	Percentile
<i>Poor</i>	Less than 7.1	Less than 20th
<i>Weak</i>	7.1 to 10.9	21st to 40th
<i>Average</i>	10.9 to 16.7	41st to 60th
<i>Strong</i>	16.7 to 25.3	61st to 80th
<i>Excellent</i>	Greater than 25.3	81st to 100th

Forecast Methods

The KMA wild stock pink salmon harvest forecast is derived from a total run forecast minus the estimated KMA escapement (5.0 million). The total run estimates were derived from a combination of Karluk and Ayakulik rivers weir count, aerial survey index, and harvest estimates.

The 2019 KMA wild stock pink salmon forecast was based on a simple linear regression model using environmental indices fit to the odd-year KMA returns from 1981 to 2017. An alternative trend forecast based on single exponential smoothing was also calculated for comparative purposes. The regression model utilizes a composite created from a series of forecast indices affecting pink salmon survival. Variables used include mean monthly air temperature (September to June), total precipitation (September to June) and peak precipitation (August to September) total run correlation anomalies. A composite was constructed using all variables and regressed against total return.

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It is assumed that environmental conditions affect the survival at early life history stages of pink salmon and the year class strength is primarily determined prior to outmigration. Monthly values (Kodiak airport) of mean air temperature, total precipitation, and peak precipitation from August to June were considered. Forecast range was estimated using the 80% confidence intervals of the absolute percent error of the composite model hindcast estimates.

The 2019 Kitoi Bay Hatchery pink salmon forecast was prepared by evaluating pink salmon survivals from odd brood years 1995 through 2015 when releases from the facility were in excess of 100 million fry. Brood years 1995 through 2015 are particularly important to the forecasting model because all pink fry were released on the same day in order to saturate the release area with fry (predator satiation). This release strategy has proven to significantly improve fry-to-adult survival.

The pink return to Kitoi Bay Hatchery is an odd-year dominant return that experiences exceptional marine survival every fourth year dating back to the first releases in 1977 (with the exception of 1997). The primary forecasting consideration for 2019 relates to this 4-year cyclical return that is above average, but is not the stronger of the 2 odd-year cycles. The midpoint estimate of 7.1 million reflects a marine survival of 3.68% for the 192 million fry released (1.09g) above the traditional target size (0.8 g). The average survival was calculated using the last 4-year cyclical returns (parent class 2001, 2005, 2009, and 2013). The range was calculated as (+/-) 25% of the predicted marine survival.

Forecast Discussion

The 2019 KMA wild stock pink salmon total run (25.4 million) is predicted to be an *Excellent* return and similar in magnitude to the last 2 odd-year returns in 2015 and 2017 (Figure D1). The environmental index predictor is strongly positive suggesting early life history conditions correlated with excellent returns. The exponential smoothing model also predicts a strong return (Figure D1) with an estimate of 29.9 million. Additionally, the KMA escapement index of 6.4 million was well above average (4.8 million in odd years).

The 2019 Kitoi Bay Hatchery pink salmon production is expected to be 7.1 million (Figure D2). The brood stock collection goal is 425,000, resulting in a total hatchery harvest projection of about 6.6 million. Cost-recovery harvest estimates are not set yet but may be between 2 and 3 million pink salmon in Kitoi Bay in 2019.

Confidence in the 2019 forecast estimate is only good considering the refinement of the forecasting models in the past years. Despite the strength of the forecast model, the authors recognize that return corollaries are often fleeting due to the dynamic nature of the Gulf of Alaska. The KMA wild stock harvest prediction 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, 2019). By the third week of July, fishing time likely will be liberalized as the true magnitude of the return becomes apparent.

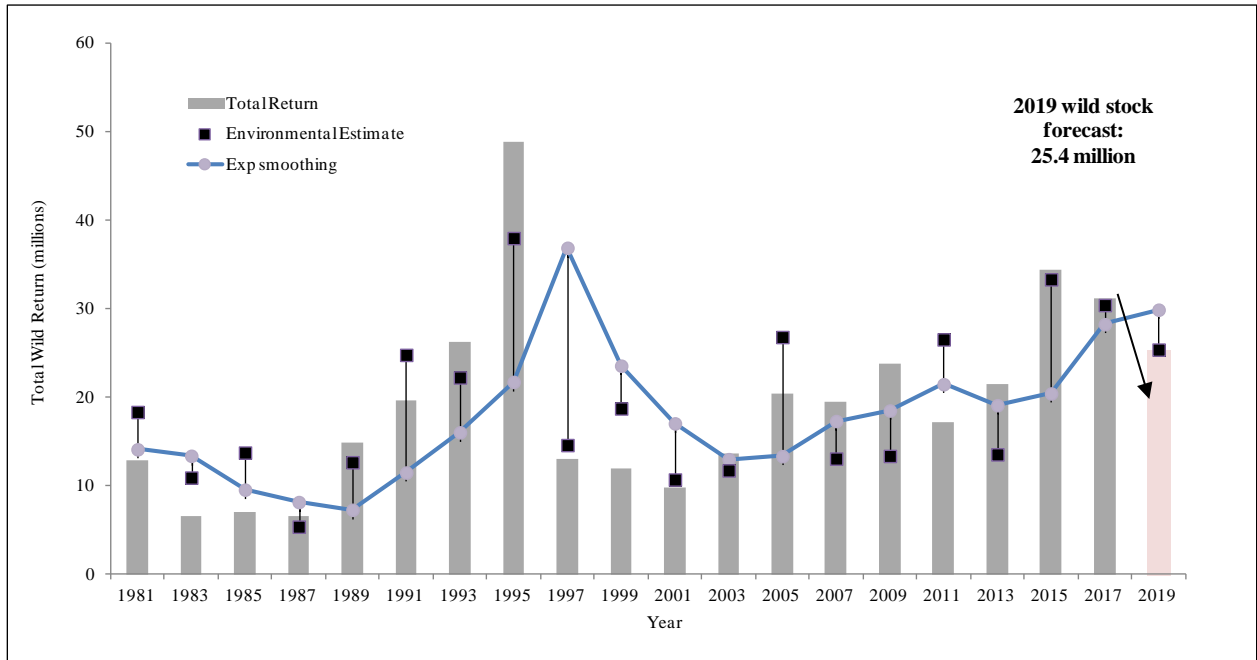


Figure D1.–Kodiak odd-year pink salmon wild stock total return compared to exponential smoothing and environmental model estimates, 1981 to 2017, and 2019 forecast.

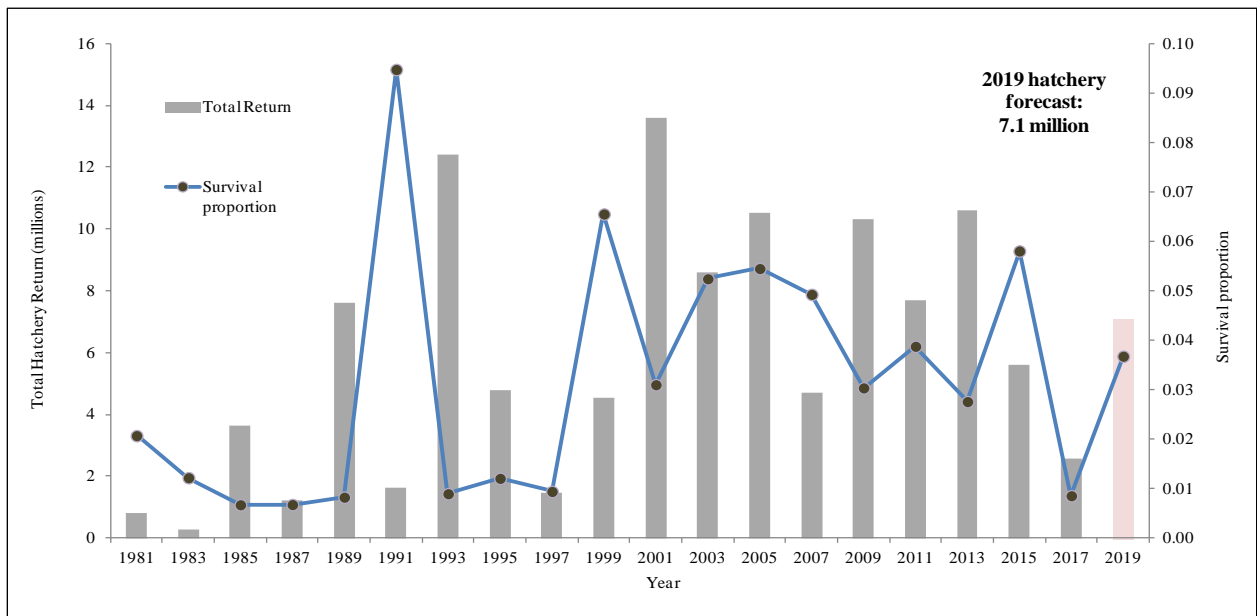


Figure D2.–Kitoi Bay hatchery odd-year pink salmon total return along with marine survival estimates, 1981 to 2017, and 2019 forecast.

M. Birch Foster, Finfish Research Biologist, Westward Region
Mike Wachter, Kitoi Bay Hatchery Manager, Kodiak Regional Aquaculture Association

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Forecast Area: Kodiak, Ayakulik River
Species: Sockeye Salmon

Preliminary forecast of the 2019 run:

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	401	218–584
Escapement Goal ^a	300	200–400
Harvest Estimate	101	

^a The escapement estimate is the sum of the approximate midpoints of escapement goals for the early (140,000–280,000) and late run (60,000–120,000).

Forecast Methods

The 2019 Ayakulik River sockeye salmon forecast was prepared primarily by investigating simple linear regression models utilizing recent outmigration year ocean age class relationships. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction intervals (80%) for the regression estimates were calculated using the variances of the regression models. The age classes that could not be estimated with one of these models were estimated using pooled medians and the 10th and 90th percentiles of the data were used to calculate the prediction interval of the median estimates.

The age-.2 sockeye salmon were predicted from prior year age-.1 returns using outmigration years (1997–2016). Age-.1, -.3, and -.4 sockeye salmon were predicted by the median return since 1999. Regression and median estimates were summed to estimate the total Ayakulik sockeye salmon run for 2019. The range was estimated as the overall 80% prediction intervals and calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The 2019 Ayakulik forecast of 401,000 sockeye salmon is about 43,000 less than the actual 2018 run estimate of approximately 444,000, and about 101,000 less than the most recent 10-year average of approximately 502,000. The 2019 run is estimated to be composed of approximately 64% age-.2 fish and 32% age-.3 fish. The confidence in the 2019 Ayakulik forecast is fair, due to the regression relationship. The projected harvest of 101,000 is based on the achievement of the midpoint of the combined escapement goal ranges (300,000). Ayakulik is managed based on both early- and late-run (post July 15) components. Based on brood year escapement proportions from what will be the major contributing brood years (2013–2015), approximately 71% of the total run will occur in the early portion of the run.

Michelle Wattum, Finfish Research Biologist, Westward Region

Forecast Area: Kodiak, Karluk River
Species: Sockeye Salmon

Preliminary forecast of the 2019 run:

Total Production		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Run	Total Run Estimate	273	128–419
	Escapement Goal ^a	200	150–250
	Harvest Estimate	73	
Late Run	Total Run Estimate	1,050	441–1,659
	Escapement Goal ^a	325	200–450
	Harvest Estimate	725	
Total Karluk River System	Total Run Estimate	1,324	569–2,078
	Escapement Goal ^a	525	350–700
	Harvest Estimate	799	

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

^a The escapement estimates are based on midpoints for the early-run and late-run escapement goals and summed for the total run.

Forecast Methods

The 2019 Karluk River sockeye salmon forecast was prepared primarily by investigating escapement, sibling age class relationships, moving average, and exponential smoothing methods.

Karluk River sockeye salmon production demonstrates strong positive autocorrelation (i.e., good years followed by good years and bad years followed by bad years). As a result, recent year trends have normally been a better prognosticator of the near future at Karluk River than utilizing age class relationships and regression models that have considerable uncertainty. Both the early and late runs were forecast using an exponential smoothing model. Parameter estimates (early run $\alpha = 0.82$; and late run $\alpha = 0.68$) placed heavy weight on recent returns and outperformed 2-, 3-, and 5-year moving averages. In addition, the combined Karluk run from smoothing hindcast estimates outperformed the modern sibling age class forecasts (2005 to present) in terms of mean square error (MSE).

The total Karluk sockeye salmon run for 2019 was calculated by combining the individual exponential smoothing model estimates for both the early and late runs. The forecast range was calculated as the 80% confidence intervals of the absolute percent error of the exponential smoothing hindcast estimates. The combined early- and late-run 80% confidence interval was calculated by summing the lower bounds and upper bounds of the 2 runs.

Forecast Discussion

The total 2019 sockeye salmon run to the Karluk River is expected to be approximately 1,324,000 (Figure D3). The early run is expected to be approximately 273,000; this is about 10,000 above the recent 10-year average (263,000) and 27,000 above the 2018 run (246,000). The late run is expected to be approximately 1,050,000; this is 322,000 above the recent 10-year average (728,000) and 41,000 less than the 2018 run (1,091,000)

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The projected harvest estimate for the early run (73,000) is based on achievement of the midpoint of the early-run escapement goal. The projected harvest estimate for the late run (725,000) is based on achievement of the midpoint of the late-run escapement goal. The majority of both runs is expected to be age-.2 fish; however, based on spawning escapement in 2013, age-.3 fish should be quite abundant. The overall confidence in the Karluk sockeye salmon forecast is fair.

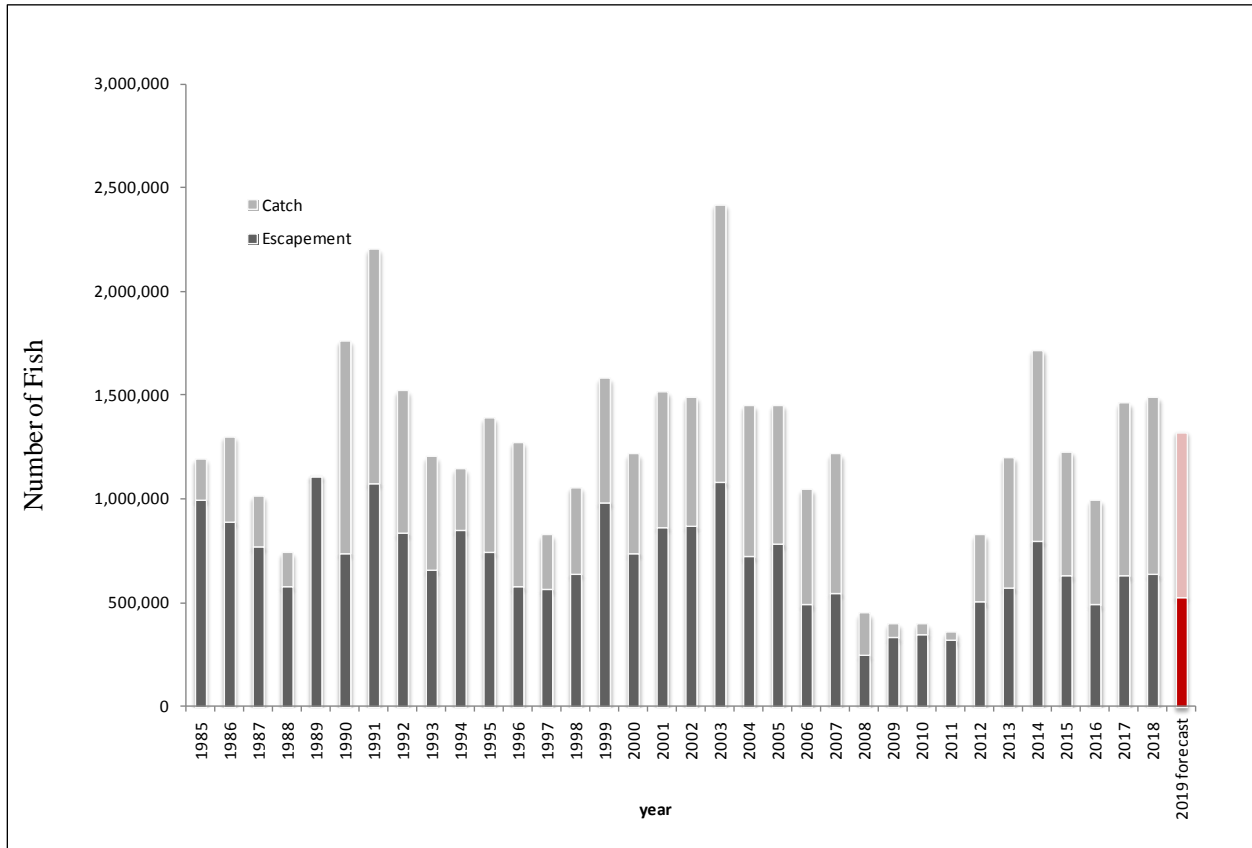


Figure D3.–Karluk River sockeye salmon annual run (combined early and late) estimates showing catch and escapement by year 1985–2018, and the 2019 forecast.

M. Birch Foster, Finfish Research Biologist, Westward Region

**Forecast Area: Kodiak, Alitak District (Frazer Lake and Upper Station)
Species: Sockeye Salmon**

Preliminary forecast of the 2019 run:

Total Production		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Upper Station	Total Run Estimate	70	43–97
	Escapement Goal ^a	65	43–93
	Harvest Estimate ^b	5	
Late Upper Station	Total Run Estimate	223	140–306
	Escapement Goal	186	120–265
	Harvest Estimate ^b	37	
Frazer Lake	Total Run Estimate	421	288–554
	Escapement Goal ^c	137	95–190
	Harvest Estimate ^b	284	
Total Alitak District	Total Run Estimate	714	471–957
	Escapement Goal	388	258–548
	Harvest Estimate ^b	326	

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

^a The Alaska Board of Fisheries removed the Upper Station early-run optimal escapement goal (OEG) of 30,000 in 2017; the Upper Station early run is now managed for a biological escapement goal (BEG) of 43,000–93,000.

^b 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 District.

^c The Frazer Lake escapement goal (75,000–170,000) is increased here by an additional 20,000; this is the 20-year median of the number of fish that pass through Dog Salmon weir but do not ascend the Frazer Lake fish pass.

Forecast Methods

The 2019 sockeye salmon run to the Alitak District was forecasted with linear regression models using ocean age class relationships by system from recent outmigration years and environmental indices. In constructing and evaluating each of the regression models, standard regression diagnostic procedures were used. Prediction intervals (80%) for the regression estimates were calculated using the variances of the regression models. The age classes that could not be estimated with one of these models were estimated using pooled medians, and the 10th and 90th percentiles of the data were used to calculate the prediction interval of the median estimate.

Upper Station early-run age-.2 fish were forecasted using prior year age-.1 returns (outmigration years: 2003–2016), Kodiak airport April precipitation, and the North Pacific Gyre Oscillation (NPGO) index for September in a multiple regression model. Precipitation data were lagged to correspond to freshwater rearing conditions in Olga Lake and smolt outmigration events and NPGO data were lagged to reflect marine rearing conditions that would affect parental escapement. Upper Station early-run age-.2 salmon were used to predict log-transformed age-.3 fish data from outmigration years 1992 to 2016. Upper Station late-run age-.2, which were log transformed, and age-.3 salmon returns were each predicted using their respective prior year age-.1 and -.2 returns (late-run outmigration years: 1998–2017 and 1999–2016 respectively).

Upper Station early- and late-run age-.1 and -.4 returns were calculated using the pooled median contributions by stock and ocean age from the last 10 years. Frazer age-.2 salmon were predicted

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using prior years' log-transformed Dog Salmon jack (age-.1) returns (outmigration years: 2003–2017). Frazer age-2.3 salmon were predicted using prior year age-2.2 returns (outmigration years: 2000–2013). Frazer age-.1, -.4, and remaining age-.3 returns (0.3, 1.3, 3.3, and 4.3 age classes) were calculated using the pooled median contributions from the last 15 years.

Regression and median estimates were summed to estimate the total Alitak District sockeye salmon run for 2019. The prediction interval ranges for each stock were calculated as the square root of the sum of the squared prediction intervals for each age class forecasted. The combined Alitak District prediction interval was calculated by summing the lower and upper prediction bounds of the 3 runs.

Forecast Discussion

The 2019 sockeye salmon run to the Alitak District is expected to be approximately 714,000, approximately 83,000 more than the recent 10-year average run (631,000) and 71,000 less than the 2018 run (785,000). The Upper Station early run is expected to be approximately 70,000; this is greater than the recent 10-year average run (66,000). The Upper Station late run is expected to be approximately 223,000; this rivals the recent 10-year average run (236,000). The Frazer Lake run is expected to be approximately 421,000; this is above the recent 10-year average (330,000). The 2019 Alitak District sockeye salmon run should be composed of approximately 67% age-.2 fish, 27% age-.3 fish, and 6% age-.1 fish. Overall, our confidence in the forecast is only fair based on the strength of the regression models and the large prediction intervals.

The projected harvest estimate of 326,000 is based on achieving the S_{MSY} estimates for both the Upper Station early and late runs and the S_{MSY} estimate plus an additional 20,000 (20-year median of the number of fish that pass through Dog Salmon but do not ascend the Frazer Lake fish pass) for the Frazer run. S_{MSY} is an estimate of the escapement that has the largest expectation of subsequent surplus production.

Heather Finkle, Finfish Research Biologists, Kodiak

APPENDIX E: CHIGNIK

Forecast Area: Chignik
Species: Sockeye Salmon

Preliminary forecast of the 2019 run:

Total Production		Forecast Estimate (thousands)	Forecast Range (thousands)
Early Run (Black Lake)	Total Run Estimate	829	0–1,747
	Escapement Goal ^a	400	350–450
	Harvest Estimate ^b	429	
Late Run (Chignik Lake)	Total Run Estimate	909	380–1,438
	Escapement Goal ^a	338	275–400
	Harvest Estimate ^b	571	
Total Chignik System	Total Run Estimate	1,739	380–3,185
	Harvest Estimate ^b	1,001	
	• Chignik Area	827	
	• SEDM Area	56	
	• Cape Igvak Section	118	

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

^a Harvest represents the midpoint of the escapement goal. An inriver run goal of 75,000 sockeye salmon is added to the lower bound of the late-run escapement goal.

^b Includes anticipated harvests of Chignik-bound fish in Southeastern District Mainland and Cape Igvak fisheries.

Forecast Methods

Simple linear regressions models using age class relationships were used to forecast the 2019 early- and late- Chignik sockeye salmon runs. Each regression model was assessed with standard regression diagnostic procedures. Prediction intervals (80%) for the regression estimates were calculated using the variances of the regression models. Age class returns not estimated with statistical models utilized pooled medians with data from 1995 to the present; median prediction intervals were calculated from the 10th and 90th percentiles of the data.

For the early run, prior year age-.2 returns predicted log-transformed age-.3 returns using data from the 1995 outmigration year to the present. Prior year early-run age-.1 returns predicted log-transformed age-.2 returns (outmigration years 1998 to present). For the late run, prior year age-.2 sockeye salmon returns predicted age-.3 returns using data from the 2000 outmigration year to the present. Prior year age-.1 early- and late-run returns were combined to predict late-run age-.2 returns (outmigration years 1988 to present).

The early- and late-run regression and median estimates were summed to estimate the total Chignik River sockeye salmon run for 2019. The prediction interval range was calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted. The combined early- and late-run 80% prediction interval was calculated by summing the lower and upper prediction bounds of the 2 runs.

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Forecast Discussion

The 2019 Chignik sockeye salmon early run is forecasted to be 829,000; this is 512,000 less than the 10-year average run of 1.34 million and almost 565,000 more than the 2018 early run of 264,000. The early run is predicted to be composed of approximately 84% age-.3 and 16% age-.2 fish. The late run is forecasted to be 909,000; this is approximately 128,000 less than the 10-year average run of 1.04 million and 634,000 more than the 2018 late run of 276,000. The 2019 late run is predicted to be composed of approximately 85% age-.3, 13% age-.2, and 1% age-.1 and -.4 fish. The 2019 total Chignik sockeye salmon run is expected to be 1.74 million; this is approximately 641,000 less than the 10-year average of 2.38 million and roughly 1.20 million more than the 2018 total run of 540,000.

The projected 2019 early-run total harvest estimate of 429,000 is based on achievement of the midpoint of the early-run escapement goal range. The projected late-run harvest estimate of 571,000 is based on achieving the midpoint (338,000) of the late-run goal; this includes the inriver run goal of 75,000 added to the lower bound (200,000) of the escapement goal. Sockeye salmon harvest estimates for both runs include fish harvested in the Chignik Management Area, Chignik-bound fish harvested in the Cape Igvak Section of the Kodiak Management Area, and fish harvested in the Southeastern District Mainland of the Alaska Peninsula Management Area.

The wide confidence intervals around the point estimate of the 2019 forecasts reflect the uncertainty inherent in the forecast models. The early run is typically more variable than the late run, resulting in wider confidence intervals for the early run. Given the sibling relationships used for forecasting both runs and the poor 2018 age-.3 returns, the 2019 forecast may overestimate returns if environmental variables—which are unknown at this time—remain spurious. Due to the range of variation in the relationships used in these forecasts and their historical accuracy, our confidence in them is fair.

Heather Finkle, Finfish Research Biologist, Westward Region
Sarah Power, Commercial Fisheries Biometrician

APPENDIX F: ALASKA PENINSULA

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

Species: Sockeye Salmon

Preliminary forecast of the 2019 run:

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	409	182–635
Escapement Goal ^a	156	117–195
Harvest Estimate	253	

^a The escapement estimate is the midpoint of the escapement goal range (117,000–195,000) in 2018.

Forecast Methods

The 2019 forecast of the Bear Lake sockeye salmon late run was prepared using simple linear regressions of sibling age classes. Models were evaluated with standard regression diagnostics. Prediction intervals (80%) for the regression estimates were calculated using the variances of the regression models. The age classes that could not be estimated with one of these models were estimated using pooled medians and the 10th and 90th percentiles of the data were used to calculate the 80% prediction interval of the medians.

Age-.3 sockeye salmon were predicted from prior year age-.2 returns from outmigration years 1990 to present. Age-.3 fish data were log transformed. Remaining age class components of the run were predicted by calculating median returns from the most recent 10 years.

Regression and median estimates were summed to estimate the total Bear Lake late-run sockeye salmon run for 2019. The range was estimated as the overall 80% prediction intervals and calculated as the square root of the sum of the squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The 2019 Bear Lake late-run forecast of 409,000 is 23,000 more than the 10-year average of approximately 386,000 and 374,000 less than the 2018 run of 783,000. The 2019 late run is expected to be composed of 3% age-.1, 56% age-.2, and 41% age-.3 fish. The projected harvest of 253,000 is based on achieving the midpoint of the late-run escapement goal range (156,000) and adequate run strength. Bear River late-run sockeye salmon returns have shown a general decline in the total run since 1990. The wide range around the point forecast is a result of large fluctuations in age-2.2 sockeye salmon returns. Over the last 10 years, age-2.2 fish have comprised an average of 50% of the annual run, but this proportion has varied from 16% (2011) to 78% (2014). Based on uncertainty associated with the variable predictive capabilities of sibling age class, our confidence in this forecast is fair.

Heather Finkle, Fishery Biologist, Alaska Peninsula

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**Forecast Area: Alaska Peninsula/Aleutian Islands Management Area, Nelson River
Species: Sockeye Salmon**

Preliminary forecast of the 2019 run:

Total Production	Forecast estimate (thousands)	Forecast range (thousands)
Total Run Estimate	370	217–523
Escapement Goal ^a	158	97–219
Harvest Estimate	212	

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

^a The escapement estimate is the midpoint of the escapement goal range (97,000–219,000) in 2019.

Forecast Methods

The 2019 Nelson River sockeye salmon run was forecasted using simple linear regression of ocean age class and parental escapement data from the past 18 years. Standard regression diagnostics were used to evaluate each model. Prediction intervals (80%) for regression estimates were calculated using the variances of the regression models. Age classes that could not be estimated with modeling were estimated using pooled medians and the 10th and 90th percentiles of the data were used to calculate the prediction interval of the median estimates.

Age-.2 sockeye salmon returns corresponding to the year of outmigration were forecasted with simple linear regression using parental escapement of predominant age-2.2 fish from 1999 to 2013. The age-.1, -.3, and -.4 returns were calculated from median estimates for each ocean age class using run data from the previous 10 years.

Regression and median estimates were summed to estimate the total Nelson River sockeye salmon run for 2019. The range was estimated as an overall 80% prediction interval and calculated from the square root of the sum of the squared 80% prediction intervals for each age class forecasted.

Forecast Discussion

The 2019 Nelson River forecast of 370,000 sockeye salmon is about 46,000 less than the most recent 10-year average (2009–2018) of 416,000 and is approximately 16,000 less than the 2018 run of about 386,000. The 2019 run should be composed mainly of age-.2 (69%) and -.3 (29%) fish. Regression relationships predicting age-.2 sockeye salmon are significant and represent the majority of the run. However, the Nelson River sockeye salmon run has been notoriously unpredictable. Therefore, confidence in this forecast is fair. The projected harvest of 270,000 is based on achieving the midpoint (158,000) of the escapement goal range.

Heather Finkle, Fishery Biologist, Kodiak

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

Preliminary forecast of the 2019 run:

Total Production	Forecast Estimate (millions)	Forecast Range (millions)
Total Run Estimate	24.6	7.5–41.9
Escapement Goal ^a	4.0	1.75–4.0
Harvest Estimate	20.6	5.75–37.9

^a The escapement estimate is the upper end of the aggregate goal range (1.75–4.0 million) in 2019.

The 2019 South Alaska Peninsula predicted pink salmon harvest is expected to be in the *excellent* category with a point estimate of 20.6 (5.75–37.9) million. Harvest categories were calculated from the 20th, 40th, 60th, and 80th percentiles of historical commercial harvest on the South Alaska Peninsula from 1979 to 2018.

S. Pen Harvest Category	Range (millions)	Percentile
<i>Poor</i>	Less than 2.6	Less than 20th
<i>Weak</i>	2.7 to 4.3	21st to 40th
<i>Average</i>	4.4 to 7.6	41st to 60th
<i>Strong</i>	7.3 to 9.4	61st to 80th
<i>Excellent</i>	Greater than 9.5	81st to 100th

Forecast Methods

The 2019 South Alaska Peninsula pink salmon harvest forecast is derived from a total run forecast minus the upper end (4 million) of the annual South Alaska Peninsula escapement goal range. The total run was forecasted with a simple exponential smoothing model. The model was fit to odd-year South Peninsula pink salmon returns from 1965 through 2017.

Forecast Discussion

The 2019 South Alaska Peninsula pink salmon total harvest (20.6 million) is predicted to be excellent. Although forecasts of pink salmon returns to the South Alaska Peninsula have only been published since 2011, odd-year forecasts of pink salmon on the South Alaska Peninsula have generally been more accurate than even years. This has been emphasized with changing ocean conditions, and recent years’ average temperatures have been outside the ranges in the historical dataset; therefore, the forecast’s predictive power has been diminished. Pink salmon that migrated to sea in 2016 returned in 2017 in numbers well above forecasted returns, and it is likely that pink salmon that went to sea in 2018 experienced similar conditions and the 2019 return is expected to also be excellent. Due to the relative strength of the predictive model, but accounting for uncertainty in changing environmental conditions, confidence in the forecast is fair.

Lucas Stumpf, Alaska Peninsula–Aleutian Islands Asst. Area Management Biologist
Heather Finkle, Region IV Finfish Research Biologist
Birch Foster, Region IV Finfish Research Biologist
Sarah Power, Commercial Fisheries Biometrician

APPENDIX G: BRISTOL BAY

Forecast Area: Bristol Bay
Species: Sockeye Salmon

Preliminary forecast of the 2019 run:

TOTAL PRODUCTION	Forecast (millions)	Forecast Range (millions)
Total Run	40.18	27.90–52.46
Escapement	12.58	
Commercial Common Property Harvest	27.60	
Bristol Bay Harvest	26.11	
South Peninsula Harvest	1.49	
Inshore Run	38.70	

Forecast Methods

The 2019 Bristol Bay sockeye salmon forecast is the sum of individual predictions of 9 river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak, and Togiak rivers) and 4 age classes (ages 1.2, 1.3, 2.2, and 2.3, plus ages 0.3 and 1.4 for the Nushagak River). Adult escapement and return data from brood years 1972–2014 were used in the analyses.

Forecasts for each age class returning to a river system were derived from models based on the relationship between adult returns of that age class and either total returns or sibling returns from the same brood years. Models based on the most recent 3 and 5 years of returns were also evaluated. In general, models with statistically significant parameters and/or the best past performance (accuracy and precision) were chosen. Performance was evaluated using mean absolute deviation, mean absolute percent error, mean arctangent absolute percent error, and mean percent error between forecasted and observed returns. These performance metrics were calculated and considered for each model across the most recent 3-, 5-, and 9-year time frames. In certain cases, competing models were averaged in a hybrid model approach.

The forecast range is the upper and lower values of the 80% confidence interval for the total run forecast. The confidence bounds were calculated from the deviation of actual runs and run forecasts from 2001 through 2018.

Forecast Discussion

A total of 40.18 million sockeye salmon (range 27.90–52.46 million) are expected to return to Bristol Bay in 2019. This is 10% smaller than the most recent 10-year average of Bristol Bay total runs (44.4 million), and 16% greater than the long-term (1963–2018) average of 34.2 million. All systems are expected to meet their spawning escapement goals.

Where practical, ADF&G will manage escapements proportional to the run size and relative to the historical record (5AAC 06.355(d)(1)). Escapement is projected as the 75th quartile of the escapement range if the forecast is above the historical trend line (Egegik, Nushagak, and Togiak rivers), as the midpoint (50th quartile) of the escapement range if the forecast is in line with the historical trend (Ugashik and Igushik Rivers), and as the 25th quartile of the escapement goal range

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if the forecast is below the historical trend line (Kvichak and Wood rivers in 2019; Table G1). Because it is passively managed, the Alagnak River exploitation rate is assumed to be the same as the Kvichak River exploitation rate; therefore, the escapement is projected to be the total run forecast minus expected harvest. Preseason harvest projections are provided to aid industry in planning. Once the run begins to develop, ADF&G relies on catch and escapement data for management decisions.

A run of 40.18 million sockeye salmon would allow for a potential total harvest of 27.60–26.11 million in Bristol Bay and 1.49 million in the South Peninsula fisheries. A Bristol Bay harvest of this size is 8% smaller than the most recent 10-year harvest of 30.0 million (range 15.4–41.9 million), and 23% greater than the long-term average harvest of 21.2 million (1963 to present).

The run forecast for each district and river system is as follows: 16.12 million to Naknek-Kvichak District (6.95 million to the Kvichak river, 3.97 million to the Alagnak river, and 5.21 million to the Naknek river); 9.07 million to the Egegik District; 3.46 million to the Ugashik District; 10.38 million to the Nushagak District (4.62 million to the Wood river, 4.18 million to the Nushagak river, and 1.58 million to the Igushik river); and 1.15 million to the Togiak District (Table G1).

We forecast that the 2019 run will consist of 15.16 million age-1.2 fish (38% of the total run), 5.49 million age-2.2 fish (14% of the total run), 17.05 million age-1.3 fish (42% of the total run), and 2.42 million age-2.3 fish (6% of the total run; Table G1).

Historically, sockeye salmon runs to Bristol Bay have been highly variable. The Bristol Bay total run has averaged 34.2 million from 1963 through 2018 and has averaged 44.4 million during the most recent 10-year period. Forecasting future salmon returns is inherently difficult and uncertain. We have used similar methods since 2001 to produce the Bristol Bay sockeye salmon forecast; this has performed well when applied to Bristol Bay as a whole. Since 2001, our forecasts have, on average, underforecast the run by 11% and have ranged from 44% below actual run in 2014 to 19% above actual run in 2011. Forecasted harvests have had a mean absolute percent error of 14% since 2001.

Individual river forecasts have greater uncertainty compared to Bay-wide forecasts. Since 2001, on average, we have underforecast returns to the Alagnak (–39%), Togiak (–12%), Kvichak (–22%), Wood (–17%), Nushagak (–21%), Ugashik (–0.2%), and Naknek (–12%) Rivers, and overforecast returns to the Igushik (13%) and Egegik rivers (18%). Overforecasting returns to some rivers and underforecasting returns to other rivers means that the overall Bristol Bay forecast is often more accurate than the forecast to any individual river. The Nushagak District had another record return in 2018. These record returns have been driven by robust returns from the 2013 and 2014 brood years. Evidence regarding the strength of the 2015 brood year in the Nushagak District is mixed with a very high level of jacks (age 1.1) in the Nushagak River and a very low level of jacks in the Wood River 2018 return.

ADF&G would like to thank the Bristol Bay Fisheries Collaborative (BBFC) for funding assistance in 2018. The BBFC began in 2016 and is an agreement between ADF&G and the Bristol

Bay Science and Research Institute (BBSRI) to work together with stakeholders to restore a world-class fishery management system and raise funds to support and maintain management. This agreement is supported by ADF&G, BBSRI, drift and set net fishermen, processors, municipalities, villages, support industries and other stakeholders. A list of organizations that committed financial support to the BBFC in 2018, as well as additional information about this agreement can be found at <https://www.bbsri.org/bbfc>.

Table G1.–Forecast of total run, escapement, and harvest of major age classes of sockeye salmon returning to Bristol Bay river systems, 2019.

DISTRICT River	Millions of Sockeye Salmon					Forecasted		South Peninsula ^a	BB Inshore
	Forecasted Production by Age Class				Total	Escapement	Harvest		
	1.2	2.2	1.3	2.3					
NAKNEK-KVICHAK									
Kvichak	2.95	1.08	2.87	0.05	6.95	4.00	2.69	0.26	6.69
Alagnak	1.88	0.19	1.88	0.02	3.97	2.28	1.54	0.15	3.82
Naknek	2.18	0.58	2.00	0.45	5.21	1.40	3.61	0.19	5.01
Total	7.01	1.84	6.74	0.53	16.12	7.68	7.84	0.60	15.53
EGEGIK									
EGEGIK	2.51	3.04	1.81	1.72	9.07	1.70	7.04	0.34	8.74
UGASHIK									
UGASHIK	1.31	0.33	1.72	0.10	3.46	0.95	2.38	0.13	3.33
NUSHAGAK									
Wood	2.41	0.23	1.94	0.04	4.62 ^b	0.98	3.47	0.17	4.45
Igushik	0.62	0.01	0.94	0.01	1.58	0.28	1.25	0.06	1.52
Nushagak	1.12	0.02	2.95	0.02	4.18	0.77	3.26	0.15	4.02
Total	4.14	0.26	5.83	0.07	10.38	2.02	7.97	0.38	9.99
TOGIAC									
TOGIAC	0.18	0.01	0.95	0.01	1.15	0.23	0.87 ^c	0.04	1.10
BRISTOL BAY									
	15.16	5.49	17.05	2.42	40.18	12.58	26.11	1.49	38.70
	38%	14%	42%	6%	100%				

Note: This table is a summary. Slight differences may appear due to rounding.

^a Projected harvest is based on the current 5-year running average exploitation rate of 3.7%.

^b Nushagak River forecast total includes age-0.3 and age-1.4 fish.

^c Forecasts for Kulukak, Kanik, Osviak, and Matogak river systems are not included. These systems contribute approximately 50,000 sockeye salmon to Togiak District harvest each year.

APPENDIX H: ARCTIC-YUKON-KUSKOKWIM

Forecast Area: Arctic-Yukon-Kuskokwim

Species: All Salmon

ADF&G does not produce formal run forecasts for most salmon runs in the Arctic-Yukon-Kuskokwim (AYK) Region. Many of the salmon run outlooks presented in this report are qualitative in nature because of a lack of information restricts developing 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. Although commercial harvest outlooks provide for a general level of expectation, fisheries management is based on inseason run assessment (Table H1). A formal forecast of Yukon River fall chum salmon is provided. A Canadian-origin Yukon River Chinook salmon forecast is produced each year and typically agreed upon in the Joint Technical Committee process, and will be made prior to the meeting of US/Canada Yukon River Panel in the spring of 2019. The Canadian-origin forecast informs the drainagewide Chinook salmon outlook, as typically the Canadian-origin run represents approximately 40% of the total run. This year's preliminary assessment indicates a run size similar to 2018; this could allow for a full subsistence harvest and some harvestable surplus of Chinook salmon for commercial harvest. There has not been Chinook salmon-directed harvest on the Yukon since 2008, the harvest of Chinook salmon in recent years has been as incidental catch during the chum salmon commercial fishery, and those harvests are the basis of the projected harvest in Table H1.

In the AYK Region, salmon production notably decreased for many stocks from 1998 to 2002 but increased rapidly beginning in 2003 to record and near-record runs from 2004 to 2006. Since 2007, Chinook salmon production has shown a sharp decline. Currently, Yukon River and southeastern 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 northeastern Bering Sea is the primary rearing habitat for juvenile Yukon and Norton Sound salmon during their first summer at sea. Marine surveys in the northeastern Bering Sea were initiated in 2002 by NOAA and have continued in recent years in partnership with ADF&G. These surveys occur primarily in September using surface trawls to capture juvenile salmon after they experience a critical transition from freshwater to marine environments. Surveys have been demonstrated to provide a leading indicator of Canadian-origin Yukon River Chinook salmon run abundance but may provide some indication of marine production trends for other northeastern Bering Sea stocks as well.

In general, management for anticipated low Chinook salmon abundance in 2019, and small processing capacity in some areas, will probably result in chum and sockeye salmon harvests that are lower than the outlook projections in the AYK Region.

Table H1.–The 2019 commercial harvest outlook by management area, in thousands of fish.

Management Area	Salmon Species					
	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim River	0	0	0	0	0	0
Kuskokwim Bay	0	0	0	0	0	0
Kuskokwim Area Total^a	0	0	0	0	0	0
Yukon	0-6	0	30-200	0	700–1,200	380–610
Norton Sound	0–2	3–5	190–240	25–75	170–220	0
Kotzebue Sound					450–650	0

^a There is not anticipated to be a commercial buyer in the Kuskokwim area in 2019.

Forecast Area: Yukon Area
Species: Fall Chum Salmon

Preliminary forecast of the 2019 run:

Total Production	Forecast Estimate (thousands)	Forecast Range (thousands)
Total Run Estimate	1,045	930–1,160
Escapement Goal	450	300–600
Harvest Estimate ^a	550	480–710

^a Includes harvests from subsistence (~100,000) and commercial fisheries.

Forecast Methods

The forecast for the 2019 Yukon Area fall chum salmon run is based on run reconstruction of 5 river systems (Tanana, Chandalar, Sheenjek, Fishing Branch and the mainstem Yukon River in Canada) and 4 age classes age-3 through age-6, with age-4 fish dominating followed by age-5 fish. Adult escapement and return data were used from the complete brood years 1974 to 2012, production from incomplete brood years 2013 and 2014 was estimated based on return per spawner from brood year returns, and an auto-regressive Ricker model was used to predict returns from the 2015 and 2016 parent years.

Predicted returns were multiplied by corresponding average maturity schedules for odd and even-numbered parent years to estimate 2019 run size, and rounded to the nearest thousand fish. The odd/even maturity schedule from 1974 to 2012 was used to estimate the 2019 return. 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 2018.

The 2019 projected run size of fall chum salmon for the Yukon Area is approximately 1,045,000. This forecast is average for odd-numbered year runs; however, recent runs have fluctuated more widely and have produced runs as low as 252,000 in 2000 to as high as 2.2 million in 2005. The 80% confidence bounds for the 2019 forecast range from 930,000 to 1,160,000. If the run materializes as forecasted, abundance would be sufficient to meet escapement goals (including Canadian border passage and harvest sharing objectives), provide an average subsistence harvest, and a surplus for commercial harvest.

Drainagewide escapements between 300,000 and 600,000 provide a mean yield of 447,000 fall chum salmon. The mean subsistence harvest from 2008 to 2017 for Alaskan subsistence and Canadian aboriginal harvests is 90,000. Commercial harvests may be allowed on the amount above 550,000 based on inseason assessments of run size. Targeting the midpoint of the escapement goal of 450,000, ADF&G anticipates a subsistence harvest of approximately 100,000 and an available commercial harvest between 380,000 and 610,000. In mid-July a projection based on the relationship of summer chum salmon to fall chum salmon returns to the Yukon River will be developed and used for initial management. The actual harvest will be dependent on inseason assessment of run size as applied to the guidelines of the 5 AAC 01.249 Yukon River Drainage Fall Chum Salmon Management Plan with further considerations of fishing effort and buying capacity.

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The forecasted total run of 1,045,000 fall chum salmon is expected to be composed of 62% age-4 and 33% 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 exhibit an odd-even abundance cycle (averaging 1,200,000 in odd-numbered years and 842,000 in even-numbered years); this pattern was most consistent between 1974 and 1992. Since 1993, the cycle has deteriorated and now wide swings in production are being observed. These swings are primarily thought to be due to conditions in the marine environment, although density dependence may also be a cause in some years. The effect of the odd-even cycle was restricted between 1993 and 2002 when most years' (1993 and 1997–2002) stocks were severely depressed, with peaks of high returns occurring in 1995, 2005, and 2017. Age-4 fish contributed greater than 90% (record levels) during the runs in 2003 and 2005. However, based on this analysis, the extremely large escapement observed in 2005 only produced an estimated 0.27 return per spawner (R/S). Further, prior to the 2013 brood year, escapements of over 800,000 produced yield above replacement only 1 year out of 9.

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 beginning in 1999. From 1999 to 2005, adjustments to the point estimates were made by reducing them by the average ratio of observed to predicted returns in attempts to reflect expected poor runs. From 2006 through 2019, 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 (Figure H1). High and low cycles in production have changed approximately 33-fold (based on 39 brood year returns) with the most drastic fluctuations occurring between brood years 2001 and 2005; therefore, forecasts of run size remain difficult to determine with accuracy.

Since forecasted ranges were established in 1999, 40% of the observed runs were within the range, 30% were below, and 30% were above. Returns of age-4 fish in odd-numbered years are typically 15% higher than even-numbered years. Sibling relationships for this stock are weak. The major contributor to the 2019 fall chum salmon run is anticipated to be age-4 fish returning from the 2015 parent year. The escapement in 2014 exceeded the upper end of the drainagewide escapement goal range, whereas escapement in 2015 was within the goal range. Productivity was at its lowest in 2005 followed by a peak in the 2009 brood year (2.41 R/S). Currently, the predicted R/S for the 2013 brood year is 2.68 and ranks fourth highest on record and production is estimated to be well above replacement—one of the few escapements over 800,000 that resulted in any yield. This shows another wide swing in production when 2 years earlier (2011 brood year) the R/S was at a low of 0.78. The forecasted run in 2019 is predicting a lower than average R/S (1.69) for the age-4 component from parent year 2015. Based on the 2 primary parent years the forecast is for an average (1974–2017) return in 2019. The forecasted run size of 1,045,000 fall chum salmon would provide for a commercial harvest of approximately 495,000 based on the current management plan.

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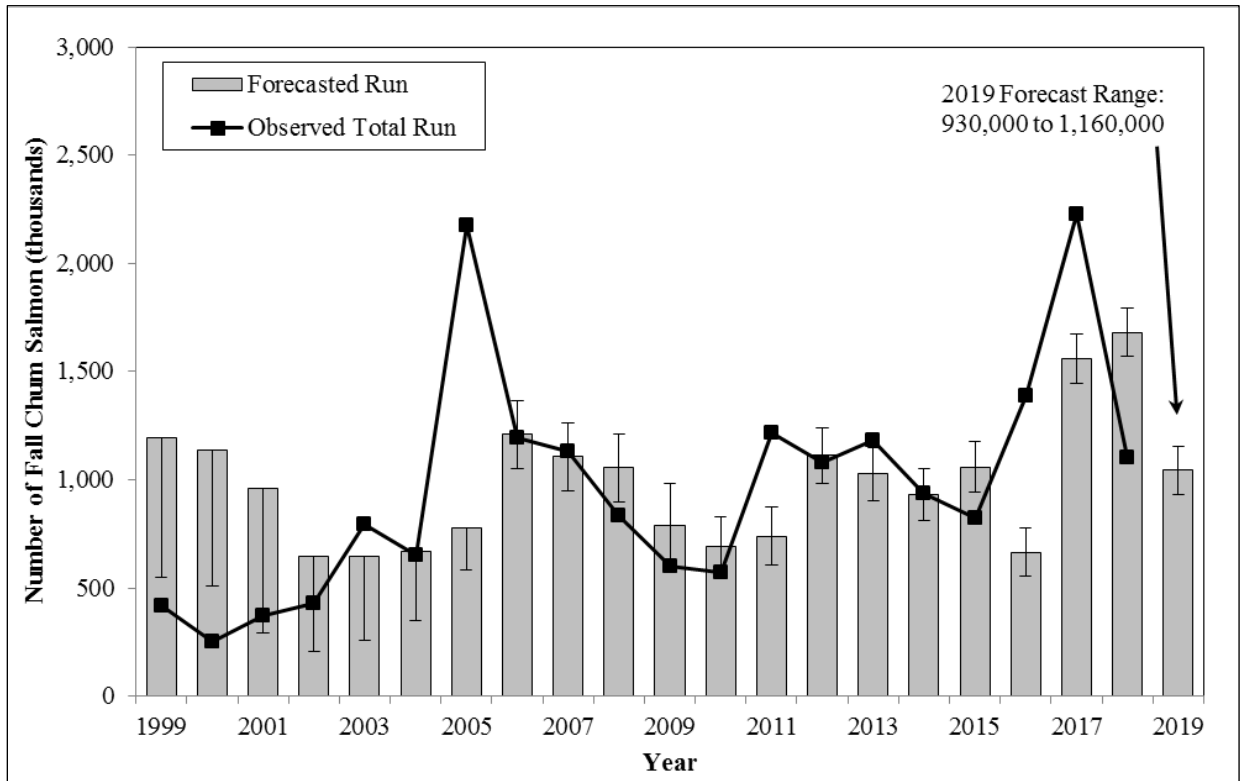


Figure H1. Observed total run of fall chum salmon compared to the spawner-recruit estimates used in the annual forecast, Yukon River, 1999–2019.

Note: The different methods used for determining bounds are documented in annual Yukon River U.S./Canada Joint Technical Committee reports.

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