Special Publication 20-06

Run Forecasts and Harvest Projections for 2020 Alaska Salmon Fisheries and Review of the 2019 Season

Edited by

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April 2020

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

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RUN FORECASTS AND HARVEST PROJECTIONS FOR 2020 ALASKA SALMON FISHERIES AND REVIEW OF THE 2019 SEASON

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The Special Publication series was established by the Division of Sport Fish in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

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. See 5 AAC 39.222(f)(3). (Also see *optimum escapement goal*.)
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.
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.
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.
Enhanced salmon stock, 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. See 5 AAC 39.222(f)(9).
Escapement, spawning population, or broodstock	The portion of a salmon run that is not harvested and survives to reach the spawning grounds or hatchery. See 5 AAC 39.222(f)(10)).
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. See 5 AAC 39.222(f)(25).
Return	Return refers to an aggregation of salmon over several or more years that represent the surviving adult offspring from a single brood year. See 5 AAC 39.222(f)(30).
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. See 5 AAC 39.222(f)(31).
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. See 5 AAC 39.222(f)(36).

ABSTRACT

This report contains a detailed review of Alaska's 2019 commercial salmon season and harvest forecasts for 2020. The Alaska all-species salmon harvest for 2019 totaled 207.9 million, about 5.3 million fewer fish than the preseason forecast of 213.2 million. This combined harvest was composed of 287,000 Chinook salmon *Oncorhynchus tshawytscha*, 55.5 million sockeye salmon *O. nerka*, 3.9 million coho salmon *O. kisutch*, 128.6 million pink salmon *O. gorbuscha*, and 19.6 million chum salmon *O. keta*. The Alaska Department of Fish and Game is expecting a decrease in commercial salmon harvests in 2020. The 2020 total commercial salmon harvest (all species) projection of 132.7 million is expected to include 320,000 Chinook salmon, 48.1 million sockeye salmon, 4.2 million coho salmon, 60.6 million pink salmon, and 19.5 million chum salmon. Compared to 2019 commercial harvests, the projected 2020 commercial harvests are expected to be as follows: 68 million fewer pink salmon, 7.4 million fewer sockeye salmon, 300,000 more coho salmon, and 100,000 fewer chum salmon.

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 2020 as well as a detailed review of Alaska's 2019 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 a decrease in commercial salmon harvest in 2020, mostly due to a decrease in pink salmon *Oncorhynchus gorbuscha* harvests compared to 2019. The 2020 total commercial salmon harvest (all species) projection of 132.7 million is expected to include 320,000 Chinook salmon *O. tshawytscha*, 48.1 million sockeye salmon *O. nerka*, 4.2 million coho salmon *O. kisutch*, 60.6 million pink salmon, and 19.5 million chum salmon *O. keta*. Compared to 2019 commercial harvests, the projected 2020 commercial harvests are expected to be as follows: 68 million fewer pink salmon, 7.4 million fewer sockeye salmon, 300,000 more coho salmon, and 100,000 fewer chum salmon. We note that—except for Southeast Alaska—pink salmon forecasts are generally based on average returns from previous brood years. The pink salmon harvest forecast for 2020 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 2020 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Region & Area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Alaska						
Natural production		909[a]	1,574[a]	12,000	1,376	15,860
Hatchery production[b]		188	566	382	7,798	8,934
Southeast Region Total	197[c]	1,098	2,140	12,382	9,174	24,990
Prince William Sound						
Natural production	30	919[d]	306[a]	3,846	469	5,570
Hatchery production[e]		1,737	192	27,092	3,942	32,962
Lower Cook Inlet						
Natural production	1[a]	136[a]	13[a]	202	81[a]	432
Hatchery production		96[f]		2,800		2,897
Upper Cook Inlet	7[a]	1,850	203[a]	383[a]	175[a]	2,618
Bristol Bay	40[a]	34,560	121[a]	909[g]	1,321[a]	36,951
Central Region Total	78	39,297	836	35,232	5,988	81,431
Kodiak						
Natural production	7[a]	1,655[h]	308[a]	9,900	723[a]	12,594
Hatchery production		157[i]	130	2,300[f]	87	2,673
Chignik	8[a]	586[j]	130[a]	224[g]	197[a]	1,145
South Peninsula & Aleutians	23[a]	2,374[c]	317[a]	450	1,080[a]	4,243
North Alaska Peninsula	3[a]	2,974[k]	57[a]	13[g]	114[a]	3,160
Westward Region Total	40	7,746	943	12,887	2,200	23,816
Arctic-Yukon-Kuskokwim Total	5	7	290	50	2,116	2,468
Statewide Total	320	48,147	4,209	60,551	19,478	132,705

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

[a] Average harvest of the previous 5 years (2015–2019).

[b] Hatchery salmon projections made by Southern Southeast Regional Aquaculture Association, Northern Southeast Regional Aquaculture Association, Douglas Island Pink and Chum, Armstrong-Keta, Inc., Kake Nonprofit Fishereis Corporation, and Metlakatla Indian Community less broodstock, other harvests from the previous year, and excess. Wild chum salmon catch estimated as 20% of total catch.

[c] The allowable catch of Chinook salmon in Southeast Alaska is determined by the Pacific Salmon Commission, which agreed to a Southeast Alaska all-gear commercial harvest quote of 163,980 Chinook salmon during 2020. Also includes an average of 33,000 "add on" harvest of fish from Alaska hatcheries. More information available here: https://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr&release=2020_02_11

[d] Includes harvest estimates for Prince William Sound and Copper River sockeye salmon.

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

[f] Includes common property plus cost-recovery harvests.

[g] Average of previous 5 even-year harvests (2010–2018).

[h] Total Kodiak harvest of natural run sockeye salmon includes projected harvests from formally forecasted systems, projected Chignik harvest at Cape Igvak, and projected harvest from additional minor systems.

[i] 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.

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

[k] 5-year average harvest (2015–2019); includes formal forecasts for Bear River late run and Nelson River sockeye salmon stocks.

The Alaska all-species salmon harvest for 2019 totaled 207.9 million, about 5.3 million fewer fish than the preseason forecast of 213.2 million. This combined harvest was composed of 287,000 Chinook, 55.5 million sockeye, 3.9 million coho, 128.6 million pink, and 19.6 million chum salmon. Table 2 shows 2019 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 2019 harvest by area and species.

Table 2.–Preliminary 2019 Alaska commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Region Total[a]	188	1,012	1,719	21,166	9,370	33,455
Prince William Sound	19	2,591	527	48,719	5,381	57,237
Lower Cook Inlet[b]	1	312	13	1,980	55	2,361
Upper Cook Inlet	3	1,720	164	71	129	2,087
Bristol Bay	33	43,033	81	7	1,395	44,549
Central Region Total	56	47,656	785	50,777	6,960	106,235
Kodiak Area	7	2,177	394	32,963	552	36,093
Chignik	4	639	248	2,453	158	3,502
South Peninsula and Aleutians	23	1,637	526	21,021	1,353	24,559
North Peninsula	4	2,408	38	118	48	2,616
Westward Region Total	38	6,860	1,206	56,554	2,112	66,770
Arctic-Yukon-Kuskokwim Region Total	5	7	198	87	1,148	1,445
Total Alaska	287	55,535	3,909	128,584	19,590	207,905

Note: Columns may not total exactly due to rounding.

[a] Total commercial harvest of Chinook salmon for the October 1, 2018, to September 30, 2019, 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 2019 Alaska commercial salmon harvests, by fishing area and species, in thousands of pounds.

	Species					
Fishing area	Chinook	Sockeye	Coho	Pink	Chum	Total
Southeast Region Total[a]	2,229	5,595	11,735	78,019	74,139	171,718
Prince William Sound	360	13,914	4,271	167,346	33,181	219,071
Lower Cook Inlet[b]	9	1,395	98	6,165	403	8,069
Upper Cook Inlet	50	9,517	925	217	870	11,580
Bristol Bay	347	225,109	456	22	9,003	234,937
Central Region Total	766	249,934	5,750	173,751	43,456	473,657
Kodiak Area	66	10,794	2,824	104,601	3,887	122,172
Chignik	39	3,614	1,581	7,584	1,037	13,856
South Peninsula and Aleutians	167	8,231	3,143	58,325	7,976	77,842
North Peninsula	58	12,791	245	376	292	13,761
Westward Region Total	330	35,430	7,793	170,886	13,192	227,632
Arctic-Yukon-Kuskokwim Region Total	53	42	1,237	296	8,322	9,951
Total Alaska	3,379	291,002	26,515	422,953	139,110	882,958

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

[a] Total commercial harvest of Chinook salmon for the October 1, 2018, to September 30, 2019, 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 2019 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 2019 ALASKA COMMERCIAL SALMON FISHERIES

SOUTHEAST REGION

SOUTHEAST ALASKA AND YAKUTAT AREAS

The combined 2019 Southeast Alaska and Yakutat area cumulative commercial salmon harvest, including hatchery cost recovery, was 33.5 million fish (Table 4). Total common property commercial harvest was 29.2 million fish (87% of the total harvest). The 2019 overall harvest, in numbers of salmon, was approximately 52% higher than the 2018 overall harvest (just under 22.0 million fish). The total commercial salmon harvest proportions by species were Chinook 1%, sockeye 3%, coho 5%, pink 63%, and chum salmon 28%. The 2019 combined-gear, large Chinook salmon harvest of 188,000 fish was 66% of the most recent 10-year average and 63% of the long-term average. The sockeye salmon harvest of 1.0 million fish was 93% of the recent 10-year average and 77% of the long-term average. The coho salmon harvest of 1.7 million fish was 65% of the 10-year average and 79% of the long-term average. The pink salmon harvest of 21.2 million fish was 57% of the 10-year average and 69% of the long-term average. The chum salmon harvest of 9.4 million fish was 90% of the 10-year average and 153% of the long-term average. The all-species total harvest was 65% of the recent 10-year average and 82% of the long-term average.

Chinook Salmon

Harvest Summary: The 2019 Chinook salmon harvest of 188,000 fish was below both the recent 10-year and long-term averages and is the third lowest harvest over the last 58 years. The average annual total Chinook salmon harvest since 1962 is approximately 300,000 fish. Preliminary harvests of coastwide Chinook salmon accountable under the Pacific Salmon Treaty included 103,000 by troll gear, 9,400 by purse seine gear, and 3,000 by gillnet gear. In 2019, a total of 41,000 (22% of total Chinook salmon harvests) hatchery-origin Chinook salmon were commercially harvested in Southeast Alaska/Yakutat, and 32,000 hatchery-origin Chinook salmon were harvested in private hatchery cost-recovery fisheries.

Sockeye Salmon

Harvest Summary: The 2019 harvest of sockeye salmon was 1.0 million fish. This was below both the recent 10-year average of 1.1 million fish and the long-term average of 1.3 million fish. The 2019 sockeye salmon harvest ranks 36th since 1962. The Southeast Alaska Area purse seine fishery harvest of approximately 445,000 fish was above the recent average, below the long-term average, and accounted for 44% of the regional total harvest. The drift gillnet fishery harvest of 395,000 fish was below the recent and long-term averages and accounted for 39% of the regional total harvest. The set gillnet fishery harvest of just under 55,000 fish was below the recent and long-term averages and accounted for 5% of the regional total harvest.

Coho Salmon

Harvest Summary: The 2019 coho salmon harvest was 1.7 million fish. This harvest was lower than both the long-term and recent averages, and ranks 35th since 1962. The coho salmon harvest in the troll fishery was approximately 975,000 fish. This was below both the long-term and recent averages, and accounted for 57% of the total harvest. Purse seine, drift, and set gillnet harvests of coho salmon were below long-term and recent averages.

Pink Salmon

Harvest Summary: The 2019 commercial pink salmon harvest was 21.2 million fish, 63% of the total regional salmon harvest. The purse seine pink salmon harvest was 18.6 million fish, 88% of the total Southeast Alaska/Yakutat harvest. This year's pink salmon harvest was below the recent and long-term averages, and ranks 33rd since 1962.

Chum Salmon

Harvest Summary: The 2019 chum salmon harvest of 9.4 million fish was below the recent average of 10.5 million fish. 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 fish.

Table 4.–Preliminary 2019 Southeast Region commercial salmon harvests, by fishing area and species in thousands of fish.

	Species					
Fishery	Chinook[a]	Sockeye	Coho	Pink	Chum	Total
Purse seine						
Southern purse seine traditional	10	384	192	16,080	1,165	17,831
Northern purse seine traditional	0	50	38	2,357	1,256	3,701
Hatchery terminal	12	12	17	174	1,959	2,174
Total purse seine	22	445	246	18,611	4,381	23,706
Drift gillnet						
Tree Point	1	16	29	205	182	434
Prince of Wales	1	24	59	424	113	622
Stikine	4	7	9	11	51	82
Taku-Snettisham	1	95	23	69	246	435
Lynn Canal	1	228	47	111	609	996
Drift gillnet hatchery terminal	12	25	28	52	1,126	1,244
Total drift gillnet	21	395	196	872	2,327	3,812
Set gillnet (Yakutat)	0	55	100	33	0	189
Troll						
Hand troll						
Traditional	3	0	29	4	1	37
Hatchery terminal	0	0	1	0	0	1
Spring areas	1	0	0	0	0	1
Total hand troll	4	0	29	4	2	39
Power troll						
Traditional	95	6	939	64	229	1,332
Hatchery terminal	1	0	7	3	29	40
Spring areas	10	0	0	0	10	21
Total power troll	107	6	946	67	268	1,393
Total troll	111	6	975	70	270	1,432
Annette Island Reservation						
Seine	0	8	3	933	39	983
Drift gillnet	1	2	14	307	58	382
Troll	1	0	0	0	0	1
Hand troll	0	0	0	0	0	0
Power troll	1	0	0	0	0	1
Trap						
Total Annette Island Reservation	1	10	18	1,240	98	1,367
Hatchery cost recovery	32	97	181	313	2,246	2,870
Miscellaneous[b]	0	3	2	26	48	78
Southeast Region Total	188	1,012	1,719	21,166	9,370	33,455

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 2019 Chinook salmon season goes from October 1, 2019, to September 30, 2019.

[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 2019 Prince William Sound (PWS) Area commercial salmon harvest was 57.2 million fish (Table 5). Overall harvest was composed of 19,000 Chinook, 2.6 million sockeye, 527,000 coho, 48.7 million pink, and 5.4 million chum salmon—including 1.4 million chum salmon for Wally Noerenberg Hatchery broodstock and cost recovery. The 2019 harvest included 50.9 million (89%) commercial common property fishery (CCPF) fish, and just under 6.4 million (11%) hatchery cost-recovery and broodstock fish.

Chinook Salmon

Run and Escapement Summary: The 2019 preseason common property harvest forecast for the Copper River District was 31,000 Chinook salmon.

Harvest Summary: Approximately 89% of the CCPF harvest of 19,000 Chinook salmon occurred in the first 8 fishing periods of the season. Season total harvest was above the recent 10-year average of 12,500 fish.

Sockeye Salmon

Run and Escapement Summary: The 2019 preseason commercial harvest forecast for the Copper River District was 756,000 sockeye salmon. Gulkana Hatchery was projected to contribute 69,000 fish to this CCPF harvest projection.

Spawning escapement to Copper River Delta index systems based on aerial survey peak counts was 61,800 sockeye salmon, within the sustainable escapement goal (SEG) range of 55,000–130,000 fish.

The aerial escapement index of 17,600 sockeye salmon for Bering River District was above the SEG range of 15,000–33,000 fish.

Prince William Sound Aquaculture Corporation (PWSAC) forecast a run of approximately 1.4 million Main Bay Hatchery enhanced sockeye salmon in 2019.

The 2019 Coghill Lake sockeye salmon total run forecast was 473,000 fish. Approximately 32,200 sockeye salmon passed through the Coghill River weir, which is within the SEG range of 20,000–60,000 fish.

Harvest Summary: The harvest of 2.6 million sockeye salmon was higher than the previous 10-year (2009–2018) average harvest of 990,000 fish. The average weight of 5.6 pounds was the largest in the last 5 years. The Copper River District commercial sockeye salmon harvest was just under 94% (1.2 million) wild fish, 3% (39,800) Gulkana Hatchery fish, and 3% (33,300) Main Bay Hatchery fish. The CCPF drift gillnet harvest of sockeye salmon in the Coghill District was 389,000 fish, which is 154% above the recent 10-year (2009–2018) average. The proportion of wild sockeye salmon in this Coghill District CCPF harvest was 57%.

The CCPF harvest of sockeye salmon in the Eshamy District gillnet (drift and set) fishery was 696,000 fish, 49% below the forecast. The proportion of wild sockeye salmon in the Eshamy District CCPF harvest was 14%. PWSAC harvested approximately 15,800 sockeye salmon for broodstock and culled 5,200 jack sockeye salmon.

The Unakwik District CCPF harvest was fewer than 10,000 sockeye salmon (Table 5) but was more than double the 10-year (2009–2018) average of 2,750 fish.

Coho Salmon

Run and Escapement Summary: The 2019 preseason commercial harvest forecast for the Copper River District was 235,000 coho salmon. Copper River Delta peak escapement counts of 36,600 fish were within the SEG range of 32,000–67,000 fish. The aerial escapement index of 9,600 coho salmon was below the SEG range of 13,000–33,000 fish.

PWSAC forecasted a 2019 run of 230,000 coho salmon to Wally Noerenberg Hatchery and required 2,700 fish for cost recovery and broodstock.

The Valdez Fisheries Development Association coho salmon run was forecasted to be 87,000 fish.

Harvest Summary: The 2019 total purse seine CCPF harvest of coho salmon in PWS was approximately 297,000 fish (Table 5).

The season total drift gillnet coho salmon commercial harvest in the Copper River District of 78,000 fish was well below the recent 10-year harvest average of 235,000 fish.

The Bering River District drift gillnet commercial harvest of 7,000 coho salmon was 89% below the previous 10-year harvest average of 67,000 fish. The coho salmon fishery was managed in concert with the Copper River District fishery and presented similar low harvest and escapement indices. The CCPF drift gillnet harvest of coho salmon in the Coghill District was 120,000 fish.

Pink Salmon

Run and Escapement Summary: The 2019 pink salmon total run forecast for PWS was approximately 66.0 million fish, of which 57.9 million fish were estimated to be available for CCPF harvest. This estimate included 23.6 million wild stock fish, 22.3 million PWSAC hatchery fish, and 20.2 million Valdez Fisheries Development Association fish. Approximately 3.4 million fish (17%) of the projected 20.2 million Valdez Fisheries Development Association pink salmon return would be needed for cost recovery and broodstock, leaving 16.7 million salmon for CCPF. Approximately 2.9 million (13%) of the projected 22.3 million pink salmon run to the PWSAC hatcheries were needed for cost recovery and broodstock. The remaining 19.4 million PWSAC pink salmon would be available for common property harvest. Based on ADF&G's wild stock pink salmon forecast of 23.6 million fish, there was a potential CCPF of 21.7 million wild pink salmon.

Inseason pink and chum salmon escapement estimates were higher than expected for the date in most districts during early July, but salmon escapements started to decline across PWS in mid-July. This midseason decline in escapement was most likely due to a record drought and heatwave. These unusual weather conditions complicated wild stock management as salmon milled offshore waiting for rain and cooler temperatures before migrating towards streams, delaying the CCPF into August. Salmon started arriving at streams in sufficient numbers in early August and CCPF opportunities were expanded in time and area to target surplus wild pink salmon. However, aerial surveys indicated that pink salmon were unable to enter streams because of low flow conditions, and significant prespawn mortality events were documented throughout PWS. The estimate of pink salmon escapement in PWS is not yet available; however, overall escapements were likely within odd-year SEG ranges in most districts. Given the drought conditions it is uncertain how viable escapements were based on the amount of prespawn mortality observed.

Harvest Summary: Pink salmon CCPF drift gillnet harvest in the Coghill District was 301,000 salmon, which is 28% of the recent 10-year average. The proportion of wild pink salmon in the Coghill District CCPF harvest was 72%.

In the Eshamy District, 320,000 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 91%.

The CCPF harvest of approximately 43.8 million pink salmon was 8.2 million fewer fish than the 5-odd-year average, and 24% below the 57.9 million CCPF preseason forecast. Total pink salmon harvest was 48.7 million fish, including 4.9 million fish for hatchery cost recovery, broodstock, and raceway sales (2.95 million fish for PWSAC, and just under 2.0 million fish for Valdez Fisheries Development Association). Pink salmon thermal marked otolith contribution estimates from CCPF harvests were 39.7% PWSAC fish, 38.9% wild stock fish, and 21.3% Solomon Gulch Hatchery fish. The number of active permits fished in the PWS purse seine fishery was the highest number (238 permits) since 1991.

Chum Salmon

Run and Escapement Summary: PWSAC forecasted a 2019 run of just under 2.0 million chum salmon to Wally Noerenberg Hatchery and required 843,000 fish (42%) for cost recovery and broodstock. The total chum salmon return to Wally Noerenberg Hatchery was 2.6 million fish and was 30% above the forecast.

The 2019 chum salmon total run forecast was 3.1 million fish, with 2.6 million fish (84%) projected to be of PWSAC origin and a wild chum salmon CCPF forecast of 327,000 fish. PWSAC forecasted a 2019 run of just under 2.0 million chum salmon to WNH and required 843,000 fish (42%) for cost recovery and broodstock. The total chum salmon return to WNH was 2.6 million fish and was 30% above forecast. Additionally, 330,000 chum salmon were expected to be harvested at Armin F. Koernig Hatchery by the purse seine fleet, and 250,000 fish were expected to be harvested at Port Chalmers by the drift gillnet fleet.

Harvest Summary: The CCPF drift gillnet harvest of chum salmon in the Coghill District was just over 1.0 million fish. The proportion of wild chum salmon in the Coghill District CCPF harvest was 3%. PWSAC harvested 1.4 million chum salmon for cost recovery and broodstock.

The CCPF harvest of chum salmon in the Eshamy District gillnet (drift and set) fishery was 164,000 fish. The proportion of wild chum salmon in the Eshamy District CCPF harvest was 4%.

The purse seine CCPF harvest of approximately 1.2 million chum salmon was above the recent 10-year harvest average of 615,000 fish. Purse seine chum salmon harvest in PWS was predominantly from the Southwestern and Eastern districts. Chum salmon commercial harvest in the Southwestern District was 545,000 fish, of which 484,000 (89%) were from Armin F. Koernig Hatchery. Eastern District chum salmon commercial harvest was 523,000 fish, of which 93% were of wild stock origin.

LOWER COOK INLET AREA

The 2019 Lower Cook Inlet Area commercial salmon harvest was approximately 2.4 million fish (Table 5). The harvest was composed of fewer than 1,000 Chinook salmon, and approximately 312,000 sockeye, 13,000 coho, 2.0 million pink, and 55,000 chum salmon. Out of the total salmon harvest in Lower Cook Inlet, approximately 339,000 fish (14%) were hatchery cost recovery and 2.0 million fish (86%) were CCPF harvest.

Chinook Salmon

Harvest Summary: The 2019 purse seine harvest for the Southern District, including homepack, was 177 Chinook salmon, which was higher than the previous 10-year average harvest of 86 fish. The set gillnet harvest for the Southern District, including homepack, was 362 fish, which was higher than the previous 10-year average harvest of 296 fish. An additional 197 Chinook salmon were harvested by purse seine in the Outer District in 2019.

Sockeye Salmon

Run and Escapement Summary: Cook Inlet Aquaculture Association (CIAA) forecasted a run of 39,000 sockeye salmon to the Kirschner Lake remote release site. CIAA also forecasted a total run of 305,600 sockeye salmon to Resurrection Bay facilities with all but 61,900 of these fish anticipated to be used for broodstock or cost-recovery purposes.

The preliminary passage estimate at the English Bay River weir was 24,044 sockeye salmon, exceeded the SEG range of 6,000–13,500 fish for this system, despite the set gillnet fishery being open in this subdistrict.

Sockeye salmon escapement was within the SEG range for 2 of 3 stocks in the Kamishak Bay District, with the exception of Mikfik Lake. Sections of Mikfik Creek dried up in mid-June due to lack of rain, blocking upstream migration. Prior to this, 2,901 sockeye salmon were counted entering Mikfik Lake, which is below the SEG range of 3,400–11,000 fish.

Sockeye salmon escapements to both Delight and Desire lakes in the Outer District were within their respective SEG ranges for those systems.

Escapement of 12,760 sockeye salmon through the weir at Bear Creek was within the desired inriver passage goal of 5,620–13,220 fish. This goal is the combination of the SEG (700–8,300 fish) and the estimated 4,920 fish required for broodstock for the CIAA Resurrection Bay sockeye salmon program at the Trail Lakes Hatchery. The only other index stock in the Eastern District is Aialik Lake, where the final escapement of 5,000 fish was within the SEG range of 3,200–5,400 fish.

Harvest Summary: The 2019 CCPF purse seine harvest for the Southern District, including homepack, was 47,210 sockeye salmon, which was higher than the previous 10-year average harvest of 35,943 fish. The set gillnet harvest for the Southern District, including homepack, was 29,381 fish, which was higher than the previous 10-year average harvest of 26,451 fish. In addition, 12,586 sockeye salmon were harvested by CIAA from special harvest areas (SHAs) in this district for cost-recovery purposes.

The Kamishak Bay District CCPF harvest was approximately 59,000 sockeye salmon, which ws higher than the previous 10-year average annual harvest of 42,594 fish. In addition, 18,698 sockeye salmon were harvested by CIAA from the Kirschner Lake SHA for cost-recovery purposes.

The Outer District harvest was approximately 15,000 sockeye salmon, including homepack, which is higher than the previous 10-year average annual harvest of 7,612 fish.

Due to small runs during the previous 10 years, no wild sockeye salmon were forecast to be available for commercial harvest from the Eastern District in 2019. Total cost-recovery harvest from the Eastern District was 124,100 sockeye salmon. In addition, 863 fish collected at the Bear Creek weir in Resurrection Bay were donated to members of the public.

Portions of Resurrection Bay were open for commercial harvest from June 24 to July 19. During this time, 4 permit holders reported harvesting 4,307 sockeye salmon.

Coho Salmon

Harvest Summary: The 2019 purse seine harvest for the Southern District was 3,088 coho salmon (including homepack), which is higher than the previous 10-year average harvest of 1,081 fish. The set gillnet harvest for the Southern District (including homepack), was 2,960 fish, which is higher than the previous 10-year average harvest of 2,134 fish.

The Kamishak Bay District commercial fishery harvest was just over 3,000 coho salmon, which was higher than the previous 10-year average annual harvest of 1,041 fish.

The Outer District harvest was just under 3,000 coho salmon, which was higher than the previous 10-year average annual harvest of 64 fish.

In the Eastern District, 1,183 coho salmon were donated at the Bear Creek weir to members of the public.

Pink Salmon

Run and Escapement Summary: In the Southern District, China Poot and Seldovia creeks did not achieve their pink salmon SEGs. Three streams (Tutka Creek, Barabara Creek, and Port Graham River) exceeded the upper end of their respective pink salmon SEG ranges.

In the Kamishak Bay District, pink salmon escapement was within the SEG range in the Bruin River and Sunday Creek and was below the SEG range at Brown's Peak Creek.

In the Outer District, preliminary estimates show that pink salmon escapement was below the SEG range for South Nuka Creek, within the range for Windy Bay Left Creek and Desire Lake, and above the range for 6 other stocks.

Harvest Summary: The 2019 purse seine harvest for the Southern District (including homepack) was 22,981 pink salmon, far fewer than 10-year average harvest of 161,082 fish. The set gillnet harvest for the Southern District (including homepack) was 6,423 fish, fewer than the previous 10-year average harvest of 17,337 fish. In addition, 179,659 fish were harvested by CIAA from SHAs in this district for cost-recovery purposes.

The Kamishak Bay District CCPF harvest was approximately 59,008 pink salmon, which was higher than the previous 10-year average annual harvest of 47,425 fish.

The Outer District pink salmon harvest was 1.7 million fish, which was higher than the previous 10-year average annual harvest of 910,978 fish.

Chum Salmon

Run and Escapement Summary: The chum salmon SEG was not met at the Port Graham River in the Southern District. Chum salmon escapement in the Outer District was within the SEG range for Island, Port Dick, and Dogfish creeks, and above the SEG range in the Rocky River. In the Kamishak District, chum salmon escapement was below the SEG range at Cottonwood Creek and McNeil River, and above the range at 5 other index streams.

Harvest Summary: The 2019 purse seine harvest for the Southern District (including homepack) was 307 chum salmon, which was much lower than the previous 10-year average harvest of

1,344 fish. The set gillnet harvest for the Southern District (including homepack) was 3,930 chum salmon, which was slightly lower than the previous 10-year average harvest of 4,044 fish.

The Kamishak Bay District commercial fishery harvest was approximately 32,000 chum salmon, which was higher than the previous 10-year average annual harvest of 17,462 fish.

The Outer District harvest was 19,460 chum salmon, which was much lower than the previous 10-year average annual harvest of 58,842 fish.

UPPER COOK INLET AREA

The 2019 Upper Cook Inlet (UCI) commercial harvest of approximately 2.1 million salmon was 37% less than the previous 10-year average annual harvest of 3.2 million fish.

Chinook Salmon

Run and Escapement Summary: In UCI, there are 2 commercial fisheries where most Chinook salmon are harvested. These include the set gillnet fisheries in the Northern District, and the Upper Subdistrict of the Central District. Chinook salmon runs were expected to be below average across Southcentral Alaska for the 2019 season. As predicted, the 2019 Chinook salmon return was below average and lower than the preseason forecasts, leading to both preseason and inseason conservation measures in all fisheries, reducing the harvest of Chinook salmon stocks.

The 2019 preseason run forecast for Deshka River Chinook salmon was approximately 8,500 fish, below the SEG of 13,000–28,000 fish. Based on this forecast, the 2019 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 Upper Cook Inlet Chinook salmon stocks in 2019 was also poor. Consequently, all sport fisheries in the Susitna drainage were initially closed. Warm summer temperatures with little to no rain stalled Chinook salmon migration to the Deshka River where the cumulative count held at 7,500 fish for a 20-day period. The estimated final 2019 escapement of Chinook salmon in the Deshka River was approximately 9,711 fish, which was below the lower end of the SEG. The Little Susitna River Chinook salmon SEG of 2,100–4,300 fish was met in the 2019 season, with a preliminary weir count of 3,666 fish.

Late-run Chinook salmon returning to the Kenai and Kasilof rivers are the primary stocks harvested in the eastside set net (ESSN) fishery. Kenai River late-run Chinook salmon are managed to meet an SEG of 13,500–27,000 large fish (≥75 cm mid eye to tail fork [METF]). If restrictions are implemented in the sport fishery (from July 1 through July 31) to achieve the SEG, restrictive paired actions are also required in the ESSN fishery. The 2019 preseason forecast was for a total run of 21,746 large Kenai River late-run Chinook salmon. Based on low preseason abundance projections for late-run Chinook salmon and low abundance of the early-run Chinook salmon stock, the 2019 late-run sport fishery in the Kenai River was restricted to no bait on July 1. 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, and gear restrictions were implemented. Beginning August 1, after the Kenai River Chinook salmon sport fishery was closed, the paired restrictive provisions in the ESSN fishery were no longer in effect (by regulation), but the ESSN fishery was still managed to meet both Chinook and sockeye salmon escapement goals. Low abundance of Chinook salmon in the Kenai River resulted in the entire ESSN fishery being closed from August 5 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 preliminary 2019 sonar count of large late-run Kenai River Chinook salmon was 14,020 fish, with an escapement estimate of 11,671 fish accounting for sport fishery harvest above the sonar site. Thus, the large fish SEG of 13,500–27,000 fish for Kenai River late-run Chinook salmon was not achieved.

Harvest Summary: In the Northern District, the directed Chinook salmon set gillnet fishery was closed for the entire 2019 season to reduce the harvest of northern Upper Cook Inlet Chinook salmon. In addition, subsistence fishing was reduced to 2 fishing periods a week to reduce the harvest of Chinook salmon destined for streams throughout the northern Upper Cook Inlet watershed. The estimated Chinook salmon harvest in the Northern District regular salmon fishery in 2019 was 202 fish, which was above the recent 10-year average of 174 fish.

The 2019 UCI commercial harvest of all Chinook salmon stocks was approximately 3,000 fish, which was 58% less than the previous 10-year (2009–2018) average annual harvest of 7,408 fish. Of this total, the ESSN fishery harvested 2,245 Chinook salmon, or 71% of the harvest. The 2,245 Chinook salmon harvested in the ESSN fishery included an estimated 1,024 (46%) large Chinook salmon, and a total of 613 (27%) large Kenai River–origin late-run fish. The drift gillnet fishery harvested 178 Chinook salmon of all sizes and all stocks.

Sockeye Salmon

Run and Escapement Summary: The 2019 total run of sockeye salmon to UCI—which includes harvest estimates for commercial, sport, personal use, educational, subsistence, and escapement estimates—of approximately 5.2 million fish was 800,000 fewer fish (13%) than the preseason forecast. Sockeye salmon runs fell short of forecast at the Kenai River by approximately 184,000 fish, at the Kasilof River by 203,000 fish, and at Fish Creek by 29,000 fish. The number of sockeye salmon returning to the Susitna River and all other systems (minor systems) was 23–41% less than forecasted for 2019.

At the Kenai River sonar, the peak day of sockeye salmon passage occurred on July 28, with a count of 99,038 fish. This was the highest daily sockeye salmon passage at the Kenai River sonar since 2014. During the previous 10 years, the average date where 50% of the yearly sonar passage occurred in the Kenai River was July 24. In 2019, 50% of the total passage did not occur until July 28. A weak Kenai River Chinook salmon run (late-run) resulted in paired restrictive actions in the sport fishery and the ESSN commercial fishery. For the ESSN fishery, this resulted in less fishing time than normally allowed in sockeye salmon management plans. The final passage estimate of approximately 1.8 million sockeye salmon exceeded the upper end of the Kenai River sockeye salmon inriver goal (1,100,000–1,300,000 fish) by more than 500,000 fish. Estimates of sport fishery harvest above the Kenai River Mile 19 sonar site are not currently available, so performance relative to the SEG range is unknown.

The Kasilof River sockeye salmon run of 378,416 fish exceeded the Kasilof River biological escapement goal (BEG) of 140,000–340,000 fish. The passage midpoint occurred on July 17, which was 1 day later than the midpoint from the previous 10 years. The peak daily passage of 17,102 fish occurred on July 10.

Sockeye salmon escapement objectives were exceeded at Fish Creek, met at Chelatna and Judd lakes, and were below objectives at Larson Lake. The final escapement estimate for Packers Lake was incomplete due to a video malfunction.

Harvest Summary: The 2019 UCI commercial harvest of 1.7 million sockeye salmon was approximately 34% less than the 2009–2018 average annual harvest of 2.6 million fish. This was the second lowest harvest in the past 10 years (2009–2018).

The total 2019 sockeye salmon harvest in the ESSN fisheries was 784,279 fish. From June 25 through August 15, the Kasilof Section was open on 18 different days, harvesting approximately 335,400 sockeye salmon, which was 32% less than the previous 10-year (excluding 2012) average of 490,700 fish. Harvest from 2012 was excluded from the historical harvest due to extensive fishery closures. From July 8 through August 14, the Kenai and East Foreland sections were open on 14 different days, producing a total sockeye salmon harvest of 450,000 fish. This was 17% greater than the previous 10-year (also excluding 2012) average annual sockeye salmon harvest of 379,000 fish for those sections.

The total UCI drift gillnet harvest in 2019 was 749,101 sockeye salmon, which was approximately 53% less than the previous 10-year average of 1.6 million fish. The peak day of harvest in the drift fleet occurred on Thursday, July 18, when 339 vessels harvested approximately 114,240 sockeye salmon, or 336 fish per boat. This was far fewer than the previous 10-year average peak day harvest per boat of 919 fish.

In 2019, approximately 58,389 sockeye salmon were harvested by setnetters in the Western Subdistrict. This was 41% greater than the previous 10-year average of approximately 41,000 fish.

Approximately 3,484 sockeye salmon were harvested in the Kustatan Subdistrict in 2019, of which 1,740 fish were harvested during the Big River fishery. The 2019 sockeye salmon harvest was approximately 7% less than the previous 10-year average harvest of 3,268 fish.

In 2019, approximately 51,806 sockeye salmon were harvested from the Kalgin Island Subdistrict, with nearly 6,751 fish (8%) of those fish taken during the Big River sockeye salmon fishery. The previous 10-year average annual sockeye salmon harvest on Kalgin Island was approximately 54,336 fish, with roughly 11,500 of those fish harvested during the early season Big River fishery.

In 2019, approximately 73,220 sockeye salmon were harvested in the Northern District. This harvest was 89% greater than the previous 10-year (2009–2018) average annual harvest of 38,734 sockeye salmon, and approximately 16% less than the 1966–2018 average of nearly 87,000 fish.

Coho Salmon

Run and Escapement Summary: In UCI, there are 4 coho salmon systems with escapement goals: Fish Creek, Little Susitna, and Deshka rivers have weirs; and McRoberts Creek is counted with foot surveys. The Fish Creek SEG is 1,200–4,400 fish. Coho salmon counts at the Fish Creek weir occurred from July 16 to September 22 and produced a final estimate of 3,158 fish. During the 2019 season, the sport fishing bag and possession limit for coho salmon was not increased; however, sport fishing was allowed at Fish Creek 7 days per week, from 5 a.m. to 10 p.m.

The Little Susitna River has a coho salmon SEG of 10,100–17,700 fish. Coho salmon escapement was counted at the Little Susitna weir from July 7 through September 3. Due to the combination of very warm weather and low river conditions, fish passage was slow. After much needed rain and cooler temperatures from August 4 to August 9, nearly one-third of the total coho salmon passage occurred in the Little Susitna River. The last push of 253 coho salmon on September 2 was still not enough to meet the minimum SEG. The final coho salmon count in the Little Susitna River was 4,226 fish.

The Deshka River coho salmon SEG of 10,200–24,100 fish was adopted at the 2017 UCI Alaska Board of Fisheries meeting. In the third year of assessing coho salmon escapement in this drainage as it related to the SEG, a total of 10,445 fish were counted through the weir by September 8.

Finally, there is a coho salmon foot survey SEG of 450–1,400 fish at McRoberts Creek, which drains into Jim Creek in the Knik River drainage. In 2019, the foot survey was conducted on September 26 and produced a count of 162 fish; the SEG was not achieved for this system.

Harvest Summary: The 2019 harvest estimate of approximately 163,859 coho salmon in all commercial fisheries in UCI was 11% less than the previous 10-year (2009–2018) average annual harvest of approximately 185,000 fish. The 2019 drift gillnet harvest of 88,618 coho salmon was 17% less than the previous 10-year average of approximately 107,000 fish. However, the Northern District set gillnet harvest of 52,000 coho salmon was the second largest harvest since 2000 and was approximately 41% greater than the previous 10-year average of 37,000 fish. The increase in Northern District setnet coho salmon harvest may be due to less overall fishing time in the drift fishery, including less time in the expanded Kenai and Kasilof corridors.

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 2019 UCI commercial pink salmon harvest was estimated to be approximately 70,741 fish, which was 16% less than the average annual harvest of nearly 84,573 fish from the previous 10 years of odd-year harvests.

Chum Salmon

Run and Escapement Summary: An aerial survey of Chinitna River/Clearwater Creek was conducted on August 13. This survey produced an estimate of approximately 9,600 chum salmon within these streams, which was approximately 1,600 fish above the SEG of 3,500–8,000 fish. Therefore, Chinitna Bay was opened to set and drift gillnetting on Tuesdays and Fridays beginning on August 16.

Harvest Summary: The 2019 harvest of 129,176 chum salmon was approximately 25% less than the previous 10-year average annual harvest of 172,000 fish.

BRISTOL BAY AREA

The 2019 commercial harvest of 43.0 million sockeye salmon (Table 5) was 65% more than the 26.1 million preseason forecast and is the second largest harvest on record. The preliminary harvests for other species are approximately 33,000 Chinook, 1.4 million chum, 81,000 coho, and 7,000 pink salmon.

Chinook Salmon

Run and Escapement Summary: The 2019 Chinook salmon escapement into the Nushagak River as enumerated at the sonar site was 46,763 fish, which was below the escapement goal range of 55,000–120,000 fish.

Harvest Summary: Except in the Nushagak and Togiak districts, the 2019 Chinook salmon harvests in Bristol Bay were above average. All Chinook salmon were caught during directed sockeye salmon periods in all commercial districts and a total of 33,318 fish were harvested, which was 23% below the 20-year average of 43,397 fish.

Sockeye Salmon

Run and Escapement Summary: The 2019 inshore Bristol Bay sockeye salmon run of 56.5 million fish is the fourth largest and was 45% more than the 39.0 million average run for the latest 20-year (1999–2018) time period. This was the fifth consecutive year that inshore sockeye salmon runs exceeded 50 million fish. The 2019 Bristol Bay sockeye salmon run was 46% more than the preseason inshore forecast of 38.7 million fish. Runs to all districts, except Ugashik, were larger than the preseason forecast.

Naknek-Kvichak, Egegik, and Ugashik districts (east side) observed relatively late run timing this season. Due to the disparity in run timing between the Nushagak and the east side districts, the processing sector was, for the most part, able to keep pace with the run. The Bristol Bay sockeye salmon run was dominated by fish with 1 year of freshwater residence (age-1.2 and age-1.3 fish). Fish with 2 years of freshwater residence (age-2.2 and age-2.3 fish) 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 13.4 million fish.

Harvest Summary: The 2019 harvest of approximately 43.0 million fish was 76% higher than the recent 20-year (1999–2018) average for all districts.

Coho Salmon

*Harvest Summary:*The total coho salmon harvest in 2019 was 80,997 fish, which was below the latest 20-year average of 93,339 fish. The Nushagak District is typically the largest producer of coho salmon but was closed due to poor escapement this season. Coho salmon harvest in the Nushagak District was 33,018 fish, which was below the 20-year (1999–2018) average of 63,771 fish. In 2019, the Togiak District produced its largest coho salmon harvest of 27,778 fish.

Pink Salmon

Harvest Summary: Pink salmon return to Bristol Bay in even years. There were not significant amounts of pink salmon present in Bristol Bay in 2019.

Chum Salmon

Harvest Summary: The 2019 preliminary Bristol Bay chum salmon harvest was approximately 1.4 million fish, which was above the latest 20-year average (1999–2018) of approximately 1.1 million fish. The Nushagak District was the largest producer of chum salmon, where 855,920 fish were harvested.

Table 5.–Preliminary 2019 Central Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing area	Chinook	Sockeye	Coho	Pink	Chum	Total
Purse seine						
Eastern District	0	81	218	20,017	523	20,840
Northern District	0	17	33	8,941	30	9,019
Coghill District	0	2	0	43	11	56
Northwestern District	0	30	4	730	10	773
Southwestern District	0	43	30	10,081	545	10,699
Montague District	0	0	1	297	1	298
Southeastern District	0	6	11	2,816	38	2,871
Unakwik District	0	2	0	2	1	5
Drift gillnet						
Bering River District	0	21	7	0	0	29
Copper River District	19	1,284	78	214	23	1,618
Coghill District	0	389	120	301	1,049	1,860
Eshamy District	0	470	1	265	125	861
Montague District	0	5	0	18	1,572	1,595
Unakwik District	0	8	0	2	1	11
Set gillnet						
Eshamy District	0	226	0	55	39	319
Hatchery[a]	0	9	23	4,936	1,414	6,382
Prince William Sound Total	19	2,591	527	48,719	5,381	57,237
Southern District	1	77	6	29	4	117
Kamishak District	0	59	3	59	32	153
Outer District	0	15	3	1,710	19	1,748
Eastern District	0	4	0	0	0	4
Hatchery[b]	0	156	1	182	0	339
Lower Cook Inlet Total[c]	1	312	13	1,980	55	2,361
Central District	3	1,647	112	64	122	1,948
Northern District	0	73	52	7	7	139
Upper Cook Inlet Total	3	1,720	164	71	129	2,087
Naknek-Kvichak District	3	11,528	1	1	135	11,667
Nushagak District	22	14,762	33	2	856	15,675
Egegik District	3	14,686	18	0	156	14,864
Ugashik District	2	1,038	1	0	20	1,061
Togiak District	4	1,019	28	4	228	1,282
Bristol Bay Total[d]	33	43,033	81	7	1,395	44,549
Central Region Total	56	47,656	785	50,777	6,960	106,235

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.

[d] Includes test fishery harvest.

ARCTIC-YUKON-KUSKOKWIM REGION

Arctic-Yukon-Kuskokwim (AYK) Region 2019 harvests totaled 1,445,000 fish (Table 6). Cumulative all-gear commercial harvest included approximately 4,516 Chinook, 7,043 sockeye, 198,428 coho, 1,147,980 chum, and 87,370 pink salmon.

KUSKOKWIM AREA

The 2019 fishing season was the fourth 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 that were intended to achieve Chinook salmon escapement goals included early season subsistence fishing closures, tributary closures, time and area restrictions, gillnet mesh size and length restrictions, and live-release requirements. The Kuskokwim Salmon Management Working Group voted to support these management actions.

Beginning June 1, 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 (YDNWR). The United States Fish and Wildlife Service (USFWS) managed the subsistence Chinook salmon fishery within the YDNWR through July 1, at which time ADF&G resumed management of the entire Kuskokwim River.

An early season gillnet subsistence fishing closure (i.e., *front-end closure*) was initiated as follows: (1) on May 28 from the YDNWR boundary at the mouth of the Kuskokwim River up to the Tuluksak River; (2) on June 1 from Tuluksak River up to the Yukon Delta Refuge Boundary at Aniak; (3) on June 6 from the Yukon Delta boundary at Aniak up to the Holitna River mouth; and (4) on June 11 upstream of Holitna River mouth. With the closure came additional restrictions including tributary closures and required live release of Chinook salmon. During the front-end closure there were two 12-hour set gillnet opportunities with 4-inch or less mesh to allow subsistence fishers time to harvest nonsalmon species. These openings occurred on June 1 and June 8. During the Special Action, USFWS offered 6-inch setnet opportunities running concurrently to the 4-inch opportunities offered by ADF&G on June 1 and June 8. Additionally, USFWS offered four 12-hour gillnet fishing periods on June 12, 15, 19, and 22 with 6-inch or less mesh.

Beginning June 12, ADF&G opened all waters upriver from the YDNWR boundary at Aniak to subsistence fishing until further notice with 6-inch or less mesh, 25-fathom gillnets. These sections are located within state waters, thus not subject to the Federal Special Action (June 1–July 1).

Inriver abundance of chum and sockeye salmon began to outnumber Chinook salmon abundance in the lower Kuskokwim River on June 23. Inseason assessment projects (Bethel Test Fish and Bethel Sonar) also indicated that the Chinook salmon run was materializing above forecast. On June 26, ADF&G opened all waters from between the YDNWR boundary at the mouth of the Kuskokwim River upstream to the boundary at Aniak to 6-inch or less mesh, 25-fathom gillents above the Johnson River mouth, with 50-fathom gillnets allowed downstream of the Johnson River mouth. When the June 26 emergency order was issued, the entirety of the Kuskokwim River was open to state residents for subsistence fishing.

Chinook Salmon

Run and Escapement Summary: The preliminary Kuskokwim River total run estimate is 233,204 Chinook salmon (95% CI = 191,580–283,872 fish). An estimated 181,641 Chinook salmon (95% CI = 140,017–232,309 fish) escaped Kuskokwim River fisheries, greatly exceeding the drainagewide SEG of 65,000–120,000 fish.

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 2 days early based on BTF.

All Chinook salmon weir escapement goals were met or exceeded within the Kuskokwim River drainage. The established SEG range of 4,800–8,800 fish at Kogrukluk River weir was exceeded (10,301 fish), as was the SEG range of 1,800–3,300 fish at George River (3,828 fish). Preliminary counts at the Kwethluk River weir (6,959 fish) were within the escapement range of 4,100–7,500 fish. Six tributaries have aerial survey SEGs and all 6 tributaries either met or exceeded their respective SEG ranges. For those tributaries without SEGs, Chinook salmon counts were well above their respective 10-year averages.

Within Kuskokwim Bay, the Chinook salmon aerial survey escapement SEG of 3,500–8,000 fish for the Kanektok River was achieved with an estimate of 7,212 fish. The North Fork Goodnews River Chinook salmon aerial SEG of 640–3,300 fish was achieved with a count 2,642 fish. The Middle Fork Goodnews River weir Chinook salmon SEG of 1,500–2,900 fish was exceeded with an estimated 6,039 fish passing the weir.

Harvest Summary: Postseason subsistence harvest surveys are presently being conducted. An assessment of subsistence salmon harvest in 2019 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 fish.

Sockeye Salmon

Run and Escapement Summary: Based on BTF, sockeye salmon run timing was 10 days late in 2019. Overall, sockeye salmon escapement was well above average across the drainage. The Kogrukluk River weir escapement of 32,116 fish exceeded the established SEG range of 4,400–17,000 fish. Personnel at the Telaquana weir observed the highest escapement of sockeye salmon since the project was established in 2010 with a count of 198,485 fish.

Within Kuskokwim Bay, the sockeye salmon aerial survey SEG for the Kanektok River of 14,000–34,000 fish was exceeded with an estimate of 349,073 fish—the highest escapement estimate on record. The sockeye salmon aerial survey SEG for the North Fork Goodnews River of 5,500–19,500 fish was exceeded with an estimate of 162,930 fish. The Middle Fork Goodnews River weir sockeye salmon SEG of 18,400–40,000 fish was exceeded with an estimated 162,711 fish passing the weir.

Coho Salmon

Run and Escapement Summary: The coho salmon run was still progressing after Bethel Sonar ceased operations on July 26 and BTF ceased operations on August 24. Therefore, cumulative CPUE and passage estimates are incomplete. All run strength and escapement indicators point to

a below-average coho salmon run. Coho salmon passage at the Kwethluk River weir was 23,982 fish, which exceeded the established lower bound SEG of greater than 19,000 fish. At the Kogrukluk River weir, 14,861 coho salmon were counted, meeting the SEG of 13,000–28,000 fish.

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. Commercial fishing opportunities were provided in early to mid-August and resulted in well below average harvests. Participants included only 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 confidentiality requirements prohibit release of the harvest information.

Chum Salmon

Run and Escapement Summary: Chum salmon run timing at BTF was 13 days late. Escapement projects showed an above average chum salmon run at the Kogrukluk, George, and Kwethluk river weirs. The escapement count of 71,006 fish at the Kogrukluk River weir exceeded the established SEG range of 15,000–49,000 fish.

YUKON AREA

The 2019 Yukon River total commercial harvest was 227,089 summer chum, 268,360 fall chum, and 58,591 coho salmon for the Alaska portion of the drainage (Table 6).

A total of 225,493 summer chum, 251,833 fall chum, and 56,243 coho salmon were harvested in the lower Yukon River (Districts 1–3); and 1,596 summer chum, 16,527 fall chum, and 2,348 coho salmon were harvested in the upper Yukon River (Districts 4–6).

The Yukon River summer season runs from early May through July 15 in District 1. On July 16, management in District 1 transitions to the fall season and becomes focused on fall chum and coho salmon entering the mouth of the Yukon River. However, summer season management continues beyond this date in upper river districts as Chinook and summer chum salmon migration progresses upstream. The subsequent transition of upriver districts to the fall season is based on the migration timing of fall chum salmon.

Summer Season

The commercial summer chum salmon season was unusually late to begin. Usually harvest begins with selective gear, to avoid retention of Chinook salmon, but the commercial chum salmon season started so late that the fleet was able to begin with 6-inch or smaller mesh gillnets and retention of Chinook salmon for personal use. Catches of Chinook salmon were low, because the bulk of the run had passed the lower river.

Chinook Salmon

Run and Escapement Summary: In 2019, all but 1 Alaskan Chinook salmon escapement goals were met. The upper end of the escapement goal at the East Fork Andreafsky weir was exceeded. The passage at the border was much lower than expected based on inseason abundance estimates of approximately 95,000 Canadian-origin salmon—an above-average abundance for that stock. The cumulative passage estimate at the Eagle sonar was approximately 45,560 Chinook salmon (90% CI = 45,110–46,010 fish). However, this is not considered a true escapement estimate because it does not account for harvest in Eagle or Canada. This passage may meet the lower end

of the interim management escapement goal for Canada of 42,500–55,000 fish (but this will be determined once harvest estimates are available). In the last 2 years under similar run sizes and management actions, Alaskans have harvested an average of 20,000 Canadian-origin salmon. Without harvest data, it is too early to speculate why so few fish made it to the border; however, it seems unlikely—in light of the many restrictions in place inseason—that harvests of the Canadian-origin stock alone could have doubled in Alaska.

Harvest Summary: For the 12th consecutive year, no commercial periods targeting Chinook salmon were allowed in the Yukon Management Area during the summer season. However, sale of incidentally caught Chinook salmon was allowed beginning July 9, because it was determined that with over 200,000 Chinook salmon counted at Pilot Station, escapement goals were likely to be met. Most fishermen in the lower river had met their needs for Chinook salmon, so allowing fishermen the choice of sale or retention of incidentally harvested fish was warranted.

Commercial fishermen were required to report any Chinook salmon caught but not sold on fish tickets, and a total of 1,148 Chinook salmon were retained for subsistence from July 3 to July 8. During the summer chum salmon commercial season in Districts 1 and 2, a preliminary total of 2,582 Chinook salmon were incidentally harvested and sold. In District 6, 31 Chinook salmon were retained for personal use.

Chum Salmon

Run and Escapement Summary: Three escapement goals exist for summer chum salmon: a drainagewide goal of 500,000–1,200,000 fish (established in 2016), and goals at the East Fork Andreafsky and the Anvik rivers. The drainagewide escapement goal and the East Fork Andreafsky River goals were exceeded; however, the Anvik River goal was not met. Although they don't have summer chum salmon escapement goals, passage estimates at the Gisasa and Henshaw creek weirs in the Koyukuk River drainage were well below average. Temperatures in the lower Yukon and Koyukuk rivers were warmer than previously recorded for an extended period in 2019. Thus, en route mortality related to heat stress may have contributed to the exceptionally low passage in the Koyukuk River. Passage estimates at the Chena and Salcha river towers were below average, but these were incomplete because the summer chum salmon run was the latest on record and the projects stopped operating before most of the summer chum salmon run was expected to arrive at the projects.

Harvest Summary: The cumulative summer chum salmon commercial harvest for Districts 1 and 2 combined was 225,493 fish. The summer chum salmon harvest was 47% less than the recent 5-year (2014–2018) average harvest of 428,554 fish and was the second-lowest harvest since 2009. Although genetic information indicates that many of the chum salmon harvested during the first fall season commercial openings were summer chum salmon, the standard reporting practice is to call all chum salmon *fall chum salmon* beginning July 16 in District 1 and July 18 in District 2. Therefore, the harvests of summer chum salmon are considered conservative estimates for 2019. The District 6 preliminary cumulative harvest was 1,596 summer chum salmon. The 2019 District 6 commercial harvest was 66% less than the recent 5-year (2014–2018) average of 4,686 summer chum salmon.

The total 2019 summer chum salmon commercial harvest for the Yukon Area was 227,089 fish, which was 55% less than the recent 5-year (2014–2018) average harvest of 509,705 fish.

Fall Season

There was a total of 40 commercial fishing periods in 2019. The majority of fall season commercial harvest occurred in the lower river districts. Commercial fishing periods were established in Subdistricts 5-B, 5-C, and in District 6, but limited markets resulted in low fishing effort and relatively small harvests. The total commercial harvest for the Yukon River in the Alaska portion of the drainage was 268,360 fall chum salmon and 58,591 coho salmon.

A total of 411 individual permit holders participated in the fall chum and coho salmon fishery: 404 in Districts 1 and 2 combined and 7 in Districts 4–6. Participation was well below the recent 5-year average (2014–2018) of 453 permits in the Yukon Area.

Chinook Salmon

Harvest Summary: During the fall season, an additional 528 Chinook salmon were sold for a Yukon area total of 3,110 fish.

Coho Salmon

Run and Escapement Summary: There are few coho salmon spawning escapement assessment projects in the Yukon River drainage because of funding limitations and late timing relative to onset of winter. The sonar in the mainstem Yukon River near Pilot Station was operated through August 31 and had an estimated passage of 86,214 coho salmon (SEG = 5,863 fish), which is well below the historical average of 155,000 fish. The Delta Clearwater River has the only established escapement goal for coho salmon, a SEG of 5,200–17,000 fish. A boat survey conducted on the Delta Clearwater River in early November counted an estimated 2,043 coho salmon, which was below the escapement goal. Escapement count estimates for coho salmon were conducted by aerial surveys in the Nenana River drainage where 3 spawning areas are monitored; all escapements were below their 1974–2018 averages.

Harvest Summary: The 2019 coho salmon harvest was also below the most recent 5-year (2014–2018) average of 137,076 fish (average weight approximately 6.0 lb).

Fall Chum Salmon

Run and Escapement Summary: The total run size of fall chum salmon is estimated postseason, based on information from individually monitored spawning escapements, and includes estimated U.S. and Canadian harvests. Escapements were monitored using sonars in the Teedriinjik (Chandalar) River, upper Porcupine River in Canada, and Canadian mainstem Yukon River (near Eagle). In 2019, the preliminary estimate of the drainagewide total run size was 800,000 fall chum salmon. The escapement after harvest is removed is expected to be within the SEG range of 300,000–600,000 fish. The final run reconstruction estimate will be determined using the Bayesian statistical methods once the subsistence harvest estimates are completed.

In the Teedriinjik (Chandalar) River, the estimated escapement of 116,000 fall chum salmon (including expansions to estimate the run after the sonar project ended) was within the SEG range of 85,000–234,000 fish. An estimated run size of 91,000 fall chum salmon in the Sheenjek River was derived from using the relationship between the Sheenjek River sonar counts and the Fishing Branch River weir. An estimate of 27,800 fall chum salmon passed the Porcupine River border sonar downstream of Old Crow (border passage is determined after removal of harvests). The Fishing Branch River weir estimate was approximately 18,000 fall chum salmon which was slightly below the lower end of the interim management escapement goal of 22,000–49,000 fish.

The fall chum salmon passage estimate at the mainstem Yukon River sonar project near Eagle was 101,678 fish (90% CI: 100,778–102,578 fish) for the dates August 15 through October 6. Because of continued high passage at the termination of the project, the fall chum salmon estimate was subsequently adjusted to 113,266 fish. The preliminary escapement for the mainstem Yukon River in Canada is derived by subtracting the upstream U.S. and Canadian harvests from the expanded sonar estimate. The preliminary mainstem Yukon River escapement estimate of 97,000 fall chum salmon is within the interim management escapement goal range of 70,000–104,000 fish.

The Tanana River preliminary escapement estimate was 190,000 fall chum salmon. Assessment of Tanana River drainage stocks was based on mixed stock analysis instead of its relationship to Canadian stocks, as there was some indication that production on the Tanana River may have been higher relative to the upper Yukon. Some confirmation of the high production in the Tanana River drainage came from the Delta River: escapement of fall chum salmon broke the record set in 2017. The estimated escapement in the Delta River of 51,748 fall chum salmon was well above the SEG of 7,000–20,000 fish. Environmental factors like the relatively warm October and November may have contributed to the way fish moved into the Delta River from the mainstem Tanana River.

Stock composition estimates were provided by USFWS Conservation Genetics Laboratory using tissue samples (fin clips) collected from chum salmon captured in the mainstem Yukon River sonar test net fishery. Chum salmon genetic samples processed from 4 strata between July 19 and August 31 (fall season) indicated that stocks represented approximately 35% summer, 20% Border U.S. (Teedriinjik/Sheenjek), 21% Canadian, and 24% Tanana.

Harvest Summary: The 2019 fall chum salmon commercial harvest was below the most recent 5-year (2014–2018) average of 329,990 fish (average weight in Districts 1 and 2 was approximately 7.0 lb).

NORTON SOUND AREA

Runs of chum, pink, sockeye, and coho salmon in the Norton Sound area in 2019 were above average. Escapement goal ranges were reached or exceeded for all salmon species, except for Chinook salmon. There are 2 Chinook salmon escapement goals in Norton Sound, 1 was achieved, and 1 was not. Commercial permit holder participation was the second highest in over 25 years with 145 permit holders fishing. Total commercial salmon harvests in 2019 were 1,390 Chinook, 7,013 sockeye, 139,837 coho, 76,408 pink, and 157,938 chum salmon.

Chinook Salmon

Harvest Summary: Commercial fishing targeting Chinook salmon was prohibited during the 2019 season. However, the run was much better than expected and the incidental harvest of 1,390 fish was the highest in 20 years.

Sockeye Salmon

Harvest Summary: Although sockeye salmon harvest accounts for a small portion of the overall harvest in Norton Sound, 2019 represents the largest harvest on record (7,013 fish).

Coho Salmon

Harvest Summary: The 2019 coho salmon harvest (139,837 fish) was well under the forecast of 190,000–240,000 fish; however, the total commercial harvest was the fourth highest on record. The

average weight of coho salmon (6.4 lb) was the lowest on record and well below the 2018 average weight of 7.1 lb.

Pink Salmon

Harvest Summary: The pink salmon run was stronger than expected in 2019, but with little buyer interest there were no directed commercial fishing periods. However, pink salmon were incidentally harvested during directed chum and coho salmon fishing periods. The total pink salmon harvest of 76,408 fish was just above the forecast range of 25,000–75,000 fish.

Chum Salmon

Harvest Summary: The 2019 forecasted commercial chum salmon harvest range was 170,000–220,000 fish, and 157,838 fish were harvested. Fishing time was limited in southern Norton Sound early in the season to protect Chinook salmon. In second half of July, weather affected fishing effort and the chum salmon harvest was under the forecast.

KOTZEBUE SOUND AREA

There were 92 permit holders that sold fish in 2019, which is lower than in 2018 (95 permit holders). The highest fishing effort occurred on July 29 when 61 permit holders fished.

Chinook Salmon

Harvest Summary: Buyers in the Kotzebue Sound area purchased 16 Chinook salmon in 2019. Permit holders retained 141 Chinook salmon for personal use.

Sockeye Salmon

Harvest Summary: Buyers in the Kotzebue Sound area purchased 29 sockeye salmon in 2019. Permit holders retained 447 sockeye salmon for personal use.

Coho Salmon

Harvest Summary: Permit holders retained 118 coho salmon for personal use in 2019.

Pink Salmon

Harvest Summary: Permit holders retained 2,743 pink salmon for personal use in 2019.

Chum Salmon

Run and Escapement Summary: No aerial surveys were flown in 2019, but the Kobuk River test fish chum salmon catch index ranked eleventh highest out of 27 years.

Harvest Summary: The Kotzebue Sound chum salmon harvest of 494,953 fish in 2019 was the seventh highest on record. The harvest was within the forecast of 450,000–650,000 fish. The 2019 harvest was the fourth time in the last 5 years the harvest exceeded 400,000 fish, but was only the tenth time in history that a harvest exceeded that number. Commercial fishing time was increased when a floating processor arrived in late July because the fishery was no longer restricted by airplane cargo capacity. Permit holders also retained 29 chum salmon for personal use.

Table 6.–Preliminary 2019 Arctic-Yukon-Kuskokwim Region commercial salmon harvests, by fishing area and species, in thousands of fish.

Fishing area	Species					
	Chinook	Sockeye	Coho	Pink	Chum	Total[a]
Kuskokwim River	Confidential					
Kuskokwim Bay	Confidential					
Kuskokwim Area Total	Confidential					
Lower Yukon River	3	0	56	11	477	548
Upper Yukon River	0	0	2	0	18	20
Yukon River Total	3	0	59	11	495	568
Norton Sound	1	7	140	76	158	383
Kotzebue Sound	0	0	0	0	495	495
AYK Region Total	5	7	198	87	1,148	1,445

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

[a] Confidential information not included.

WESTWARD REGION

KODIAK AREA

Commercial fishing effort in the 2019 Kodiak salmon fishery was above average. The combined purse seine and beach seine participation of 179 permits fished was above the previous 10-year average of 169 permits fished. The set gillnet participation of 148 permits fished was equal to the previous 10-year average of 148 permits fished.

The 2019 commercial harvest (not including personal use or ADF&G test fishery) in the Kodiak Management Area (KMA) was approximately 7,000 Chinook, 2.2 million sockeye, 394,000 coho, just under 33.0 million pink, and 552,000 chum salmon (Table 7). The total KMA harvest (including aquaculture association cost recovery) of 36.1 million fish was above the 2019 forecast of 30.6 million fish, as well as the previous 10-year average of approximately 21.2 million fish.

Chinook Salmon

Run and Escapement Summary: The total 2019 Kodiak area Chinook salmon escapement of 5,863 fish was below the previous 10-year average of 6,012 fish. Escapement goals for Chinook salmon have been developed for the Karluk and Ayakulik rivers, and escapements are estimated using fish-counting weirs.

The 2019 Chinook salmon escapement through the Karluk River weir of 3,898 fish was within the BEG range of 3,000–6,000 fish. The Chinook salmon escapement through the Ayakulik River weir of 1,948 fish was below the BEG range of 4,800–8,400 fish.

Harvest Summary: There are no directed Chinook salmon commercial fisheries in the KMA, but incidental commercial harvest occurs during fisheries targeting local sockeye, pink, chum, and coho salmon. The 2019 commercial harvest of Chinook salmon in the KMA totaled approximately 7,400 fish, which was below the previous 10-year average of 12,400 fish and below the 2019 forecast of 8,000 fish.

Sockeye Salmon

Run and Escapement Summary: Sockeye salmon runs in many systems in the KMA were moderate to average. The established escapement goals were met in all major sockeye salmon systems in the KMA; escapement objectives were not met in 1 small system (Malina Lake). The entire KMA

estimated sockeye salmon escapement of approximately 1,287,032 fish was below the previous 10-year average of 1,332,458 fish.

Harvest Summary: The 2019 commercial harvest of sockeye salmon was approximately 2.2 million fish. The harvest was below both the recent 10-year average of approximately 2.3 million fish and the preseason forecast of just over 2.3 million fish.

Early season sockeye salmon management for much of the Westside of Kodiak Island is driven by Karluk early-run sockeye salmon and the Kodiak area pink salmon fishery. A total of 281,888 sockeye salmon were harvested in early-season Westside areas opened based on Karluk early-run sockeye salmon and local pink and chum salmon. The Karluk early-run sockeye salmon harvest was above the projected harvest of 73,000 fish.

Late-season management for much of the Westside of Kodiak is driven by the Kodiak area pink salmon fishery and Karluk late-run sockeye salmon. A total of 780,196 sockeye salmon were commercially harvested in Westside areas opened based on local pink and chum salmon and Karluk late-run sockeye salmon. The Karluk late-run sockeye salmon harvest was above the projected harvest of 725,000 fish.

The Ayakulik sockeye salmon run was moderate, allowing for periodic commercial salmon fishing periods during early-run sockeye salmon management. The Ayakulik early-run sockeye salmon harvest of 74,928 fish was slightly above the projected harvest of 60,600 fish. The strength of the Ayakulik late-run sockeye salmon was moderate to strong. The Ayakulik late-run sockeye salmon harvest of 291,230 fish was well above the projected harvest of 40,400 fish.

The Frazer Lake sockeye salmon run was moderate; however, Upper Station early-run sockeye salmon escapement was weak. To better control Frazer Lake sockeye salmon escapement and at the same time allow for more Upper Station early-run sockeye salmon escapement, extended commercial fishing time was allowed in the terminal gillnet only Dog Salmon Flats section. The Alitak District early-run sockeye salmon harvest of 226,165 fish was above the projected harvest of 175,400 fish.

The Upper Station late-run sockeye salmon run came in weaker than expected and the fishing time was restricted for most of August. The total harvest of the Alitak District late-run sockeye salmon of 103,952 fish was below the forecasted harvest of 150,500 fish.

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 weak and the allocative and biological criteria to allow fishing in the Cape Igvak Section were never met. No sockeye salmon were harvested in the Cape Igvak Section through July 25. The preseason forecast was approximately 118,000 fish (Table 7).

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 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 20, when it was estimated that the cumulative sockeye salmon harvest had approached the 15,000 fish limit. The total July 6 to July 25 harvest in the North Shelikof Unit was 55,926 sockeye salmon; this included both the Shoreward and Seaward Zone harvests. A Seaward Zone closure did not take place in the Southwest Afognak Section; however, the harvest cap of 50,000 was exceeded on the last day of the fishery on July 25. A total of 51,743 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 SHA with only 1,091 fish harvested.

In the Spiridon Bay SHA (Telrod Cove) and the Spiridon Bay Section, 41,010 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 45,658 Spiridon enhancement fish were harvested outside of Telrod Cove and the Spiridon Bay Section, bringing the total Spiridon enhancement sockeye salmon harvest to 86,668 fish—well below the forecast of 206,000 fish.

The Kitoi Bay Hatchery harvest was 12,306 sockeye salmon, which was below the forecast of 26,000 fish. This includes the commercial harvest of both enhanced and wild sockeye 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 are in the Northeast Kodiak and Eastside Kodiak districts for the following systems: American (400 fish), Olds (1,000 fish), Buskin (4,700–9,600 fish), and Pasagshak (1,200 fish) rivers, all of which achieved their respective goals in 2019.

Coho salmon enter systems in the fall after most of the weirs have been removed. ADF&G conducted foot surveys on streams near the city of Kodiak and on Afognak and Shuyak islands, and determined coho salmon escapement was 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 394,000 fish was above both the forecast (318,000 fish) and the previous 10-year average of 310,014 fish. 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 approximately 5.6 million fish was above the previous 10-year average of approximately 4.5 million fish. Pink salmon escapement goals have been established as aggregate goals for the entire Kodiak Archipelago and the Mainland District. The 2019 escapement for the Kodiak Archipelago (under 4.7 million fish) was near the upper end of the escapement goal range of 2.0–5.0 million fish; however, due to budget restrictions ADF&G did not conduct peak surveys for much of Kodiak Area. The Mainland

District pink salmon escapement of 904,400 fish was above average but within the established escapement goal range (250,000–1,000,000 fish). However, due to budget restrictions peak aerial surveys were not conducted on approximately half the Mainland District.

Harvest Summary: The 2019 pink salmon harvest of just under 33.0 million fish was above the forecast of 27.0 million fish, and above the previous 10-year average harvest of 17.8 million fish.

Pink salmon harvest in wild stock areas totaled approximately 28.1 million fish, well above the forecast of 20.4 million fish. Most of the pink salmon were harvested in the Westside and Eastside Kodiak Districts.

The Kitoi Bay Hatchery pink salmon run was weaker than expected with approximately 4.9 million pink salmon harvested in sections near the hatchery (6.6 million fish 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 2019.

Chum Salmon

Run and Escapement Summary: The overall KMA chum salmon escapement of 413,473 fish was above the previous 10-year average of 375,444 fish. A peak indexed escapement goal based on 17 streams in the Kodiak Archipelago has been established. The 2019 peak indexed escapement of 96,700 fish was below the goal of 101,000 fish. Chum salmon runs on the Westside of Kodiak and Mainland districts were strong. However, chum salmon runs to the Alitak, Eastside, and Northeast districts were well below average.

Harvest Summary: Most of the KMA wild chum salmon are harvested during the directed pink and chum salmon fisheries in July. The 2019 KMA chum salmon harvest of approximately 552,000 fish was well below the 2019 forecast of 935,000 fish. Although chum salmon harvest was above average on both the Mainland District and Westside of Kodiak, restrictions to the commercial fisheries were needed in the Alitak, Eastside, and the Northeast Kodiak districts to allow for additional chum salmon escapement. The Kitoi Bay Hatchery chum salmon harvest of only 17,329 fish was below the forecast of 261,000 fish.

CHIGNIK AREA

The commercial fishing effort in 2019 was below average compared to recent years. Participation rates for purse seine were below the previous 10-year averages.

The 2019 commercial harvest in the Chignik Management Area (CMA) was approximately 4,286 Chinook, 638,772 sockeye, 248,281 coho, 2.5 million pink, and 157,517 chum salmon (Table 7).

Chinook Salmon

Run and Escapement Summary: The Chignik River is the only major Chinook salmon-producing stream within the CMA and is 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 fish. Chinook salmon escapement in 2019 (1,517 fish) was within the BEG range of 1,300–2,700 fish and below all recent averages. The overall Chinook salmon run for Chignik was weak in 2019. Even though escapement fell within the BEG range, no commercial fishing occurred before July 16

and typical harvest of Chinook salmon in the Central and Chignik Bay districts did not occur, likely increasing escapement of Chinook salmon during this time period.

Harvest Summary: A total of 4,286 Chinook salmon were harvested from the CMA in 2019, similar to the 5-year average, but below the recent 10- and 20-year average harvests. A total of 26 Chinook salmon were retained as homepack from the commercial fishery.

Sockeye Salmon

Run and Escapement Summary: The Chignik River watershed supports 2 genetically distinct sockeye salmon runs that traditionally provide most directed harvest opportunities within the CMA. The 2019 overall sockeye salmon run of approximately 1.3 million fish (escapement and harvest) was well below all recent year's harvest in the CMA.

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.

The Chignik River sockeye salmon early run peaked in late June and the late run peaked in mid-July. The 2019 estimated total Chignik River watershed sockeye salmon escapement (681,995 fish) was below all recent averages. The early-run escapement was estimated at 345,918 fish and was slightly below the early-run BEG of 350,000–450,000 fish. The late-run estimated escapement of 336,077 fish was within the late-run SEG range of 220,000–400,000 fish. The late-run escapement includes a postweir estimate for August 19 to September 30.

The late-run Chignik River sockeye salmon inriver run goal (IRRG) requires 10,000 fish to escape past the Chignik River weir in August in addition to the minimum escapement needs for the month (approximately 50,000 fish). This requires that a minimum of 60,000 sockeye salmon escape past the weir in August. The IRRG also requires that 10,000 sockeye salmon escape during September. In 2019, the August component of the IRRG was met with approximately 91,218 sockeye salmon. August escapement included a postweir estimate of 5,512 fish between August 19 and August 31. The 2019 September IRRG component was also met with an estimated 42,280 sockeye salmon escaping into the Chignik River. The entire September escapement was a postweir estimate that was produced due to the early removal of the Chignik weir (August 18).

Harvest Summary: 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 and harvest information. From late June through July, the CMA is managed largely to achieve adequate escapement of the Chignik River early- and late-run sockeye salmon and local pink and chum salmon stocks. Beginning in early July, opportunity to target early-run 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.

The 2019 CMA sockeye salmon harvest of 638,772 fish was well below the recent 5-, 10-, and 20-year average sockeye salmon harvests. Most sockeye salmon harvest came from the Chignik Bay and Western districts. Sockeye salmon harvest occurred from mid-July through early August.

Neither the Cape Igvak Section of Area K (Kodiak) nor the Southeastern District Mainland (SEDM) section of Area M (Alaska Peninsula) fished for salmon during the allocation period in 2019 (June 1 through July 25). As a result, all sockeye salmon harvested that were considered Chignik-bound came from the CMA.

The 2019 Chignik River early-run sockeye salmon run did not develop as forecasted and no directed sockeye salmon commercial fishing periods were scheduled from early June through mid-July. Approximately 14,996 early-run sockeye salmon were harvested in 2019; however, these fish were a result of commercial openings directed at late-run sockeye salmon. The late-run harvest of 623,788 sockeye salmon was slightly below the 10- and 20-year averages, but above the 5-year average. The total Chignik-bound commercial sockeye salmon harvest was 638,772 fish. This makes the total run estimate (harvest plus escapement) of Chignik-bound sockeye salmon 1.3 million fish.

In 2019, the Chignik early run was approximately 470,000 sockeye salmon below the forecast, and the late run was approximately 60,000 fish above the forecast.

Coho Salmon

Run and Escapement Summary: Coho salmon enter CMA drainages in mid-August and generally continue through November. The 2019 Chignik River coho salmon escapement estimate through August 18 was 282 fish. Due to the early removal of the Chignik weir, a majority of the coho salmon run was not counted in 2019. Late season coho salmon stream surveys were not conducted in the CMA in 2019 due to inclement weather in September.

Due to late season run timing and limited directed effort, escapement goals for coho salmon have not been established in the CMA.

Harvest Summary: A total of 248,281 coho salmon were harvested in the CMA during 2019, which was well above all recent average harvests.

Pink Salmon

Run and Escapement Summary: Pink salmon began entering the Chignik River in late June and peaked in mid-August with a total escapement of 18,073 fish. The 2019 Chignik River pink salmon escapement was above the 10- and 20-year averages but below the 5-year average.

Escapements into other CMA streams were monitored via aerial surveys. During the season, streams that have been historically monitored for pink salmon were surveyed and compared to historical run timing and distribution. The 2019 overall combined peak escapement estimate for the CMA was approximately 842,748 fish. Pink salmon escapement was strong in the CMA but below odd-year historical averages. The current odd-year SEG of 260,000–450,000 fish is composed of 8 index streams in 4 of the 5 districts in the CMA. The 2019 calculated peak escapement, based on aerial surveys of index streams, was within the odd-year SEG with 415,300 fish.

Harvest Summary: The 2019 CMA pink salmon harvest (approximately 2.5 million fish) was similar to the 10-year odd average of approximately 2.4 million fish, and all commercially harvested pink salmon were sold to processors by fishermen. The 2019 CMA pink salmon harvest was the third largest on record, the next largest harvests occurred in 1988 and 2017.

Chum Salmon

Run and Escapement Summary: A limited number of chum salmon return to the Chignik River, mainly in late-July and August. The 2019 Chignik River chum salmon escapement was 67 fish, which was below all recent average escapements.

Escapements into other CMA streams were monitored via aerial surveys. In season, streams that have been historically monitored for chum salmon were surveyed and compared to historical run timing and distribution. The 2019 overall combined peak escapement estimate for the CMA was 282,967 fish, which was above all recent averages. The current SEG of 45,000–110,000 fish is based on 6 index streams located in 4 of the 5 CMA districts. The peak aerial surveys from the index streams were summed and compared to the areawide aggregate SEG for chum salmon. The 2019 CMA chum salmon escapement estimate of 98,000 fish based on the index streams was within the SEG and slightly above the 10-year average.

Harvest Summary: A total of 157,517 chum salmon were harvested from the CMA during the 2019 season, which was similar to the 20-year average, but below the 5- and 10-year averages. Chum salmon harvest in the CMA occurred from early July through August.

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

The 2019 commercial salmon harvest in the Alaska Peninsula, Aleutian Islands, and Atka-Amlia Islands Management areas totaled approximately 27,000 Chinook, 4.0 million sockeye, 564,000 coho, 21.1 million pink, and 1.4 million chum salmon.

Chinook Salmon

Run and Escapement Summary: Nelson River is the only river in Area M (South Alaska Peninsula and Aleutian Islands) with a Chinook salmon escapement goal. At the Nelson River weir, a total of 12,163 Chinook salmon escaped, exceeding the escapement goal of 2,400–5,000 fish. The total Northern District Chinook salmon escapement of 21,327 fish was above the most recent 10-year average of 10,650 fish.

Harvest Summary: On the North Alaska Peninsula, 3,986 Chinook salmon were harvested, which was above the previous 10-year average (2009–2018) of 2,021 fish. The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 10,049 Chinook salmon. The total commercial harvest for the South Peninsula post-June fishery (including the SEDM from July 26 to October 31) was 12,506 Chinook salmon.

Sockeye Salmon

Run and Escapement Summary: The Orzinski Lake sockeye salmon record low escapement of 4,367 fish was well below the SEG of 15,000–20,000 fish.

The South Peninsula sockeye salmon escapement of 31,667 fish was below the management objective range of 48,200–86,400 fish. Escapement into Mortensens Lagoon (800 fish) was well below the SEG range of 3,200–6,400 fish. Escapement into Thin Point Lagoon (9,600 fish) was below the SEG range of 14,000–28,000 fish.

The 2019 sockeye salmon escapement in the Northwestern District was within the escapement objective range of 52,600–106,000 fish, with a total escapement of 94,600 fish.

The 2019 North Creek salmon escapement of 11,000 sockeye salmon met the escapement goal of 7,500–10,000 fish.

The Nelson Lagoon Section was opened for all weekly fishing periods along with many extensions in fishing time in 2019. The Nelson (Sapsuk) River total run of 198,879 sockeye salmon (includes harvest and escapement) was below the estimated forecast of 370,000 fish. From the total run, 83,879 fish were harvested in Nelson Lagoon and 115,000 fish escaped in the Nelson River. The 2019 escapement met the BEG of 97,000–219,000 fish.

The Bear River early-run (through July 31) sockeye salmon escapement of 294,727 fish exceeded the escapement goal of 176,000–293,000 fish. The Bear River late-run (after July 31) sockeye salmon escapement of 205,273 fish exceeded the escapement goal of 117,000–195,000 fish. The Bear River season sockeye salmon escapement was 500,000 fish, surpassing the combined early- and late-run sockeye salmon escapement goal of 293,000–488,000 fish.

The 2019 Sandy River sockeye salmon escapement of 71,000 fish met the season ending escapement goal range of 34,000–74,000 fish.

In 2019 the Ilnik River system sockeye salmon escapement through the weir was 75,000 fish, exceeding the Ilnik River escapement goal of 40,000–60,000 fish.

Aerial escapement surveys of the Meshik River began on June 19. Subsequent surveys occurred throughout the season and the final sockeye salmon escapement into the Meshik River system was 107,200 fish, exceeding the escapement goal of 48,000–86,000 fish. 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 95,775 fish exceeded the escapement goal of 36,000–94,000 fish.

Harvest Summary: The South Unimak and Shumagin Islands commercial sockeye salmon harvest for the June fishery was 630,888 fish. There were no commercial openings in the SEDM between June 1 and July 25. Between July 26 and October 31, 67,562 sockeye salmon were harvested in the SEDM. The total commercial harvest for the South Peninsula post-June fishery (including the SEDM from July 26–October 31) was 993,588 sockeye salmon.

On the North Peninsula a total of 2.4 million sockeye salmon were harvested, which was above the 10-year average of 2.1 million fish. Out of that harvest, a total of 5,644 fish were harvested in the Northwestern District; 83,879 fish were harvested in the Nelson Lagoon Section; 159,481 fish were harvested in the Bear River Section; 93,776 fish were harvested in the Three Hills Section; 1.5 million fish were harvested in the Ilnik Section (well above historical averages); and 527,343 fish in the Outer Port Heiden Section.

Coho Salmon

Run and Escapement Summary: There were no coho salmon surveys flown on the South Peninsula streams in 2019. 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.

Coho salmon surveys were done on most Northern District streams in early September before the peak of the 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 2019 was 168,800 fish. Both the Nelson and Ilnik rivers have coho salmon lower bound escapement goals in the Northern District. The Nelson River escapement of 23,000 coho salmon exceeded the lower bound escapement goal of 18,000 fish. A total of 27,000 coho salmon were observed during early September in the Ilnik River in 2019, which exceeded the lower bound escapement goal of 9,000 fish. More coho salmon are expected to enter the Ilnik and Nelson river systems during September and October. Coho salmon escapement into the Cinder River was 42,000 fish, and aerial surveys observed 52,000 fish escaping into the Meshik River system.

Harvest Summary: The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 3,681 coho salmon. The total commercial harvest for the South Peninsula post-June fishery (including the SEDM from July 26–October 31) was 517,067 fish. During the 2019 commercial coho salmon fishery, 4,739 fish were harvested in the Northwestern District; 13,653 fish were harvested in the Nelson Lagoon Section (well below the recent 10-year average of 31,000 fish); and 13,581 fish were harvested in the Ilnik Section.

Pink Salmon

Run and Escapement Summary: The South Peninsula pink salmon total indexed escapement of 4,236,700 fish was above the SEG range of 1.75–4.0 million salmon.

There are no escapement goals for pink salmon on the North Peninsula. In some years, depending on market conditions, a directed pink salmon fishery may occur; however, this did not happen in 2019. A total of 83,078 pink salmon were observed in the Northern District during 2019, and 197,500 pink salmon were observed in the Northwestern District.

Harvest Summary: The South Unimak and Shumagin Islands commercial harvest for the June fishery consisted of approximately 9.0 million pink salmon. The total commercial harvest for the South Peninsula post-June fishery (including the July 26 to October 31 SEDM fishery) was 11.5 million fish. During 2019 in the Northwestern District commercial pink salmon fishery, the harvest was 460,356 fish.

Chum Salmon

Run and Escapement Summary: The South Peninsula Chum salmon indexed total escapement of 672,475 fish was above the cumulative district escapement goal range of 330,400–660,800 fish.

In the Northwestern District, the chum salmon escapement of 173,600 fish was within the SEG of 100,000–215,000 fish.

The Northern District has a districtwide chum salmon escapement goal of 119,600–239,200 fish. This goal was met with an escapement of 208,397 fish. Most of the chum salmon escapement occurred in the Herendeen–Moller Bay Section (95,050 fish) and the Black Hills Section (61,000 fish).

Harvest Summary: The South Unimak and Shumagin Islands commercial salmon harvest for the June fishery consisted of 549,072 chum salmon. The total commercial harvest for the South Peninsula post-June fishery (including the SEDM from July 26 to October 31) was 617,470 fish.

During 2019 commercial chum salmon fishery, a total of 185,873 fish were harvested in the Northwestern District, and 48,347 fish were harvested in the Northern District.

Table 7.–Preliminary 2019 Westward Region commercial salmon harvests, by fishing area and species, in thousands of fish.

	Species					
Fishing area	Chinook	Sockeye	Coho	Pink	Chum	Total
Kodiak	7	2,177	394	32,963	552	36,093
Chignik	4	639	248	2,453	158	3,502
South Peninsula and Aleutians Islands[a]	23	1,637	526	21,021	1,353	24,559
North Peninsula [a]	4	2,408	38	118	48	2,616
Alaska Peninsula Total	27	4,045	564	21,138	1,402	27,175
Westward Region Total	38	6,860	1,206	56,554	2,112	66,770

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

[a] Catches include test fishery catch.

SALMON SPECIES CATCH AND PROJECTIONS

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

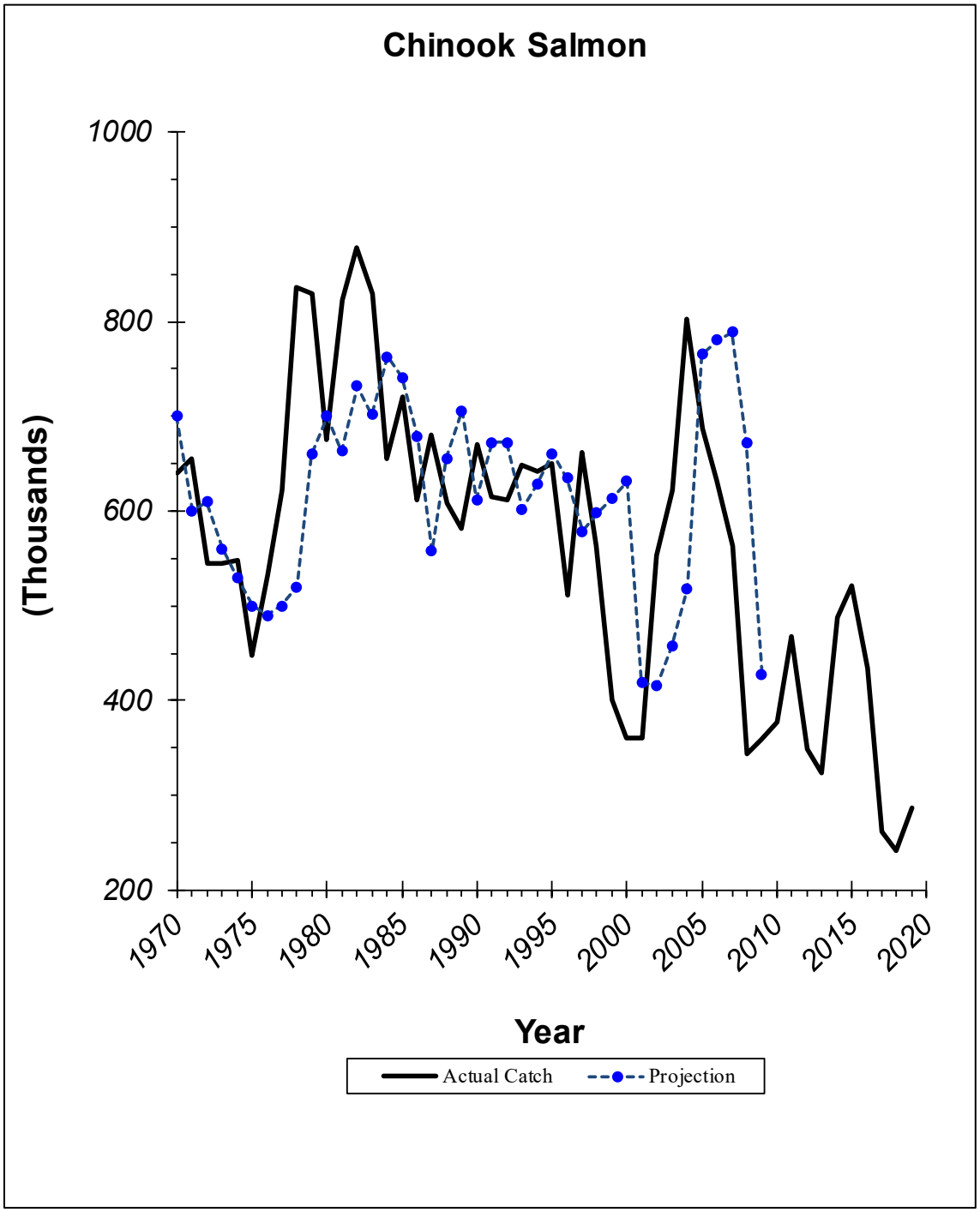

Figure 2.–Relationship between actual catch and projected catch in thousands, for Alaska Chinook salmon fisheries from 1970 to 2019; 2010–2020 projections are not available.

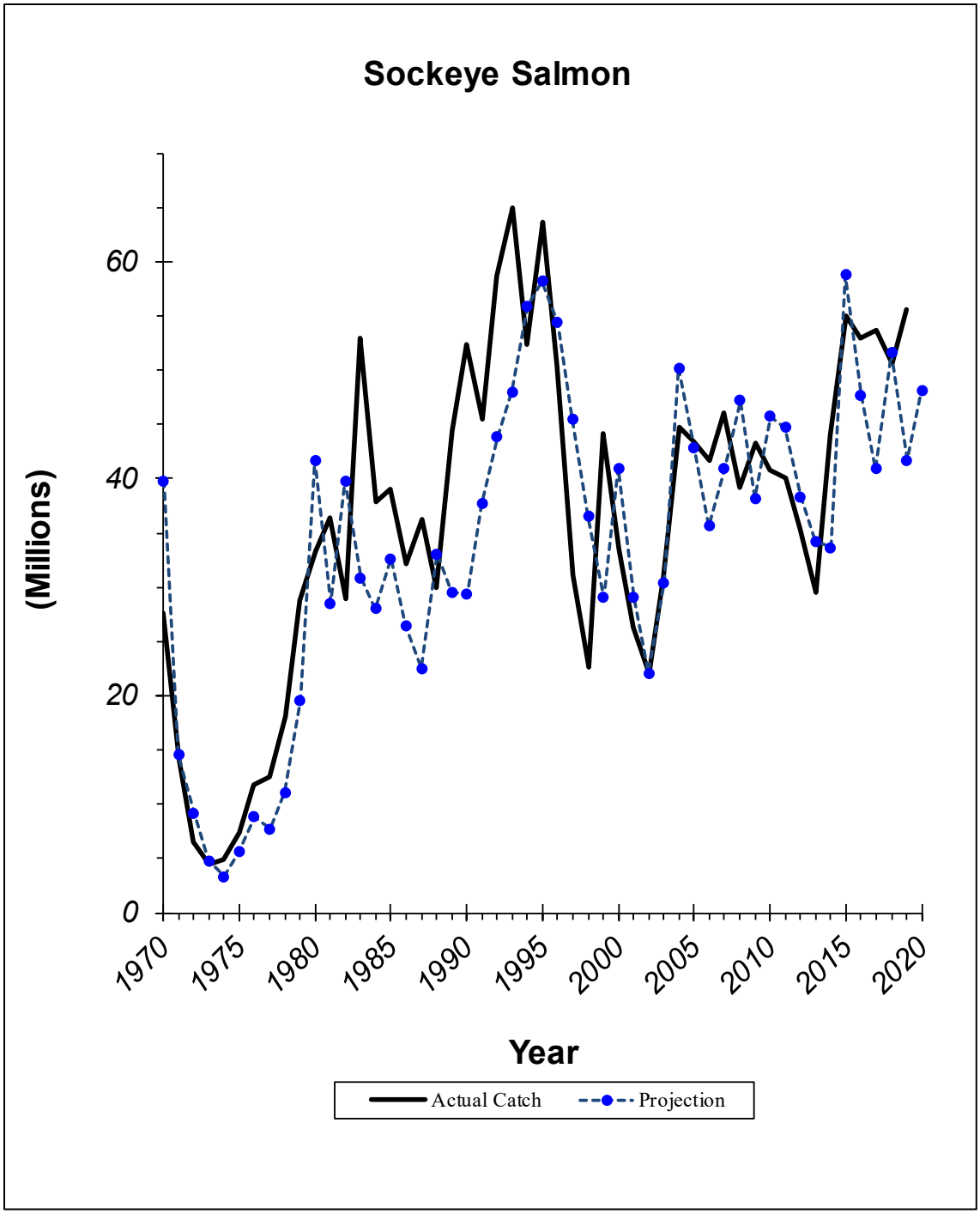

Figure 3.–Relationship between actual catch and projected catch in millions, for Alaska sockeye salmon fisheries from 1970 to 2019, with the 2020 projection.

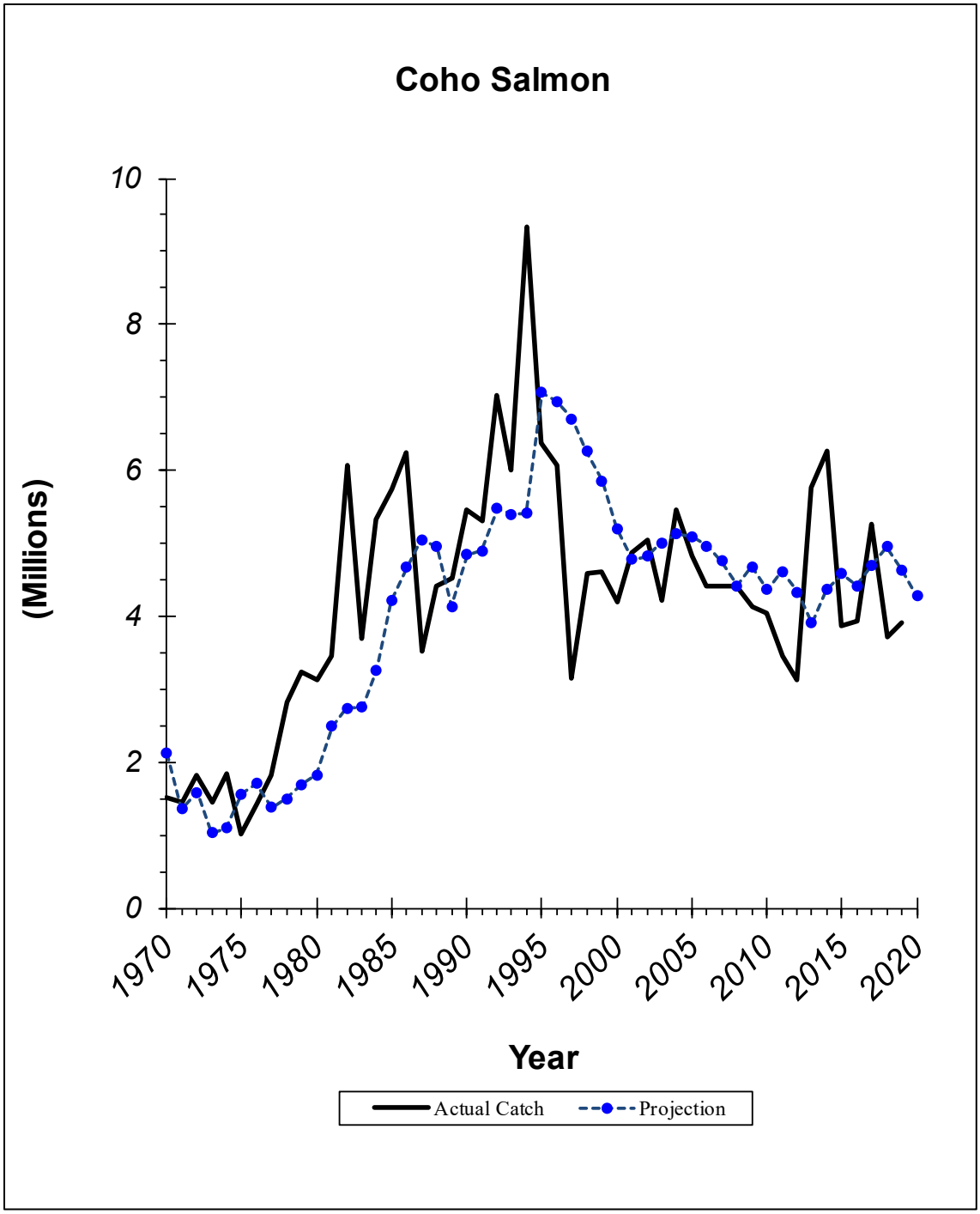

Figure 4.–Relationship between actual catch and projected catch in millions, for Alaska coho salmon fisheries from 1970 to 2019, with the 2020 projection.

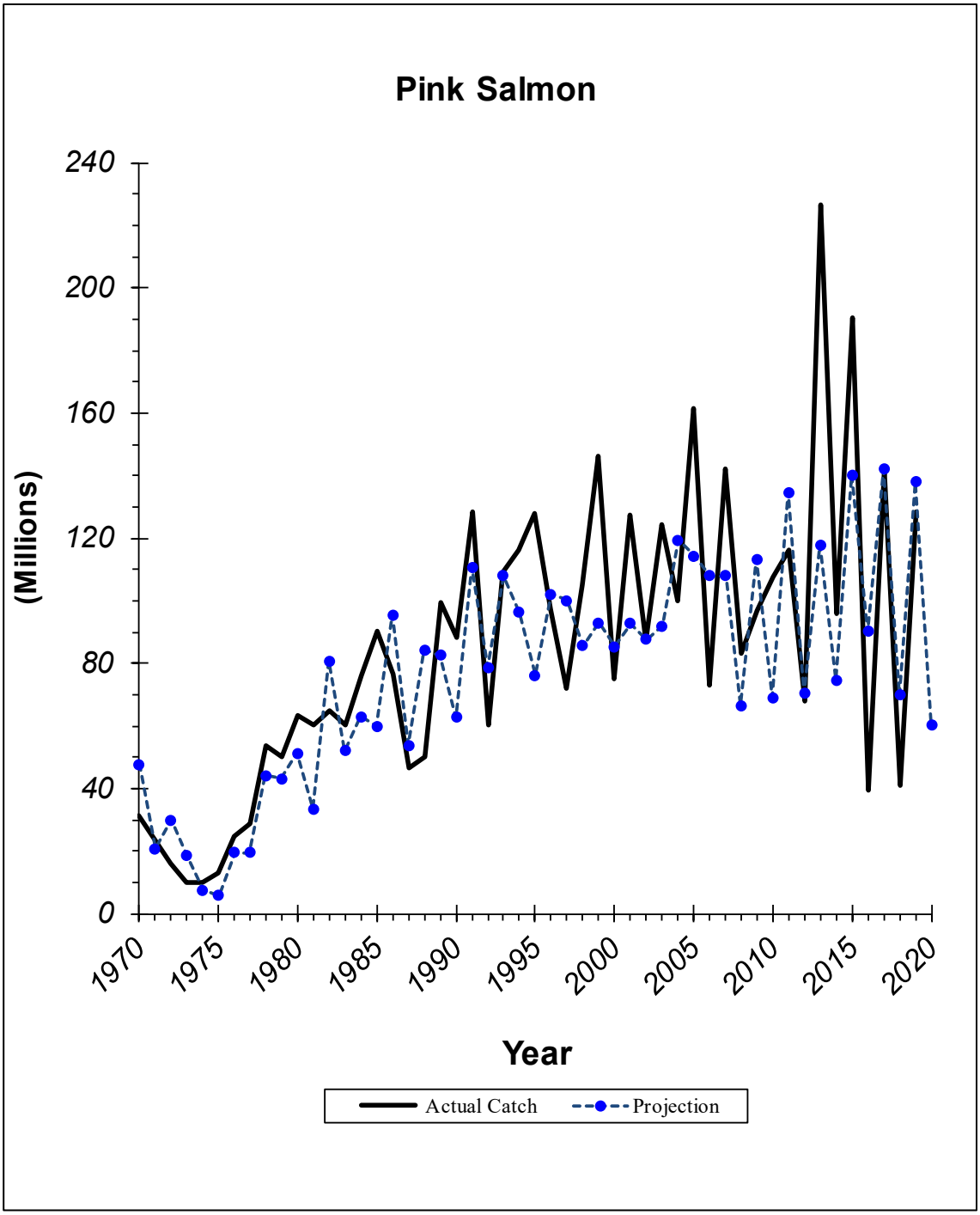

Figure 5.–Relationship between actual catch and projected catch in millions, for Alaska pink salmon fisheries from 1970 to 2019, with the 2020 projection.

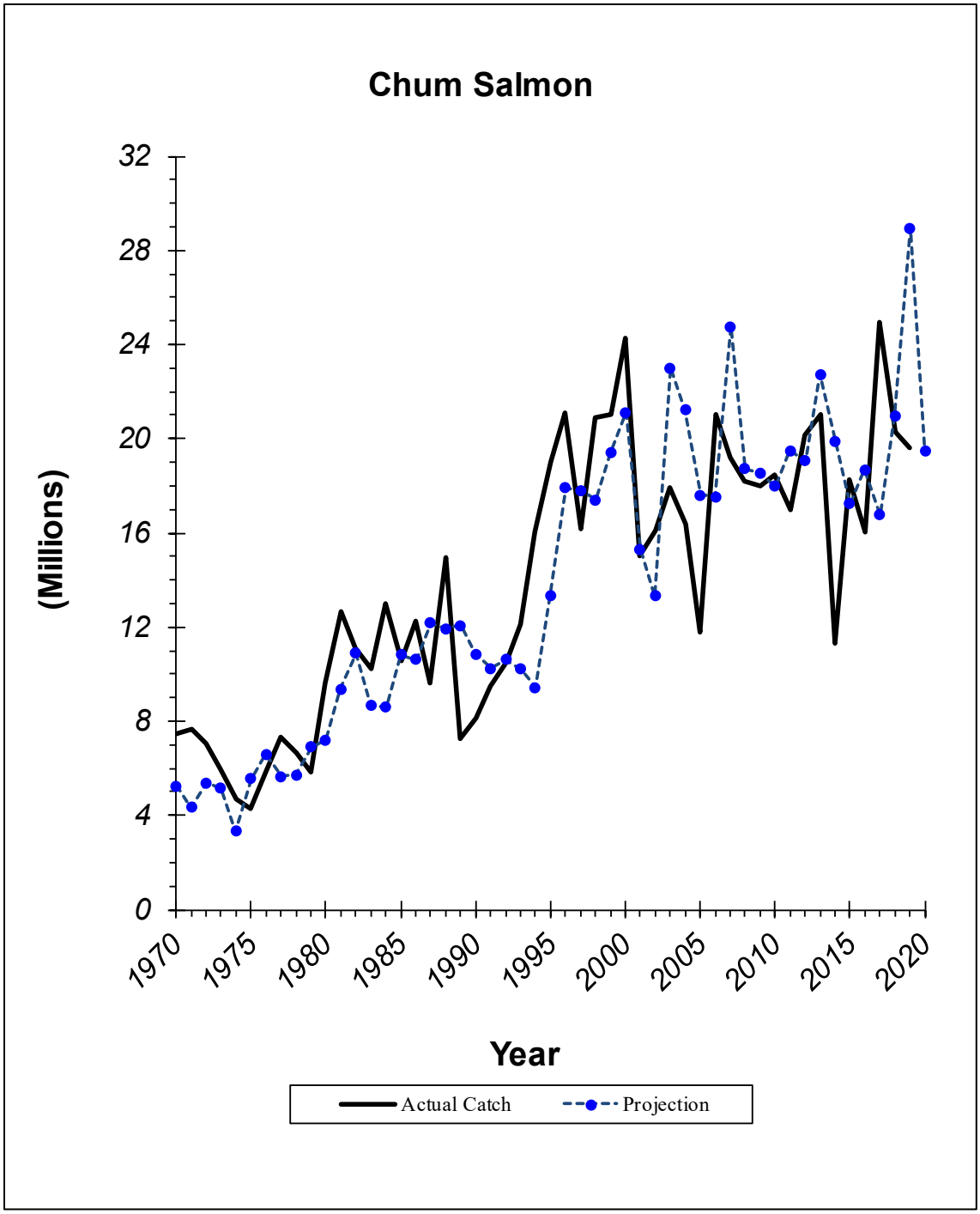

Figure 6.–Relationship between actual catch and projected catch in millions, for Alaska chum salmon fisheries from 1970 to 2019, with the 2020 projection.

PRELIMINARY FORECASTS OF 2020 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 (Table 8).

Table 8.–Forecast fisheries for the 2020 fishing year.

Southeast Region	pink salmon
Central Region	
Copper River and Prince William Sound	wild Chinook, sockeye, pink, and chum salmon
Upper Cook Inlet	sockeye salmon
Lower Cook Inlet	pink salmon
Bristol Bay	sockeye salmon
Arctic-Yukon-Kuskokwim Region	
Yukon Management Area	fall chum salmon
Westward Region	
Kodiak Management Area	pink salmon
Ayakulik River	sockeye salmon
Karluk River	sockeye salmon
Alitak District (Frazer Lake and Upper Station)	sockeye salmon
Spiridon Lake	sockeye salmon
Chignik Management Area	sockeye salmon (early and late runs)
Alaska Peninsula/Aleutian Islands	sockeye salmon
Bear Lake	sockeye salmon (late run)
Nelson River	sockeye salmon
South Alaska Peninsula Aggregate	pink 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.

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.

SOUTHEAST REGION

Pink Salmon

The Southeast Alaska (SEAK) pink salmon harvest in 2020 is predicted to be in the *weak* range with a point estimate of 12 million fish (80% prediction interval: 7–19 million fish). 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 (Table 9).

Table 9.–Southeast Alaska (SEAK) pink salmon harvest ranges.

Category	Range (millions)	Percentile
Poor	Fewer 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: The NOAA Alaska Fisheries Science Center, Auke Bay Laboratories (NOAA) initiated the Southeast Alaska Coastal Monitoring (SECM) project in 1997 to better understand the effects of climate and nearshore ocean conditions on year class strength of salmon and ecologically related species (Orsi et al. 1997). Since 2018, the SECM project has been conducted cooperatively by NOAA and the Alaska Department of Fish and Game (ADF&G), and both agencies have combined efforts to produce a joint pink salmon harvest forecast using SECM data (Piston et al. 2019). The ADF&G research vessel *Medeia* is now used to conduct the SECM surveys, and biologists from NOAA, ADF&G, and the regional aquaculture associations provided direct assistance to the sampling effort during the June, July, and August surveys. In the future, we plan to continue working toward increased coordination between agencies, and will continue to look for ways to focus and expand the SECM survey to provide a wide variety of valuable information to the fishing industry.

The 2020 SEAK pink salmon harvest forecast (Figures 7 and 8) was primarily based on juvenile pink salmon abundance indices collected by the SECM project in northern SEAK inside waters. These data were obtained from systematic surveys conducted annually in June and July 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 2019 juvenile pink salmon abundance index (monthly peak juvenile CPUE; standardized catch based on 20-minute trawl sets) of 1.20 was the third lowest in the 23 years of SECM surveys.

Forecasts were developed using an approach described by Murphy et al. (2019). A multiple regression model was developed using the juvenile pink salmon abundance index and associated environmental parameters. The model used is:

$$E(y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \varepsilon$$

where *E(y)* is the expected value for *y*, the natural log of Southeast Alaska pink salmon harvest, β_1 is the coefficient for the natural log of CPUE +1, β_2 is the coefficient for the natural log of the environmental covariate water temperature (e.g., summer water temperature indices in the upper 20 m in Icy Strait), β_3 is the interaction term, and ε represents the normally distributed error term. Leave-one-out cross validation (hindcast), Akaike Information Criterion for small sample sizes (Burnham and Anderson 2004), and the model performance metric mean absolute scaled error

(MASE; Hyndman and Kohler 2006) were then used to evaluate forecast accuracy of alternative models. The 80% prediction intervals around the forecast were calculated using the car package in program R (Fox and Weisberg 2019).

Forecast Discussion: The 2020 harvest forecast of 12 million pink salmon is approximately one-third of the recent 10-year average harvest of 35 million pink salmon. A harvest near this forecast would also be approximately 60% of the average even-year harvest since 2006. The 2019 peak June–July juvenile pink salmon index value (1.20) ranked 21st out of the 23 years that SECM information has been collected. Pink salmon harvests associated with juvenile indices below a value of 2.0 have ranged from 8 to 37 million fish (mean = 21 million fish).

The low juvenile abundance index in 2019 was not unexpected. Pink salmon escapements in the parent year (2018) were very poor throughout northern Southeast Alaska inside waters and the escapement goal was not met in that subregion, which may have resulted in below-optimal egg deposition. Escapement and harvest of pink salmon in the Northern Southeast Inside subregion have been very poor since 2012, and the 2020 forecast indicates this pattern is likely to continue. Pink salmon escapement goals for the Southern Southeast and Northern Southeast Outside subregions were met in 2018, but harvests were well below average. The low juvenile abundance index in 2019 may also indicate that brood year 2018 pink salmon experienced poor freshwater and/or early marine survival. It is possible that drought conditions present in Southeast Alaska from the parent year 2018 spawn through the spring of 2019 reduced spawning success or negatively impacted overwinter survival of developing juvenile salmon, but the exact reasons for the low juvenile abundance are not known. However, juvenile pink salmon caught in the 2019 SECM survey trawls were among the largest (in length) in the 23-year time series (Figure 9) and were in good condition, which indicates favorable nearshore marine conditions in the spring. The size of juvenile pink salmon was similar to the large size of juveniles observed during the marine heat wave of 2014–2016 (Figure 9) and returns from those juvenile years were all below average.

Like many recent years, a potential source of uncertainty regarding the 2020 pink salmon return is the anomalously warm sea surface temperatures in the Gulf of Alaska in 2019. Warm temperatures persisted throughout the Gulf of Alaska from fall 2013 through much of 2016 (Bond et al. 2015; Di Lorenzo and Mantua 2016; Walsh et al. 2018), returned in 2018, and strengthened in 2019. Compared to sea surface temperatures since 1997, when NOAA first started the SECM project, surface temperatures in the Gulf of Alaska in 2019 immediately offshore of Southeast Alaska were the warmest of the time series in July, the 4th warmest in August, and 3rd warmest in September.[1] Sea surface temperatures were well above average across the entire Gulf of Alaska during that time. Pink salmon that went to sea from 2014 to 2018 returned in numbers below expectation and below recent odd- and even-year averages. The impact of warm sea surface temperatures on the survival of pink salmon that went to sea in 2019 is unknown and adds uncertainty to the forecast.

ADF&G will manage the 2020 commercial purse seine fisheries inseason based on the strength of salmon runs. Aerial escapement surveys and fishery performance data will continue, as always, to be essential in making inseason management decisions.

[1] https://www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst-v5

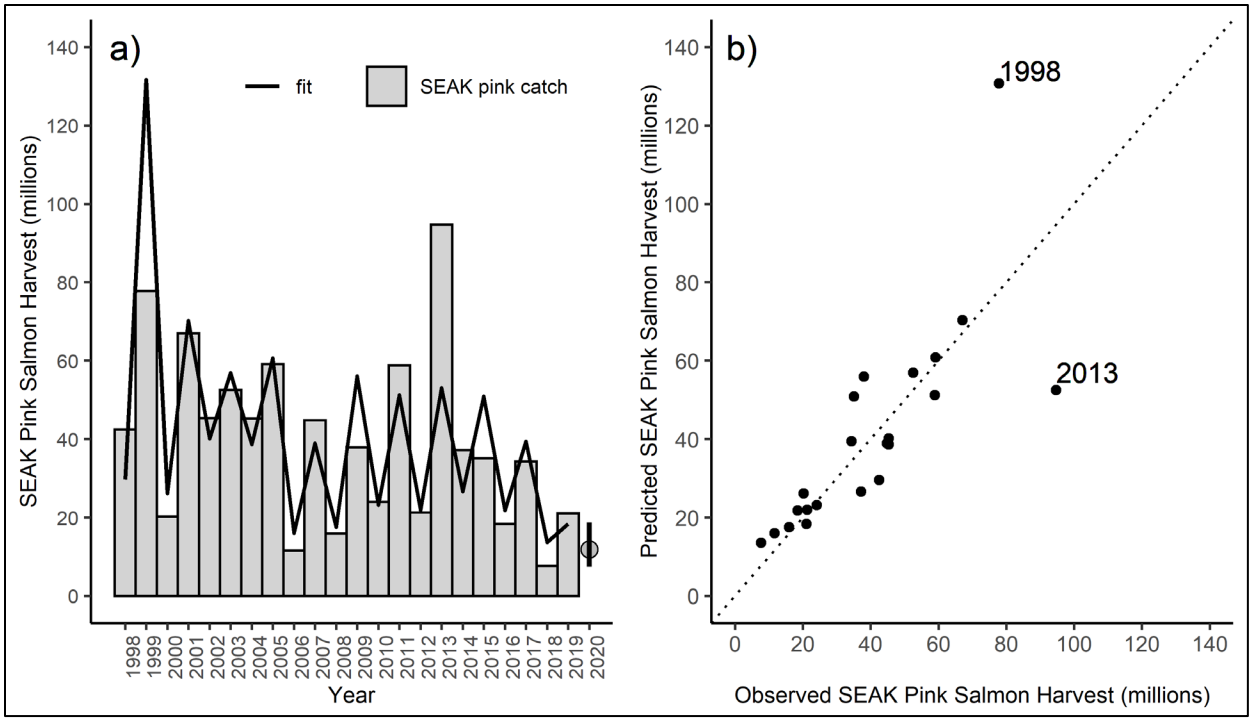

Figure 7. Forecast model fit (hindcasts) for total Southeast Alaska (SEAK) pink salmon harvest, 1998–2019 by year (a) and by the fitted values (b).

Note: The 2020 forecast is shown as a grey circle in panel *a* with the 80% prediction interval as a black vertical line. The observed SEAK pink salmon harvest is represented by the grey bars and the model fit is shown by the black line in figure *a*. The dotted line in panel *b* represents a one-to-one line; circles above the line represent hindcasts that would have been greater than the actual harvest, and circles below the line represent hindcasts that would have been less than the actual harvest.

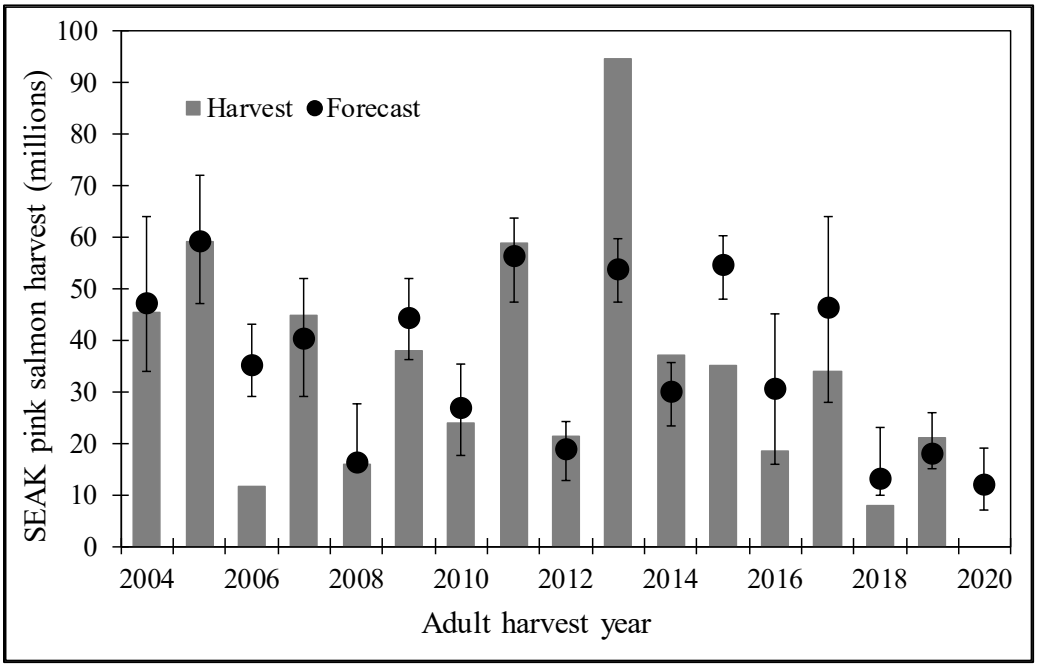

Figure 8.–Annual harvests of pink salmon in SEAK compared to the actual preseason harvest forecasts, 2004–2019. The error bars represent the 80% confidence intervals of the forecasts.

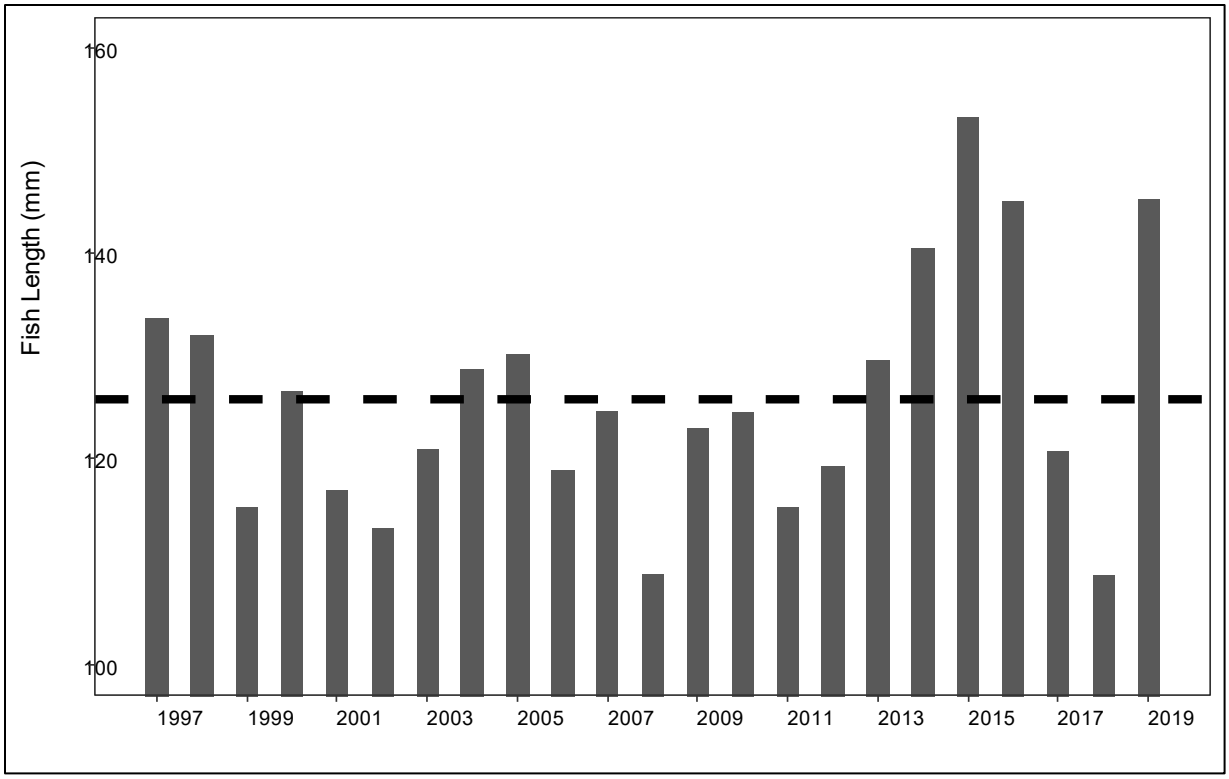

Figure 9.–Average snout to fork length of juvenile pink salmon (standardized to July 24) captured during trawl surveys in upper Chatham and Icy straits, 1997–2019. The dashed line represents the 1997–2019 average length.

Forecast by Andy Piston, Steve Heinl, Sara Miller, and Rich Brenner, Alaska Department of Fish and Game; and Jim Murphy, Jordan Watson, Andy Gray, and Emily Fergusson, NOAA, Auke Bay Lab, Alaska Fisheries Science Center.

CENTRAL REGION

COPPER RIVER AND PRINCE WILLIAM SOUND

Forecasts of total run were calculated for Copper River wild Chinook and sockeye salmon, Gulkana Hatchery sockeye salmon, Coghill Lake sockeye salmon, and for wild Prince William Sound (PWS) pink and chum salmon (Table 10). Prince William Sound Aquaculture Corporation (PWSAC) and Valdez Fisheries Development Association provide additional forecasts for hatchery-specific stocks. In addition to forecasts, a summary of recent 10-year averages (2010–2019) of commercial common property fishery (CCPF) harvest for most wild stocks and Gulkana Hatchery production is also included (Table 11). Salmon forecasts are inherently uncertain and are primarily used to gauge the magnitude of expected runs and set early-season harvest management strategy. In 2020, 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 10.–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					
Wild production	Chinook salmon	Total run	60	39–82	20.0% above
Wild production	Sockeye salmon	Total run	1,422	903–1,942	32.7% below
Gulkana Hatchery production	Sockeye salmon	Total run	109	69–149	62.3% below
Total production	Sockeye salmon	Total run	1,531	972–2,091	
Coghill Lake					
Wild production	Sockeye salmon	Total run	175	81–268	6.4% below
Prince William Sound					
Wild production	Pink salmon	Total run	4,421	1,197–16,327	18.8% above
Wild production	Chum salmon	Total run	604	342–865	18.9% above

Table 11.–Prince William Sound Area recent 10-year (2010–2019) average CCPF salmon harvest by species (thousands of fish).

Area/Production Type	Chinook	Sockeye	Coho	Pink	Chum	Total
Bering River						
Natural production	0	4	63	0	0	67
Copper River						
Natural production	13	1,080	223	54	17	1,387
Hatchery production	0	225	0	0	0	225
Total production	13	1,305	223	54	17	1,612
Prince William Sound						
Natural production	1	208	N/A[a]	2,664[b]	279	3,152
Area Totals						
Natural production	14	1,517	286	2,718	296	4,831

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

[b] Recent 10 even-year CCPF harvest (2009–2018).

Copper River Area

Chinook Salmon

The 2020 Copper River Chinook salmon total run point estimate is 60,000 fish (80% prediction interval: 39,000–82,000 fish). The recent 10-year average (2010–2019) Copper River Chinook salmon total run is 48,000 fish. Subtracting the lower bound SEG of 24,000 fish from the total run forecast results in a common property harvest point estimate (all fisheries) of 36,000 fish (range: 15,000–58,000 fish).

Forecast Methods: Several forecast methods were examined for the 2020 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 21 years (1999–2019) of inriver abundance estimates available for this analysis.

For 2020, exponential smoothing and moving average models produced similar forecast results (range: 53,000–63,000 fish). 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 2020 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 and bias. 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 and 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% prediction intervals were calculated from the mean squared error of the retrospective forecast predictions.

Sockeye Salmon

The 2020 wild Copper River sockeye salmon total run point estimate is 1,422,000 fish (80% prediction interval: 903,000–1,942,000 fish). The recent 10-year average (2010–2019) Copper River wild sockeye salmon total run is 2,113,000 fish. Gulkana Hatchery sockeye salmon total run is predicted to be 109,000 fish (80% prediction interval: 69,000–149,000 fish) for a total Copper River sockeye salmon run (wild + hatchery production) of 1,531,000 fish (80% prediction interval: 972,000–2,091,000 fish). Total Copper River sockeye salmon common property harvest (all fisheries) is predicted to be 970,000 fish (80% prediction interval: 554,000–1,386,000 fish) with a CCPF harvest of 771,000 fish (80% prediction interval: 355,000–1,187,000 fish).

Forecast Methods: Forecast models examined for wild Copper River sockeye salmon for 2020 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, -2.2, and -2.3 sockeye salmon. These 4 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 and -0.3 sockeye salmon were calculated as the 5-year (2015–2019) mean return of those age classes. The 2020 run to Gulkana Hatchery was estimated as the recent 5-year weighted average fry-to-adult survival estimate (0.70%) 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 40% age-4 and 60% age-5 fish.

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 2020. There are currently 55 years (1965–2019) of harvest, escapement, and age composition data available for this analysis. Total run 80% prediction intervals were calculated from the mean squared error of the retrospective forecast predictions.

Forecast by Stormy Haught, Area Finfish Research Biologist, Cordova.

Prince William Sound Area

Sockeye Salmon

The 2020 Coghill Lake sockeye salmon total run point estimate is 175,000 fish (80% prediction interval: 81,000–268,000 fish). Subtracting the escapement target of 30,000 fish from the total run forecast results in a common property harvest point estimate (all fisheries) of 145,000 fish (range: 51,000–238,000 fish). The recent 10-year average (2010–2019) Coghill Lake sockeye salmon total run is 187,000 fish.

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. Linear regression models with log-transformed data were used to predict returns of age-1.3 and -1.2 sockeye salmon. These linear regression models were parameterized using the historical relationship between returns of age-1.3 fish and returns of the age-1.2 fish 1 year previous, and returns of age-1.2 fish and returns of the age-1.1 fish 1 year previous (sibling models). For example, the model to predict the return of age-1.3 fish in 2020 used the return of age-1.2 fish in 2019 as the input parameter. Predicted returns of age-1.1, -2.2, and -2.3 sockeye salmon were calculated as the 2010–2019 mean return of that age class.

Harvest, escapement, and age composition data are available for Coghill Lake sockeye salmon runs dating back to 1962; however, inclusion of escapements prior to the installation of a full weir in 1974 reduce 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 2015–2019 forecasts and actual runs as the forecast variance. Over the previous 10-year period (2010–2019) Coghill Lake sockeye forecasts have an average error of 35% for total run predictions and 12% for commercial harvest predictions.

The number of age-1.1 fish sampled at the Coghill River weir in 2019 was high relative to previous years and resulted in a 2019 age-1.1 Coghill Lake sockeye salmon total run estimate of 11,400 fish, well above the previous record high of 7,500 fish set in 2017, and well above the recent 10-year average run of 2,500 age-1.1 fish to Coghill Lake. The 2019 run of age-1.2 fish (15,400 fish), however, was well below the recent 10-year average (49,500 fish). The high

abundance of age-1.1 fish in the 2019 run resulted in a large forecast of age-1.2 fish for 2020 (110,800; 63% of the predicted 2020 total run). For the recent 10-years (2010–2019), the linear regression sibling model predicting the number of age-1.2 Coghill Lake sockeye salmon from the previous year's run of age-1.1 fish has a mean absolute percentage error MAPE of 40.3% and an average error of –4.9%. Coghill Lake sockeye salmon run age structure has been dominated by age-1.2 fish (>50% of total run) in 7 years since 1968 (1981, 1995, 1999, 2003, 2006, 2010, and 2018), and during that same time period there have only been 4 years when age-1.2 returns to Coghill Lake have exceeded 100,000 fish (1981, 1999, 2011, 2018).

Pink Salmon (natural run only)

The 2020 PWS wild pink salmon total run point estimate is 4,421,000 fish (80% prediction interval: 1,197,000–16,327,000 fish). The recent 10 even-year average (2000–2018) PWS wild pink salmon total run is 3,721,000 fish.

Forecast Methods: Total wild run of pink salmon by year was estimated as the total wild (nonhatchery) contribution to commercial harvests combined with stream escapement indices. The stream escapement index is calculated as the area under the curve of weekly aerial escapement surveys adjusted for estimates of stream life. For this forecast, total run estimates were natural log-transformed. Hatchery and wild stock contributions were determined from thermal marked otolith recoveries (1997–2018), 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 2020 PWS wild pink total run forecast including exponential smoothing and 2-, 3-, and 5-year running averages of past even-year total runs. Exponential smoothing and moving average models produced similar forecast results in the 3.7–4.9 million fish 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 2-year running average forecast was selected for 2020 because it marginally outperformed other forecast models by having the lowest bias to over- or underforecast and the lowest mean percent error and mean squared error. The 80% prediction intervals were calculated from the mean squared error of the retrospective forecast predictions.

Chum Salmon (natural run only)

The 2020 PWS wild chum total run point estimate is 604,000 fish (80% prediction interval: 342,000–865,000 fish). The recent 10-year average (2010–2019) PWS wild chum salmon total run is 508,000 fish.

Forecast Methods: Total wild run of chum salmon by year was estimated as the total wild (nonhatchery) contribution to commercial harvests combined with the stream escapement index. Several models were examined for the 2020 PWS wild chum total run forecast including exponential smoothing and 2-, 3-, and 5-year running averages of past total runs. For 2020, the 2-year running average outperformed the other models by having the lowest mean absolute percentage error, the lowest mean absolute squared error, and relatively low bias when compared retrospectively. CCPF harvest contributions of wild stock chum salmon were estimated using prehatchery average natural runs (1998–2003) or thermally marked otolith estimates (2004–2018) for each district in PWS. The 80% prediction intervals were calculated from the mean squared error of the retrospective forecast predictions.

Forecast by Stormy Haught, Area Finfish Research Biologist, Cordova.

UPPER COOK INLET

Sockeye Salmon

In 2020, a run of approximately 4.3 million sockeye salmon is forecasted to return to UCI with a commercial harvest of 1.8 million (Table 12).

Table 12.–The forecasts of the 2020 Upper Cook Inlet sockeye salmon run and harvests.

	Forecast estimate (millions)	Forecast range (millions)
Total run	4.27	3.36–5.18
Escapement	1.73	
UCI commercial harvest	1.85	
Other UCI harvests	0.70	

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. Four models were evaluated to forecast the total run of sockeye salmon to UCI in 2020: (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 returns. Several forecast models were evaluated for each stock and age class. Model that provided the smallest 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 2020 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 fry that reared in Kenai and Skilak lakes in 2016. A spawner-recruit model was used to predict the age-1.2 salmon return based upon the spawning escapement in 2016. 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 2019, 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 2019.

The returns of age-1.2, -1.3, and -2.2, Kasilof River sockeye salmon in 2020 were all forecasted using sibling models based upon returns of age-1.1, -1.2, and -2.1 fish in 2019. The return of age-2.3, Kasilof River sockeye salmon in 2020 was forecasted using a smolt model of age-2 smolt emigrating in spring 2016.

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.

The total 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, which was estimated as 17% of the escapement into monitored systems. Commercial harvest was estimated from the average fraction (2011–2018) 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 2020 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 2010 through 2019.

In 2019, the commercial harvest of sockeye salmon in UCI (1.7 million fish) was 1.3 million fewer fish than the preseason forecast of 3.0 million fish. In 2019, the estimated total run was 3.6 million to the Kenai River; 669,000 to the Kasilof River; 260,000 to the Susitna River; and 90,000 to Fish Creek. The 2019 run forecast was 3.8 million to the Kenai River; 873,000 to the Kasilof River; 343,000 to the Susitna River; and 124,000 to Fish Creek. Overall, the 2019 sockeye salmon run (5.2 million fish) was 13% below forecast (6.0 million fish), due to either overforecasting age-1.2, -2.2, and -2.3 fish, or unfavorable ocean survival.

Forecast Discussion: In 2020, a run of approximately 4.3 million sockeye salmon is forecasted to return to UCI with a commercial harvest of 1.8 million fish. The forecasted commercial harvest in 2020 is 1 million fewer fish than the 20-year average annual harvest. Run forecast numbers and 20-year averages for the Kenai River, Kasilof River, Susitna River, and Fish Creek are discussed below and presented in Table 13.

The run forecast for the Kenai River is approximately 2.2 million sockeye salmon, which is 1.4 million (38%) fewer fish than the 20-year average run of 3.6 million fish. A fry model based on the number of age-0 sockeye salmon fry rearing in Kenai and Skilak lakes in 2016 (26.1 million; 20-year average = 19.3 million) and the average weight of age-0 fall fry rearing in Skilak Lake (0.8 g; 20-year average = 1.0 g) predicts a return of 1.4 million age-1.3 salmon in 2020. A sibling model from return of age-1.2 salmon in 2019 (248,000; 20-year average = 393,000) also predicted a return of 1.4 million age-1.3 fish. The fry model was selected for this forecast because the 10-year MAPE was lower for the fry model (25%) than for the sibling model (29%). A sibling model based upon the return of age-2.2 salmon in 2019 (91,000; 20-year average = 229,000) predicted a return of 300,000 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 2016 (1.4 million; 20-year average = 2.1 million) predicted a return of 361,000 age-2.3 fish. The sibling model was selected for the forecast, because the 10-year MAPE was lower for the sibling model (98%) than for the fry model (130%), but it should be noted that both methods have relatively high uncertainty compared to other age classes. The predominant age classes in the 2020 run forecast are age-1.2 (17%), age-1.3 (63%) and age-2.3 (13%) fish. The 10-year MAPE for the set of models used for the 2020 Kenai sockeye salmon run forecast is 19%.

The Kasilof River sockeye salmon run forecast is 723,000 fish, which is 248,000 (26%) fewer fish than the 20-year average of 971,000 fish. A sibling model based upon the return of age-1.2 salmon in 2019 (321,000; 20-year average = 326,000) was used to forecast a return of 297,000 age-1.3 salmon in 2020 with a corresponding MAPE of 58%. A sibling model based upon the return of age-1.1 salmon in 2019 was selected to forecast a return of 213,000 age-1.2 salmon in 2020. A spawner-recruit model based upon spawner abundance in 2016 forecasted a return of 220,000 age-1.2 salmon. The sibling model was selected for this forecast, because the 10-year

MAPE was lower for the sibling model (38%) than for the spawner-recruit model (46%). A sibling model based upon the return of age-2.1 fish in 2019 was used to forecast a return of 188,000 age-2.2 fish in 2020. A spawner-recruit model forecast for age-2.2 fish was 155,000 fish. The sibling model was selected for this forecast, because the 10-year MAPE was lower for the sibling model (24%) than for the spawner-recruit model (37%). The predominant age classes in the 2020 run forecast are age-1.2 (29%), age-1.3 (41%), and age-2.2 (26%) fish. The 10-year MAPE for the set of models used for the 2020 Kasilof sockeye salmon run forecast is 21%.

The Susitna River sockeye salmon run forecast is 571,000 fish, which is 49% greater than the 10-year average of 384,000 fish. This forecast was derived using mean return per spawner by age class and mark–recapture estimates of spawner abundance for brood years 2006–2014. Sonar estimates of spawner abundance were not used, because mark–recapture studies have shown that the Yentna River sonar project underestimated sockeye salmon escapement, causing estimates of adult returns to also be underestimated. The 5-year MAPE for this forecast method is 23%. The predominant age classes in the 2020 Susitna sockeye salmon run forecast are age-1.2 (25%) and age-1.3 (54%) fish.

The Fish Creek sockeye salmon run forecast is 121,000 fish, which is 42% greater than the 20-year average run of 86,000 fish. A sibling model based upon the return of age-1.1 fish in 2019 (4,000; 20-year average = 3,000 fish) was used to forecast a return of 72,000 age-1.2 fish. A spawner-recruit model forecasted a return of 69,000 age-1.2 fish. The sibling model was used for this forecast, because the 10-year MAPE was lower for the sibling (65%) than for the spawner-recruit model (104%). Sibling models were also used to forecast the returns of age-1.3, -2.2 and -2.3 fish. The predominant age classes in the 2020 Fish Creek run forecast are age 1.2 (58%) and age 1.3 (22%) fish. The 10-year MAPE for the Fish Creek sockeye salmon run forecast is 70%.

Table 13.–Sockeye salmon run forecasts, 20-year average runs and escapement goals (in thousands of fish) to individual freshwater systems in Upper Cook Inlet.

		Major age classes					Escapement
System		1.2	1.3	2.2	2.3	Total run[a]	goals[b]
Kenai River	Forecast	369	1,403	114	300	2,231	900–1,100[c]
	20-yr average	393	2,133	229	750	3,578	
Kasilof River	Forecast	213	297	188	10	723	160–340
	20-yr average	326	305	244	76	971	
Susitna River	Forecast	141	308	45	22	571	Lakes goals[d]
	20-yr average	106	181	24	36	384	
Fish Creek	Forecast	72	27	9	1	121	1 –45
	20-yr average	50	19	6	2	86	
Unmonitored	Forecast	136	348	61	57	624	No goal
	20-yr average	149	451	86	148	858	
Total run	Forecast	931	2,383	417	389	4,270	
	20-yr average	1,024	3,089	589	1,012	5,877	

[a] Total run includes all age classes.

[b] Escapement 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 fewer than 2.3 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 weirs. 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).

Other Salmon Species

Forecast Methods: The recent 5-year average commercial harvest was used to forecast the harvest of chum, coho, and Chinook salmon in 2020 (Table 14). The forecast for pink salmon is based upon the average harvest during the previous 5 even-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.

Table 14.–The forecast of the 2020 Upper Cook Inlet area commercial harvest of other salmon species.

Species	Commercial harvest forecasts
Pink salmon	383,000
Chum salmon	175,000
Coho salmon	203,000
Chinook salmon	6,900

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

LOWER COOK INLET

Pink Salmon

Forecast Methods: A naïve forecast based on historical even-year pink salmon harvests (1960–2018) was used to predict the 2020 CCPF harvest in LCI (Table 15). 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 (202,270–1,247,150 fish). The 2-year running average model using even-year data inputs (log-transformed) 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.

Table 15.–Preliminary forecast of the 2020 Lower Cook Inlet area pink salmon run.

	Forecast estimate (thousands)	Forecast range (thousands)
Commercial common property harvest	202	41–989

Note: Commercial common property harvest refers to fish available for harvest outside of hatchery special harvest areas (SHAs); no prediction of fishing effort is made. Additional commercial common property harvest 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: http://www.ciaanet.org.

Forecast Discussion: Prior to 2018, the even-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. However, preliminary results from otolith sampling in LCI during 2014–2019 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. Consequently, 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 2018, the parent year for the upcoming 2020 return, LCI experienced a wide range of escapements to pink salmon index streams. Six of 18 stocks with SEGs failed to achieve the low end of their respective escapement goal ranges, including 2 of the larger producers in the Outer District (Rocky River, Island Creek); and 8 stocks exceeded their SEG range including Port Dick, Port Chatham, Dogfish, Port Graham, and Seldovia. The 2020 CCPF harvest forecast of 202,300 pink salmon has a forecast range of 41,400–989,100 fish. If realized, a CCPF harvest of 202,000 pink salmon would be approximately 30% less than the recent 5-year average CCPF harvest of 289,000 fish for even-year returns between 2010 and 2018.

Other Salmon Species

Forecast Methods: Naïve forecasts based on historical harvests (1960–2019) were used to predict the 2020 CCPF harvest of other, less abundant salmon species in LCI (Table 16). 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 nontransformed 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]).

Table 16.–The forecast of the 2019 Lower Cook Inlet area CCPF harvest of other, less abundant salmon species.

Species	CCPF harvest forecasts	Model	Dataset
Sockeye salmon[a]	135,650	Exponential smoothing	Log-transformed
Chum salmon	80,830	Exponential smoothing	Nontransformed
Coho salmon	13,000	2-year running average	Nontransformed
Chinook salmon	496	2-year running average	Nontransformed

[a] Additional CCPF and hatchery cost-recovery harvests of sockeye salmon may be expected from hatchery returns in and around special harvest areas (SHAs). Lower Cook Inlet hatchery forecasts are available from Cook Inlet Aquaculture Association: http://www.ciaanet.org.

Forecast Discussion: Prior to 2018, 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 in 2018, for consistency, we transitioned to the same trend forecast methods we used for LCI pink salmon.

Forecast by Edward O. Otis, Area Finfish Research Biologist, Homer; and Glenn J. Hollowell, Area Finfish Management Biologist, Homer.

BRISTOL BAY AREA

Sockeye Salmon

Forecast Methods: The 2020 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 1972–2016 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 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, MAPE, 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 5-year time frames. In certain cases, competing models were averaged in a weighted 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 2002 through 2019.

A total of 48.95 million sockeye salmon (range 36.42–61.49 million fish; Table 17) are expected to return to Bristol Bay in 2020. This is 6% larger than the most recent 10-year average of Bristol Bay total runs (45.9 million fish) and 29% greater than the long-term (1963–2019) average of 34.6 million fish. All systems are expected to meet their spawning escapement goals.

Table 17.–Preliminary forecast of the 2020 Bristol Bay area sockeye salmon run.

Total production	Forecast (millions)	Forecast range (millions)
Total run	48.95	36.42–61.49
Escapement	12.04	
Commercial common property harvest	36.91	
Bristol Bay harvest	34.56	
South Peninsula harvest	2.35	
Inshore run	46.60	

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 (1) the 75th quartile of the escapement range if the forecast is above the historical trend line (Egegik and Wood rivers); (2) the midpoint (50th quartile) of the escapement range if the forecast is in line with the historical trend (Ugashik, Igushik and Togiak Rivers); or (3) the 25th quartile of the escapement goal range if the forecast is below the recent historical trend line (Kvichak, Naknek, and Nushagak Rivers in 2020; Table 18). 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 48.95 million sockeye salmon would allow for a potential total harvest of 36.91 million fish—34.56 million fish in Bristol Bay and 2.35 million fish in the South Peninsula fisheries. A Bristol Bay harvest of this size is 11% greater than the most recent 10-year harvest (31.1 million fish; range 15.4–42.0 million), and 38% greater than the long-term average harvest of 21.5 million fish (1963 to present).

The run forecast for each district and river system is as follows: 19.97 million fish to Naknek-Kvichak District (10.42 million to the Kvichak River, 4.08 million to the Alagnak River, and 5.47 million to the Naknek River); 10.75 million fish to the Egegik District; 4.67 million fish to the Ugashik District; 12.63 million fish to the Nushagak District (8.66 million to the Wood River, 2.90 million to the Nushagak River, and 1.07 million to the Igushik River); and 930,000 fish to the Togiak District (Table 18).

We forecast that the 2020 run will consist of 19.14 million age-1.2 fish (39% of the total run), 7.06 million age-2.2 fish (14% of the total run), 21.04 million age-1.3 fish (43% of the total run), and 1.68 million age-2.3 fish (3% of the total run; Table 18).

Table 18.–Forecast of total run, escapement, and harvest of major age classes of sockeye salmon returning to Bristol Bay river systems, 2020.

	Millions of sockeye salmon								
	Forecasted production by age class					Forecasted		South	Bristol Bay
DISTRICT/River	1.2	2.2	1.3	2.3	Total	Esc.	Harvest	Peninsula[a]	Inshore
NAKNEK-KVICHAK									
Kvichak	5.07	2.23	3.04	0.07	10.42	4.00	5.92	0.50	9.92
Alagnak	1.94	0.48	1.61	0.06	4.08	1.57	2.32	0.20	3.89
Naknek	0.78	0.17	4.19	0.33	5.47	1.10	4.11	0.26	5.21
Total	7.80	2.88	8.84	0.46	19.97	6.67	12.34	0.96	19.01
EGEGIK	1.88	3.13	4.66	1.08	10.75	1.70	8.53	0.52	10.23
UGASHIK	2.31	0.87	1.46	0.04	4.67	1.18	3.28	0.22	4.45
NUSHAGAK									
Wood	5.81	0.14	2.68	0.04	8.66	1.53	6.72	0.42	8.25
Igushik	0.37	0.00	0.68	0.01	1.07	0.28	0.74	0.05	1.02
Nushagak	0.67	0.03	2.12	0.06	2.90[b]	0.50	2.26	0.14	2.77
Total	6.85	0.18	5.47	0.10	12.63	2.30	9.72	0.61	12.03
TOGIAK	0.30	0.01	0.61	0.01	0.93	0.20	0.69[c]	0.04	0.88
BRISTOL BAY	19.14	7.06	21.04	1.68	48.95	12.04	34.56	2.35	46.60
	39%	14%	43%	3%	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 4.8%.

[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.

Forecast Discussion: Historically, sockeye salmon runs to Bristol Bay have been highly variable. The Bristol Bay total run has averaged 34.6 million fish (1963–2019) and has averaged 45.9 million fish 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, and they have performed well when applied to Bristol Bay as a whole. Since 2001, our forecasts have, on average, underforecast the run by 14% and have ranged from 44% below the actual run in 2014 to 19% above the actual run in 2011. Forecasted harvests have had a MAPE of 14% since 2001.

Individual river forecasts have greater uncertainty compared to baywide forecasts. Since 2001, on average, we have underforecast returns to the Alagnak (–33%), Togiak (–12%), Kvichak (–22%), Wood (–17%), Nushagak (–20%), Ugashik (–0.5%), and Naknek (–14%) rivers, and overforecast returns to the Igushik (+13%) and Egegik (+14%) rivers. 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. In 2019, the Nushagak District exceeded 200% of the long-term average return for the third year in a row. This is not expected to continue in 2020. Another notable feature of the 2019 run was the presence of record-setting numbers of age-1.2 sockeye to the Egegik River (11.6 million fish) and Naknek River (5.3 million fish).

Forecast by Greg Buck, Jordan Head, and Stacy Vega, Bristol Bay Research Biologists.

ARCTIC-YUKON-KUSKOKWIM REGION

All Salmon

ADF&G prepares formal run forecasts annually for the following stocks in the Arctic-Yukon-Kuskokwim (AYK) Region: Kuskokwim River Chinook salmon; Yukon River Chinook salmon; Canadian-origin Yukon River Chinook salmon; Yukon River summer chum salmon; and Yukon River fall chum salmon. Of these, only the Yukon River fall chum salmon forecast method and discussion is presented in this report. For the remaining stocks a brief summary is provided.

The Kuskokwim River Chinook salmon run forecast is based on the estimated run size from the prior year (midpoint), and uncertainty is represented as the recent 7-year average percent error between forecasted and actual run estimates. The preliminary 2020 Kuskokwim River Chinook salmon forecast is for a range of 200,000–260,000 fish. The drainagewide Chinook salmon escapement goal is 65,000–120,000 fish. If the run comes back as projected, the drainagewide escapement goal is expected to be achieved and a full subsistence harvest may be realized. There is currently no commercial buyer in the Kuskokwim Area, and commercial harvest of Chinook salmon is not expected during the 2020 season.

Separate forecasts are prepared for Canadian-origin Yukon River Chinook salmon and total run. The Canadian-origin run forecast is produced by a U.S./Canada Joint Technical Committee and presented to the Yukon River Panel. The forecast is based on projections of brood year returns, sibling relationships, and juvenile abundance estimates from marine trawl surveys conducted in the northeastern Bering Sea. The preliminary 2020 Canadian-origin run forecast is for 59,000–91,000 fish, which is similar to the 2019 run size of 74,000 fish. The Interim Management Escapement Goal for this stock component is 42,500–55,000 fish. The Canadian-origin forecast informs the drainagewide Chinook salmon outlook, because the Canadian-origin run represents approximately 40% of the total run. Yukon River Chinook salmon is classified as a *stock of yield concern* under the Sustainable Salmon Fisheries Policy. Direct commercial harvest of Yukon River Chinook salmon is not expected during the 2020 season.

The Yukon River summer chum salmon run forecast is developed by forecasting the run size of the Anvik River component, based on projections of brood year returns and sibling relationships, and then scaling up based on historical contribution of the Anvik River to the total run. The preliminary total run forecast is 1.7–2.1 million fish, which is similar to the 2019 run size of 1.8 million fish. The drainagewide escapement goal for this stock is 500,000–1,200,000 fish. The 2020 run is anticipated to provide for escapements, a normal subsistence harvest, and a surplus for commercial harvest. The 2020 commercial harvest of summer chum is expected to be affected by measures taken to protect Chinook salmon from incidental harvest in chum salmon-directed fisheries.

ADF&G does not produce formal run forecasts for other salmon stocks returning to the Kuskokwim or Yukon Areas or any salmon stocks returning to the Norton Sound or Kotzebue Management Areas. Consequently, commercial harvest outlooks for these stocks 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 given the fishery management plans in place and commercial processing capacity. Currently, southeastern Norton Sound Chinook salmon stocks are classified as *stocks of yield concern*. In general, management for anticipated low Chinook salmon abundance in 2020, small processing capacity in some areas,

and lack of a commercial buyer in the Kuskokwim will probably result in chum and sockeye salmon harvests that are lower than the outlook projections in the AYK Region (Table 19).

Table 19.–The 2020 Arctic-Yukon-Kuskokwim area all-salmon commercial harvest outlook by management area, in thousands of fish.

	Salmon species					
Management area	Chinook	Sockeye	Coho	Pink	Summer 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	30–100	0	750–1,200	277–495
Norton Sound	1–3	5–8	200–250	25–75	180–230	0
Kotzebue Sound	–	–	–	–	450–650	0

[a] There is not anticipated to be a commercial buyer in the Kuskokwim area in 2020.

YUKON AREA

Fall Chum Salmon

Forecast Methods: The forecast for the 2020 Yukon Area fall chum salmon run is based on run reconstruction of 5 river systems (Tanana, Teedriinjik/Chandalar, Sheenjek, and Fishing Branch rivers; and the mainstem Yukon River in Canada) and 4 age classes (age-3 to age-6 fish, with age-4 fish dominating, followed by age-5 fish). Adult escapement and return data was used from the complete brood years 1974–2013, production from incomplete brood years 2014 and 2015 was estimated based on return per spawner from brood year returns, and the Ricker model was used to predict returns from the 2016 and 2017 parent years.

Predicted returns were multiplied by corresponding average maturity schedules for even- and odd-numbered parent years to estimate 2020 run size, rounded to the nearest thousand fish. The odd/even 1974–2013 maturity schedule was used to estimate the 2020 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 2019.

The 2020 projected run size of fall chum salmon for the Yukon Area is approximately 936,000 fish. This forecast is above average for even-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 2020 forecast range from 827,000 to 1,045,000 fall chum salmon (Table 20). 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 provide a surplus for commercial harvest.

Table 20.–Preliminary forecast of the 2020 Yukon Area fall chum salmon run.

Total production	Forecast estimate (thousands)	Forecast range (thousands)
Total run estimate	936	827–1,045
Escapement goal	450	300–600
Harvest estimate[a]	550	377–595

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

Drainagewide escapements between 300,000 and 600,000 fish provide a mean yield of 447,000 fall chum salmon. The mean subsistence harvest from 2008 to 2018 for Alaskan subsistence and Canadian aboriginal harvests is 88,000 fall chum salmon. Commercial harvests may be allowed on the amount above 550,000 fish based on inseason assessments of run size. Targeting the midpoint of the escapement goal of 450,000 fall chum salmon, ADF&G anticipates a subsistence harvest of no more than 100,000 fish and an available commercial harvest between 277,000 and 495,000 fish. 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 depend on inseason assessment of the run size guidelines of the Yukon River Drainage Fall Chum Salmon Management Plan (5 AAC 01.249), with further considerations of fishing effort and buying capacity.

The forecasted total run of 936,000 fall chum salmon is expected to be composed of 72% age-4 and 24% 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 even-odd abundance cycle (averaging 1,200,000 in odd-numbered years and 843,000 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 contribute in some years. The effect of the even-odd cycle was restricted between 1993 and 2002, during which 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, the 1974–2013 brood year escapements of over 800,000 fish produced yields above replacement only 2 years out of 10.

Forecast Discussion: Point projections for expected returns have been developed since 1987 for fall chum salmon in the Yukon River drainage. Beginning in 1999, forecast methods were changed to provide ranges. 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 2020 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 10). High and low cycles in production have changed approximately 33-fold (based on 40 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, 38% of the observed runs were within the range, 33% were below, and 29% were above. Returns of age-4 fish in even-numbered years are typically 15% less than odd-numbered years. Sibling relationships for this stock are weak. The major contributor to the 2020 fall chum salmon run is anticipated to be age-4 fish returning from the 2016 parent year. The escapement in 2015 was within the drainagewide escapement goal range, whereas escapement in 2016 exceeded the upper end of the goal range. Productivity was at its lowest in 2005. The next peak was the 2009 brood year (2.47 R/S), which was followed by a 2011 brood year that was below replacement (0.76 R/S)—showing yet another wide swing in production. The most recent peak was from the 2013 brood year (2.63 R/S) which is ranked the fourth highest on record. Production from 2013 was well above replacement and is 1 of the 2 escapements over 800,000 that resulted in any yield. The forecasted run in 2020 is predicting a lower than average (1.22 R/S) age-4 component from parent year 2016. Based on the 2 primary

parent years, the forecast is for an average (1974–2018) return in 2020. The forecasted run size of 936,000 fall chum salmon would provide for a commercial harvest of approximately 386,000 fish based on the current management plan.

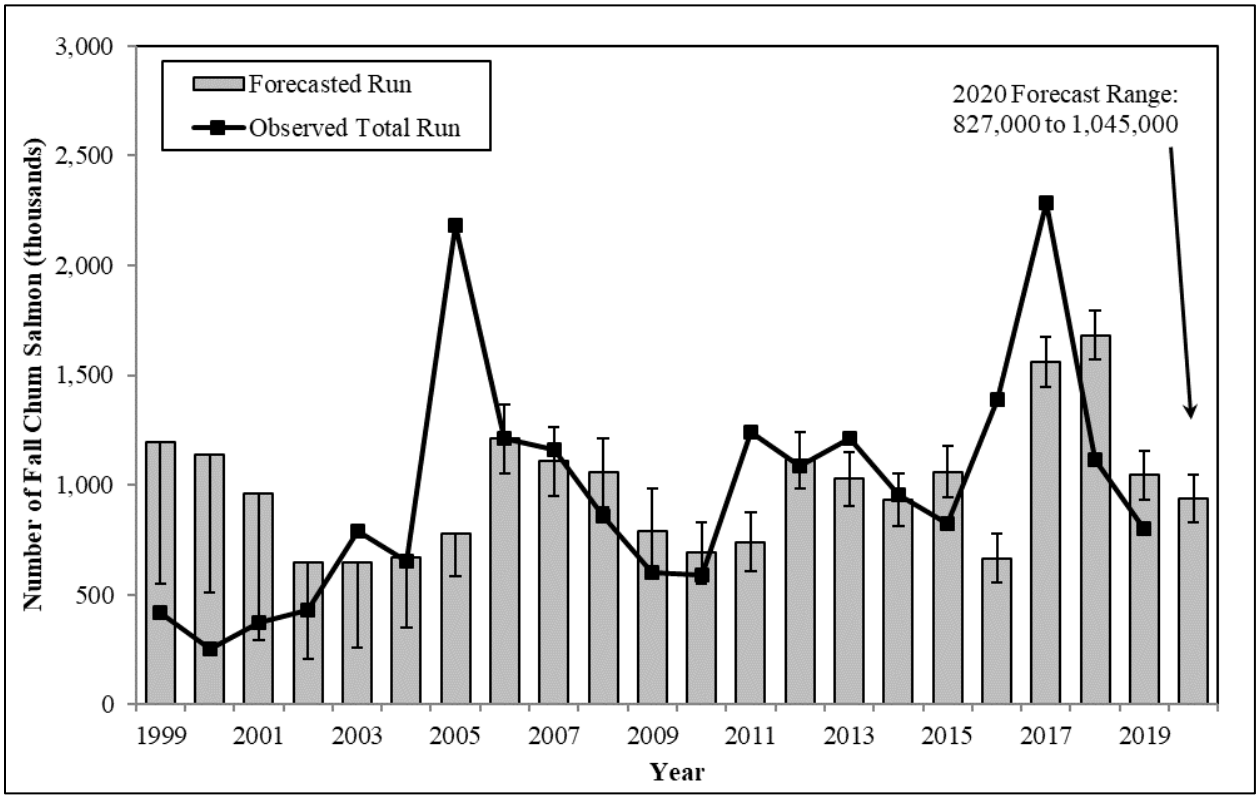

Figure 10.–Observed total run of fall chum salmon compared to the spawner-recruit estimates used in the annual forecast, Yukon River, 1999–2019.

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

Forecasts by Bonnie Borba, Yukon Area Fall Season Research Project Leader, Fairbanks.

WESTWARD REGION

KODIAK MANAGEMENT AREA

Pink Salmon

The 2020 Kodiak Management Area (KMA) predicted pink salmon harvest is expected to be in the *Average* category with a point estimate of 12.2 million fish combining the wild stock and Kitoi Bay Hatchery harvest estimates (Table 21). Harvest categories were delimited from the 20th, 40th, 60th, and 80th percentiles of historical commercial harvest in the KMA from 1978 to 2019.

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 fish). The total run estimates were derived from a combination of the Karluk and Ayakulik rivers' weir count, aerial survey index, and harvest estimates.

The 2020 KMA wild stock pink salmon forecast (Table 22) was based on a simple linear regression model using environmental indices, mean district escapement, and previous year (lag-1) return fit to the even-year KMA returns from 1980 to 2018. The regression model utilizes a composite created from a series of forecast indices affecting pink salmon returns. Environmental 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. In addition, mean KMA district pink salmon escapement and the total KMA previous year pink salmon return total run correlation anomalies were used. A composite was constructed using all variables and regressed against total return; environmental indices, escapement, and previous year return were equally weighted in the composite.

Table 21.–The 2020 Kodiak Management Area predicted pink salmon harvest categories.

KMA harvest category	Range (millions)	Percentile
Poor	Fewer than 7.2	Less than 20th
Weak	7.2 to 11.0	21st to 40th
Average	11.0 to 16.7	41st to 60th
Strong	16.7 to 27.1	61st to 80th
Excellent	Greater than 27.1	81st to 100th

Table 22.–Preliminary forecast of the 2020 Kodiak Management Area pink salmon run.

Total production	Forecast estimate (millions)	Forecast range (millions)
KMA Wild Stock Total Run	14.9	8.3–21.6
KMA Escapement Goal[a]	5.0	
KMA Wild Stock Harvest	9.944	3.3–16.6
Kitoi Bay Hatchery Harvest[b]	2.3	1.6–3.0
Total KMA Pink Salmon Harvest	12.2	4.9–19.6

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

[a] The 2020 estimated escapement is within the range of the even-year aggregate escapement goals for the Kodiak Archipelago (3.0–7.0 million) and the Mainland District (250,000–1.0 million).

[b] This figure is the total expected return (2.8 million) minus the broodstock collection goal of 430,000 fish; the Kitoi Bay Hatchery has yet to determine cost-recovery goals (if any) for 2020.

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. The range was estimated as the overall 80% prediction intervals of the regression model.

The 2020 Kitoi Bay Hatchery pink salmon forecast was prepared by evaluating pink salmon survivals from even brood years 1995 through 2017 when releases from the facility were in excess of 100 million fry (excludes 2016). These brood years 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 which 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 2020 relates to this 4-year cyclical return which is below average and is the weaker of the 2 even-year cycles. The midpoint estimate of 2.8 million reflects a marine survival of 1.9% for the 145 million fry released (1.12 g), above the traditional target size (0.8 g). The average survival was calculated using the last 4-year cyclical returns (parent class 2002, 2006, 2010, and 2014). The range was calculated as ±25% of the predicted marine survival.

Forecast Discussion: The 2020 KMA wild stock pink salmon total run (14.9 million) is predicted to be an *Average* return but greater in magnitude than the previous even-year returns since 2012 (Figure 11). The environmental index predictor is the strongest in the even-year cycle (since 2004), suggesting early life history conditions correlated with strong returns. Mean district escapement was close to average but strong in the Southwest Kodiak and Alitak districts. Average escapement in the KMA in 2018 is tempered by the very large pink salmon return in 2019, which tends to be negatively correlated to the following year return.

The 2020 Kitoi Bay Hatchery pink salmon production is expected to be 2.8 million fish (Figure 12). The brood stock collection goal is 425,000 fish, resulting in a total hatchery harvest projection of about 2.3 million fish. There will be no cost-recovery fishery in 2020.

Confidence in the 2020 forecast estimate is 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. This forecast level will allow an initial weekly fishing period length of 81 hours (3½ days) for most of the KMA during the initial general pink salmon fisheries (beginning July 6, 2020). Harvests during the initial period provide important data to assess run strength, and subsequent fishing periods will be adjusted by section and district to ensure escapement goals will be met.

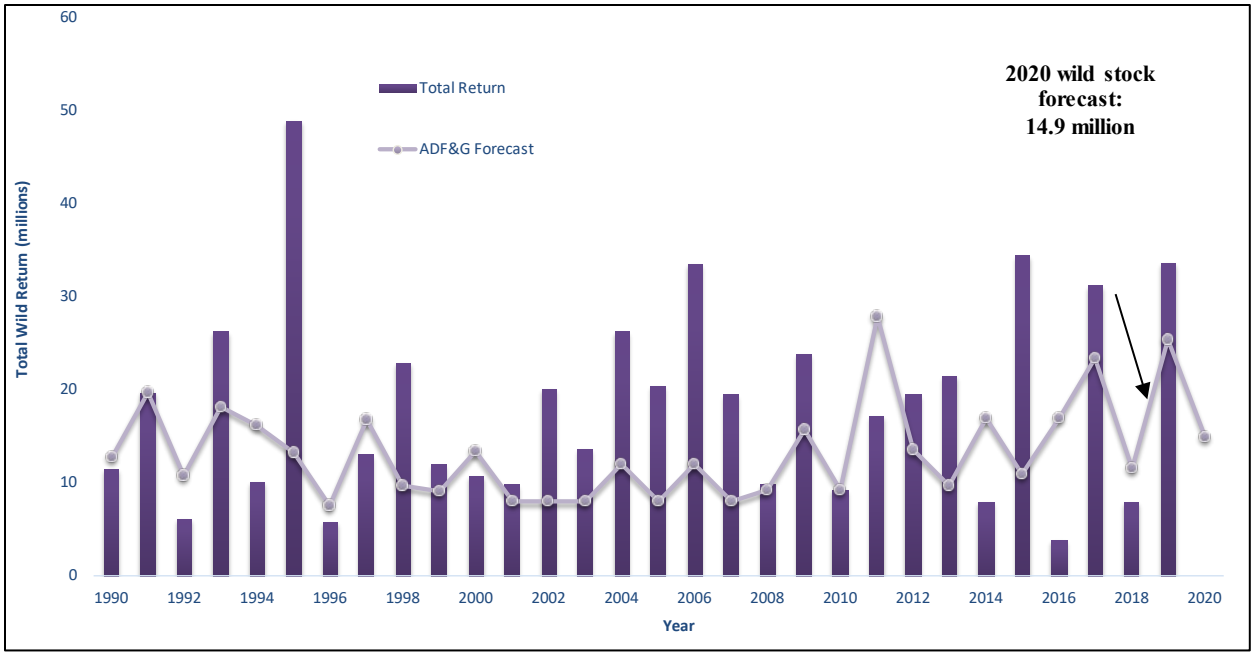

Figure 11.–Kodiak pink salmon wild stock total return compared to ADF&G forecasts, 1990 to 2019, and 2020 forecast.

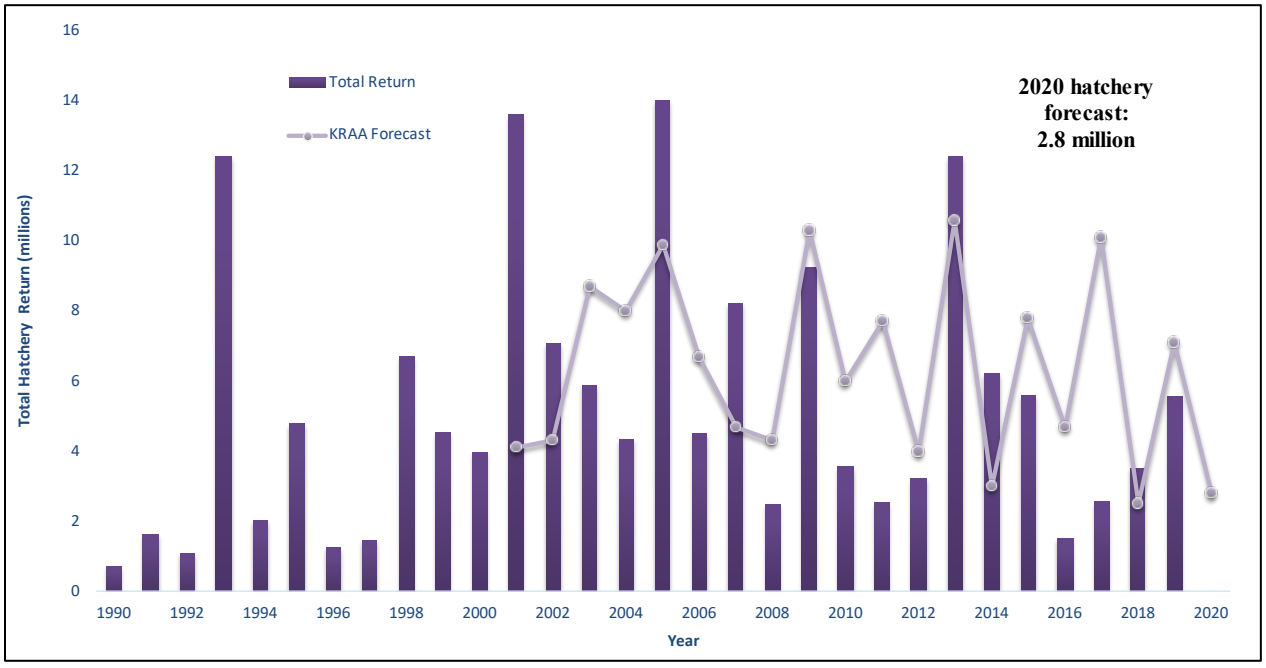

Figure 12.–Kitoi Bay hatchery pink salmon total return compared to KRAA forecasts, 1990 to 2019, and 2020 forecast.

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

Ayakulik River

Sockeye Salmon

Forecast Methods: The 2020 Ayakulik River sockeye salmon forecast (Table 23) was prepared primarily by investigating simple linear regression models utilizing recent outmigration year 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.

Table 23.–Preliminary forecast of the 2020 Ayalulik River sockeye salmon run.

Total production	Forecast estimate (thousands)	Forecast range (thousands)
Total run estimate	375	196–622
Escapement goal[a]	300	200–400
Harvest estimate	75	

[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).

The age-.2 sockeye salmon were predicted from prior year age-.1 returns using outmigration years (1997–2017). Age-1.3 sockeye salmon were predicted from prior year age-1.2 returns using outmigration years (1998–2017). Age-.1 and all other age classes were predicted by the median return since 1999. Regression and median estimates were summed to estimate the total Ayakulik River sockeye salmon run for 2020. The range was estimated as the sum of the individual 80% prediction intervals.

Forecast Discussion: The 2020 forecast of 375,000 sockeye salmon is about 205,000 fewer fish than the actual 2019 run estimate of approximately 580,000 fish, and about 146,000 fewer fish than the most recent 10-year average of approximately 522,000 fish (Table 23). The 2020 run is estimated to be composed of approximately 50% age-.2 fish and 45% age-.3 fish. Since 2000, Ayakulik River sockeye salmon have shown an increasing tendency to spend only 1 year rearing in Red Lake; resulting returns have been demonstrating increasing proportions of age-1.2 and age-1.3 fish. With a major shift in life history such as this, forecasting could become more difficult. Thus, confidence in the 2020 Ayakulik forecast is only fair. The projected harvest of 75,000 fish is based on the achievement of the midpoint of the combined escapement goal ranges (300,000 fish). Ayakulik River is managed based on both early- and late-run (after July 15) components. Based on brood year escapement proportions from what will be the major contributing brood years (2014–2016), approximately 70% of the total run will occur in the early portion of the run.

Forecast by M. Birch Foster, Finfish Research Biologist, Westward Region.

Karluk River

Sockeye Salmon

Forecast Methods: The 2020 Karluk River sockeye salmon forecast (Table 24) was prepared primarily by investigating escapement, sibling age class relationships, moving average, and exponential smoothing methods.

Table 24.–Preliminary forecast of the 2020 Karluk River sockeye salmon run.

Total production		Forecast estimate (thousands)	Forecast range (thousands)
Early run	Total run estimate	274	56–489
	Escapement goal[a]	200	150–250
	Harvest estimate	74	
Late run	Total run estimate	849	507–1,317
	Escapement goal[a]	325	200–450
	Harvest estimate	524	
Total Karluk River System	Total run estimate	1,123	564–1,806
	Escapement goal[a]	525	350–700
	Harvest estimate	598	

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

[a] Escapement estimates are based on midpoints for the early-run and late-run escapement goals and summed for the total run.

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 been a good prognosticator of the near future at Karluk River. Utilizing sibling age class relationships and regression models has been the preferred method since 1994. An exponential smoothing model was also fit to recent-year early- and late-run total returns. Parameter estimates (early run $\alpha = 0.83$; and late run $\alpha = 0.65$) placed heavy weight on recent returns and outperformed 2-, 3-, and 5-year moving averages. However, the sibling age class forecasts for the early, late, and total outperformed the exponential smoothing model hindcast estimates (1994 to present) in terms of MSE. Therefore, the sibling age class methods were used for the 2020 forecast.

For the early run, age-.2 sockeye salmon returns were predicted based on the abundance of the prior-year return of age-.1 fish using outmigration years (2005–2017). Age-.3 sockeye salmon returns were predicted based on the abundance of the prior-year return of age-.2 fish using recent outmigration years (2005–2016). The age-.1 and -.4 return predictions were calculated using their pooled 10-year median contribution.

For the late run, age-.2 sockeye salmon returns were predicted based on the abundance of the prior-year return of age-2.1 and age-1.2 fish using recent outmigration years (2004–2017). The age-.1, age-.3, and age-.4 return predictions were calculated using their pooled 10-year median contribution.

Regression and median estimates were summed to estimate the total Karluk sockeye salmon run for 2020. The range was estimated as the overall 80% prediction intervals. The combined early- and late-run 80% prediction interval was calculated by summing the lower prediction bounds and upper prediction bounds of the 2 runs.

Forecast Discussion: The total 2020 sockeye salmon run to the Karluk River is expected to be approximately 1,123,000 fish. The early run is expected to be approximately 274,000 fish, which is about 7,000 fewer fish than the recent 10-year average (281,000 fish) and 31,000 more fish than 2019 run (243,000 fish). The late run is expected to be approximately 849,000 fish, which is 81,000 more fish than the recent 10-year average (768,000 fish) and 113,000 more fish than the 2019 run (736,000 fish; Table 24). In comparison to the sibling age class forecast, the combined exponential smoothing estimates for the early and late runs is 30,000 fewer fish (1,092,000).

The projected harvest estimate for the early run (74,000 fish) is based on achievement of the midpoint of the early-run escapement goal. The projected harvest estimate for the late run (524,000 fish) 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 2014, age-.3 fish should be quite abundant. The overall confidence in the Karluk sockeye salmon forecast is fair.

Alitak District (Frazer Lake and Upper Station)

Sockeye Salmon

Forecast Methods: The 2020 sockeye salmon run to the Alitak District (Table 25) 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.

Table 25.–Preliminary forecast of the 2020 Alitak District sockeye salmon run.

Total production		Forecast estimate (thousands)	Forecast range (thousands)
Early Upper Station	Total run estimate	80	49–130
	Escapement goal[a]	65	43–93
	Harvest estimate[b]	15	
Late Upper Station	Total run estimate	263	148–396
	Escapement goal	186	120–265
	Harvest estimate[b]	77	
Frazer Lake	Total run estimate	407	238–707
	Escapement goal[c]	137	95–190
	Harvest estimate[b]	270	
Total Alitak District	Total run estimate	750	435–1,233
	Escapement goal	388	258–548
	Harvest estimate[b]	362	

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 fish in 2017; the Upper Station early run is now managed for a biological escapement goal (BEG) of 43,000–93,000 fish.

[b] 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 fish, which is the 20-year median of the number of fish that escape the Dog Salmon weir but do not ascend the Frazer Lake fish pass.

Upper Station early-run age-.2 fish were forecasted using prior year age-.1 returns (outmigration years 2003–2018), 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 2017. Upper Station late-run age-.2 and log-transformed age-.3 returns

were each predicted using their respective prior year age-.1 (late-run outmigration years 1998–2018) and age-.2 returns (late-run outmigration years 1999–2017). 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 Lake age-.2 fish were predicted using log-transformed prior year age-.1 returns (outmigration years 2003–2018). Frazer Lake age-2.3 fish were predicted using prior year age-2.2 returns (outmigration years 2000–2014). Frazer Lake 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 2020. The combined Alitak District prediction interval was calculated by summing the lower and upper prediction bounds of the 3 runs.

Forecast Discussion: The 2020 sockeye salmon run to the Alitak District is expected to be approximately 750,000 fish, approximately 143,000 more fish than the recent 10-year average run (608,000 fish) and 79,000 more fish than the 2019 run (672,000 fish). The Upper Station early run is expected to be approximately 80,000 fish, which is greater than the recent 10-year average run (64,000 fish). The Upper Station late run is expected to be approximately 263,000 fish, which is greater than the recent 10-year average run (220,000 fish). The Frazer Lake run is expected to be approximately 407,000 fish, which is greater than the recent 10-year average (324,000 fish; Table 25). The 2020 Alitak District sockeye salmon run should be composed of approximately 76% age-.2, 18% age-.3, and 6% age-.1 fish. Overall, our confidence in the forecast is fair based on the strength of the regression models and the large prediction intervals.

The projected harvest estimate of 362,000 fish 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 fish (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 Lake run. S_{MSY} is an estimate of the escapement that has the largest expectation of subsequent surplus production.

Forecast by Heather Finkle, Finfish Research Biologists, Kodiak.

Spiridon Lake

Sockeye Salmon

Forecast Methods: The 2020 Spiridon Lake sockeye salmon forecast (Table 26) is estimated by multiplying the estimated number of smolt released for both net pen and lake combined, by the mean smolt-to-adult survival proportions by ocean age and mean return by age proportion of each age class for completed brood years 2002–2011. The Spiridon Lake and Telrod Cove range estimates the 95% CI created using the Goodman's variance equation (1960).

Table 26.–Preliminary Forecast of the 2020 Spiridon Lake sockeye salmon run.

Total production	Forecast estimate (thousands)	Forecast range (thousands)
Total run estimate	115	18–213
Spiridon	53	11–96
Telrod Cove net pen	62	7–117
Escapement goal	0	

Forecast Discussion: Sockeye salmon are prevented from returning to Spiridon Lake because barrier falls block upstream migrations in the outlet creek (Telrod Creek). Therefore, all returning adult sockeye salmon are available for harvest, primarily in the Central Section of the Northwest Kodiak District and in the Spiridon Bay SHA in Telrod Cove. The point estimate forecast of 115,000 fish in 2020 (Table 26) is fewer than the 2019 forecast (206,000 fish). A trend recently discovered a significant increase in harvest of sockeye salmon bound for Telrod Cove during common property fishing within the Spiridon Bay Section (254-41). Production estimates now incorporate the combined harvests of Spiridon Bay and Telrod Cove sections to better approximate the run strength and total enhancement production.

The majority of the 2020 run will likely be composed of 2 major age classes: age-1.3 fish (58%) and age-1.2 fish (36%). All other age classes will make up the remaining 6% of the run estimate. If realized, this run will be about 119,000 fewer fish than the recent 10-year average (2010–2019) run of 234,000 fish. The peak of the Spiridon Lake sockeye salmon run timing through the Westside fishery is typically in early to mid-July.

The 2020 season will mark the seventh year of adult returns to Telrod Cove originating from net pen releases. Of the returning fish to Telrod Cove in 2020, age-1.1, -1.2, -1.3, -1.4 sockeye salmon will be apportioned between lake and net pen production through evaluation of differential otolith marks created during hatchery incubation.

Forecast by Nate Weber, Research and Monitoring Manager, KRAA.

CHIGNIK AREA

Sockeye Salmon

Forecast Methods: Simple linear regressions models using age class relationships were used to forecast the 2020 early and late Chignik sockeye salmon runs (Table 27).

Table 27.–Preliminary Forecast of the 2020 Chignik area sockeye salmon run.

Total production		Forecast estimate (thousands)	Forecast range (thousands)
Early run (Black Lake)	Total run estimate	501	226–1,110
	Escapement goal[a]	400	350–450
	Harvest estimate	101	
Late run (Chignik Lake)	Total run estimate	795	281–1,482
	Escapement goal[a]	310	220–400
	Harvest estimate	485	
Total Chignik system	Total run estimate	1,296	507–2,591
	Harvest estimate[b]	586	
	Chignik Area	586	
	SEDM Area	0	
	Cape Igvak Section	0	

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 20,000 sockeye salmon is added to the lower bound of the late-run escapement goal.

[b] A harvestable surplus of Chignik River system sockeye salmon is forecast to be below 600,000 fish in the Chignik Area; therefore, as outlined in regulations 5 AAC 09.360 and 5 AAC 18.360, no commercial fisheries are anticipated in the Southeastern District Mainland and Cape Igvak during the regulatory timeframe through July 25, thus the harvest of Chignik-bound sockeye salmon in those areas is expected to be zero.

Each regression model was assessed with standard regression diagnostic procedures. Data were log transformed to address nonnormality or unequal variance. 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 log-transformed 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 returns predicted age-.3 returns using data from the 2000 outmigration year to the present. Prior year log-transformed age-.1 early- and late-run returns were combined to predict log-transformed 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 2020. The combined early- and late-run 80% prediction interval was calculated by summing the lower and upper prediction bounds of the 2 runs.

Forecast Discussion: The 2020 Chignik sockeye salmon early run is forecasted to be 501,000 fish, which is 790,000 fewer fish than the 10-year average run of 1.29 million and almost 140,000 fish more than the 2019 early run of 361,000. The early run is predicted to be composed of approximately 72% age-.3 and 27% age-.2 fish. The late run is forecasted to be 795,000 fish, which is approximately 216,000 fewer fish than the 10-year average run of 1.01 million fish and 165,000 fewer fish than the 2019 late run of 960,000 fish (Table 27). The 2020 late run is predicted to be composed of approximately 65% age-.3, 34% age-.2, and 1% age-.1 and age-.4 fish. The 2020 total Chignik sockeye salmon run is expected to be 1.30 million fish, which is approximately 1.01 million fewer fish than the 10-year average of 2.30 million fish, and roughly 25,000 fewer fish than the 2019 total run of 1.32 million fish.

The projected 2020 early-run total harvest estimate of 101,000 fish is based on achievement of the midpoint of the early-run escapement goal range. The projected late-run harvest estimate of 485,000 fish is based on achieving the midpoint (310,000 fish) of the late-run goal, which includes the inriver run goal of 20,000 fish added to the lower bound (200,000 fish) of the escapement goal. For 2020, it is projected that sockeye salmon harvests for both early and late runs in the Chignik Management Area will not exceed a 600,000 fish surplus beyond escapement goals and, by regulation, preclude commercial fisheries from harvesting Chignik-bound fish in the Cape Igvak Section of the KMA and in the SEDM of the Alaska Peninsula Management Area during the regulatory period through July 25.

The wide confidence intervals around the point estimate of the 2020 forecasts reflect the uncertainty inherent in the forecast models. Given the sibling relationships used for forecasting both runs and the poor 2019 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.

Forecast by Heather Finkle, Finfish Research Biologist, Westward Region.

ALASKA PENINSULA/ALEUTIAN ISLANDS AREA

Bear Lake

Sockeye Salmon

Forecast Methods: The 2020 forecast of the Bear Lake sockeye salmon late run (Table 28) 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.

Bear Lake (Late Run)

Table 28.–Preliminary forecast of the 2020 Bear Lake (late run) sockeye salmon run.

Total production	Forecast estimate (thousands)	Forecast range (thousands)
Total run estimate	408	106–706
Escapement goal[a]	156	117–195
Harvest estimate	252	

[a] The escapement estimate is the midpoint of the escapement goal range (117,000–195,000) in 2019.

Age-.3 sockeye salmon were predicted from prior year age-.2 returns from outmigration years 1990 to present. 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 2020. The range was estimated as the sum of the 80% prediction intervals and 10th and 90th percentiles intervals for each age class forecasted.

Forecast Discussion: The 2020 Bear Lake late-run forecast of 408,000 sockeye salmon is 8,000 fish more than the 10-year average of approximately 400,000 fish, and 41,000 fewer fish than the 2019 run of 449,000 fish. The 2020 late run is expected to be composed of 3% age-.1, 63% age-.2, and 34% age-.3 fish. The projected harvest of 252,000 fish is based on achieving the midpoint of the late-run escapement goal range (156,000 fish) and adequate run strength. 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 made up 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.

Forecast by Sarah Power, Biometrician, Juneau.

Nelson River

Sockeye Salmon

Forecast Methods: The 2020 Nelson River sockeye salmon run (Table 29) was forecasted using simple linear regression of ocean age class and parental escapement data from the past 19 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.

Table 29.–Preliminary forecast of the 2020 Nelson River sockeye salmon run.

Total production	Forecast estimate (thousands)	Forecast range (thousands)
Total run estimate	362	154–567
Escapement goal[a]	158	97–219
Harvest estimate	204	

[a] The escapement estimate is the midpoint of the escapement goal range (97,000–219,000) in 2020.

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 2000 to 2014. 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 2020. The range was estimated as an overall 80% prediction interval and calculated from the sum of the 80% prediction intervals for each age class forecasted.

Forecast Discussion: The 2020 Nelson River forecast of 362,000 sockeye salmon is about 37,000 fewer fish than the most recent 10-year average (2010–2019) of 399,000 fish, and is approximately 164,000 fish more than the 2019 run of about 199,000 fish (Table 29). The 2020 run should be composed mainly of age-.2 (67%) and -.3 (29%) fish. The projected harvest of 204,000 fish is based on achieving the midpoint (158,000 fish) of the escapement goal range.

Other models were considered such as simple exponential smoothing, naïve, and other time series models involving trends; however, the regression predicting age-.2 sockeye salmon from parental escapement performed better. Despite this, the Nelson River sockeye salmon run has been notoriously unpredictable. Therefore, confidence in this forecast is fair.

Forecast by Sarah Power, Biometrician, Juneau; and Heather Finkle, Finfish Research Biologist, Westward Region.

South Alaska Peninsula Aggregate

Pink Salmon

The 2020 South Alaska Peninsula pink salmon harvest is expected to be in the *poor* category with a point estimate of 450,000 (fewer than 2.0 million) fish (Table 30). Harvest categories were calculated from the 20th, 40th, 60th, and 80th percentiles of historical post-June commercial harvest on the South Alaska Peninsula from 1980 to 2019 (Table 31).

Table 30.–Preliminary forecast of the 2020 South Alaska Peninsula aggregate pink salmon run.

Total production	Forecast estimate (millions)	Forecast range (millions)
Total run estimate[a]	2.20	0–7.8
Escapement goal[b]	1.75	1.75–4.0
Post-June harvest estimate	0.45	0–3.8

[a] Post-June harvest and escapement.

[b] The escapement estimate is the minimum of the aggregate goal range (1.75–4.0 million) in 2020.

Table 31.–The 2020 South Alaska Peninsula pink salmon harvest categories, calculated from the 20th, 40th, 60th, and 80th percentiles of historical post-June commercial harvest on the South Alaska Peninsula from 1980 to 2019.

South Peninsula harvest category	Range (millions)	Percentile
Poor	Fewer than 2.0	Less than 20th
Weak	2.0 to 4.2	20th to 40th
Average	4.2 to 6.7	40th to 60th
Strong	6.7 to 9.3	60th to 80th
Excellent	Greater than 9.3	80th to 100th

Forecast Methods: The 2020 South Alaska Peninsula pink salmon harvest forecast is derived from a total run forecast minus the minimum (1.75 million fish) of the combined even- and odd-year South Alaska Peninsula escapement goal range. The total run was forecasted with a simple exponential smoothing model fit to even-year South Alaska Peninsula pink salmon returns from 1964 through 2018.

Forecast Discussion: June harvest of pink salmon has been omitted from the South Alaska Peninsula aggregate pink salmon forecast due to the variability of pink salmon harvest that occurs during the June fishery, and the origin of these fish are unknown. The 5-year even-year average harvest of pink salmon in June is 726,000 fish.

The 2020 South Alaska Peninsula pink salmon post-June harvest (450,000 fish) is predicted to be poor due to the low return that occurred in 2018. The pink salmon escapement estimate of 732,000 fish was below the minimum escapement goal of 1.75 million fish and below the 5-year even-year average of 867,000 fish. The weather during the 2018 season was exceptionally poor for aerial surveys, and many streams were surveyed only once during the season. Due to overall reduced survey time, the peak of the run may not have been captured; however, the total run in 2018 was still estimated to be low.

The pink salmon that returned in 2018 had ample rainfall to facilitate escapement and provide adequate spawning habitat; however, ocean conditions encountered by the fish returning in 2020 are unknown. This year's forecasting model does not take into consideration environmental factors. Changing ocean conditions and recent years' average temperatures have been outside the ranges in the historical dataset; therefore, the predictive power has been diminished for formerly used forecasting methods that used environmental data.

The 2020 forecast utilizes a simple exponential smoothing model, which is a time series forecasting method without additional parameters to account for underlying trends. Models that accounted for underlying trends did not improve the forecast so were not used. Accounting for uncertainty in changing environmental conditions and the model, confidence in the forecast is fair.

Forecast by Cassandra Whiteside, Alaska Peninsula–Aleutian Islands Assistant Area Management Biologist; and Sarah Power, Biometrician, Juneau.

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