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Board Members:

I am a retired Fishery Biologist with ADF&G, a career that began in 1981. From 1989 to spring of 2011 I held the position of Kuskokwim Area Research Biologist for Commercial Fisheries Division. I am currently not affiliated with any agency or NGO, and not seeking any affiliation. Still, I would like to comment on three Kuskokwim Area proposals that are before the BOF.

Re: Proposal 104 – 5AAC 01.286. Customary and traditional subsistence uses of fish stocks and amounts necessary for subsistence uses (ANS).

Support OPTION A with Modification

The ADF&G Subsistence Division report to the BOF describes options for ANS in the Kuskokwim Area (Ikuta 2012) and all options maintain the 2001 approach of listing one ANS per species for the entire Kuskokwim River. I encourage you to instead consider partitioning the Kuskokwim River ANS into three geographical segments: 1) communities downstream of Bethel, 2) Bethel alone, and 3) communities upstream of Bethel. Below are 3 rationales for this alternative approach:

1. Need to recognize the dominance of Bethel in the subsistence harvest (average 31% for Chinook). Even modest increases in annual Bethel harvest could mask shortfalls in other Kuskokwim River communities.

2. There is a growing tendency for commercial harvest to be focused in Subdistrict W1-B (i.e., downstream of Bethel; Figure 1), which results in a differential impact on subsistence fishermen fishing above and below Bethel and can mask disparities in "reasonable opportunity." Fishermen in W1-B tend to have ample opportunity to harvest most of the subsistence fish they need prior to the onset of commercial fishing season, but upstream subsistence harvest occurs later and can be more impacted by the removal of fish in the W1-B commercial fishery. Consequently,

subsistence fisherman fishing in W1-B may do well in achieving their subsistence harvest, while fishermen upstream of W1-B do poorly. The reason for this change is that Coastal Villages Seafood's, a CDQ group, is now the dominant commercial fish buyer, and they are most interested in using their limited processing capacity to serve their constituent communities, which are located within W1-B. It is unlikely that this situation will change in the foreseeable future because of limited interest by other commercial buyers.

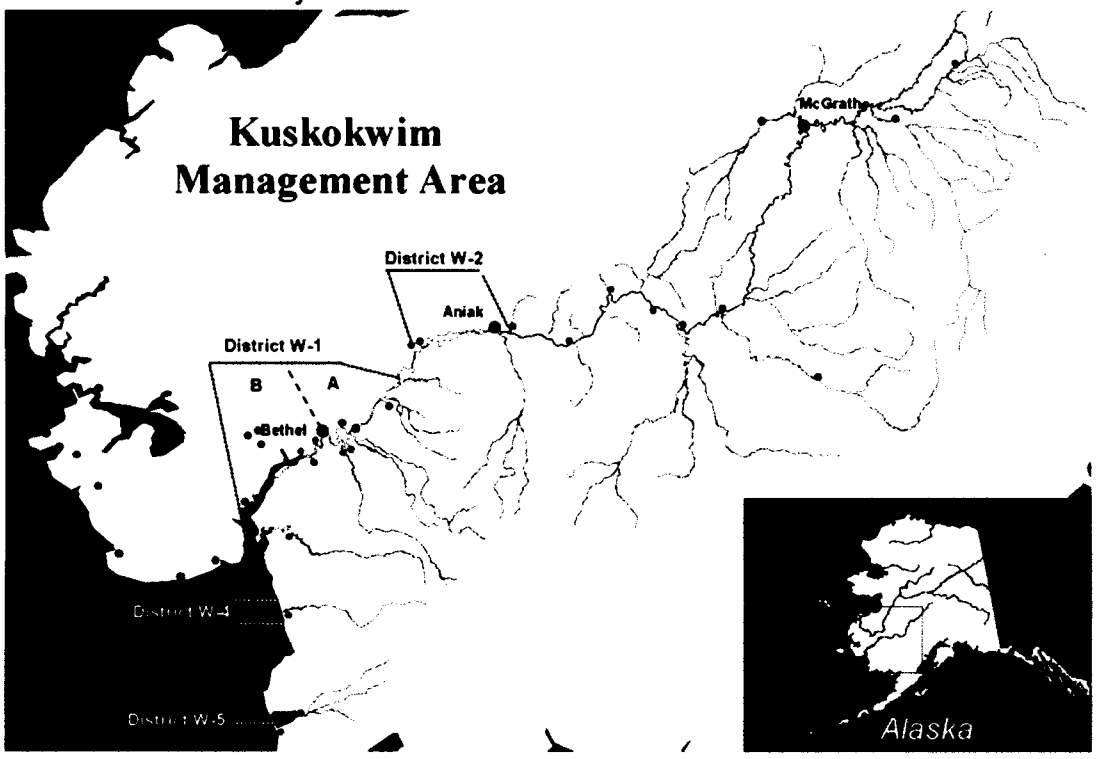

Figure 1. Kuskokwim Management Area with community locations (dots) and commercial fishing districts. Note that District W-1 has two subdistricts: B ("below Bethel") and A ('above Bethel").

3. The new ADF&G drainagewide escapement goal for Chinook salmon is a game changer for salmon management in the Kuskokwim River and has strong potential for differential impact to "reasonable opportunity" between lower and upper river communities. Historically, the average Chinook escapement in the Kuskokwim River has been 150,000 fish. This is a rough proxy of the level of Chinook salmon abundance that is available to subsistence gillnets upstream of Bethel. However, the new drainage wide goal of 65,000 to 120,000 fish (mid-point of 92,500 fish) is well below the historical average and creates a situation where there could be unprecedented commercial fishing effort to "harvest down" to the drainage wide escapement goal range. This could result in record high commercial harvest of Chinook salmon in the lower Kuskokwim River and a substantial reduction in the average Chinook salmon abundance levels available to upper river subsistence fishermen. Consider the following hypothetical scenario:

Average Chinook Run	247,000 fish
Average subsistence harvest	-84,000 fish
Commercial harvest down to the escapement goal mid-pt.	-70,500 fish
Final drainage wide escapement (SEG mid-pt)	92,500 fish

So instead of the historical average of 150,000+ Chinook swimming around upstream of Bethel, now there would only be 92,500+ fish. The reduced abundance would strongly erode "reasonable opportunity" to provide normally diligent fishermen with a reasonable expectation of success in harvesting the amount of Chinook salmon that they normally harvested in past years. That is, upriver subsistence fishermen will have to apply much more effort to catch the amount of fish they normally harvest. Consequently, ANS could be achieved if measured only on a drainagewide scale, but actually fall short for communities upstream of Bethel. The scenario described above assumes achieving the "mid-point" of the escapement goal range, so there could be even fewer fish available to upriver subsistence fishermen if actual commercial harvest results in escapements closer to the lower end of the new escapement goal range (65,000 fish). Consider too that the largest historical commercial Chinook harvest was 55,700 fish (1987), much less than the 70,500 fish commercially harvested under this hypothetical scenario.

For all three of these situations, partitioning the Kuskokwim River ANS into the three segments described above gives managers a much better metric for assessing whether "reasonable opportunity" is indeed being achieved for communities throughout the drainage. Table 1 lists suggested ANS ranges for the three segments. The criteria used are consistent with Option A described by ADF&G Subsistence Division in Ikuta 2012.

Table 1. Kuskowim River subsistence salmon harvest by geographic segment (**OPTION A2**).

Reporting Group	Species	Low	Average	High	Revised ANS	Current ANS
Communities Downstream of Bethel (Kongiganak, Eek-Tuntutullak to Oscarville)						
	King	24,033	26,948	33,319	24,000 - 27,000	
	Chum	13,247	27,469	48,064	13,200 - 27,500	
	Sockeye	7,646	12,163	17,474	7,600 - 12,200	
	Coho	3,442	5,768	9,024	3,400 - 5,800	
Bethel						
	King	18,041	25,854	34,925	18,000 - 25,900	
	Chum	8,078	16,224	34,257	8,100 - 16,200	
	Sockeye	8,464	10,346	12,094	8,500 - 10,300	
	Coho	11,565	18,965	32,988	11,600 - 19,000	
Communities Upstream of Bethel (Akiachak-Kwethluk to Nikolai)						
	King	25,991	36,214	41,565	26,000 - 36,200	
	Chum	15,780	37,249	71,504	15,800 - 37,200	
	Sockeye	14,456	19,937	28,599	14,500 - 20,000	
	Coho	8,797	12,876	18,367	8,800 - 12,900	
Total Kuskokwim River						
	King	68,065	89,016	109,809	68,000 - 89,100	64,500 - 83,000
	Chum	37,105	80,942	153,825	37,100 - 80,900	39,500 - 75,500
	Sockeye	30,566	42,446	58,167	30,600 - 42,500	27,500 - 39,500
	Coho	23,804	37,609	60,379	23,800 - 37,700	24,500 - 35,000

Re: Proposal 106 – 5AAC 07.365. Kuskokwim River Salmon Rebuilding Management Plan. Adopt a drainagewide optimum escapement goal (OEG) for king salmon in the Kuskokwim River, adjust tributary goals accordingly, and add preseason and inseason management tools ...

Support with Modification

I suggest replacing "OEG" with a minimum "Inriver Goal". The intent being to assure adequate Chinook salmon abundance upstream of Bethel to provide reasonable subsistence opportunity for communities located upstream of Bethel. Determining whether reasonable opportunity is achieved can be assessed annually by comparing post-season subsistence harvest estimates with ANS.

The Bethel test fishery is currently the primary tool for making inseason run strength projections. Given the limited accuracy of this inseason tool, I suggest the minimum Inriver Goal as being equal to the mid-point of the drainagewide escapement goal (92,500 Chinook), plus the average subsistence harvest taken by communities upstream of Bethel (36,214 Chinook), plus one half of the average subsistence harvest for Bethel (12,927 Chinook). This assumes that approximately half of the Bethel subsistence harvest is taken from waters upstream of Bethel, which is a best guess. The values listed above in parenthesis are based on revised harvest estimates from Hamazaki 2011 (Table 1) and include years 1990-1999 consistent with OPTION A by ADF&G Subsistence (Ikuta 2012). These values sum to 141,641 fish (rounded 142,000 fish).

Re: Proposal 110 – 5AAC 07.331. Gillnet specifications and operations. Remove the option for gillnet mesh to be up to 8 inches in District 1 [commercial fishery] of the Kuskokwim River.

Support Proposal.

The advent of the new drainage wide escapement goal for Kuskokwim River Chinook salmon is a game changer for fisheries management in the Kuskokwim River. Based on this escapement goal, and the associated run reconstruction and data analysis on which it is founded (Bue et al. 2012 and Hamazaki et al. 2012), there are much higher numbers of Chinook salmon available for harvest than previously thought. For example, in an average run of 247,000 Chinook, the new escapement goal requires 65,000 to 120,000 fish and the average subsistence harvest requires 84,000 fish. What remains is 43,000 to 98,000 Chinook salmon that are available for commercial harvest, which is twice the 19,414 to 48,663 range that occurred between 1976 to 1986 when there was a

directed commercial fishery for Chinook salmon. So, this new perception of reality, which is scientifically defensible, creates incentive for unprecedentedly high levels of Chinook salmon commercial harvest in the Kuskokwim River. But the choice of method as to how this harvest is taken makes all the difference between maintaining a sustainable fishery with escapements reflecting diverse age and sex composition, and creating an unsustainable situation with escapements dominated by small and predominantly male fish.

Proposal 110 requests repeal of current regulation allowing use of gillnets with up to 8-inch mesh in the commercial fishery. As a result, regulations would revert to limiting commercial nets to 6-inch or smaller mesh sizes. Table 2 compares two hypothetical management approaches to harvesting Kuskokwim River Chinook salmon to illustrate how the outcomes differ. **Scenario A** is a fishery with commercial gillnet mesh size restricted to 6-inch and smaller web, while **Scenario B** is a fishery in which the commercial mesh size is unrestricted and dominated by 8-inch web. Both scenarios assumes an average run of 247,000 Chinook, and both include an average subsistence catch of 84,000 fish harvested with unrestricted mesh as is the common practice and allowed by regulation. Both scenarios also allow a commercial harvest of 70,500 fish that result in an escapement of 92,500 Chinook salmon. In both cases the overall exploitation rate is 63%, but the exploitation rate by age class is dramatically different between the two scenarios. Also dramatically different is the age (and sex) composition on the spawning grounds relative to pre-exploitation age composition of the run entering the Kuskokwim River. Note that the age class composition information (percentages) applied to the harvest and total run are based on those presented in Bue et al. 2012.

In **Scenario A**, with commercial harvest restricted to 6-inch or smaller mesh, the exploitation rate between the major age classes (4 to 7 year olds) are similar, ranging from 56 to 68%. The aberration with the "Other" group (91%) is a result of the low occurrence of the age classes lumped in this group (less than 1% of total run).

In **Scenario B**, however, with the commercial harvest taken with unrestricted mesh, the exploitation rate is progressively skewed towards the older age classes: 22% for age 4, to 66% age 5, to 83% age 6, and to 86% for age 7). These older age classes, particularly age 6 and 7, tend to be mostly female fish (Table 2 footnotes a-d).

Another dramatic difference between the two scenarios is the age composition of the escapement compared to the age composition of the total run (i.e., the pre-exploited age composition of fish as they entered the Kuskokwim River). Under **Scenario A**, the age composition of the total escapement is similar to the total run, each differing by no more than 6%. But in **Scenario B**, there is a marked difference between the two with escapements having twice as many of the male dominate age-4 fish and half as many female dominated age-6 and -7 fish. As a result, the age composition of the escapement does not reflect the unexploited population, which is contrary to the aims of the **Policy for the Management of Sustainable Salmon Fisheries** whereby "*salmon escapement should be managed in a manner to maintain genetic and phenotypic characteristics of the stock by assuring appropriate geographic and temporal distribution of spawners as well as consideration of size ranges, sex ratios, and other population attributes*" (5 AAC 39.222 (2) (D)). As demonstrated by numerous

investigators, the effects of such size selective harvest practices is detrimental to maintaining genetic and phenotypic stock characteristics (e.g., Allendorf and Hard 2009, Bromaghin, et al. 2011, Bromaghin et al. 2008, Eldridge et al. 2010, Hard. et al. 2008, Hutchings and Rowe 2008, and Swaine et al. 2007).

The common rational offered for retaining the "up to 8-inch" provision is to allow commercial harvest on Chinook salmon when chum salmon abundance is too low to allow for commercial harvest. But there is no guarantee that use of the 8-inch option will be limited to that circumstance. It may also be argued that commercial harvest of Chinook salmon will not exceed the 50,000 guideline harvest level listed in regulation (5 AAC 07.365 (d) (1)), but again there is no guarantee. In both cases, managers may choose to play down or alter these guidelines, particularly if Chinook salmon are consistently exceeding escapement goals.

It could also be argued that ADF&G will monitor the age and sex composition of the escapement to insure adequate compositions. But this too is an ambiguous promise with no formal guideline as to what is "adequate". Also lacking is any formal policy that provides clear leverage needed to prompt management actions.

Allowing even the potential use of 8-inch mesh is going in the wrong direction as a sustainable management policy. Elsewhere managers have moved away from the use of large mesh gillnets to harvest Chinook salmon in recognition of its detrimental effects. The Yukon River is limiting all fishers, commercial and subsistence, to gillnet mesh sizes of 7.5 inches or smaller. Also the commercial fisheries of Kuskokwim Bay have a long history of commercial gillnets being limited to mesh sizes of 6-inches or smaller, yet support a directed Chinook commercial fishery (District W4) and produce Chinook salmon that are on average larger at age than are found in the neighboring Kuskokwim River. Then there is the mounting scientific evidence about the ills of size selective harvest as a long-term evolutionary force that results in fish populations with smaller and smaller fish with each generation.

Leaving the 8-inch option on the books in the Kuskokwim River commercial fishery is not a prudent option for sustainable salmon management.

Two additional graphics are provided below that may be of use for board deliberations.

- Figure 2 illustrates the relative abundance and run timing of salmon species in the Kuskokwim River.
- Figure 3 illustrate the Kuskokwim River Chinook salmon run reconstruction with the escapement and the commercial and subsistence harvest components shown for each year. Figure 3 also shows the new drainagewide escapement goal range for comparison to past escapement levels.

Table 2. Comparison of hypothetical management strategies to harvest Kuskowim River Chinook salmon, and the impacts each strategy has on age compostion.

Description	Age-1.2 [a] (4 year olds)		Age-1.3 [b] (5 year olds)		Age-1.4 [c] (6 year olds)		Age-1.5 [d] (7 year olds)		Other [e]		Total
	No. of Fish	%	No. of Fish	%	No. of Fish	%	No. of Fish	%	No. of Fish	%	
SCENARIO A: Commercial Restricted to ≤ 6-inch mesh, Subsistence Unrestricted Mesh											
Commercial [f] Harvest	25,470	36%	22,793	32%	20,631	29%	1,205	2%	401	1%	70,500
Subsistence [g] Harvest	6,925	8%	33,390	40%	40,251	48%	3,044	4%	389	0%	84,000
Total Harvest	32,396		56,183		60,883		4,249		790		154,500
Total Escapement	25,667	28%	36,300	39%	28,209	30%	2,248	2%	76	0%	92,500
Total Run	58,063	24%	92,482	37%	89,092	36%	6,498	3%	866	0%	247,000
Exploitation Rate by Age Class	56%		61%		68%		65%		91%		63%
SCENARIO B: Commercial and Subsistence Both with Unrestricted Mesh Size											
Commercial [h] Harvest	5,812	8%	28,024	40%	33,782	48%	2,555	4%	327	0%	70,500
Subsistence [g] Harvest	6,925	8%	33,390	40%	40,251	48%	3,044	4%	389	0%	84,000
Total Harvest	12,737		61,413		74,034		5,600		716		154,500
Total Escapement	45,325	49%	31,069	34%	15,058	16%	898	1%	150	0%	92,500
Total Run	58,063	24%	92,482	37%	89,092	36%	6,498	3%	866	0%	247,000
Exploitation Rate by Age Class	22%		66%		83%		86%		83%		63%

Note: Scenarios are hypothetical based on the average age compositions of the commercial harvest with mesh size restricted to ≤ 6-inches (11 years: 1995-1999 and 2004-2010), subsistence harvest with mesh size unrestricted (11 years: 2001-2011), and total run (11 years: 2001-2011) as listed in Appendix A6 of Bue et al. 2012. Total commercial, total subsistence, and total escapement are variables that can be altered to explore and compare alternate "what if" management scenarios. Under the two scenarios depicted, total subsistence harvest was fixed at 84,000 fish (historical average; 1990-2011), and the total run was set at 247,000 (historical average; 1976-2011). Total commercial harvest was set at 70,500 fish to result in an escapement of 92,500 (mid-point of ADF&G drainage wide escapement goal range of 65,000-120,000). The subsistence fishery most commonly uses large mesh (≥8 inches) gillnets which are selective for larger older fish. Since 1987, the commercial fishery has been restricted to using small mesh (≤6 inch) gear. However, at the 2007, Board of Fisheries meeting, a proposal was passed that, at the management biologists discretion, allows commercial fishermen to use up to 8 inch mesh gear.

a < 1% of age-1.2 Chinook are female, based on "sex confirmed' fish sampled from the District 1 commercial fishery (1997-2010).

b 15% of age-1.3 Chinook are female, based on "sex confirmed' fish sampled from the District 1 commercial fishery (1997-2010).

c 60% of age-1.4 Chinook are female, based on "sex confirmed' fish sampled from the District 1 commercial fishery (1997-2010).

d 71% of age-1.5 Chinook are female, based on "sex confirmed' fish sampled from the District 1 commercial fishery (1997-2010).

e Other includes uncommon age classes including: age-0.2, -1.1, -2.1, -2.2, -2.3, -2.4, -1.6, and -2.5. For computational purposes, the percent contribution of "Other" ages was calculated as 100% minus the sum of the percent contribution of the other more dominant ages.

f Age composition of the commercial harvest was calculated from years 1995-1999 and 2004-2010 (no age samples available from 2000-2003).

g Age composition of the subsistence harvest was calculated from years 2001–2011.

h Age composition of the commercial harvest using ≥8 mesh was modeled using subsistence age composition data.

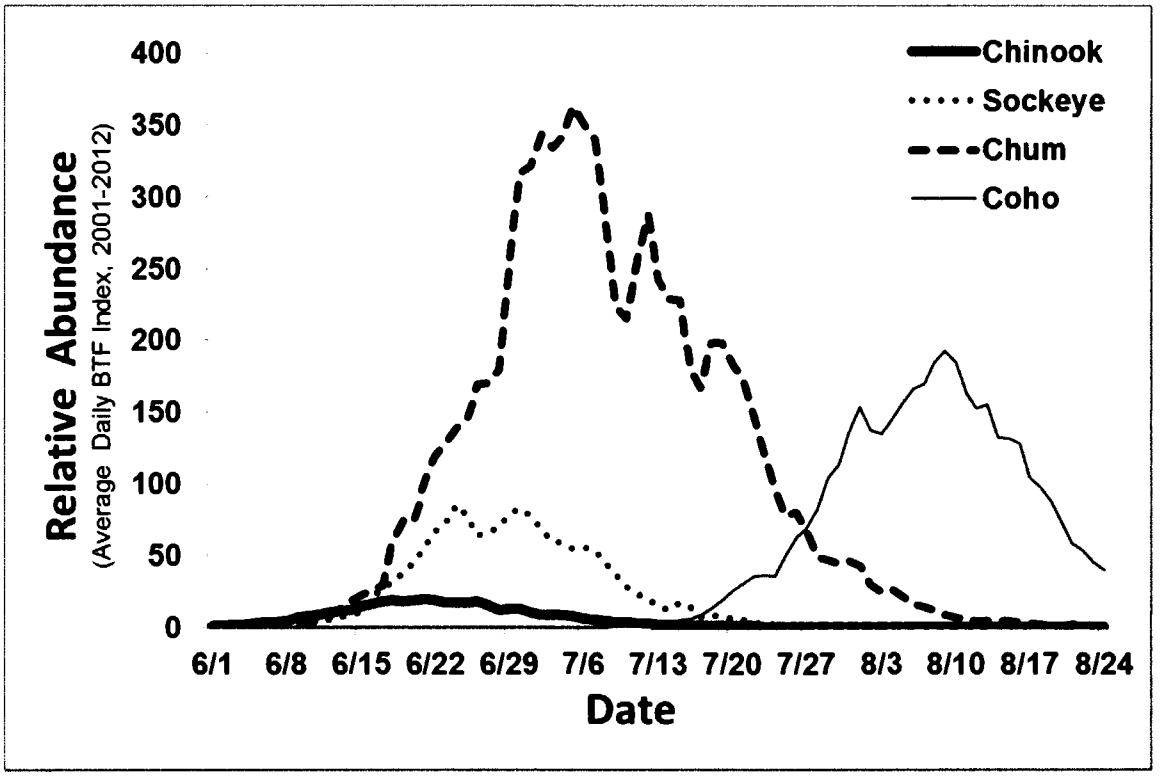

Figure 2. Average timing and relative abundance of Kuskokwim River salmon runs at Bethel.

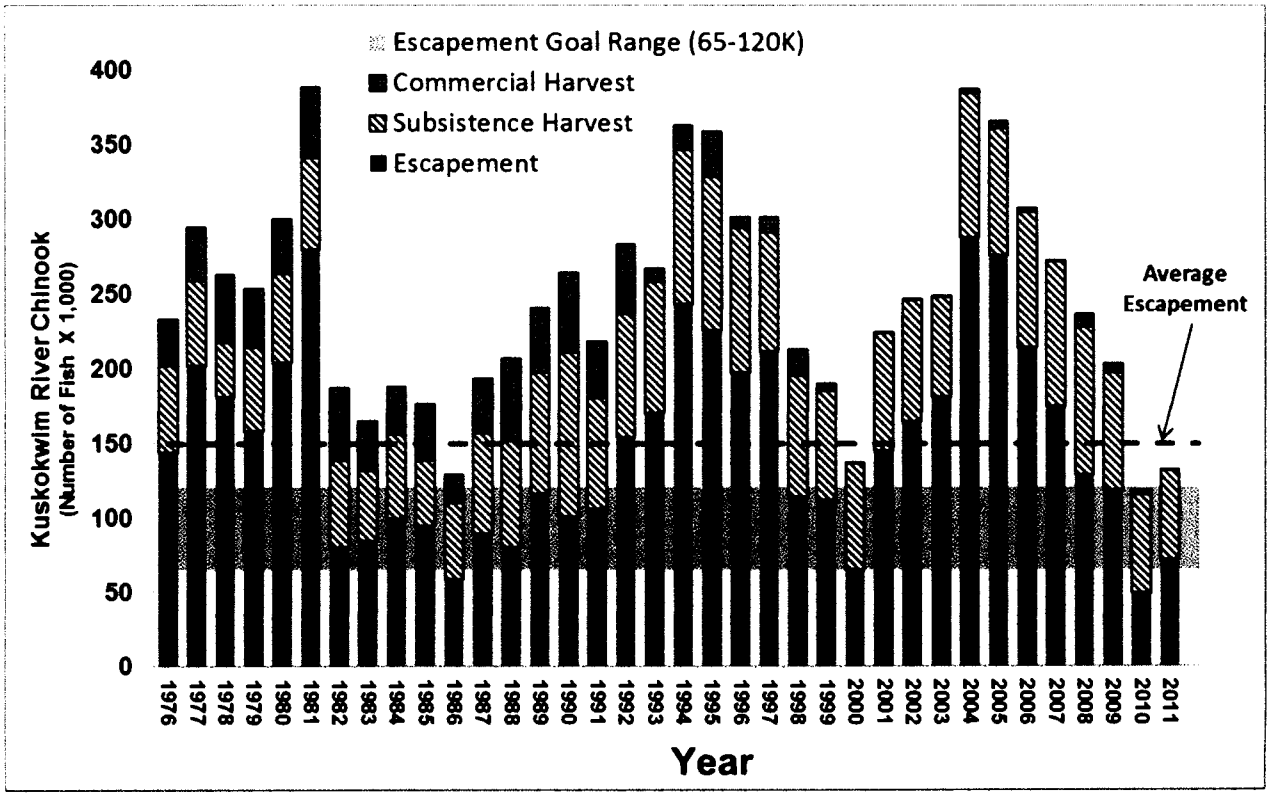

Figure 3. Kuskokwim River Chinook salmon run reconstruction with the annual escapement and commercial and subsistence harvest components.

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