

Updated Relationship of 3 System Inriver Total Run Index and Total Western Alaska AEQ

Drafted by:

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Amendment 110, implemented in July 2016, was developed by the Council to create a comprehensive Chinook and chum salmon bycatch avoidance program. In addition to other measures, this amendment identified additional management actions that would be taken when a three river index of Western Alaska inriver run abundance (Unalakleet River, Upper Yukon River, and Kuskokwim River) falls below a 250,000 Chinook salmon threshold, based on the State of Alaska's post-season inriver Chinook salmon run size assessment².

A positive linear relationship between the 3 System Total Run Index and total Western Alaska AEQ (combined AEQ of Coastal Western AK (CWAK), Upper Yukon and Middle Yukon) was identified as the basis for determining a threshold, excluding outlier years (2006-2009) where AEQ was higher than would have been expected based on run abundance. The Council chose a 250,000 Chinook salmon threshold based on a natural break in the data, distinguishing historically very poor run years in Western Alaska³ (2000 and 2010-2012, Figures 1 and 2). During these years there were widespread failures to meet escapement goals, restrictions to subsistence harvests, and federal fisheries disaster declarations. In addition, these years exhibited particularly poor runs across all Western Alaska systems; both northerly and southerly Western Alaska stocks concurrently experienced low run abundance. In this determination the Council recognized that indexed abundance could fall above the natural break in years where one or more, but not all systems were poor (e.g. 2009, 2008, 2007, etc.), and severe subsistence fishing restrictions and inability to meet escapement objectives may be experienced in some but not all systems². Because of the need of timely information for management purposes, the Council chose to use the post-season estimates of the 3 System Total Run Index (Figure 1) rather than the final estimates (Figure 2) to annually determine whether run abundance is above or below the threshold².

Since implementation of Amendment 110 more years of bycatch and run abundance information have occurred, and updated AEQ and revised run abundances have been developed. The relationship upon which the threshold was based can be affected by: (1) an update to AEQ estimation for Western AK Chinook salmon provided by Ianelli and Stram, May 2018; (2) revisions to the Kuskokwim River inriver run reconstruction model, which forms one component of the 3 System Index; and (3) the addition of run abundance and AEQ data from 2013-2017.

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² <https://npfmc.legistar.com/LegislationDetail.aspx?ID=2237783&GUID=89E4DA9C-19B8-4BDE-8643-B19D68DD9EE3>

³ Public Review Environmental Assessment/ Regulatory Impact Review/ Initial Regulatory Flexibility Analysis for Proposed Amendment to the Fishery Management Plan for Bering Sea Aleutian Islands Groundfish Bering Sea Chinook and Chum salmon bycatch management measures, March 2015.

The update of the AEQ estimation changes the overall magnitude of the AEQ estimated from Western Alaska (vertical axis) relative to the run size estimates for both post-season (Figure 4) and final (Figure 5) 3 System Index estimates. For most years the revised Western Alaska AEQ estimates are lower, but the general pattern of the relationship remains consistent with that seen when the threshold was first developed. However, the 2009 estimate that had been considered an outlier in the prior AEQ estimation (Figures 1 & 2), can no longer be considered an outlier with the updated AEQ estimation (Figures 3 & 4). It is important to note that AEQ revisions adjust this 3 System Index/AEQ relationship in the vertical axis, but not the horizontal axis. Since the threshold was based on a number on the horizontal axis of this relationship, this new data input does not affect the association of the data to the threshold. Subsequent figures and discussion utilize the updated AEQ estimates only.

Revisions to the Kuskokwim River run reconstruction model and rationale for why model revisions were undertaken are described in the companion document provided by the Kuskokwim River Interagency Model Development Team⁴. This memo only addresses how these revisions influence the relationship between the 3 System Index and Total WAK AEQ.

For those years used in establishment of the 3 System Index threshold (1994-2012), the change to the Kuskokwim Run Reconstruction model results in an average 4-5% decrease in the 3 System Index estimate for postseason and final estimates, respectively (Table 1). The revised 3 System Index estimate increased in four of the 19 years, and all other years decreased in abundance due to the revised Kuskokwim model results. The largest single year difference was a 16% increase in abundance for the revised estimate in 2006. The years identified as historically poor based on the 250,000 fish threshold remained unchanged (Table 1, Figures 5 & 6).

The largest decreases in Kuskokwim River run size estimates were between 2014-2017; years that were not used to establish the 3 System Index threshold. As noted by the Kuskokwim River Interagency Model Development Team, Kuskokwim River run reconstruction model changes were developed, in part, to address changing harvest patterns when significant harvest restrictions were implemented³. Between 2014 and 2017, annual Chinook salmon harvest in the Kuskokwim River was among the lowest on record in this river. The previous model overestimated the total Chinook salmon runs in those years. The overestimation of the Kuskokwim River Chinook salmon run contributed to 3 System Index total run estimates determined as greater than 250,000 fish for each year since 2015. However, using the revised Kuskokwim River run reconstruction model, the revised estimates (postseason and final) indicate that the 3 System Index was less than the 250,000 fish threshold in each year since 2010 (Table 1, Figures 7-9).

⁴ Executive Summary Revisions to the Kuskokwim River Chinook Salmon Run Reconstruction Model. Kuskokwim River Interagency Model Development Team. May 2018.

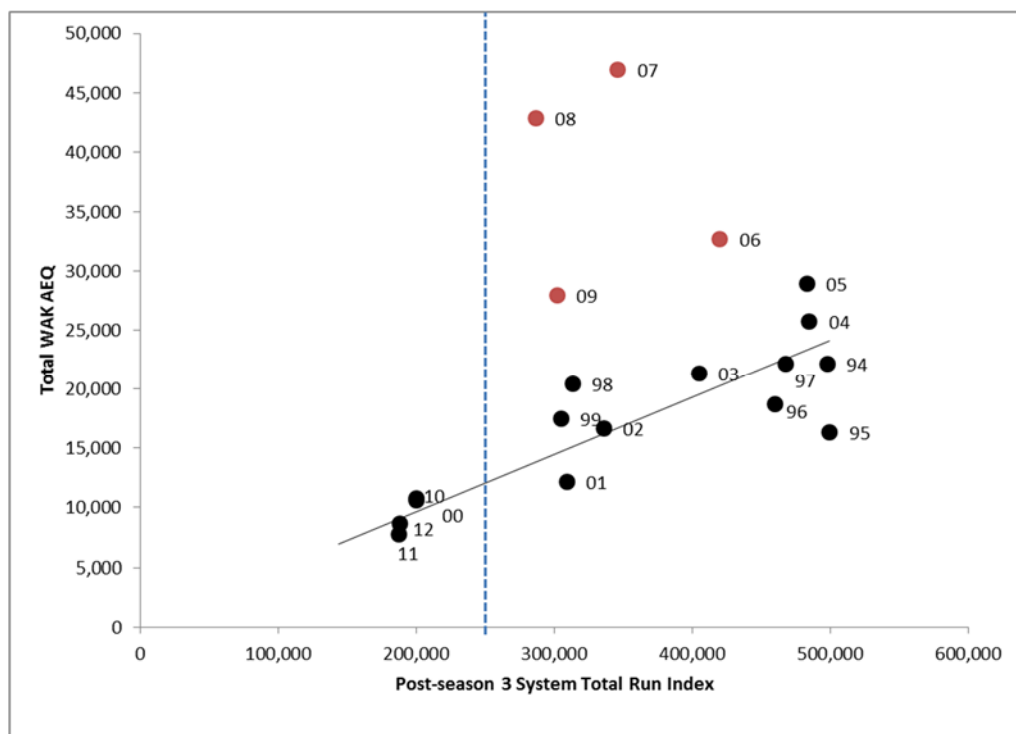


Figure 1. Relationship between post-season inriver run abundance of the 3 System Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon). The 250,000 Chinook salmon reference point is indicated by the vertical line.

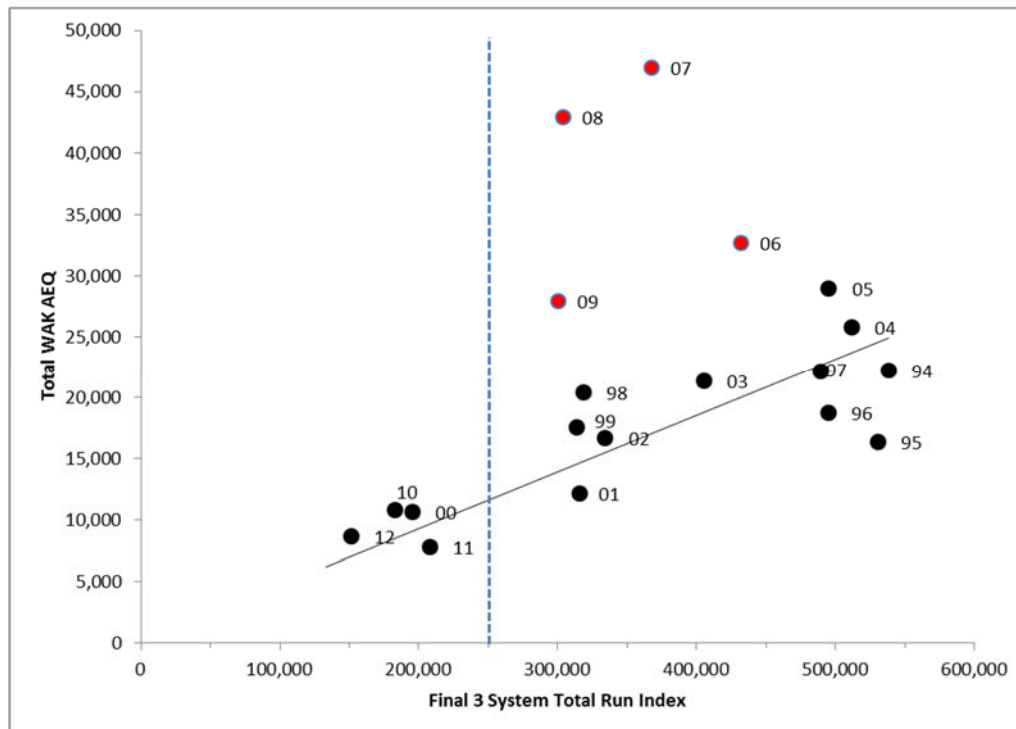


Figure 2. Relationship between final inriver run abundance of the 3 System Index and the bycatch AEQ attributed to all Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon). The 250,000 Chinook salmon reference point is indicated by the vertical line.

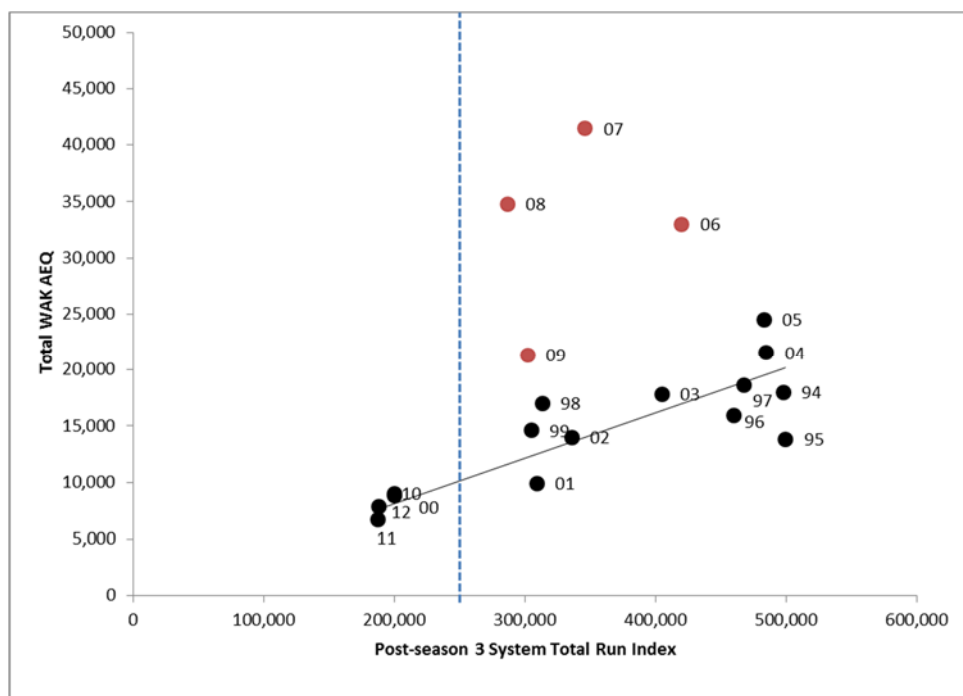


Figure 3. Relationship between post-season inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised AEQ estimates by Ianelli and Stram (May 2018). The 250,000 Chinook salmon reference point is indicated by the vertical line.

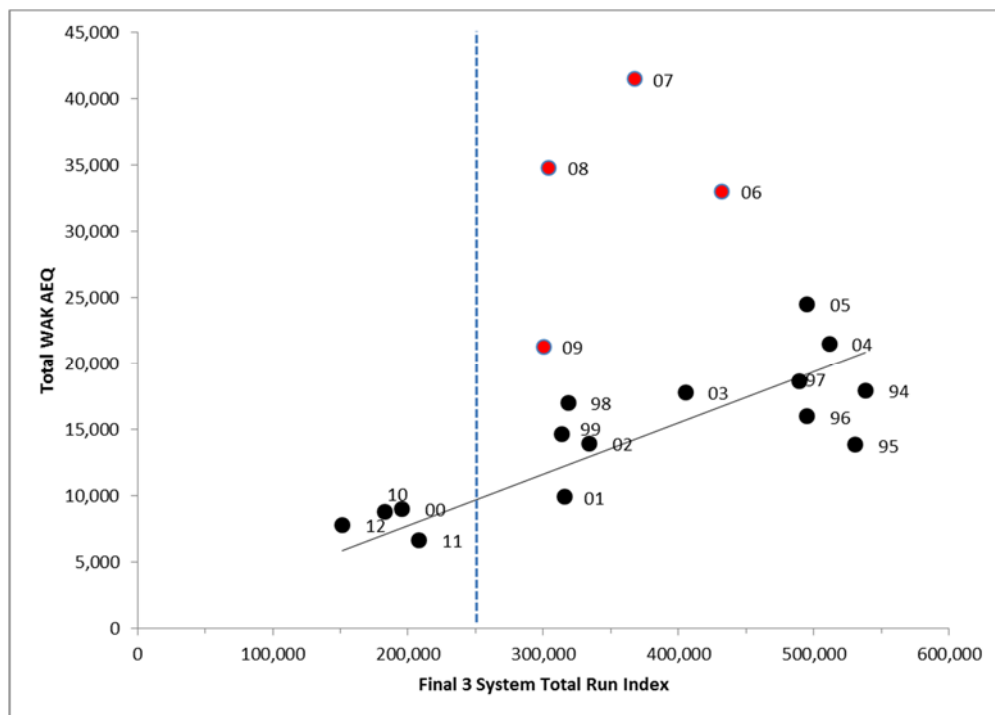


Figure 4. Relationship between final inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised AEQ estimates by Ianelli and Stram (May 2018). The 250,000 Chinook salmon reference point is indicated by the vertical line.

Table 1. Postseason and final 3 System Index estimates using previous and new Kuskokwim run reconstruction model estimates. Those years above the heavy black line are those that were used in the establishment of the 3 System Index threshold. Grey shading indicates those estimates falling below a 250,000 fish threshold. A positive percent difference from the prior estimate indicates an increased abundance using the revised model, while a negative number indicates a lower abundance.

YEAR	Prior to Kuskokwim River Model Revisions		With Kuskokwim River Model Revisions		% Difference	
	POSTSEASON 3 System Inriver Index	FINAL 3 System Inriver Index	POSTSEASON 3 System Inriver Index	FINAL 3 System Inriver Index	POSTSEASON 3 System Inriver Index	FINAL 3 System Inriver Index
1994	497,860	548,831	544,338	586,324	9%	7%
1995	499,894	556,290	510,460	543,402	2%	-2%
1996	460,288	513,278	464,757	503,578	1%	-2%
1997	468,042	522,599	460,673	482,782	-2%	-8%
1998	313,335	314,556	283,848	289,870	-9%	-8%
1999	304,938	325,110	273,796	283,703	-10%	-13%
2000	200,486	190,991	196,211	188,747	-2%	-1%
2001	309,263	344,898	290,708	298,830	-6%	-13%
2002	335,922	335,884	315,732	316,944	-6%	-6%
2003	404,958	407,011	388,451	378,407	-4%	-7%
2004	485,053	514,761	463,959	504,998	-4%	-2%
2005	483,112	495,366	443,415	440,183	-8%	-11%
2006	420,120	432,168	438,525	500,486	4%	16%
2007	346,400	367,689	318,094	346,236	-8%	-6%
2008	286,692	303,911	269,327	288,803	-6%	-5%
2009	302,330	299,916	286,953	287,325	-5%	-4%
2010	200,405	182,604	194,874	177,763	-3%	-3%
2011	186,891	208,189	165,213	189,247	-12%	-9%
2012	187,686	151,697	167,971	131,325	-11%	-13%
2013	143,396	133,976	133,077	124,172	-7%	-7%
2014	218,842	204,954	167,415	149,656	-23%	-27%
2015	279,000	265,640	222,462	218,011	-20%	-18%
2016	270,719	261,574	222,641	215,733	-18%	-18%
2017	273,116	264,432	239,520	230,880	-12%	-13%
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1994-2012 Average					-4%	-5%
2013-2017 Average					-16%	-16%

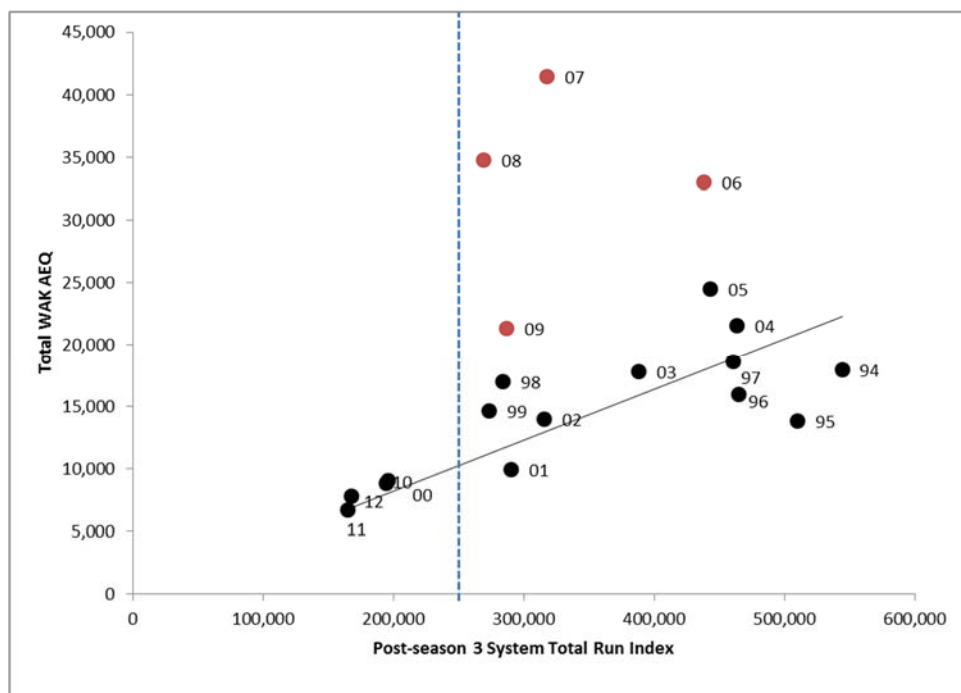


Figure 5. Relationship between post-season inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised Kuskokwim run reconstruction model input to the 3 System Index estimate. The 250,000 Chinook salmon reference point is indicated by the vertical line.

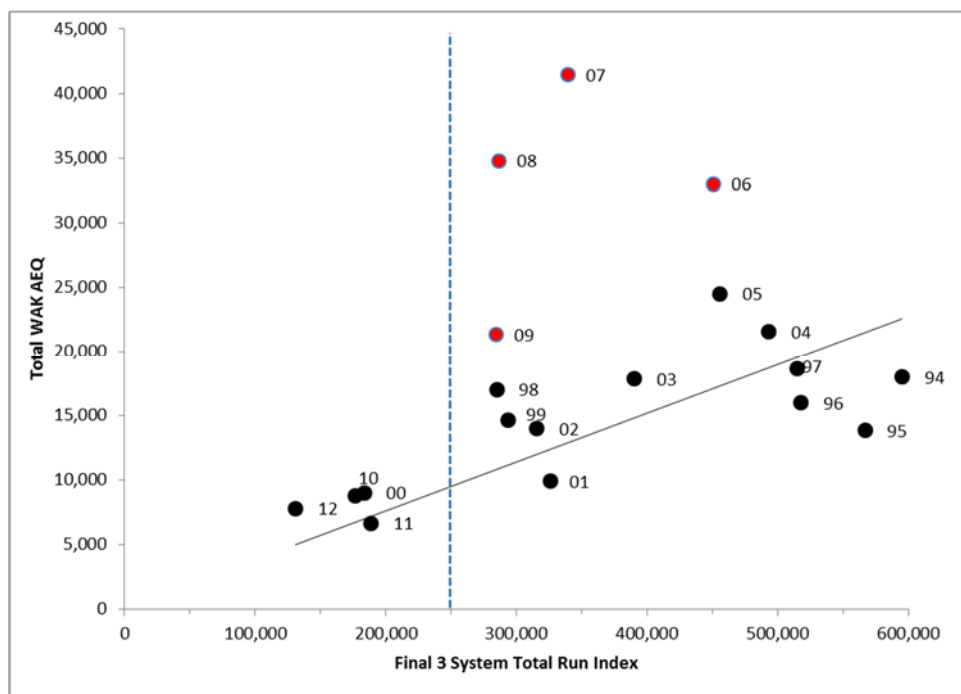


Figure 6. Relationship between final inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised Kuskokwim run reconstruction model input to the 3 System Index estimate. The 250,000 Chinook salmon reference point is indicated by the vertical line.

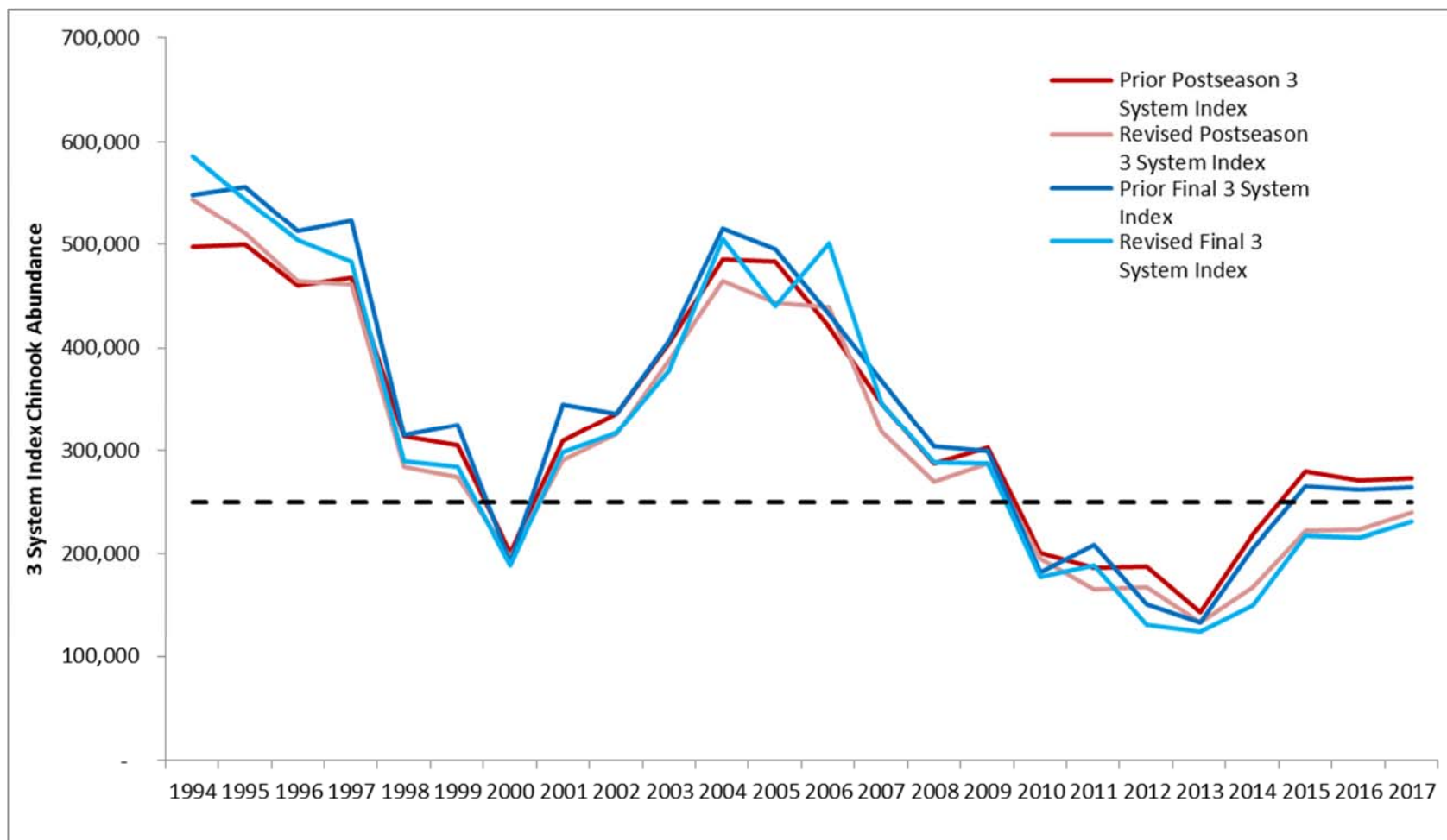


Figure 7. Postseason (red lines) and final (blue lines) 3 System Index estimates prior to the Kuskokwim run reconstruction model revisions and including the Kuskokwim run reconstruction model revisions.

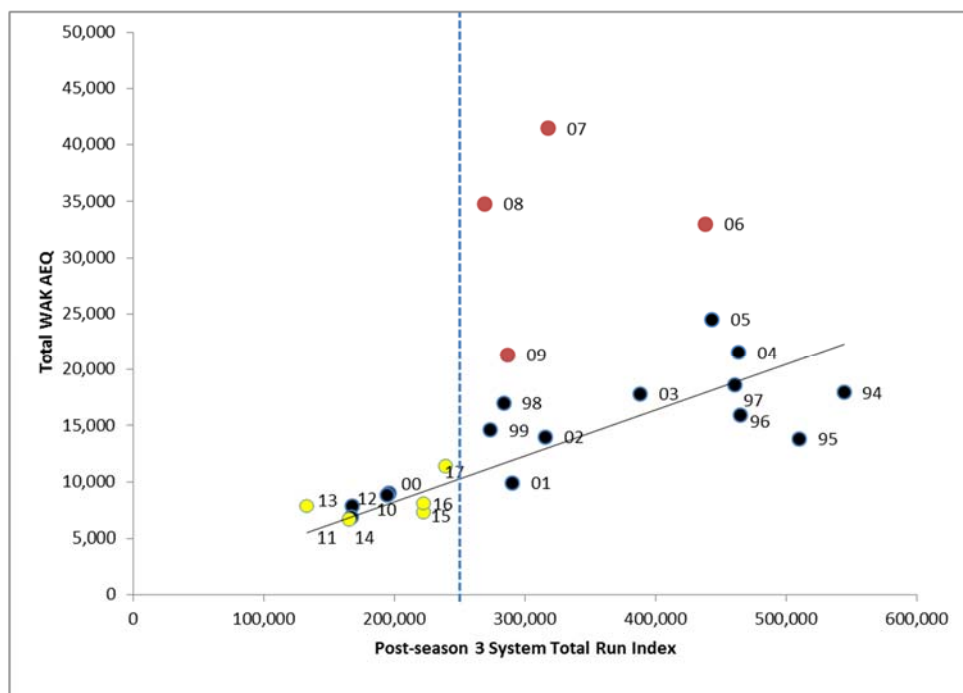


Figure 8. Relationship between post-season inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised Kuskokwim run reconstruction model input to the 3 System Index estimate and data through 2017 run year. The 250,000 Chinook salmon reference point is indicated by the vertical line.

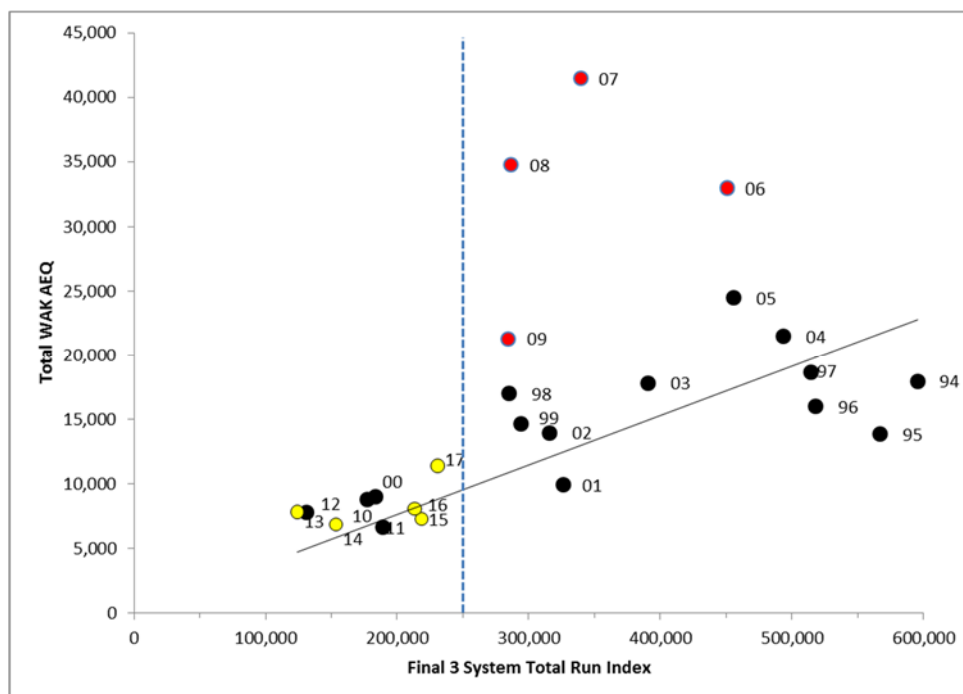


Figure 9. Relationship between final inriver run abundance of the 3 System Index and the bycatch AEQ attributed to Western Alaska stocks (combined AEQ of CWAK, Upper Yukon and Middle Yukon) using the revised Kuskokwim run reconstruction model input to the 3 System Index estimate and data through 2017 run year. The 250,000 Chinook salmon reference point is indicated by the vertical line.