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2022 Bristol Bay Sockeye Salmon Processing Capacity Survey Summary

by

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and

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May 2022

Alaska Department of Fish and Game **Divisions of Sport Fish and 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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2022 BRISTOL BAY SOCKEYE SALMON PROCESSING CAPACITY SURVEY SUMMARY

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ABSTRACT

The 15 primary salmon processing companies in Bristol Bay were surveyed to estimate the expected capacity to purchase and process sockeye salmon, by number and weight of fish, in the summer of 2022. All 15 companies responded with estimates of total intended purchases, daily processing capacity, "in Bristol Bay" tender fleet capacity, and long-haul tender fleet capacity. Bristol Bay companies intend to purchase 265.17 million pounds of sockeye salmon *Oncorhynchus nerka* in 2022, a 25% increase from 2019 when the survey was last conducted. The 265.17 million pounds converts to approximately 52.10 million fish; this is 7.84 million fish less than the 59.94 million fish harvestable surplus forecasted to return in 2022. The survey estimated a maximum daily processing capacity of 3.15 million fish per day, sustainable for approximately 20 days.

Keywords: Bristol Bay, sockeye salmon, processing capacity, forecast, harvest

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) surveyed 15 commercial salmon processing companies who intend to purchase sockeye salmon *Oncorhynchus nerka* in Bristol Bay during the 2022 season. All 15 processing companies completed and returned the survey. All but one of the companies recorded salmon landings in Bristol Bay during the 2021 season. Taken together, these companies accounted for 99.8% of the recorded landings of sockeye salmon landed in Bristol Bay during the 2021 season. Companies' salmon processing capacities are protected as confidential information under Alaska statute (AS 16.05.815(a)). This document provides a nonconfidential summary of the 2022 Bristol Bay sockeye salmon processing capacity survey.

The Bristol Bay area commercial salmon fishery includes all coastal and inland waters east of a line from Cape Newenham to Cape Menshikof (Figure 1). The area includes 9 major river systems: Naknek, Kvichak, Alagnak, Egegik, Ugashik, Wood, Nushagak, Igushik, and Togiak. Collectively, these rivers are home to the largest commercial sockeye salmon *O. nerka* fishery in the world. Sockeye salmon are by far the most abundant salmon species that return to Bristol Bay each year, but Chinook *O. tshawytscha*, chum *O. keta*, coho *O. kisutch*, and—in even years—pink salmon *O. gorbuscha* returns are important to the fishery as well. The Bristol Bay area is divided into 5 management districts (Naknek-Kvichak, Egegik, Ugashik, Nushagak, and Togiak) that correspond to major river systems. The management objective for each river is to achieve salmon escapements within established ranges while harvesting fish in excess of those ranges through orderly fisheries. In addition, regulatory management plans have been adopted for individual species in certain districts. This survey estimates processing capacity for the entire Bristol Bay area and does not summarize capacity by district.

Results of this processing capacity survey should be viewed in relationship to the ADF&G sockeye salmon forecast (Buck et al. 2021; Appendix A). The primary function of the salmon forecast is to provide processors and harvesters an indication of the salmon return anticipated by ADF&G for the coming season. The 2022 sockeye salmon forecast for Bristol Bay is 75.27 million fish (range: 61.01–89.54 million). This is a record high forecast—44% larger than the most recent 10-year average of Bristol Bay total runs (52.09 million) and 111% greater than the long-term (1963–2021) average of 35.73 million fish. All systems are expected to meet their spawning escapement goals. In total, sockeye salmon escapement goals in Bristol Bay range from 5.70 million fish at the lower bound to 18.80 million fish at the upper bound. In 2022, escapement is forecasted at 13.46 million fish (Buck et al. 2021).

Based on forecasts of total run and escapement, there is a forecasted harvestable surplus of 59.94 million sockeye salmon in Bristol Bay in 2022 (Buck et al. 2021). This is 7.84 million fish

more than the total intended purchases of 52.10 million fish which would represent a record harvest. A Bristol Bay harvest of this size would be 75% larger than the most recent 10-year average harvest of 34.24 million fish and 170% larger than the long-term average harvest of 22.22 million fish (1963 to present).

BACKGROUND

ADF&G conducted the first statewide salmon processing capacity survey in 1978 and continued conducting voluntary and informal surveys of statewide processing capacity throughout the 1990s. Beginning in 2001, ADF&G conducted formal salmon capacity surveys in which survey forms were mailed to selected companies who represented most of the processing capacity in Alaska. These surveys were formal, but still voluntary. The voluntary nature of the surveys changed in 2004, when regulations were enacted that made participation a regulatory requirement (5 AAC 39.132). In addition, the regulations clarified that individual surveys were confidential under AS 16.05.815(a). In 2008, ADF&G phased out salmon capacity surveys for all fishing regions except Bristol Bay and has conducted these surveys as needed since. Surveys were not conducted from 2012 to 2014, but large forecasts prompted the division to conduct the survey again for the 2015 season. The processing capacity survey was not conducted from 2019 to 2021 after the results of several consecutive surveys suggested processing capacity in Bristol Bay was relatively stable at around 40 million fish (Poetter and Larsen 2019). Large harvests in recent years and the record-size forecast for 2022 prompted ADF&G to conduct a new processing capacity survey for the 2022 season. Large harvests have the potential to cause processing capacity bottlenecks, especially if salmon run timing is compressed.

A large projected harvestable surplus can prompt questions about allowing foreign processing vessels into the internal waters of the State of Alaska. The Bristol Bay sockeye salmon processing capacity survey is an instrument that can be used to determine whether domestic processors have enough capacity to handle the expected harvest. The Magnuson–Stevens Fishery Conservation and Management Act provides the framework requirements that must be met before foreign processing ships are allowed into the internal waters of the state. The Magnuson–Stevens Fishery Conservation and Management Act requires the governor to determine whether adequate domestic processing capacity exists and whether that capacity will be used to process the available harvest, before allowing any foreign processors into state waters (16 U.S. Code § 1856(c)). Should the governor receive a request to bring foreign processing ships into the internal waters of the state to process salmon in Bristol Bay in 2022, information from this survey would be considered by the governor, along with other information, in determining whether foreign vessels should be allowed to enter the internal waters of the State of Alaska to process salmon (16 U.S. Code § 1856(c); 5 AAC 39.198).

Capacity is measured as a combination of actual physical processing capacity and the intent of processors to purchase and process salmon during the season in aggregate. Processors were asked to report the maximum amount of sockeye salmon—in pounds—that they intend to purchase and process during the upcoming Bristol Bay salmon fishing season.

Results of the 2022 Bristol Bay sockeye salmon capacity survey should be interpreted as a snapshot of anticipated processing capacity made months before the fishery opens. As companies finalize operational plans and assess the domestic and world markets for salmon, their plans may change between the time of the survey and the salmon fishing season. The salmon capacity estimated in

this report is not guaranteed, nor is there an implied guarantee that all fishermen will have buyers for all their salmon.

METHODS

Companies were selected to receive survey forms based on 2 sources of information: the 2020 Commercial Operator's Annual Report (COAR) and 2021 commercial fishery fish tickets. Companies were selected for inclusion in the survey if one of their processing facilities reported purchasing more than 100,000 pounds of Bristol Bay sockeye salmon on their 2020 COAR, or if one of their processing facilities recorded landing of more than 100,000 pounds of Bristol Bay sockeye salmon in 2021. These criteria identified 15 commercial salmon processing companies to receive surveys. These 15 companies represented 23 processing facilities (as determined by distinct processor code) in Bristol Bay. Surveys were emailed on January 14, 2022, with a completion deadline of January 28, 2022. In the survey, companies were asked to estimate the amount of sockeye salmon, in pounds, they intended to purchase during the 2022 season from Bristol Bay. A copy of the ADF&G 2022 Bristol Bay sockeye salmon forecast was provided with the survey forms (Appendix B).

All companies that responded to the survey reported their intended purchases and capacity in pounds. The 5-year (2017–2021) mean weight of 5.09 pounds per fish (Table 1), as recorded on fish tickets, was used to convert survey capacity in pounds to numbers of fish.

After converting to numbers of fish, the projected capacity was compared to the 2022 sockeye salmon forecast by Buck et al. (2021; Appendix A).

BRISTOL BAY SOCKEYE SALMON PROCESSING CAPACITY

TOTAL INTENDED PURCHASES

This survey provides an estimate of the total intended purchases for the entire season. The 15 surveyed companies indicated they are prepared to purchase and process 265.17 million pounds, or 52.10 million fish during the 2022 Bristol Bay salmon season (Table 2). The total intended purchases are approximately 7.84 million fish under the forecasted Bristol Bay available harvest surplus of 59.94 million fish (Table 2).

DAILY PROCESSING CAPACITY

In the 2022 Bristol Bay sockeye salmon processing capacity survey (Appendix B), companies were asked to estimate their daily processing capacity and to estimate the number of days their facilities could operate at that daily capacity. They were also asked by what date they expect their facilities to operate at their quoted daily capacity.

The total daily capacity reported in the survey was 16.02 million pounds or 3.15 million fish (Table 3). Companies expect to be at or near full capacity by June 28 and expect to sustain this capacity for approximately 20 days.

The comparison of projected capacity to harvest forecast and past peak daily harvests allows an evaluation of the industry's capability to harvest this year's forecast. The projected daily capacity exceeds most historical peak daily harvests. At the maximum projected daily harvest capacity of 3.15 million fish per day, the projected intended purchases of 52.10 million fish could be achieved

in approximately 17 days. This projected processing capacity of 3.15 million fish in 2022 has been met only 1 day in the past 5 years, on July 3, 2017 (Table 4). It should be noted that processor limits likely restricted the daily maximums listed in Table 4, but this is not accounted for in this review.

Operating at maximum daily capacity is contingent on several factors including fish size and run timing, mechanical operations, logistics (tender performance, grading systems, etc.), and employee availability. Operating at peak capacity also does not guarantee that all Bristol Bay salmon permit holders will always have a buyer during this season.

IN BRISTOL BAY TENDER FLEET

Most Bristol Bay processing companies provide tenders that service locally inside Bristol Bay waters. This fleet of tenders is considered the *in-Bristol Bay* tender fleet. Surveyed companies were asked if their company intends to provide tenders during the 2022 season, their tender fleet *in-Bristol Bay* holding capacity, and the date they expect to have all their tenders available. Companies were asked to consider only their *in-Bristol Bay* fleet capacity and exclude any additional capacity provided by their long-haul tender fleet.

Of the 15 companies surveyed, 10 will provide tenders inside Bristol Bay waters. The reported *in-Bristol Bay* tender fleet holding capacity is 52.23 million pounds, or 10.28 million fish (Table 3). Companies expect to have their tenders become available sometime between June 20 and June 24, 2022.

LONG HAUL TENDER FLEET

Some Bristol Bay processing companies provide long haul tenders that transport fish from Bristol Bay to other processing facilities around the state. Long haul tenders allow companies to purchase more salmon during the peak of the season. Surveyed companies were asked if any of their facilities intend to provide long haul-tenders during the 2022 season, their long-haul tender daily capacity, and season capacity.

Of the 15 companies surveyed, 7 reported that they will provide long-haul tender services. The reported long-haul tender daily capacity is 8.50 million pounds or 1.67 million fish (Table 3). The season capacity was reported as 44.30 million pounds or 8.70 million fish (Table 3). This is an increase from 2019, when 3 companies planned to provide long-haul tenders, with a projected daily capacity of 3.46 million pounds (0.65 million fish) and season capacity of 9.63 million pounds (1.8 million fish; Poetter and Larsen 2019). Long-haul tenders will be in most use during the peak of the season, and it is not known how many will deploy at the same time. Long haul tenders will deliver to at least 4 potential destinations outside Bristol Bay.

SUMMARY

The 2022 Bristol Bay sockeye salmon processing capacity survey had a complete response rate from the 15 companies surveyed. The capacity survey is an estimate of the aggregate capacity for the entire season and is made many months before the start of the season.

The results of this survey found the 2022 Bristol Bay sockeye salmon total intended purchases is approximately 7.84 million fish lower than the forecasted harvest surplus of 59.94 million fish (Table 2). The survey estimated a maximum daily harvest capacity of 3.15 million fish per day, sustainable for approximately 20 days. Capacity is higher in 2022 than 2019, the last time this

survey was conducted. Total processing capacity rose 25% (265.17 million pounds in 2022 vs. 213.10 million pounds in 2019), and the peak daily capacity rose 18% (16.02 million lb in 2022 vs. 13.65 million pounds in 2019; Table 3; Poetter and Larsen 2019). These estimates are not directly comparable for a variety of reasons (fish weight, forecast, tender numbers, etc.) but are useful to provide context and understand this year's processing capabilities. It is also helpful to note that the processing capacity survey in recent years (2015–2019) has provided a reliable estimate of total capacity in that the total purchases were similar to the survey's projected total purchases.

Nearly all (96%) of the increased capacity from 2019 to 2022 comes from 5 companies. The total processing capacity increase of 25% was largely attributed to 3 of the largest established companies that increased capacity by 20–30% each, and the other 2 were new to the survey in 2019 and report increased capacity by ~5% each since then.

REFERENCES CITED

Buck, G., J. Head, and S. Vega. 2020. 2021 Bristol Bay sockeye salmon forecast. Alaska Department of Fish and Game, Division of Commercial Fisheries. Advisory Announcement, Juneau, AK [issued November 13, 2020, cited March 22, 2022] available at: https://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1232415165.pdf (accessed April 2022).

Poetter, A. D., and S. J. Larsen. 2019. 2019 Bristol Bay sockeye salmon processing capacity survey summary. Alaska Department of Fish and Game, Special Publication No. 19-08, Anchorage.

TABLES AND FIGURES

Table 1.–Bristol Bay sockeye salmon mean weights in pounds, calculated using commercial fisheries fish tickets, 2017–2021.

Year	Mean weight
2017	5.36
2018	5.15
2019	5.18
2020	5.06
2021	4.73
5-year Avg.	5.09

Table 2.–Comparison of the 2022 Bristol Bay sockeye salmon harvest forecast and projected intended purchases. Salmon assumed to weigh 5.09 lb.

	Number of salmon	Pounds of salmon
Projected harvest surplus[a]	59.94 million[a]	305.09 million[b]
Projected intended purchases	52.10 million[b]	265.17 million[c]
Difference (surplus of capacity)	7.84 million	39.92 million

[a] From Buck et al. (2021).

[b] Estimated using 5-year average weight of 5.09 lb/salmon.

[c] Survey results from this study.

Table 3.–Projected processing capacities for 2022 Bristol Bay sockeye salmon.

	Number of salmon[a]	Pounds of salmon[b]
Daily capacity	3.15 million	16.02 million
In-Bristol Bay tender capacity	10.28 million	52.23 million
Daily long-haul tender capacity	1.67 million	8.50 million
Season long-haul tender capacity	8.70 million	44.30 million

[a] Estimated using 5-year average weight of 5.09 lb/salmon.

[b] Survey results from this study.

Table 4.–Salmon daily landings, 5-year daily mean, minimum, and maximum, in numbers of fish, Bristol Bay, 2017–2021.

Date of landing (MM/DD)	2017[a]	2018	2019	2020[a]	2021	5-year daily mean	5-year daily minimum	5-year maximum
06/25	859,780	907,078	665,905	278,996	516,512	645,654	278,996	907,078
06/26	1,534,606	1,075,114	736,693	450,273	1,101,197	979,577	450,273	1,534,606
06/27	734,878	921,045	825,698	196,281	845,483	704,677	196,281	921,045
06/28	365,105	408,467	1,073,022	364,536	493,639	540,954	364,536	1,073,022
06/29	144,366	505,913	1,464,405	547,176	506,105	633,593	144,366	1,464,405
06/30	232,201	1,692,318	1,550,247	435,372	2,211,986	1,224,425	232,201	2,211,986
07/01	71,230	2,045,337	1,565,592	393,904	2,451,489	1,305,510	71,230	2,451,489
07/02	642,456	1,590,832	1,634,447	668,085	1,702,298	1,247,624	642,456	1,702,298
07/03	3,716,432	1,005,255	1,615,194	1,285,575	1,415,986	1,807,688	1,005,255	3,716,432
07/04	2,916,221	1,271,788	1,884,219	1,235,380	1,774,304	1,816,382	1,235,380	2,916,221
07/05	1,767,668	1,449,801	2,134,912	2,439,527	2,465,718	2,051,525	1,449,801	2,465,718
07/06	2,310,840	1,575,475	2,195,473	3,146,623	2,979,448	2,441,572	1,575,475	3,146,623
07/07	2,284,010	1,240,024	2,420,146	2,637,869	2,722,767	2,260,963	1,240,024	2,722,767
07/08	2,116,335	1,259,689	2,542,075	2,475,549	1,771,160	2,032,962	1,259,689	2,542,075
07/09	2,230,949	1,228,606	2,262,362	2,256,116	2,272,007	2,050,008	1,228,606	2,272,007
07/10	1,848,042	2,119,482	1,892,344	1,613,143	1,654,001	1,825,402	1,613,143	2,119,482
07/11	1,543,234	2,298,889	2,129,125	2,635,553	1,977,064	2,116,773	1,543,234	2,635,553
07/12	1,982,925	1,720,185	2,047,372	2,252,867	2,436,266	2,087,923	1,720,185	2,436,266
07/13	1,619,271	1,662,806	1,625,872	1,478,401	2,493,544	1,775,979	1,478,401	2,493,544
07/14	1,706,941	1,924,251	1,482,499	2,155,753	1,530,286	1,759,946	1,482,499	2,155,753
07/15	1,506,853	1,295,091	1,306,486	2,005,387	1,347,560	1,492,275	1,295,091	2,005,387
07/16	898,324	1,889,582	1,321,234	1,493,825	1,016,512	1,323,895	898,324	1,889,582
07/17	1,084,927	1,844,424	1,072,764	1,145,402	629,357	1,155,375	629,357	1,844,424
07/18	1,251,305	1,236,067	647,133	970,260	402,561	901,465	402,561	1,251,305
07/19	623,853	1,321,167	1,023,092	768,345	291,596	805,611	291,596	1,321,167
07/20	325,297	1,269,705	670,974	756,647	385,956	681,716	325,297	1,269,705

[a] Daily processor capacity limits constrained daily landings during portions of 2017 and 2020.

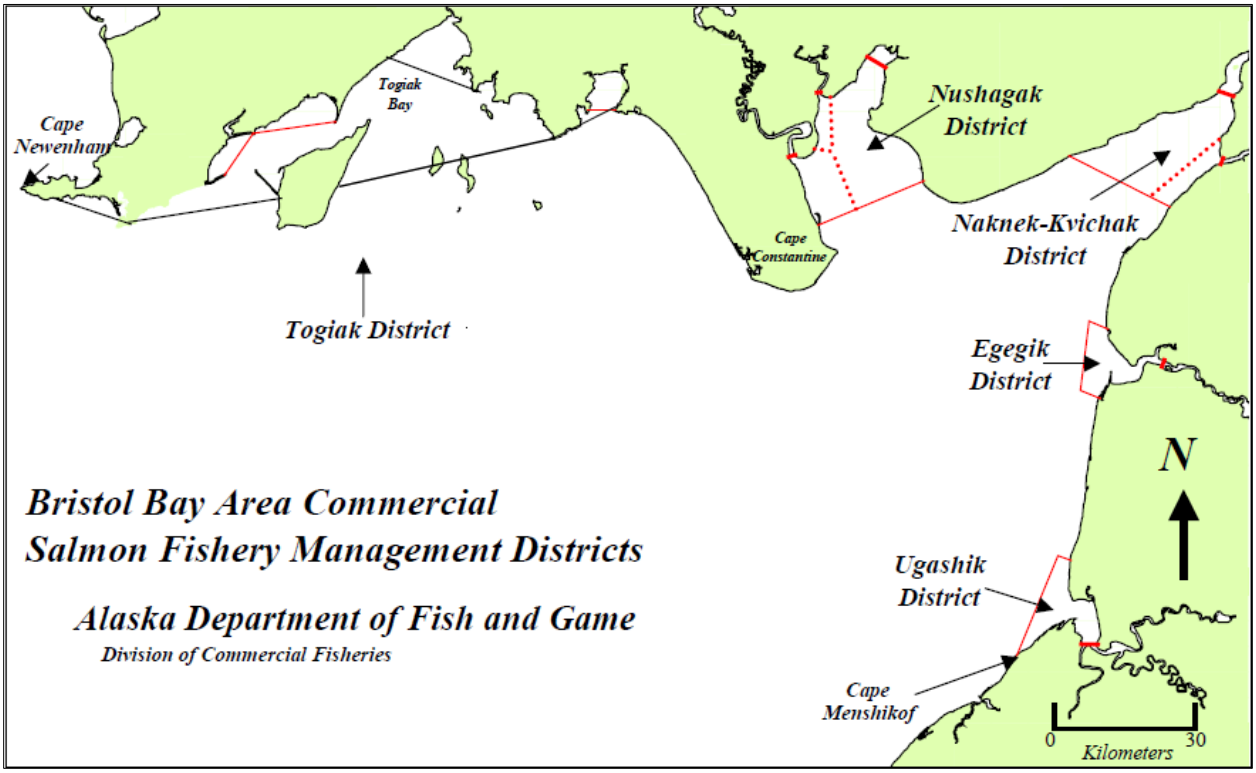

Figure 1.–Bristol Bay area commercial salmon fisheries management district.

APPENDICES

Appendix A.–2022 Bristol Bay sockeye salmon forecast. (Note: Page and figure numbers within this forecast apply only to this appendix.) This Advisory Announcement can be found at https://www.adfg.alaska.gov/static/applications/dcfnewsrelease/1346495668.pdf.

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2022 Bristol Bay Sockeye Salmon Forecast

FORECAST AREA: Bristol Bay

SPECIES: Sockeye salmon

FORECAST OF THE 2022 RUN:

TOTAL PRODUCTION:	Forecast (millions)	Forecast range (millions)
Total run	75.27	61.01 – 89.54
Escapement	13.46	
Total harvestable surplus	61.82	
Bristol Bay harvestable surplus	59.94	
South Peninsula harvest	1.88	
Inshore run	73.40	

METHODS

The 2022 Bristol Bay sockeye salmon forecast is the sum of individual predictions of nine river systems (Kvichak, Alagnak, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak, and Togiak Rivers) and four age classes (ages 1.2, 1.3, 2.2, and 2.3). Adult escapement and return data from brood years 1972–2018 were used in the analyses for most rivers.

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

Where practical, the Alaska Department of Fish and Game (department) will manage escapements proportional to the run size and relative to the historical record (5 AAC 06.355(d)(1)). Escapement is projected as the 75th percentile of the escapement range if the forecast is above the trend experienced in recent years (Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak, and Togiak

-continued-

Rivers in 2022) and as the 25th percentile of the escapement goal range if the forecast is below the trend experienced in recent years (Kvichak River in 2022; Table 1). Because it is passively managed, the Alagnak River exploitation rate is assumed to be the same as the Kvichak River exploitation rate and therefore, the escapement is projected to be the total run forecast minus expected harvestable surplus. Over the past five years, about 2.5% of the Bristol Bay return is thought to be harvested in the South Peninsula fisheries in June. Preseason harvestable surplus projections are provided to aid industry in planning. Once the run begins to develop, the department relies on catch and escapement data for management decisions.

RESULTS

A total of 75.27 million sockeye salmon (within a range of 61.01–89.54 million) are expected to return to Bristol Bay in 2022 (Table 1). This is 44% larger than the most recent 10-year average of Bristol Bay total runs (52.09 million) and 111% greater than the long-term (1963–2021) average of 35.73 million fish. All systems are expected to meet their spawning escapement goals. The forecast range is the upper and lower values of the 80% confidence interval for the total run forecast. The confidence bounds were calculated from the deviation of actual runs and run forecasts from 2004 through 2021.

A run of 75.27 million sockeye salmon would allow for a potential harvestable surplus of 61.82 million fish; 59.94 million fish in Bristol Bay and 1.88 million fish in South Peninsula fisheries. A Bristol Bay harvest of this size is 75% greater than the most recent 10-year average harvest of 34.24 million which has ranged from 15.38 million to 42.94 million, and 170% greater than the long-term average harvest of 22.22 million fish (1963 to present).

Age-specific forecasts for the 2022 run consists of 30.68 million age-1.2 fish (41% of the total run), 6.39 million age-2.2 fish (8% of the total run), 35.58 million age-1.3 fish (47% of the total run), and 2.58 million age-2.3 fish (3% of the total run; Table 1).

DISCUSSION

Forecasting future salmon returns is inherently difficult and uncertain. We have used similar methods since 2001 to produce the Bristol Bay sockeye salmon forecast which have performed well when applied to Bristol Bay as a whole. Since 2001, our forecasts have, on average, under forecast the run by 12% and have ranged from 44% below the actual run in 2014 to 19% above the actual run in 2011. Forecasted harvestable surplus has had a mean absolute percent error of 16% since 2001.

Individual river forecasts have greater uncertainty compared to the baywide forecast. Since 2001, on average, we have under forecast returns to the Alagnak (-33%), Togiak (-14%), Kvichak (-21%), Wood (-20%), Nushagak (-25%), Ugashik (-5%), and Naknek (-15%) Rivers, and over forecast returns to the Igushik (11%) and Egegik rivers (13%). Over forecasting returns to some rivers while under forecasting returns to other rivers means that the overall Bristol Bay forecast is often more accurate than the forecast to any individual river.

The department would like to thank the Bristol Bay Fisheries Collaborative (BBFC) for providing funding for fisheries assessment over the past several years during the department's time of budget shortfalls. Without their support, assessment projects integral to the construction of brood tables and in turn this forecast could have been lost. The BBFC began in 2016 and is an agreement between the department and Bristol Bay Science and Research Institute (BBSRI) to work together with stakeholders to restore a world-class fishery management system and raise funds to support and maintain management. We look forward to continuing the collaboration with BBSRI and the

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BBFC as we continue to work towards a world-class fishery management system. A list of organizations that committed financial support to the BBFC, as well as additional information about this agreement can be found at https://www.bbsri.org/bbfc.

Due to the COVID-19 pandemic, there were many logistical challenges the department faced during the 2021 salmon season in Bristol Bay. Without the generosity of processors and Bristol Bay communities who provided access for our technicians to collect data, critical information needed to develop this forecast would not have been available. The department would like to extend its gratitude for keeping our crews safe and our data collection continuous.

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Table 1.–Forecast of total run, escapement, and harvest of major age classes of sockeye salmon returning to Bristol Bay River systems in 2022.

DISTRICT	Millions of sockeye salmon								
	Forecasted production by age class					Forecasted		South	
River	1.2	2.2	1.3	2.3	Total	Escapement	Surplus	Peninsula[a]	BB Inshore
NAKNEK-KVICHAK									
Kvichak	4.36	1.24	2.57	0.19	8.37	4.00	4.16	0.21	8.16
Alagnak	1.93	0.09	2.05	0.16	4.23	2.02	2.10	0.11	4.12
Naknek	3.54	0.59	4.16	0.32	8.61	1.70	6.70	0.21	8.40
Total	9.83	1.92	8.78	0.68	21.21	7.72	12.96	0.53	20.68
EGEGIK	7.97	3.52	3.53	1.38	16.40	1.70	14.29	0.41	15.99
UGASHIK	1.95	0.69	3.27	0.35	6.25	1.18	4.92	0.16	6.10
NUSHAGAK									
Wood	7.00	0.18	2.33	0.11	9.63	1.53	7.86	0.24	9.39
Igushik	0.45	0.01	1.54	0.01	2.01	0.34	1.62	0.05	1.96
Nushagak	3.10	0.06	15.33	0.06	18.60 [b]	0.77	17.37	0.46	18.13
Total	10.56	0.25	19.20	0.18	30.24	2.63	26.85	0.75	29.48
TOGIAK	0.37	0.00	0.80	0.00	1.18	0.23	0.92 [c]	0.03	1.15
BRISTOL BAY	30.68	6.39	35.58	2.58	75.27	13.46	59.94	1.88	73.40
	41%	8%	47%	3%	100%				

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

[a] Projected harvest is based on the current 5-year running average exploitation rate of 2.5%.

[b] Nushagak River forecast total includes approximately 52,000 age-0.3 and age-1.4 fish.

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

Appendix B.–2022 Bristol Bay sockeye salmon survey questions.

1. Does your company intend to purchase and process Bristol Bay sockeye salmon during the 2022 season?
2. Please enter the amount of sockeye salmon your company intends to purchase in Bristol Bay in the 2022 season. Please provide this answer in **pounds** of fish.
3. What is your company's **Daily Processing Capacity** of sockeye salmon in **pounds** of fish?
4. How many days could your company sustain the daily processing capacity listed in Question 3?
5. What **Date** do you expect to be at the daily processing capacity listed in Question 3?
6. Comments on Daily Processing Capacity?
7. Does your company provide tenders? **(yes or no)**
8. If "Yes" what is your tender fleet's "In-Bristol Bay" holding capacity in **Pounds** of fish? ***Please DO NOT include long hauls.***
9. What **Date** do you expect to have all your tenders in Bristol Bay?
10. Comments on your company's tender fleet capacity?
11. Will your company provide long haul tenders? **(yes or no)**
12. If "Yes", what is the daily capacity of your long-haul tender fleet in **Pounds** of fish?
13. What is the **Season Capacity** of your long-haul tender fleet in **Pounds** of fish?
14. Comments on your company's long haul tender fleet capacity?
15. Are there factors that would affect your company's ability to increase average daily capacity, and sustain this capacity at peak level, that you would like to tell us about such as changes in fleet size, access to processing worker, etc.?