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Update on Chinook salmon mortality due to bycatch in the EBS pollock fishery

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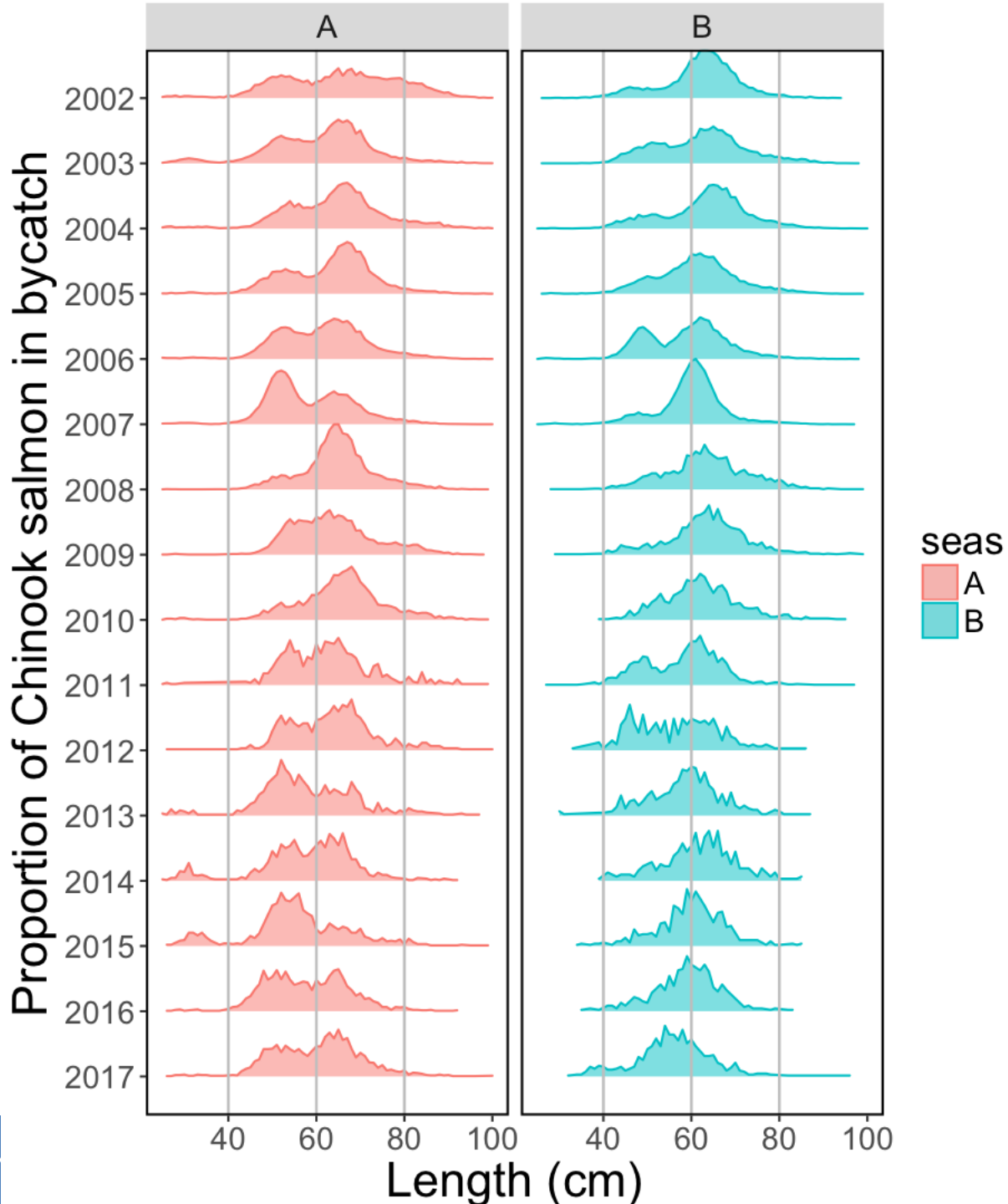
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Steps

1. Compile PSC statistics
 - a. Total bycatch by season (Table 1)
 - b. Length and sex composition of the bycatch
 - c. Date and location
2. Convert seasonal length compositions to PSC by age
3. Apply oceanic survival and maturity-at-age
4. Use genetic stock ID information (Table 5)
5. Run the AEQ model (1994-2017) and summarize
6. Compare subset with available run-strength estimates

Chinook salmon bycatch by season and fleet category, pollock fishery

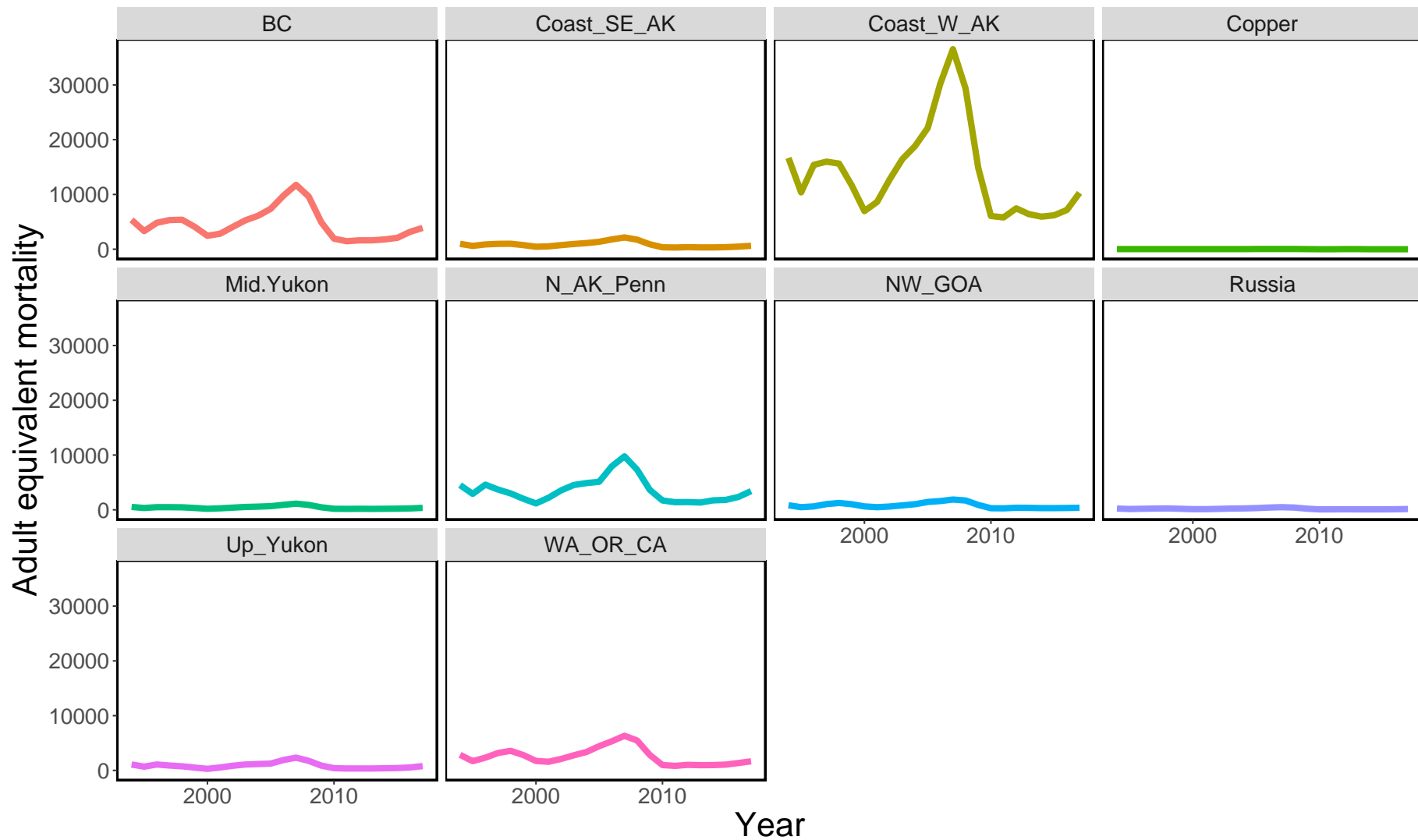
Sector	A Season			B Season			Total
	CV	At sea	A sub-total	CV	At sea	B sub-total	
1991	10,192	26,646	36,838	1,667	548	2,215	39,053
1992	6,725	16,688	23,413	1,604	8,654	10,258	33,671
1993	3,017	12,398	15,415	2,614	18,590	21,204	36,619
1994	8,346	18,939	27,285	1,206	3,399	4,605	31,890
1995	2,040	6,942	8,982	781	3,640	4,421	13,403
1996	15,228	20,757	35,985	9,944	9,544	19,488	55,473
1997	4,954	5,393	10,347	22,551	11,423	33,974	44,321
1998	4,334	10,784	15,118	27,218	8,909	36,127	51,245
1999	3,103	3,248	6,351	2,662	2,964	5,626	11,977
2000	878	2,544	3,422	718	821	1,539	4,961
2001	8,555	9,928	18,483	3,779	11,182	14,961	33,444
2002	10,336	11,457	21,793	9,560	3,141	12,701	34,494
2003	15,367	17,242	32,609	6,998	5,979	12,977	45,586
2004	11,576	11,529	23,105	22,231	6,364	28,595	51,700
2005	13,797	13,491	27,288	34,826	5,204	40,030	67,318
2006	35,638	22,653	58,291	22,648	1,731	24,379	82,670
2007	36,463	33,770	70,233	41,338	10,680	52,018	122,251
2008	10,692	5,823	16,515	4,245	588	4,833	21,348
2009	6,241	3,643	9,884	2,207	485	2,692	12,576
2010	3,735	3,894	7,629	1,932	135	2,067	9,696
2011	4,442	2,695	7,137	13,950	4,412	18,362	25,499
2012	7,988	3,148	11,136	9,955	146	10,101	21,237
2013	6,592	4,595	11,187	4,105	542	4,647	15,834
2014	6,420	5,116	11,536	2,712	783	3,495	15,031
2015	7,789	4,522	12,311	2,492	3,180	5,672	17,983
2016	8,040	8,776	16,816	1,984	3,117	5,101	21,917
2017	9,057	12,538	21,595	5,991	2,339	8,330	29,925
2018	2,682	3,825	6,507	0	0	0	6,507



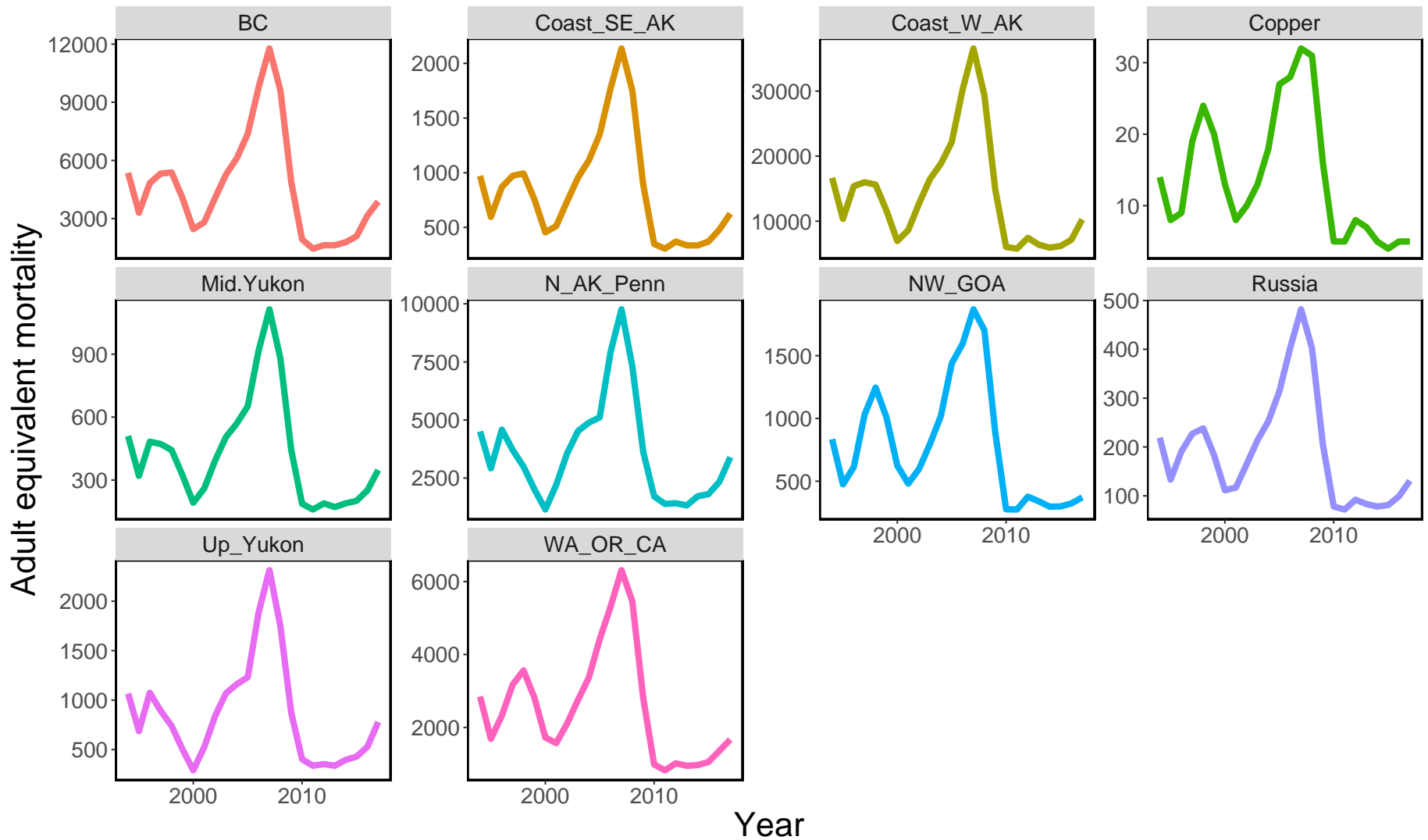
Chinook salmon bycatch stock composition estimates (Source: ABL Publications)

	Russia	Coast W AK	Mid-Yukon	Up Yukon	N AK Penn	NW GOA	Copper	NE GOA	Coast SE AK	BC	WA/OR/CA	% in A season
A season												% in A season
2011	0.2%	53.9%	1.8%	7.4%	21.8%	0.6%	0.0%	0.0%	3.1%	7.2%	4.0%	28%
2012	0.5%	67.8%	1.2%	3.1%	16.2%	0.2%	0.0%	0.1%	1.7%	7.3%	1.9%	68%
2013	0.9%	50.2%	1.1%	7.2%	19.1%	0.5%	0.1%	0.0%	1.9%	17.0%	2.0%	63%
2014	0.6%	54.7%	3.3%	4.1%	22.7%	0.1%	0.0%	0.0%	0.6%	10.2%	3.7%	77%
2015	0.6%	45.9%	1.0%	3.6%	14.5%	2.8%	0.2%	0.0%	3.9%	19.1%	8.4%	67%
2016	0.6%	39.0%	1.7%	2.2%	16.9%	0.6%	0.0%	0.0%	3.9%	26.1%	8.9%	77%
B season												% in B season
2011	1.0%	73.7%	1.3%	0.7%	3.4%	3.6%	0.6%	0.1%	1.4%	7.8%	6.4%	72%
2012	2.4%	51.9%	0.2%	1.0%	0.1%	3.8%	0.1%	0.1%	8.2%	15.3%	16.9%	32%
2013	0.9%	51.9%	1.9%	1.4%	5.9%	6.9%	0.1%	0.0%	1.9%	14.3%	14.8%	37%
2014	0.4%	31.7%	1.7%	1.6%	0.1%	18.4%	0.1%	0.1%	3.6%	24.5%	17.9%	23%
2015	0.5%	39.6%	1.7%	2.7%	10.6%	4.0%	0.1%	0.0%	4.5%	21.8%	14.5%	33%
2016	0.2%	16.5%	0.4%	0.7%	1.1%	5.8%	1.8%	0.0%	6.5%	37.0%	29.9%	23%
Total												
2011	0.8%	68.2%	1.4%	2.6%	8.5%	2.8%	0.4%	0.1%	1.9%	7.6%	5.7%	
2012	1.1%	62.8%	0.9%	2.4%	11.1%	1.3%	0.0%	0.1%	3.7%	9.8%	6.7%	
2013	0.9%	50.8%	1.4%	5.1%	14.2%	2.9%	0.1%	0.0%	1.9%	16.0%	6.7%	
2014	0.6%	49.3%	2.9%	3.5%	17.5%	4.4%	0.0%	0.0%	1.3%	13.5%	7.0%	
2015	0.6%	43.8%	1.2%	3.3%	13.2%	3.2%	0.2%	0.0%	4.1%	20.0%	10.4%	
2016	0.5%	33.8%	1.4%	1.8%	13.2%	1.8%	0.4%	0.0%	4.5%	28.7%	13.8%	

Chinook salmon AEQ estimates, 1994-2017



Chinook salmon AEQ estimates, 1994-2017 (rescaled)

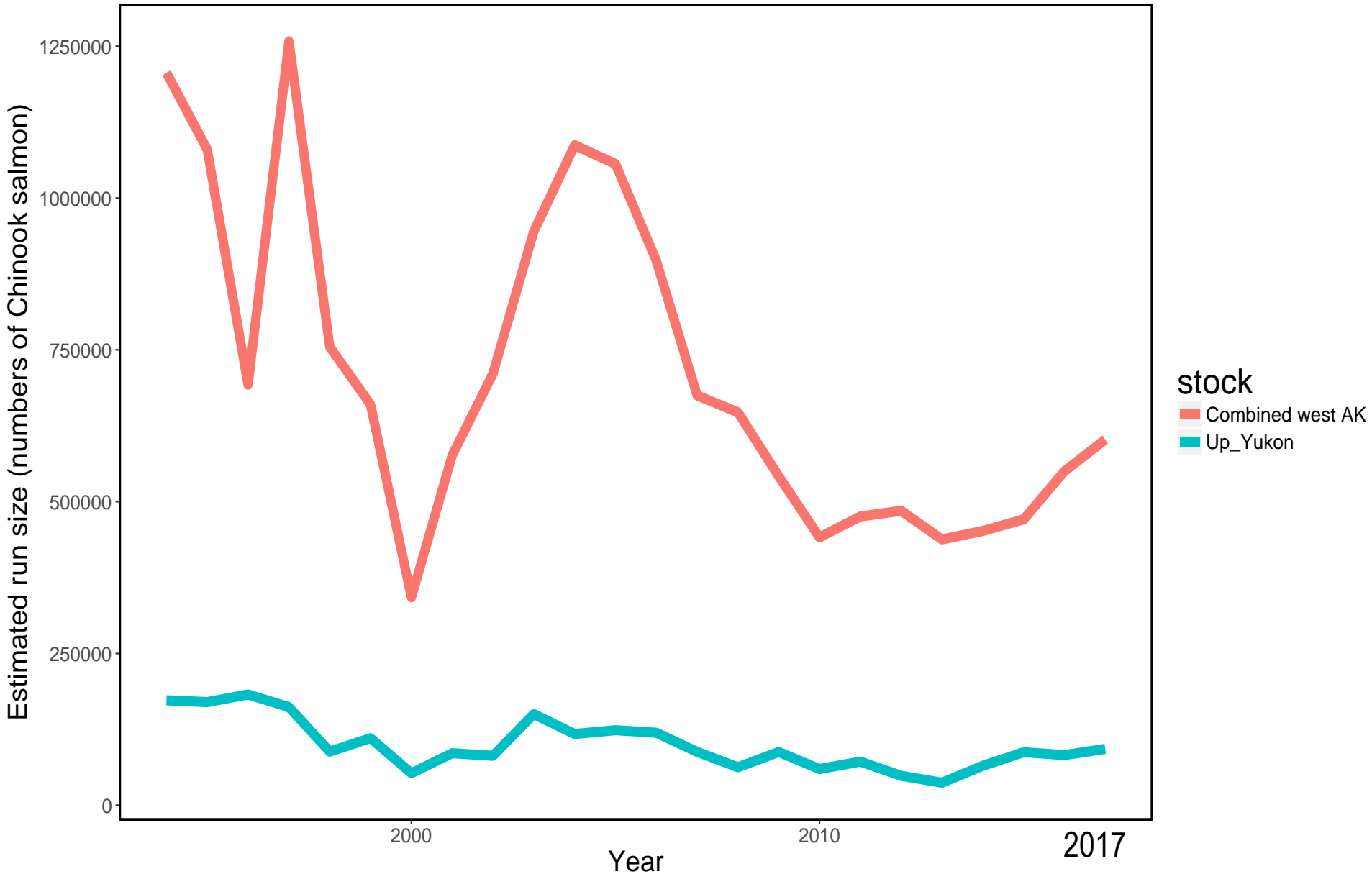


Chinook salmon bycatch AEQ Estimates

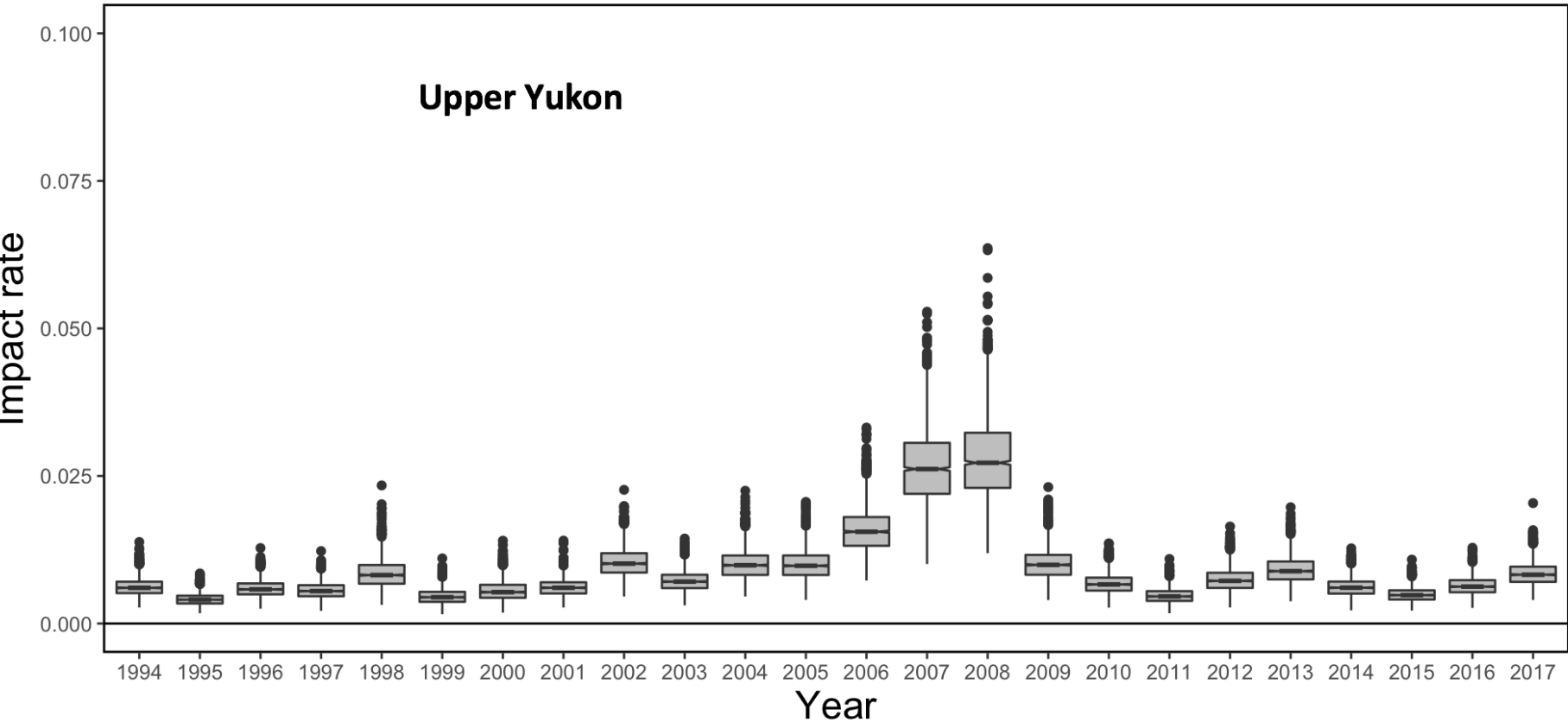
	BC- WA-OR	Coast W AK	Middle Yukon	Upper Yukon	<i>Combined</i> <i>West. AK</i>	N AK Penin	NW GOA	Russia	SEAK	Other	Total
1994	8,211	16,681	510	1,067	18,258	4,507	835	219	972	14	33,016
1995	4,983	10,367	320	687	11,374	2,916	475	133	596	8	20,485
1996	7,151	15,406	483	1,075	16,964	4,585	612	191	869	9	30,381
1997	8,499	15,998	472	893	17,363	3,707	1,032	227	973	20	31,821
1998	8,946	15,634	443	740	16,817	2,993	1,246	238	994	25	31,259
1999	6,884	11,643	324	505	12,472	2,011	1,010	183	754	21	23,335
2000	4,176	6,969	192	291	7,452	1,149	625	111	455	13	13,981
2001	4,382	8,636	260	525	9,421	2,204	481	117	512	8	17,125
2002	6,173	12,764	393	839	13,996	3,555	599	165	737	10	25,235
2003	8,027	16,466	505	1,069	18,040	4,524	796	214	955	13	32,569
2004	9,479	18,839	570	1,162	20,571	4,885	1,020	253	1,112	19	37,339
2005	11,794	22,156	652	1,232	24,040	5,109	1,439	314	1,350	28	44,074
2006	15,090	30,213	917	1,886	33,016	7,941	1,595	403	1,775	29	59,849
2007	18,092	36,543	1,114	2,315	39,972	9,766	1,870	482	2,137	33	72,352
2008	15,078	29,362	879	1,748	31,989	7,311	1,704	402	1,752	32	58,268
2009	7,706	14,873	443	871	16,187	3,638	888	205	892	16	29,532
2010	2,909	6,061	187	403	6,651	1,710	276	78	348	5	11,977
2011	2,276	5,798	160	337	6,295	1,387	275	72	306	5	10,616
2012	2,642	7,460	189	354	8,003	1,417	377	92	370	8	12,909
2013	2,570	6,396	171	337	6,904	1,324	340	83	336	7	11,564
2014	2,743	5,941	189	397	6,527	1,718	297	78	335	5	11,703
2015	3,135	6,187	201	429	6,817	1,811	299	81	370	4	12,517
2016	4,509	7,147	251	529	7,927	2,336	323	99	479	5	15,678
2017	5,551	10,292	348	779	11,419	3,398	372	131	627	5	21,503

Chinook salmon run-strength estimates

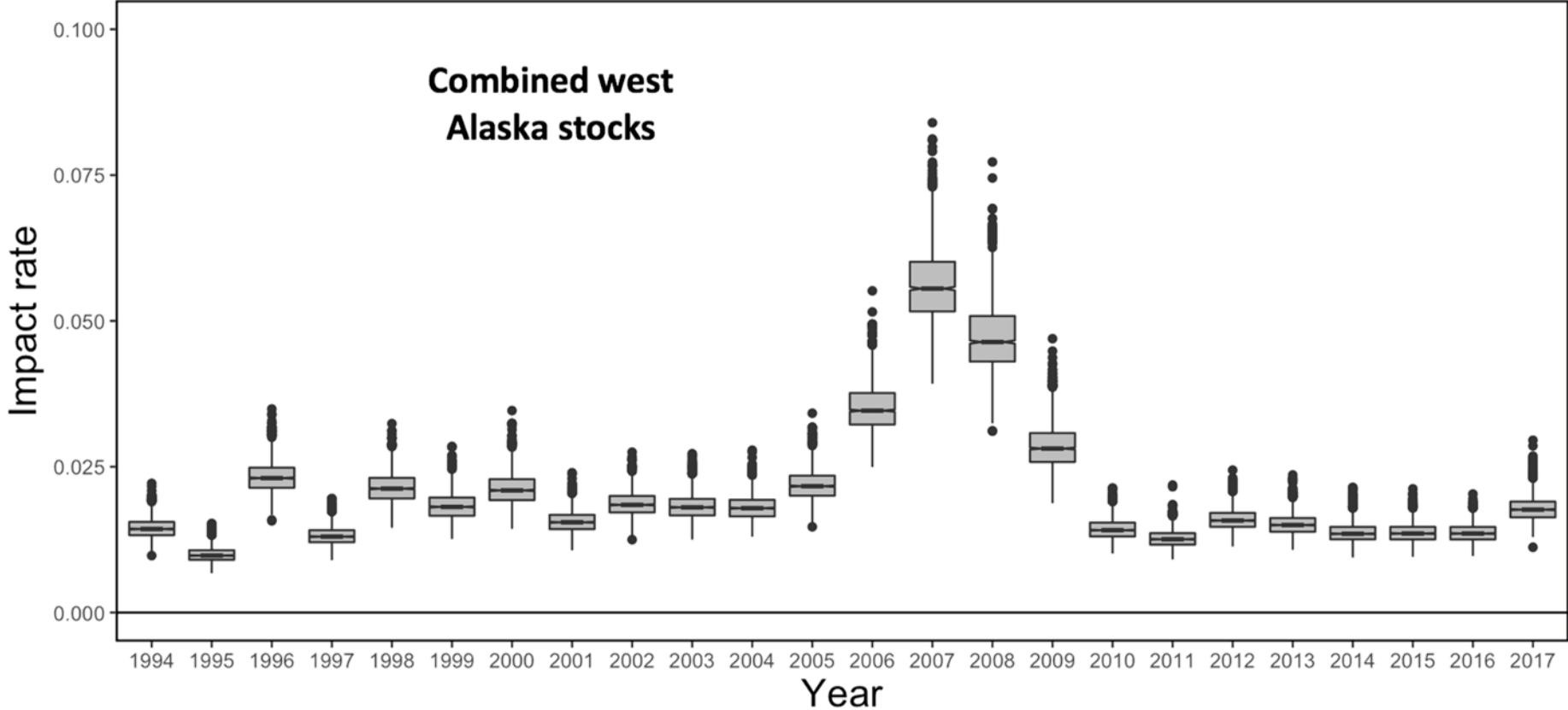
(courtesy of ADFG)



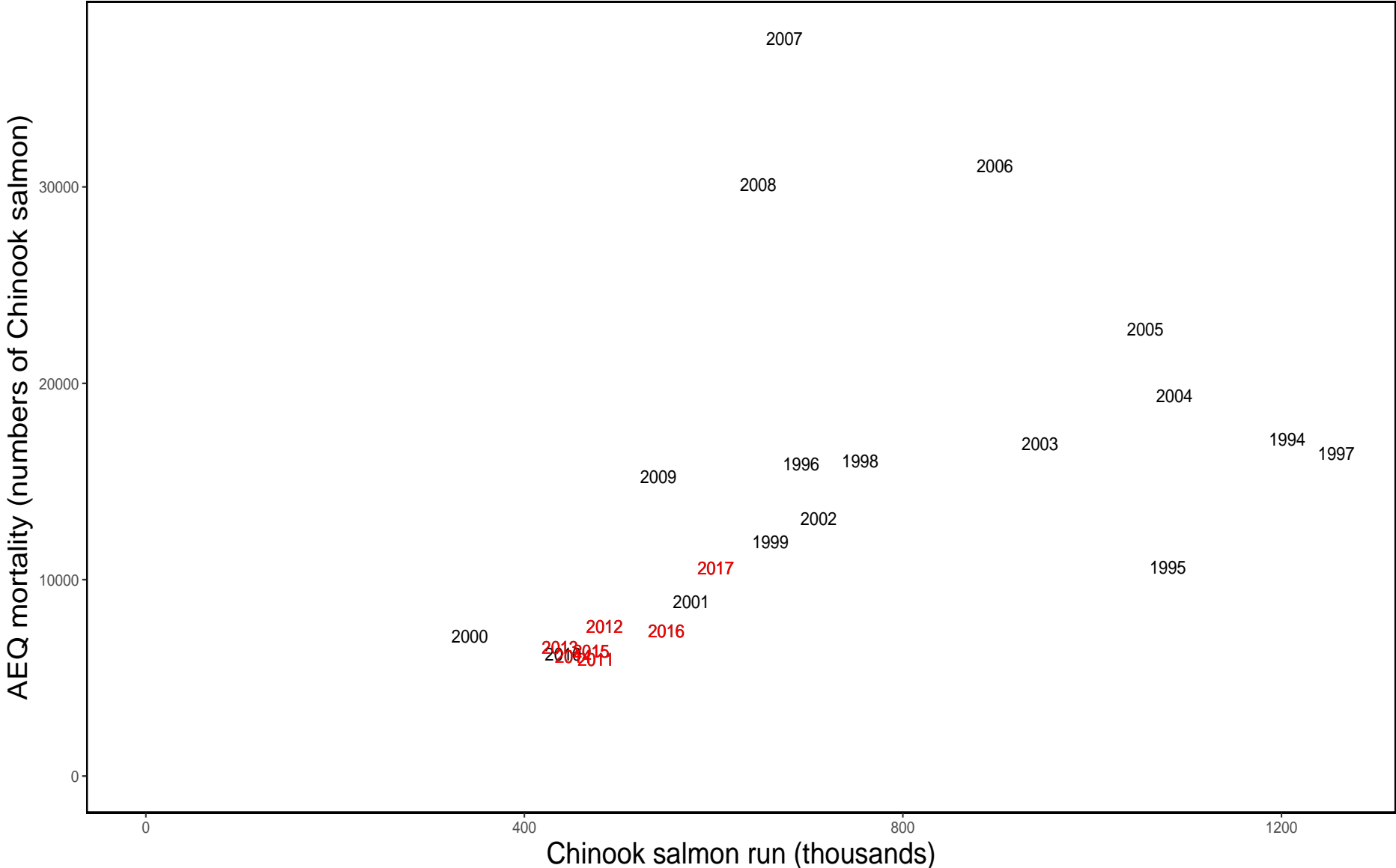
Chinook salmon AEQ / run strength



Chinook salmon AEQ / run strength



Combined west Alaska stocks



Summary

- Overall, similar results to past analyses
- Update from Amendment 110 (NMFS/NPFMC 2015)
 - Basic data stratifications
 - Original age data (new data may be available from the bycatch)
- New aspects of this study
 - Stock identification results (by season) 2011-2016
 - Total bycatch numbers
 - Length frequencies
 - Run-strength estimates updated
- Further work
 - Sampling levels, e.g., increasing the length composition
 - Contemporary length-at-age data for the age-length keys, Ohlberger et al. 2018 suggest some changes over time