AYK REGION
Norton Sound/Kotzebue
Salmon Escapement Report # 25

1981 Kwiniuk River Salmon Counting Tower Project

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INTRODUCTION

The Kwiniuk River is located about 98 miles northeast of Nome and drains into Norton Sound. A salmon counting tower was initiated on this system in 1965. Counting methods have not changed since they were carefully described in the 1976 Kwiniuk River report, (AYK Reports, Norton Sound/Kotzebue Escapement Report #17).

OBJECTIVES

1. Obtain daily and seasonal timing and magnitude of salmon escapement.
2. Periodically sample the Moses Point commercial salmon catch and the Kwiniuk River escapement for age, sex, and size composition.

RESULTS

The 18 hour counting schedule began June 19 and ended August 2. The tower was set up at the same location as 1980.

The unexpanded counts were: 136 chinook, 34,327 chum, and 551,710 pink. The adjusted and expanded counts were: 34,561 chum and 566,417 pinks. King salmon counts were not expanded because of the sporatic and small daily counts observed and the small percentage change made when expanding counts. After each commercial fishing period, 60 chum salmom were sampled for age data. 34% of the samples were of the 5 age class by the Gilbert-Rich method, 65% 4_1 age class and the remainder 3_1 or 6_1 age class.

The tower crew recorded the hourly counts as well as the first 30 minutes count each hour. Using these numbers, the daily expanded 30 minute count could be compared with the daily actual count. A ratio of estimated count/actual count was computed on a daily basis (table 7). These ratios were treated as a students t-distribution and confidence limits were calculated. Outliers were defined as any actual daily count of less than ten fish; negative count days showed the least comparison.

Using the ratios from table 7 for chum salmon:

$\bar{Y} = 1.0046$ $\quad s = 1.003$ $\quad v = 35$

$S\bar{y} = \frac{s}{v\bar{v}}$ $\quad \bar{sy} = 0.01695$

for pink salmon:

$\bar{Y}_1 = 0.9784$ $\quad Y_2 = 1.0440$ $\quad s_1 = 0.10096$

$s_2 = 0.4182$ $\quad v_1 = 35$ $\quad v_2 = 40$ $\quad s\bar{y} = \frac{s}{v\bar{v}}$

$sy_1 = 0.0171$ $s\bar{y}_2 = 0.0661$

Using the expression: $Y \pm (t.s\bar{y})$ = confidence limits

At the 99% confidence interval, $t_1 = 2.727$. For chum salmon the ratio of estimated/actual counts ranged from 95.84% to 105.08% with $\bar{Y} = 100.46\%$ The idea of $Y = 100.00 \pm 0.00\%$, or perfect correlation between estimated and actual counts, is very nearly met by this confidence interval. These limits indicate a 99% assurance that the estimated daily count will be within 5% of the actual count. Had the 30 minute counts been used, 34,434 chum salmon would have been the calculated escapement which compares to escapement of 34,333 chum salmon derived from the whole hour counting method.

DISCUSSION

Several changes were made in camp life in 1981. The camp site was moved downstream to the vicinity of the Tower and boat landing. Two tent frames were built, one near the cache and one further off the river for sleeping. This resulted in better morale because sleeping shifts were uninterrupted, and privacy more easily maintained.

One tower was eliminated because the light string which was tied off to that tower, was not used this year. Instead a single car headlight powered by a car battery was beamed across the river over the flash panel. This greatly reduced the use of the generator and associated gas consumption making it easier to sleep at night.

A new weir of drilled angle cross members and rigid conduit pickets was used in 1981. This type of weir is easy to install, take down and clean.

A wet suit was purchased and used to install the weir and clean the flash panel.

The Tower crew operated on an 18 hour counting schedule. Once a week a 24 hour count was made in order to expand the 18 hour daily count. The expanded count was made by multiplying the actual count with a percentage perived from the nearest 24 hour sample period. It was felt that each year has a different run timing so that average percentages should not be used.

For pink salmon, the ratios of estimated/actual counts ranged from 93.18% to 102.50% with $\bar{Y}_1 = 97.84\%$ disregarding the outliers. When the outliers are included the ratios ranged from 86.53% to 122.27% with $\bar{Y}_2 = 104.40\%$. In the daily estimation of pink counts, the outliers play a much greater

role in establishing the confidence limits. At the Kwiniuk site, pink salmon are more likely to move downstream in mass than the other salmon species prior to spawning. Water temperature seemed to be the major cause of these reverse migrations.

At the 95% confidence interval, t = 2.031 and t = 2.021. For chum salmon, the ratios ranged from 97.02% to 103.90% with Y = 100.46%. For pink salmon, the ratios ranged from 94.37% to 101.32% with Y = 97.84% with the outliers included the ratios ranged from 91.03% to 117.77% with Y = 104.40%.

The salmon fishery in the Moses Pt. subdistrict is targeted on chum salmon; pink salmon are virtually untouched. Should pink salmon become a target species, the more accurate estimation of daily pink salmon counts would become important. Many outlying days can be predicted and it should be remembered that these outlying days rarely involve more than 50 fish. The daily counts are used in a cumulative manner, so that low count days can be ignored with little effect on the cumulative escapement curves used for in-season management.

Statistical methods used here are found in Biometry (Sokal and Rohlf). The table of critical values is found in Statistical Tables (Rohlf and Sokal).

RECOMMENDATIONS

The Smokercraft 16' riverboat is in fair condition, but the transom flexes badly when the motor lift is used. A 35 horsepower jet unit would eliminate much of this problem as well as the ground-up props that occur late in the season.

The last three days of counting were incomplete this year because the generator failed and the light's battery could not be charged. A more reliable generator is needed.

The crew had some counting problems with fish cutting around the wier as closely as possible. In the future the weir should be set up so that it overlaps the flash panel by 18 inches to eliminate the sneaky fish problem.

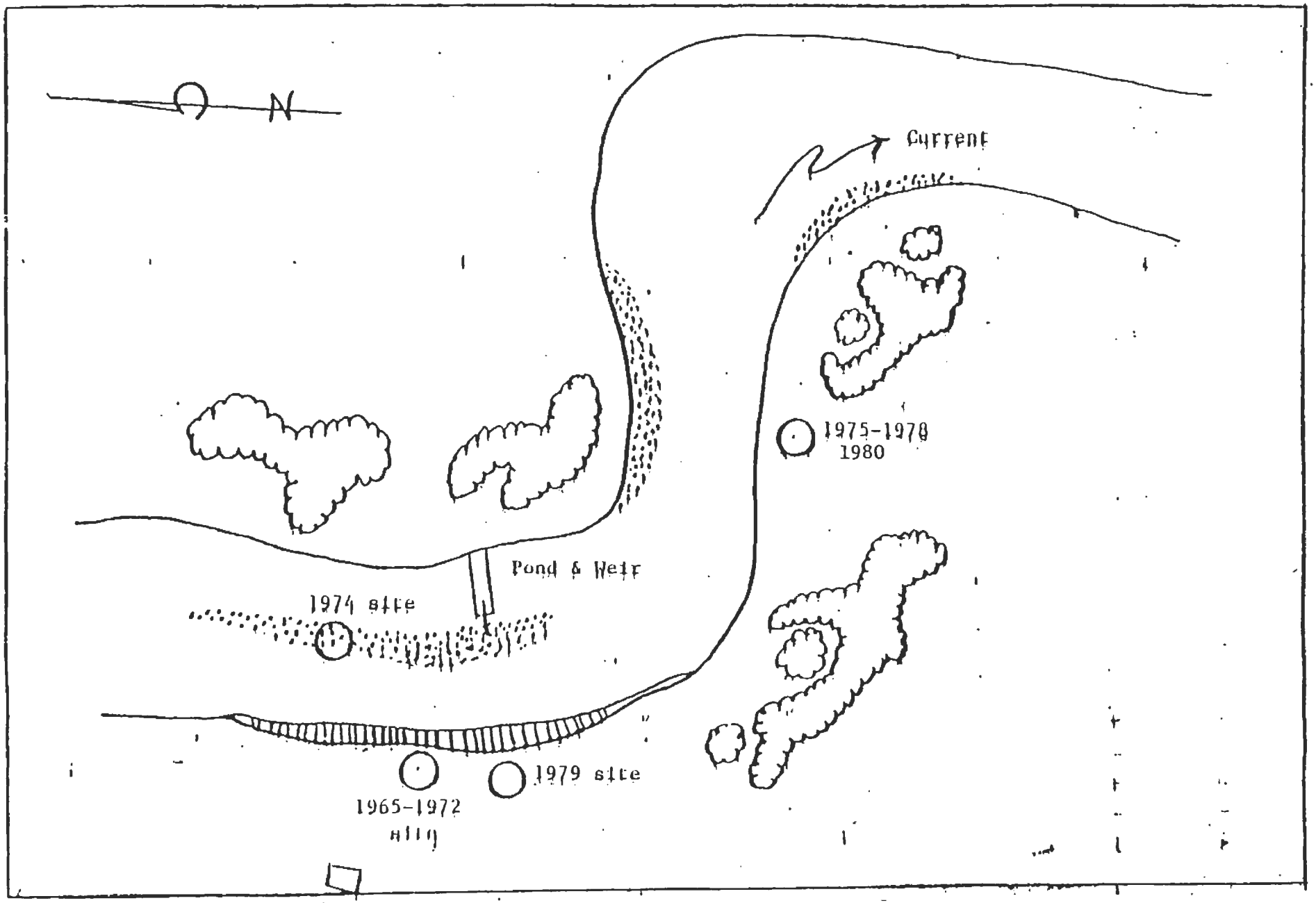

Figure 1. 1980 Kwiniuk River salmon counting tower site

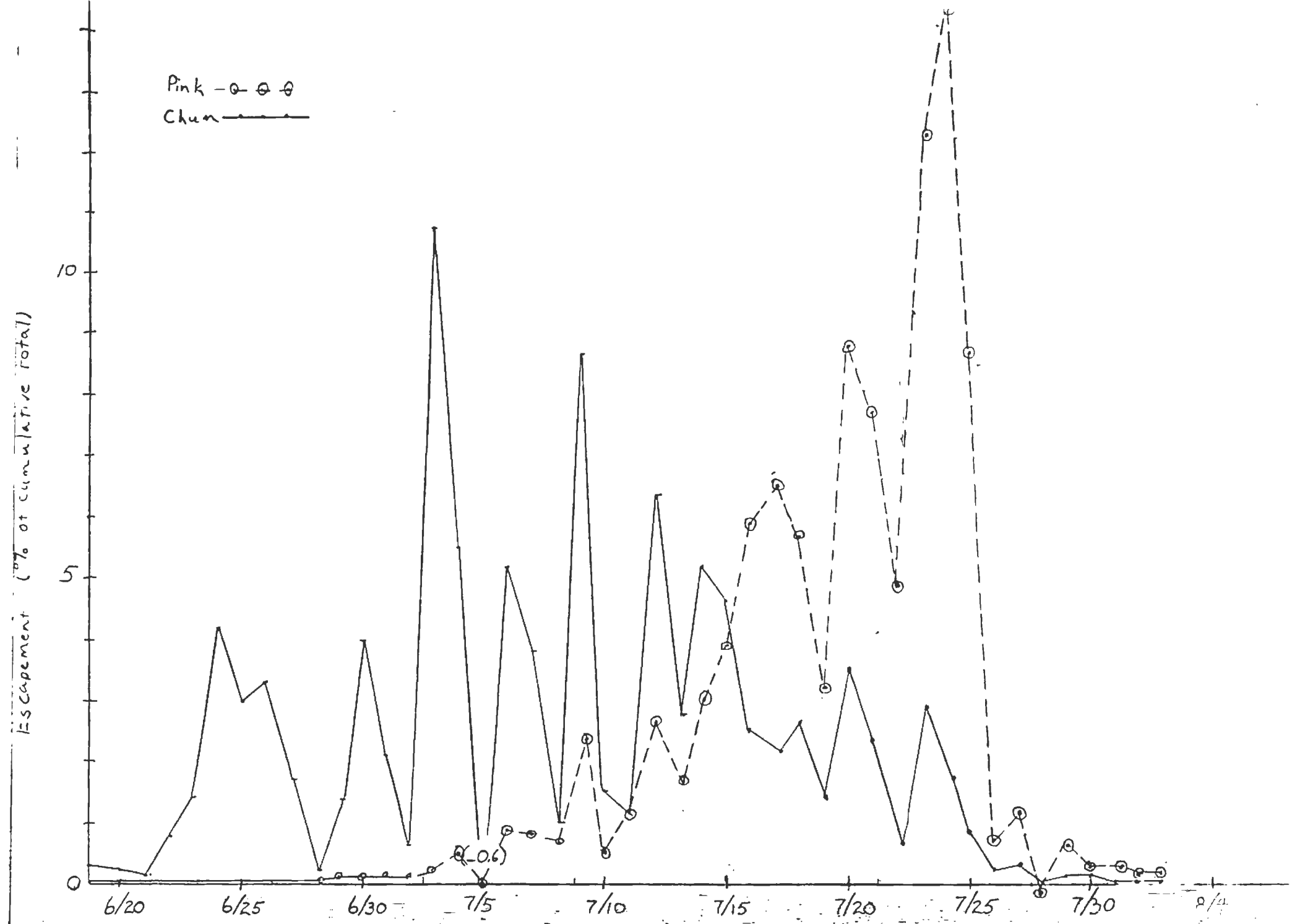

Figure Daily salmon escapement past Kwini River counting tower, 1981

Table 1. Estimates of daily salmon migration past Kwiniuk River tower, using expanded 30 minute counts, Kwiniuk River, 1981

	CHUM SALMON			PINK SALMON		
		Expanded 1/			Expanded 1/	
Date	30 minute Counts	30 minute Counts	Actual Counts	30 minute Counts	30 minute Counts	Actual Counts
6/19	-	-	96	-	-	16
6/20	-	-	58	-	-	38
6/21	-	-	32	-	-	-24
6/22	184	368	282	7	14	19
6/23	106	212	474	9	18	47
6/24	939	1878	1436	109	218	194
6/25	514	1028	1015	58	116	157
6/26	709	1418	1120	104	208	228
6/27	326	152	567	134	268	216
6/28	28	56	60	42	84	117
6/29	216	432	471	139	278	287
6/30	749	1498	1381	237	474	460
7/1	369	738	735	191	382	339
7/2	89	188	203	163	326	334
7/3	1660	3320	3655	731	1482	1563
7/4	1045	2090	1884	1555	3110	2984
7/5	-151	-302	-209	-185	-370	-104
7/6	919	1838	1807	2711	5422	5194
7/7	624	1248	1316	2071	4142	4169
7/8	168	336	343	2030	4060	4007
7/9	1601	3202	2964	7456	14912	13361
7/10	284	568	525	1565	3130	2835
7/11	195	390	395	3278	6556	5917
7/12	1091	2182	2185	6905	13810	14111
7/13	469	938	961	4586	9172	8951
7/14	768	1536	1785	7958	15916	16695
7/15	688	1376	1562	10772	21544	21438
7/16	395	790	842	14890	29780	32658
7/17	349	698	710	18358	36716	35565
7/18	473	946	903	16735	33470	31503
7/19	210	420	470	8790	17580	17832
7/20	613	1226	1203	22864	45728	48380
7/21	401	802	797	21928	43856	43404
7/22	91	182	190	11941	23882	27003
7/23	521	1042	989	33466	66932	67653
7/24	295	590	573	39779	79558	79425
7/25	154	308	286	25703	51406	47260
7/26	34	68	80	2013	4026	3780
7/27	52	104	108	2565	5130	5912
7/28	0	0	0	-159	-318	-308
7/29	17	34	38	1801	3602	3396
7/30	10	20	19	671	1342	1609
7/31	4	8	11	763	1526	1635
8/1	3	6	8	306	612	730
8/2	0	0	3	246	492	515
TOTALS	17212	34434	34333	275286	552456	551612

1/ Expanded to eighteen hour count.

Table 2. Daily/Hourly migration past Kwiniuk River counting tower, 1981. Species: CHUM

Hour/ Date	00	01	02	03	04	05	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	Daily % of Total
6/19							0	0	43	16	1	12	0	1	2	2	3	16	96	0.3
6/20	43	12	1	0	2	2	0	-6	0	1	0	0	2	1	1	0	5	-6	58	0.2
6/21	-1	1	5	3	0	0	-2	-2	0	-2	0	0	0	3	6	2	6	13	32	0.1
6/22	14	7	1	3	7	5	0	0	0	17	0	0	0	25	78	74	33	15	279	0.8
6/23	3	-6	8	0	0	0	0	0	0	7	0	0	54	25	13	27	113	230	484	1.4
6/24	108	160	186	109	67	17	77	8	2	26	17	1	0	81	228	295	50	4	1436	4.2
6/25	70	6	1	6	3	2	0	0	0	0	3	6	18	305	133	136	228	98	1015	3.0
6/26	1	1	0	2	0	3	1	0	0	0	50	13	344	103	204	251	92	55	1120	3.3
6/27	19	2	2	2	0	0	5	0	-7	16	74	38	24	4	22	313	47	6	567	1.7
6/28	-9	0	8	2	0	0	0	0	0	0	0	0	0	5	45	3	4	2	60	0.2
6/29	103	66	63	13	4	6	92	0	0	1	0	8	12	6	29	49	5	14	471	1.4
6/30	47	31	29	18	3	1	2	0	0	602	306	146	3	2	46	11	64	70	1381	4.0
7/1	133	31	20	11	0	0	9	18	7	74	9	68	18	46	146	74	61	10	735	2.1
7/2	16	26	2	2	7	0	24	1	5	3	1	0	0	7	7	26	25	51	203	0.6
7/3	179	38	22	2	1	4	2	9	781	518	405	90	867	241	92	107	89	208	3655	10.7
7/4	143	20	8	12	10	0	-1	39	149	111	206	230	561	101	169	100	11	15	1884	5.5
7/5	6	5	0	1	3	0	-74	-24	-40	-72	-20	2	4	-3	-31	6	16	12	-209	-0.6
7/6	-3	-3	-3	-3	2	-1	0	0	0	0	1	3	4	23	182	668	280	651	1801	5.2
7/7	43	107	95	90	77	122	5	3	1	1	2	81	96	164	116	263	46	4	1316	3.8
7/8	0	7	1	1	10	3	0	0	0	-5	-2	-5	36	121	28	43	67	35	340	1.0
7/9	5	0	0	2	4	12	0	116	91	24	129	493	434	156	400	227	602	269	2964	6.6
7/10	81	28	25	9	3	2	0	-2	1	0	2	1	32	21	81	130	90	21	525	1.5
7/11	3	2	0	5	3	2	0	-4	1	2	0	7	0	19	38	61	131	125	395	1.1
7/12	39	42	19	21	7	0	0	0	0	4	203	74	181	650	418	258	180	89	2185	6.4
7/13	32	14	8	5	2	1	-2	-1	4	8	14	11	88	177	278	182	102	38	961	2.8
7/14	3	6	5	3	5	2	-2	0	107	86	83	143	377	421	184	221	107	34	1785	5.2
7/15	12	6	6	2	6	1	-1	0	1	5	12	27	69	309	537	287	200	83	1562	4.6
7/16	118	26	12	32	18	14	1	145	157	58	7	1	3	6	20	100	103	22	842	2.5
7/17	6	7	0	5	5	0	5	54	97	38	51	128	131	65	47	24	37	10	710	2.1
7/18	0	-1	0	6	26	1	0	3	2	6	151	101	77	102	106	110	137	76	903	2.6
7/19	7	1	0	21	64	8	0	7	43	79	52	27	44	30	12	21	23	31	470	1.4
7/20	8	5	7	27	24	12	14	11	93	240	254	143	60	72	81	94	48	10	1203	3.5

Table 2. Daily/Hourly migration past Kwiniuk River counting tower, 1981. Species: CHUM (continued)

Hour/ Date	00	01	02	03	04	05	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	Daily % of Total
7/21	6	0	0	9	7	2	0	20	72	271	167	137	11	37	5	7	11	24	786	2.3
7/22	1	1	0	2	2	0	0	0	0	2	0	5	11	10	6	81	44	25	190	0.6
7/23	33	8	9	43	45	20	24	33	59	101	96	11	21	52	125	137	92	80	989	2.9
7/24	85	23	5	29	35	61	1	11	12	15	16	11	4	5	42	85	77	56	573	1.7
7/25	11	12	9	22	37	12	-5	6	3	4	1	4	2	24	19	80	32	13	286	0.8
7/26	5	3	1	7	11	4	6	2	0	3	2	6	10	1	1	2	1	15	80	0.2
7/27	0	0	1	10	25	41	1	1	5	0	0	2	1	3	4	7	8	-1	108	0.3
7/28	0	0	0	0	0	0													0	0.0
7/29							-1	1	1	0	4	3	11	9	5	4	1	0	38	0.1
7/30	2	3	0	1	3	1	1	1	0	1	0	0	1	0	0	3	2	0	19	0.1
7/31	0	0	0	0	0	2	1	1	3	2	0	0	1	0	0	1	0		11	0.0
8/1							0	0	0	0	0	0	0	0	3	4	1		8	0.0
8/2							0	0	2	1	1	0	0	0	0	0	-1		3	0.0
Hourly Total	1372	697	556	535	528	362	183	451	1695	2264	2298	2028	3612	3430	3928	4576	3273	2522	34310	
% of Hourly Total	4.0	2.0	1.6	1.6	1.6	1.1	0.5	1.3	4.9	6.6	6.6	5.9	10.0	11.4	13.3	9.5	7.4			

Table 3. Daily/Hourly migration past Kwiniuk River counting tower, 1981. Species: PINK

Hour/ Date	00	01	02	03	04	05	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	Daily % of Total
6/19							0	0	0	4	4	2	3	4	1	4	-4	-2	16	0.0
6/20	37	5	0	2	1	1	0	0	0	5	1	-2	2	3	0	2	0	-19	38	0.0
6/21	-18	-2	-6	-1	0	0	0	1	0	0	-1	0	0	0	4	0	1	-2	-24	0.0
6/22	3	0	0	-2	1	0	0	0	0	0	0	0	0	7	0	7	2	0	18	0.0
6/23	5	1	0	0	0	0	0	0	0	0	0	1	3	3	0	0	23	11	47	0.0
6/24	25	26	13	4	0	1	4	2	2	2	1	5	0	12	27	53	8	9	147	0.0
6/25	10	-4	0	0	0	0	0	0	0	0	2	12	51	43	0	18	13	12	157	0.0
6/26	-2	0	0	0	0	0	0	0	0	0	2	1	88	24	63	31	16	5	228	0.0
6/27	7	1	0	0	0	0	0	0	2	5	16	26	16	2	6	106	31	-2	216	0.0
6/28	2	9	6	0	0	0	1	0	0	3	0	1	0	5	13	15	48	14	117	0.0
6/29	59	28	44	4	1	0	22	2	0	0	0	8	3	5	20	59	9	23	287	0.1
6/30	34	13	22	13	4	1	3	-3	0	152	73	27	15	22	5	9	28	42	460	0.1
7/1	50	13	25	15	4	2	1	13	0	9	11	51	11	14	30	48	36	31	364	0.1
7/2	4	23	1	5	1	0	25	23	33	3	2	0	3	4	7	64	75	61	334	0.1
7/3	97	31	26	4	2	-3	1	0	170	71	77	26	447	264	105	91	97	57	1563	0.3
7/4	102	23	25	14	12	0	2	14	54	76	127	416	825	458	494	291	31	20	2984	0.5
7/5	27	8	9	5	5	-3	-115	-50	-81	-204	-52	3	13	18	48	63	68	122	-116	0.0
7/6	20	-10	0	-7	-1	-3	0	0	0	19	0	13	19	134	550	1360	790	2310	5194	0.9
7/7	120	188	136	197	153	256	16	14	8	39	5	122	286	566	670	1090	260	43	4169	0.8
7/8	46	21	10	21	77	100	0	3	-5	-15	-5	3	693	1540	403	268	580	254	3994	0.7
7/9	34	17	20	52	114	66	5	270	171	107	563	1379	290	893	2050	1010	2810	1510	13361	2.4
7/10	481	187	136	111	13	8	10	-32	34	3	4	56	179	164	482	453	431	115	2835	0.5
7/11	92	15	68	23	27	21	0	-11	0	5	6	-2	18	261	366	523	1860	2645	5917	1.1
7/12	629	415	204	157	41	8	29	35	17	31	530	581	1380	3310	2610	2065	1391	678	14111	2.6
7/13	432	175	151	81	38	13	10	8	27	229	205	301	1025	1221	1720	1755	1125	434	8950	1.6
7/14	159	87	77	14	19	16	7	15	602	645	796	846	1810	2242	1930	4125	2525	780	16695	3.0
7/15	310	122	166	150	65	72	7	16	30	114	241	485	523	2822	4740	4645	4376	2665	21549	3.9
7/16	4110	873	1463	2194	524	635	93	3300	4970	1212	107	149	299	411	921	5155	4905	1325	32646	5.9
7/17	396	73	116	139	637	46	431	4010	2800	1017	1335	3845	5750	3345	4705	2110	3400	1410	35565	6.5
7/18	-47	-17	-18	140	1449	156	38	58	109	635	2980	2900	2195	3550	4215	4490	5370	3300	31503	5.7
7/19	177	20	85	1469	1664	517	68	300	1147	1382	940	690	1595	1660	795	1383	2200	1740	17832	3.2
7/20	315	126	231	1124	761	567	706	1195	6300	5970	5120	3190	2525	3652	6300	5880	3310	1180	48380	8.8

Table 3. Daily/Hourly migration past Kwiniuk River counting tower, 1981. Species: PINK
(continued)

Hour/ Date	00	01	02	03	04	05	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	Daily% of Total
7/21	79	66	29	534	893	518	334	1460	3990	7470	8710	7790	1110	2690	1142	747	2117	2431	42110	7.7
7/22	115	17	71	400	1031	442	146	154	648	569	510	1240	1345	1825	2560	9150	4160	2620	27003	4.9
7/23	1058	204	458	1165	2015	1445	2400	3098	5450	4450	4200	820	3240	6835	6285	10160	8130	6240	67653	12.3
7/24	3490	512	568	2958	6955	15920	215	2028	2184	3915	3550	4550	2030	2430	5350	7470	9250	6050	79425	14.4
7/25	1500	362	992	4450	10880	6790	261	1826	589	298	50	1147	1330	6930	2720	4330	1610	1195	47260	8.6
7/26	142	17	33	441	700	-6	44	48	29	130	147	559	880	198	102	41	51	224	3780	0.7
7/27	7	-2	3	-72	1350	3800	216	19	562	-239	-261	-1	93	70	20	132	82	124	5912	1.1
7/28	0	-8	-6	-33	-172	-89													-308	-0.1
7/29							10	67	55	70	101	200	1020	880	565	178	177	73	3396	0.6
7/30	32	43	28	131	173	113	17	39	24	20	53	80	138	227	373	190	-143	71	1609	0.3
7/31	11	7	20	140	251	223	16	-5	31	163	137	99	169	214	80	46	33		1635	0.3
8/1							-5	21	36	11	18	10	32	145	310	76	63		717	0.1
8/2							46	92	61	54	21	37	37	66	52	30	11		507	0.1
Hourly Total	14150	3685	5206	16042	29688	31633	5064	18030	30049	28430	30326	31666	33491	49178	52839	69723	61356	39727	550,283	
% of Hourly Total	2.6	0.7	0.9	2.9	5.4	5.7	0.9	3.3	5.5	5.2	5.5	5.8	6.1	8.9	9.6	12.5	11.2	7.2		100.0%

TABLE 3. AGE, SEX, AND SIZE COMPOSITION OF NORTON SOUND CHUM SALMON, MOSES POINT (SUBDISTRICT 3) COMMERCIAL CATCH, 5 3/8-5 7/8" MESH, 1981.

		COMBINED			AGE 3			AGE 4			AGE 5			AGE 6		
DATE	SEX	NO.	PCT.	LENGTH	NO.	PCT.[1]	LENGTH	NO.	PCT.[1]	LENGTH	NO.	PCT.[1]	LENGTH	NO.	PCT.[1]	LENGTH
6/23	MALE	33	56.9	609.1	-	-	-	17	29.3	600.1	16	27.6	620.6	-	-	-
	FEMALE	25	43.1	585.0	-	-	-	14	24.1	581.5	11	19.0	591.0	-	-	-
	SUBTL	58	100.0	598.8	-	-	-	31	53.4	591.7	27	46.6	608.5	-	-	-
6/26	MALE	35	60.3	616.3	-	-	-	23	39.6	608.9	12	20.7	630.4	-	-	-
	FEMALE	23	39.7	592.0	-	-	-	16	27.6	593.9	7	12.1	587.7	-	-	-
	SUBTL	58	100.0	601.5	-	-	-	39	67.2	602.7	19	32.8	614.7	-	-	-
6/30	MALE	32	55.2	604.3	-	-	-	26	44.8	601.2	6	10.3	618.2	-	-	-
	FEMALE	26	44.8	583.2	-	-	-	16	27.6	574.1	10	17.2	597.6	-	-	-
	SUBTL	58	100.0	594.8	-	-	-	42	72.4	590.9	16	27.6	605.3	-	-	-
7/3	MALE	24	40.0	604.0	1	1.7	520.0	10	16.7	600.2	13	21.7	613.3	-	-	-
	FEMALE	36	60.0	577.2	-	-	-	28	46.7	570.8	8	13.3	599.6	-	-	-
	SUBTL	60	100.0	587.9	1	1.7	520.0	38	63.3	578.5	21	35.0	608.1	-	-	-
7/7	MALE	26	45.6	584.6	-	-	-	19	33.3	574.2	7	12.3	612.9	-	-	-
	FEMALE	31	54.4	565.6	-	-	-	15	26.3	561.9	16	28.1	569.2	-	-	-
	SUBTL	57	100.0	574.3	-	-	-	34	59.6	568.8	23	40.4	582.5	-	-	-
7/10	MALE	23	39.7	589.3	-	-	-	18	31.0	587.8	5	8.6	594.6	-	-	-
	FEMALE	35	60.3	559.3	1	1.7	500.0	28	48.3	558.8	6	10.3	571.3	-	-	-
	SUBTL	58	100.0	571.2	1	1.7	500.0	46	79.3	570.1	11	19.0	581.9	-	-	-
7/14	MALE	31	54.4	601.5	-	-	-	15	26.3	588.1	15	26.3	609.7	1	1.8	620.0
	FEMALE	26	45.6	595.6	-	-	-	10	17.5	585.6	16	28.1	601.8	-	-	-
	SUBTL	57	100.0	598.8	-	-	-	25	43.9	587.1	31	54.4	605.6	1	1.8	620.0
7/21	MALE	18	33.3	584.5	-	-	-	17	31.5	584.8	1	1.9	580.0	-	-	-
	FEMALE	36	66.7	553.8	1	1.9	559.0	29	53.7	551.4	6	11.1	564.3	-	-	-
	SUBTL	54	100.0	564.0	1	1.9	559.0	46	85.2	563.7	7	13.0	566.5	-	-	-
TOTAL	MALE	222	48.3	601.0	1	0.2	520.0	145	31.5	593.7	75	16.3	615.5	1	0.2	620.0
	FEMALE	238	51.7	574.4	2	0.4	529.5	156	33.9	568.8	80	17.4	586.7	-	-	-
	TOTAL	460	100.0	586.6	3	0.7	526.3	301	65.4	580.8	155	33.7	600.7	1	0.2	620.0

Table 4. Daily salmon migration past Kwiniuk River counting tower, 1981: CHINOOK

Date	Daily Count	Cumulative
6/19	0	0
6/20	0	0
6/21	0	0
6/22	0	0
6/23	0	0
6/24	2	2
6/25	12	14
6/26	2	16
6/27	0	16
6/28	3	19
6/29	6	25
6/30	6	31
7/1	2	33
7/2	4	37
7/3	19	56
7/4	15	71
7/5	1	72
7/6	9	81
7/7	4	85
7/8	8	93
7/9	16	109
7/10	5	114
7/11	2	116
7/12	4	120
7/13	0	120
7/14	4	124
7/15	2	126
7/16	1	127
7/17	0	127
7/18	1	128
7/19	1	129
7/20	1	130
7/21	0	130
7/22	0	130
7/23	1	131
7/24	0	131
7/25	0	131
7/26	2	133
7/27	0	133
7/28	0	133
7/29	0	133
7/30	1	134

Table 4. cont.

Date	Daily Count	Cumulative
7/31	2	136
8/1	0	136
8/2	0	136
	136	136

Table 5 Actual and Expanded daily Salmon Migration, Kwiniuk River, 1981

Date	CHUM Actual Count	CHUM Expanded Count 1/	PINK Actual Count	PINK Expanded Count 1/
6/19	96	96	16	16
6/20	58	59	38	40
6/21	32	32	-24	-23
6/22	.011 282	282	.053 19	19
6/23	474	479	47	49
6/24	1436	1452	194	204
6/25	1015	1026	157	165
6/26	1120	1132	228	240
6/27	567	567	216	200
6/28	60	60	117	108
6/29	471	471	287	266
6/30	1381	1381	460	426
7/1	.000 735	735	-.074 339	339
7/2	203	203	334	309
7/3	3655	3655	1563	1563
7/4	1884	1884	2984	2763
7/5	-209	-207	-116	-117
/6	1801	1823	5194	5210
7/7	1316	1328	4169	4182
7/8	.009 343	343	.003 4007	4007
7/9	2964	2991	13361	13401
7/10	525	530	2835	2844
7/11	395	399	5917	5935
7/12	2185	2183	14111	14111
7/13	961	960	8950	8951
7/14	1785	1783	16695	16695
7/15	1562	1560	21549	21549
7/16	-.001 842	842	.000 32658	32659
7/17	710	709	35565	35565
7/18	903	907	31503	31503
7/19	470	477	17832	18367
7/20	1203	1220	48380	49831
7/21	.014 797	797	.030 43404	43404
7/22	190	193	27003	27813
/23	989	1003	67653	69683

Table 3 (con't)

Date	CHUM Actual Count	CHUM Expanded Count	PINK Actual Count	PINK Expanded Count
7/24	573	581	79425	81808
7/25	286	290	47260	48678
7/26	80	81	3780	3893
7/27	108	110	5912	6089
7/28 2/	0	0	-308	-92
7/29 2/	38	101	3396	8531
7/30	19	19	1609	1657
7/31	11	11	1635	1689
8/1	8	13	730	1175
8/2	3	5	515	829
	34327	34561 6	551710	566417 534

1/ Actual Count expanded by factor found during weekly 24 hour count, factor shown in actual count column.

2/ Counts adjusted to account for missed hours using the two nearest complete sample days.

Table 6. Water temperatures and pink and chum migration percentages Kwiniuk River, 1981

Date	Temperature celsius	Pink % of migration	Chum % of migration
6/19	no data	0.0	0.3
6/20	no data	0.0	0.2
6/21	no data	0.0	0.1
6/22	no data	0.0	0.8
6/23	no data	0.0	1.4
6/24	no data	0.0	4.2
6/25	no data	0.0	3.0
6/26	12.2	0.0	3.3
6/27	10.0	0.0	1.7
6/28	10.0	0.0	0.2
6/29	13.3	0.1	1.4
6/30	12.2	0.1	4.0
7/1	10.6	0.1	2.1
7/2	11.1	0.1	0.6
7/3	11.1	0.3	10.7
7/4	10.0	0.5	5.5
7/5	8.9	0.0	-0.6
7/6	8.9	0.9	5.2
7/7	10.0	0.8	3.8
7/8	8.9	0.7	1.0
7/9	9.5	2.4	8.6
7/10	10.0	0.5	1.5
7/11	10.6	1.1	1.1
7/12	11.1	2.6	6.4
7/13	12.2	1.6	2.8
7/14	12.2	3.0	5.2
7/15	12.2	3.0	4.6
7/16	13.3	5.9	2.5
7/17	11.1	6.5	2.1
7/18	10.0	5.7	2.6
7/19	13.3	3.2	1.4
7/20	12.2	8.8	3.5
7/21	12.2	7.7	2.3
7/22	12.2	4.9	0.6
7/23	15.0	12.3	2.0
7/24	16.2	14.4	1.7
7/25	16.2	8.6	0.8
7/26	15.0	0.7	0.2
7/27	12.8	1.1	0.3
7/28	11.1	-0.1	0.0
7/29	10.0	0.6	0.1
7/30	11.1	0.3	0.1
7/31	11.1	0.3	0.0
8/1	10.0	0.1	0.0
8/2	11.1	0.1	0.0

Table 7. 30 minute Estimated Count/Actual Count

Date	Chum	Pink	Date	Chum	Pink
6/24	1.31	1.12	7/21	1.01	1.01
6/25	.99	.74	7/22	.96	.88
6/26	1.27	.91	7/23	1.05	.99
6/27	1.15	.81	7/24	1.03	1.00
6/28	.93	.72	7/25	1.08	1.09
6/29	.92	.97	7/26	.85	1.07
6/30	1.08	1.03	7/27	.96	.87
7/1	1.00	1.13	7/28	1.00 1/	1.03 1/
7/2	.93	.98	7/29	.89	1.06
7/3	.91	.94	7/30	1.05	.83
7/4	1.11	1.04	7/31	.73 1/	.93
7/5	1.44 1/	3.15 1/	8/1	.75 1/	.84
7/6	1.02	1.04	8/2	- 1/	.96
7/7	.95	.99	8/3		
7/8	.98	1.01			
7/9	1.08	1.12			
7/10	1.12	1.10			
7/11	.99	1.11			
7/12	1.00	.98			
7/13	.98	1.02			
7/14	.86	.95			
7/15	.88	1.00			
7/16	.94	.91			
7/17	.98	1.03			
7/18	1.04	1.06			
7/19	.89	.98			
7/20	1.02	.95			

1/ Actual count of less than 10

Appendix Table 1. Daily total cumulative salmon escapements, Kwiniuk River, 1965-1979.

Species	Date	1965	1966	1967	1968	1969
CHUM	6/18	5				
	6/19		24			
	6/20		50			
	6/21		158			
	6/22		506			
	6/23		759			
	6/24		1,048	5		
	6/25		597	24	66	
	6/26		1,060	77	231	57
	6/27	213	1,189	270	1,066	113
	6/28	983	1,697	315	1,812	427
	6/29	2,576	1,768	1,455	2,838	571
	6/30	3,443	2,180	2,148	3,309	1,475
	7/1	7,741	5,728	2,739	4,443	2,057
	7/2	8,794	7,619	3,027	5,971	2,744
	7/3	9,988	8,054	3,491	5,914	3,361
	7/4	11,050	10,050	5,647	8,427	6,056
	7/5	12,078	11,958	6,157	9,409	7,137
	7/6	12,602	13,184	9,605	10,247	8,107
	7/7	13,445	13,703	13,088	12,428	9,314
	7/8	13,824	15,703	15,691	15,033	10,568
	7/9	15,630	17,703	18,513	16,720	11,727
	7/10	19,147	17,472	21,487	18,003	12,197
	7/11	22,818	19,531	23,439	18,284	12,577
	7/12	23,491	25,549	25,165	18,349	13,200
	7/13	26,444	27,225	26,473	18,415	14,198
	7/14	32,026	27,579	26,459	18,431	14,379
	7/15	32,190	28,604	26,532	18,564	16,057
	7/16	32,437	28,336	26,584	18,590	16,634
	7/17	32,503	28,384	26,598	18,601	17,117
	7/18	32,861	29,965	26,625	18,636	18,345
	7/19		31,584	26,631	18,760	18,707
	7/20		32,154	26,681	18,315	18,918
	7/21		32,389	26,661	18,347	19,233
	7/22		32,723		18,907	19,373
	7/23		32,938		18,951	19,390
	7/24		33,030		19,976	19,325
	7/25		33,137			19,554
	7/26		33,153			19,749
	7/27		33,153			
	7/28		33,184			
	7/29		33,192			
		-6,227 2/	-396 2/	-2,222 2/	-163 2/	-62 2/
		26,634	32,786	24,444	18,813	19,687

1/1970 was the first year of 13-hour counts, 12 noon until 5AM the next day. The average escapement for the hours from 5AM until 12 noon for the years 1965-1969 was 2.1 percent of the total escapement for chums and 3.56 percent for pink salmon.

2/Subsistence catch.

Appendix Table 1. (continued) Daily total cumulative salmon escapements, Twitchuk River, 1965-1979.

Species	Date	1970	1971	1972	1973	1974	1975
CHM	6/18						
	6/19					16	
	6/20					79	
	6/21					80	
	6/22					202	
	6/23					479	
	6/24					950	
	6/25	2			11	1,113	
	6/26	17	23		13	3,316	
	6/27		51		17	5,047	
	6/28		95	11	17	6,942	
	6/29	645	139	51	17	8,358	
	6/30	2,302	196	158	26	9,805	
	7/1	3,327	452	697	97	11,256	
	7/2	6,420	728	1,375	207	13,776	
	7/3	14,467	1,181	1,607	402	15,674	
	7/4	20,873	3,362	2,793	1,514	16,985	72
	7/5	26,699	4,783	4,143	4,545	17,972	363
	7/6	30,396	6,178	5,314	4,933	19,061	728
	7/7	31,468	6,631	9,277	5,075	19,479	835
	7/8	34,695	10,677	12,100	8,495	19,766	985
	7/9	40,012	11,539	14,384	8,870	20,126	1,136
	7/10	40,362	13,401	16,242	15,022	20,347	1,446
	7/11	44,180	16,902	17,337	15,337	21,633	1,587
	7/12	47,305	18,694	21,735	16,303	22,745	2,046
	7/13	47,738	19,346	22,997	16,776	23,682	2,354
	7/14	50,304	20,566	24,998	18,944	25,084	3,430
	7/15	56,943	20,858	25,589	19,566	31,243	5,151
	7/16	60,275	21,909	25,305	20,138	32,179	7,395
	7/17	62,577	26,955	26,133	22,396	32,570	9,497
	7/18	63,065	27,336	27,284	24,075	33,388	10,443
	7/19	63,624	30,680	27,993	25,227	33,391	11,919
	7/20	65,673	33,300	28,371	26,995	34,084	12,676
	7/21	65,717	34,473	28,502	27,304	34,209	13,435
	7/22	66,062	35,237	29,020	27,341	34,294	13,809
	7/23	66,176	35,310	29,458	27,370	34,676	13,962
	7/24	66,336	36,195	29,756	28,008	34,979	14,033
	7/25	66,345	36,959	29,995	28,029	35,130	14,049
	7/26	66,384	37,680	30,005		35,161	
	7/27	66,399	38,107				
	7/28	66,602	38,186				
	7/29	66,604	38,243				
		x 2.1[illegible]1/	x 2.1[illegible]1/	x 2.1[illegible]1/	x 2.1[illegible]1/	x 2.1[illegible]1/	x 2.1[illegible]1/
Expanded		1,400	803	631	588	738	295
Escapement		+66,604	+38,243	+30,053	+28,029	+35,151	+14,049
Total		68,004	39,046	30,686	28,617	35,899	14,344
Expanded			- 367 2/				
Escapement			38,679				

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River. 1965-1981.

Species	Date	1976	1977	1978 3/	1979 3/	1980
CHUM	6/18					
	6/19					
	6/20					
	6/21					
	6/22					0
	6/23					10
	6/24					54
	6/25					201
	6/26					339
	6/27		12		14	390
	6/28	6	271		188	639
	6/29	31	468		294	985
	6/30	33	678		1923	1099
	7/01	105	2095		2185	3579
	7/02	134	2924		2316	3529
	7/03	195	4133		2588	3436
	7/04	426	4607	591	2842	3651
	7/05	746	6065	1498	2884	5268
	7/06	884	7049	3163	3228	6721
	7/07	1095	8295	4203	3406	8050
	7/08	1515	11949	5320	3594	10965
	7/09	1622	14680	6112	4508	11569
	7/10	1776	16207	6812	5216	12103
	7/11	2160	18118	7496	5418	12701
	7/12	2639	19264	8754	5528	13800
	7/13	3343	19445	9181	6236	15468
	7/14	3459	19867	9448	6866	15222
	7/15	3872	20601	10173	8141	15457
	7/16	4239	20716	10470	9196	15750
	7/17	4800	20999	10564	9757	16505
	7/18	4899	21245	10830	8910	17161
	7/19	5112	21492	10827	10272	17745
	7/20	5419	21643	10891	10688	18272
	7/21	5773	21815	10952	11275	18686
	7/22	6021	22083	10957	11938	18771
	7/23	6300	22189		12027	18894
	4/24	6384	22255		12069	18931
	7/25	6484	22289		12101	18960
	7/26	6675				18964
	7/27	6732				18971
	7/28	6770				18974
	7/29	6804				
	7/30	6813				
	7/31	6834				
		x 2.1%	x 2.1%	x 2.1%	x 2.1%	x 2.1%
Expanded		143	468	230	254	400
Escapement		+6834	+22,289	+10957	+12101	+18974
Total		6977	22,757	11187	12355	19374
Expanded		-511 2/				
Escapement		6466		14408 4/		

3/ Corrected figures. Expanded to compensate for missing hourly counts.

4/ Point estimate (range 13698-15120). Expanded figure to compensate for fish not counted before 7/4 and after 7/22.

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River.

Species	Date	1981
CHUM	6/18	
	6/19	96
	6/20	154
	6/21	186
	6/22	465
	6/23	939
	6/24	2375
	6/25	3390
	6/26	4510
	6/27	5077
	6/28	5137
	6/29	5608
	6/30	6989
	7/01	7724
	7/02	7927
	7/03	11582
	7/04	13466
	7/05	13257
	7/06	15058
	7/07	16374
	7/08	16714
	7/09	19678
	7/10	20203
	7/11	20598
	7/12	22783
	7/13	23744
	7/14	25539
	7/15	27091
	7/16	27933
	7/17	28643
	7/18	29546
	7/19	30016
	7/20	31219
	7/21	32005
	7/22	32195
	7/23	33184
	4/24	33757
	7/25	34043
	7/26	34123
	7/27	34231
	7/28	34231
	7/29	34269
	7/30	34288
	7/31	34299
	8/1	34307
	8/2	34310
		34561 5/

5/ Expanded using weekly 24 hour counts to compensate for 6 AM - 12 noon counts.

Appendix Table 1. Daily and cumulative salmon escapements, Kenai River, 1965-1979
(continued)

Species	Date	1965	1966	1967	1968	1969
PINK	6/18					
	6/19					
	6/20					
	6/21					
	6/22					
	6/23					
	6/24					
	6/25					
	6/26					17
	6/27					19
	6/28	174			48	41
	6/29	250			214	52
	6/30	220			534	117
	7/1	276		1	735	131
	7/2	314	11	3	1,330	232
	7/3	349	29	4	1,732	378
	7/4	396	317	6	2,501	1,165
	7/5	388	317		3,141	2,259
	7/6	390	533		4,777	3,974
	7/7	412	568	13	13,719	6,415
	7/8	388	607	45	38,560	8,683
	7/9	650	673	521	67,509	11,406
	7/10	820	683	718	81,776	12,684
	7/11	1,120	722	1,282	105,997	13,539
	7/12	1,526	758	1,926	112,984	15,447
	7/13	1,653	817	2,685	113,323	18,250
	7/14	2,356	898	3,138	113,247	19,379
	7/15	4,488	1,205	3,160	114,504	25,056
	7/16	7,301	1,008	3,320	115,018	27,350
	7/17	7,456	1,206	3,348	117,172	34,863
	7/18	7,571	1,771	3,380	121,392	37,840
	7/19	8,668	3,259	3,406	124,510	43,397
	7/20		3,864	3,432	125,848	47,626
	7/21		4,190	3,367	127,088	51,943
	7/22		5,338	3,387	128,002	54,177
	7/23		6,777		129,466	54,772
	7/24		7,843		129,052	55,741
	7/25		10,015			56,217
	7/26		10,691			57,497
	7/27		10,798			
	7/28		10,364			
	7/29					
		-367 2/	-215 2/	-79 2/	-2,298 2/	-614 2/
		8,301	10,629	3,308	126,764	56,583

2/Subsistence catch.

Appendix Table 1. Daily total cumulative salmon escapements, Kvichak River, 1965–1979.
(continued)

Species	Date	1970	1971	1972	1973	1974
Pink	6/18					
	6/19					
	6/20					1
	6/21					2
	6/22					39
	6/23					223
	6/24					464
	6/25	3			322	539
	6/26	13			831	1,313
	6/27	16			1,053	2,436
	6/28	17	9	15	1,276	3,455
	6/29	47	12	48	1,413	5,390
	6/30	198	31	513	1,575	8,306
	7/1	298	125	1,490	1,762	10,047
	7/2	465	182	2,780	1,854	12,312
	7/3	1,096	241	2,899	1,938	14,668
	7/4	4,643	532	4,210	2,190	17,574
	7/5	10,949	819	7,564	3,491	19,180
	7/6	20,413	1,221	10,521	3,556	21,600
	7/7	20,159	1,327	21,264	3,631	22,668
	7/8	25,359	2,343	27,662	4,795	23,385
	7/9	30,729	2,490	35,297	4,979	23,781
	7/10	31,459	3,061	39,082	7,079	24,187
	7/11	39,601	5,963	42,329	7,327	24,764
	7/12	50,921	6,462	47,520	8,539	25,504
	7/13	52,800	6,994	49,581	9,281	26,840
	7/14	59,521	7,418	52,553	12,312	29,336
	7/15	90,681	7,519	53,539	13,393	33,294
	7/16	127,335	7,732	53,923	14,569	34,160
	7/17	148,750	9,646	54,483	18,347	34,302
	7/18	155,935	10,401	55,674	21,214	35,590
	7/19	161,963	12,470	57,721	27,748	36,313
	7/20	179,160	13,938	57,698	30,789	36,920
	7/21	185,247	14,571	57,997	32,842	37,086
	7/22	198,958	15,123	59,024	33,249	37,298
	7/23	208 403	15,309	59,576	35,112	38,101
	7/24	214,223	15,485	59,892	36,956	38,668
	7/25	222,209	15,538	60,147	37,070	39,263
	7/26	225,546	15,318	60,246		39,375
	7/27	226,712	15,996	60,256		
	7/28	226,329	16,089			
	7/29	226,831	16,151			
		x 3.66%1/	x3.66%1/	x3.66%1/	x3.66%1/	x3.66%1/
		8,300	59	2,205	1,356	1,441
Expanded		226,831	+16,151	+60,256	+37,070	+39,375
Escapement		235,131	16,742	62,461	38,426	40,816
			-108 2/			
Total Expanded Escapement			16,634			

1/1970 was the first year of 18-hour counts, 12 noon until 6AM the next day. The average escapement for the hours from 6AM until 12 noon for the years 1965–1969 was 2.1 percent of the total escapement for chums and 3.66 percent for pink salmon.

2/Subsistence catch.

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River, 1965-1981.

Species	Date	1975	1976	1977	1978	1979	1980
PINK	6/18						
	6/19						
	6/20						
	6/21						
	6/22						0
	6/23						3
	6/24						20
	6/25						34
	6/26						43
	6/27			17			48
	6/28		213	35		17	75
	6/29		406	116		17	116
	6/30		439	191		213	130
	7/01		702	313		572	812
	7/02		781	491		605	601
	7/03		1004	592		1051	708
	7/04		1756	699	98	1531	1323
	7/05		2763	884	460	1662	2561
	7/06	79	3300	1240	1473	2683	3952
	7/07	185	4229	2037	2341	5062	7476
	7/08	176	5869	2707	3142	6547	35832
	7/09	294	6942	5478	4487	9744	41967
	7/10	584	8034	9435	7227	12746	53421
	7/11	820	9903	21882	9475	14356	62417
	7/12	959	11105	27876	18087	15615	78464
	7/13	1001	14384	30466	26128	20113	115995
	7/14	1013	14982	33086	28619	27872	111660
	7/15	1304	16072	37508	37930	44290	119532
	7/16	1770	16947	38005	41055	63390	130144
	7/17	2529	19185	39530	45077	75904	160738
	7/18	5183	19692	40232	52343	82253	187484
	7/19	10772	20121	40926	54786	100508	226843
	7/20	22354	20956	41460	60573	113462	254669
	7/21	38220	22084	42361	60273	134349	285090
	7/22	45466	23038	43467	69719	153686	291675
	7/23	50902	24663	44236		158229	299332
	7/24	52935	25170	44479		160871	301695
	7/25	54838	25710	44602		161578	305246
	7/26	55293	26411				307044
	7/27		27045				308736
	7/28		27333				309077
	7/29		27549				
	7/30		28063				
	7/31		28307				
	8/1		28431				

	1975	1976	1977	1978	1979	1980
	x 3.66%	x 3.66%	x 3.66%	x 3.66%	x 3.66%	x 3.66%
	2024	1040	1632	2551	5914	11312
Expanded	+55293	+28431	+44602	+69719	+161578 3/	+309077
Escapement	57317	29471	46234	72270 3/	167492 3/	320389
		- 1381 2/				
Total Expanded Escapement		28087		75993 4/		

2/ Subsistence catch.

3/ Corrected figure. Expanded to compensate for missing hourly counts.

4/ Expanded to compensate for an estimated 9% of total pink escapement not counted after 7/22.

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River.

Species	Date	1981
PINK	6/18	
	6/19	16
	6/20	54
	6/21	30
	6/22	48
	6/23	95
	6/24	289
	6/25	446
	6/26	674
	6/27	890
	6/28	1007
	6/29	1294
	6/30	1754
	7/01	2118
	7/02	2452
	7/03	4015
	7/04	6999
	7/05	6883
	7/06	12077
	7/07	16246
	7/08	20240
	7/09	33601
	7/10	36436
	7/11	42353
	7/12	56464
	7/13	65414
	7/14	82109
	7/15	103658
	7/16	136304
	7/17	171869
	7/18	203372
	7/19	221204
	7/20	269584
	7/21	311694
	7/22	338697
	7/23	406350
	7/24	485775
	7/25	533035
	7/26	536815
	7/27	542727
	7/28	542419
	7/29	545815
	7/30	547424
	7/31	549039
	8/1	549776
	8/2	550283
Expanded Total		566417 5/

5/ Expanded using weekly 24 hour counts to compensate for 6 AM - 12 noon counts.