

Submitted by the Alaska Department of Fish and Game at the request of the Alaska Board of Fisheries.

October 16, 2017

On October 10, 2017, the department received an information request from the Alaska Board of Fisheries (board). This request asked the Alaska Department of Fish and Game (department) provide the following to inform board discussion on Agenda Change Request 11:

1. Commercial and Other sockeye salmon harvest by year and also a 3 year mean (2014–2016) by reporting group stock (Kenai, Kasilof, Susitna, Other) for Upper Cook Inlet and the CI harvest in the KMA.
2. UCI total runs of the 4 reporting groups (Kenai, Kasilof, Susitna, Other) by year, also 3 year mean 2014 – 2016 with and without KMA harvest added in.
3. Per year and 3 year mean percentage of harvest rates from UCI and KMA as it relates to the individual runs of the 4 reporting groups. Break down the harvest rate % as it relates to Northern District and Central Districts (Drift, ESSN, West Side) commercial harvest as well as Other Harvest for the 4 reporting groups. Include KMA harvest numbers to get the total run sizes as an estimate of true run size. Compare harvest percentage of the 4 reporting groups in relation to their runs and user groups including KMA as a whole. Example- What percentage of the Susitna sockeye run is harvested by N. District, Central Drift, ESSN, Westside, Other, KMA.
4. Estimate the potential (per year and 3 year mean) of what the non-sampled harvest of CI stock could be. Please apply a comparison of this to the above requests. For example, if 55% of the KMA fishery harvest was sampled, is it acceptable to assume the 45% that was not sampled had the same stock composition (local versus CI) as the sampled harvest? What would be a safe scientific assumption?
5. Summary of restrictive actions (codified and non-codified) taken by ADFG and the BOF for Susitna SOC and how KMA harvest information could relate to the Susitna SOC action plan?

In response, the department is providing the following information:

- Items 1 – 3: We provide a methods section and two tables (Tables 1 and 2) to address these items. The methods and data sources used to estimate total run and harvest rates to populate Tables 1 and 2 are described below. Discussion on calculating estimated total run and harvest rates is provided, as well as caveats on application of these methods
- Item 4: The department has no genetic information regarding the stock compositions of unsampled strata within Kodiak Management Area (KMA). The department is not able to provide scientifically defensible estimates of Cook Inlet stocks within unsampled strata. However, it is not appropriate to assume that unsampled strata have the same stock compositions as sampled strata. For example, harvests that occurred after the sampling periods in terminal areas in KMA were much more likely to harvest KMA stocks.
- Item 5: We provide Table 3 to address restrictive actions (codified and non-codified) taken by the department and board with regard to Susitna River sockeye salmon. Stock-specific estimates of UCI-origin sockeye salmon harvested in KMA were not available in 2008 when Susitna River sockeye salmon were designated a stock of concern by the board and potential KMA harvest of Susitna River sockeye salmon was not a consideration in the SOC designation. The department

does not believe new KMA stock of origin harvest data inform potential changes to the Susitna River Sockeye Salmon Action Plan because of the short-term nature of the study, the limited scope of sampling, the observed variability of the annual results, and the imprecision inherent in attempting stock-specific management of fisheries in distant waters.

## Methods for estimating total run and harvest rates for Kenai, Kasilof and Susitna sockeye salmon reporting groups

The total runs of Kenai, Kasilof, and Susitna sockeye salmon in 2014–2016 were estimated from the sum of spawner abundances, and personal use, sport, and commercial harvests from Upper Cook Inlet (UCI) and the selected strata from the Kodiak Management Area represented in Shedd et al. (2017). Stock-specific harvest rates in all UCI fisheries (personal use, sport, and commercial) were estimated from the ratio of stock-specific total harvest in all UCI fisheries and stock-specific total run.

Spawner abundances for Kenai and Kasilof river sockeye salmon were estimated by subtracting harvests in sport fisheries upstream of sonar sites on each river from sonar estimates of upstream passage of sockeye salmon (Glick and Willette 2016). For the Susitna River, spawner abundances were estimated by subtracting harvests in upstream sport fisheries from estimates of inriver run. The inriver run of Susitna River sockeye salmon was estimated by summing inriver run estimates for the Yentna and mainstem Susitna rivers, which are major tributaries of the Susitna River. On the Yentna River, inriver runs in 2014–2015 were estimated using a genetic mark-recapture method (Willette et al. 2016), and in 2016 the inriver run was estimated by expanding the Chelatna Lake sockeye salmon weir count using an average expansion factor (3.919) estimated from genetic mark-recapture studies conducted in 2008–2015 (Willette et al. 2016). On the mainstem Susitna River, the inriver run was estimated by expanding the Larson Lake sockeye salmon weir count using an average expansion factor (1.905) estimated from mark-recapture studies conducted in 2006–2008 (Yanusz et al. 2007, Yanusz et al. 2011a, Yanusz et al. 2011b).

Harvests of sockeye salmon in personal use and educational fisheries were estimated from harvest reports returned to the department by personal use and educational fishery permit holders (Shields and Dupuis 2015, 2016, 2017). Harvest of sockeye salmon in sport fisheries was estimated using the Statewide Harvest Survey (Jennings et al. 2015) and creel surveys (King 1995, 1997) conducted during these fisheries (Begich et al. 2017; Oslund et al. 2017; Pawluk, personal communication). Sockeye salmon sport harvests in the Kasilof and Susitna rivers in 2016 were estimated using average harvest rates in these fisheries in 2014 and 2015.

Harvests of the UCI commercial fisheries were estimated from department fish ticket information, and stock-specific harvests were estimated using genetic mixed-stock analysis methods (Barclay et al. 2010). Stock-specific harvest of the UCI commercial catch in 2014, 2015, and 2016 were estimated by multiplying the harvest estimates from the Annual Management Reports (Shields and Dupuis 2015, 2016, 2017) with the genetic stock composition estimates for represented strata (Barclay pers. com.). Unrepresented strata accounted for 10%, 5%, and 1% for 2014, 2015, and 2016, respectively. Stock compositions for unrepresented strata were estimated using historic genetic stock composition information for similar area/time strata. Ninety-four percent of the unrepresented harvests in 2014 and 2015 were in the Kasilof River Special Harvest Area (KRSHA). Stock compositions in these fisheries

were estimated from historical stock compositions in the KRSHA that were very consistent among years (Barclay et al. 2010).

Harvests of the selected strata of the KMA commercial fisheries were taken from Shedd et. al (2017).

## Discussion on calculating total run and harvest rates and application of these results

Under the 5 AAC 39.222. Policy for the Management of Sustainable Salmon Fisheries, "*run*" is defined as: "*the total number of salmon in a stock surviving to adulthood and returning to the vicinity of the natal stream in any calendar year, composed of both the harvest of adult salmon plus the escapement.*"

Harvest rates are calculated by dividing the stock-specific harvests by total run and are therefore sensitive to the areas and time covered by the total run size estimate. Traditionally, total run estimates for Cook Inlet have included only sockeye salmon that are caught within Cook Inlet Area fisheries and escape into Cook Inlet tributaries. Total runs can be calculated by expanding the "vicinity" where fish are captured, but this has not been traditionally done in Cook Inlet because reliable estimates of total harvest of UCI-origin fish for areas outside UCI have not been available.

Harvest data for UCI-origin sockeye salmon are now available for selected time and area strata in KMA for three years, allowing for an estimation of run size for select UCI sockeye salmon stocks using these newly available data. This estimate is referred to here as "estimated total run" and differs from the way total run has previously been calculated for UCI salmon stocks. Estimated harvest rate of UCI-origin sockeye salmon in the 2014 – 2016 KMA sampled areas is provided in Table 2. These estimates are not comparable to traditional Cook Inlet harvest rate estimates that have been previously provided to the board because the estimates change with the inclusion of UCI-origin sockeye salmon harvested in KMA. Estimated harvest and harvest rates of UCI-origin sockeye salmon in KMA provided here are similar in magnitude to those previously reported in Vining and Barrett (1995).

Like most other scientific studies, these results are reflective of environmental and fishery conditions during a specific period of time. Nonetheless, these studies are conducted so that future scientific and policy activities may be better informed. We expect that these results will be referenced in the future as one data set available to examine stock composition of sockeye salmon harvested in Kodiak Management Area commercial fisheries. However, while this three- year data set provides some measure of interannual variability in stock composition, some caution must be exercised when extrapolating the results to years and areas not analyzed because changes in relative abundance among reporting groups, prosecution of fisheries, or migratory behavior due to ocean conditions might affect distribution of stock-specific harvests among fisheries.

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Table 1. Commercial, personal use (PU), educational (Edu), and sport fishery harvests of Kenai, Kasilof, Susitna and all other Upper Cook Inlet sockeye salmon stocks in all Upper Cook Inlet salmon fisheries and the select Kodiak Management Area commercial salmon fisheries strata represented in Shedd et al. (2017), 2014–2016. Estimated spawner abundance and total run are also indicated for Kenai, Kasilof and Susitna sockeye salmon, 2014-2016.

Year	Stock	UCI Commercial Harvest				Sampled	Estimated	PU/Edu Harvest	Sport Harvest	Estimated	Spawners	Estimated
		Drift	ESSN	Northern	Other	KMA CF Harvest	total CF Harvest			Total Harvest		Total Run
2014	Kenai	1,050,326	356,198	4,775	7,933	60,973	1,480,205	385,938	380,055	2,246,198	1,218,342	3,464,540
	Kasilof	170,039	356,396	66	5,030	36,019	567,550	111,080	19,819	698,449	440,192	1,138,641
	Susitna	105,616	2,189	11,544	4,107	4,466	127,922	0	6,084	134,006	161,353	295,359
	Other	174,693	9,614	21,303	63,205	11,908	280,723	ND	ND	ND	ND	ND
2015	Kenai	709,362	909,654	5,091	17,019	365,335	2,006,461	385,641	392,126	2,784,228	1,400,047	4,184,275
	Kasilof	86,499	479,984	14	5,373	103,539	675,409	116,567	15,553	807,529	470,677	1,278,206
	Susitna	116,547	60,047	21,811	1,963	75,989	276,357	0	5,411	281,768	368,504	650,272
	Other	99,648	31,652	28,959	76,044	80,698	317,001	ND	ND	ND	ND	ND
2016	Kenai	1,126,467	822,236	9,515	22,627	272,160	2,253,005	265,766	346,090	2,864,861	1,118,155	3,983,016
	Kasilof	2,914	141,324	49	2,327	22,501	169,115	84,812	9,359	263,286	239,981	503,267
	Susitna	98,695	5,737	16,445	5,278	39,440	165,595	0	7,928	173,523	304,140	477,663
	Other	38,517	28,471	21,141	55,065	49,536	192,730	ND	ND	ND	ND	ND
Mean (2014–2016)	Kenai	962,052	696,029	6,460	15,860	232,823	1,913,224	345,782	372,757	2,631,762	1,245,515	3,877,277
	Kasilof	86,484	325,901	43	4,243	54,020	470,691	104,153	14,910	589,755	383,617	973,371
	Susitna	106,953	22,658	16,600	3,783	39,965	189,958	0	6,474	196,432	277,999	474,431
	Other	104,286	23,246	23,801	64,771	47,381	263,485	ND	ND	ND	ND	ND

Note: ND indicates where no data are available to estimate harvest.

Table 2. Harvest rates on Kenai, Kasilof and Susitna sockeye salmon in commercial, personal use (PU), educational (Edu), and sport fisheries in all Upper Cook Inlet salmon fisheries and the select Kodiak Management Area commercial salmon fisheries strata represented in Shedd et al. (2017), 2014–2016.

Year	Stock	UCI Commercial Harvest				Sampled KMA CF Harvest	Estimated Total CF Harvest	PU/Edu Harvest	Sport Harvest	Estimated Total Harvest
		Drift	ESSN	Northern	Other					
2014	Kenai	30.3%	10.3%	0.1%	0.2%	1.8%	42.7%	11.1%	11.0%	64.8%
	Kasilof	14.9%	31.3%	0.0%	0.4%	3.2%	49.8%	9.8%	1.7%	61.3%
	Susitna	35.8%	0.7%	3.9%	1.4%	1.5%	43.3%	0.0%	2.1%	45.4%
	Other	ND	ND	ND	ND	ND	ND	ND	ND	ND
2015	Kenai	17.0%	21.7%	0.1%	0.4%	8.7%	48.0%	9.2%	9.4%	66.5%
	Kasilof	6.8%	37.6%	0.0%	0.4%	8.1%	52.8%	9.1%	1.2%	63.2%
	Susitna	17.9%	9.2%	3.4%	0.3%	11.7%	42.5%	0.0%	0.8%	43.3%
	Other	ND	ND	ND	ND	ND	ND	ND	ND	ND
2016	Kenai	28.3%	20.6%	0.2%	0.6%	6.8%	56.6%	6.7%	8.7%	71.9%
	Kasilof	0.6%	28.1%	0.0%	0.5%	4.5%	33.6%	16.9%	1.9%	52.3%
	Susitna	20.7%	1.2%	3.4%	1.1%	8.3%	34.7%	0.0%	1.7%	36.3%
	Other	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean (2014–2016)	Kenai	25.2%	17.6%	0.2%	0.4%	5.8%	49.1%	9.0%	9.7%	67.8%
	Kasilof	7.4%	32.3%	0.0%	0.4%	5.2%	45.4%	11.9%	1.6%	58.9%
	Susitna	24.8%	3.7%	3.6%	0.9%	7.2%	40.2%	0.0%	1.5%	41.7%
	Other	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note: ND indicates where no data are available to estimate harvest.

Table 3. Commercial fishing restrictions taken in the Central District drift (Drift) and Northern District set (ND Set) gillnet fisheries from 2014-2016 as required in the Susitna River Sockeye Salmon Action Plan and in 5 AAC 21.353 *Central District Drift Gillnet Management Plan* and 5 AAC 21.358 *Northern District Salmon Management Plan*.

Year	Date	Fishery	Action	EO Number
2014	10-Jul	Drift	Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	14-Jul		Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	17-Jul		Restricted to Area 1/Expanded Corridors	2S-20-14
	21-Jul		Restricted to Area 1/Expanded Corridors	2S-29-14
	24-Jul		Restricted to Expanded Corridors/AP Section	2S-33-14
	28-Jul		Restricted to Expanded Corridors/AP Section	2S-41-14
	31-Jul		Restricted to Expanded Corridors/AP Section	2S-41-14
2015	9-Jul	Drift	Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	13-Jul		Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	16-Jul		Restricted to Expanded Corridors/AP Section	2S-21-15
	20-Jul		Restricted to Area 1/Expanded Corridors/AP Section	2S-26-15
	23-Jul		Restricted to Expanded Corridors/AP Section	2S-29-15
	27-Jul		Restricted to Area 1/Expanded Corridors	2S-34-15
	30-Jul		Restricted to Expanded Corridors/AP Section	2S-38-15
2016	11-Jul	Drift	Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	14-Jul		Restricted to Area 1/Expanded Corridors	Action Plan/Regulation
	21-Jul		Restricted to Expanded Corridors/AP Section	2S-19-16
	28-Jul		Restricted to Expanded Corridors/AP Section	2S-24-16
Year	Date	Fishery	Action	EO Number
2014	21-Jul	ND Set	Reduced gear to 1 net/permit	2S-27-14
	24-Jul		Reduced gear to 1 net/permit	2S-27-14
	28-Jul		Reduced gear to 1 net/permit	2S-27-14
	31-Jul		Reduced gear to 1 or 2 nets/permit	2S-44-14
	4-Aug		Reduced gear to 1 or 2 nets/permit	2S-44-14
2015	20-Jul		Reduced gear to 1 net/permit	2S-24-15
	23-Jul		Reduced gear to 1 net/permit	2S-24-15
	27-Jul		Reduced gear to 1 net/permit	2S-24-15
	30-Jul		Reduced gear to 1 net/permit	2S-24-15
	3-Aug		Reduced gear to 1 or 2 nets/permit	2S-42-15
	6-Aug		Reduced gear to 1 or 2 nets/permit	2S-42-15
2016	21-Jul		Reduced gear to 1 or 2 nets/permit	2S-18-16
	25-Jul		Reduced gear to 1 or 2 nets/permit	2S-18-16
	28-Jul		Reduced gear to 1 or 2 nets/permit	2S-18-16
	1-Aug		Reduced gear to 1 or 2 nets/permit	2S-25-16
	4-Aug		Reduced gear to 1 or 2 nets/permit	2S-25-16

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Year	Date	Fishery	Action	EO Number
2014	9-Aug	Sport	Larson Creek closed to retention of sockeye salmon	2-RS-2-47-14
2015	5-Aug		Larson Creek closed to sport fishing for sockeye salmon	2-RS-2-52-15
2016	11-Aug		Larson Creek closed to sport fishing for sockeye salmon	2-RS-2-38-16

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