

Kwiniuk River
Salmon Enumeration Studies
1976

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Abstract

The Kwiniuk River salmon counting tower completed its twelfth season of operation in 1976. Kwiniuk River total expanded escapement in 1976 was 6,466 chum salmon (Oncorhynchus keta), 28,087 pink salmon (O.gorbuscha). An unexpanded escapement of 12 king salmon (O.tschawytscha) and 12 coho salmon (O.kisutch) was also enumerated past the tower. Chum salmon escapement to the Kwiniuk River was the lowest in the project's history and represented the second consecutive below average escapement.

Aerial surveys were conducted of the Kwiniuk and Tubutulik Rivers in conjunction with counting tower operations. Commercial and subsistence catch sampling was accomplished to collect age, sex and size information of the chum salmon.

Introduction

A salmon counting tower project was initiated in 1965 on the Kwiniuk River, approximately 110 miles east of Nome and five miles from Moses Point (Figure 1). The present site is located approximately 200 yards downstream from sites utilized during 1965-1974 (Figure 2). The Kwiniuk River, similar to other major rivers in Norton Sound, receives moderate runs of chum and pink salmon which are harvested by subsistence and commercial fishermen. Effective

management of local stocks requires frequent in-season escapement estimates obtained by aerial survey counts or tower counts. Tower counts are more accurate and provide a check on aerial surveys conducted.

Objectives

The 1976 project objectives were to:

1. Obtain daily and seasonal timing and magnitude of salmon escapements.
2. Periodically sample the Moses Point commercial salmon catch and the Kwiniuk River escapement for age, sex and size composition.
3. Determine feasibility of assessing age composition of king salmon escapements by visual length categorization.

Methods and Materials

A portable 20 foot aluminum counting tower was erected on the south bank of the Kwiniuk River approximately five miles upstream from the mouth (Figure 2). The base legs were attached to two feet square plywood boards and the tower was firmly guyed to increase stability.

A 50 foot weir of one-inch chicken wire was constructed to

divert upstream migrants towards the counting tower. The weir extended from a sandbar on the north side of the river to a flash panel, which it overlapped by approximately three feet. The structure was supported by seven foot fence stakes placed in the substrate at three foot intervals and guyed from additional stakes ten feet upriver from the weir. Chicken wire was rolled out along supporting stakes, fastened and anchored at the bottom with sandbags. Stakes were extended deeper into the substrate later in the season due to river wash out under the weir.

A 60'x50' white canvas background panel was placed on the river substrate to enhance counting visibility. It was secured by 1/4-inch wire cable which was threaded through panel eyelets. The cable, weighted with sandbags at three foot intervals, was anchored from two fence stakes, one below the tower and the other in mid-stream.

Facsimiles of king salmon were painted on the background panel in lengths of 50, 60 and 80 centimeters to provide an immediate reference for estimating the length of migrating king salmon.

A powerline with three 400-watt bulbs housed in 18-inch diameter reflectors was strung across the main channel to provide illumination during periods of darkness and overcast. A heavy tripod, weighted with sandbags, was positioned on the sandbar opposite the tower. A rope was run from the tower to the top of the tripod. The powerline was attached onto the rope with loops and drawn across

the river to the tripod. An 1,800 watt generator provided electrical power for the lights.

A three person crew began 18-hour counting operations on June 28 and terminated counting operations on August 1. Each crew member counted salmon for two 3-hour shifts daily, from 1200 hours until 0600 hours the following day. Hourly counts were totaled and live salmon moving downstream were subtracted from the total.

Based upon research data from 1965 to 1969, when 24 hour counts were made, the average chum and pink salmon escapement during the non-counted hours from 0600 until 1200 hours was 2.1 and 3.66 percent of the total run, respectively. Eighteen hour counts made since 1970 were expanded by these percentages to estimate "expanded" salmon escapement past the tower. Known subsistence catches were subtracted from the expanded escapement to yield "total expanded" escapement figures. Small king and coho escapements were not expanded.

Ten-minute counts were made at the beginning of each counting hour to determine if 10-minute counts could be used as a basis for estimating hourly migration. Ten-minute counts were expanded by a factor of six to obtain an estimate of hourly migration.

At times it was impossible to make counts of salmon escapement due to inclement weather and turbid water conditions. These missing counts were expanded by averaging the last complete hourly/daily

count with the next complete hourly/daily count and multiplying by the number of days counts could not be made.

Salmon catches were periodically sampled for age, sex and size information at the commercial buying station near the river mouth. Salmon escapement was sampled with fish captured in beach seines by subsistence fishermen upstream from the counting tower.

Results

In 1976, an unexpanded total of 12 kings, 6,834 chum, 28,431 pink and 12 coho salmon was counted past the tower (Table 1). The peak of the chum salmon escapement occurred during July 11-July 17 with the first chum observed passing the tower on June 28. The pink salmon escapement peaked during July 10-July 16 with the first pink observed passing the tower on June 28 (Figure 3). Daily chum and pink salmon migration was heaviest at 2200-2400 hours daily (Figure 4). A majority of the observed king salmon escapement was noted between July 15-July 24, while coho salmon were counted during July 28-August 1.

Ten minute counts resulted in an expanded estimate of 8,508 chum and 35,226 pink salmon (Table 2).

A total of 213 chum salmon was sampled for age, sex and length data from the Moses Point subdistrict commercial fishery (Table 3). Weighted age composition of this sample was 37.1% age 4₁, and 62.9% age 5₁. Male to female ratio of the sample was 1.00:1.34. Samples

taken on July 28 yielded an age composition of age 3 γ , 4 γ and 5 γ chums of 31.8%, 36.4% and 31.8%, respectively. Chum salmon were sampled from the Kwiniuk River escapement. Age composition of this sample was 12.9% age 3 γ , 51.8% age 4 γ and 35.3% age 5 γ , with a male to female ratio of 1.52:1.00 (Table 4). The 12 king salmon passing the counting tower were estimated to length as follows; 0 (less than 50 cm); 1 (50 to 60 cm); 3 (60 to 80 cm) and 8 (greater than 80 cm) (Table 5).

An aerial survey conducted of the Tubutulik River via chartered Cessna 180 on July 8 yielded an estimated 496 chum and 1,259 pink salmon. A second survey taken in a Cessna 185 on July 15 yielded 1,095 chum, 6,065 pink and 2,600 salmon which could not be separated by species. An aerial survey of the Kwiniuk River was flown in a Cessna 185 on July 11 and yielded 268 chum and 1,735 pink salmon.

In 1976, commercial fishermen of the Moses Point subdistrict harvested 19 king, 10,813 chum, 5,072 pink and 233 coho salmon. Commercial fishing activity was conducted from June 24 until July 7 when the commercial salmon season was closed due to poor chum salmon escapements. This fishery was re-opened to commercial endeavors July 26, and closed August 28 after an additional 11 king, 123 pink, 356 chum and 233 coho salmon were taken. The subsistence harvest for this subdistrict was an estimated 22 king, 1,548 chum and 5,016 pink salmon.

Discussion

The expanded 1976 chum salmon escapement was 6,977, while the expanded pink salmon escapement was 29,471. A total of 511 chum and 1,381 pinks were captured by subsistence fishermen in the Kwiniuk River above the counting site, reducing the total expanded escapement to 6,466 chum and 28,087 pink salmon (Appendix Table 1).

The total expanded 1976 chum salmon escapement was the lowest recorded since the project's inception in 1965 and represented the second consecutive below average escapement. The chum salmon escapement was 79.3 percent below the previous ten-year average of 31,344 and 54.9 percent below the previous record low of 14,344 set in 1975. Total expanded chum salmon escapements were 78.9 percent below the 1972 brood year escapement. The total expanded pink salmon escapement of 28,087 was 56.7 percent below the previous ten-year average of 64,837 and 31.1 percent below the 1974 brood year escapement.

Daily Kwiniuk River water temperatures indicated a seasonal warming trend until early July when a period of overcast and rainfall resulted in colder water temperatures. Significant increases in water temperatures did not occur until July 8. Accelerated rates of chum and pink salmon migrations appear to have been triggered at this time (Table 6).

Schooling or milling of salmon off shore may have occurred during the period of cold water temperatures, thus enhancing catchability of salmon in the commercial fishery. This milling or schooling phenomenon and the fact that commercial fishermen almost exclusively target chum salmon, using large mesh gill nets, may have resulted in excessive numbers of chum salmon being caught. This may, in part, explain the high pink to chum ratio to the Kwiniuk River in 1976. In early July it was noted that escapement rates were seasonally lagging and the commercial chum salmon harvest rate was exceptionally high. An emergency order, issued July 8, closed Moses Point to commercial salmon fishing. During this closure, river water temperatures began warming and salmon escapement rates and numbers improved. By inspection of Figure 5, it appears the purpose of the commercial closure was too late for enhancing chum salmon escapement to the Kwiniuk River, especially in light of the overall poor escapement.

Comparison of expanded 10-minute tower counts made at the beginning of each counting hour and complete hour counts indicated relative errors of -24.5% and +23.9% for chum and pink salmon, respectively. These figures differed significantly from 1975 figures of +3.31% and -6.26%, however, a large relative error was expected due to the small escapements in 1976. Additional studies should be initiated before attempting to utilize this

method to determine salmon escapement past the Kwiniuk River counting tower.

Aerial survey totals were small in comparison to counting tower figures. This indicates additional comparisons should be made in future seasons to upgrade observer skills.

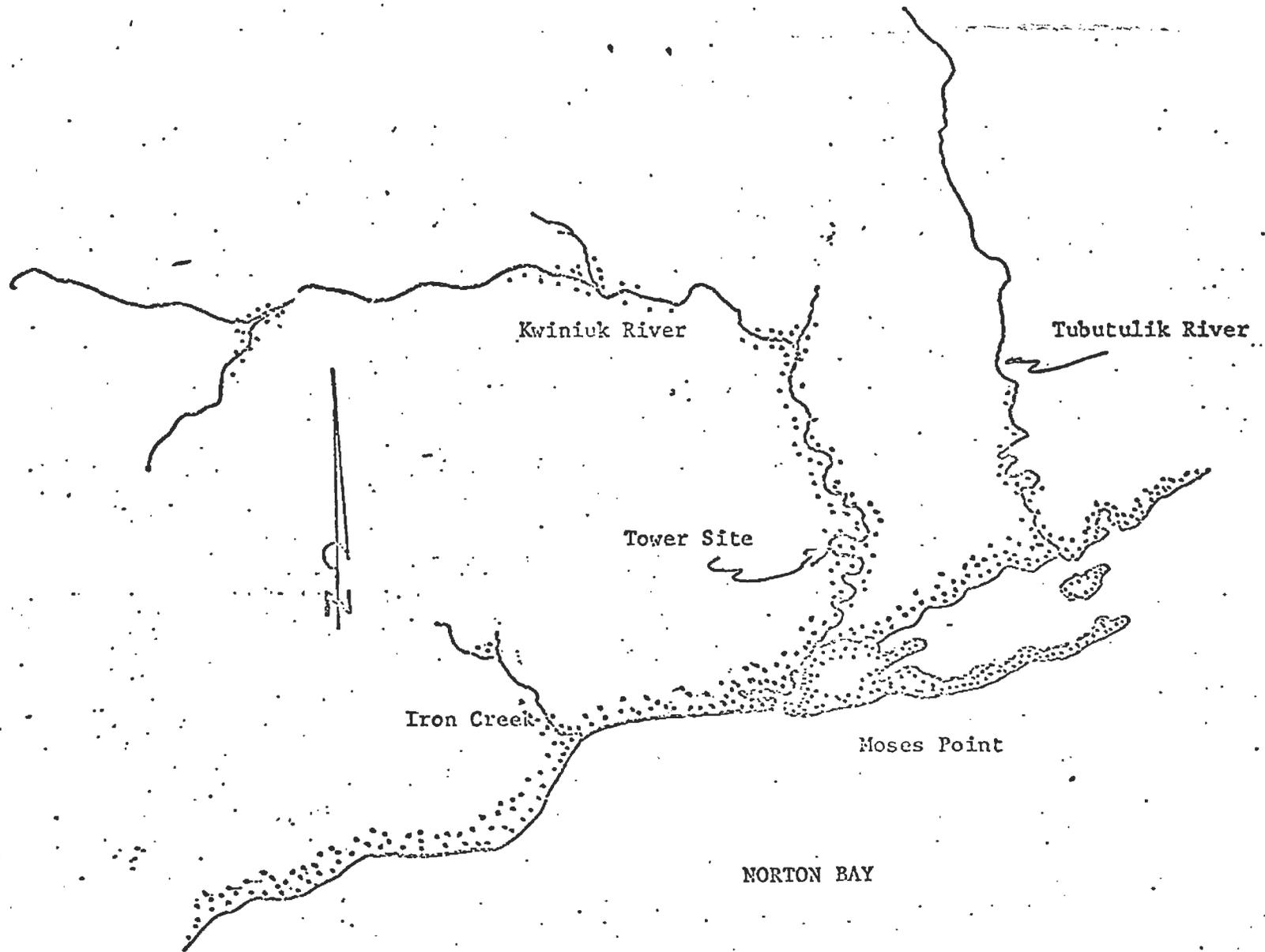


Figure 1. Salmon Counting Tower Location, Kwiniuk River, 1976.

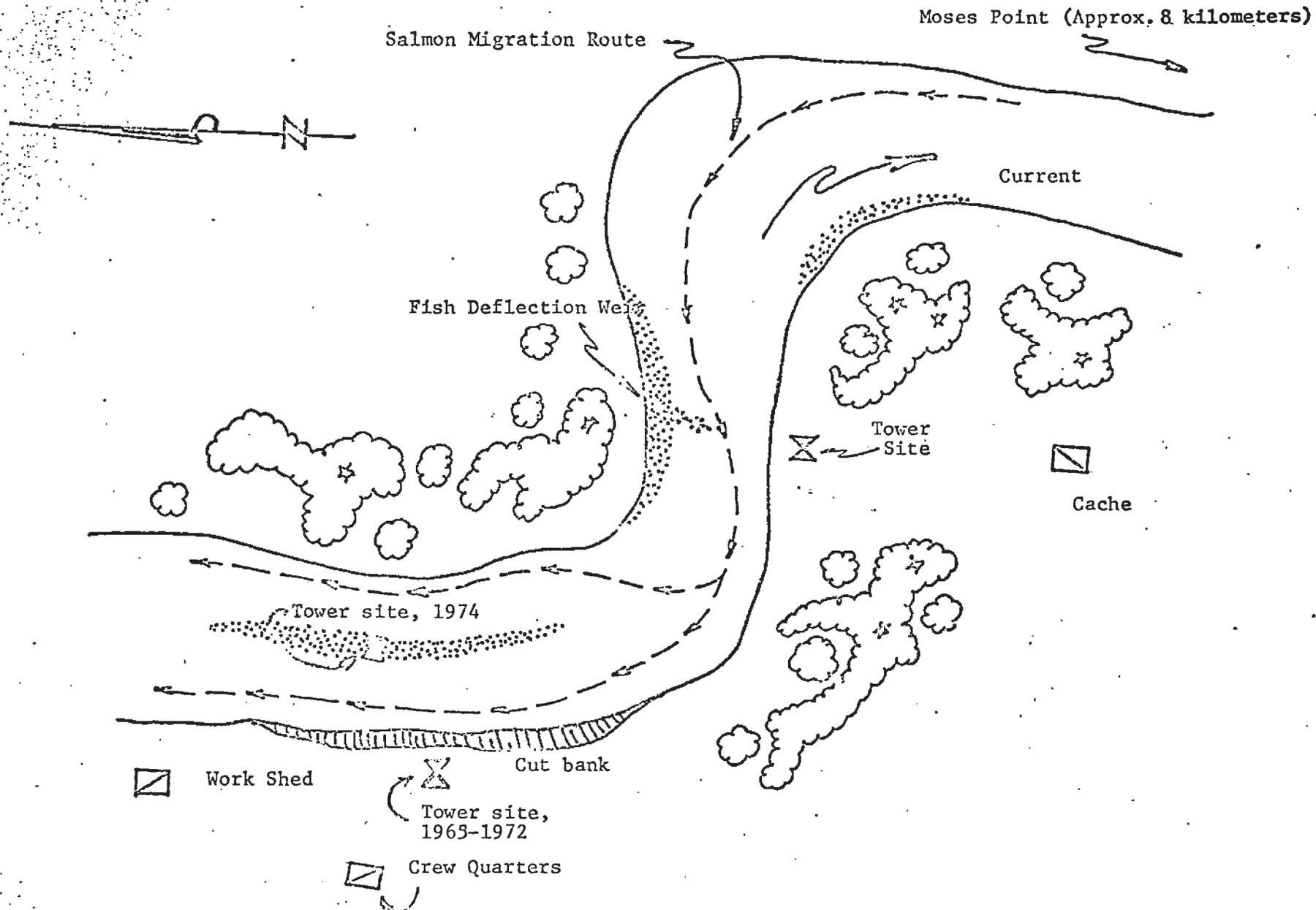


Figure 2. Kwiniuk River salmon counting tower site, 1976.

Figure 3. Daily salmon escapement past Kwiniuk River salmon counting tower, 1976.

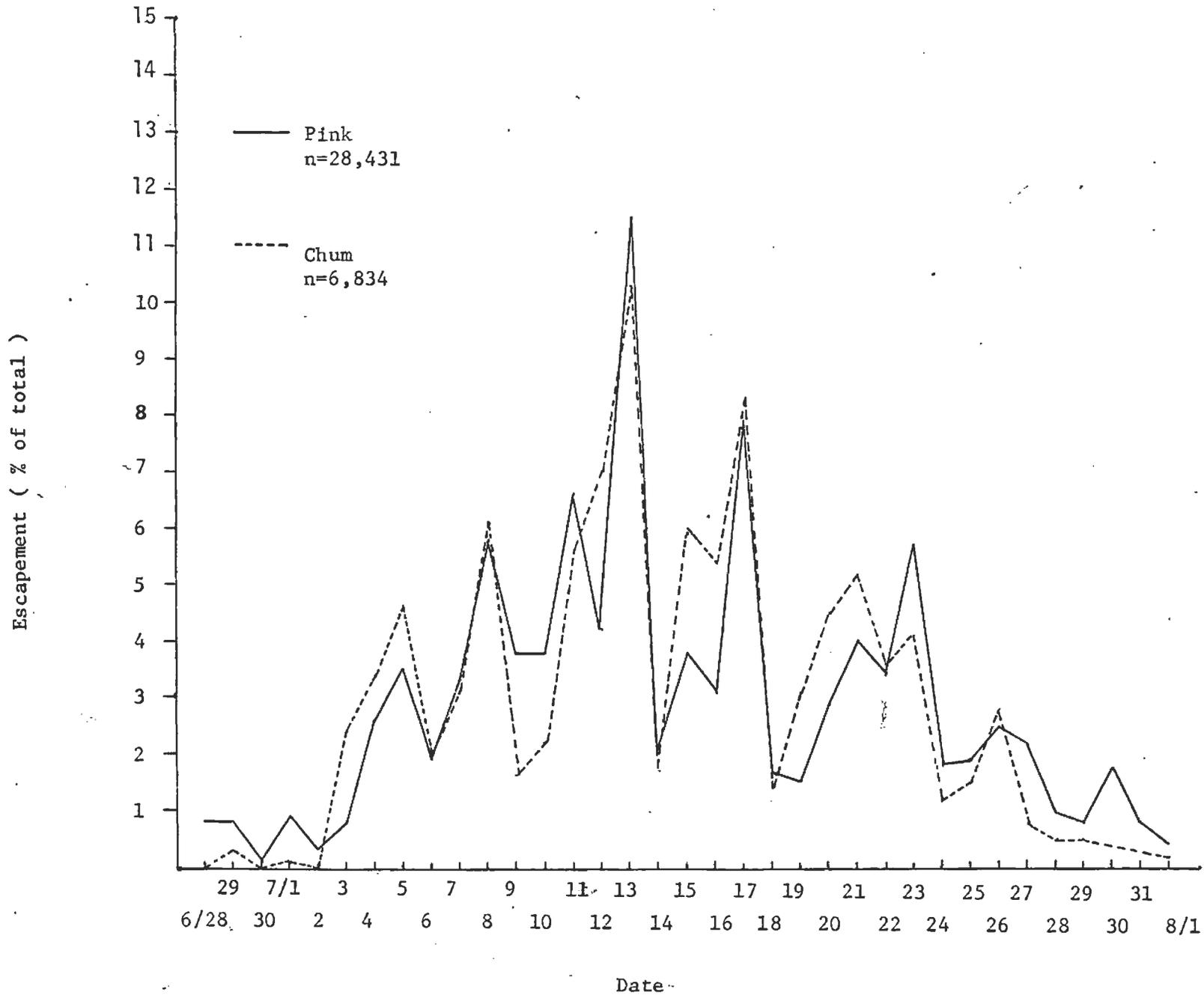


Figure 4. Hourly migration of chum and pink salmon enumerated past the Kwiniuk River salmon counting tower, 1976.

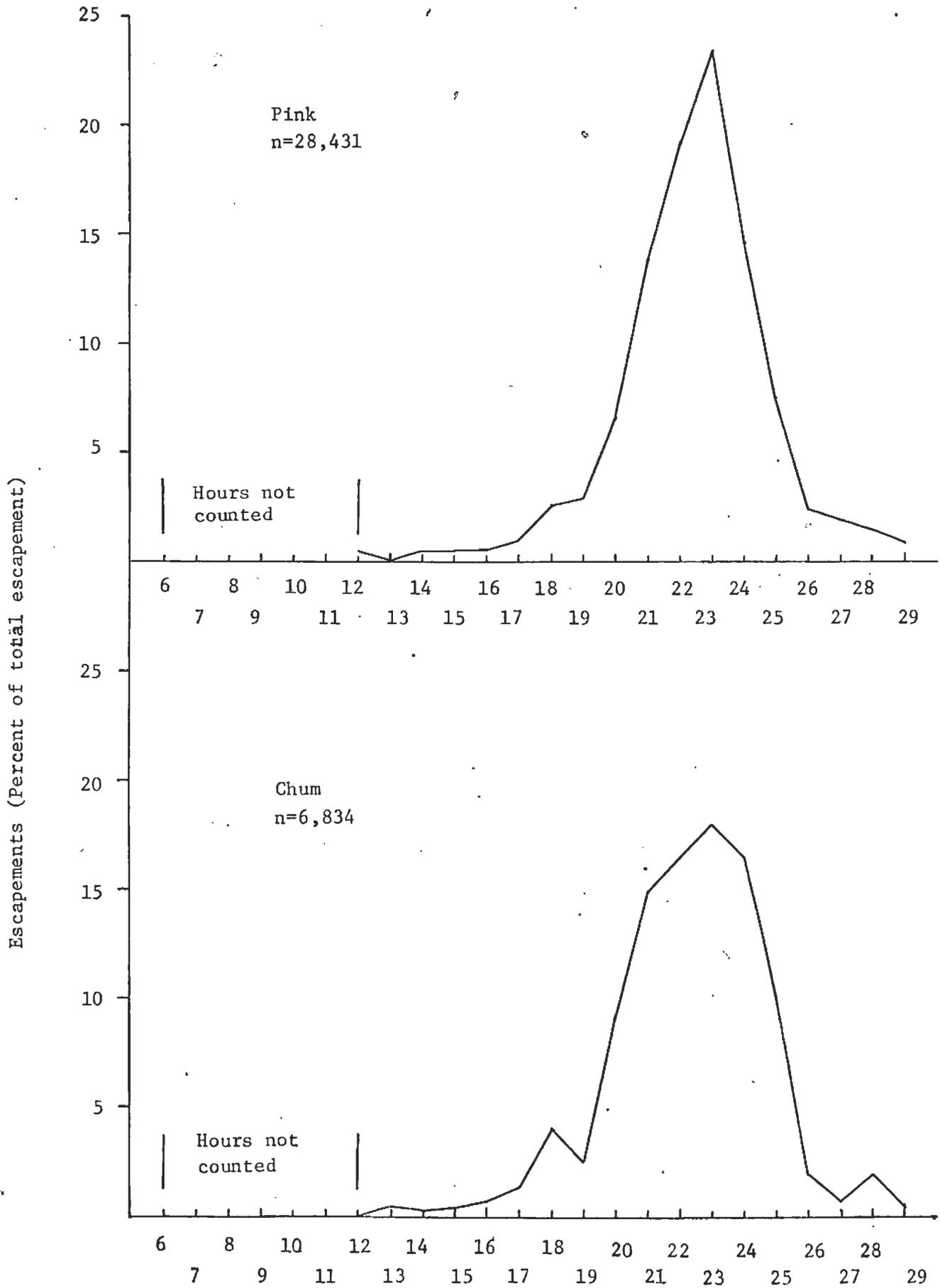


Figure 5 . Kwiniuk River water temperatures, salmon escapement and Moses Point commercial salmon harvest, by day, 1976.

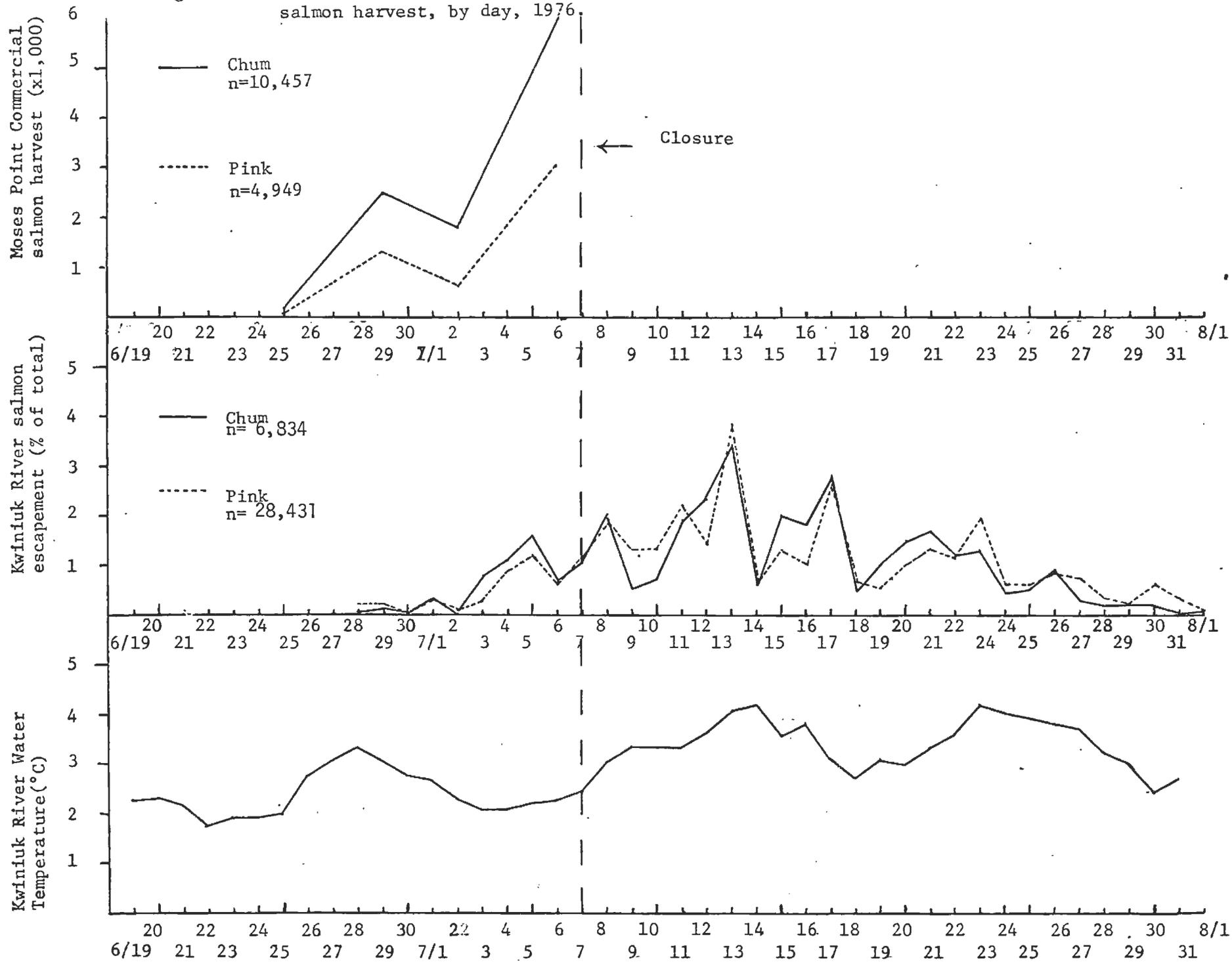


Table 1 . Daily/Hourly salmon migration past Kwiniuk River salmon counting tower, 1976

Species: Chum

Hour/ Date	0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	DAILY TOTAL
6/28	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	5	-	6
6/29	3	3	-	-	-	-	-	-	-	-	-	-	19	-	-	-	-	-	25
6/30	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
7/1	-	45	26	-2	2	-	-	-	-	-	-	-	-	-	-	-	1	-	72
7/2	-5	1	-67	-4	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-71
7/3	-	127	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-3	-	161
7/4	-9	-3	-	-	-	-	-	-	-	-	-	-	17	7	22	45	44	110	233
7/5	99	39	-	1	8	-	-	-	1	13	80	-	14	3	-	18	15	27	318
7/6	7	75	-	-	-	-	-	-	-	-	-	-	-	-1	-	4	16	37	138
7/7	41	28	24	-	-	-	-	-	-	-	-	-	17	2	12	-	42	45	211
7/8	28	11	5	-	-	1	-	1	2	5	3	4	99	45	130	56	28	2	420
7/9	2	1	13	-	3	1	-	-	-	-	-	-	-	4	12	26	29	16	107
7/10	12	7	1	24	2	-	1	-	-	-	-	-	-	8	14	14	111	42	154
7/11	58	8	5	11	-	1	-	-	-	-	-	-4	1	-	1	5	18	187	384
7/12	53	19	1	-	3	2	1	-	-	-	-	-5	-	4	232	143	131	8	479
7/13	83	107	1	-	-	-	-	-	-	1	14	95	29	1	-	2	66	240	704
7/14	87	3	3	-1	-	-1	-	-30	-	-	-18	-50	-	-10	6	20	72	41	116
7/15	9	11	-	-	-	-	-	-	-	-	-	-	-	-	19	103	77	199	413
7/16	119	45	-	-	56	3	-	-	-4	-11	-52	-17	-1	-	13	95	142	44	367
7/17	36	3	2	-	-	-	-	-	1	-1	-	-	-	-	81	295	4	6	565
7/18	55	10	-	-	7	-	-	-	1	-	-	1	-	-	10	6	4	1	95
7/19	4	1	-	-2	-	-	2	65	3	7	11	51	34	14	1	1	59	17	213
7/20	32	67	4	-	-	-	-	-	-	1	4	-	9	55	24	6	39	41	307
7/21	97	5	19	10	7	-	-	11	-1	4	-	-	15	13	6	74	93	55	354
7/22	21	33	34	2	10	1	-	-	-	-	-	-	-	-	-	22	15	32	248
7/23	125	25	7	3	10	-	-	-	-	-	-	-	-	-	13	23	54	11	279
7/24	44	-	-	-	-	-	-	-	-	-	1	-	-	-	-	7	2	21	84
7/25	64	7	-	4	1	-	-	-	-	-	-	-	-	-	-	-	64	22	100
7/26	29	2	-	-	2	-	-	-	6	-	1	4	-1	-1	-	3	1	80	191
7/27	15	7	-	-	18	9	-	-20	2	6	1	-	2	2	9	2	-	3	57
7/28	11	-	5	-	-	-	-	-	-	3	-	3	4	8	3	1	-	-	38
7/29	-	1	-	-	-	-	-	-	-	-	-	-	12	5	8	6	1	2	34
7/30	-2	3	2	1	-	-	-	-1	2	-1	-	-	1	-	3	-	2	-	9
7/31	1	-2	-	-	-	-	-	-	-	-	-	-	-	-	1	3	-	4	9
8/1	4	3	1	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	12
Hourly Total	1124	692	124	47	132	18	4	28	13	27	45	88	271	172	630	1011	1118	1290	6834
% of total		10.1		0.7		0.3		0.4		0.4		1.3		2.5		14.8		18.9	
Escapement	16.4		1.8		1.9		0.0		0.2		0.7		4.0		9.2		16.4		

Table 1 . Daily/hourly salmon migration past Kwiniuk River salmon counting tower, 1976

Species: Pin.

Hour	0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total
6/28	7	5								2	2	18	37	19	33	36	30	24	213
6/29	33	31	5	7	-3	16	-	2	1	4	-	5	42	18	1	9	3	19	193
6/30	2	5	2	-	1	6	3	2	-1	-	1	3	-	-	-	9	-		33
7/1	-1	75	7	-1	1	5	-	-	1	1	-	1	-	7	1	24	130	12	263
7/2	-5	7	-7	-2	-	-	-	-	-	-	-	-	-	-	1	5	18	62	79
7/3	3	167	45	-	-1	-	-	-	-	-	-	-	-	-	-	-	9	-	223
7/4	-2	-	3	-	2	-	-	-	-	-	-	-	4	9	16	20	107	593	752
7/5	184	49	-	2	11	1	-	-	2	27	111	-	212	21	-	87	126	174	1007
7/6	36	123	6	4	-	-	-	-	-	4	1	-	2	5	-	59	49	248	537
7/7	55	52	12	2	-	-	-	-	-	3	10	10	9	2	21	9	149	595	929
7/8	142	24	24	19	11	-2	3	2	4	10	10	9	143	146	350	397	341	7	1640
7/9	13	6	90	52	21	19	-	-	-1	4	-	5	8	51	183	313	180	129	1073
7/10	127	51	3	131	10	3	2	7	3	4	5	5	11	37	92	96	206	299	1092
7/11	252	57	73	38	3	5	-	-	6	3	2	-50	20	2	18	158	504	778	1869
7/12	175	59	18	3	3	-	4	-10	-	3	9	-22	3	54	442	336	74	51	1202
7/13	368	382	4	5	3	4	-5	3	7	15	76	340	79	3	8	19	945	1023	3279
7/14	266	40	8	4	-	2	-	-50	-	2	-31	-120	-	-73	14	83	214	239	598
7/15	76	22	-	-3	5	-	-1	-	1	-	1	1	1	3	32	126	120	706	1090
7/16	382	137	10	-	56	5	-	-	-33	-33	109	-85	-	4	9	106	285	141	875
7/17	70	11	7	1	-	-	-1	2	5	-	2	-	-	-	319	1281	474	58	2238
7/18	288	66	-	3	2	-	-	-	-	-	-	3	61	1	25	36	61	22	507
7/19	36	14	8	6	9	-	-22	79	12	19	13	101	13	6	4	-22	32	73	429
7/20	84	210	19	2	4	3	-	-6	-	4	10	20	20	219	12	17	176	48	835
7/21	303	77	78	86	38	-	-4	3	-	-	-	4	5	19	36	115	129	224	1128
7/22	88	120	74	27	16	5	-	-	3	-	7	-	5	6	-1	79	294	231	954
7/23	470	162	43	45	97	10	-1	3	14	10	11	12	2	150	99	301	151	43	1625
7/24	127	18	28	12	19	-	-	-	-	3	-35	-	16	10	4	44	119	156	507
7/25	157	56	24	28	8	4	-	-	-	-	-	-	3	16	31	11	61	128	540
7/26	101	16	6	12	16	19	-	-	9	2	18	4	15	12	2	39	192	250	701
7/27	117	21	-	10	54	94	-	-112	61	47	37	3	15	26	29	15	132	85	634
7/28	95	5	12	9	11	1	-	-	-	-	-	3	31	29	34	25	29	20	288
7/29	29	5	4										25	12	36	36	27	36	216
7/30	38	24	26	17	3	15	144	-51	45	1	22	21	1	22	24	7	51	80	514
7/31	19	19	15	7	3	16	10	6	4	-2	-	-		-10	12	43	29	72	244
8/1	26	32	37	5	11	13													124
Hourly Total	4170	2148	684	531	414	244	132	-120	143	133	173	291	783	826	1887	3919	5447	6626	28431
% of Total Escapement	14.6		2.4		1.5		0.5		0.5		0.6		2.7		6.6		19.2		
		7.5		1.9		0.9		0.4		0.5		1.0		2.9		13.8		23.3	

Table 2. Estimated of daily salmon migration past Kwiniuk River tower, using expanded 10-minute counts, Kwiniuk River, 1976.

Date	Chum Salmon			Pink Salmon		
	10minute Counts	Expanded ^{1/} 10-minute Counts	Actual Counts	10-minute Counts	Expanded ^{1/} 10-minute Counts	Actual Counts
6/28	4	24	6	46	276	213
6/29	12	72	25	32	192	193
6/30	-	-	2	4	24	33
7/1	15	90	72	57	342	263
7/2	-3	-18	-71	14	84	79
7/3	21	126	161	43	258	223
7/4	20	120	233	41	246	752
7/5	99	594	318	247	1482	1007
7/6	19	114	138	75	450	537
7/7	50	300	211	155	930	929
7/8	86	516	420	289	1734	1640
7/9	29	174	107	305	1830	1073
7/10	28	168	154	184	1104	1092
7/11	102	612	384	448	2688	1869
7/12	85	510	479	211	1266	1202
7/13	141	846	704	598	3588	3279
7/14	55	330	116	206	1236	598
7/15	72	432	413	360	2160	1090
7/16	92	582	367	308	1848	875
7/17	70	420	565	346	2076	2238
7/18	17	102	95	65	390	507
7/19	35	210	213	74	444	429
7/20	80	480	307	215	1290	835
7/21	70	420	354	274	1644	1128
7/22	32	192	248	106	636	954
7/23	77	462	279	336	2016	1625
7/24	12	72	84	90	540	507
7/25	23	150	100	110	660	540
7/26	23	216	191	153	918	701
7/27	18	108	57	129	774	634
7/28	4	24	38	34	204	288
7/29	11	66	34	77	462	216
7/30	2	18	9	144	864	514
7/31	1	6	9	68	408	244
8/1	-	-	12	27	162	124
TOTALS 1418	8508	6834	5871	35226	28431	

^{1/}Expanded to eighteen hour count.

Tabl . Age, sex and size composition of Norton Sound District chum salmon, commercial catch sample taken at Moses Point (subdistrict 3), 1976.^{1/}

Date of Samples	Combined Sex	Age 3 ₁			Age 4 ₁			Age 5 ₁			Age 6 ₁		
		No.	%	Length ^{2/}	No.	%	Length ^{2/}	No.	%	Length ^{2/}	No.	%	Length ^{2/}
6/26	Males	15	27.8		3	5.6	(580.0)	9	16.7	(615.6)	3	5.5	(613.0)
	Females	39	72.2		13	24.1	(567.7)	26	48.1	(592.0)	-	-	-
	Subtotal	54	100.0		16	29.7	(570.0)	35	64.8	(598.1)	3	5.6	(613.0)
6/29	Males	31	58.5		12	22.6	(578.7)	19	35.9	(610.8)			
	Females	22	41.5		13	24.5	(565.4)	9	17.0	(581.3)			
	Subtotal	53	100.0		25	47.1	(571.8)	28	52.9	(601.4)			
7/2	Males	22	37.3		7	11.9	(564.3)	15	25.4	(609.3)			
	Females	37	62.7		16	27.1	(563.6)	21	35.6	(577.8)			
	Subtotal	59	100.0		23	39.9	(563.8)	36	61.0	(590.9)			
7/6	Males	23	48.9		5	10.6	(571.4)	18	38.3	(595.5)			
	Females	24	51.1		10	21.3	(559.7)	14	29.8	(570.8)			
	Subtotal	47	100.0		15	31.9	(563.6)	32	68.1	(584.7)			
TOTALS	Males	91	42.7		27	12.7	(573.8)	61	28.6	(606.6)	3	1.4	(613.0)
	Females	122	57.3		52	24.4	(564.3)	70	32.9	(582.1)	-	-	-
	Totals	213	100.0		79	37.1	(567.6)	131	61.5	(593.6)	3	1.4	(613.0)
Weighted ^{3/} Percentages	Males		49.3			14.1			35.2				
	Females		50.7			23.0			27.7				
	Totals		100.0			37.1			62.9				
7/28	Males	14	63.6	7	31.8	(524.0)	4	18.2	(560.3)	3	13.6	(601.7)	
	Females	8	36.4				4	18.2	(576.8)	4	18.2	(582.8)	
	Totals	22	100.0	7	31.8	(524.0)	8	36.4	(568.6)	7	31.8	(590.9)	

1/ Type of gear: 5 1/2" - 5 7/8" mesh set gill net.

2/ Type of measurement: mid-eye to fork of tail, mean length.

3/ Weighted by commercial catch.

Table 4. Age, sex and size composition of Norton Sound district chum salmon, escapement taken at Kwiniuk River (subdistrict 3), 1976.

Dates of Samples	Combined Sex	Age 3 ₁			Age 4 ₁			Age 5 ₁				
		No.	%	No.	%	Length ^{2/}	No.	%	Length ^{2/}	No.	%	Length ^{2/}
7/7	Males	40	71.4	2	3.5	(514.0)	17	30.4	(597.6)	21	37.5	(621.3)
	Females	16	28.6				9	16.1	(572.4)	7	12.5	(604.4)
	Subtotal	56	100.0	2	3.5	(514.0)	26	46.5	(588.9)	28	50.0	(617.0)
7/14	Males	13	39.4	6	18.2	(527.5)	4	12.1	(565.8)	3	9.1	(592.0)
	Females	20	60.6				15	45.4	(555.3)	5	15.2	(593.2)
	Subtotal	33	100.0	6	18.2	(527.5)	19	57.5	(557.5)	8	24.3	(592.8)
7/16	Males	17	62.9	7	25.9	(521.4)	6	22.2	(555.3)	4	14.8	(608.0)
	Females	10	37.1				9	33.3	(562.7)	1	3.7	(578.0)
	Subtotal	27	100.0	7	25.9	(521.4)	15	55.5	(559.7)	5	18.5	(602.0)
TOTALS	Males	70	60.3	15	12.9	(521.4)	27	23.3	(583.4)	28	24.1	(616.3)
	Females	46	39.7				33	28.5	(562.0)	13	11.2	(598.0)
	Total	116	100.0	15	12.9	(521.4)	60	51.8	(571.7)	41	35.3	(610.5)

^{1/} Type of gear: 1-3/4" (44.4mm) mesh beach seine.

^{2/} Type of measurement: mid-eye to fork of tail, over the body, mean length.

Table 5. Daily king salmon migration enumerated by length category past the Kwiniuk River counting tower, 1976.

Date	Total#	Estimated length			
		<50(cm)	50-60(cm)	60-80(cm)	>80(cm)
7/7	1	-	-	-	-
7/8	-	-	-	-	-
7/9	-	-	-	-	-
7/10	-	-	-	-	-
7/11	-	-	-	-	-
7/12	-	-	-	-	-
7/13	-	-	-	-	-
7/14	-	-	-	-	-
7/15	1	-	-	-	1
7/16	2	-	-	-	2
7/17	-	-	-	-	-
7/18	-	-	-	-	-
7/19	-	-	-	-	-
7/20	-	-	-	-	-
7/21	2	-	-	-	2
7/22	1	-	-	-	1
7/23	2	-	1	1	-
7/24	3	-	-	2	1
TOTALS	<u>12</u>	<u>-</u>	<u>1</u>	<u>3</u>	<u>8</u>
% of Totals			8.3	25.0	66.7

Table 6 . Water temperatures, and chum and pink salmon migration percentages, Kwiniuk River, 1976.

Date	Temperature		Pink	Chum
	Celsius	(Fahrenheit)	% of Migration	% of Migration
6/19	9.2	(48.5)		
6/20	9.2	(48.5)		
6/21	8.7	(47.5)		
6/22	7.0	(44.5)		
6/23	7.8	(46.0)		
6/24	7.8	(46.0)		
6/25	8.1	(46.5)		
6/26	11.2	(52.0)		
6/27	12.3	(54.0)		
6/28	13.4	(56.0)	0.7	0.1
6/29	12.3	(54.0)	0.7	0.4
6/30	11.2	(52.0)	0.1	0.0
7/1	10.9	(51.5)	0.9	1.1
7/2	9.4	(48.8)	0.3	-1.0
7/3	8.4	(47.0)	0.8	2.4
7/4	8.4	(47.0)	2.6	3.4
7/5	9.0	(48.0)	3.5	4.7
7/6	9.2	(48.5)	1.9	2.0
7/7	10.1	(50.0)	3.3	3.1
7/8	12.3	(54.0)	5.8	6.1
7/9	13.7	(56.5)	3.8	1.6
7/10	13.7	(56.5)	3.8	2.2
7/11	13.7	(56.5)	6.6	5.6
7/12	14.8	(58.5)	4.2	7.0
7/13	16.8	(62.0)	11.5	10.3
7/14	17.1	(62.5)	2.1	1.7
7/15	14.8	(58.5)	3.8	6.0
7/16	15.7	(60.0)	3.1	5.4
7/17	12.9	(55.0)	7.9	8.3
7/18	11.2	(52.0)	1.8	1.4
7/19	12.9	(55.0)	1.5	3.1
7/20	12.3	(54.0)	2.9	4.5
7/21	13.7	(56.5)	4.0	5.2
7/22	14.8	(58.5)	3.4	3.6
7/23	17.1	(62.5)	5.7	4.0
7/24	16.2	(61.0)	1.8	1.2
7/25	16.0	(60.5)	1.9	1.5
7/26	15.7	(60.0)	2.5	2.8
7/27	15.4	(59.5)	2.2	0.8
7/28	13.4	(56.0)	1.0	0.5
7/29	12.3	(54.0)	0.8	0.5
7/30	10.1	(50.0)	1.8	0.5
7/31	11.2	(52.0)	0.9	0.1
8/1			0.4	0.2

Appendix Table 1. Daily total cumulative salmon escapements, Kwiniuk River, 1965-1976.

Species	Date	1965	1966	1967	1968	1969
CHUM	6/18	6				
	6/19		24			
	6/29		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	218	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	3,445	2,180	2,148	3,509	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	6,914	3,861
	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	9,514
	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	19,551	23,459	18,284	12,577
	7/12	23,491	25,549	26,165	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	14,879
	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	28,884	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	18,815	18,918
	7/21		32,398	26,661	18,847	19,233
	7/22		32,723		18,907	19,373
	7/23		32,938		18,951	19,390
	7/24		33,030		19,976	19,525
	7/25		33,137			19,554
	7/26		33,153			19,749
	7/27		33,153			19,749
	7/28		33,184			19,749
	7/29		33,182			19,749
		<u>-6,227^{2/}</u>	<u>-396^{2/}</u>	<u>-2,217^{2/}</u>	<u>-163^{2/}</u>	<u>-622^{2/}</u>
		26,634	32,786	24,444	18,813	19,687

^{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 escapements,
(continued) Kwiniuk River, 1965-1976.

Species	Date	1970	1971	1972	1973	1974	1975
CHUM	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	33	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	11,266	
	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	30,596	6,178	5,314	4,933	19,061	728
	7/7	31,468	6,651	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	17,537	15,337	21,633	1,887
	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	56,948	20,858	25,589	19,666	31,243	5,151
	7/16	60,275	21,909	25,805	20,138	32,179	7,395
	7/17	62,577	26,955	26,133	22,396	32,570	9,497
	7/18	63,065	27,836	27,284	24,075	33,388	10,443
	7/19	63,624	30,680	27,993	26,227	33,891	11,919
	7/20	65,673	33,800	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	35,510	29,458	27,570	34,676	13,962
	7/24	66,336	36,185	29,756	28,008	34,979	14,033
	7/25	66,545	36,959	29,995	28,029	35,130	14,049
	7/26	66,584	37,680	30,005		35,161	
	7/27	66,599	38,107				
	7/28	66,602	38,186				
	7/29	66,604	38,243				
		x <u>2.1%</u>	<u>2.1%</u>				
Expanded		1,400	803	631	588	738	295
Escapement		+66,604	+38,243	+30,055	+28,029	+35,161	+14,049
Total		<u>68,004</u>	<u>39,046</u>	<u>30,686</u>	<u>28,617</u>	<u>35,899</u>	<u>14,344</u>
Expanded			- 367				
Escapement			<u>38,679</u>				

Appendix Table 1. Daily total cumulative salmon escapement,
(continued) Kwiniuk River, 1965-1976.

Species	Date	1976
CHUM	6/18	
	6/19	
	6/20	
	6/21	
	6/22	
	6/23	
	6/24	
	6/25	
	6/26	
	6/27	
	6/28	6
	6/29	31
	6/30	33
	7/1	105
	7/2	134
	7/3	195
	7/4	428
	7/5	746
	7/6	884
	7/7	1,095
	7/8	1,515
	7/9	1,622
	7/10	1,776
	7/11	2,160
	7/12	2,639
	7/13	3,343
	7/14	3,459
	7/15	3,872
	7/16	4,239
	7/17	4,804
	7/18	4,899
	7/19	5,112
7/20	5,419	
7/21	5,773	
7/22	6,021	
7/23	6,300	
7/24	6,384	
7/25	6,484	
7/26	6,675	
7/27	6,732	
7/28	6,770	
7/29	6,804	
7/30	6,813	
7/31	6,822	
8/1	6,834	
	x 2.1%	
		143
Expanded		+6,834
Escapement		6,977
Total		- 5112/
Expanded Escapement		6,466

Appendix Table 1. Daily total cumulative salmon escapements,
(continued) Kwiniuk River, 1965-1976. SPECIES: PINK

Date	1965	1966	1967	1968	1969
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	260			214	52
6/30	220			534	117
7/1	276		1	755	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	517		3,141	2,259
7/6	390	533		4,777	3,974
7/7	412	568	18	13,719	6,415
7/8	588	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	2,856	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	27,850
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	3,269	3,406	124,510	43,897
7/20		3,894	3,432	125,848	47,626
7/21		4,190	3,567	127,088	51,943
7/22		5,558	3,587	128,002	54,177
7/23		6,777		128,466	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		10,864			
7/29					
	<u>-367^{2/}</u>	<u>-235^{2/}</u>	<u>-79^{2/}</u>	<u>-2,288^{2/}</u>	<u>-814^{2/}</u>
	8,301	10,629	3,508	126,764	56,683

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,
(continued) Kwiniuk River, 1965-1976. SPECIES: PINK

DATE	1970	1971	1972	1973	1974
6/18					
6/19					
6/20					1
6/21					2
6/22					39
6/23					223
6/24					464
6/25	3			322	559
6/26	13			831	1,513
6/27	16			1,053	2,456
6/28	17	9	15	1,276	3,455
6/29	47	12	48	1,413	5,590
6/30	198	31	513	1,575	8,506
7/1	298	125	1,490	1,762	10,047
7/2	465	182	2,780	1,854	12,512
7/3	1,096	241	2,899	1,938	14,668
7/4	4,643	552	4,210	2,190	17,674
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	42,529	7,327	24,764
7/12	50,921	6,462	47,520	8,539	25,604
7/13	52,800	6,994	49,581	9,281	26,840
7/14	59,521	7,418	52,553	12,512	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	34,502
7/18	155,935	10,401	55,674	21,214	35,690
7/19	161,963	12,470	57,721	27,748	36,513
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	214,233	15,485	59,892	36,956	38,668
7/25	222,209	15,658	60,147	37,070	39,263
7/26	225,546	15,818	60,246		39,375
7/27	226,712	15,996	60,256		
7/28	226,829	16,089			
7/29	226,831	16,151			
	<u>x3.66%^{1/}</u>	<u>x3.66%^{1/}</u>	<u>x3.66%^{1/}</u>	<u>x3.66%^{1/}</u>	<u>x3.66%^{1/}</u>
	8,300	590	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			

Appendix Table 1. Daily total cumulative salmon escapement,
(continued) Kwiniuk River, 1965-1976. SPECIES: PINK

DATE	1975	1976
6/18		
6/19		
6/20		
6/21		
6/22		
6/23		
6/24		
6/25		
6/26		
6/27		
6/28		213
6/29		406
6/30		439
7/1		702
7/2		781
7/3		1,004
7/4		1,756
7/5		2,763
7/6	79	3,300
7/7	185	4,229
7/8	176	5,869
7/9	294	6,942
7/10	584	8,034
7/11	820	9,903
7/12	959	11,105
7/13	1,001	14,384
7/14	1,013	14,982
7/15	1,304	16,072
7/16	1,770	16,947
7/17	2,529	19,185
7/18	5,183	19,692
7/19	10,772	20,121
7/20	22,354	20,956
7/21	38,220	22,084
7/22	45,466	23,038
7/23	50,902	24,663
7/24	52,935	25,170
7/25	54,858	25,710
7/26	55,293	26,411
7/27		27,045
7/28		27,333
7/29		27,549
7/30		28,063
7/31		28,307
8/1		28,431
	<u>x3.66%^{1/}</u>	<u>x3.66%</u>
	2,024	1,040
Expanded	+55,293	+28,431
Escapement	<u>57,317</u>	<u>29,471</u>
		- 1,381 ^{2/}
Total Expanded Escapement		<u>28,087</u>