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3 Introduction

This Stock Assessment and Fishery Evaluation (SAFE) report includes assessments of five *Oncorhynchus spp.* (Pacific salmon) harvested in the CI Exclusive Economic Zone (EEZ) Area. The following species and stocks are assessed in this SAFE:

- 1 Chinook salmon, *O. tshawytscha,* stocks (Aggregate Chinook salmon stock complex);

- 3 sockeye salmon, *O. nerka*, stocks (Kenai River Late-Run, Kasilof River, and Aggregate "Other" sockeye salmon stock complex);

- 1 coho salmon, *O. kisutch*, stock (Aggregate coho salmon stock complex);

- 1 chum salmon, *O. keta*, stock (Aggregate chum salmon stock complex); and

- 1 pink salmon, *O. gorbuscha*, stock (Aggregate pink salmon stock complex- divided into even- and odd-year broodlines).

This SAFE report is for the federally managed salmon fishery in the CI EEZ under amendment 16 to the Fishery Management Plan for the Salmon Fisheries in the EEZ off Alaska (Salmon FMP), and a Federal requirement (50 CFR part 600). For 2025, this SAFE provides the best scientific information available on the biological condition of salmon stocks in CI and builds on the 2024 SAFE and the information and analysis in the Environmental Assessment/Regulatory Impact Review (EA/RIR) prepared for amendment 16 and the implementing regulations. The EA/RIR also provides information on the social and economic condition of the sport, subsistence, personal use, and commercial fisheries, the fish processing industries, and communities in CI and is incorporated here by reference.

The SAFE report summarizes the current biological status of fisheries, reference points, and analytical information used for the Federal assessment. Additional information on CI Salmon fisheries is available on the National Marine Fisheries Service web page at: https://www.fisheries.noaa.gov/action/amendment-16-fmp-salmon-fisheries-alaska. Information pertaining to the adjacent Upper Cook Inlet (UCI) commercial and recreational salmon fisheries managed by the State of Alaska is available on the ADF&G website at: https://www.adfg.alaska.gov.

The Salmon FMP defines those salmon stocks with evidence of historical harvests in the CI EEZ and this SAFE recommends classifying these stocks as belonging to one of three "tiers" based on the information available for the stock. Under the terms provided in the Salmon FMP and as further detailed in this SAFE, the tier level for each stock determines the methods used to set Federal status determination criteria (SDC) and harvests specifications. Each year, the SAFE Report will recommend the salmon stocks that belong in each tier for consideration by the Science and Statistical Committee (SSC) of the North Pacific Fishery Management Council (Council).

Currently, there are 43 salmon stocks defined by the State for its management of UCI salmon fisheries (Munro 2023). Broadly, the State has defined salmon stocks throughout Alaska, including UCI, based on the availability and specificity of spawning escapement, harvest, and other data and considerations; and manages for the achievement of long-term sustainable yields for each stock. When sufficient data are available to define stock recruitment characteristics, and it is practical and achievable to do so, the State's management approach also attempts to implement and manage for spawning escapement goals that have the greatest potential to result in maximum sustainable yield in future generations[1,2]. For the State's salmon management, escapement goal committees—consisting of fisheries scientists, biometricians,

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[1] https://www.akleg.gov/basis/aac.asp#5.39.222

[2] https://www.akleg.gov/basis/aac.asp#5.39.223

7 2025 Stock Assessments

7.1 Data and assessments for all stocks

Existing estimates of escapement and stock assessments used for this SAFE originate from the State of Alaska with data available through its website (www.adfg.alaska.gov) and associated publications (https://www.adfg.alaska.gov/sf/publications/); additional details are provided below in the assessments for each stock. 2024 salmon harvests in the EEZ were obtained from eLandings/EEZ landed fish tickets. The most recent stock assessments and escapement goal recommendations for Kenai River late-run sockeye salmon (Hasbrouck et al. 2022), Kenai Late Run Large Chinook salmon (Fleischman and Reimer 2017), Susitna River Chinook salmon (Reimer and DeCovich 2020), and assessments for other stocks (Mckinley et al. 2024) can be found through the ADF&G publications page (ADF&G 2024a) and the State's Board of Fisheries website (ADF&G 2024b). Additional data, estimates, and other relevant information can be found within, or referenced in, annual management reports (Lipka and Stumpf 2024), season summaries (Stumpf 2024), preseason forecasts (Gatt and Erickson 2024), the Sport Fish harvest survey website (ADF&G 2024c), the statewide escapement goal reports (Munro 2023), the CI Area commercial salmon fishing regulations (ADF&G 2024d), and other publications.

Future SAFEs may incorporate some or all of the ADF&G's UCI preseason salmon forecasts; however, whether this occurs is largely determined by the extent to which such forecasts are available in time to be reviewed by NMFS and the SSC. For the 2025 SAFE, an AR1 model described previously was used to generate preseason forecasts of run size for Tier 1 stocks.

Methods used by the NMFS SAFE Team to estimate historical harvests within the CI EEZ are described in the EA/RIR prepared for amendment 16 and the implementing regulations (NOAA Fisheries 2024). Of note is that, while there is now a Federal salmon fishery in the CI EEZ, these historical estimates continue to be used in SDC for the stocks. In summary, these estimates were made by considering the geographical overlap between the Federal CI EEZ and the State statistical areas where salmon landings were reported by fishers to have occurred, combined with professional judgment of managers regarding the distribution of the drift fleet. Because there was not a wholly-Federal salmon fishery confined to the CI EEZ prior to 2024, the accuracy of the historical EEZ harvest proportion estimates are unknown and treated deterministically in this 2025 SAFE. At the discretion of the SSC, future analyses could incorporate some measure of agreed-upon uncertainty into the historical EEZ estimates from stock composition studies (Barclay 2020, 2024; Barclay and Chenowith 2021; Barclay et al. 2019) and other sources.

The analyses and data estimates used for the stock status summaries in this SAFE, including versions of model updates, are available through the following GitHub repository: https://github.com/afsc-assessments/Cook-Inlet-SAFE.

The NMFS SAFE Team welcomes feedback on the analyses, either through GitHub or by contacting the NMFS SAFE Team authors directly via e-mail or phone.

Figure 3. Classic Ricker model fit to Kenai River late-run sockeye salmon. Spawner-recruit data from 1979–2015 (solid line) and 1979–2012 (dashed line). From Mckinley et al. (2024), the most recent ADF&G stock assessment for Kenai Late Run sockeye salmon. Vertical lines represent $S_{MSY-POINT}$ for each model. The shaded area is the current escapement goal (750,000–1,300,000)
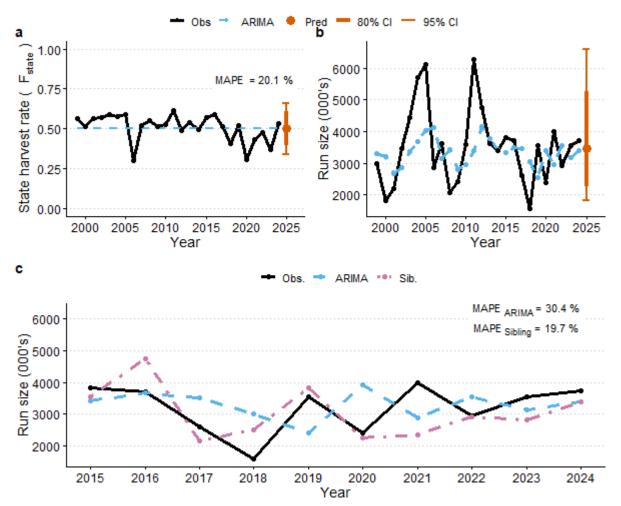
Figure 4. Kenai River Late Run sockeye salmon preseason ARIMA model fits to timeseries. (a) ARIMA white noise model fit (AR(0,0,0);blue dashed line) to historic estimated drift gillnet harvest proportions (black solid line) occurring in State waters for years 1999 -2024 and the 2025 predicted State harvest proportion (red) and the associated 80 and 95% confidence intervals. (b) AR1 model fit (blue dashed line) to historic Kenai River late sockeye salmon total run size (black solid line) and the predicted 2025 run size (red) and the 80 and 95% confidence intervals. (c) Retrospective one-step-ahead predictions for ARIMA (blue line), the ADF&G sibling forecast (purple line) and the observed run size (black). ARIMA models were fit using the auto.ARIMA function in R using the timeseries from 1999 to the year prior to each year's prediction. Mean absolute percent error (MAPE) was calculated for ARIMA and sibling forecasts and presented in the plot (MAPE$_{ARIMA}$= 30.4% and MAPE$_{SIBLING}$=19.7%
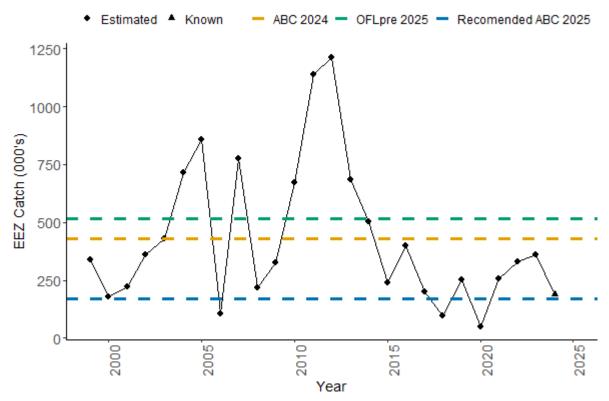
Figure 5. Timeseries of Kenai River late run sockeye salmon harvest in the EEZ for years 1999 - 2024. For 2025, the OFL$_{PRE}$ is 514,761 and the NMFS SAFE Team recommends a buffer of 67.3%, resulting in an ABC of 168,485. EEZ harvest estimates prior to 2024 are based on methods and assumptions are described in section 7.1 of this SAFE report. The Kenai River late run sockeye salmon stock catch is estimated from the total CI EEZ catch using genetic mixed stock analysis.
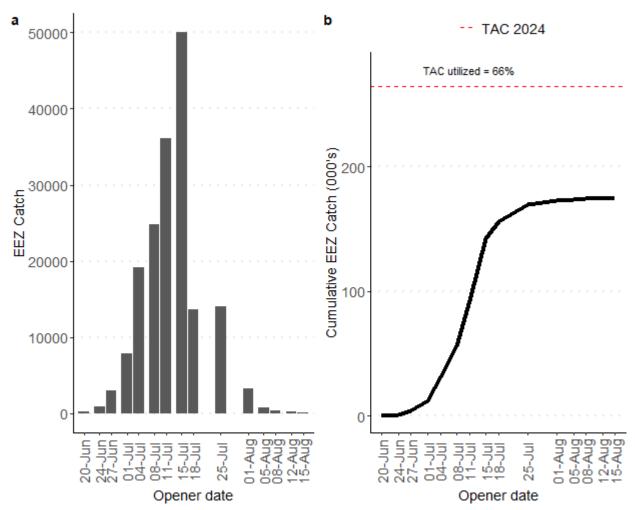
Figure 6. Kenai River Late Run sockeye salmon EEZ (a) catch by day and (b) cumulative catch compared to the 2024 TAC. Note that the Kenai River Late Run sockeye salmon catch is estimated from the total CI EEZ sockeye salmon catch using genetic mixed stock analysis.

Table 7. Status and recommended catch specifications for Tier 1 Kenai River Late Run sockeye salmon. For 2025, the NMFS SAFE Team recommends a buffer of 0.673 be used to reduce the preseason OFL (potential yield in the CI EEZ) to the recommended ABC of 168K sockeye salmon. **Values for MSST, MFMT, OFL, and ABC have been presented to reflect the recommendation by the SSC to use $S_{MSY\text{-}POINT}$ (1,212,000 spawners) as the escapement target. Additionally, for comparison, these values are also presented using the lower bound of the State's escapement goal (750K spawners; NMFS SAFE Team Recommendation).** *An overfished determination is assessed postseason by comparing the minimum stock size threshold (**MSST**), one half of the sum of the stock's spawning escapement target summed across a generation, with actual cumulative escapement summed across a generation (**Cum. Escap.**). For* <u>Tier 1 stocks</u>, *overfishing is assessed postseason by comparing the maximum fishing mortality threshold (**MFMT**), the largest potential harvest rate in the EEZ while still achieving the spawning escapement target and non-EEZ harvests, with the actual estimated harvest rate assessed over a generation (**F_{EEZ}**). Rates are normalized to total run size. Shaded values are new estimates or projections based on the current assessment, the projected EEZ Cum. Escap. for the coming fishing season only including the first four years (T-1) of the current generation. Note that estimates for EEZ harvests prior to 2024 were calculated as described in section 7.1.*

| Esc. Target	Year	MSST	Cum. Escap.	MFMT	F_{EEZ}	Total Run	EEZ Harvest	OFL_{PRE}	ABC
S_{MSY}	2020	3,030	6,069	0.094	0.073	2,394	50	NA	NA
	2021	3,030	6,957	0.145	0.061	3,992	256	NA	NA
	2022	3,030	7,106	0.161	0.068	2,929	330	NA	NA
	2023	3,030	8,160	0.204	0.076	3,553	362	NA	NA
	2024	3,030	8,258	0.204	0.072	3,724	189	901.9	431*
	2025	3,030	6,652	0.196	0.094	3,454		514.8	168
Lower Bound	2020	1,775	6,069	0.255	0.073	2,394	50	NA	NA
	2021	1,800	6,957	0.299	0.061	3,992	256	NA	NA
	2022	1,825	7,106	0.308	0.068	2,929	330	NA	NA
	2023	1,850	8,160	0.348	0.076	3,553	362	NA	NA
	2024	1,875	8,258	0.343	0.072	3,724	189	1,165	---*
	2025	1,875**	6,652	0.337	0.012	3,454		976.8	710

* ABC was calculated using the 2024 buffer method that considered positive and negative errors, whereas the new 2025 buffer only considers the positive errors (over-forecasting). Because of the change in buffer methodology, a 2024 ABC using the lower bound of the escapement goal is not presented.

** Calculated as (Lower Bound of 750,000 sockeye salmon × **0.5** × 5 years), which assumes that 375,000 spawners per year over a generation represents an overfished condition. A somewhat more precautionary approach assumes that 450,000 spawners per year over a generation (Lower Bound of 750,000 × **0.6** × 5) represents an overfished condition, resulting in an MSST of 2,250,000. The NMFS SAFE Team recommends that the lower bound of the escapement goal represents S_{MSY} for this and other SDC.

Table 8. Historical data for Tier 1 Kenai River Late Run sockeye salmon used to inform the SDCand harvest specifications. The table includes year of the salmon run, the estimate of total run size (000's), the spawning escapement (000's), the Federal spawning escapement target ($S_{MSY-POINT}$; 000's), the total catch across all fisheries (000's), the estimate State waters catch (000's), the fraction of the catch estimated to have occurred in State waters, the estimated EEZ catch (000's), the fraction of the total catch estimated to have occurred in the EEZ, the maximum fishing morality threshold, and the potential yield in the EEZ (000's), cumulative escapement (000's), and minimum stock size threshold (MSST; 000's). For this SAFE, MFMT and Potential Yield in the EEZ reflect the 2024 SSC recommendation that these be based on a point estimate of S_{MSY} ($S_{MSY-POINT}$) for this stock of 1,212,000 spawners. The lower bound of the State escapement goal is 750K sockeye salmon (2017 - 2024). For this table, MFMT and Potential Yield in the EEZ reflect the 2024 SSC recommendation that these be based on a point estimate of S_{MSY} ($S_{MSY-POINT}$) for this stock of 1.212 million spawners. Note that EEZ harvest prior to 2024 is estimated as described in section 7.1.

Year	Run size	Esc.	Esc. Target ($S_{MSY-POINT}$)	Total catch	State catch	F_{STATE}	EEZ Catch	F_{EEZ}	MFMT	Potential Yield EEZ	Cum. Esc.	MSST
1999	2985	949	1212	2035	1694	0.568	341	NA	NA	79	NA	NA
2000	1815	697	1212	1118	937	0.516	181	NA	NA	0	NA	NA
2001	2190	738	1212	1451	1230	0.562	221	NA	NA	0	NA	NA
2002	3467	1127	1212	2340	1980	0.571	360	NA	NA	275	NA	NA
2003	4440	1402	1212	3037	2606	0.587	431	0.103	0.066	622	4913	3030
2004	5705	1691	1212	4015	3299	0.578	716	0.108	0.119	1194	5655	3030
2005	6109	1654	1212	4455	3598	0.589	857	0.118	0.155	1299	6612	3030
2006	2849	1892	1212	957	850	0.298	107	0.109	0.185	787	7766	3030
2007	3602	964	1212	2638	1864	0.517	774	0.127	0.195	526	7603	3030
2008	2082	709	1212	1374	1154	0.554	220	0.131	0.187	0	6910	3030
2009	2430	848	1212	1582	1254	0.516	328	0.134	0.153	0	6067	3030
2010	3596	1038	1212	2558	1886	0.524	672	0.144	0.124	498	5451	3030
2011	6263	1281	1212	4982	3842	0.613	1140	0.174	0.124	1209	4840	3030
2012	4770	1213	1212	3557	2343	0.491	1214	0.187	0.153	1215	5089	3030
2013	3628	980	1212	2648	1965	0.542	683	0.195	0.163	451	5360	3030

Year	Run size	Esc.	Esc. Target ($S_{MSY\text{-}POINT}$)	Total catch	State catch	F_{STATE}	EEZ Catch	F_{EEZ}	MFMT	Potential Yield EEZ	Cum. Esc.	MSST
2014	3404	1218	1212	2186	1682	0.494	504	0.194	0.179	510	5730	3030
2015	3819	1400	1212	2419	2181	0.571	238	0.173	0.174	426	6092	3030
2016	3712	1118	1212	2594	2194	0.591	400	0.157	0.15	306	5929	3030
2017	2596	1057	1212	1539	1337	0.515	202	0.118	0.101	47	5773	3030
2018	1566	831	1212	735	638	0.407	97	0.095	0.085	0	5624	3030
2019	3542	1457	1212	2085	1833	0.518	252	0.078	0.084	497	5863	3030
2020	2394	1606	1212	788	738	0.308	50	0.072	0.094	444	6069	3030
2021	3992	2006	1212	1986	1730	0.433	256	0.061	0.145	1050	6957	3030
2022	2929	1206	1212	1723	1393	0.476	330	0.068	0.161	324	7106	3030
2023	3553	1885	1212	1668	1306	0.368	362	0.076	0.204	1035	8160	3030
2024	3724	1555	1212	2169	1980	0.532	189	0.072	0.204	532	8258	3030

*Table 9. Tier 1 Kenai River Late Run sockeye salmon 2025 ARIMA model forecasted run size, State harvest proportion ($\hat{F}_{STATE}$), and resulting OFL, buffer, ABC, forecasted F_{EEZ}, and MFMT. For this preliminary SAFE, Potential Yield, Buffer, MFMT, OFL, the preseason ABC, F_{EEZ}, and MFMT reflect the 2024 SSC recommendation that these be based on a point estimate of S_{MSY} ($S_{MSY\text{-}POINT}$) for this stock of 1,212,000 spawners (**top row**). The values in the **bottom row** are calculated using the lower bound of the escapement goal (2025 NMFS SAFE Team Recommendation).*

Target	Run Size ($\hat{R}$)	$\hat{F}_{STATE}$	Potential yield EEZ	Buffer	OFL	ABC	Forecasted F_{EEZ}	MFMT
$S_{MSY\text{-}POINT}$	3,453,522	0.5	514,761	0.673	514,761	168,485	0.094	0.196
Lwr Bound	3,453,522	0.5	976,761	0.273	976,761	709,954	0.12	0.327

Table 10. Kenai River late-run sockeye salmon observed escapements (2014 - 2024) and current escapement targets ($S_{MSY\text{-}POINT}$ and Lower bound) in thousands of fish.

Year	Federal escapement target ($S_{MSY\text{-}POINT}$)	Lwr. Bound	Escapement
2014	1,212	750	1,218
2015	1,212	750	1,400
2016	1,212	750	1,118
2017	1,212	750	1,057
2018	1,212	750	831
2019	1,212	750	1,457
2020	1,212	750	1,606
2021	1,212	750	2,006
2022	1,212	750	1,206
2023	1,212	750	1,885
2024	1,212	750	1,555

*Table 12. Status and catch specifications for Tier 1 Kasilof River sockeye salmon. <u>For 2025, the NMFS SAFE Team recommends a buffer of 0.673 be used to reduce the preseason potential yield ("preseason OFL") to the recommended single-year ABC of **131K** sockeye salmon.</u>* **Values for MSST, MFMT, OFL, and ABC have been presented to reflect the recommendation by the SSC to use $S_{MSY-POINT}$ (222,000 spawners) as the escapement target. Additionally, for comparison, these values are also presented using the lower bound of the State's escapement goal (NMFS SAFE Team Recommendation).** *An ovverfished determination is assessed postseason by comparing the minimum stock size threshold (**MSST**), one half of the sum of the stock's spawning escapement target summed across a generation, with actual cumulative escapement summed across a generation (**Cum. Escap**.). For <u>Tier 1 stocks</u>, overfishing is assessed postseason by comparing the maximum fishing mortality threshold (**MFMT**), the largest potential harvest rate in the EEZ while still achieving the spawning escapement target and non-EEZ harvests, with the actual estimated harvest rate assessed over a generation (**F_{EEZ}**). Rates are normalized to total run size. Shaded values are new estimates or projections based on the current assessment, the projected EEZ Cum. Escap. for the coming fishing season only including the first four years (T-1) of the current generation. Note that EEZ harvest estimates prior to 2024 are estimated as described in section 7.1.*

Target	Year	MSST	Cum. Escap.	MFMT	F_{EEZ}	Total Run	EEZ Harvest	OFL_{PRE}	ABC
$S_{MSY-POINT}$	2020	555	1,902	0.254	0.05	845	6	NA	NA
	2021	555	2,179	0.301	0.027	925	21	NA	NA
	2022	555	2,788	0.395	0.026	1,450	50	NA	NA
	2023	555	3,333	0.464	0.031	1,299	71	NA	NA
	2024	555	4,008	0.495	0.036	1,787	78	541	375.5*
	2025	555		0.51	0.131	1,313		664	131
Lower Bound	2020	390	1,902	0.349	0.025	845	6	NA	NA
	2021	380	2,179	0.391	0.027	925	21	NA	NA
	2022	370	2,788	0.476	0.026	1,450	50	NA	NA
	2023	360	3,333	0.540	0.031	1,299	71	NA	NA
	2024	350	4,008	0.560	0.036	1,787	78		---*
	2025	350**		0.572	0.143	1,313		746	321

* ABC was calculated using the 2024 buffer method that considered positive and negative errors, whereas the new 2025 buffer only considers the positive errors (over-forecasting). Because of the change in buffer methodology, a 2024 ABC using the lower bound of the escapement goal is not presented.

** Calculated as (Lower Bound of 140,000 × **0.5** × 5 years), which assumes that 70,000 spawners per year over a generation represents an overfished condition. A somewhat more precautionary approach assumes that 84,000 spawners per year over a generation (Lower Bound of 140,000× **0.6** × 5) represents an overfished condition, resulting in an MSST of 420,000. The NMFS SAFE Team recommends that the lower bound of the escapement goal represents S_{MSY} for this and other SDC.

Table 18. Status and catch specifications for Tier 3 Aggregate "Other" sockeye salmon stock complex. An overfished determination is assessed postseason by comparing the minimum stock size threshold (MSST; one half of the sum of the indicator stock's spawning escapement goal summed across a generation, with actual cumulative escapement of the indicator stocks summed across a generation (Cum. Escap.). Overfishing is assessed postseason by comparing the actual harvest summed across a generation (EEZ Cum. Harvest) with the postseason overfishing limit (OFL). Unless otherwise noted, values are in the thousands of fish. Shaded values are new estimates or projections based on the current assessment, the projected EEZ Cum. Harvest for the coming fishing season only including the first four years (T-1) of the current generation. Bolded EEZ Harvest values are used to calculate OFL and OFL$_{PRE}$. Note that EEZ harvest prior to 2024 is estimated as described in section 7.1.

Year	MSST[a]	Cum. Esc.[a]	Total Comm. Harvest	State Drift Gillnet Harvest	EEZ Harvest	EEZ Cum. Harvest	OFL	OFL$_{PRE}$
1999	NA	NA	649	208	157	NA	NA	NA
2000	NA	NA	435	98	119	NA	NA	NA
2001	NA	NA	456	116	109	NA	NA	NA
2002	NA	NA	634	195	144	NA	NA	NA
2003	335	848	620	268	234	763	NA	NA
2004	315	815	759	286	218	824	NA	NA
2005	295	714	676	95	61	766	NA	NA
2006	275	711	256	108	39	695	NA	NA
2007	275	650	651	120	**230**	781	NA	NA
2008	275	487	424	95	**85**	633	NA	NA
2009	260	580	540	103	**136**	551	NA	NA
2010	245	732	637	136	**202**	691	NA	NA
2011	230	797	835	300	**254**	907	NA	NA
2012	215	780	473	170	166	843	NA	NA
2013	200	795	507	129	144	902	NA	NA
2014	200	714	469	150	136	902	NA	NA
2015	200	754	505	148	70	771	NA	NA
2016	200	686	308	89	49	566	NA	NA
2017	193	751	656	180	132	532	NA	NA
2018	185	772	362	74	79	467	NA	NA
2019	177	822	449	90	73	404	NA	NA
2020	170	686	331	40	13	346	NA	NA
2021	163	736	132	85	54	352	NA	NA
2022	163	695	234	97	129	348	NA	NA
2023	163	631	763	236	209	478	NA	NA
2024	163	529	331	241	57	463	1,271b	888b
2025	163	422	---	---	---	450	907	181

[a]Calculated based on escapements and escapement targets for indicator stocks (Fish Creek, Chelatna Lake, Judd Lake, and Larson Lake)

[b]For the 2024 SAFE, a different method was used to calculate the Tier 3 OFL and OFL$_{PRE}$. See the Final 2024 CI EEZ SAFE for additional details.