

## **Yukon River Panel Salmon Bycatch Summary**

**April 2022**

The Yukon River Salmon Agreement identifies the need to identify, quantify, and undertake efforts to reduce marine catches and bycatch of Yukon River salmon. This section provides an overview of information on U.S. groundfish fisheries in the Bering Sea-Aleutian Islands (BSAI) management region, bycatch regulations, and bycatch impacts on Yukon River Canadian-origin salmon.

### ***Bycatch impacts on Canadian-origin salmon***

Yukon River Canadian-origin salmon are caught as bycatch in BSAI groundfish fisheries along with other salmon stocks from Alaska, the west coast of Canada and the United States, eastern Asia, and Russia. The total number of salmon captured as bycatch is always much greater than the number of returning adult Canadian-origin salmon that are removed from the Yukon River due to bycatch. For example, the total annual bycatch of Chinook salmon in BSAI pollock fishery has varied from approximately 5,000 to 122,000 (Table 1), but the adult equivalent (AEQ) bycatch of Canadian-origin Chinook salmon varied from approximately 400 to 2,400 fish over the same time period (Table 2). The average bycatch impact rate by the pollock fishery on the Canadian-origin Chinook salmon run is estimated to be 1.0% with an annual impact rate less than 3.1% (Ianelli and Stram, 2018). Average bycatch impact rates to western Alaska chum salmon (not Canadian-origin chum salmon) is estimated to be 0.4% with an annual rate less than 1.3% (Murphy et al. 2017). Ongoing regulatory and management measures implemented by the North Pacific Fisheries Management Council (NPFMC) are a key factor limiting bycatch impact rates on Canadian-origin salmon in BSAI groundfish fisheries.

### ***Current BSAI bycatch information***

- Total Chinook salmon bycatch in all BSAI groundfish fisheries (pelagic trawl, bottom trawl, and hook-and-line fisheries) during 2021 was 15,827, which is 52% lower than the recent 5-year average (Table 1). Chinook salmon bycatch in the BSAI pollock fishery accounted for 87% ( $n=13,783$ ) of the total Chinook salmon bycatch during 2021.
- Total non-Chinook salmon bycatch (primarily chum salmon) in BSAI groundfish fisheries (pelagic trawl, bottom trawl, and hook-and-line fisheries) during 2021 was 535,282, which is a 49% increase in the recent 5-year average (Table 1). Bycatch of non-Chinook salmon in the BSAI pollock fishery accounted for 99% ( $n=530,626$ ) of the total non-Chinook salmon bycatch during 2021.
- Bycatch impacts to Canadian-origin Chinook salmon by BSAI Pollock fishery is estimated by run year. The 2017 run is the most recent year for which bycatch impact estimates are available for Canadian-origin Chinook salmon. The NPFMC has requested an update to the salmon bycatch impact analysis through the most current year. Additional information is contained in the bycatch impact methods section of this summary report.
  - For 2017, the total Canadian-origin Chinook salmon run was 93,188. Adult equivalent models estimate that an additional 772 Canadian-origin Chinook salmon would have contributed to the 2017 run if they had not been captured as bycatch in the BSAI pollock fishery (Table 2). This represents an impact rate of 0.83% on the Canadian-origin Chinook salmon run during 2017.

## **Background Information**

### ***Bycatch management***

- U.S. groundfish trawl fisheries in the BSAI management area are managed to limit the bycatch of salmon under the Magnuson-Stevens Fisheries Conservation and Management Act by the NPFMC and are regulated by National Marine Fisheries Service (NMFS).
- The pollock fishery is the primary focus of bycatch management as it accounts for an average of 88% of the total Chinook salmon bycatch and 99% of the non-Chinook salmon bycatch in the BSAI management area.
- The pollock fishery is managed according to the Fishery Management Plan (FMP) for Groundfish of the BSAI Management Area.

<https://www.npfmc.org/wp-content/PDFdocuments/fmp/BSAI/BSAIfmp.pdf>

### ***Bycatch regulations***

- The BSAI groundfish FMP contains regulatory measures to reduce salmon bycatch.
- The BSAI pollock fishery is one of the most heavily regulated and monitored fisheries in the world and includes 100% observer coverage.
- Notable bycatch reduction measures include amendment 91 and amendment 110.
- Amendment 91 (<https://alaskafisheries.noaa.gov/rules-notices/search>) was implemented in 2011 and, among other things, established bycatch caps.
- Amendment 110 (<https://alaskafisheries.noaa.gov/rules-notices/search>) was implemented in 2016 and, among other things, established abundance-based bycatch caps to further protect western Alaska and Canadian-origin Chinook salmon stocks harvested for subsistence purposes. Bycatch caps are set relative to the combined in-river run size for the Unalakleet, Upper Yukon (Canadian-origin), and Kuskokwim River Chinook salmon stock groups (termed the three-system index).

### ***Bycatch impact methods***

- The number of salmon captured as bycatch in a given year is not equivalent to the number of adult salmon that would have returned to the Canadian portion of the Yukon River drainage in that year for two reasons.
  - Salmon stocks throughout the North Pacific are captured as bycatch in the BSAI groundfish fisheries. Information on stock origin is required to evaluate the impact of bycatch to a given stock or stock group.
  - Salmon are predominately captured as bycatch during their immature life-history stage and will spend one or more years in the ocean before returning to freshwater as mature spawners. Bycatch numbers of immature salmon require an adjustment for natural mortality before they can be compared to the number of mature adults returning to freshwater. Bycatch estimates that are adjusted for natural mortality are referred to as Adult Equivalent (AEQ) bycatch.
- Bycatch impacts on Yukon River Canadian-origin salmon require stock-specific Adult Equivalent (AEQ) estimates of bycatch. These estimates rely on the following data inputs: total salmon bycatch, bycatch stock mixtures, bycatch age composition, salmon maturity

schedules, and assumptions on the natural mortality of salmon in marine habitats (Ianelli and Stram 2014).

- The bycatch AEQ analysis has not been updated since the last Yukon River Panel bycatch summary.
- During its October 2021 meeting, the NPFMC requested an analysis on the estimated impacts of salmon bycatch in the BSAI pollock trawl fishery that includes:
  - An updated Chinook bycatch impact analysis (AEQ) for Western Alaska stocks caught in the Bering Sea pollock fishery. This was last completed for the 2017 season and will be updated with recent genetic stock composition data and scale/age samples from the pollock fishery to inform the age-length key along with updated run reconstruction estimates.
  - Recommendations on the best way to evaluate impacts of chum catch in the Bering Sea pollock fishery on Western Alaska stocks using currently available data.
  - A request for the State to provide the Council with a stock status update on Western Alaska Chinook and chum salmon sometime in 2022.
  - Intent to draft a letter to the Secretary of State to request help identifying stock composition of salmon catch outside of US waters and a letter to the Secretary of Commerce for increased and dedicated funding for salmon research.
- This Yukon River Panel bycatch summary report will include updated bycatch impact information as soon as it is available.

### *Additional resources*

- Bycatch numbers are reported by the National Marine Fisheries Service, available at: <https://alaskafisheries.noaa.gov/fisheries-catch-landings?tid=286>
- Bycatch updates are reported by the North Pacific Fisheries Management Council, available at: <https://www.npfmc.org/bsai-salmon-bycatch/>

### *References*

- Ianelli, J. N. and D. L. Stram. 2014. Estimating impacts of the pollock fishery bycatch on western Alaska Chinook salmon. *ICES J. Mar. Sci.* **72**: 1159-1172. doi:10.1093/icesjms/fsu173
- Ianelli, J. N., and D. L. Stram. 2018. Chinook Bycatch Mortality Update. Discussion paper presented to the North Pacific Fishery Management Council, April 2018. Available online at: <http://npfmc.legistar.com/gateway.aspx?M=F&ID=e172520e-fc22-46e8-b5aa-72ba233f129e.pdf>
- Murphy, J.M. E.V. Farley, J.N. Ianelli, and D.L. Stram. 2017. Distribution, diet, and bycatch of chum salmon in the Eastern Bering Sea. *N. Pac. Anadr. Fish. Comm. Bull.* **6**:219-234. doi: 10.23849/npafcb6/219.234

Table 1.—Numbers of Chinook and non-Chinook (chum) salmon captured as bycatch in the Bering Sea-Aleutian Islands (BSAI) groundfish fisheries by season (A-season: winter, B-season: summer/fall), 1991-2020.

Year	BSAI Chinook Salmon Bycatch						BSAI Non-Chinook Salmon Bycatch					
	A-season		B-season		Annual		A-season		B-season		Annual	
	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries	Pollock Fisheries	All Fisheries
1991 <sup>a</sup>	38,791	46,392	2,114	2,488	40,905	48,880	2,850	3,015	26,101	27,245	28,951	30,260
1992 <sup>a</sup>	25,691	31,418	10,259	10,536	35,950	41,954	1,951	2,120	38,324	39,329	40,275	41,449
1993 <sup>a</sup>	17,264	24,688	21,252	21,325	38,516	46,013	1,593	1,848	240,597	241,422	242,191	243,270
1994	28,451	38,921	4,686	4,899	33,137	43,820	3,990	5,599	88,681	88,949	92,672	94,548
1995	10,579	18,939	4,405	4,497	14,984	23,436	1,707	3,033	17,556	18,842	19,264	21,875
1996	36,068	43,316	19,554	19,888	55,622	63,204	221	665	77,014	77,395	77,236	78,060
1997	10,935	16,401	33,973	34,128	44,908	50,529	2,083	2,710	63,904	64,285	65,987	66,995
1998	16,132	19,869	40,308	40,679	56,440	60,548	4,090	4,520	60,866	61,177	64,956	65,697
1999	6,352	8,793	5,627	5,805	11,979	14,598	362	393	44,909	46,739	45,271	47,132
2000	3,422	6,567	1,539	1,655	4,961	8,222	212	350	58,358	58,976	58,571	59,326
2001	18,484	24,871	14,961	15,676	33,445	40,547	2,386	2,903	54,621	57,827	57,007	60,730
2002	21,794	26,276	12,701	13,407	34,495	39,683	1,377	1,697	79,274	80,784	80,651	82,481
2003	33,478	40,058	13,055	13,603	45,661	53,661	3,831	3,831	184,513	184,559	188,344	188,390
2004	24,925	30,766	26,663	29,272	51,762	60,038	426	426	451,907	452,131	452,333	452,560
2005	27,960	33,622	40,861	41,462	68,184	75,084	594	594	710,196	710,926	710,790	711,520
2006	58,547	62,547	24,362	24,568	82,752	87,115	1,323	1,323	305,674	305,852	306,997	307,175
2007	72,943	78,156	51,781	51,844	122,195	130,000	8,481	8,489	84,387	85,152	92,868	93,641
2008	16,495	18,828	4,811	5,009	21,307	23,837	247	247	14,732	14,732	14,980	14,980
2009	9,882	11,289	2,697	2,825	12,579	14,115	48	48	45,397	45,397	45,445	45,445
2010	7,649	9,480	2,069	2,921	9,737	12,399	40	40	13,238	13,237	13,278	13,278
2011	7,137	7,602	18,362	19,007	25,499	26,609	297	414	191,138	194,405	191,435	194,819
2012	7,765	8,981	3,578	3,949	11,343	12,929	11	307	22,172	23,766	22,183	24,073
2013	8,237	9,186	4,797	6,821	13,016	15,989	215	447	125,101	126,554	125,316	127,001
2014	11,539	13,837	3,498	4,261	15,037	18,106	577	1,629	218,865	222,634	219,442	224,263
2015	12,304	17,502	6,025	7,752	18,329	25,254	4,756	6,158	232,996	237,196	237,752	243,354
2016	16,828	25,721	5,098	6,840	21,926	32,568	3,903	4,838	339,098	342,503	343,001	347,341
2017	21,828	27,008	8,248	9,272	30,076	36,277	1,906	2,313	465,772	469,134	467,678	471,447
2018	8,631	11,251	5,095	6,130	13,740	17,394	1,201	2,120	293,863	306,926	295,064	309,045
2019	15,781	20,088	9,203	11,323	24,984	31,412	2,239	4,509	345,643	354,294	347,882	358,804
2020	18,369	20,436	13,925	14,531	32,294	34,967	807	1,161	319,338	321,540	320,478	323,032
2021	9,502	10,718	4,281	5,109	13,783	15,827	160	372	530,466	534,910	530,626	535,282

[https://www.fisheries.noaa.gov/sites/default/files/akro/chinook\\_salmon\\_mortality2021.html](https://www.fisheries.noaa.gov/sites/default/files/akro/chinook_salmon_mortality2021.html);

[https://www.fisheries.noaa.gov/sites/default/files/akro/chum\\_salmon\\_mortality2021.html](https://www.fisheries.noaa.gov/sites/default/files/akro/chum_salmon_mortality2021.html)

<sup>a</sup> Community Development Quota (CDQ) bycatch not included.

Table 2. –Estimated adult equivalent (AEQ) bycatch of Canadian-origin Chinook from the Yukon River in the Bering Sea-Aleutian Islands (BSAI) pollock fisheries by run year, run size of the Canadian-origin Chinook salmon, and bycatch exploitation rates, 1994–2017 (Ianelli and Stram, 2018).

Run Year	Canadian-Origin AEQ Bycatch	Canadian-Origin Run	Canadian-Origin Impact Rate
1994	1,035	172,885	0.60%
1995	817	169,789	0.48%
1996	998	182,504	0.55%
1997	995	161,700	0.62%
1998	760	88,282	0.86%
1999	588	110,446	0.53%
2000	347	52,842	0.66%
2001	508	85,663	0.59%
2002	835	81,487	1.02%
2003	1,044	149,979	0.70%
2004	1,214	117,247	1.04%
2005	1,267	123,612	1.02%
2006	1,843	119,485	1.54%
2007	2,361	87,899	2.69%
2008	1,918	62,610	3.06%
2009	1,127	87,899	1.28%
2010	518	59,741	0.87%
2011	359	71,726	0.50%
2012	351	48,494	0.72%
2013	364	37,177	0.98%
2014	401	64,886	0.62%
2015	455	87,323	0.52%
2016	532	82,765	0.64%
2017	772	93,188	0.83%