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Preliminary Harvest Rates of Western Alaska and Alaska Peninsula Chum Salmon Stocks in South Alaska Peninsula Fisheries, 2022

by

Alaska Department of Fish and Game Staff

February 2023

Alaska Department of Fish and Game **Division of Commercial Fisheries**

Symbols and Abbreviations

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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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PRELIMINARY HARVEST RATES OF WESTERN ALASKA AND ALASKA PENINSULA CHUM SALMON STOCKS IN SOUTH ALASKA PENINSULA FISHERIES, 2022

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ABSTRACT

This document provides preliminary harvest rate estimates of western Alaska and Alaska Peninsula stocks in the 2022 South Alaska Peninsula commercial fisheries. The methods used in the Western Alaska Salmon Stock Identification Program (WASSIP) study were followed as closely as possible and deviations are described. These results supplement previous studies and may be useful to inform fishery management and the regulatory process.

Keywords: South Alaska Peninsula, commercial fisheries, chum salmon, *Oncorhynchus keta*, harvest rate

INTRODUCTION

The South Alaska Peninsula commercial salmon fishery occurs in the Alaska Peninsula Management Area and harvests a mixture of local and non-local stocks. Information about the mixed stock nature of these harvests has been the impetus for several historical studies to investigate the relative composition of these harvests (reviewed in Munro et al. 2012). The most recent and comprehensive study was the Western Alaska Salmon Stock Identification Program (WASSIP), which was a multiyear joint effort by the Department of Fish and Game (ADF&G) and 11 stakeholder groups with integrated external scientific review. During this study, chum salmon *Oncorhynchus keta* harvests in Western Alaska and the Alaska Peninsula during the 2007–2009 fishing seasons were sampled and analyzed (DeCovich et al. 2012; Eggers et al. 2011). This study remains the most complete assessment of fisheries in this area and provides context, and a robust set of methods, to apply to subsequent stock composition studies and the estimation of harvest and harvest rates.

Here we present preliminary harvest rate estimates of western Alaska and Alaska Peninsula stocks in the 2022 South Alaska Peninsula commercial fisheries. When possible, we have followed the methods used in the WASSIP study, especially those used for the estimation of escapement by reporting group (Eggers et al. 2012), estimating stock-specific harvest in fisheries, and estimating stock-specific harvest rates (Munro et al. 2012). These methods were reviewed and approved during the WASSIP study by an Advisory Panel of 11 stakeholder groups and a Technical Committee of 4 non-ADF&G scientists. When WASSIP methods could not be applied because of changes in assessment of harvest or escapement, we used the most similar method possible.

The results presented here are preliminary estimates of stock-specific harvest rates on Western Alaska and the Alaska Peninsula chum salmon reporting groups in South Alaska Peninsula commercial fisheries. These results supplement previous studies and may be useful to inform fishery management and the regulatory process.

METHODS

Following the methods used in WASSIP, we apply a statistical approach for estimating the total run to each stock (i.e., reporting group per terminology used in WASSIP). Once the total run for each stock has been estimated, we estimate stock-specific harvest rates within Alaska Peninsula fisheries using the stock-specific harvest estimates from Dann et al. (2023).

TOTAL RUN

The key elements necessary to calculate the total run for each reporting group for a given year are estimates (and associated uncertainty) of each run component for the reporting group. These stock-specific run components are: 1) the terminal harvest, 2) the harvest in Western Alaska and South Peninsula commercial and subsistence fisheries, and 3) the escapement.

As in WASSIP, the uncertainty in each component of the model was modeled as a lognormal random variable (*cf.* Munro et al. 2012).

STOCK-SPECIFIC HARVEST OF CHUM SALMON

The first component necessary to calculate harvest rates is an estimate of the total harvest of a stock in the fisheries it encountered prior to being counted as escapement.

To estimate stock-specific total runs for 2022, stock-specific estimates of harvests in commercial and subsistence fisheries in Western Alaska were needed. Only South Peninsula fisheries were sampled for genetics in 2022 (Dann et al. 2023), and those estimates are used in these analyses. For other fisheries (hereafter referred to as non-sampled fisheries), we relied upon the fisheries sampling design of WASSIP (Eggers et al. 2011) and the associated stock composition estimates or assumed stock composition estimates (as agreed to in the WASSIP process) to estimate the harvest by reporting group in 2022 (see Tables 1–8). Deviations from WASSIP methods are noted below.

Spatial and Temporal Strata

Spatial (fishery) and temporal strata for chum salmon harvests were generated to align with the spatial and temporal strata of the WASSIP sampling plan. Because start and end dates of temporal strata varied slightly among WASSIP sampling years, start and end dates were selected to best match the dates of the same stratum from WASSIP and minimize overlap with adjacent temporal strata.

Proxy stock compositions

Stock compositions of the harvest during WASSIP were estimated using Bayesian mixed stock analysis. Posterior stock composition estimates from these analyses were selected to serve as proxy stock composition estimates for chum salmon harvested in fisheries that were not sampled for each of the time and area strata during the 2022 study. Typically, there were 1 to 3 stock composition estimates from WASSIP (3 years) for a given matching stratum. If only a single stock composition estimate was available, it was assumed that it was sufficient to represent the stock composition of the harvest in 2022. If two or more stock compositions were available (i.e., from 2007, 2008, or 2009), the mixture posteriors were combined to create a single weighted average proxy stock composition. This was the same method used in Munro et al. (2012) for harvests that did not have an associated stock composition estimate. A major difference between WASSIP and this analysis, however, is that in WASSIP, proxy stock compositions were based on data from adjacent temporal strata or data from within the 3 consecutive years of WASSIP (2007–2009). By necessity, this analysis uses stock composition estimates from over a decade prior to the 2022 harvests to which they are being applied, in contrast to the South Peninsula fisheries which were sampled in 2022. A major assumption is that the stock compositions in fisheries from 13–15 years ago are sufficiently representative of the fisheries in 2022, despite changes in the absolute and relative abundance of chum salmon stocks, changes in the marine and freshwater environments, and changes in fisheries (e.g., regulation changes, fishery closures, etc.).

Mixture posteriors used in Munro et al. (2012) were composed of 100,000 iterations (final 20,000 iterations of 5 chains) as compared to mixture posteriors generated for Dann et al. (2023) which were composed of 2,000 iterations thinned from the final 20,000 of 25,000 iterations of a single chain. Therefore, it was necessary to thin the individual mixture posteriors from WASSIP by every

fiftieth (50) iteration to 2,000 iterations, after which they were combined as described above to add the component parts for total run calculations.

Following the methods in Munro et al. (2012), some strata were assumed to be 100% comprised of a single reporting group with a CV of 0.00; therefore, mixture posteriors were generated for each reporting group with the proportion set to 1 for a given reporting group and zero for all others.

Stock-specific Harvest

Following the methods of Munro et al. (2012), 2,000 harvest estimates for each stratum were sampled from a lognormal distribution with a mean equal to the harvest and a specified CV of 0.05 for commercial harvests other than Bristol Bay, which had a CV of 0.1. The specified CV for subsistence harvests was set to 0.1. Each harvest sample was multiplied by the associated proxy stock composition posterior for a given stratum to generate reporting group-specific harvest posteriors. These posteriors were then summed across all strata to generate an overall stock-specific harvest posterior. This posterior was summarized to produce stock-specific summary statistics for commercial and subsistence chum salmon harvests in 2022.

Commercial Harvest by Area and Fishery

Chignik/Kodiak

Details of the commercial chum salmon harvest and proxy stock compositions applied to the Chignik Management Area harvest are provided in Table 1. When available, stock compositions from 2007 to 2009 were used. When stock composition estimates were not available (i.e., late season catches), it was assumed that harvest was 100% from the Chignik/Kodiak reporting group with a CV of 0.00, following the procedures of Munro et al. (2012). Harvest in the Kodiak Management Area was not included in the reporting group harvest estimate or total run estimate. Kodiak harvest was not included during WASSIP, as harvest from outside of the WASSIP area were not included in harvest, total run, or harvest rate estimates based on agreement of the WASSIP Advisory Panel (Munro et al. 2012).

South Peninsula

Details of the reporting group-specific harvest estimates for South Peninsula commercial chum salmon fisheries can be found in Dann et al. (2023).

North Peninsula

Details of the commercial chum salmon harvest and proxy stock compositions applied to the North Peninsula fisheries harvest are provided in Table 2. When available, stock compositions from 2007–2009 were used. When stock composition estimates were not available (i.e., late season catches Northern District fisheries), it was assumed that harvest was 100% from the Northern District reporting group with a CV of 0.00, following the procedures of WASSIP (Munro et al 2012). As with Munro et al. (2012), terminal harvests in the Northern and Northwestern Districts were estimated and it was assumed these harvests were 100% Northern District or 100% Northwestern District stocks.

Bristol Bay

Details of the commercial chum salmon harvest and proxy stock compositions applied to the Bristol Bay fisheries harvest are provided in Table 3. The fishing season was divided into 5 temporal strata similar to the sampling plan in Eggers et al. (2011). Stock compositions from 2007

to 2009 were used and temporal strata dates for 2022 were approximated to best match temporal strata from 2007 to 2009, which varied.

Kuskokwim Area

Details of the commercial chum salmon harvest and proxy stock compositions applied to the harvest Kuskokwim Area harvest are provided in Table 4. Stock compositions from 2007 to 2009 were used and temporal strata for 2022 approximated to best match temporal strata from 2007 to 2009. Because there was no commercial harvest in 2022, proxy stock composition estimates were not required for this area.

Yukon-Northern Area Summer-Run

Details of the commercial summer-run chum salmon harvest and proxy stock compositions applied to the Yukon-Northern Area harvest are provided in Table 5. Temporal strata for 2022 were approximated to best match temporal strata from 2007 to 2009. Because there was no commercial harvest in 2022, proxy stock composition estimates were not required for this area.

Yukon-Northern Area Fall-Run

Details of the commercial fall-run chum salmon harvest and proxy stock compositions applied to the Yukon-Northern Area harvest are provided in Table 6. Temporal strata for 2022 were approximated to best match temporal strata from 2007 to 2009. Because there was no commercial harvest in 2022, proxy stock composition estimates were not required for this area.

Norton Sound-Kotzebue Area

Details of the commercial chum salmon harvest and proxy stock compositions applied to the Norton Sound-Kotzebue Area harvest are provided in Table 7. Stock compositions from 2007 to 2009 were used and temporal strata for 2022 approximated to best match temporal strata from 2007 to 2009.

When available, stock compositions from 2007 to 2009 were used. Stock composition estimates from WASSIP were not available to apply as proxies to the 2022 commercial harvest of chum salmon in Subdistrict 1 (Nome) or Subdistrict 4 (Norton Bay) because fisheries were closed in 2007–2009 and were not part of the WASSIP sampling plan. For Subdistrict 4, harvest was assumed to be 100% Coastal Western Alaska (CWAK) reporting group (CV = 0.00), and for Subdistrict 1, the stock composition estimate from the 2007 Subdistrict 1 subsistence harvest was used after consulting with area biologists and managers.

Subsistence Harvest (proxy)

Final estimates of subsistence harvest in 2022 will not be available until later in 2023; therefore, to account for all sources of harvest for the total run estimates, proxy subsistence harvests were used in this analysis. In future updates, final estimates of subsistence harvest will be used in total run and harvest rate calculations. The data used were provided by various regional and Subsistence Section staff and comprise a mix of preliminary 2022 survey estimates (Yukon Area), 2021 harvest estimates as a proxy for 2022 (Kuskokwim), and averages of prior years for the remainder (typically 2017–2021).

Estimates of subsistence harvest were collated for the same areas and fisheries as in Munro et al. (2012). Some subsistence fisheries were part of the WASSIP sampling plan and have stock composition estimates from samples collected during the program. Other subsistence fisheries

were not part of the sampling plan and stock composition was assumed to be 100% comprised of the local reporting group (*cf.* Munro et al. 2012). Table 8 provides a list of the proxy subsistence harvest by area used in this analysis as well as a description of the stock compositions used to estimate reporting group-specific harvests. A CV of 0.1 was assumed for all harvests following the convention in Munro et al. (2012), despite many of the estimates being averages. Because these are proxy estimates and will be updated with final estimates in future analyses, alternative CVs were not derived.

REPORTING GROUP-SPECIFIC ESCAPEMENT OF CHUM SALMON

Regional chum salmon escapements were estimated following the methods and process described in Eggers et al. (2012). The methods were applied as closely as possible, but because of changes in assessment projects and methods, modifications were necessary. Deviations from WASSIP (if required) are noted within each of the following subsections. Data in some cases are preliminary because final estimates of escapement or harvest upstream of assessment projects were not available at the time data were compiled for this analysis. In cases where final estimates were not available, either preliminary estimates or proxy estimates from previous years were used. These changes are noted below, and final escapement estimates will be updated in future analyses.

Chignik/Kodiak Reporting Group

Methods to estimate escapement of the Chignik/Kodiak reporting group followed the methods of Eggers et al. (2012). Aerial survey indexes, expanded regional escapement, and CV for 2022 are provided in Table 9. It should be noted here that escapement for Kodiak Management Area streams is included in the reporting groups estimate of total run, where the commercial harvest from Kodiak is not.

South Peninsula Reporting Group

Methods to estimate escapement of the South Peninsula reporting group followed the methods of Eggers et al. (2012). Aerial survey indexes, expanded regional escapement, and CV for 2022 are provided in Table 10.

Northwestern District and Northern District Reporting Groups of North Alaska Peninsula Area

Methods to estimate escapement of the Northwestern District and Northern District reporting groups followed the methods of Eggers et al. (2012). Aerial survey indexes, expanded regional escapements, and CV for 2022 are provided in Table 11.

Coastal Western Alaska Reporting Group

The CWAK reporting group consists of all chum salmon stocks in the Bristol Bay, Kuskokwim, and Norton Sound Management Areas, as well as the summer-run chum salmon stocks in the Yukon River. Escapement and escapement CV estimates are presented for the aggregate stocks of the CWAK reporting group in Table 12. Details on source of escapement and escapement CV estimates are provided by management area and for the summer-run chum salmon in the Yukon River in subsequent tables.

Bristol Bay Area Chum Salmon

Methods to estimate escapement in the Bristol Bay Area generally followed the methods of Eggers et al. (2012). As in Eggers et al., escapements to the river systems in the Bristol Bay districts were

estimated based on expanding the chum salmon catch by the appropriate sockeye salmon *O. nerka* harvest rate, which are assumed to be an appropriate proxy for chum salmon harvest rates (Table 13). The only deviation from Eggers et al. (2012) is that the methods for determining stock-specific harvest of sockeye salmon in Bristol Bay have changed dramatically since that analysis. The current method uses genetic stock composition and an age-based run reconstruction model (Cunningham et al. 2018; ADF&G staff, personal communication). This method uses genetics to reallocate harvest from all districts to their stock of origin. The previous catch allocation method assumed that all fish caught in a single-stock district originated from that district whereas catch in mixed stock districts (e.g., Naknek-Kvichak and Nushagak) was allocated to individual stocks using escapement proportions for individual catch and escapement periods throughout the season. The estimated escapements and CV of chum salmon in Bristol Bay for 2022 are provided in Table 14.

Kuskokwim Area Chum Salmon

Methods to estimate escapement in the Kuskokwim Area for 2022 differed significantly from Eggers et al. (2012) because of the lack of assessment projects in 2022 compared to 2007–2009. For 2022, escapement for Kuskokwim River included estimated escapement from 3 weirs: Kogrukluk River, Kwethluk River, and George River. This contrasts with the 5 weirs (previously listed weir projects plus Tatlawiksuk and Takotna Rivers) and 1 sonar (Aniak River)) used by Eggers et al. (2012) previously to estimate escapement. The expansion factor used to scale escapement to a total escapement estimate based on data from Bue et al. (2008) was recalculated using the methods of Eggers et al. (2012) and the expansion factor increased from 2.30 to 14.69 due to the reduced number of assessment projects available use in the calculation and hence a lower proportion of the total escapement directly assessed in 2022 (Aniak sonar accounted for about 75% of the assessed escapement in WASSIP years). Similarly, the CV of the total escapement was recalculated. Because of the reduced number of assessment projects used to estimate the total escapement, the escapement CV increased from 0.39 to 0.50 for the Kuskokwim River.

The other escapement components for the Kuskokwim Area include Goodnews Bay (District 5) and Kanektok River (District 4). In 2022, there were no assessments in these areas; therefore, alternative methods for estimating escapements were needed. Rather than estimating escapements explicitly for Goodnews Bay and Kanektok River, the escapement to Kuskokwim River was expanded to the Kuskokwim Area, with the assumption that the proportion of escapement that the Kuskokwim River contributes to the overall Kuskokwim Area is similar between 2022 and 2007–2009 (average = 79.7%). The CV was estimated using the variance product of dependent variables. This estimation of variance is different from Eggers et al. (2012), but this method of estimating escapement for an area is different from any of the methods used in Eggers et al. (2012). The estimated escapement and associated CV for the Kuskokwim Area in 2022 is provided in Table 15.

Yukon River Summer-Run Chum Salmon

Methods used to estimate the Yukon River summer-run chum salmon escapement followed methods in Eggers et al. (2012). However, the escapement to the Andreafsky River had to be estimated using an ad hoc method and escapements upriver of Anvik were estimated before subsistence harvest estimates were available. For this reason, 2021 subsistence harvest estimates were used as a proxy when adjusting Pilot Station sonar counts by the harvest upriver of the

assessment project. The estimated escapement and associated CV for Yukon River summer-run chum salmon are provided in Table 16.

The East Fork Andreafsky weir did not operate in 2022 because the East Fork forest fire delayed access and high water prevented installation of the weir. Historically, both forks of the Andreafsky River compose about 5% of the total Yukon River summer chum run, and in the last 10 years it has been about 4%. An approximate estimate of 20,000 chum salmon for Andreafsky River escapement was provided based on 4% of the preliminary Pilot Station sonar count minus the approximate downriver harvest estimate (i.e., 465,000 fish). The CV applied to the Andreafsky River escapement was the same as used in Eggers et al. (2012). Although this probably overvalues the confidence in this escapement estimate, there is little information to develop an alternative.

Norton Sound Area Chum Salmon

Methods used to estimate the escapement of chum salmon to the Norton Sound Area followed the methods of Eggers et al. (2012). In 2022, assessment projects for some systems were available that were not available between 2007 and 2009.

In the Unalakleet Subdistrict, the Unalakleet River weir estimate for 2022 was used. This is different from Eggers et al. (2012), where an expansion of the tower count from North River (a tributary of the Unalakleet River) was used. The CV of the weir escapement was assumed to be 0.04 per Eggers et al. (2012), compared to the CV of 0.27 for Unalakleet Subdistrict for 2007–2009. For Shaktoolik and Norton Bay Subdistricts, escapements for the Shaktoolik, Inglutalik, and Ungalik Rivers in 2022 were assessed with towers. This differs from Eggers et al. (2012), which relied upon aerial surveys and relationships between historical aerial surveys for these rivers to estimate escapements for 2007–2009. Therefore, the overall certainty in escapement estimates for the Eastern Norton Sound Subdistricts was improved for 2022 (CV = 0.09) compared to Eggers et al. (2012; CV range: 0.39–1.17). Escapement and associated CV for Eastern Norton Sound Subdistricts for 2022 are provided in Table 17.

Methods to estimate escapement in the remaining Norton Sound Area subdistricts (i.e., Moses Point, Golovin, and Nome Subdistricts) followed the methods of Eggers et al. (2012). Details of the estimated escapement and associated CVs for each subdistrict, as well as aggregate Norton Sound Area, are provided in Table 18.

Upper Yukon River Reporting Group

The Upper Yukon River reporting group includes the fall-run chum salmon in the Yukon River. Preliminary escapement estimates (Table 19) were provided by ADF&G staff and based on the Yukon River fall chum run reconstruction (Fleischman and Borba 2009) similar to the escapements in Eggers et al. (2012). As with estimates for 2008 and 2009, the CV for the 2022 escapement was based on a 5-year average (2003–2007), because the run reconstruction report only estimated escapements up to 2007.

Kotzebue Sound Reporting Group

Methods to estimate escapement for the Kotzebue Sound reporting group followed the methods of Eggers et al. (2012) and are provided in Table 20 with estimated CV.

RESULTS

TOTAL RUN

Stock-specific estimates of escapement and associated uncertainties varied greatly among reporting groups (Table 21). For comparison, total run estimates for 2007–2009 (Tables 4–6 in Munro et al. 2012) are provided in Appendix A1–A3 and Figure 1. Subsistence harvest estimates used in this analysis are proxies because final estimates were not available at this time. Future updates of this analysis will include final 2022 subsistence harvest estimates.

HARVEST RATES BY FISHERY

Stock-specific harvest rate estimates by fishery are provided in Table 22–41 and Figures 2–21 and follow the hierarchical spatiotemporal strata of Dann et al. (2023). Harvest rates were not calculated for individual spatiotemporal strata unless a given hierarchical stratum contained only one stratum (e.g., August gillnet). Summary statistics for stock-specific harvest rates include the median, 90% credibility interval, mean, and standard deviation and are reported to the nearest tenth of a percentage point. The figures are presented with the y-axis range from 0 to 100%. This is the same as the way of displaying harvest rates that was agreed upon by the WASSIP Advisory Panel (*cf.* Munro et al. 2022).

In 2022, median stock-specific harvest rates ranged from 0.6% (Upper Yukon River) to 6.2% (Northwestern District) for the sampled South Peninsula fisheries as a whole (Table 41, Figure 21). The harvest rates of the South Peninsula (5.9%) and CWAK (5.8%) stocks were similar to the Northwestern District stock (6.2%) with overlapping 90% credibility intervals.

DISCUSSION

HARVEST RATES

Most genetic stock identification studies for salmon in Alaska only report stock composition estimates for the sampled fishery strata, mainly due to the challenges of estimating total runs at the same scale as genetic stock identification. This is particularly challenging for chum salmon. The extension of estimated genetic stock proportions in the 2022 South Peninsula fisheries as reported by Dann et al. (2023) to stock-specific harvest rates was not part of the original project plan. Estimation of harvest rates provides a fundamentally different view of stock-specific fishery impacts but requires detailed assessments of harvest and escapement for the fishery stocks of interest, with explicit statements of uncertainties associated with each. When considering harvest rates, it is important to recognize that they are most likely overestimates of true harvest rates. This is because our estimates of stock-specific escapement are almost certainly biased low (see Eggers et al. 2012) and we are unable to account for harvest of stocks included in this analysis that are outside of the WASSIP area – as explained in Munro et al. (2012). Each of these caveats contribute to estimates of stock-specific total runs (denominator in harvest rate calculations) that are biased low, which results in harvest rate estimates which are biased high.

SUMMARY STATISTICS

We refer the reader to the discussion of summary statistics in the WASSIP chum salmon harvest and harvest rate report (Munro et al. 2012), which have direct relevance to this analysis because WASSIP methodology and reporting of results are similar. Of particular note is the section “Quirks

Regarding Distributional Statistics". Like WASSIP, the uncertainty in stock composition estimates, commercial and subsistence harvest numbers, and escapement estimates were incorporated in this analysis so that interpretation of results could take uncertainty into account. The distributions of these uncertainties are best reflected by the empirical Monte Carlo distribution of the estimate that the harvest rate results are based upon. Therefore, to derive the point estimates and the uncertainty measures (i.e., 90% CI, SD), Monte Carlo distributions were added, multiplied or divided by iteration to come up with point estimates. The estimates are not the same as estimates produced by simply dividing or multiplying the point estimates of the distributions, especially for variables with high uncertainty and skewed distributions. These phenomena are relevant to the harvest rate calculations where dividing the point estimate (mean) of the harvest by the point estimate (mean) of the total run does not always produce the same point estimate (mean) of harvest rate as the harvest rate estimated using the full Monte Carlo distributions.

APPLYING WASSIP DATA OUTSIDE OF WASSIP YEARS

Munro et al. (2012) provides guidance and advice for making inferences within and outside of the WASSIP years. This guidance is relevant to this analysis because it uses WASSIP stock composition estimates to infer stock composition of 2022 chum salmon harvest in Western Alaska that was not sampled as part of the study by Dann et al. (2023). WASSIP analyses represent environmental and fishery conditions during a specific period of time, but the study was done to better inform scientific and policy activities in the future. Munro et al. (2012), note that, "…while the [three years of data from WASSIP] provides some measure of interannual variability in stock composition, some caution must be exercised when extrapolating the results to years not analyzed because changes in relative abundance among reporting groups, prosecution of fisheries, or migratory behavior due to ocean conditions might affect distribution of stock-specific harvests among fisheries." This warning also applies to using these data as proxies in analyses outside of the WASSIP years, as done in this analysis, where stock compositions from 2007 to 2009 were used to estimate stock-specific harvest and total runs over a decade later for fisheries in 2022.

COMPARISON TO WASSIP HARVEST RATE ESTIMATES

Given the differences in the sampling design of the South Peninsula fisheries in 2022 compared to WASSIP, direct spatial and temporal comparison of 2022 harvest rates with those from WASSIP (2007–2009) is difficult without reanalyzing the WASSIP data, which has not been done to this point and there was not time for this analysis. The closest comparison can be made at the June and post-June fisheries level, with the caveat that Southeast District Mainland (SEDM) was not included in the South Peninsula fishery estimates in WASSIP (Munro et al. 2012) like was done for the current project (Dann et al. 2023). In 2022, no chum salmon were harvested in SEDM in June because there were no commercial fishery openings. For the 2022 post-June fishery, only 752 chum salmon were harvested in July, but about 35,000 fish were harvested in August. In the WASSIP years the August harvest in SEDM was assumed to be 100% South Peninsula reporting group fish.

For the three WASSIP years, the harvest rate of the Coastal Western Alaska reporting group averaged 4.2% in the June fishery (ranging from 2.1% in 2007 to 6.9% in 2009, Figure 21). For 2022, the harvest rate was estimated to be 5.5% (Table 28). The Northwestern District reporting group averaged 2.5% (ranging from 0.2% to 6.5%) in the June fishery in the WASSIP years and was 3.7% in 2022. The harvest rate for all other Western Alaska and Alaska Peninsula reporting

groups were 1% or less for the WASSIP years. In 2022, Kotzebue Sound was the only other reporting group with a harvest rate over 1% (at 1.5%) in the June fishery.

For the three WASSIP years, the harvest rate of the South Peninsula group averaged 13.6% in the post-June fishery (ranging from 6.3% in 2007 to 26.8% in 2009). For 2022, the harvest rate was estimated to be 5.1% (Table 40). The Chignik/Kodiak group averaged 1.8% (similar for all years) in the post-June fishery in the WASSIP years and was 2.6% in 2022. The harvest rates for all other Western Alaska and Alaska Peninsula groups averaged 1% or less for the WASSIP years. In 2022, Northern District was the only other reporting group with a harvest rate over 1% (2.4%) in the post-June fishery 2022.

NEXT STEPS

Results presented here are the preliminary estimates of the harvest rates on western Alaska and Alaska Peninsula stocks during the 2022 in South Alaska Peninsula commercial fisheries. However, as noted, final estimates of subsistence harvest in 2022 were not available this analysis; therefore, proxy estimates were used. In addition, some escapement estimates were preliminary at the time they were provided. Given this, it would be prudent to re-run the analysis at a time when all 2022 data are finalized and available to be included. In addition, because the estimation of harvest rates was not part of the original study reported in Dann et al. (2023), and the timeline for conducting and completing this analysis was compressed, this analysis did not go through the normal ADF&G Operational Planning review nor did this report. As such, it is critical that this analysis be fully reviewed after final 2022 data can be incorporated.

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TABLES AND FIGURES

Table 1.–Chignik/Kodiak fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest.

Area	Temporal stratum	period	Harvest	Proxy stock composition			
				2007	2008	2009	Other
Eastern District	1	6/1–7/31	0	Eastern District stratum 1 Jun 25–Jul 5	NA	Eastern District stratum 1 Jul 1–Jul 31	
	Late catch	8/1–	107	——— Not in WASSIP sampling plan ———			100% Chignik/ Kodiak
Central District	1	6/1–7/31	2,494	Central District stratum 1 Jun 15–Jul 31	Central District stratum 1 Jun 24–Jul 31	Central District stratum 1 Jun 20–Jul 31	
	Late catch	8/1–	4,162	——— Not in WASSIP sampling plan ———			100% Chignik/ Kodiak
Chignik Bay District	season	6/1–9/30	7,863	——— Not in WASSIP sampling plan ———			100% Chignik/ Kodiak
Western and Perryville Districts	1	6/1–7/31	30,148	Western and Perryville Dist. stratum 1 Jul 9–Jul 31	Western and Perryville Dist. stratum 1 Jun 24–Jul 31	Western and Perryville Dist. stratum 1 Jun 22–Jul 31	
Western and Perryville Districts	Late catch	8/1–	26,112	——— Not in WASSIP sampling plan ———			100% Chignik/ Kodiak

Note: NA = stock composition estimates not available; blank cell in 'Other' indicates an alternative stock composition estimate was not needed.

Note: Harvest CV = 0.05.

Note: Harvest of chum salmon in Kodiak was not included as it was outside the sampling area in the original WASSIP study. The lack of inclusion of Kodiak harvest will possibly result in overestimates of harvest rate on this reporting group.

Table 2.–North Peninsula fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest.

Area	Temporal stratum	Period	Harvest	Proxy stock composition			
				2007	2008	2009	Other
Bear River Section	1	6/1–7/31	592	Bear River Section stratum 1 Jun 11–Jul 31	NA	Bear River Section stratum 1 Jun 8–Jul 28	
	Late Catch	8/1–	943	——— Not in WASSIP sampling plan ———			100% Northern District
Three Hills and Ilnik Sections	1	6/1–7/31	1,785	Three Hills and Ilnik Sections stratum 1 Jun 20–Jul 31	NA	Three Hills and Ilnik Sections stratum 1 Jun 27–Jul 28	
	Late Catch	8/1–	639	——— Not in WASSIP sampling plan ———			100% Northern District
Northern District Terminal[a]	Season		181	——— Not in WASSIP sampling plan ———			100% Northern District
Northwestern District Terminal[a]	Season		9,357	——— Not in WASSIP sampling plan ———			100% Northwestern Dist.

Note: NA = stock composition estimates not available; blank cell in 'Other' indicates an alternative stock composition estimate was not needed.

Note: Harvest CV = 0.05.

[a] Terminal harvest determined same as Appendix B1 in Munro et al. (2012).

Table 3.–Bristol Bay fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest.

Area	Temporal stratum	Period	Harvest	Proxy stock composition 2007	2008	2009
Eastside Districts (Ugashik, Egegik, Naknek-Kvichak)	1	6/1–6/25	5,425	Eastside Districts stratum 1 Jun 12–Jun 26	Eastside Districts stratum 1 Jun 9–Jun 26	Eastside Districts stratum 1 Jun 15–Jun 25
	2	6/26–6/30	6,300	Eastside Districts stratum 2 Jun 27–Jun 29	Eastside Districts stratum 2 Jun 27–Jul 1	Eastside Districts stratum 2 Jun 26–Jun 30
	3	7/1–7/5	14,630	Eastside Districts stratum 3 Jun 30–Jul 5	Eastside Districts stratum 3 Jul 2–Jul 10	Eastside Districts stratum 3 Jul 1–Jul 6
	4	7/6–7/15	26,702	Eastside Districts stratum 4 Jul 6–Jul 15	Eastside Districts stratum 4 Jul 11–Jul 17	Eastside Districts stratum 4 Jul 7–Jul 11
	5	7/16–8/31	25,295	Eastside Districts stratum 5 Jul 16–Aug 31	Eastside Districts stratum 5 Jul 18–Aug 21	Eastside Districts stratum 5 Jul 12–Aug 31
Nushagak District	1	6/1–6/27	45,174	Nushagak District stratum 1 Jun 11–Jun 27	Nushagak District stratum 1 Jun 9–Jun 29	Nushagak District stratum 1 Jun 7–Jun 27
	2	6/28–7/5	63,490	Nushagak District stratum 2 Jun 28–Jul 7	Nushagak District stratum 2 Jun 30–Jul 5	Nushagak District stratum 2 Jun 28–Jul 2
	3	7/6–7/12	40,578	Nushagak District stratum 3 Jul 8–Jul 12	Nushagak District stratum 3 Jul 6–Jul 11	Nushagak District stratum 3 Jul 3–Jul 4
	4	7/13–7/17	17,804	Nushagak District stratum 4 Jul 13–Jul 17	Nushagak District stratum 4 Jul 12–Jul 15	Nushagak District stratum 4 Jul 5–Jul 9
	5	7/18–8/31	6,480	Nushagak District stratum 5 Jul 18–Aug 12	Nushagak District stratum 5 Jul 16–Aug 15	Nushagak District stratum 5 Jul 10–Aug 18
Togiak District	1	6/1–6/27	1,023	Togiak District stratum 1 Jun 18–Jun 28	Togiak District stratum 1 Jun 18–Jun 27	Togiak District stratum 1 Jun 22–Jun 30

-continued-

Table 3.–Page 2 of 2.

Area	Temporal stratum	Period	Harvest	Proxy stock composition 2007	2008	2009
Togiak District	2	6/28–7/5	6,820	Togiak District stratum 2 Jul 2–Jul 9	Togiak District stratum 2 Jun 30–Jul 4	Togiak District stratum 2 Jul 1–Jul 2
	3	7/6–7/12	15,190	Togiak District stratum 3 Jul 10–Jul 15	Togiak District stratum 3 Jul 5–Jul 11	Togiak District stratum 3 Jul 3–Jul 7
	4	7/13–7/17	9,112	Togiak District stratum 4 Jul 16–Jul 20	Togiak District stratum 4 Jul 12–Jul 16	Togiak District stratum 4 Jul 8–Jul 11
	5	7/18–8/31	20,625	Togiak District stratum 5 Jul 21–Aug 4	Togiak District stratum 5 Jul 17–Aug 6	Togiak District stratum 5 Jul 13–Aug 27

Note: NA = stock composition estimates not available.

Note: Harvest CV = 0.1.

Table 4.–Kuskokwim Area fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest. No commercial harvest of chum salmon occurred in 2022.

Area	Temporal stratum	Period	Harvest	Proxy stock composition		
				2007	2008	2009
District 1 Commercial	1	6/1–6/26	0	District 1 Commercial stratum 1 Jun 7–Jun 26	District 1 Commercial stratum 1 Jun 20–Jun 24	District 1 Commercial stratum 1 Jun23–Jun26
	2	6/27–7/15	0	District 1 Commercial stratum 2 Jun 27–Jul 11	District 1 Commercial stratum 2 Jun 27–Jun 27	District 1 Commercial stratum 2 Jul 1–Jul 18
	3	7/16–8/31	0	District 1 Commercial stratum 3 Jul 12–Aug 24	District 1 Commercial stratum 3 Jul 12–Aug 25	District 1 Commercial stratum 3 Jul 28–Aug 22
District 4 Commercial	1	6/1–6/28	0	District 4 Commercial stratum 1 Jun 14–Jun 28	District 4 Commercial stratum 1 Jun 14–Jun 26	District 4 Commercial stratum 1 Jun 15–Jun 30
	2	6/29–7/15	0	District 4 Commercial stratum 2 Jul 2–Jul 16	District 4 Commercial stratum 2 Jul 1–Jul 14	District 4 Commercial stratum 2 Jul 6–Jul 15
	3	7/16–8/31	0	District 4 Commercial stratum 3 Jul 18–Aug 31	District 4 Commercial stratum 3 Jul 16–Aug 29	District 4 Commercial stratum 3 Jul 16–Aug 24
District 5 Commercial	1	6/1–7/4	0	District 5 Commercial stratum 1 Jun 19–Jul 4	NA	District 5 Commercial stratum 1 Jun 22–Jun 30
	2	7/5–7/16	0	District 5 Commercial stratum 2 Jul 6–Jul 16	NA	District 5 Commercial stratum 2 Jul 6–Jul 17
	3	7/17–8/31	0	District 5 Commercial stratum 3 Jul 18_Aug 31	NA	NA

Note: NA = stock composition estimates not available.

Note: Harvest CV = 0.05.

Table 5.–Yukon-Northern Area Summer-Run fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest. No commercial harvest of chum salmon occurred in 2022.

Area	Temporal stratum	Period	Harvest	Proxy stock composition 2007	2008	2009	Other
District 1 Commercial Black River only	1	6/1–7/1	0	District 1 Commercial Black River only stratum 1 Jun 19–Jun 22	NA	NA	
	2	7/2–7/5	0	District 1 Commercial Black River only stratum 2 Jun 26–Jul 2	NA	NA	
	3	7/6–8/31	0	NA	NA	NA	
District 1 Commercial marine areas excluding Black R.	1	6/1–7/1	0	District 1 Commercial excl. Black River stratum 1 Jun 19–Jun 22	NA	District 1 Commercial excl. Black River stratum 1 Jun 29–Jul 2	
	2	7/2–7/5	0	District 1 Commercial excl. Black River stratum 2 Jun 26–Jul 2	District 1 Commercial excl. Black River stratum 2 Jul 2–Jul 5	District 1 Commercial excl. Black River stratum 2 Jul 3–Jul 8	
	3	7/6–8/31	0	District 1 Commercial excl. Black River stratum 3 Jul 6–Jul 15	District 1 Commercial excl. Black River stratum 3 Jul 8–Jul 14	District 1 Commercial excl. Black River stratum 3 Jul 10–Jul 15	
Yukon River Terminal[a]	Season		0				100% CWAK

Note: NA = stock composition estimates not available.

Note: Harvest CV = 0.05.

[a] Terminal harvest determined same as Appendix B2 in Munro et al. (2012).

Table 6.–Yukon-Northern Area Fall-Run fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest. No commercial harvest of chum salmon occurred in 2022.

Area	Temporal stratum	Period	Harvest	Proxy stock composition 2007	2008	2009	Other
District 1 Commercial Black River only	1	7/15–7/25	0	NA	NA	NA	
	2	7/26–8/25	0	NA	NA	NA	
	3	7/26–9/30	0	NA	NA	NA	
District 1 Commercial marine areas excluding Black R.	1	7/15–7/25	0	NA	District 1 Commercial excl. Black River stratum 1 Jul 17–Jul 25	District 1 Commercial excl. Black River stratum 1 Jul 18–Jul 22	
	2	7/26–8/25	0	District 1 Commercial excl. Black River stratum 2 Aug 14–Aug 24	District 1 Commercial excl. Black River stratum 2 Jul 29–Aug 1	District 1 Commercial excl. Black River stratum 2 Jul 29–Aug 5	
	3	7/26–9/30	0	District 1 Commercial excl. Black River stratum 3 Aug 26–Sep 9	District 1 Commercial excl. Black River stratum 3 Aug 26–Sep 10	NA	
Yukon River Terminal[a]	Season		0				100% Upper Yukon R.

Note: NA = stock composition estimates not available.

Note: Harvest CV = 0.05.

[a] Terminal harvest determined same as Appendix B3 in Munro et al. (2012).

Table 7.–Norton Sound-Kotzebue Area fisheries, 2022. Commercial harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest.

Area	Temporal stratum	Period	Harvest	Proxy stock composition			
				2007	2008	2009	Other
Subdistrict 1 Nome	Season		3,966	——— Not in WASSIP sampling plan ———			Subdist. 1 Nome Subsistence 2007, Jun 23–Jul 15
Subdistrict 2 Golovin	Season		8,701	NA	Subdistrict 2 Golovin Season Jul 1–Aug 22	NA	
Subdistrict 3 Moses Point	Season		4,030	Subdistrict 3 Moses Point Season Jul 10–Aug 29	Subdistrict 3 Moses Point Season Jul 5–Aug 30	NA	
Subdistrict 4 Norton Bay	Season		3,477	——— Not in WASSIP sampling plan ———			100% CWAK
Subdistrict 5 Shaktoolik	1	6/1–7/21	4,417	Subdistrict 5 Shaktoolik stratum 1 Jul 18–Jul 21	Subdistrict 5 Shaktoolik stratum 1 Jul 9–Jul 22	Subdistrict 5 Shaktoolik stratum 1 Jul 10–Jul 21	
	2	7/22–8/5	2,016	Subdistrict 5 Shaktoolik stratum 2 Jul 22–Aug 2	Subdistrict 5 Shaktoolik stratum 2 Jul 23–Aug 5	Subdistrict 5 Shaktoolik stratum 2 Jul 22–Aug 4	
	3	8/6–9/30	1,058	NA	Subdistrict 5 Shaktoolik stratum 3 Aug 6–Sep 9	Subdistrict 5 Shaktoolik stratum 3 Aug 5–Sep 11	
Subdistrict 6 Unalakleet	1	6/1–7/21	945	Subdistrict 6 Unalakleet stratum 1 Jul 18–Jul 21	Subdistrict 6 Unalakleet stratum 1 Jul 8–Jul 15	Subdistrict 6 Unalakleet stratum 1 Jul 8–Jul 15	
	2	7/21–7/31	1,875	Subdistrict 6 Unalakleet stratum 2 Jul 22–Jul 31	Subdistrict 6 Unalakleet stratum 2 Jul 17–Jul 29	Subdistrict 6 Unalakleet stratum 2 Jul 16–Jul28	
	3	8/1–9/30	764	NA	Subdistrict 6 Unalakleet stratum 3 Jul 30–Sep 12	Subdistrict 6 Unalakleet stratum 3 Jul 29–Sep 11	
Kotzebue Area	Season		475,624	Kotzebue Area Season Jul 17–Aug 31	Kotzebue Area Season Jul 21–Aug 29	Kotzebue Area Season Jul 10–Aug 31	

Note: NA = stock composition estimates not available; blank cell in 'Other' indicates an alternative stock composition estimate was not needed.

Note: Harvest CV = 0.05.

Table 8.–Proxy subsistence harvest, 2022. Subsistence harvest of chum salmon and description of stock compositions used as proxies to estimate reporting group-specific harvest.

Area	Sub area	Harvest (proxy)[a]	Proxy stock composition
Chignik/Kodiak	Chignik	40	100% Chignik/Kodiak
	Kodiak	235	100% Chignik/Kodiak
AK Peninsula	South Peninsula districts	586	100% South Peninsula
	Northern District	2	100% Northern District
	Northwestern District	29	100% Northwestern District
Bristol Bay	Below assessment projects[b]	2,367	100% CWAK
Kuskokwim Area	Total[c]	9,621	100% CWAK
	Mekoryuk[d]	NA	
	Toksook Bay[e]	NA	
Yukon Summer	Yukon River Summer[f]	5,432	100% CWAK
	Hooper Bay (Coastal District)[g]	NA	
	Scammon Bay[h]	NA	
Yukon Fall	Yukon River Fall[i]	1,550	100% Upper Yukon River
Norton Sound	Stebbins[j]	4,095	Stebbins Area Subsistence 2007 and 2008
	St. Michael[j]	3,476	St. Michael Area Subsistence 2007 and 2008
	Subdistrict 6 Unalakleet	1,844	100% CWAK
	Subdistrict 5 Shaktoolik	500	100% CWAK
	Subdistrict 4 Norton Bay	3,443	100% CWAK
	Subdistrict 3 Moses Point	499	Moses Point Subsistence 2007
	Subdistrict 2 Golovin	518	100% CWAK
	Subdistrict 1 Nome Area	912	Nome Area Subsistence 2007
	Cape Woolley	0	100% CWAK
	Port Clarence District	3,888	Port Clarence District Subsistence 2007
Kotzebue Sound	Kotzebue Sound[k]	54,325	100% Kotzebue Sound

Note: NA = Not applicable (included in next level aggregation); blank indicates proxy stock composition not needed.

Note: Harvest CV = 0.1.

[a] Proxy harvest estimates until final 2022 subsistence harvest estimates are available. Estimates are 5-year averages (2017–2021) unless otherwise noted.

[b] Includes only harvest below escapement assessment projects; harvest above is included in escapement estimate.

[c] Total 2021 subsistence harvest estimate. Includes Mekoryuk and Tooksook Bay, which were part of WASSIP sampling plan.

[d] No estimate will be available for 2022 and no samples collected in 2007–2009, Munro et al. (2012) assumed 100% CWAK.

[e] No estimate will be available for 2022; examined stock composition estimates from 2007–2009: >99.5% CWAK.

[f] Preliminary 2022 survey estimates for Yukon River. Includes Hooper Bay (Coastal District) and Scammon Bay, which were part of WASSIP.

[g] Examined stock composition estimates from 2007–2009: 99.9% CWAK.

[h] Scammon Bay community harvested in Coastal District and Y1 in 2022; 2007–2009 samples were from Black River (95% CWAK, 5% Upper Yukon River).

[i] Preliminary 2022 survey estimates for Yukon River.

[j] Average 2014–2016.

[k] Average 2000–2004; no survey; subsistence harvest estimate used in Munro et al. (2012).

Table 9.–Escapement (thousands of fish) and coefficient of variation (CV) of chum salmon in the Chignik/Kodiak reporting group, 2022.

Chignik/Kodiak					
Chignik area		Kodiak area			
Aerial survey index[a]	Chignik weir[b]	Aerial survey index[a]	Weirs	Region escapement	CV
238.20	0.09	215.35	2.33	3,245.18	1.09

[a] Expansion factor = 7.15 and CV = 1.09 assumed for all Chignik and Kodiak aerial survey indices.

[b] CV = 0.04 is assumed for weir escapement estimates.

Table 10.–Escapement (thousands of fish) and coefficient of variation (CV) of chum salmon in the South Peninsula reporting group, 2022.

South Peninsula[a]					
S. Unimak District aerial survey index	Southwestern District aerial survey index	South Central District aerial survey index	Southeastern District aerial survey index	Region escapement	CV
0.70	62.70	150.40	150.40	2,603.95	1.09

[a] Peak aerial counts of live fish in stream; Expansion factor = 7.15 and CV = 1.09 assumed for all South Peninsula aerial survey indices.

Table 11.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Northwestern District and Northern District reporting groups, 2022.

Northwestern District[a]			Northern District[a]		
Aerial survey index	Region escapement	CV	Aerial survey index	Region escapement	CV
42.90	306.74	1.09	159.30	1,139.00	1.09

[a] Peak aerial counts of live fish in stream; Expansion factor = 7.15 and CV = 1.09 assumed for all North Peninsula aerial survey indices.

Table 12.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Coastal Western Alaska reporting group, 2022.

Bristol Bay area		Kuskokwim area		Yukon summer-run		Norton sound area		Coastal Western Alaska reporting group	
Aggregate escapement	CV	Aggregate escapement	CV	Aggregate escapement	CV	Aggregate escapement	CV	Aggregate escapement	CV
189.37	0.17	562.02	0.74	483.70	0.20	209.26	0.15	1,444.36	0.54

Table 13.–Statistics relevant to estimating method of expanding Bristol Bay chum salmon catch to escapement (Escape.) based on district-specific harvest rates on sockeye salmon. Catch numbers are in thousands of fish.

	Ugashik District			Egegik District			Naknek/Kvichak District		
Year	Chum Salmon catch	Ugashik Sockeye harvest rate	Ugashik escape. based on expanded catch	Chum Salmon catch	Egegik Sockeye harvest rate	Egegik escape. based on expanded catch	Chum Salmon catch	Alagnak Sockeye harvest rate	Alagnak escape. based on expanded catch
2007	242.03	0.66	183.48	157.99	0.82	51.08	383.93	0.42	766.42
2008	135.29	0.80	50.69	92.90	0.85	23.17	237.26	0.63	203.58
2009	64.44	0.65	50.44	124.13	0.91	18.10	258.14	0.63	222.28
2022	16.18	0.80	5.93	28.05	0.90	4.73	34.13	0.63	29.95

	Nushagak District				Togiak District		
Year	Chum Salmon catch	Nushagak River Sockeye harvest rate	Nushagak Escape. based on expanded catch	Nushagak sonar count	Chum Salmon catch	Togiak Sockeye harvest rate	Togiak escape based on expanded catch
2007	953.28	0.80	351.45	161.48	202.49	0.75	98.03
2008	492.33	0.70	308.37	326.30	301.97	0.76	139.81
2009	775.34	0.75	381.50	438.48	143.42	0.64	118.00
2022	173.53	0.78	72.47	116.69	52.77	0.71	32.07

Note: Escapements based on expanded catch include a relative bias correction of -46.6% (see Eggers et al. 2012) for details.

Table 14.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Bristol Bay Management Area, 2022.

Ugashik River estimate[a]	CV	Egegik River estimate[b]	CV	Alagnak River estimate[c]	CV	Nushagak River estimate	CV	Togiak River estimate[d]	CV	Aggregate escapement estimate	CV
5.93	0.39	4.73	0.39	29.95	0.39	116.69	0.39	32.07	0.39	189.37	0.17

[a] District catch of chum salmon expanded by harvest rate on Ugashik sockeye salmon.

[b] District catch of chum salmon expanded by harvest rate on Egegik sockeye salmon.

[c] District catch of chum salmon expanded by harvest rate on Alagnak sockeye salmon.

[d] District catch of chum salmon expanded by harvest rate on Togiak sockeye salmon.

Table 15.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Kuskokwim Area, 2022.

Kuskokwim Bay area				Kuskokwim River					Kuskokwim area[a]	
Middle Fork Goodnews River	North Fork Goodnews River	Kanektok River		Aniak River	Tatlawiksuk and Takotna	Kogrukluk, Kwethluk, and George				
Weir	Estimate	Weir	Expansion factor	Sonar	Weirs	Weirs	Aggregate escapement[a]	CV	Aggregate escapement[b]	CV
NA	NA	NA	2-3	NA	NA	30.46	447.52	0.50	562.02	0.74

Note: NA = assessment project not run in 2022.

[a] Kuskokwim River chum salmon escapement is estimated by multiplying the sum of the Kogrukluk, Kwethluk, and George weir counts by 14.77, with a CV = 0.50.

[b] Kuskokwim Area chum salmon escapement is estimated by multiplying the Kuskokwim River aggregate escapement estimate by 1.26, with a CV of 0.74, which includes uncertainty in Kuskokwim River aggregate escapement estimate.

Table 16.–Escapement (thousands of fish) and coefficients of variation (CV) of summer-run chum salmon in Yukon Area, 2022.

Yukon River Summer-Run							
Andreafsky escapement[a]	CV	Anvik escapement[b]	CV	Above Anvik escapement[c,d]	CV	Aggregate escapement	CV
20.00	0.24	46.44	0.17	417.27	0.20	483.70	0.19

[a] Andreafsky River chum salmon escapement estimated as about 4% of approximate total run based on information available October 2022. CV is same as Eggers et al. (2012).

[b] Anvik River chum salmon escapement is Anvik River sonar count.

[c] Above Anvik River chum salmon escapement is Pilot Station Sonar count less half District 2 utilization, above District 2 utilization, and the Anvik River sonar count.

[d] Above Anvik River chum salmon escapement estimated prior to subsistence harvest estimates were available and 2021 estimate used as proxy. Preliminary 2022 Yukon River subsistence harvest survey estimates indicate chum salmon harvest was larger in 2022; therefore aggregate escapement overestimated by about 400 fish.

Table 17.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Eastern Norton Sound subdistricts, 2022.

Unalakleet District		Shaktoolik District		Norton Bay Subdistrict				Eastern Norton Sound	
Unalakleet River		Shaktoolik River		Inglutalik River		Ungalik River			
Weir[a]	CV	Tower	CV	Tower	CV	Tower	CV	Aggregate escapement estimate	CV
12.82	0.04	13.33	0.10	6.20	0.10	16.54	0.10	48.89	0.09

[a] Unalakleet weir preliminary estimate and does not include estimate of missed passage.

Table 18.–Escapement (thousands of fish) and coefficients of variation (CV) of chum salmon in the Norton Sound Area, 2022.

Moses Point Subdistrict				Golovin Subdistrict		
Tubutulik estimated escapement[a]	Kwiniuk tower	Estimated escapement	CV	Niukluk River tower	Estimated escapement	CV
8.41	10.13	18.53	0.64	37.60	114.34	0.12

Nome Subdistrict								
Escapement estimates or weir/tower counts by River system								
Sinuk River[b]	Nome River[c]	Bonanza River[b]	Snake River[c]	Solomon River[b]	Flambeau River[b]	Eldorado River[c]	Estimated escapement	CV
3.65	2.43	2.47	5.56	0.89	4.97	7.52	27.50	0.64

Eastern Norton Sound Subdistricts		Norton Sound area	
Estimated escapement	CV	Aggregate escapement	CV
48.89	0.09	209.26	0.15

[a] Tubutulik escapement assumed to be 0.83 times the Kwiniuk tower count.

[b] Expanded aerial count.

[c] Weir counts

Table 19.–Escapement (thousands of fish) and coefficient of variation (CV) of chum salmon in the Upper Yukon River reporting group, 2022

Upper Yukon River	
Escapement	CV
239.69	0.07

Table 20.–Commercial harvest (thousands of fish), subsistence harvest (thousands of fish), commercial fishing effort (boat days per season), escapement (thousands of fish) and escapement coefficient of variation (CV) of chum salmon in the Kotzebue Sound reporting group, 2022.

Kotzebue Sound					
Commercial harvest	Subsistence harvest[a]	Effort (boat days)	Total run[b]	Region escapement	CV
475.62	54.33	370.33	1,522.96	993.01	1.02

[a] Subsistence harvest not available, based on the average subsistence harvest, 2000–2004, estimated from run reconstruction as done in Eggers et al. (2012).

[b] Total Run estimated by expansion of commercial catch and harvest rate. Harvest rate estimated from fishing effort and catchability (q = 0.001).

Table 21.–Components and estimates of the total run for chum salmon by stock in Western Alaska and Alaska Peninsula, 2022. Components include stock-specific means and CVs of commercial harvest for South Alaska Peninsula commercial fisheries genetic stock composition project (Dann et al. 2023), other non-sampled commercial harvest from fisheries that were included in WASSIP, proxy subsistence harvest estimates, and escapement. Estimates of the total run include median, 90% credibility interval, mean, SD and CV.

	Harvest[a]						Escapement[a]		Total run					
	South Peninsula commercial		Other commercial		Subsistence[b]					90% CI				
Reporting Group	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Median	5%	95%	Mean	SD	CV
Kotzebue Sound	21,663	0.18	474,554	0.05	54,568	0.10	974,140	0.97	1,243,771	675,288	3,253,021	1,524,925	972,778	0.64
CWAK	103,939	0.07	335,812	0.09	36,246	0.10	1,433,341	0.53	1,742,359	965,598	3,392,033	1,909,338	791,712	0.41
Upper Yukon River	1,693	0.54	508	1.70	1,577	0.10	239,563	0.07	243,038	216,481	271,691	243,342	16,853	0.07
Northern District	8,142	0.22	9,783	0.13	3	1.30	1,115,327	1.03	785,671	194,895	3,157,744	1,133,254	1,154,831	1.02
Northwestern District	14,604	0.17	9,867	0.05	30	0.14	300,361	1.03	231,874	70,649	872,119	324,861	311,843	0.96
South Peninsula	107,572	0.07	2,292	0.40	586	0.10	2,549,860	1.03	1,867,990	512,832	7,300,814	2,660,311	2,641,757	0.99
Chignik/Kodiak[c]	72,274	0.09	53,286	0.05	275	0.10	3,177,771	1.03	2,313,205	623,833	9,080,418	3,303,607	3,291,708	1.00

Note: Total run means and medians can be used to estimate symmetry of posterior distribution. Total run mean is the sum of the harvest and escapement means.

[a] Means and CV of simulated data sampled from lognormal distributions and may differ from those means reported elsewhere due to rounding error.

[b] 2022 subsistence harvest estimates are not available until later in 2023. Estimates used in this analysis are considered proxies and include preliminary 2022 survey estimates (Yukon River), 2021 harvest estimate (Kuskokwim Area), and averages from previous years with estimates. Estimates are adjusted, where possible, to not include harvest above assessment projects.

[c] Harvest of chum salmon in the Kodiak Management Area was not included in this estimate, as it was outside the sampling area in the original study.

Table 22.–Southeastern and South Central Districts, South Alaska Peninsula area, June 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 167,282; 4 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.5	0.2	1.0	0.6	0.2
CWAK	1.3	0.7	2.2	1.3	0.4
Upper Yukon	0.1	0.0	0.2	0.1	0.1
Northern Dist.	0.0	0.0	0.3	0.1	0.1
Northwestern Dist.	0.4	0.1	1.5	0.6	0.5
South Peninsula	0.2	0.0	0.7	0.3	0.2
Chignik/Kodiak	0.2	0.0	0.7	0.3	0.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 10 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 23.–Southeastern and South Central Districts, South Alaska Peninsula area, June 2022, gillnet, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 10,729; 1 stratum				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.1	0.0	0.1	0.1	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.0	0.0	0.0
Northwestern Dist.	0.0	0.0	0.0	0.0	0.0
South Peninsula	0.1	0.0	0.2	0.1	0.1
Chignik/Kodiak	0.1	0.0	0.3	0.1	0.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest table, Appendix B5 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 24.–Southeastern and South Central Districts, South Alaska Peninsula area, June 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 178,011; 5 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.6	0.2	1.0	0.6	0.3
CWAK	1.4	0.8	2.3	1.4	0.5
Upper Yukon	0.1	0.0	0.2	0.1	0.1
Northern Dist.	0.0	0.0	0.3	0.1	0.1
Northwestern Dist.	0.4	0.1	1.5	0.6	0.5
South Peninsula	0.2	0.1	1.0	0.3	0.3
Chignik/Kodiak	0.3	0.1	1.0	0.4	0.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 11 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 25.–Unimak and Southwestern Districts, South Alaska Peninsula area, June 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 321,875; 4 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.8	0.3	1.7	0.9	0.4
CWAK	3.2	1.8	5.5	3.3	1.1
Upper Yukon	0.4	0.0	1.1	0.4	0.3
Northern Dist.	0.5	0.1	2.1	0.7	0.7
Northwestern Dist.	3.1	0.8	9.8	3.9	2.9
South Peninsula	0.3	0.1	1.3	0.5	0.4
Chignik/Kodiak	0.1	0.0	0.6	0.2	0.2

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 12 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 26.–Unimak and Southwestern Districts, South Alaska Peninsula area, June 2022, gillnet, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 44,251; 4 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.2	0.1	0.3	0.2	0.1
CWAK	1.0	0.5	1.6	1.0	0.3
Upper Yukon	0.1	0.0	0.2	0.1	0.1
Northern Dist.	0.1	0.0	0.4	0.1	0.1
Northwestern Dist.	0.2	0.0	0.6	0.2	0.2
South Peninsula	0.0	0.0	0.1	0.1	0.1
Chignik/Kodiak	0.0	0.0	0.2	0.1	0.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 13 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 27.–Unimak and Southwestern Districts, South Alaska Peninsula area, June 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 366,126; 8 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	1.0	0.3	1.9	1.0	0.5
CWAK	4.2	2.3	7.0	4.3	1.4
Upper Yukon	0.5	0.1	1.2	0.6	0.3
Northern Dist.	0.6	0.2	2.5	0.9	0.8
Northwestern Dist.	3.3	0.9	10.3	4.1	3.1
South Peninsula	0.4	0.1	1.4	0.5	0.5
Chignik/Kodiak	0.2	0.0	0.8	0.3	0.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 14 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 28.–South Alaska Peninsula area, June 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 544,137; 13 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	1.5	0.6	2.8	1.6	0.7
CWAK	5.5	3.0	9.2	5.7	1.9
Upper Yukon	0.6	0.2	1.3	0.6	0.4
Northern Dist.	0.7	0.2	2.7	0.9	0.9
Northwestern Dist.	3.7	1.0	11.8	4.7	3.4
South Peninsula	0.6	0.2	2.3	0.9	0.7
Chignik/Kodiak	0.5	0.1	1.8	0.6	0.6

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 15 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 29.–Southeastern and South Central Districts, South Alaska Peninsula area, July 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 126,102; 3 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.1	0.0	0.0
CWAK	0.1	0.0	0.2	0.1	0.0
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.0	0.0	0.3	0.1	0.1
Northwestern Dist.	0.5	0.1	2.2	0.7	0.7
South Peninsula	1.8	0.5	6.2	2.4	1.9
Chignik/Kodiak	0.9	0.2	3.1	1.2	1.0

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 16 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 30.–Southeastern and South Central Districts, South Alaska Peninsula area, July 2022, gillnet, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 14,114; 3 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.0	0.0	0.0
Northwestern Dist.	0.0	0.0	0.1	0.0	0.0
South Peninsula	0.2	0.1	0.9	0.3	0.3
Chignik/Kodiak	0.3	0.1	0.9	0.3	0.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 17 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 31.–Southeastern and South Central Districts, South Alaska Peninsula area, July 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 140,216; 6 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.1	0.0	0.0
CWAK	0.1	0.1	0.2	0.1	0.0
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.0	0.0	0.3	0.1	0.1
Northwestern Dist.	0.5	0.1	2.2	0.7	0.7
South Peninsula	2.1	0.6	7.1	2.7	2.2
Chignik/Kodiak	1.1	0.3	4.1	1.5	1.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 18 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 32.–Unimak and Southwestern Districts, South Alaska Peninsula area, July 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 42,716; 2 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.1	0.0	0.3	0.1	0.1
CWAK	0.3	0.2	0.5	0.3	0.1
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.2	0.1	1.0	0.3	0.3
Northwestern Dist.	1.0	0.3	3.2	1.3	1.0
South Peninsula	0.2	0.1	0.8	0.3	0.2
Chignik/Kodiak	0.2	0.1	0.8	0.3	0.2

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 19 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 33.–Unimak and Southwestern Districts, South Alaska Peninsula area, July 2022, gillnet, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 5,839; 2 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.0	0.0	0.0
Northwestern Dist.	0.2	0.0	0.6	0.2	0.2
South Peninsula	0.2	0.0	0.6	0.2	0.2
Chignik/Kodiak	0.0	0.0	0.2	0.1	0.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 20 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 34.–Unimak and Southwestern Districts, South Alaska Peninsula area, July 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 48,555; 4 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.1	0.0	0.3	0.2	0.1
CWAK	0.3	0.2	0.5	0.3	0.1
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.2	0.1	1.0	0.4	0.3
Northwestern Dist.	1.2	0.3	3.7	1.5	1.2
South Peninsula	0.4	0.1	1.4	0.5	0.4
Chignik/Kodiak	0.3	0.1	0.9	0.3	0.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 21 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 35.–South Alaska Peninsula area, July 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 188,771; 10 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.2	0.1	0.3	0.2	0.1
CWAK	0.4	0.2	0.7	0.4	0.2
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.3	0.1	1.3	0.4	0.4
Northwestern Dist.	1.7	0.4	5.7	2.2	1.7
South Peninsula	2.5	0.7	8.4	3.2	2.6
Chignik/Kodiak	1.4	0.4	4.9	1.9	1.5

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 22 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 36.–Southeastern and South Central Districts, South Alaska Peninsula area, August 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 45,499; 2 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.1	0.0	0.0
Northwestern Dist.	0.0	0.0	0.2	0.0	0.1
South Peninsula	1.0	0.3	3.4	1.3	1.1
Chignik/Kodiak	1.0	0.3	3.6	1.3	1.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 23 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 37.–Unimak and Southwestern Districts, South Alaska Peninsula area, August 2022, seine, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 28,824; 2 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.1	0.0	0.0
Northwestern Dist.	0.6	0.2	1.9	0.8	0.6
South Peninsula	1.3	0.4	4.5	1.7	1.4
Chignik/Kodiak	0.1	0.0	0.4	0.1	0.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 24 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 38.–South Alaska Peninsula area, August 2022, gillnet, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 7,048; 1 stratum				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.0	0.0	0.0
Northern Dist.	0.0	0.0	0.0	0.0	0.0
Northwestern Dist.	0.0	0.0	0.0	0.0	0.0
South Peninsula	0.2	0.1	0.8	0.3	0.3
Chignik/Kodiak	0.1	0.0	0.3	0.1	0.1

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Appendix B28 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 39.–South Alaska Peninsula area, August 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 81,371; 5 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.0	0.0	0.0	0.0	0.0
CWAK	0.0	0.0	0.0	0.0	0.0
Upper Yukon	0.0	0.0	0.1	0.0	0.0
Northern Dist.	0.0	0.0	0.1	0.0	0.1
Northwestern Dist.	0.6	0.2	2.0	0.8	0.6
South Peninsula	2.6	0.7	8.8	3.3	2.7
Chignik/Kodiak	1.2	0.3	4.2	1.6	1.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 25 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 40.–South Alaska Peninsula area, post-June 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 270,142; 15 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	0.2	0.1	0.3	0.2	0.1
CWAK	0.4	0.2	0.7	0.4	0.2
Upper Yukon	0.0	0.0	0.2	0.1	0.0
Northern Dist.	0.3	0.1	1.3	0.5	0.4
Northwestern Dist.	2.4	0.7	7.6	3.0	2.3
South Peninsula	5.1	1.4	17.3	6.6	5.3
Chignik/Kodiak	2.6	0.7	9.0	3.4	2.8

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 26 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

Table 41.–South Alaska Peninsula area, 2022, all strata. Estimates of stock-specific harvest rate including median, 90% credibility interval, mean, and standard deviation (SD).

	Harvest rate (%) Harvest = 814,279; 28 strata				
		90% CI			
Reporting group	Median	5%	95%	Mean	SD
Kotzebue Sound	1.7	0.7	3.1	1.8	0.7
CWAK	5.9	3.3	9.9	6.2	2.0
Upper Yukon	0.6	0.2	1.4	0.7	0.4
Northern Dist.	1.0	0.3	3.9	1.4	1.3
Northwestern Dist.	6.2	1.8	18.9	7.7	5.6
South Peninsula	5.8	1.5	19.2	7.4	6.0
Chignik/Kodiak	3.1	0.9	10.6	4.1	3.3

Note: Harvest is summed from experimental design table (Table 4, Dann et al. 2023).

Note: Corresponds to stock composition and harvest Table 27 (Dann et al. 2023).

Note: Harvest may differ from stock composition and harvest tables in Dann et al. (2023) because of sampling from lognormal distributions and rounding errors.

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

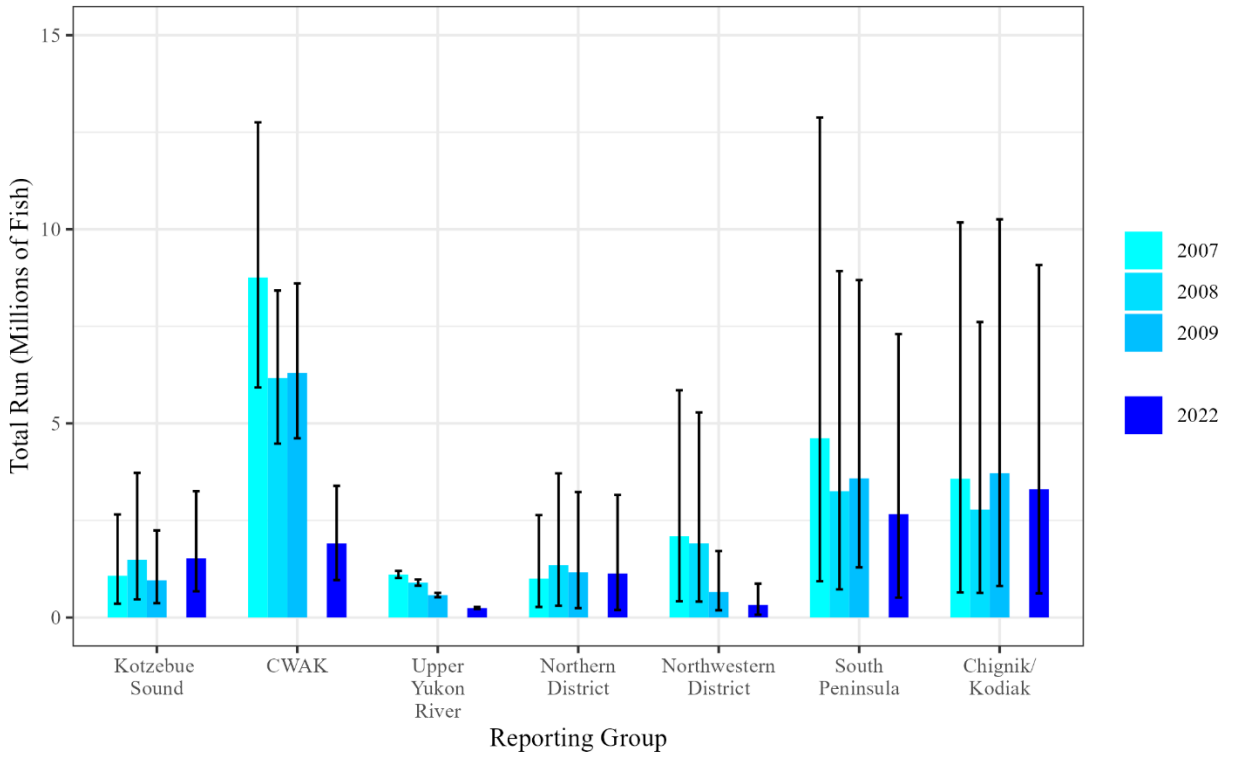

Figure 1.–Comparison of 2022 mean total run estimates and 90% credibility intervals for chum salmon in Western Alaska and the Alaska Peninsula to estimates from WASSIP (2007–2009, Munro et al. 2012).

Note: Estimates of total run for the Chignik/Kodiak reporting group are biased low, as the Kodiak commercial harvest is not included in these total run estimates.

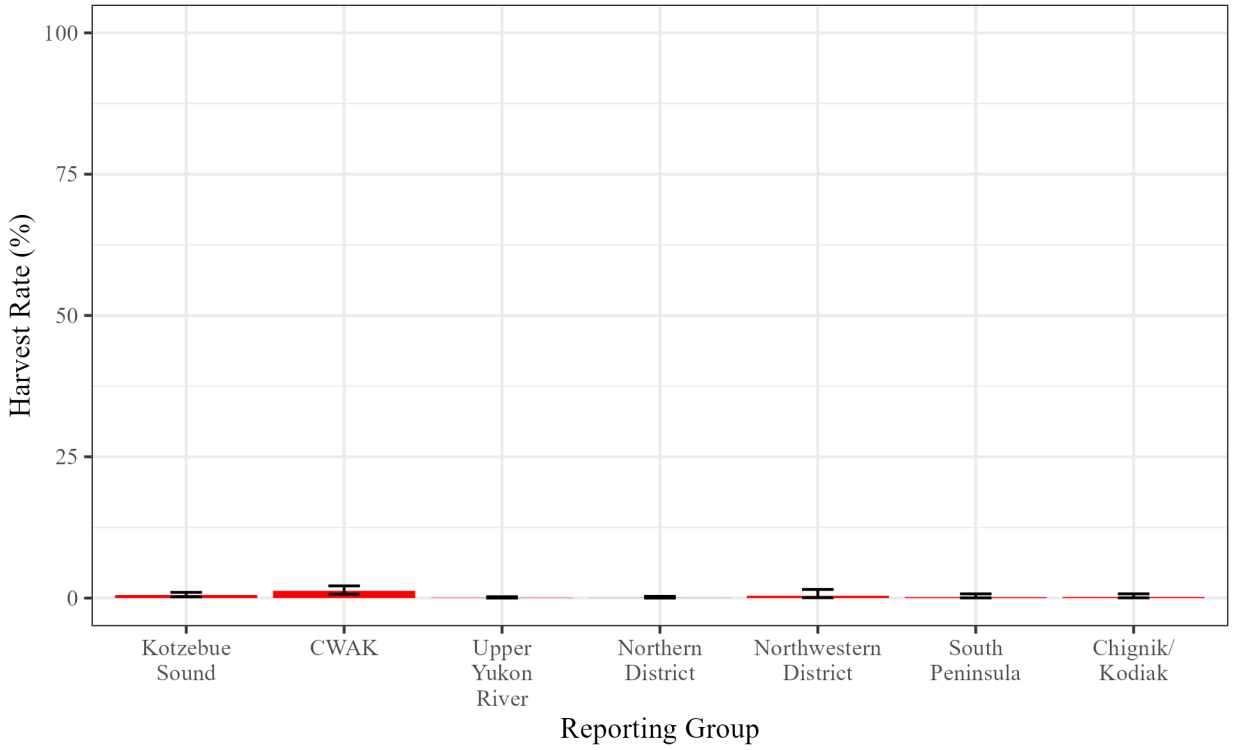

Figure 2.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Southeastern and South Central Districts in June 2022.

Note: Corresponds to Figure 7 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

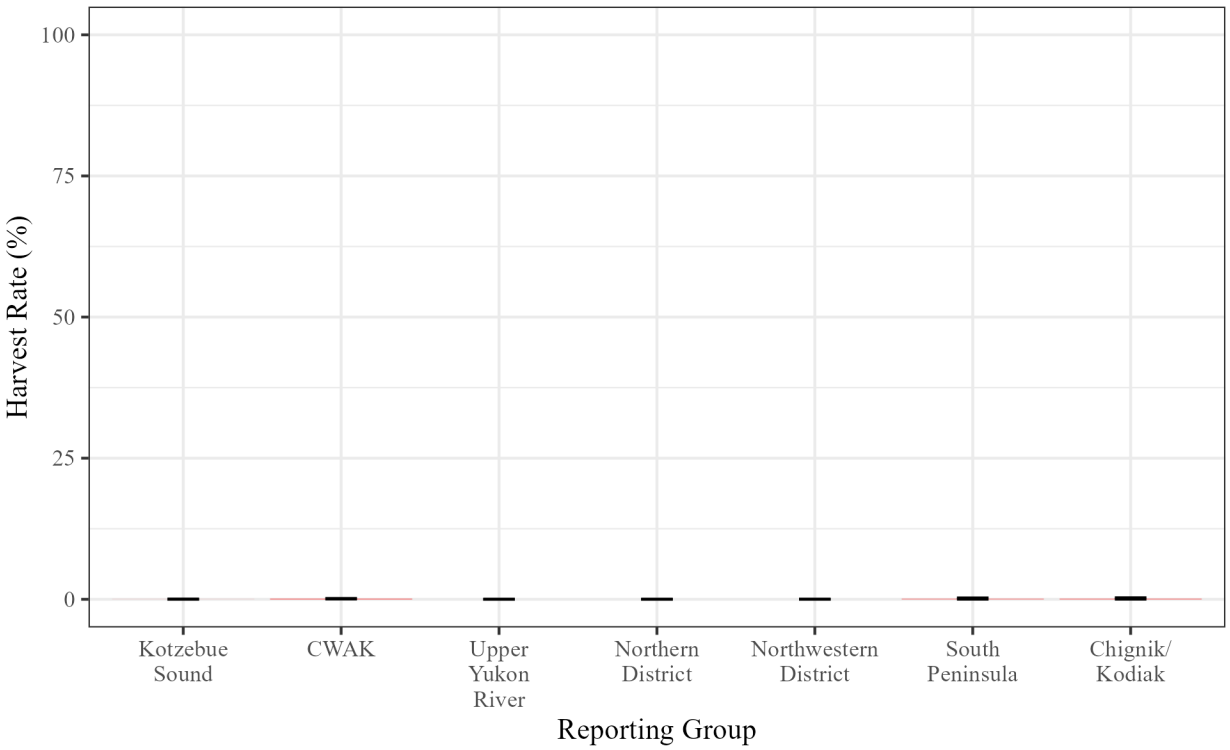

Figure 3.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the gillnet fishery in the Southeastern and South Central Districts in June 2022.

Note: Corresponds to Figure 8 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

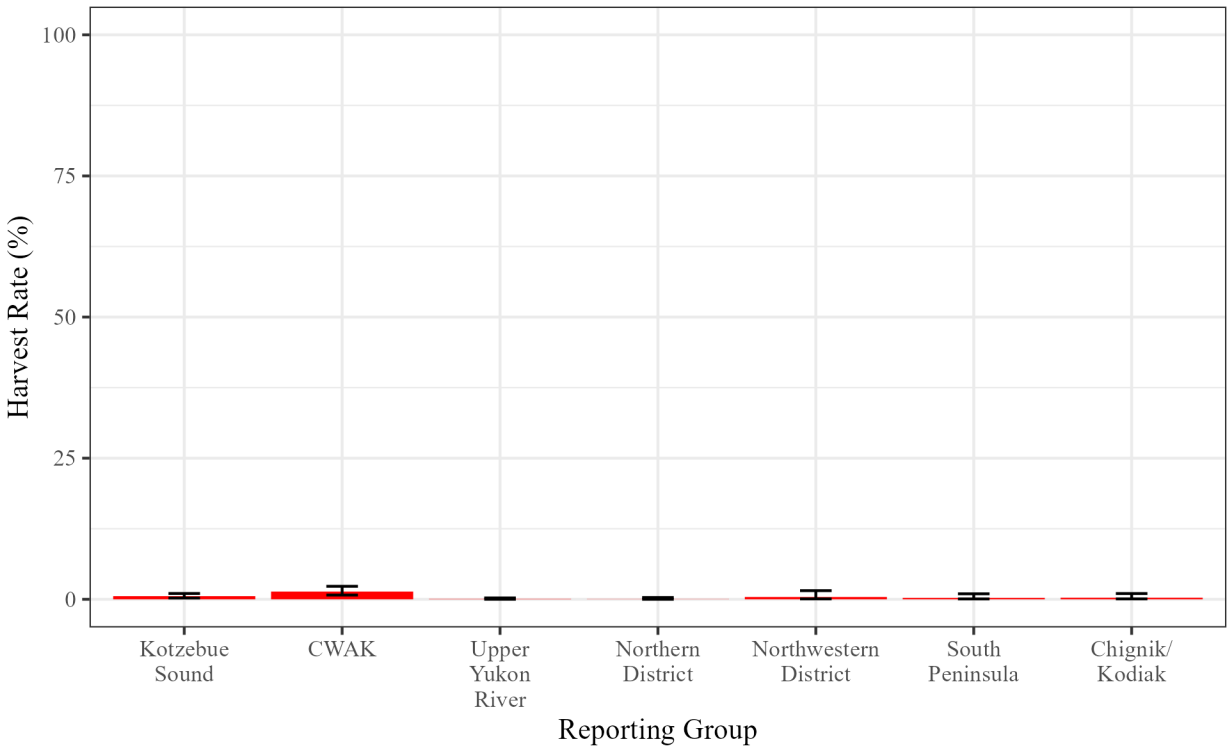

Figure 4.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the Southeastern and South Central Districts in June 2022.

Note: Corresponds to Figure 9 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

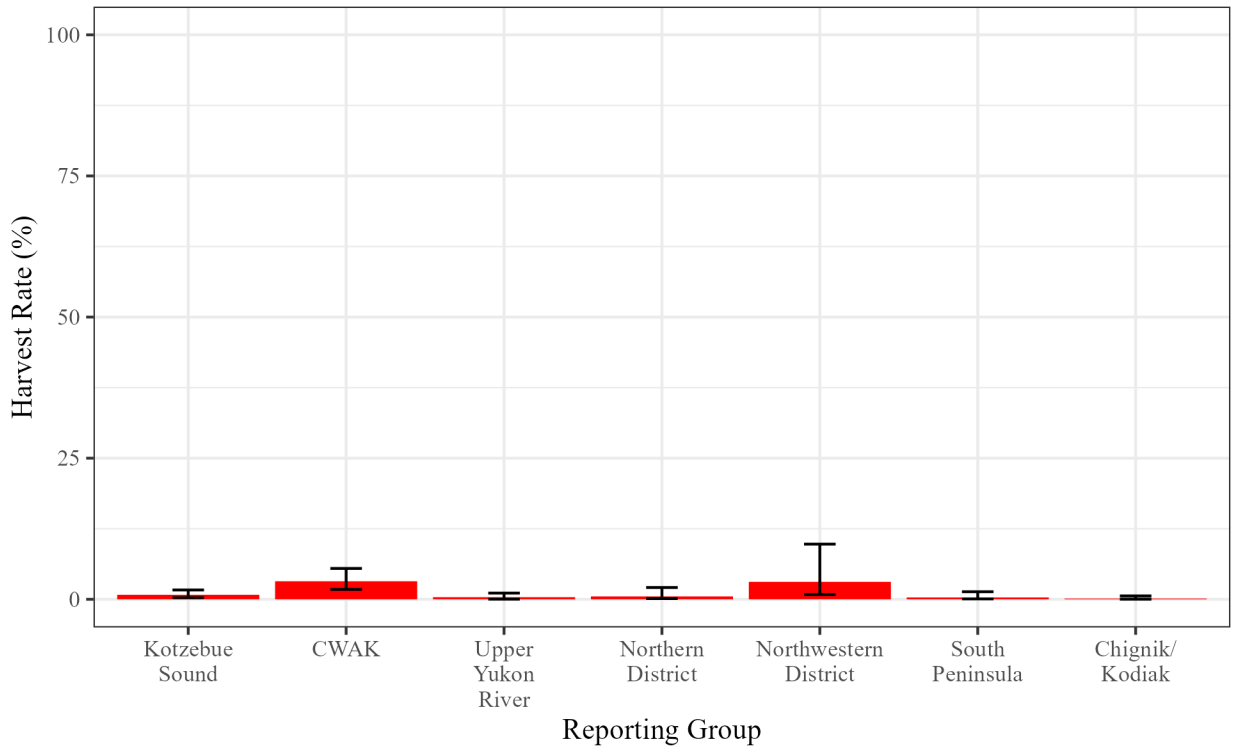

Figure 5.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Unimak and Southwestern Districts in June 2022.

Note: Corresponds to Figure 11 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are likely overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

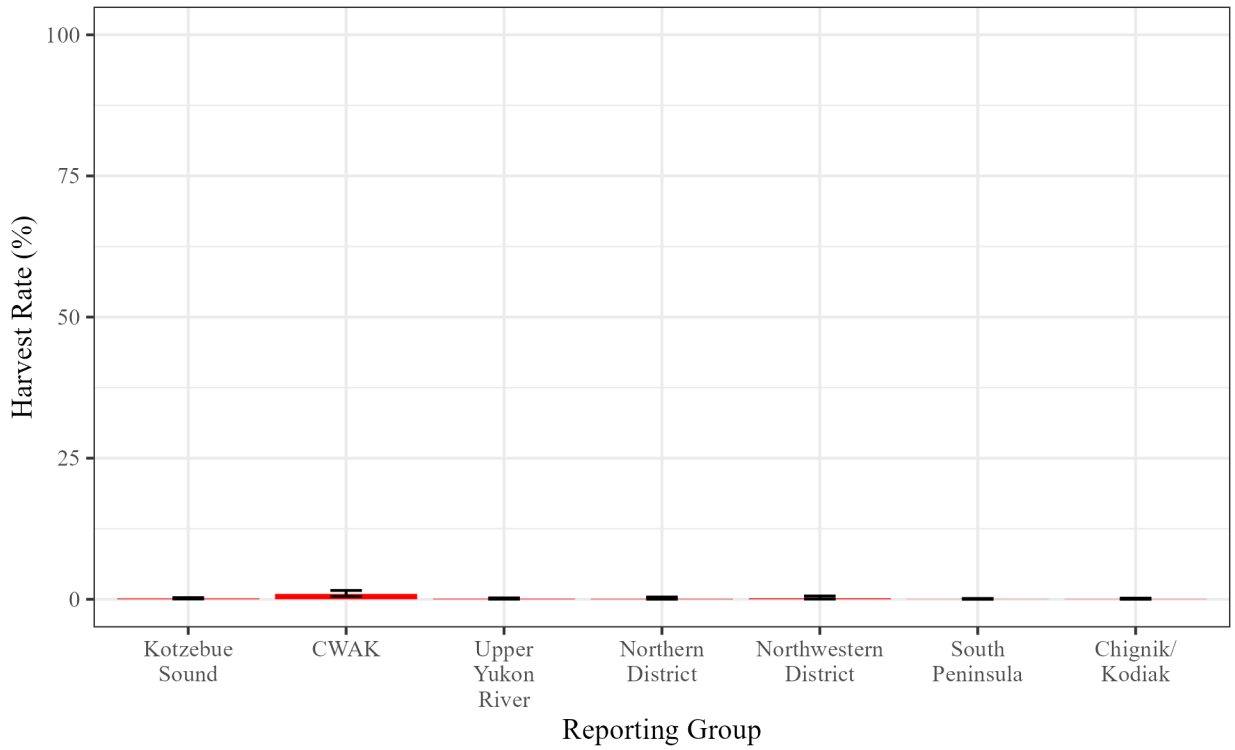

Figure 6.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the gillnet fishery in the Unimak and Southwestern Districts in June 2022.

Note: Corresponds to Figure 13 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

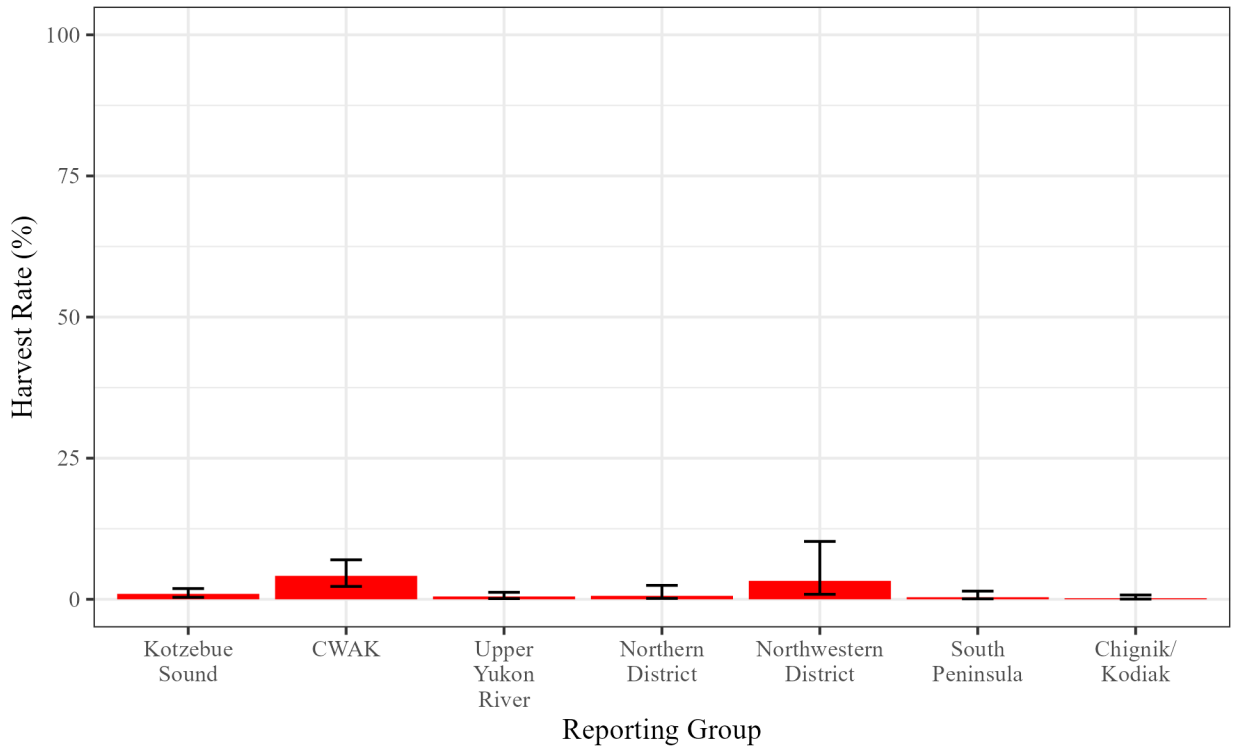

Figure 7.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the Unimak and Southwestern Districts in June 2022.

Note: Corresponds to Figure 14 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

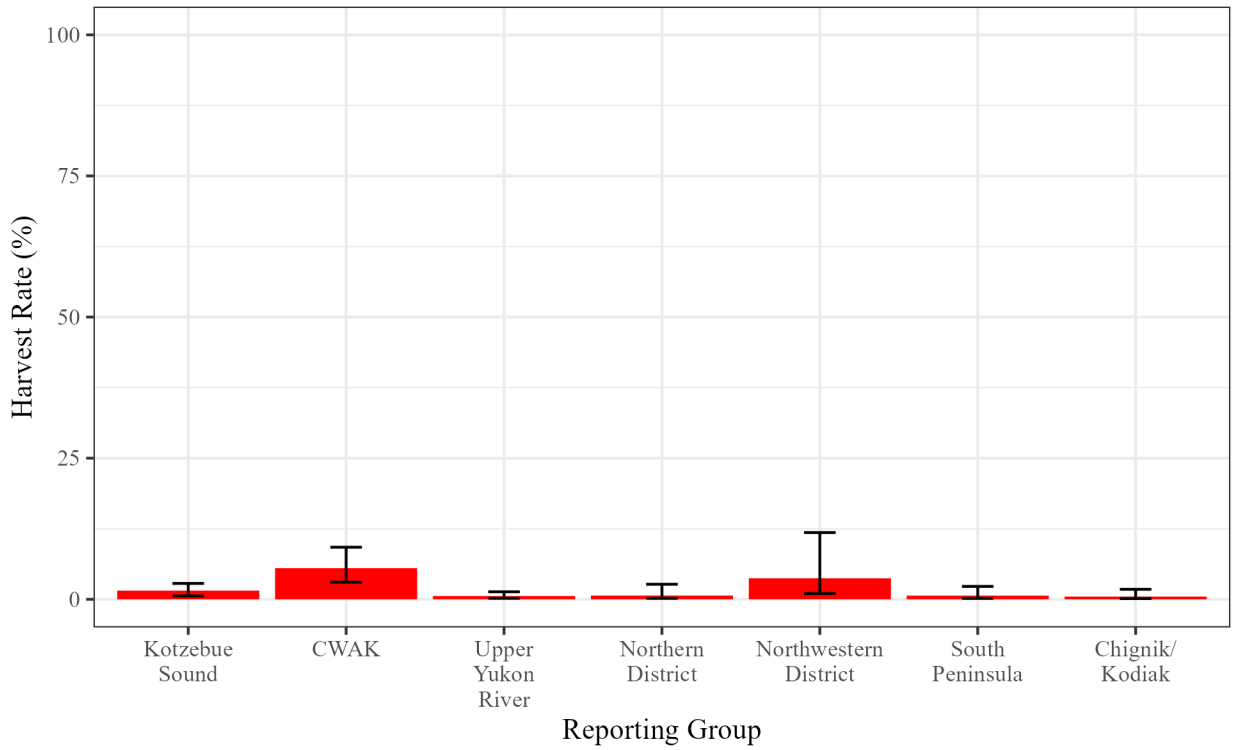

Figure 8.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the fisheries in the South Alaska Peninsula in June 2022.

Note: Corresponds to Figure 15 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

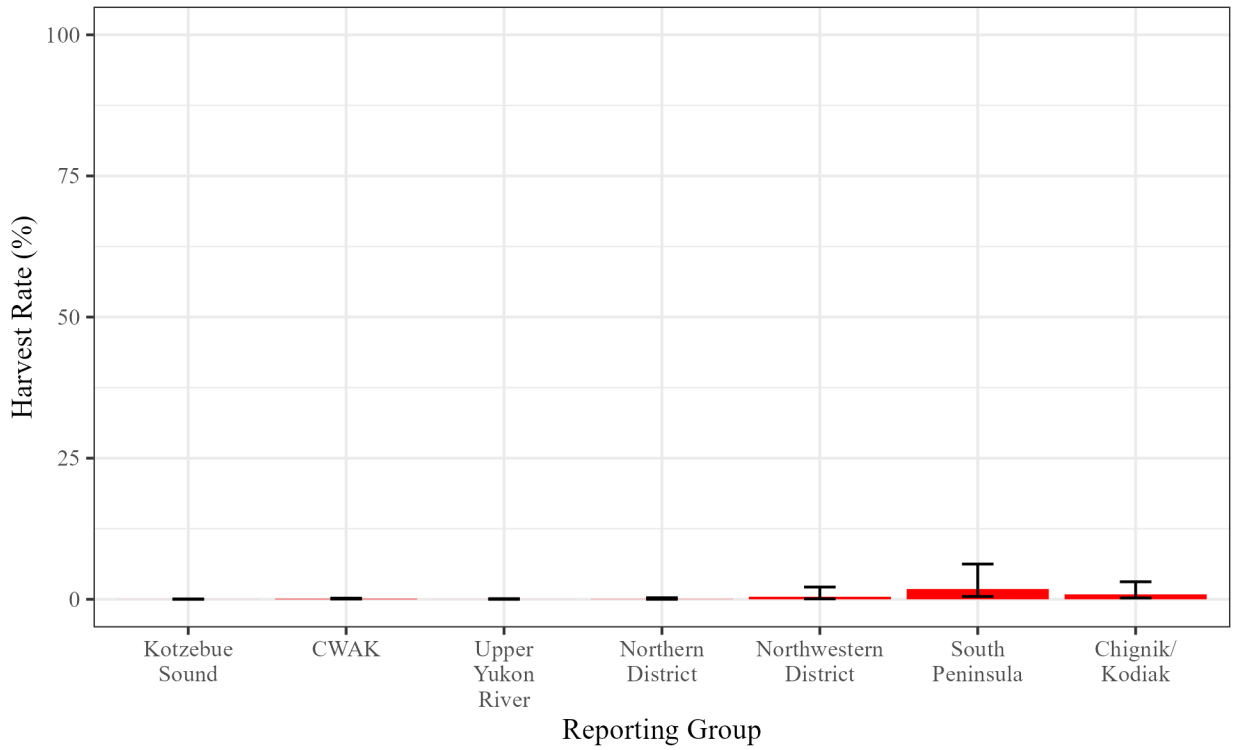

Figure 9.–Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Southeastern and South Central Districts in July 2022.

Note: Corresponds to Figure 17 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

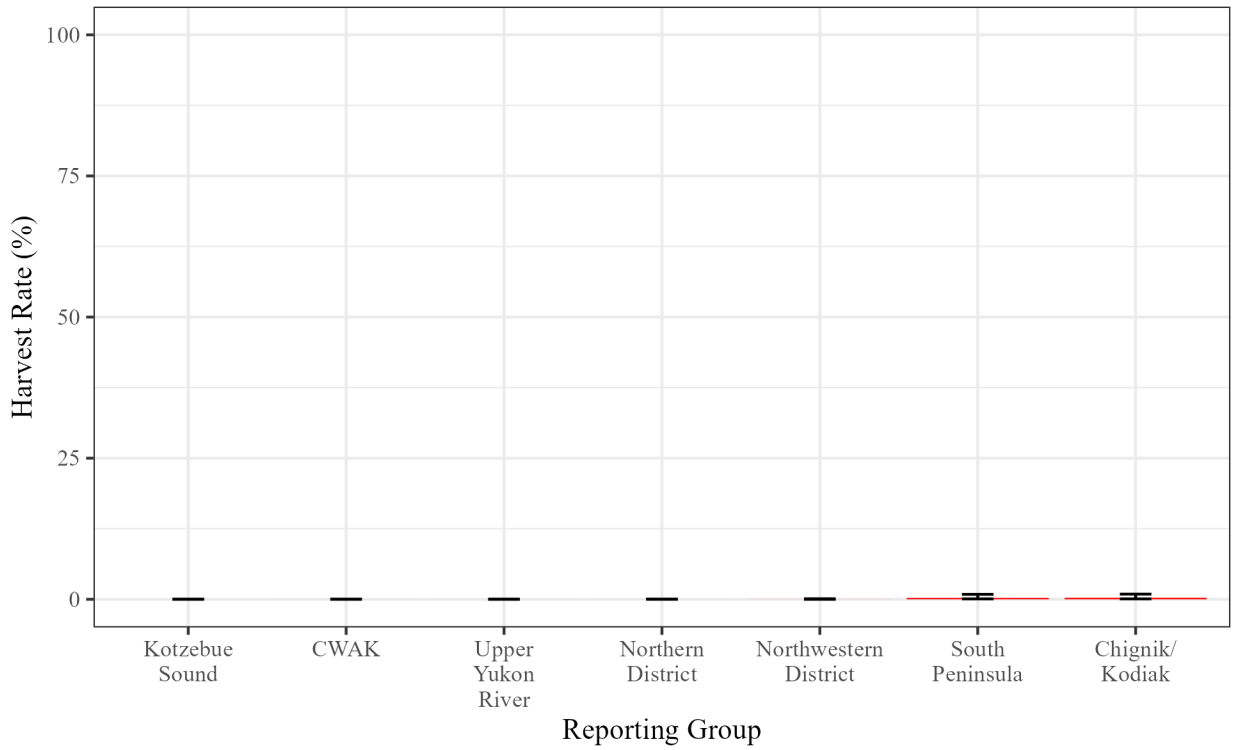

Figure 10.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the gillnet fishery in the Southeastern and South Central Districts in July 2022.

Note: Corresponds to Figure 19 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

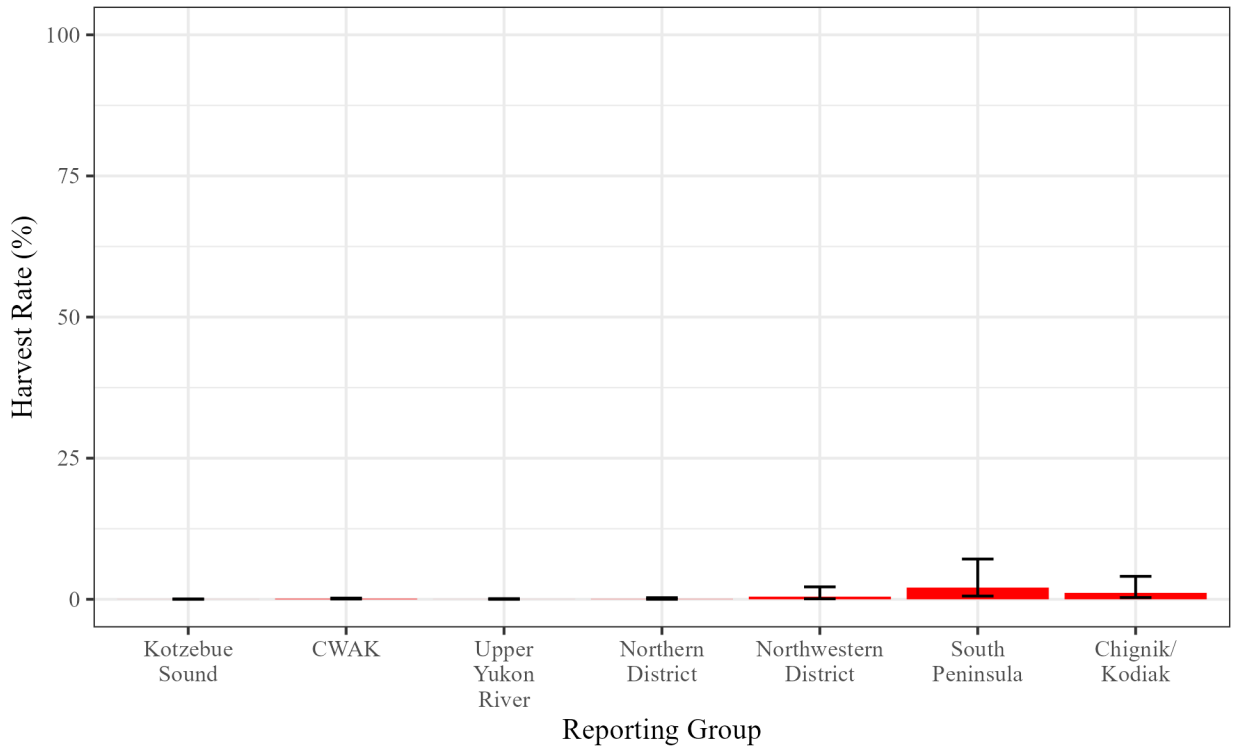

Figure 11.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the Southeastern and South Central Districts in July 2022.

Note: Corresponds to Figure 20 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

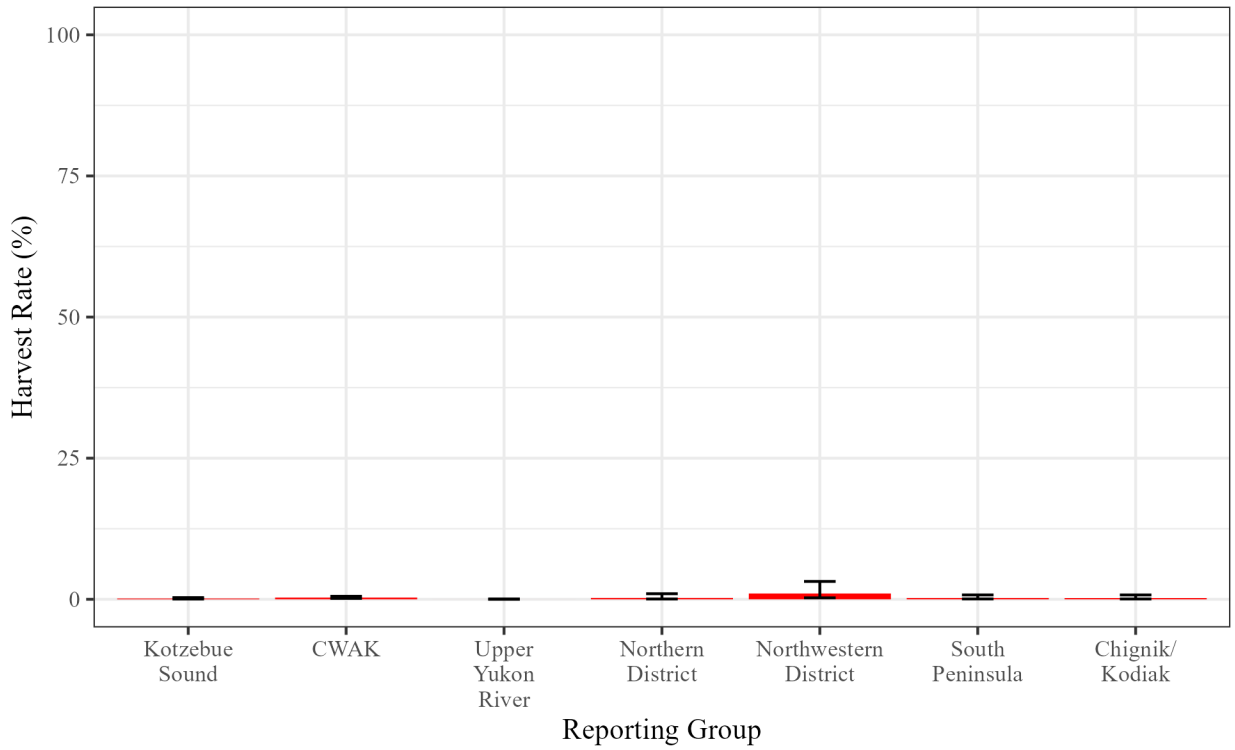

Figure 12.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Unimak and Southwestern Districts in July 2022.

Note: Corresponds to Figure 22 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

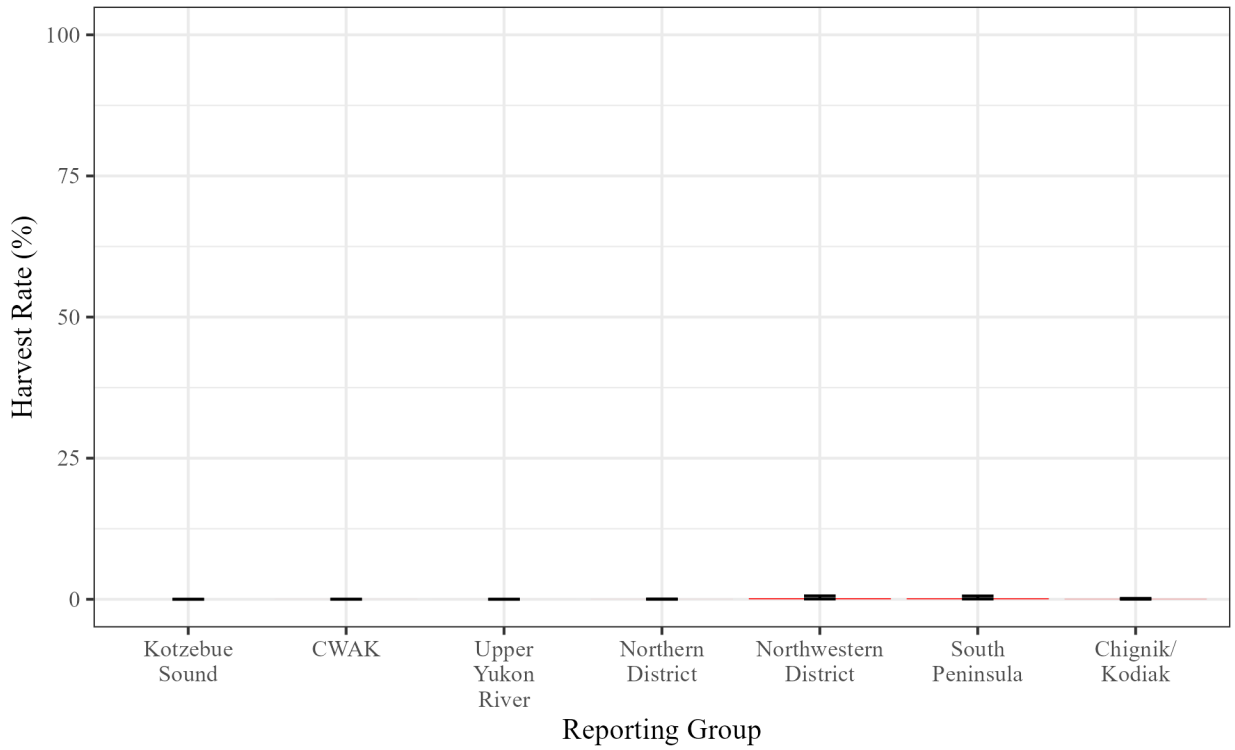

Figure 13.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the gillnet fishery in the Unimak and Southwestern Districts in July 2022.

Note: Corresponds to Figure 24 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

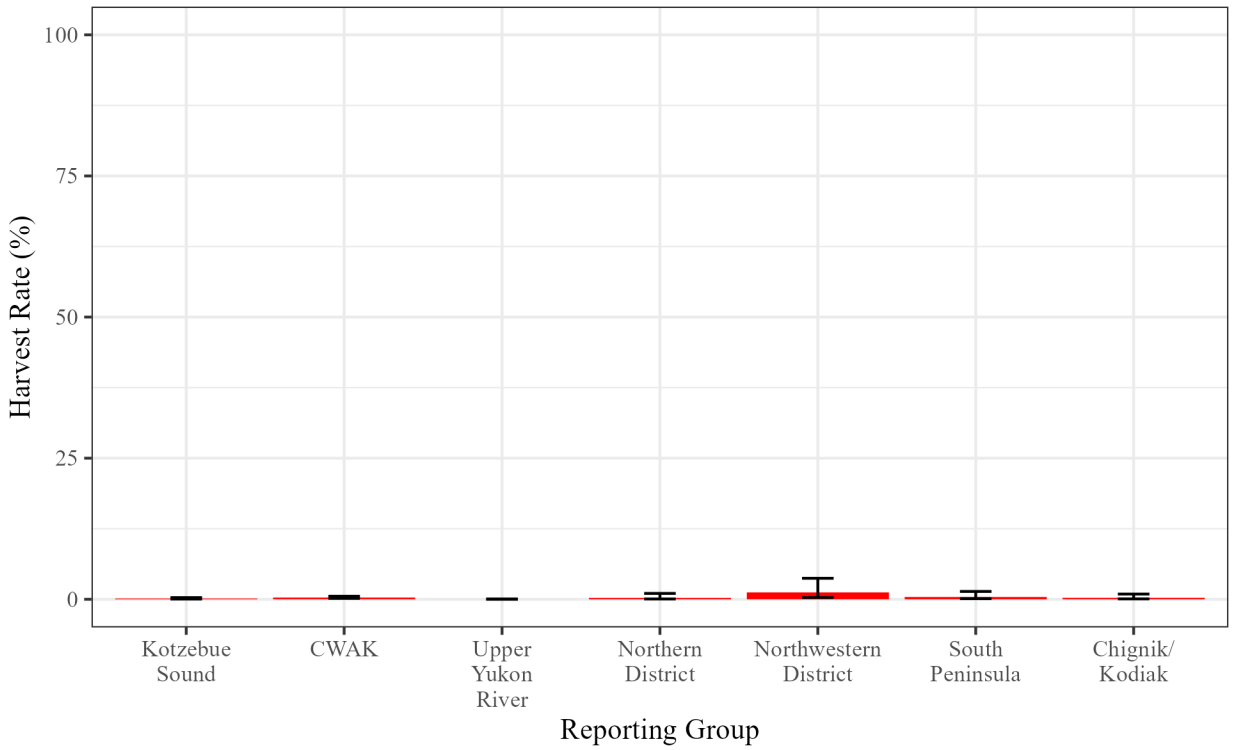

Figure 14.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the Unimak and Southwestern Districts in July 2022.

Note: Corresponds to Figure 25 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

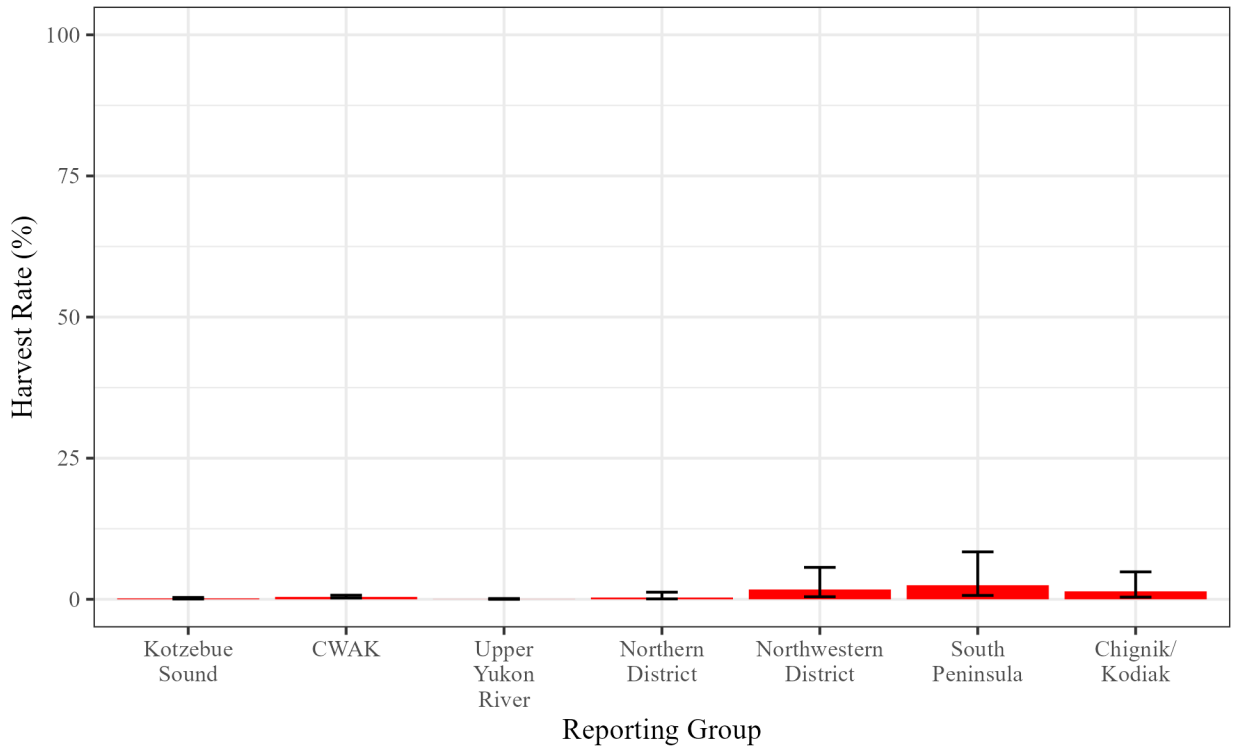

Figure 15.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the fisheries in the South Alaska Peninsula in July 2022.

Note: Corresponds to Figure 26 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

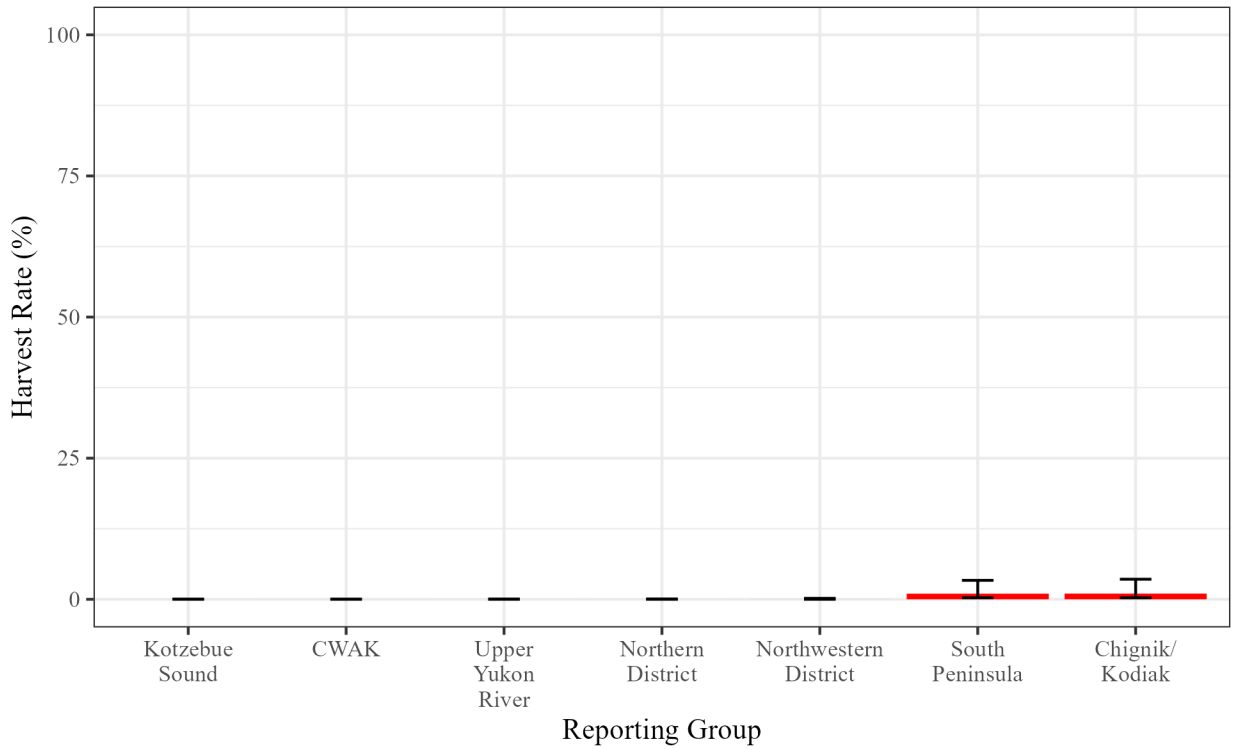

Figure 16.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Southeastern and South Central Districts in August 2022.

Note: Corresponds to Figure 28 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

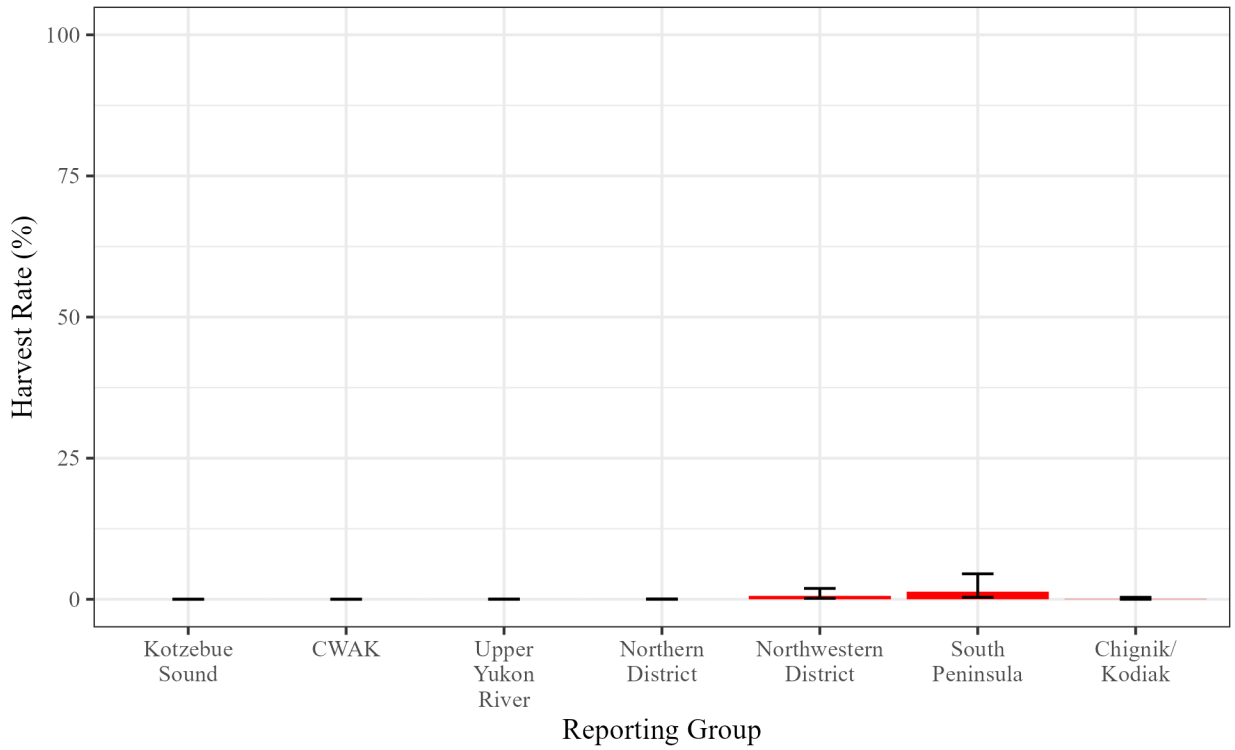

Figure 17.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the seine fishery in the Unimak and Southwestern Districts in August 2022.

Note: Corresponds to Figure 30 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

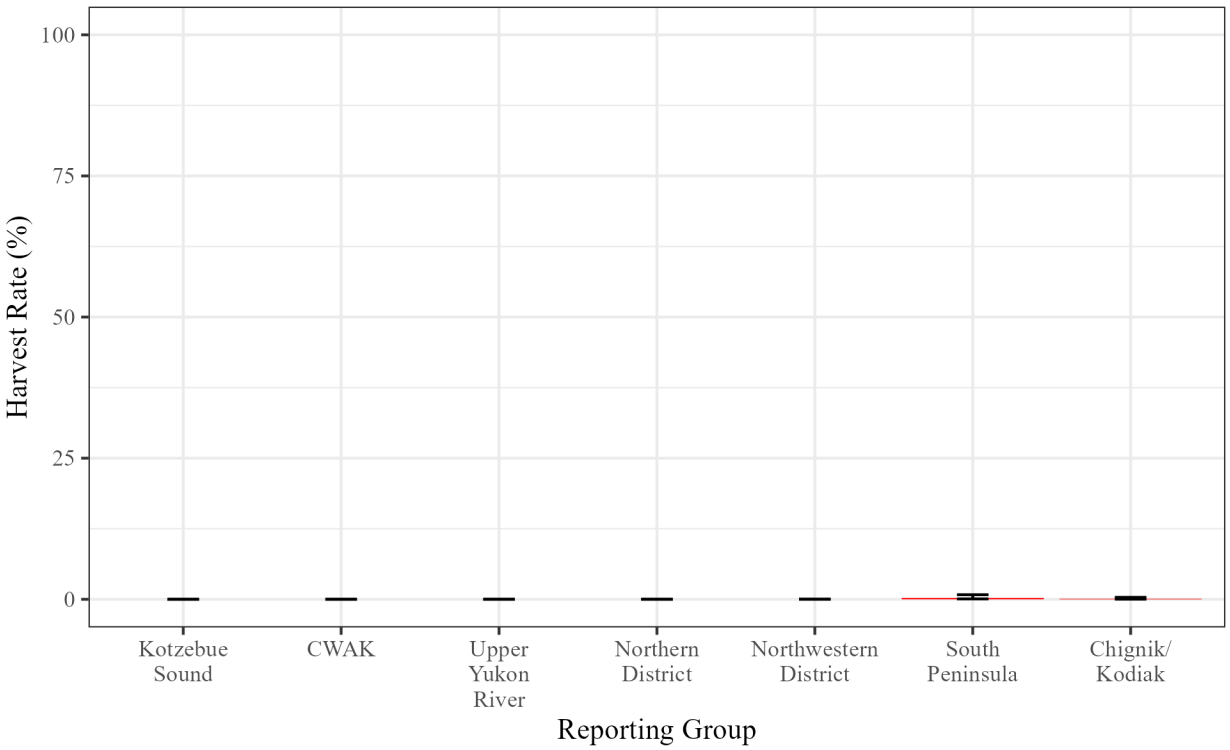

Figure 18.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from the gillnet fishery in the South Alaska Peninsula in August 2022.

Note: Corresponds to Figure 31 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

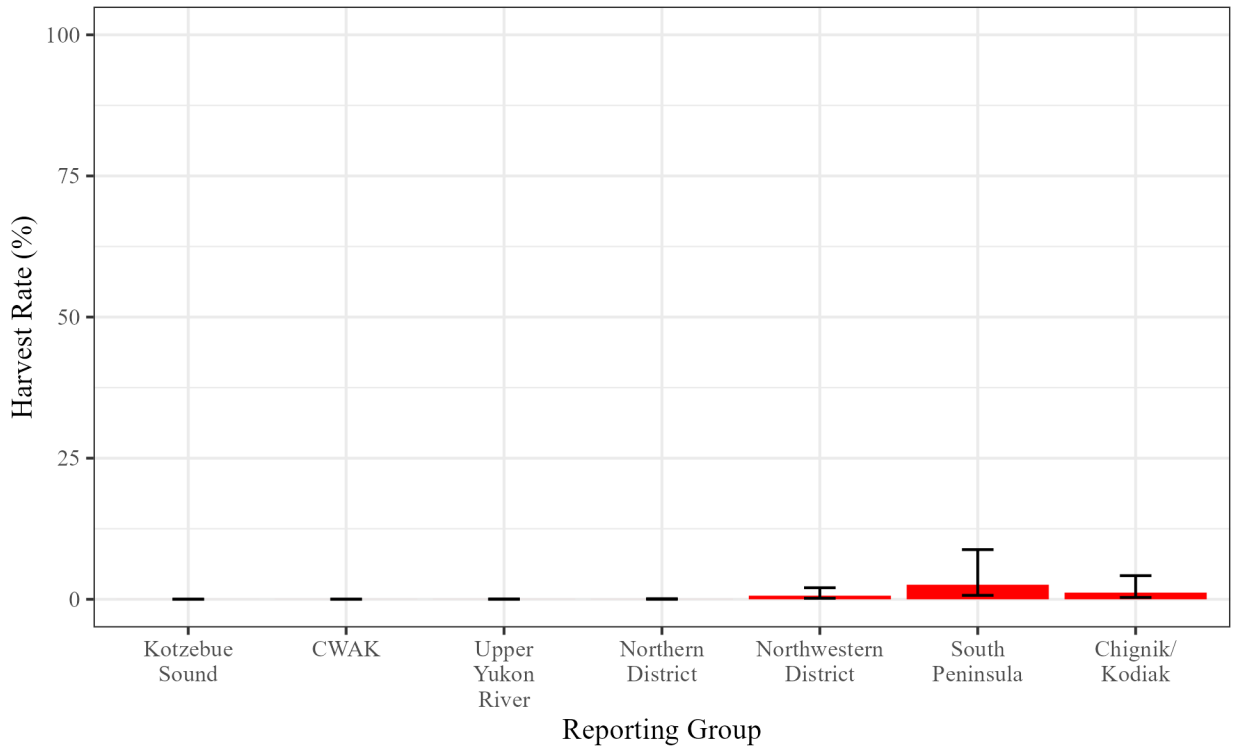

Figure 19.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the South Alaska Peninsula in August 2022.

Note: Corresponds to Figure 32 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

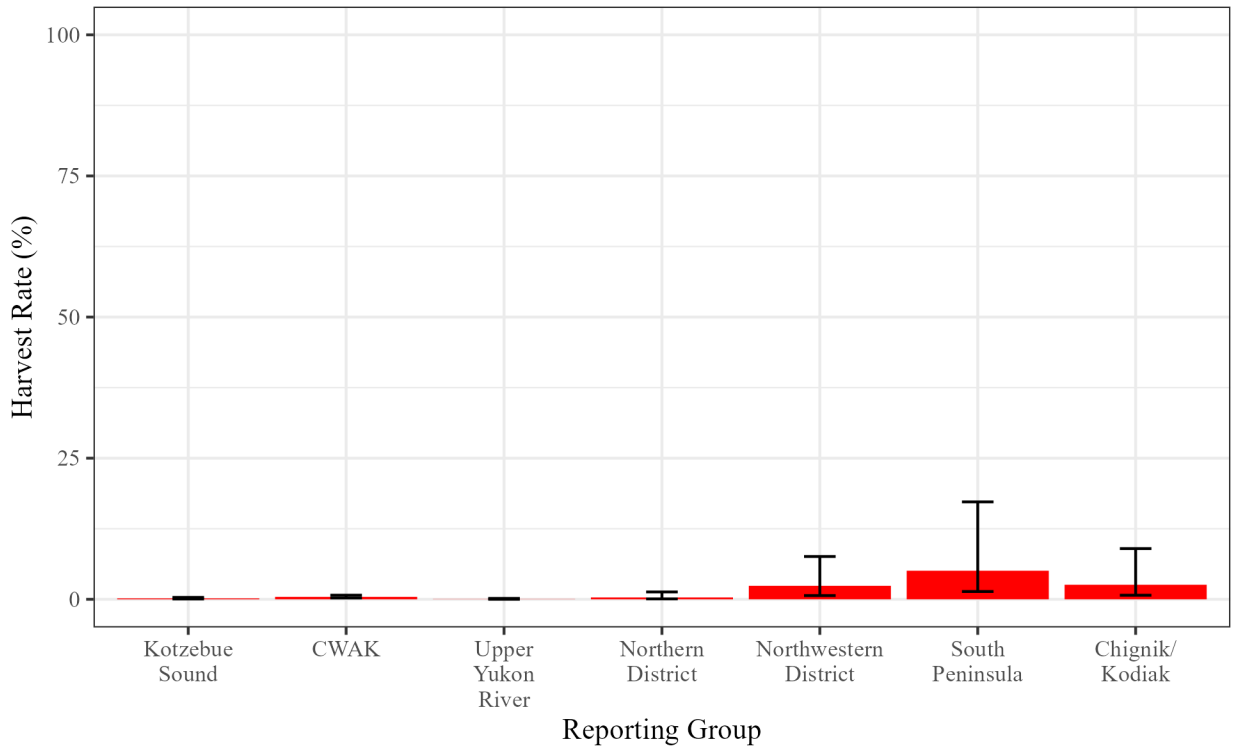

Figure 20.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the South Alaska Peninsula in post-June 2022.

Note: Corresponds to Figure 33 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

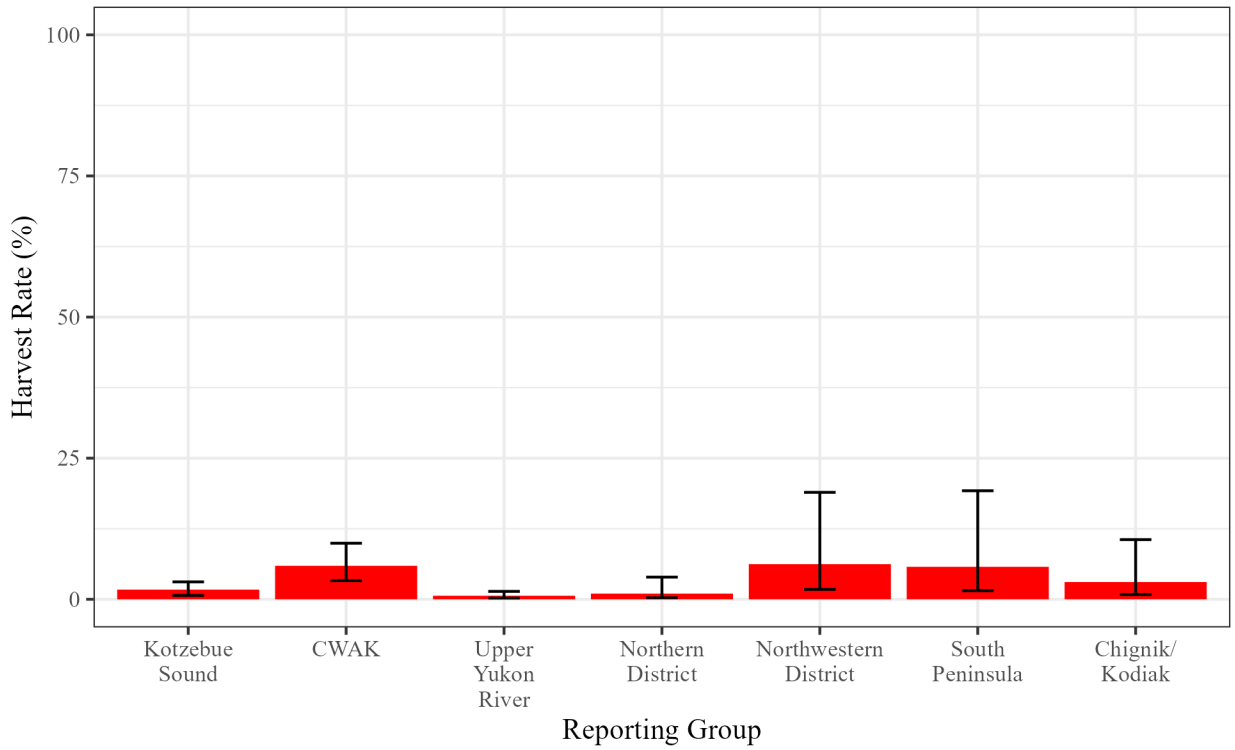

Figure 21.– Stratified estimates of median reporting group harvest rates (%) and 90% credibility intervals for chum salmon sampled from fisheries in the South Alaska Peninsula in 2022.

Note: Corresponds to Figure 34 in Dann et al. (2023).
Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

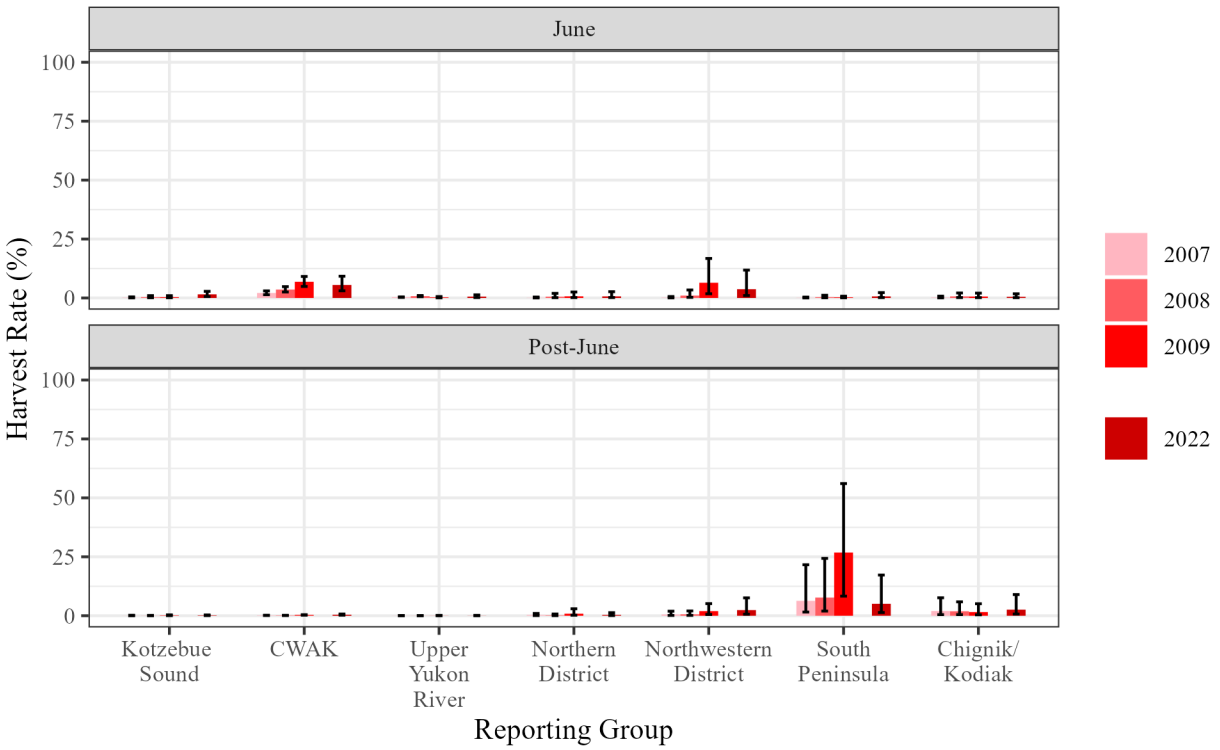

Figure 22.–Comparison of stock-specific harvest rates (median and 90% CI) in the June and post-June fisheries, 2022 with estimates from WASSIP (2007–2009; Munro et al. (2012)).

Note: Harvest rate estimates for the Chignik/Kodiak reporting group are probably overestimated, as the total run estimate does not include Kodiak commercial chum salmon harvest.

APPENDIX: TOTAL RUN ESTIMATES OF CHUM SALMON 2007–2009

Appendix A1.–Components and estimates of the total run for chum salmon by reporting group for the Western Alaska Salmon Stock Identification Program (WASSIP), 2007. Components include reporting group-specific means and CVs of commercial harvest for fisheries included in the Program sampling plan, subsistence harvest not in the sampling plan, and escapement. Estimates of the total run include median, 90% credibility interval, mean, SD and CV. (Reproduced from Munro et al. (2012), Table 4.)

	Harvest				Escapement[a]		Total Run					
	WASSIP Comm. & Sub.		Subsistence[a,b]					90% CI				
Reporting Group	Mean	CV	Mean	CV	Mean	CV	Median	5%	95%	Mean	SD	CV
Kotzebue Sound	150,660	0.05	54,351	0.10	868,390	1.02	812,275	355,542	2,654,603	1,073,401	887,227	0.83
CWAK[c]	2,245,151	0.03	151,885	0.10	6,175,741	0.35	8,401,581	5,925,006	12,755,184	8,755,495	2,156,688	0.25
Upper Yukon River[d]	42,455	0.04	101,415	0.10	910,776	0.06	1,105,252	1,017,366	1,200,659	1,106,480	55,799	0.05
Northern District[e]	126,434	0.15	NA	NA	866,749	1.09	724,126	271,823	2,637,779	1,002,307	941,411	0.94
Northwestern District[f]	11,431	0.15	NA	NA	1,984,776	1.09	1,447,460	418,672	5,853,315	2,092,248	2,166,618	1.04
South Peninsula	250,038	0.03	520	0.10	4,365,013	1.09	3,200,468	934,501	12,879,080	4,615,571	4,736,543	1.03
Chignik/Kodiak[g]	100,352	0.06	431	0.10	3,475,000	1.10	2,449,575	645,894	10,176,517	3,575,783	3,809,197	1.07

Note: Total run means and medians can be used to evaluate symmetry of posterior distribution. Total run mean is the sum of the harvest (including terminal and inriver harvest) and escapement means.

NA = Subsistence harvest reports are not comprehensive for these areas; therefore subsistence harvest (if any) is unknown.

[a] Means and CV of simulated data sampled from lognormal distributions; therefore, they may differ from those reported in the escapement report and subsistence harvest appendices in this report.

[b] Subsistence harvest adjusted, where possible, to not include harvest above assessment projects and already accounted for in escapement estimate or part of WASSIP sampling plan.

[c] CWAK reporting group includes 182,695 inriver commercial harvest of summer chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[d] Upper Yukon River reporting group total run includes 51,825 inriver commercial harvest of fall chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[e] Northern District reporting group total run includes 9,123 terminal harvest of chum salmon in Black Hills, Nelson Lagoon, Port Moller Bight, and Herendeen–Moller Bay sections, Northern District commercial fisheries; CV = 0.05.

[f] Northwestern District reporting group total run includes 96,006 terminal harvest of chum salmon in Dublin Bay, Urilia Bay, Swanson Lagoon, Bechevin Bay, and Izembek-Moffet Bay section in Northwestern District commercial fisheries; CV = 0.05.

[g] Harvest estimates in the Chignik/Kodiak reporting group do not include Kodiak commercial harvest. These estimates of total run are biased low and the resulting harvest rate estimates would be overestimated.

Appendix A2.–Components and estimates of the total run for chum salmon by reporting group for the Western Alaska Salmon Stock Identification Program (WASSIP), 2008. Components include reporting group-specific means and CVs of commercial harvest for fisheries included in the Program sampling plan, subsistence harvest not in the sampling plan, and escapement. Estimates of the total run include median, 90% credibility interval, mean, SD and CV. (Reproduced from Munro et al. (2012), Table 5.)

	Harvest				Escapement[a]		Total Run					
	WASSIP Comm. & Sub.		Subsistence[a,b]					90% CI				
Reporting Group	Mean	CV	Mean	CV	Mean	CV	Median	5%	95%	Mean	SD	CV
Kotzebue Sound	197,281	0.05	54,317	0.10	1,236,779	1.01	1,121,008	467,038	3,725,121	1,488,377	1,252,171	0.84
CWAK[c]	1,635,819	0.02	138,363	0.10	4,249,413	0.29	6,001,760	4,478,543	8,422,337	6,168,990	1,233,432	0.20
Upper Yukon River[d]	68,631	0.05	89,552	0.10	687,018	0.07	895,238	818,667	979,934	896,726	49,148	0.05
Northern District[e]	44,298	0.18	66	0.11	1,245,318	1.08	951,652	302,040	3,713,435	1,350,576	1,348,845	1.00
Northwestern District[f]	23,152	0.10	NA	NA	1,783,367	1.10	1,333,844	410,110	5,282,994	1,910,651	1,969,270	1.03
South Peninsula	249,313	0.03	790	0.10	3,001,672	1.08	2,292,472	724,383	8,923,204	3,251,776	3,227,197	0.99
Chignik/Kodiak[g]	233,437	0.03	243	0.10	2,544,822	1.10	1,946,912	633,371	7,610,712	2,778,501	2,807,686	1.01

Note: Total run means and medians can be used to evaluate symmetry of posterior distribution. Total run mean is the sum of the harvest (including terminal and inriver harvest) and escapement means.

NA = Subsistence harvest reports are not comprehensive for these areas; therefore subsistence harvest (if any) is unknown.

[a] Means and CV of simulated data sampled from lognormal distributions therefore, they may differ from those reported in the escapement report and subsistence harvest appendices in this report.

[b] Subsistence harvest adjusted, where possible, to not include harvest above assessment projects and already accounted for in escapement estimate or part of WASSIP sampling plan.

[c] CWAK reporting group includes 145,378 inriver commercial harvest of summer chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[d] Upper Yukon River reporting group total run includes 51,539 inriver commercial harvest of fall chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[e] Northern District reporting group total run includes 60,892 terminal harvest of chum salmon in Black Hills, Nelson Lagoon, Port Moller Bight, and Herendeen–Moller Bay sections, Northern District commercial fisheries; CV = 0.05.

[f] Northwestern District reporting group total run includes 104,140 terminal harvest of chum salmon in Dublin Bay, Urilia Bay, Swanson Lagoon, Bechevin Bay, and Izembek-Moffet Bay section in Northwestern District commercial fisheries; CV = 0.05.

[g] Harvest estimates in the Chignik/Kodiak reporting group do not include Kodiak commercial harvest. These estimates of total run are biased low and the resulting harvest rate estimates would be overestimated.

Appendix A3.–Components and estimates of the total run for chum salmon by reporting group for the Western Alaska Salmon Stock Identification Program (WASSIP), 2009. Components include reporting group-specific means and CVs of commercial harvest for fisheries included in the Program sampling plan, subsistence harvest not in the sampling plan, and escapement. Estimates of the total run include median, 90% credibility interval, mean, SD and CV. (Reproduced from Munro et al. (2012), Table 6.)

	Harvest				Escapement[a]		Total run					
	WASSIP comm. & sub.		Subsistence[a,b]					90% CI				
Reporting group	Mean	CV	Mean	CV	Mean	CV	Median	5%	95%	Mean	SD	CV
Kotzebue Sound	191,457	0.05	54,303	0.10	711,399	1.03	744,622	369,262	2,243,171	957,159	733,988	0.77
CWAK[c]	2,036,101	0.02	111,421	0.10	3,991,880	0.31	6,123,152	4,616,373	8,605,774	6,302,064	1,245,524	0.20
Upper Yukon River[d]	13,565	0.10	66,161	0.10	482,333	0.07	574,892	521,453	634,583	576,021	34,528	0.06
Northern District[e]	64,411	0.13	NA	NA	1,091,118	1.09	810,538	242,153	3,232,353	1,162,822	1,193,351	1.03
Northwestern District[f]	43,979	0.08	39	0.10	557,480	1.06	478,720	186,466	1,712,261	655,679	593,308	0.90
South Peninsula	856,535	0.03	428	0.10	2,726,903	1.09	2,701,080	1,291,446	8,692,035	3,583,866	2,960,123	0.83
Chignik/Kodiak[g]	266,195	0.04	482	0.10	3,448,767	1.08	2,598,353	811,531	10,256,476	3,715,444	3,717,870	1.00

Note: Total run means and medians can be used to evaluate symmetry of posterior distribution. Total run mean is the sum of the harvest (including terminal and inriver harvest) and escapement means.

NA = Subsistence harvest reports are not comprehensive for these areas; therefore, subsistence harvest (if any) is unknown.

[a] Means and CV of simulated data sampled from lognormal distributions; therefore, they may differ from those reported in the escapement report and subsistence harvest appendices in this report.

[b] Subsistence harvest adjusted, where possible, to not include harvest above assessment projects and already accounted for in escapement estimate or part of WASSIP sampling plan.

[c] CWAK reporting group includes 162,702 inriver commercial harvest of summer chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[d] Upper Yukon River reporting group total run includes 13,965 inriver commercial harvest of fall chum salmon in Districts 1 through 6 (except District 1 marine harvest included in WASSIP sampling plan) commercial fisheries, Yukon River; CV = 0.05.

[e] Northern District reporting group total run includes 7,294 terminal harvest of chum salmon in Black Hills, Nelson Lagoon, Port Moller Bight, and Herendeen–Moller Bay sections, Northern District commercial fisheries; CV = 0.05.

[f] Northwestern District reporting group total run includes 54,169 terminal harvest of chum salmon in Dublin Bay, Urilia Bay, Swanson Lagoon, Bechevin Bay, and Izembek-Moffet Bay section in Northwestern District commercial fisheries; CV = 0.05.

[g] Harvest estimates in the Chignik/Kodiak reporting group do not include Kodiak commercial harvest. These estimates of total run are biased low and the resulting harvest rate estimates would be overestimated.