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SOCKEYE SALMON AVERAGE WEIGHTS FROM KODIAK  
COMMERCIAL FISH TICKET RECEIPTS- ARE THEY ACCURATE?

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## INTRODUCTION

Commercial salmon catch is sold by fishers to processors either directly through dock deliveries or tenders operating on the grounds. Each transaction is recorded on a receipt or fish ticket issued by the buyer which denotes the name or number of the vessel from which the catch involved is taken, the name of the fishing permit holder, vessel license number, the date of the landing, the location (statistical area) where the catch was made, and the weight (pounds), and number of each species delivered. This is required under the provisions of Alaska Statutes 16.05.690 (ADF&G 1993).

While strict catch reporting standards are regulated, there is not an economic incentive for fishers or processors to accurately report salmon catch numbers. This is because fishers market their catch by species weight and not by species numbers.

This report evaluates the accuracy of average sockeye *Oncorhynchus nerka* salmon weights derived from fish tickets in the Kodiak Management Area (KMA) during July 1993.

## METHODS

Approximately six tender loads of commercially harvested salmon were sampled weekly for average sockeye weight starting on 2 July and ending on 2 August. The sampling was conducted at fish processing facilities located in Alitak and the Port of Kodiak (Figure 1). Tender selection was made based on staff availability at the time of sampling; when staff were free from other activities they telephoned the local fish processors for tender arrivals and sampled the first available tender. Consequently, preselection or known bias for or against tenders delivering from multiple catch areas and or mixed gear type areas was avoided.

From each tender, approximately 600 sockeye salmon were sampled. Two methods were used: (1) When a tender off-loaded, the catch was typically sorted by species by processing personnel and placed in plastic totes that held about 200-300 fish. For subsampling, the closest totes that were accessible by fork lift to the processor's electronic weight scale were chosen. The sockeye salmon from each sampled tote were hand tallied and placed in a preweighed empty tote. After completing the count, the preweighed tote was reweighed to determine the sample weight. This process was continued until a total sample of about 600 fish each was obtained. (2) At locations where the sockeye catch delivery was stored in a chilled bin, the processor staff transferred two batches of approximately 300 fish each from the bin into totes. The subsamples were then hand tallied, transferred into preweighed totes, and weighed.

In both methods, fish other than sockeye salmon in the sample totes were not counted or weighed.

All sample weights were recorded to the nearest pound (lb). The processor scales were not checked for accuracy at the time of weighing, but each scale had a current accuracy verification

stamp from the State of Alaska, Department of Commerce and Economic Development, Division of Measurement Standards.

For each sampled tender delivery, a copy of the fish tickets (sale receipts), tender tally sheet, or a tender delivery report from the processor was obtained depending on which one was readily available at the time. Each provided the reported number and weight in pounds (lbs) of salmon marketed by species.

Total KMA sockeye catch numbers and weights for the sampling period were obtained from computer generated summaries of individual sales receipts.

### *Data Analysis*

Estimated total catch weight for a specific tender, was derived by multiplying the sample average weights by the reported catch numbers for each tender. A paired t-test (Freund and Simon 1992) at  $\alpha=0.10$  was used to test whether: (1) the sample average weights were significantly different than the recorded fish ticket average weights and (2) the reported total catch weights were statistically different from the estimated total catch weights.

## **RESULTS**

From 2 July through 2 August, a total of 25 deliveries from 16 tenders and three processors were sampled from a variety of catch areas (Table 1; Figure 2; Appendix A). These deliveries represented a reported total of 187,253 sockeye salmon at 994,294 lbs (Table 1). The average delivery number and weight of sockeye salmon were 7,490 fish (range: 850 - 16,276; Figure 3), and 39,772 lbs (range 4,175 - 83,906 lbs; Figure 3). Overall, the 25 sampled deliveries represented about 8.1% of the total KMA sockeye catch for the sampled period.

Per delivery, an average of 631 sockeye salmon were sampled (range: 561-711; Table 1). The average percentage of each sockeye delivery sampled by weight was 14.4% (range 3.5% to 66.2%; Figure 4). The weighted average was 8.4%.

The reported sockeye average weight for the 25 deliveries was 5.35 lbs while the samples averaged 5.29 lbs, a difference of 1.2% (Table 1). Among individual deliveries, the variation ranged from a high of 13.2% to a low of -15.0%, and the average was 1.1% (Figure 5).

A paired t-test, comparing the sample average weights to the reported average weights associated with each tender, yielded a  $t$  value of -1.117 for a  $t$  distribution of 24 degrees of freedom (df). This  $t$  value corresponds to a  $P$ -value of 0.275 which is considered to be statistically insignificant at  $\alpha = 0.10$ . Therefore, there was no statistical difference between the reported and sampled average weights.

A second paired  $t$ -test, comparing the reported total catch weights to the estimated total catch weight, yielded a  $t$  value of 0.596 for a  $t$  distribution of 24 df. This  $t$  value corresponds to a

*P*-value of 0.557, which is considered to be statistically insignificant at  $\alpha = 0.10$ . This indicates that there was no statistical difference between the fish tickets and the sample with regards to sockeye catch weights.

## CONCLUSION

Misrepresentation of sockeye average weights and numbers did not occur in the KMA fish tickets during July 1993.

Typically questions arise as to whether fish ticket data can be used for evaluating fishing performance and stock composition and abundance. According to this study they can be used at least for the KMA during July 1993.

## LITERATURE CITED

- ADF&G (Alaska Department of Fish and Game). 1993. 1993 Cook Inlet/Kodiak/Chignik Commercial Fishing Regulations, Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau.
- Freund, J.E. and A. Simon. 1992. Modern Elementary Statistics 8th ed., Prentice Hall, Englewood Cliffs, New Jersey.

Table 1. Sockeye salmon number, weight, and average weight, by sampled delivery.

Sample Number	Sample		Fish Ticket		Average Weight Difference		Percent Delivery Weight Sampled		
	Number of fish	Weight (lbs) Total	Average	Number of fish	Weight (lbs) Total	Average		Pounds	Percent
1	561	2,764	4.93	15,761	77,985	4.95	0.02	0.4%	3.5%
2	684	3,305	4.83	10,668	52,397	4.91	0.08	1.6%	6.3%
3	600	2,943	4.91	8,629	44,562	5.16	0.26	5.0%	6.6%
4	600	2,934	4.89	9,746	46,743	4.80	-0.09	-2.0%	6.3%
5	711	3,882	5.46	6,020	30,491	5.06	-0.39	-7.8%	12.7%
6	649	3,725	5.74	10,032	50,068	4.99	-0.75	-15.0%	7.4%
7	654	3,493	5.34	16,276	83,906	5.16	-0.19	-3.6%	4.2%
8	685	3,526	5.15	13,686	70,893	5.18	0.03	0.6%	5.0%
9	600	2,895	4.83	6,382	30,397	4.76	-0.06	-1.3%	9.5%
10	600	3,061	5.10	6,901	33,750	4.89	-0.21	-4.3%	9.1%
11	690	3,562	5.16	8,885	52,848	5.95	0.79	13.2%	6.7%
12	705	3,609	5.12	7,103	38,145	5.37	0.25	4.7%	9.5%
13	661	3,667	5.55	13,978	83,578	5.98	0.43	7.2%	4.4%
14	668	3,693	5.53	1,933	11,573	5.99	0.46	7.7%	31.9%
15	609	3,508	5.76	8,333	46,353	5.56	-0.20	-3.6%	7.6%
16	605	3,744	6.19	8,249	54,304	6.58	0.39	6.0%	6.9%
17	600	3,199	5.33	3,471	18,278	5.27	-0.07	-1.2%	17.5%
18	600	3,187	5.31	4,453	22,922	5.15	-0.16	-3.2%	13.9%
19	600	3,127	5.21	9,086	47,136	5.19	-0.02	-0.5%	6.6%
20	624	3,730	5.98	2,155	12,909	5.99	0.01	0.2%	28.9%
21	600	2,762	4.60	850	4,175	4.91	0.31	6.3%	66.2%
22	602	3,235	5.37	2,736	14,057	5.14	-0.24	-4.6%	23.0%
23	641	3,264	5.09	1,271	7,170	5.64	0.55	9.7%	45.5%
24	611	3,318	5.43	5,123	30,728	6.00	0.57	9.5%	10.8%
25	626	3,180	5.08	5,526	28,926	5.23	0.15	3.0%	11.0%
Total	15,786	83,313		187,253	994,294				
Average	631	3,333	5.29 <sup>a</sup>	7,490	39,772	5.35 <sup>a</sup>	0.06	1.2% <sup>a</sup>	8.4%

<sup>a</sup> Weighted average.

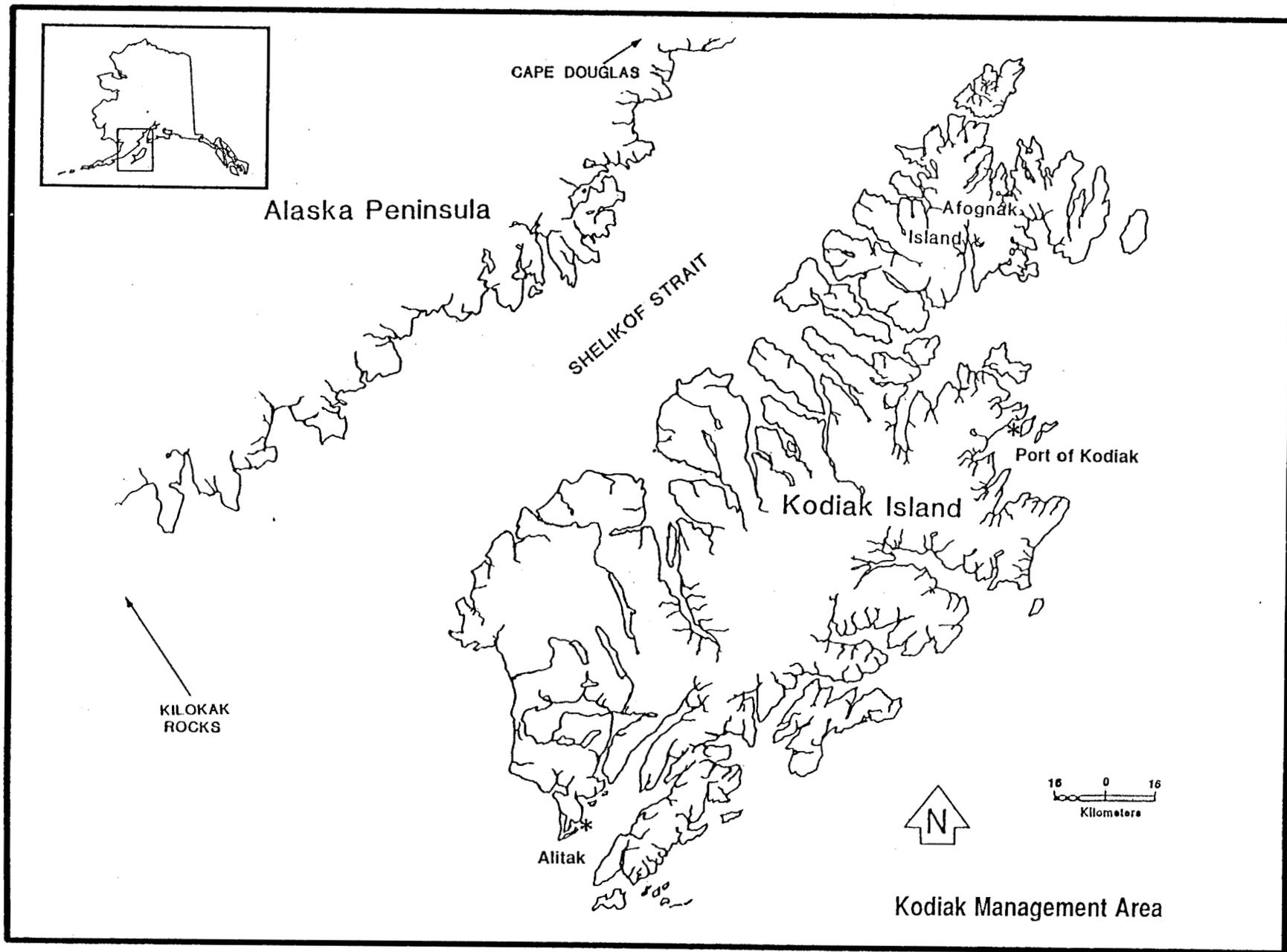


Figure 1. Map of the Kodiak Management Area identifying the sampling locations.

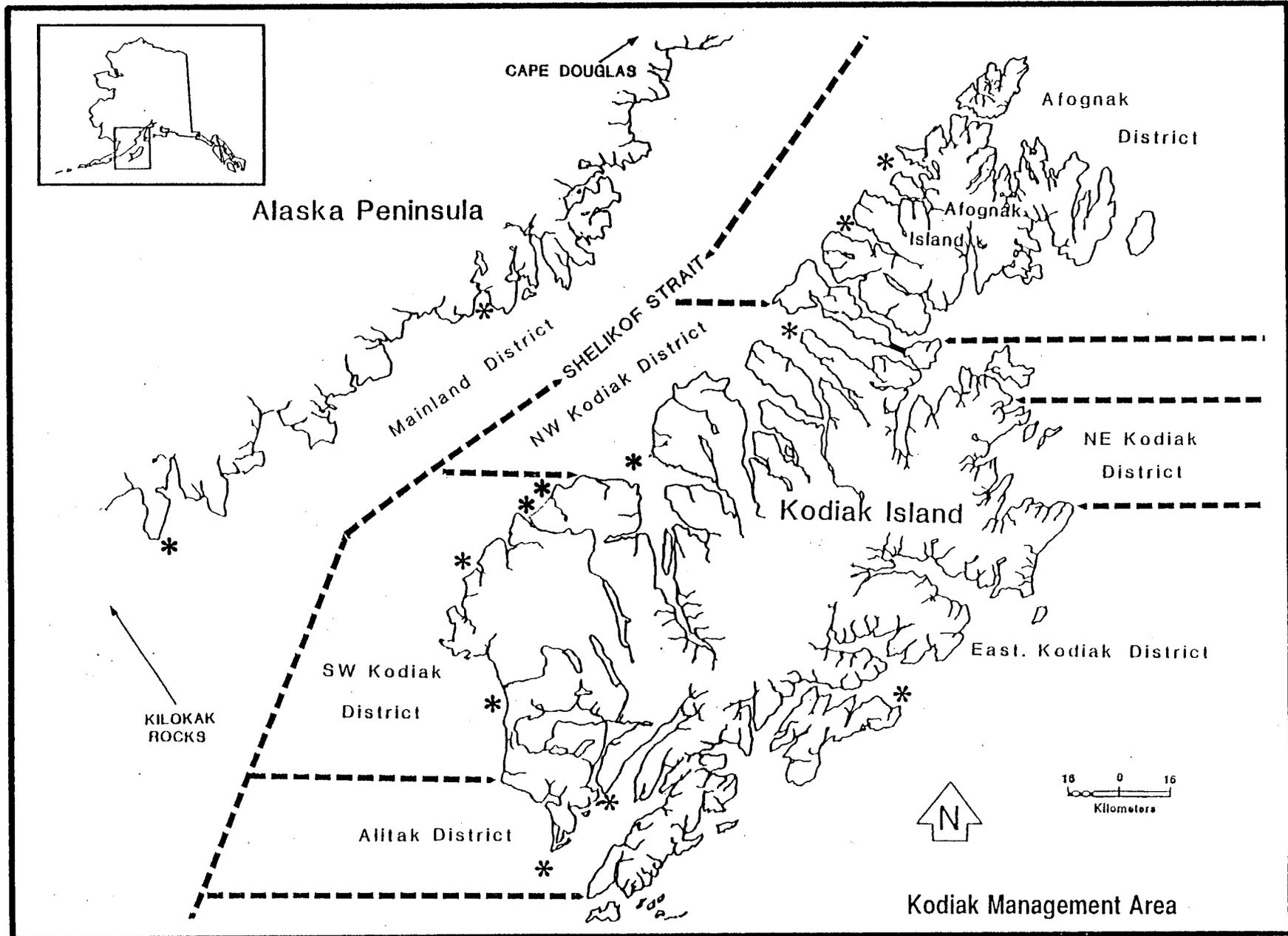


Figure 2. Map illustrating the general areas from which catches were sampled.

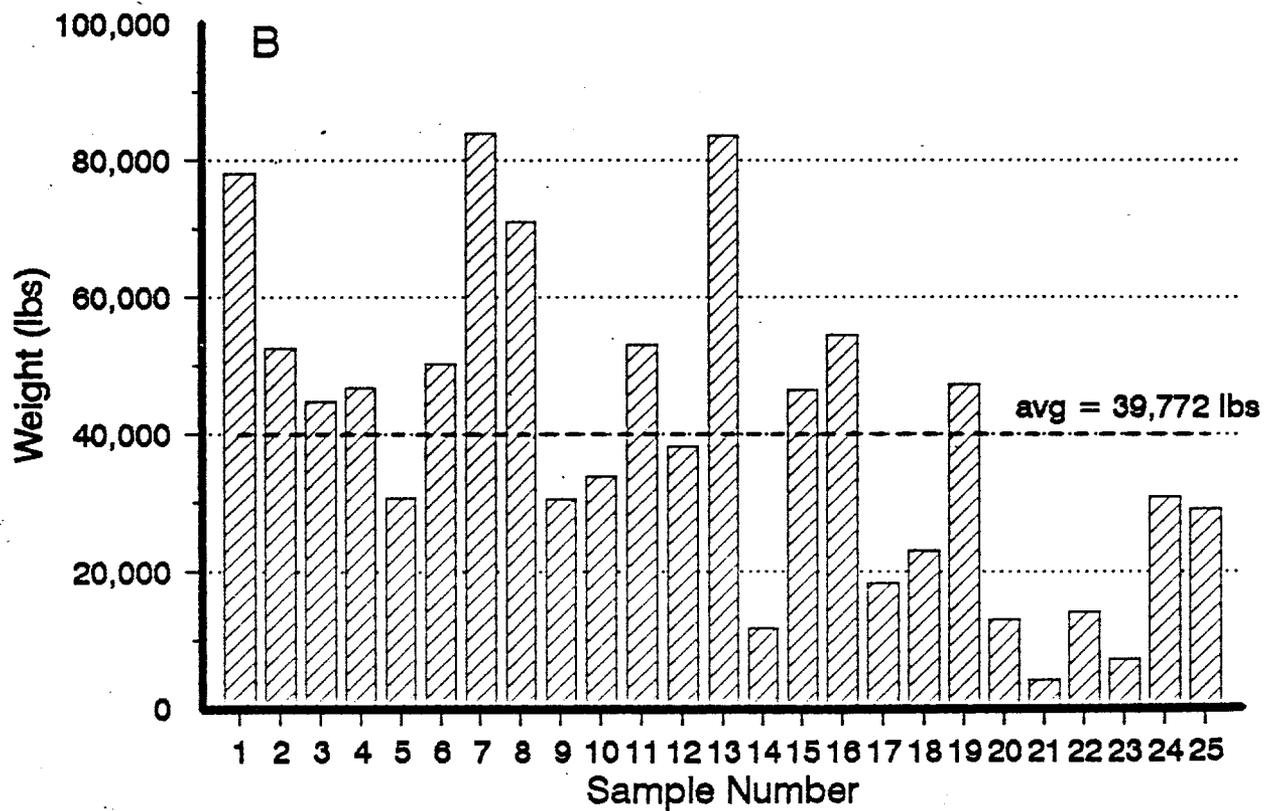
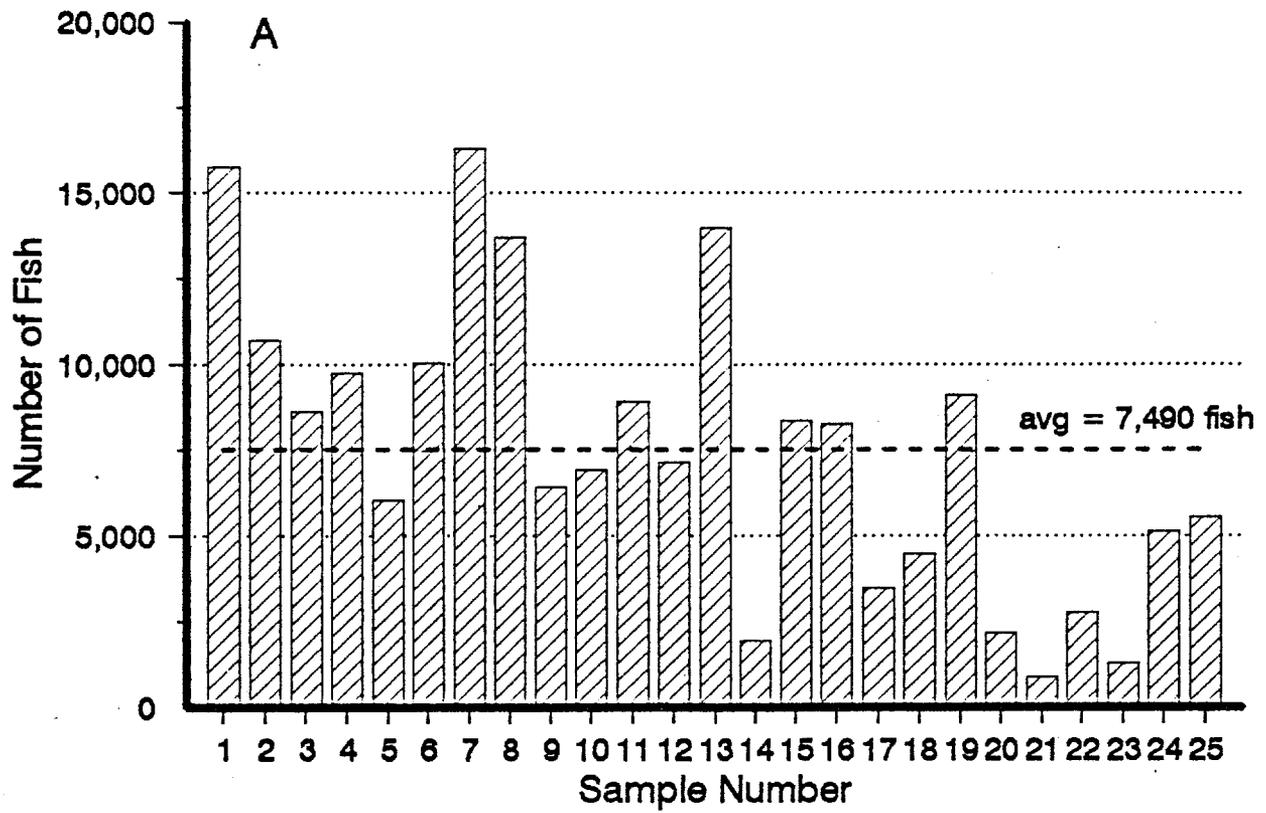


Figure 3. Reported numbers (A) and weight (B) of sockeye salmon by tender delivery sampled, 2 July through 2 August, 1993.

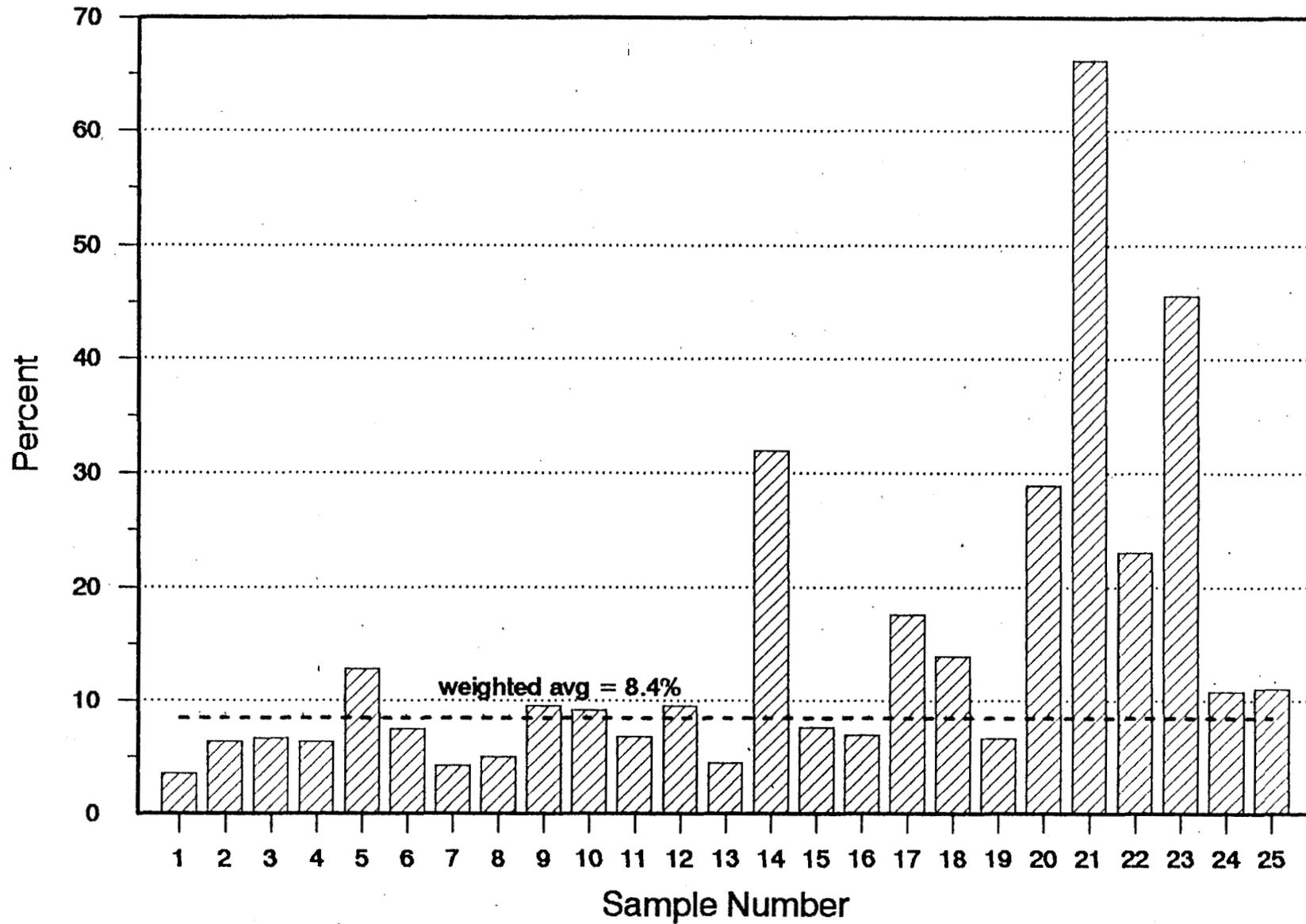


Figure 4. Percent of the reported sockeye salmon weight sampled by delivery, 2 July through 2 August, 1993.

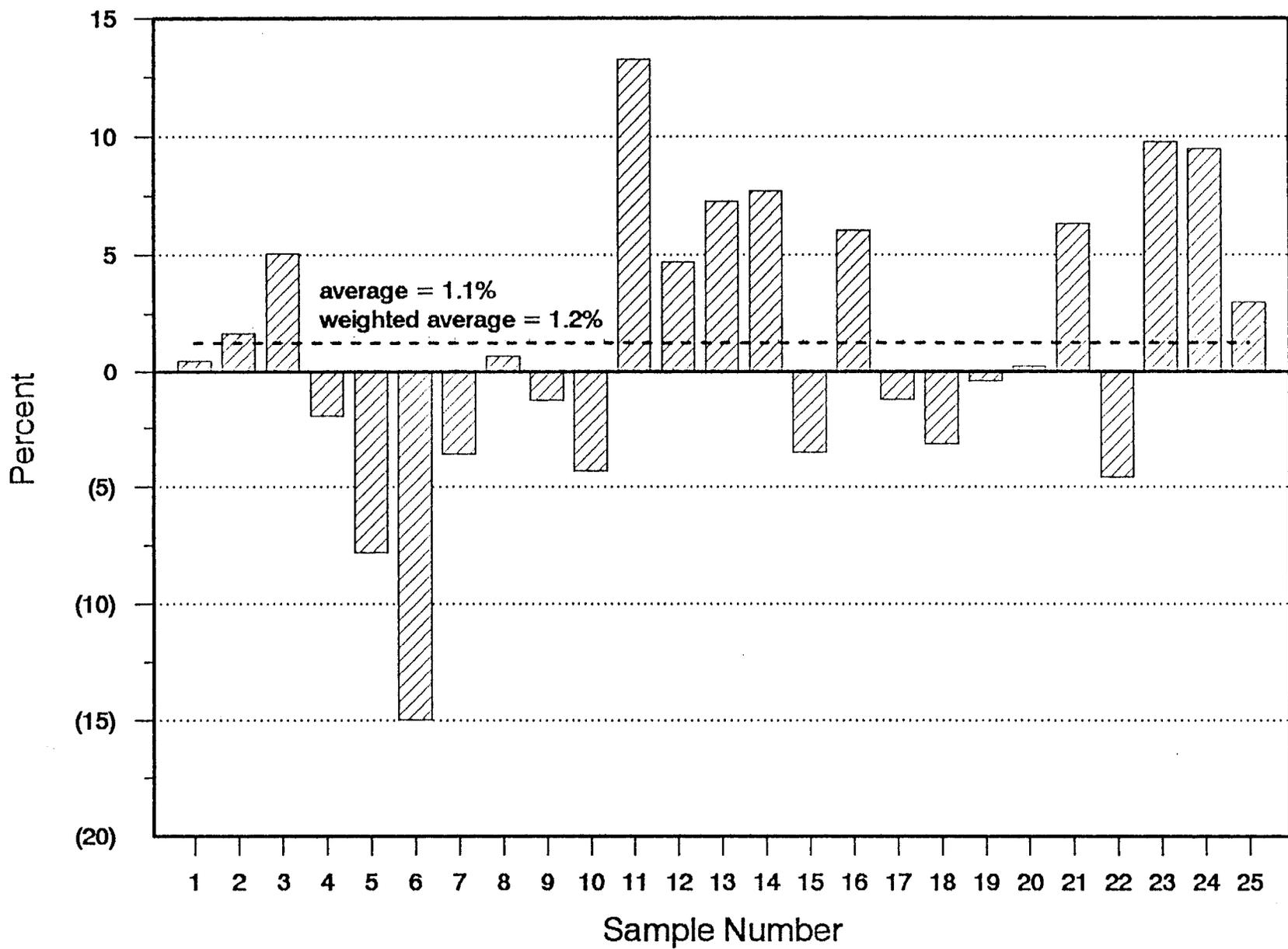


Figure 5. Percent difference between the reported and estimated average sockeye salmon weight by delivery, 2 July through 2 August, 1993.

## **APPENDIX**

Appendix A. Kodiak sockeye salmon weight samples collected, 1993.

Sample	Catch Date	Sample Date	Sample			Fish Ticket			Catch Area, Processor Code(PC), Tender Code(TC)
			Number of fish	Weight (lbs)		Number of fish	Weight (lbs)		
				Total	Average		Total	Average	
1 a	6/29 - 7/1	7/2	269	1,356	5.04				
b	6/29 - 7/1	7/2	292	1,408	4.82				
total			561	2,764	4.93	15,761	77,985	4.95	SW Kodiak District, PC1, TC51
2 a	7/1-2	7/3	324	1,606	4.96				
b	7/1-2	7/3	360	1,699	4.72				
total			684	3,305	4.83	10,668	52,397	4.91	Halibut Bay /Inner &Outer Ayakulik mix, PC2, TC52
3 a	7/3-4	7/5	300	1,436	4.79				
b	7/3-4	7/5	300	1,507	5.02				
total			600	2,943	4.91	8,629	44,562	5.16	Inner & Outer Ayakulik, PC3, TC53
4 a	7/4	7/5	300	1,456	4.85				
b	7/4	7/5	300	1,478	4.93				
total			600	2,934	4.89	9,746	46,743	4.80	Olga Bay, PC3, TC54
5 a	7/4-5	7/6	345	1,883	5.46				
b	7/4-5	7/6	366	1,999	5.46				
total			711	3,882	5.46	6,020	30,491	5.06	Cape Alitak, PC2, TC55
6 a	7/7-9	7/9	215	1,239	5.76				
b	7/7-9	7/9	223	1,245	5.58				
c	7/7-9	7/9	211	1,241	5.88				
total			649	3,725	5.74	10,032	50,068	4.99	SW Afognak / Kupreanof Straight mix, PC1, TC56
7 a	7/7-8	7/9	218	1,150	5.28				
b	7/7-8	7/9	209	1,143	5.47				
c	7/7-8	7/9	227	1,200	5.29				
total			654	3,493	5.34	16,276	83,906	5.16	Eastside 75% / Alitak mix, PC1, TC57
8 a	7/6-9	7/10	222	1,132	5.10				
b	7/6-9	7/10	223	1,170	5.25				
c	7/6-9	7/10	240	1,224	5.10				
total			685	3,526	5.15	13,686	70,893	5.18	Eastside 90% / Alitak 10% mix, PC1, TC58
9 a	7/11-12	7/13	300	1,436	4.79				
b	7/11-12	7/13	300	1,459	4.86				
total			600	2,895	4.83	6,382	30,397	4.76	Moser/Olga Bay, PC3, TC59
10 a	7/12-13	7/13	300	1,551	5.17				
b	7/12-13	7/13	300	1,510	5.03				
total			600	3,061	5.10	6,901	33,750	4.89	Cape Alitak, PC3, TC60

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Sample	Catch Date	Sample Date	Sample			Fish Ticket			Catch Area, Processor Code(PC), Tender Code(TC)
			Number of fish	Weight (lbs)		Number of fish	Weight (lbs)		
				Total	Average		Total	Average	
11 a	7/9-12	7/13	246	1,212	4.93				
b	7/9-12	7/13	225	1,195	5.31				
c	7/9-12	7/13	219	1,155	5.27				
total			690	3,562	5.16	8,885	52,848	5.95	Cape Igvak 98% / Inner Karluk 2% mix, PC1, TC61
12 a	7/13-15	7/16	231	1,154	5.00				
b	7/13-15	7/16	232	1,198	5.16				
c	7/13-15	7/16	242	1,257	5.19				
total			705	3,609	5.12	7,103	38,145	5.37	Eastside 75% / Alitak 25% mix, PC1, TC58
13 a	7/16	7/16	190	1,125	5.92				
b	7/16	7/16	245	1,282	5.23				
c	7/16	7/16	226	1,260	5.58				
total			661	3,667	5.55	13,978	83,578	5.98	Mainland / Uyak / Inner Karluk mix, PC1, TC57
14 a	7/18	7/18	237	1,335	5.63				
b	7/18	7/18	266	1,453	5.46				
c	7/18	7/18	165	905	5.48				
total			668	3,693	5.53	1,933	11,573	5.99	Cape Barnabas, PC1, TC61
15 a	7/20-21	7/22	310	1,809	5.84				
b	7/20-21	7/22	299	1,699	5.68				
total			609	3,508	5.76	8,333	46,353	5.56	Dakavak, PC2, TC62
16 a	7/20-21	7/23	196	1,228	6.27				
b	7/20-21	7/23	206	1,272	6.17				
c	7/20-21	7/23	203	1,244	6.13				
total			605	3,744	6.19	8,249	54,304	6.58	Mainland, PC1, TC63
17 a	7/21-23	7/23	400	2,207	5.52				fish sampled in slush ice
b	7/21-23	7/23	200	992	4.96				fish sampled in dry totes
total			600	3,199	5.33	3,471	18,278	5.27	Eastside - Sitkalidak Section, PC3, TC64
18 a	7/22	7/23	300	1,606	5.35				
b	7/22	7/23	300	1,581	5.27				
total			600	3,187	5.31	4,453	22,922	5.15	Moser Bay, PC3, TC59
19 a	7/22-24	7/24	300	1,582	5.27				
b	7/22-24	7/24	300	1,545	5.15				
total			600	3,127	5.21	9,086	47,136	5.19	Cape Alitak, PC3, TC60
20 a	7/23-25	7/25	207	1,245	6.01				
b	7/23-25	7/25	222	1,319	5.94				
c	7/23-25	7/25	195	1,166	5.98				
total			624	3,730	5.98	2,155	12,909	5.99	NW & SW Afognak mix, PC1, TC57

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Appendix A. (page 3 of 3)

Sample	Catch Date	Sample Date	Sample			Fish Ticket			Catch Area, Processor Code(PC), Tender Code(TC)
			Number of fish	Weight (lbs)		Number of fish	Weight (lbs)		
				Total	Average		Total	Average	
21 a	7/27-28	7/29	300	1,318	4.39				
b	7/27-28	7/29	300	1,444	4.81				
total			600	2,762	4.60	850	4,175	4.91	Eastside, PC3, TC64
22 a	7/28	7/29	228	1,214	5.32				
b	7/28	7/29	374	2,021	5.40				
total			602	3,235	5.37	2,736	14,057	5.14	Cape Alitak, PC3, TC65
23 a	7/30	8/1	378	1,937	5.12				slush ice
b	7/30	8/1	263	1,327	5.05				slush ice
total			641	3,264	5.09	1,271	7,170	5.64	Cape Igvak 99% / Alinchak 1% mix, PC1, TC56
24 a	7/29-7/31	8/1	304	1,658	5.45				
b	7/29-7/31	8/1	307	1,660	5.41				
total			611	3,318	5.43	5,123	30,728	6.00	Mainland mix, PC2, TC66
25 a	7/31-8/2	8/2	177	911	5.15				
b	7/31-8/2	8/2	242	1,154	4.77				
c	7/31-8/2	8/2	207	1,115	5.39				
total			626	3,180	5.08	5,526	28,926	5.23	Alitak / Eastside mix, PC1, TC61

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