Sea State Inc.

March 29, 2024

Ms. Angel Drobnica Chair
North Pacific Fishery Management Council
1007 West Third, Suite 400
Anchorage, AK 99501

Re: Comments on C2 - Salmon bycatch– review Chum salmon bycatch initial review analysis, salmon bycatch genetics reports, pollock IPA reports

Dear Chair Drobnica, Council Members, and members of the SSC,

Sea State Inc. is a third-party independent monitoring agent that facilitates the salmon avoidance plans described in the Incentive Plan Agreements (IPAs). These IPAs have incentivized fleet avoidance of salmon bycatch and the 2012–2023 data used in the analysis reflect this fleet behavior. Our data indicate that dominance of Russian hatchery chum – as confirmed by the genetic stock identification program – is the primary driver that affects fleet behavior (i.e., avoiding areas of high-density hatchery chum and redistributing effort into areas with lower chum rates but higher proportions of Western Alaska chum). The rising number of Asian chum salmon, particularly from Russian hatcheries, is altering the incentives for fisheries. To avoid the growing number of hatchery fish, captains are now more motivated to fish in areas with lower chum rates, but where naturally occurring Western Alaska chum salmon are likely to be found in higher proportions.

Summary

1. **The scale of this action is small relative to known catch and escapement data for Western Alaska chum.**
- The exact numbers of Western Alaska chum salmon caught and escaping are incomplete, creating some uncertainty. Yet, according to available data, the measures under consideration would impact less than 2.5% of the annual Western Alaska chum salmon population.

2. **There is an increasing problem related to hatchery chum salmon.**
- US and Russian chum salmon hatchery outputs are growing by about 2.2% annually, while Japan's output has decreased by 50% since 2014.
- The proportion of Northeast Asian chum salmon in bycatch is increasing each year.
- The Northeast Asian chum reporting group has the widest distribution in the Bering Sea.
- Data for the rolling hotspot program increasingly reflects the distribution and abundance of hatchery fish, with a diminishing focus on Western Alaska fish.

3. **A total chum cap would not necessarily lead to lower bycatch of Western Alaska chum.**
- The dynamics of fishing effort and fleet behavior adapt to shifting conditions and different policy scenarios.
- Closures and limits tend to favor hatchery fish over Western Alaska chum salmon because overall chum salmon catch rates determine the fishing fleet's avoidance tactics and the timing and location of closures.
- The most effective approach to reduce conflict between PSC species, especially under fluctuating conditions, is to enhance fleet efficiency and minimize the amount of time spent fishing.

1. The scale of this action is small relative to known catch and escapement data for Western Alaska chum

The current analysis on how the pollock fishery's bycatch affects chum salmon returning to rivers in Western Alaska lacks detail. Analysts face challenges in accurately assessing the impact or producing AEQ (Adult Equivalent) estimates due to a lack of sufficient data regarding the return of chum salmon to numerous rivers. However, there is publicly available data from ADF&G such as fish passage counts at sonar project sites, commercial harvest records in all districts, and escapement estimates for Bristol Bay. These data sources also include chum salmon catch numbers from the June South Peninsula fishery and an aggregate figure for all chum harvests in the US, all sourced from the ADF&G and the North Pacific Anadromous Fish Commission websites. The ADF&G site also offers in-season data, and season summaries. From 2011 onwards, data also include bycatch numbers of Western Alaska and central/upper Yukon (YUK) chum salmon in the pollock fishery. When combined (Figure 1), these data suggest an impact from bycatch (Table 1, % of total known). However, limited (best available) data might overestimate this effect. This analysis, despite its potential overestimation, could help the Council and the public assess the value of proposed measures for chum salmon conservation. We suggest that a similar analysis, possibly enhanced with additional in-river return data, should be considered for inclusion in the next revision of the Environmental Impact Statement (EIS), as Council staff might have access to more comprehensive data.

The actual impact of the fishery on Western Alaska and mid and upper Yukon runs is less than the percentage shown, for the following reasons:

1) No Kuskokwim data are available for 2011–2017.
2) No subsistence catches for any of these Western AK districts are used (although they would be included in Yukon sonar counts, and partially in the later Bethel sonar counts).
3) No escapement information is available for Norton Sound or Kotzebue Sound rivers.
4) No marine mortality is assumed for chums intercepted in the pollock fishery, i.e., this is not an AEQ analysis, but a comparison between straight bycatch estimates from the Genetic Stock Identification (GSI) analyses and known values returning to Western Alaska rivers.

One problem with the yearly percentages reported in the EIS is that only a portion of these fish caught are mature, and the immature fraction return to rivers in subsequent years. Resolving the adult equivalency (AEQ) requires age composition estimates of Western Alaskan fish. Without the proper AEQ estimate, the estimates of trawl impacts on Western Alaskan chum are biased upwards.

The 1% pre-2019 impact does not include any entries for a Kuskokwim run prior to 2017 and would certainly be below 1% if these data were included along with the AEQ estimates of trawl bycatch. For example, runs of only 500,000 fish to the Kuskokwim and a 10% overall marine mortality value would result in a 0.86% (rather than 1.0%) impact. For the four post-2019, 2020-2023, the impact is 2.4%. The Kuskokwim is represented in the post-crash series by the inclusion of Bethel sonar data, but all other gaps from missing data, including escapement to Kuskokwim drainages below Bethel, and particularly escapements in the Kotzebue region which had very high catch (and presumably high escapement) in 2022, remain. Further, commercial harvests in 2020 and 2021 in both Norton Sound and the Kotzebue District, which are the basis for entries in those areas, may have been depressed by the effect of COVID both on harvesters and buyers.

Table 1. Chum salmon escapement estimates from Central and Western Alaska (from ADF&G).

Year	Yukon summer + fall (Pilot station counts)	Aniak sonar + commercial landings (early), Bethel sonar 2018 onward	Bristol Bay westside (Nushagak + Togiak) catch + escapement	Norton Sound commercial catch	Kotzebue district commercial catch	Total known (sum columns to left)	Total chum incidental catch, B season pollock	WAK + YUK chums in bycatch, based on GSI	% of total known	Total chum catch reported for US	South Peninsula June chum
1995	4,769,018	605,918	1,044,210	42,898	290,730	6,752,774	17,555			20,168,000	537,433
1996		610,045	940,528	10,609	82,110	1,643,292	77,013			22,503,000	359,820
1997	1,938,884	306,680	417,670	34,103	142,720	2,840,057	63,903			17,050,000	322,325
1998	1,200,123	559,601	758,232	16,324	55,907	2,590,187	60,865			20,262,000	245,619
1999	1,420,964	237,435	706,241	7,881	138,605	2,511,126	44,909			21,622,000	245,306
2000	721,871	188,954	514,883	6,150	159,802	1,591,660	58,357			25,026,000	239,537
2001	851,507	410,102	1,707,763	11,100	211,672	3,192,144	54,620			17,927,000	48,350
2002	1,465,655	474,246	1,077,287	600	8,390	3,026,178	79,274			18,520,000	378,817
2003	2,106,549	480,304	1,222,799	3,560	25,763	3,838,975	184,513			19,733,000	282,438
2004	1,977,581	693,179	1,028,348	6,296	51,077	3,756,481	451,907			18,973,000	482,310
2005	4,464,384	1,220,482	1,626,748	3,983	75,971	7,391,568	710,196			12,804,000	427,830
2006	4,744,998	1,152,696	2,151,502	10,042	137,691	8,196,929	305,674			22,886,000	299,827
2007	2,615,686	707,584	1,317,244	22,431	147,087	4,810,032	84,387			19,003,000	297,539
2008	2,486,078	-	1,449,204	25,124	190,550	4,150,956	14,732			19,559,000	410,932
2009	1,751,413	-	1,324,935	34,122	187,562	3,298,032	45,397			18,890,000	696,775
2010	1,881,475	-	907,245	117,743	270,343	3,176,806	13,243			19,572,000	271,700
2011	2,925,378	-	702,614	110,555	264,321	4,002,868	191,138	45,791	1.1%	18,386,000	423,335
2012	2,914,634	-	843,276	62,772	227,965	4,048,647	22,172	3,932	0.1%	21,665,000	395,060
2013	3,714,978	-	1,172,993	118,709	319,062	5,325,742	125,101	31,488	0.6%	23,441,000	399,058
2014	2,726,939	-	895,253	107,745	636,187	4,366,124	218,865	40,365	0.9%	12,782,000	390,139
2015	2,260,988	-	895,683	147,497	305,383	3,609,551	232,996	43,323	1.2%	19,938,000	178,715
2016	2,916,508	-	1,005,079	51,176	400,417	4,373,180	339,098	76,791	1.7%	17,311,000	270,614
2017	**4,923,666**	**-**	**1,424,884**	**163,473**	**463,749**	**6,975,772**	**465,772**	**96,070**	**1.4%**	**26,773,000**	**640,891**
2018	2,541,352	552,011	1,989,839	238,029	695,153	6,016,384	293,863	58,810	1.0%	21,511,000	537,466
2019	2,244,966	385,409	1,734,323	157,035	494,593	5,016,326	345,643	55,862	1.1%	20,139,000	549,072
2020	955,041	73,432	302,846	26,365	149,808	1,507,492	343,014	28,694	1.9%	9,038,000	490,128
2021	**299,915**	**26,973**	**262,154**	**6,410**	**96,492**	**691,944**	**545,883**	**50,797**	**6.8%**	**13,580,000**	**1,168,601**
2022	789,523	103,864	341,832	31,249	475,624	1,742,092	242,309	54,108	3.0%	17,002,000	544,097
2023	1,216,003	251,542	338,215	15,693	141,781	1,963,234	111,819	11,786	0.6%		205,522

	Total known		WAK + YUK
Total know chum returns and bycatch	49,639,356		597,817
Bycatch as a percent of total known returns	1.2%		
Total known chum returns and bycatch (2011 ·	43,734,594		452,432
Bycatch as a percent of total known returns	1.03%		
Total known chum returns and bycatch (2020 ·	5,904,762		145,385
Bycatch as a percent of total known returns	2.5%		

In addition to representing low levels of impact in both pre- and post-2019 periods, Table 1 shows interesting patterns in chum harvest, particularly just before 2019. In 2017, which was in the middle of the marine heat wave the Western Alaska and Yukon component of the pollock fishery bycatch reached a maximum, In the same year, returns to the Yukon reached their highest point in the series, and the entire "Total known (for Western Alaska)" column would likely have peaked for the series as well if any Kuskokwim data were included for that year. More broadly, catch for the entire US peaked as well, which seems to indicate a positive effect on adult chum production during the heatwave. The analysis and Council should consider whether there are indicators available that would suggest that restrictions on chum bycatch be relaxed when returns are so high, as the impact is clearly minimal and further restrictions cannot but help contribute to increased chinook bycatch.

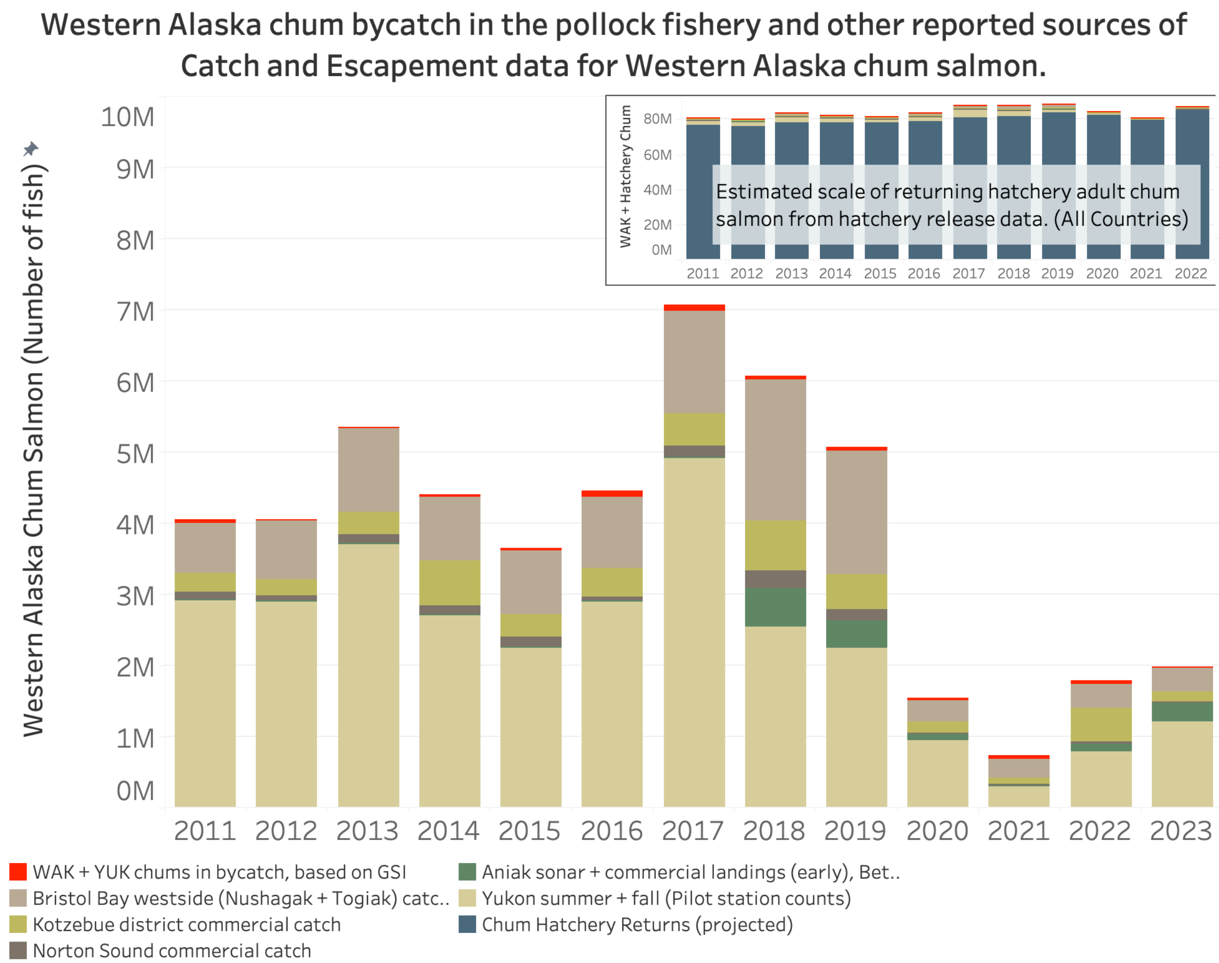

Figure 1. Western Alaska Chum bycatch in the pollock fishery (red) compared with available Western Alaska chum catch and escapement data and the scale of Western Alaskan chum relative to the estimated scale of returning adult hatchery chum salmon based on hatchery release data.

The relatively high bycatch in 2021 is also interesting in that the South Peninsula June fishery also harvested very high numbers (almost 3x previous the ten-year average). Unusually high percentages of 3-year-old fish, which would have been unlikely to return in the year taken-at-sea, may have led to these high takes as well as the high percentage of bycatch/total known returns that was seen in 2021 (Table 2).

Table 2. Age groups in Western Alaska chum bycatch based on GSI groupings.

Year	3	4	5
2016	15%	73%	12%
2017	20%	64%	16%
2018	20%	74%	6%
2019	12%	77%	11%
2020	71%	22%	7%
2021	33%	65%	2%
2022	11%	83%	6%

2. There is an increasing problem related to hatchery chum salmon.

The release of hatchery chum salmon into the North Pacific Ocean continues to increase. In the last 23 years, total chum salmon hatchery releases in the Bering Sea from all countries combined have averaged about 3 billion per year and have been remarkably stable over this period. However, closer examination of the data shows that Russian production has been increasing at a rate of roughly 5% per year, and the United States about 2% per year; whereas, Japan has been decreasing production by 2% per year (Figure 2). In the last decade, chum salmon hatchery production has increased by about 800 million (excluding Japan) fish due to the development of new hatcheries in Russia.

Between 2011 and 2023, the proportion of NE Asian chum salmon in the AFA pollock overall chum salmon bycatch has increased (Figure 3). Moreover, the spatial extent of Asian chum salmon is much more widely distributed than any other chum salmon reporting group in the GSI results (Figure 4). The relative differences between the spatial distribution and proportions of Western Alaska chum and Russian chum salmon are shown in Figure 5. Areas of chum bycatch rates during the B-season are generally highest in genetic clusters 1 and 2, and the proportion of Western Alaska chum salmon is also highest in these two clusters. In genetic cluster 2, the bycatch is dominated by NE Asian chum salmon (Figure 5).

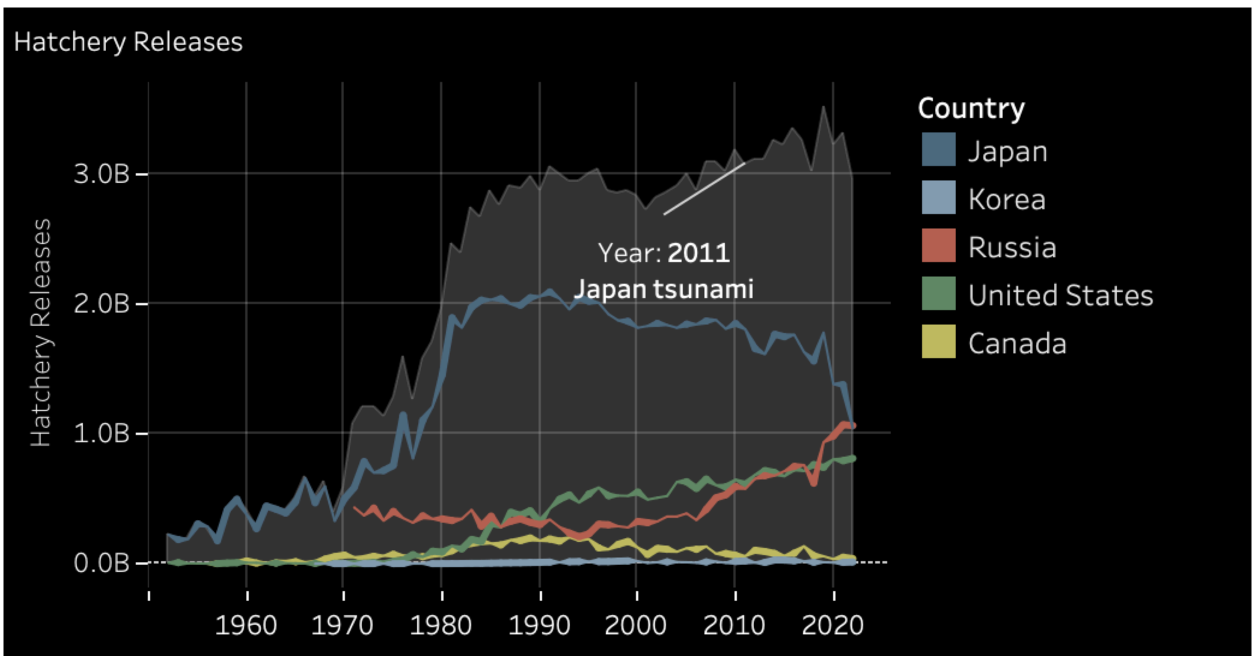

Figure 2. Chum salmon hatchery releases between 1950 and 2022 by country. The colored ribbons show the total number of releases by Country and the shaded region is the cumulative total releases by all countries. Data provided by the North Pacific Anadromous Fish Commission (https://www.npafc.org/).

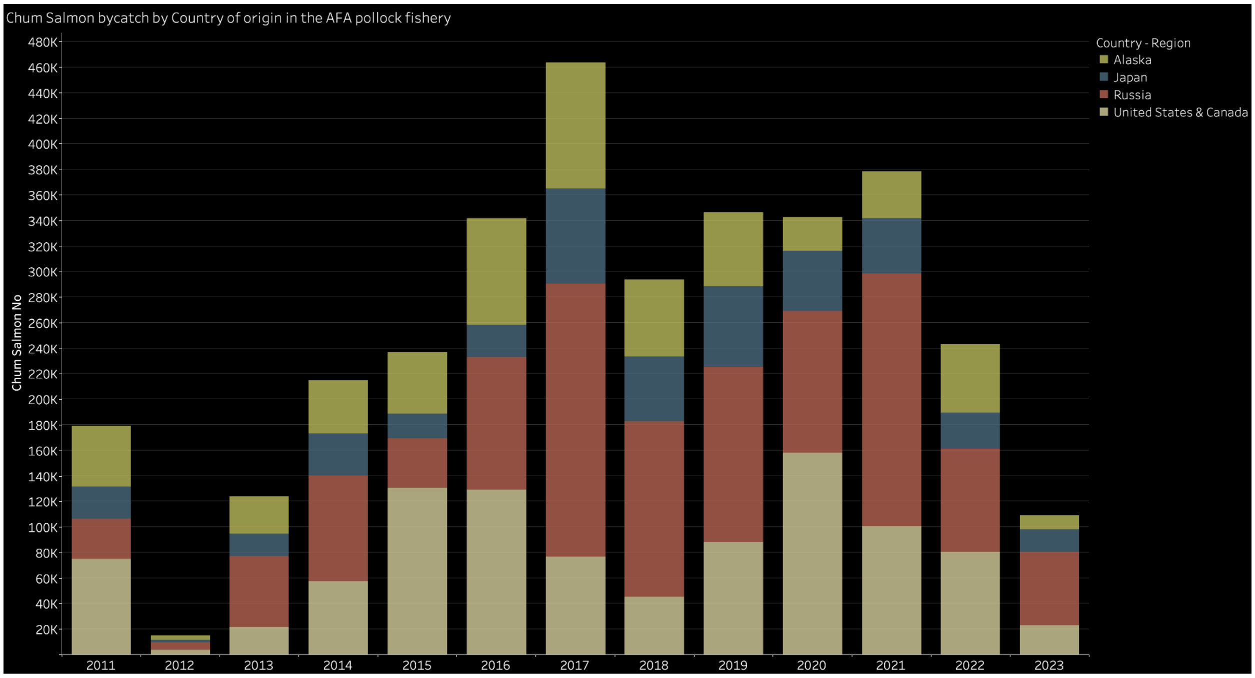

Figure 3. Chum bycatch between 2011 and 2023 broken down by country/region and year. Western Alaska stocks are labeled Alaska, and the United States and Canada contain the SE Alaska genetic groupings.

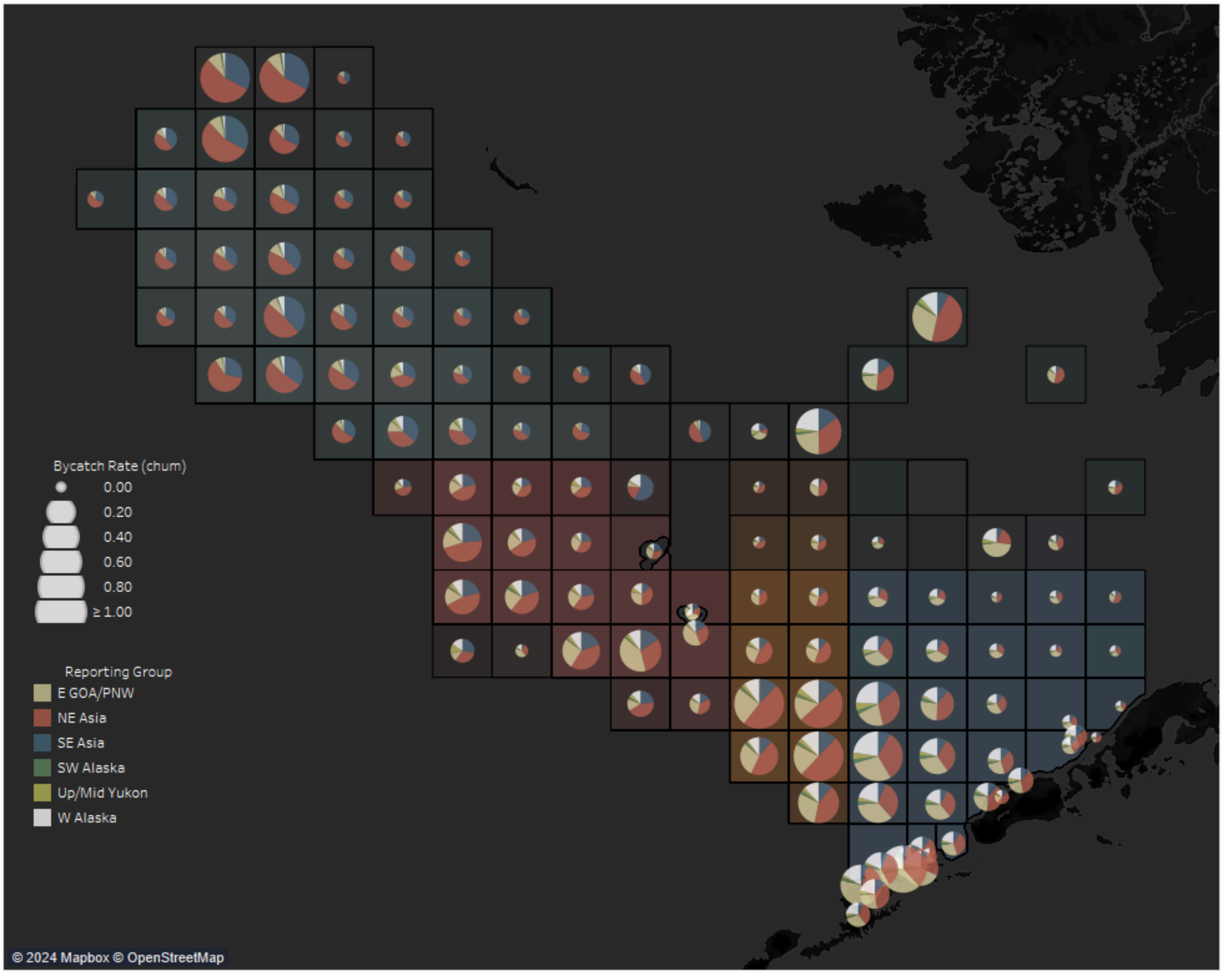

Figure 4. Spatial distribution of chum salmon bycatch rates for all sectors combined in the Bering Sea. Each square represents an ADF&G statistical area, and the radius of each pie chart within a stat area represents the chum salmon bycatch rate. Each section of the pie chart shows the genetic reporting group percentage from the GSI analysis.

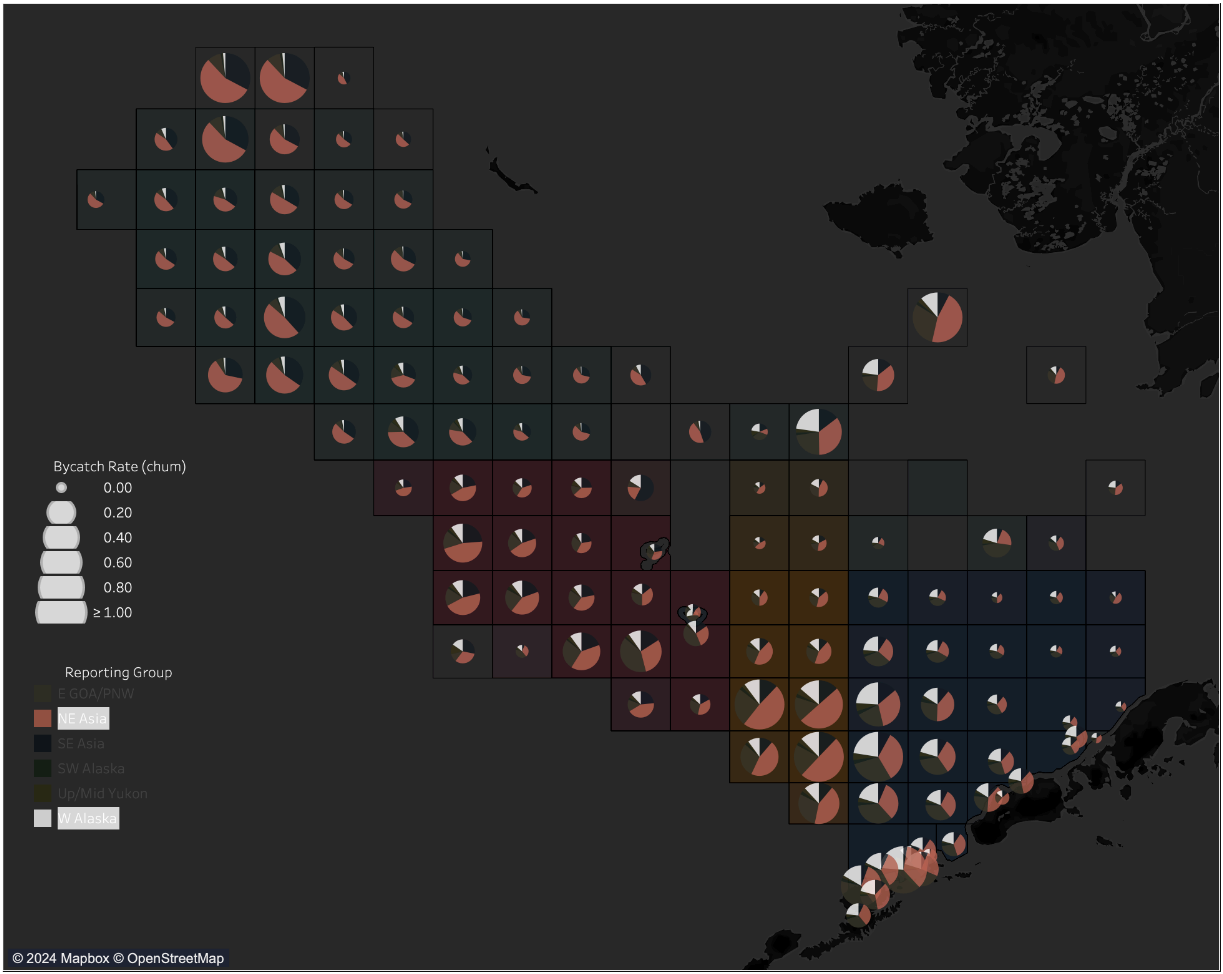

Figure 5. Spatial distribution of chum salmon bycatch rates for all sectors combined in the Bering Sea, with the Western Alaska chum salmon highlighted in white and the Russian proportion of the chum salmon shown in red. Each square represents an ADF&G statistical area, and the radius of each pie chart within a stat area represents the chum salmon bycatch rate. Each section of the pie chart shows the genetic reporting group percentage from the GSI program.

Sea State Inc. continues to collaborate closely with the geneticist at the Auke Bay laboratory to integrate the results of the genetic sampling into our database to help inform the predictions about the potential impacts on Western Alaska chum salmon populations (Figure 5). Each week, an assessment of the relative bycatch rates by genetic cluster is taken into consideration when implementing a rolling hotspot closure. Since 2011, we have compiled the weekly bycatch rates by genetic reporting group based on the spatial and temporal resolution of the genetics sampling program (Table 3). For comparative purposes, we can compare the bycatch rates (i.e., Number of Chum / Pollock Wt) of each reporting group in each genetic cluster to inform the probability of encountering Western Alaska chum salmon relative to the more abundant Asian salmon stocks. We also compare the pollock CPUE in each of the genetic clusters to determine the potential risk to Western Alaska chum salmon populations when implementing rolling hotspot closures.

In general, the risk to SW Alaska chum salmon and Up/Mid Yukon chum salmon is about 80% less than that of Western Alaska chum salmon in both early and late periods (Table 3). The risk of catching NE Asian stocks is 50% to 1088% higher in the late season and 75% to 347% higher than Western Alaska chum in the early season (Table 3). SE Asian stocks are more at risk in genetic clusters 3 and 4, and more so in the early season than the late season.

Table 3. B-Season average relative chum salmon bycatch rates by reporting group

		Temporal Stratum / Reporting Group											
		Early						Late					
	Cluster	E GOA/PNW	NE Asia	SE Asia	SW Alaska	Up/Mid Yukon	W Alaska	E GOA/PNW	NE Asia	SE Asia	SW Alaska	Up/Mid Yukon	W Alaska
Chum Salmon Rate by Reporting Group	1	0.088	0.135	0.049	0.014	0.016	0.077	0.179	0.134	0.023	0.013	0.013	0.089
	2	0.087	0.435	0.112	0.018	0.026	0.097	0.313	0.256	0.061	0.016	0.012	0.076
	3	0.036	0.100	0.061	0.003	0.008	0.027	0.250	0.186	0.077	0.010	0.019	0.059
	4	0.005	0.019	0.022	0.000	0.005	0.005	0.023	0.120	0.085	0.003	0.001	0.010
% Difference in Chum Salmon Rate by Reporting Group from the 'W Alaska' along Reporting Group	1	14%	75%	-37%	-81%	-80%	0%	100%	50%	-74%	-85%	-85%	0%
	2	-11%	347%	15%	-82%	-73%	0%	311%	236%	-21%	-79%	-85%	0%
	3	34%	275%	128%	-89%	-68%	0%	323%	214%	30%	-83%	-69%	0%
	4	16%	314%	358%	-94%	10%	0%	128%	1088%	748%	-75%	-87%	0%
Avg. Pollock CPUE (AdfgStatArea)	1	284.1	284.1	284.1	284.1	284.1	284.1	90.3	90.3	90.3	90.3	90.3	90.3
	2	33.0	33.0	33.0	33.0	33.0	33.0	35.0	35.0	35.0	35.0	35.0	35.0
	3	31.9	31.9	31.9	31.9	31.9	31.9	32.5	32.5	32.5	32.5	32.5	32.5
	4	23.7	23.7	23.7	23.7	23.7	23.7	22.8	22.8	22.8	22.8	22.8	22.8

In 2010, Russia made more investments in hatchery production which doubled their hatchery releases between 2010 and 2022. Russia is now the single largest producer of hatchery chum salmon in the North Pacific, and annual production has been increasing at a rate of 2.2% year over year. This increase in production is expected to continue; however, with the recent war between Ukraine and Russia it is uncertain if this trend will continue.

3. A total chum cap would not necessarily lead to lower Western Alaska chum bycatch.

The addition of a cap changes the incentive landscape, where avoidance of a cap is only constraining under conditions of high chum abundance, and less constraining during periods of low abundance. Given that Asian hatchery chum dominates the bycatch (see Section 2), a cap does not create the incentive to avoid the less abundant Western Alaska chum salmon. In fact, if overall chum bycatch rates are lower in genetic cluster 1, then the fleet is incentivized to move to this area with higher proportions of Western Alaska stocks in the bycatch. This move results in a net benefit to the hatchery chum and a net loss to the Western Alaska stocks.

The 2021 and 2022 B-seasons demonstrate how a cap would not necessarily lead to Western Alaska chum savings. In 2021, the shoreside sector encountered approximately 300,000 chum salmon along the shelf edge in genetic cluster 2 over a 3-week period (see Figure 6 for a map of fishing ground references). In response to this extreme bycatch event, the shoreside sector implemented a chum salmon advisory area intending to reduce its bycatch by 200,000 chum salmon in 2022. The shoreside sector accomplished the objective by effectively closing genetic cluster 2 to fishing. In response, effort from the shoreside sector in 2022 was displaced from the shelf edge eastward up on the shelf near the 50-fathom edge (Figure 6). The net result of this effort displacement was a savings of 200,000 hatchery fish and a net loss of 3,311 Western Alaska chum salmon (Table 1, Figure 3).

In 2023, the fleets had a bigger problem avoiding herring than chum. To avoid hitting the herring PSC limit, the shoreside fleet moved out of the Unimak Area and off the shelf, fishing more north to the Pribilof Islands, Zhemchug Canyon, and even Pervenets Canyon. These northern regions are less often fished by a few select shoreside vessels due to high travel expenses and short delivery windows. While they tend to have higher rates of chum salmon, the proportions of Western Alaska chum are lower. Overall chum salmon bycatch was low in 2023, but the Western Alaska chum bycatch was even lower proportionally due to the fleet's movement northwest to avoid herring (Table 1, Figure 3, Figure 7).

A total chum cap would incentivize individual vessels to avoid areas of high hatchery chum and move towards areas that may have lower total chum rates but higher proportions of Western Alaska chum. A better approach to avoiding Western Alaska chum is to use and improve upon the current fleet flexibility included in the IPAs. With each year, more genetic information accumulates and becomes more informative about the timing and location of rolling hotspot closures on the impacts of Western Alaska chum salmon.

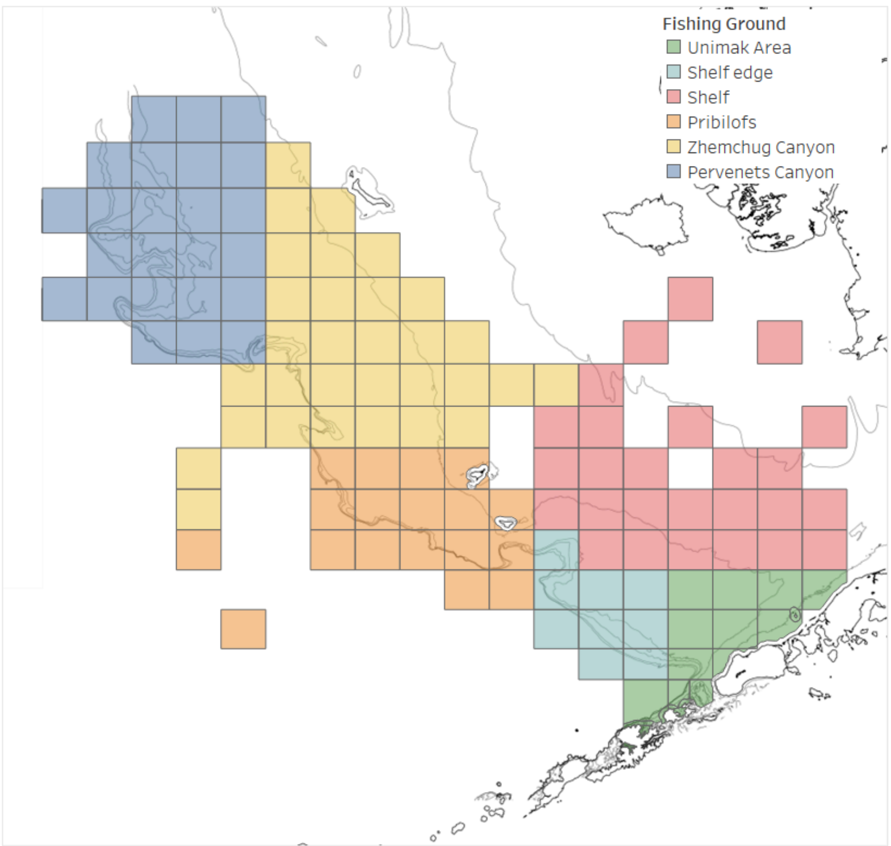

Figure 6. Map of fishing grounds referred to in the text.

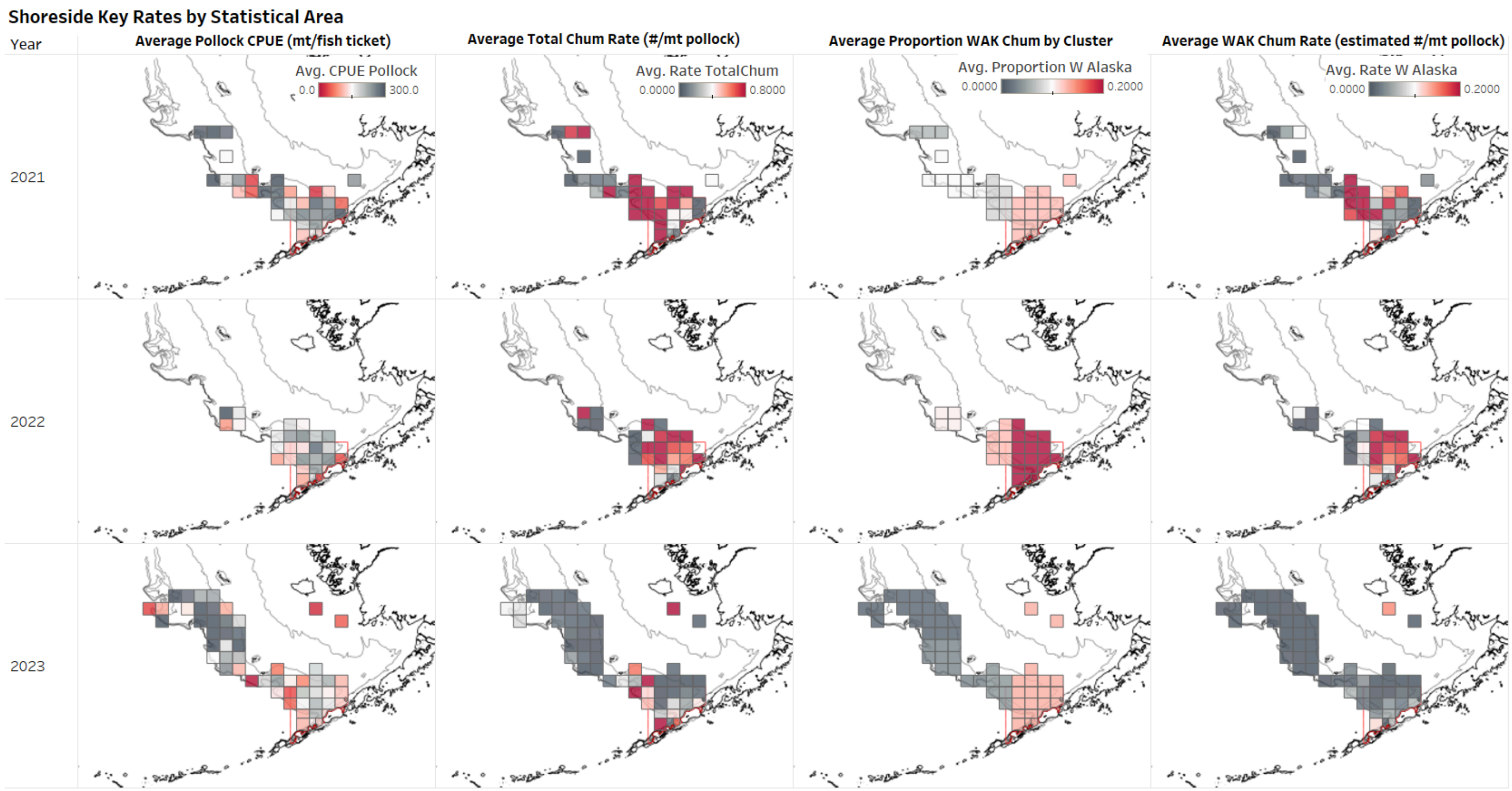

Figure 7. Fishing distribution shifts led to changes in total chum bycatch between 2021 and 2022. Average pollock CPUE, total chum rate (number of chum per mt pollock), and proportion of Western Alaska chum from the NOAA genetic report the following year by statistical area for 2021 and 2022. The average rate of total chum, total chum and Western Alaska chum bycatch are shown in the table on the left.

Sea State acknowledges and commends the authors and collaborators of the Draft Environmental Impact Statement for their significant effort in compiling the information quickly. We also appreciate our collaboration with the Auke Bay genetics lab. Their swift turnaround time and provision of these data are key to avoiding Western Alaskan chum salmon in the Bering Sea pollock fishery.

Sincerely,

Steve Martell, PhD
Merrill Rudd, PhD
Karl Haflinger, Pres.