AYK Region
Norton Sound
Salmon Escapement
Report #42

1985 North River Salmon Counting Tower

Compiled by:
Charles Lean
Fisheries Biologist

Alaska Department of Fish and Game
Division of Commercial Fisheries
Nome, Alaska 99762
January 1986

Table of Contents

Table of Contents (continued)

North River Tower 1985

INTRODUCTION

The North River is the largest tributary to the Unalakleet River, the most important salmon producing river in Norton Sound. In 1984 a salmon counting tower was re-established on the North River near the 1973 tower site (Figure 1). During 1972 through 1974 a counting tower operated within 400 yards of the North River bridge. (Regnart, R.I. and L.L. Trasky, 1973., Cunningham, 1973, 1974, 1975.). The tower was discontinued due to the small chum run on the North River and its lack of commercial importance. During the past ten years, both the price and run size of the chinook and coho runs have increased. The even year portion of the pink salmon run has also increased dramatically. The increasing commercial importance of the chinook and coho salmon returns to the Unalakleet subdistrict resulted in the reestablishment of the North River tower (Lean, 1985).

The North River tower provides the management biologist with information on the daily and seasonal timing and magnitude of the salmon escapement primarily. The North River tower counts are also compared with test fishing results and aerial survey data as a means of providing an abundance index to the total Unalakleet River returns.

METHODS

Tower counts

A 20 foot tower was erected on the east bank of the North River using aluminum scaffolding. The feet of the tower were nailed to two planks which were blocked with wood and sand bags to provide a firm foundation. Two more planks were laid across the lowest rungs of the scaffolding where sand bags were stacked to provide a low center of gravity for the tower. One-quarter inch aircraft cable was used for guy wires and anchored to the bases of large alder bushes.

A 40 foot long weir made of fence posts and cattle fencing was placed on the opposite shore to deflect salmon closer to the tower.

A flash panel, 50 feet x 5 feet, was placed between the weir and the cut bank under the tower. The panel was tied at one foot intervals to an air craft cable running on the river bottom between fence post anchors.

Lighting during dark hours was accomplished using a car headlight set inside a 5 gallon can. The beam was placed angling slightly downstream and across the flash panel. Car batteries used to power the light were charged during the day using a generator.

The three person tower crew counted 18 hours per day, 6 days per week except Sunday when they counted 24 hours per day. The weekly 24 hour counts allowed for expansion of the 18 hour counts taking into consideration recent hourly passage rates.

The counting crew worked three hour shifts alternating turns in the tower. Each crew member was given a day off but no two people were given the same day. Every crew member was required to work the day of the 24 hour count.

Daily counts were radioed to Unalakleet and relayed from there to Nome where a running total was kept. After the field season missing hourly counts were adjusted by averaging the same hourly counts of the two nearest days.

Aerial Surveys

There were four aerial surveys flown on the Unalakleet River system during 1985. The North River was surveyed on July 6 and covered from the counting tower 25 miles upstream on the North River. The conditions were poor due to recent rains.

On July 13 a second survey was flown of the North River. Conditions were fair and the lower 20 miles of the river were surveyed.

On July 18 the main Unalakleet River was surveyed using a Department of Public Safety super cub, unlike the other surveys which were flown in a Cessna 180. Conditions were poor especially in the lower river. The survey began at the mouth and continued upstream to the North Fork River mouth.

The final aerial survey of the season was flown on July 22 under fair conditions. The North River, Old Woman River and the upper Unalakleet River from North Fork River to 8 miles above Old Woman River were surveyed.

RESULTS

Tower Counts

The unadjusted counts were 1196 chinook, 1459 coho, 4227 pink and 3909 chum salmon. Hourly and daily totals are presented in Tables 2, 3, and 4. The expanded counts are 1426 chinook, 2045 coho, 4360 pink and 4690 chum salmon (Table 5).

The counting schedule began on July 6 when salmon were first observed from the tower. Two people were stationed at the tower beginning June 27, and made observations from the tower during evening hours for four days, but saw no salmon. Rain caused the river to begin rising on June 29 and by July 1 the water was too turbid to count fish. Counting resumed July 5 at 1800 hours when the first chinook salmon was observed. The following day the first chum salmon began to move past the tower also. Because of the early turbid water an aerial survey was flown on July 6. A total of 28 chinook salmon were observed upstream of the counting tower, 27 more than had been counted by the crew. It was decided that the tower crew would adjust their expanded counts by 27 on July 6 to account for king salmon missed during the high water.

High water occurred again on July 8 until July 10. Counts were halted and again an aerial survey was flown on July 13. The aerial survey of July 13 indicated that the expanded chum salmon counts should be adjusted by 262 due to the difference between the aerial counts and the tower counts.

Tower counting conditions remained good until August 15 when counts stopped for 37 hours due to turbid water conditions. Unfortunately the peak of the coho salmon return was passing the counting tower at this time. Counts resumed on August 17 and continued until counts were stopped for a crew change for 36 hours on August 23. After the new crew had counted only 36 hours, weather became very poor and only a few hourly counts were possible until August 30 when two daily counts were made to finish the month. The tower project was closed for the season at midnight August 31.

The Appendix Tables 1, 2, and 3 show the historical tower counts by species for the years the North River tower has operated. Appendix Table 4 presents the aerial surveys made since State management began.

Aerial Surveys

The aerial survey of July 6 was flown to determine how many salmon had passed the counting tower during the turbid water period of July 1 through July 5. A total of 28 chinook and 80 chum salmon were counted above the tower. Since both these counts exceeded the tower counts to date the tower counts were expanded in season to reflect these uncounted salmon.

Since turbid water conditions again caused the counting tower to cease operation on July 7 the process was repeated on July 13 when the water cleared.. This aerial survey counted a total of 81 chinook and 1100 chum salmon. However only 9 chinook and 425 chum salmon had been counted upstream of the tower during the survey. The chum salmon aerial count was again larger than the cumulative tower chum salmon count of 50, so the tower counts were expanded to 425.

The aerial survey of July 18 was a reconniasance flight to determine the stage of the salmon runs on the Unalakleet drainage. The survey was flown under poor conditions and counted 30 chinook and 886 chum salmon. It was determined that the salmon were not yet at the peak of their spawning conditions and were not yet high enough in the river system to get a good count.

The final survey of the system was flown by Ron Regnart under partially cloudy conditions in the afternoon. He observed 202 chinook and 510 chum salmon on the Old Woman, 400 chinook and 1640 chum salmon on the upper Unalakleet, and 873 chinook, 730 pink and 2537 chum salmon on the North River.

Of the salmon observed on the North River 703 chinook, 325 pink and 1625 chum salmon were upstream of the counting tower.

DISCUSSION

As in 1984 a late spring compressed the early salmon runs and delayed the migration peaks. The peak counts for the chinook, pink and chum salmon migration past the North River tower all occurred on July 20. This was a period of gradually warming water conditions and dropping river levels. There were no significant weather condition changes recorded in Unalakleet at that time. Climatic conditions do not seem to have triggered a mass migration yet all three species doubled the previous daily counts. The salmon may have reached an abundance threshold that caused them to move.

During the season some concern was expressed by Fish and Game personnel that the aerial survey counts were larger than the tower counts. The tower counts used in this comparison were unexpanded and did not take into account missed hours particularly the 6 hour block only counted once per week. The following table compares the July 22 aerial survey counts with the cumulative tower counts on that date.

	Chinook	Pink	Chum
aerial count	703	325	1625
unexpanded tower count	674	1846	1826
expanded tower count	747	1917	2052

The aerial and tower counts of chinook salmon were similar. From the air during late July, chinook salmon are easily differentiated from other species by their size and color. The close agreement between these two methods indicates that the tower counts of chinook could be compared to the aerial survey index.

Since coho salmon are also easily distinguished from the air and seem to have a return of roughly the same magnitude as chinook salmon in the North River, it seems reasonable that the tower count of coho could also be compared to aerial survey index.

The very different estimates of pink salmon abundance indicates that pink salmon are hard to spot from the air and can be "covered" by other salmon or mildly adverse conditions. Pink salmon tower counts are not comparable to the aerial survey index.

Chum salmon tower counts appear to have some of the same problems as the pink salmon counts and should therefore not be compared with aerial survey counts.

Literature Cited

Regnart, R.I. and L.L. Trasky. Norton Sound Anadromous Fish Investigation, Unalakleet Area 1972. AYK Region, Fisheries Bulletin No. 18. April 1973. 33pp. In Nome office files.

Cunningham, P. North River Salmon Counting Tower, 1972-1973. AYK Region NS/K Escapement Report No. 11. (from AYK Area Arctic Anadromous Fish Investigations) p.7-39. In Nome office files.

Cunningham, P. B. Arctic Anadramous Fish Investigations Technical Report, July 1, 1974 to June 30, 1975. AYK Region, NS/K State/Fed Report No. 3. December 1975. 28pp. In Nome office files.

Lean, C.F. 1984 North River Salmon Counting Tower. AYK Region, NS Escapement Report #34. March 1985. 17pp. In Nome office files.

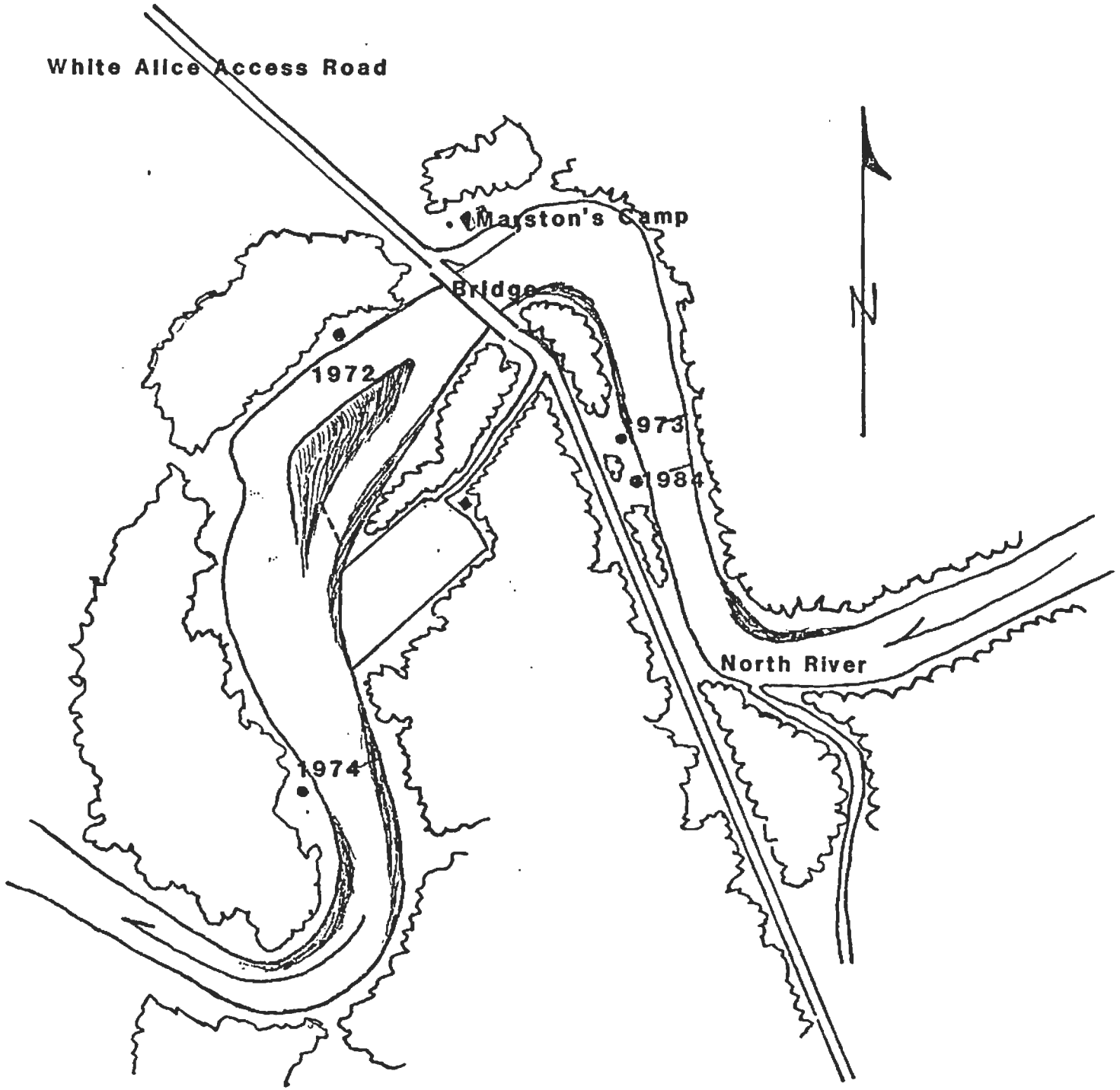

Figure 1. Locations of the North River Counting Towers.

FIGURE 2. 1985 NORTH RIVER

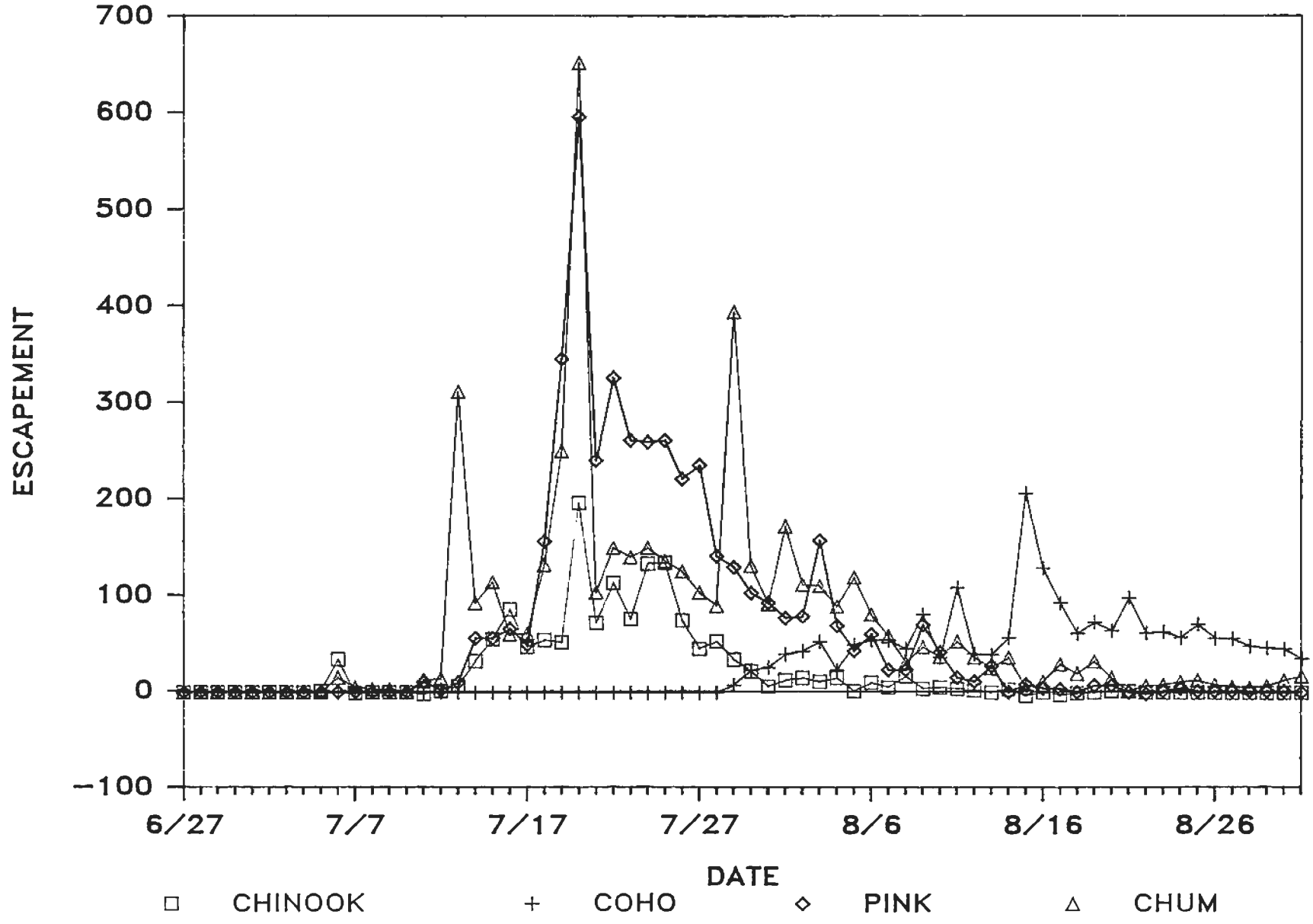

FIGURE 3. 1985 NORTH RIVER

CUMULATIVE EXPANDED SALMON COUNTS/DATE

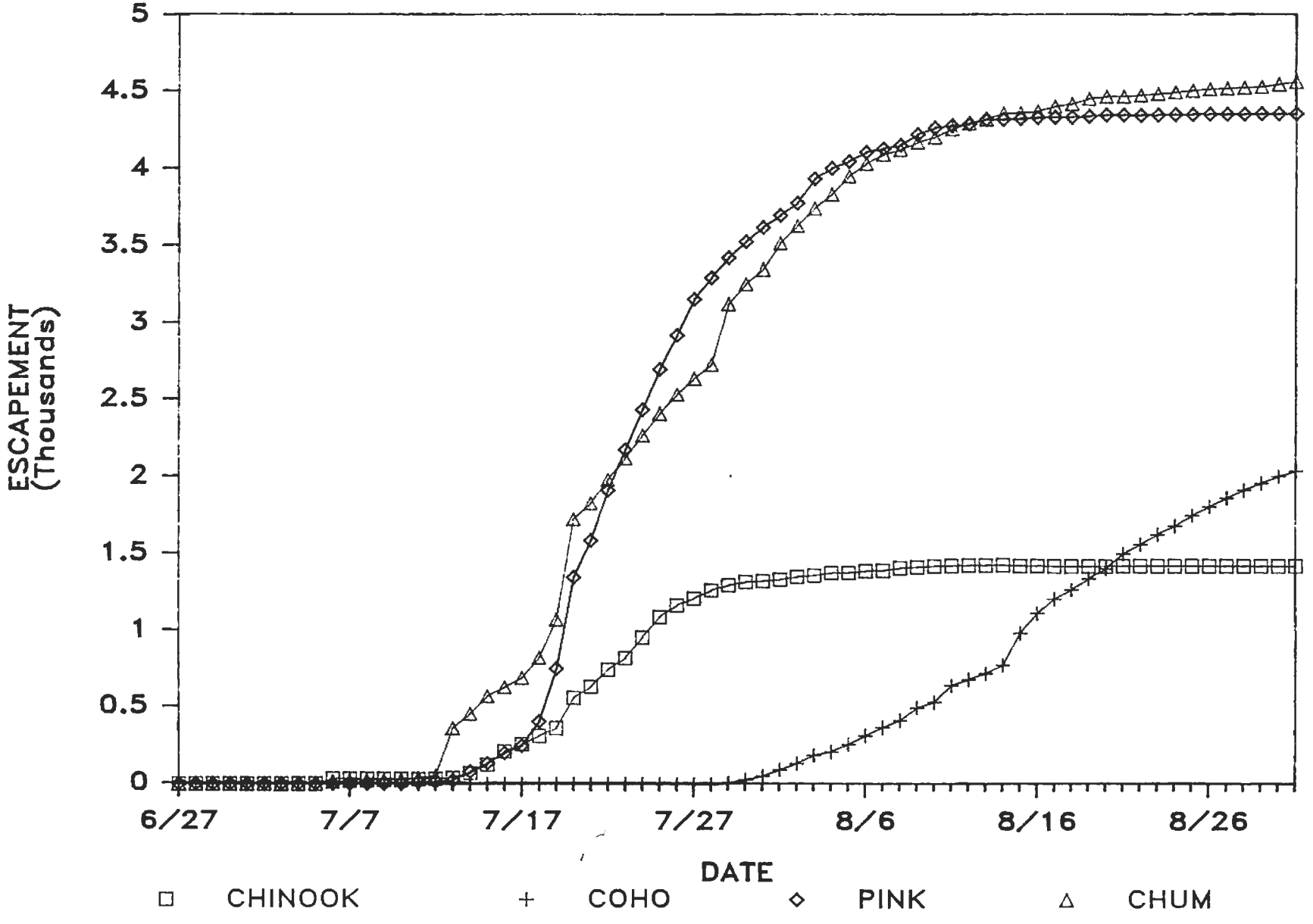

Table 1. Daily cumulative salmon escapement, North River, 1985.

Date	Chinook	Coho	Pink	Chum
6/27	0	0	0	0
6/28	0	0	0	0
6/29	0	0	0	0
6/30	0	0	0	0
7/01	Turbid water - no counts			
7/02	Turbid water - no counts			
7/03	Turbid water - no counts			
7/04	Turbid water - no counts			
7/05	0	0	0	0
7/06	8	0	0	9
7/07	7	0	0	14
7/08	Turbid water - no counts			
7/09	Turbid water - no counts			
7/10	7	0	0	14
7/11	5	0	11	26
7/12	6	0	13	39
7/13	12	0	23	89
7/14	39	0	79	175
7/15	85	0	135	281
7/16	157	0	201	336
7/17	194	0	250	387
7/18	237	0	399	498
7/19	278	0	728	708
7/20	434	0	1295	1254
7/21	506	0	1536	1358
7/22	596	0	1846	1484
7/23	656	0	2095	1602
7/24	762	0	2342	1728
7/25	884	0	2619	1863
7/26	952	0	2854	1988
7/27	993	0	3103	2091
7/28	1046	0	3245	2181
7/29	1077	8	3382	2572
7/30	1097	31	3491	2703
7/31	1102	57	3589	2794
8/01	1114	95	3659	2965
8/02	1128	136	3731	3076
8/03	1138	187	3875	3186
8/04	1153	210	3944	3275
8/05	1154	257	3983	3394
8/06	1163	309	4038	3474
8/07	1168	361	4059	3531
8/08	1185	405	4076	3560
8/09	1189	484	4127	3603
8/10	1194	519	4157	3637
8/11	1198	628	4172	3690
8/12	1200	667	4180	3723
8/13	1200	705	4200	3746
8/14	1203	760	4200	3779
8/15	1199	939	4208	3777
8/16	Turbid water - no counts			
8/17	1196	953	4209	3778
8/18	1195	1014	4209	3794
8/19	1195	1080	4216	3824
8/20	1196	1138	4223	3838
8/21	1197	1226	4223	3839
8/22	1197	1285	4221	3857
8/23	Crew change - no counts			
8/24	1197	1298	4225	3869
8/25	1197	1363	4226	3873
8/26	Turbid water - few counts			
8/27	Turbid water - few counts			
8/28	Turbid water - few counts			
8/29	Turbid water - few counts			
8/30	1197	1424	4227	3892
8/31	1197	1459	4227	3909
Total	1197	1459	4227	3909

Table 2. Daily hourly migration past North River counting tower, 1985. Species: Chinook.

Date	00	01	02	03	04	05	06-11	12	13	14	15	16	17	18	19	20	21	22	23	Total	%
6/27																0	0	0	0	0	0
6/28									0	0	0	0	0	0	0	0	0	0	0	0	0
6/29														0	0					0	0
6/30														0	0	0	0	0	0	0	0
7/01																				0	0
7/02																				0	0
7/03																				0	0
7/04																				0	0
7/05														1	0	0	0	0	0	1	0.1
7/06	1							0	3	0	0	-1	3	-1	2	0	0	0	0	7	0.6
7/07	-1	-1	0	0	-1	1	-2	0	0	1	4	0	0	-2	-2	1	0	1		-1	-0.1
7/08																				0	0
7/09																				0	0
7/10									0	-1	0	1	0	0	-2	0	0	0	2	0	0
7/11	0	0	0	0	0	0		0	0	-1	0	0	-1	0	-2	0	0	0	2	-2	-0.2
7/12	0	0	0	0	0	0		0	0	0	0	0	1	0	0	0	0	0	0	1	0.1
7/13	0	0	1	0	0	-1	1	0	0	0	0	0	0	0	1	0	1	3	0	6	0.5
7/14	0	2	0	1	0	4		0	3	-2	2	4	2	0	0	4	1	2	4	27	2.3
7/15	6	4	2	3	0	4		2	1	2	4	4	3	2	0	3	0	-1	7	46	3.8
7/16	4	12	10	2	1	5		1	-4	3	0	1	1	7	4	5	3	8	9	72	6.0
7/17	4	2	3	-1	4	1		3	1	1	1	2	3	3	4	2	2	1	1	37	3.1
7/18	6	2	4	1	1	1		-1	3	0	4	6	0	0	0	4	1	5	6	43	3.6
7/19	1	7	4	7	1	5		0	8	0	-1	0	2	-1	2	0	3	1	2	41	3.4
7/20	3	16	12	10	16	11		5	4	3	7	16	24	14	0	1	2	2	10	156	13.0
7/21	2	7	9	1	2	1	15	6	4	8	0	1	1	-1	0	0	2	9	5	72	6.0
7/22	20	14	5	4	5	-2		6	0	5	4	4	2	1	2	8	6	2	4	90	7.5
7/23	8	3	3	7	3	2		2	5	1	0	0	3	2	4	6	1	2	8	60	5.0
7/24	10	4	7	5	13	11		7	3	3	1	0	3	5	3	10	8	5	8	106	8.9
7/25	29	9	17	5	14	5		0	12	16	7	0	1	0	-1	2	2	0	4	122	10.2
7/26	8	10	7	8	11	8		3	4	2	2	5	2	-2	1	1	-2	-1	1	68	5.7
7/27	0	7	2	5	3	4		-1	2	1	8	1	0	3	0	3	1	2	0	41	3.4
7/28	2	2	9	3	4	9	5	1	4	0	0	1	1	0	-1	2	4	5	2	53	4.4
7/29	2	3	2	1	5	8		-2	-2	1	2	1	0	1	0	3	2	3	1	31	2.6
7/30	-1	3	6	3	2	1		0	1	-1	3	0	0	1	1	1	-1	0	1	20	1.7
7/31	0	1	0	2	1	-1		0	0	1	-2	0	1	2	0	-1	0	0	1	5	0.4
8/01	-2	3	1	5	1	-4		3	1	-2	-2	0	-2	2	2	5	1	0	0	12	1.0
8/02	2	2	2	2	2	1		1	1	0	0	0	-2	1	1	2	1	-2	0	14	1.2
8/03	0	0	0	0	1	0		2	1	1	0	1	0	-1	1	0	0	1	3	10	0.8
8/04	0	1	3	1	1	0	1	0	0	0	0	-1	4	1	0	0	2	2	0	15	1.3
8/05	1	2	1	0	0	0		0	1	0	0	0	-1	-2	0	-1	0	0	0	1	0.1
8/06	1	0	0	1	0	-2		2	4	0	-1	3	3	-1	-1	0	1	-2	1	9	0.8
8/07	1	1	0	0	2	1		2	0	0	-1	0	-1	0	-1	3	-1	-1	0	5	0.4
8/08	0	-2	1	-3	-6	0		0	0	0	2	1	-3	3	1	3	1	1	0	17	1.4
8/09	-2	-1	-1	3	-3	2		3	-2	3	0	0	-1	1	0	0	3	-2	1	4	0.3
8/10	3	1	1	0	0	-1		0	0	1	1	-1	0	-3	1	3	-2	1	0	5	0.4
8/11	1	-2	0	3	0	-1	6	0	1	3	-2	-1	0	-2	1	-1	-2	0	0	4	0.3
8/12	0	0	0	2	1	0		-3	-2	3	1	0	1	1	1	-1	-2	0	0	2	0.2
8/13	0	1	0	-1	0	-1		0	0	0	0	-1	0	0	0	0	0	2	0	0	0.
8/14	2	-1	1	0	0	0		0	0	0	-1	0	0	0	0	0	2	0	0	3	0.3
8/15	0	0	0	0	-1	0		0	-1	1	0	-1	-1	0	-1	0				-4	-0.3
8/16																				0	0
8/17								-1	0	-1	0	0	0	-1	0	0	0	0	0	-3	-0.3
8/18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	-1	-0.1
8/19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
8/20	0	0	0	0	0	0		0	0	0	0	0	0	1	0	0	0	0	0	1	0.1
8/21	0	0	0	0	0	0		0	0	0	0	1	0	0	0	0	0	0	0	1	0.1
8/22	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0.
8/23																				0	0.
8/24								0	0	0	0	0	0	0	0	0	0	0	0	0	0.
8/25	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0			0	0.
8/26																				0	0.
8/27																		0	0	0	0.
8/28	0	0	0	0																0	0.
8/29																		0	0	0	0.
8/30	0	0	0	0						0	0	0	0	0	0	0	0	0	0	0	0.
8/31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.
Total	111		112		95		26		56		43		49		21		40		83		100.
		112		86		72		41		52		47		35		68		48		1197	
%	9.3		9.4		7.9		2.2		4.7		3.6		4.1		1.8		3.3		6.9		
		9.4		7.2		6.0		3.4		4.3		3.9		2.9		5.7		4.0			100

Table 3. Daily hourly migration past North River counting tower, 1985. Species: coho.

Date	00	01	02	03	04	05	06-11	12	13	14	15	16	17	18	19	20	21	22	23	Total	%
6/27																0	0	0	0	0	0
6/28									0	0	0	0	0	0	0	0	0	0	0	0	0
6/29														0	0					0	0
6/30														0	0	0	0	0		0	0
7/01																				0	0
7/02																				0	0
7/03																				0	0
7/04																				0	0
7/05														0	0	0	0	0	0	0	0
7/06	0							0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
7/08																				0	0
7/09																				0	0
7/10									0	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/14	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/15	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/16	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/17	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/20	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/22	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/23	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/24	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/25	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/26	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/27	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/29	0	0	0	0	0	0		0	0	0	2	0	0	2	0	0	0	2	2	8	0.5
7/30	2	0	0	3	2	2		0	0	0	0	0	0	0	2	0	0	2	10	23	1.6
7/31	2	1	7	3	2	3		0	0	0	0	1	0	0	0	1	3	0	3	26	1.8
8/01	3	5	3	3	2	6		-1	-1	1	1	0	2	0	1	4	2	5	2	38	2.6
8/02	9	1	7	11	5	0		0	1	2	0	0	0	2	0	1	0	0	2	41	2.8
8/03	3	4	8	8	8	0		1	0	0	0	1	0	0	0	0	3	1	14	51	3.5
8/04	0	1	3	6	2	3	1	0	0	0	0	2	2	1	2	0	0	0	0	23	1.6
8/05	10	7	0	13	7	1		0	0	0	0	0	2	3	0	1	0	-1	4	47	3.2
8/06	11	6	10	11	7	0		3	0	0	0	0	1	1	0	1	1	-1	1	52	3.6
8/07	4	1	4	8	6	5		0	-1	0	0	0	2	0	0	1	6	12	4	52	3.6
8/08	4	8	16	6	1	-1		0	0	0	0	0	0	1	1	3	1	1	3	44	3.0
8/09	11	8	8	9	10	6		1	0	5	0	1	-1	2	-1	0	9	4	7	79	5.4
8/10	2	7	4	4	6	2		0	0	0	0	2	0	2	0	0	0	0	6	35	2.4
8/11	8	5	8	10	4	3	1	-3	8	2	4	7	8	6	15	0	8	9	6	109	7.5
8/12	3	4	3	12	6	2	1	0	0	0	-1	1	0	0	0	4	1	-1	5	39	2.7
8/13	3	3	3	7	4	2		0	0	0	1	0	0	1	0	5	0	4	5	38	2.6
8/14	1	11	9	13	6	2		0	0	1	1	0	-2	3	0	0	4	-2	8	55	3.8
8/15	13	19	16	24	27	11		8	1	4	8	17	13	10	5	3				179	12.3
8/16																				0	0
8/17								2	1	2	0	1	1	0	1	1	1	2	2	14	1.0
8/18	0	8	3	12	5	2	6	2	2	0	2	0	2	3	1	5	2	1	5	61	4.2
8/19	3	12	6	7	4	8		1	0	1	-1	1	1	0	14	4	2	1	2	66	4.5
8/20	-1	15	9	5	10	2		0	1	0	0	1	2	0	6	-1	-1	2	8	58	4.0
8/21	3	8	4	12	9	3		3	0	2	3	0	0	3	2	15	11	4	6	88	6.0
8/22	4	5	8	8	9	0		0	1	0	0	0	2	1	0	3	10	7	1	59	4.0
8/23																				0	0
8/24								0	0	0	3	2	1	-1	-2	1	3	1	5	13	0.9
8/25	4	9	8	14	6	8	3			0	0	-2	4	6	5	0	0			65	4.5
8/26																				0	0
8/27																		2	3	5	0.3
8/28	2	11	7	2																22	1.5
8/29																		1	2	3	0.2
8/30	8	4	2	0						0	0	1	2	0	2	2	3	2	5	31	2.1
8/31	1	2	10	7	3	-1	4	1	0	0	0	0	0	0	2	1	2	0	3	35	2.4
Totals		165		218		69		18		20		36		46		55		58		1459	
	113		166		151		16		13		23		42		56		71		124		100
%	7.7		11.4		10.3		1.0		0.9		1.6		2.9		3.8		4.9		8.5		
		11.3		14.9		4.7		1.2		1.4		2.5		3.2		3.8		4.0			100

Table 4. Daily hourly migration past North River counting tower, 1985. Species: pink

Date	00	01	02	03	04	05	06-11	12	13	14	15	16	17	18	19	20	21	22	23	Total	%
6/27																0	0	0	0	0	0
6/28									0	0	0	0	0	0	0	0	0	0	0	0	0
6/29														0	0					0	0
6/30														0	0	0	0	0		0	0
7/01																				0	0
7/02																				0	0
7/03																				0	0
7/04																				0	0
7/05														0	0	0	0	0	0	0	0
7/06								0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
7/08																				0	0
7/09																				0	0
7/10									0	0	0	0	0	0	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0		0	0	0	0	0	0	0	2	-1	0	0	10	11	0.3
7/12	0	0	0	1	0	0		0	0	0	0	0	0	0	0	0	0	1	0	2	0.0
7/13	0	0	0	0	1	1	0	0	0	0	0	1	3	0	0	0	2	1	1	10	0.2
7/14	5	15	1	0	0	0		0	0	0	0	0	0	1	0	1	6	15	12	56	1.3
7/15	16	2	6	0	15	1		-1	1	3	0	0	0	2	0	3	3	1	4	56	1.3
7/16	8	5	7	5	12	8		0	0	1	0	-1	1	1	-1	0	4	12	4	66	1.6
7/17	3	1	4	1	6	1		0	1	0	3	1	0	0	2	8	6	4	8	49	1.2
7/18	16	0	31	13	13	3		3	0	3	1	0	5	5	3	12	5	13	23	149	3.5
7/19	43	60	68	22	22	22		0	4	0	1	0	0	6	4	10	21	29	17	329	7.8
7/20	64	157	118	91	54	10		1	2	6	0	-2	6	1	8	3	13	10	25	567	13.4
7/21	40	50	30	4	5	13	12	6	0	0	2	3	5	5	6	3	27	10	20	241	5.7
7/22	26	71	50	29	27	23		1	6	-2	2	9	13	2	5	9	14	11	14	310	7.3
7/23	34	33	12	24	28	33		2	1	6	0	4	1	4	7	17	17	8	18	249	5.9
7/24	15	23	11	21	9	15		4	10	4	7	1	2	8	12	12	47	35	11	247	5.8
7/25	26	42	38	17	16	70		3	5	2	1	-1	0	8	12	11	8	6	13	277	6.6
7/26	45	65	29	29	21	2		-2	14	3	-5	-4	-3	23	4	-1	5	8	2	235	5.6
7/27	75	28	39	15	13	3		6	2	3	6	-11	5	0	10	12	9	6	28	249	5.9
7/28	11	17	21	17	21	4	-8	1	0	1	-4	1	-2	1	2	11	16	10	22	142	3.4
7/29	16	22	15	15	25	3		3	1	0	0	1	1	4	5	6	8	6	6	137	3.2
7/30	21	4	10	14	13	20		2	3	4	2	2	2	2	7	1	-1	1	2	109	2.6
7/31	25	11	15	13	10	4		2	1	1	1	0	5	3	1	-1	3	8	-4	98	2.3
8/01	14	4	4	8	3	1		1	-3	5	-3	-1	2	18	8	9	2	-1	-1	70	1.7
8/02	7	10	6	8	12	11		0	2	0	-1	-1	0	1	8	6	0	2	1	73	1.7
8/03	8	25	14	2	15	5		4	3	-1	0	1	0	10	3	16	13	12	14	144	3.4
8/04	6	1	1	5	3	8	6	1	6	1	2	1	4	6	3	-1	1	4	11	69	1.6
8/05	10	4	-1	2	1	0		-1	0	-1	2	7	0	1	-1	3	6	1	6	39	0.9
8/06	-1	0	3	11	2	7		6	5	1	-1	2	-2	6	9	4	-2	1	4	55	1.3
8/07	14	-25	12	2	7	-1		2	0	0	5	1	1	0	-1	0	4	0	0	21	0.5
8/08	4	3	1	0	3	3		-1	0	-1	0	-1	-1	0	1	3	2	1	0	17	0.4
8/09	2	2	6	17	12	4		-1	-1	2	3	-1	1	0	0	2	1	0	2	51	1.2
8/10	4	10	6	-1	-1	1		0	2	0	1	-2	0	3	0	0	0	3	4	30	0.7
8/11	2	2	1	0	-1	1	4	0	1	0	-1	-2	1	4	-1	0	1	1	2	15	0.4
8/12	2	1	0	0	4	0		0	0	2	0	0	-1	0	0	0	1	-2	1	8	0.2
8/13	3	7	2	1	2	0		0	2	1	0	-1	1	-1	0	2	1	0	0	20	0.5
8/14	-1	-5	1	0	1	0		2	1	1	0	1	-2	0	0	1	1	-1	0	0	0.
8/15	0	0	2	0	0	3		-2	0	-2	3	0	1	2	1	0				8	0.2
8/16																				0	0
8/17								1	0	0	-1	0	0	1	0	0	1	0	-1	1	0.0
8/18	-1	1	0	-1	0	0	1	0	0	0	-1	2	0	0	0	0	0	0	-1	0	0
8/19	1	0	1	0	0	0		0	0	0	1	0	1	0	1	1	1	0	0	7	0.2
8/20	2	4	2	0	-1	0		0	0	0	-1	1	-1	0	1	0	0	0	0	7	0.2
8/21	1	0	-1	0	0	0		0	0	0	-1	0	1	0	0	0	0	0	0	0	0
8/22	0	0	0	-1	0	0		0	0	0	0	0	0	-1	0	0	-1	1	0	-2	-0.0
8/23																				0	0
8/24								0	0	0	2	1	1	0	0	0	0	0	0	4	0.1
8/25	0	0	0	0	0	0	0			0	0	0	1	0	0	0	0			1	0.0
8/26																				0	0
8/27																		0	0	0	0
8/28	0	0	0	0																0	0
8/29																		0	0	0	0
8/30	0	0	0	0						0	0	0	0	0	0	1	0	0	0	1	0.0
8/31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		650		384		279		43		43		12		126		163		217		4227	
	566		565		373		8		69		26		52		121		245		278		100
%	13.3		13.3		8.8		0.3		1.6		0.6		1.2		2.9		5.8		6.6		
		15.3		9.1		6.6		1.0		1.0		0.3		3.0		3.9		5.1		100	

Table 5. Daily hourly migration past North River counting tower, 1985. Species: Chum.

Date	00	01	02	03	04	05	06-11	12	13	14	15	16	17	18	19	20	21	22	23	Total	%
6/27																0	0	0	0	0	0
6/28									0	0	0	0	0	0	0	0	0	0	0	0	0
6/29														0	0					0	0
6/30														0	0	0	0	0		0	0
7/01																				0	0
7/02																				0	0
7/03																				0	0
7/04																				0	0
7/05														0	0	0	0	0	0	0	0
7/06	1							0	0	0	0	0	0	0	2	0	4	2	0	9	0.2
7/07	0	0	0	0	1	-1	2	0	0	0	1	1	0	0	0	0	1	0		5	0.1
7/08																				0	0
7/09																				0	0
7/10									0	0	0	0	0	0	0	0	-1	-1	2	0	0
7/11	0	0	0	0	1	0		-1	0	2	0	0	1	-1	-1	0	0	0	11	12	0.3
7/12	0	0	2	1	0	4		0	3	0	0	0	0	0	0	0	3	0	0	13	0.3
7/13	0	10	27	0	1	2	4	0	0	0	0	-1	-1	0	0	0	0	7	1	50	1.3
7/14	3	5	28	10	5	13		0	1	1	0	0	1	0	4	3	7	4	1	86	2.2
7/15	15	15	19	8	21	17		0	0	0	0	0	0	0	0	2	0	2	7	106	2.7
7/16	13	4	5	0	7	14		0	2	0	0	0	1	1	1	5	2	0	0	55	1.4
7/17	11	4	5	1	2	3		0	0	0	0	0	-2	3	5	5	5	0	9	51	1.3
7/18	21	7	19	17	14	3		0	1	2	2	1	4	0	1	1	5	10	3	111	2.8
7/19	27	39	48	11	14	17		0	4	6	-1	1	1	6	0	4	6	13	14	210	5.4
7/20	41	103	113	138	103	16		0	0	3	0	3	1	3	2	0	8	1	11	546	14.0
7/21	7	8	13	9	3	2	17	0	0	0	3	3	4	2	0	-1	6	1	19	104	2.7
7/22	17	23	30	7	6	4		2	7	1	-1	7	1	3	1	1	6	1	10	126	3.2
7/23	2	4	14	19	21	38		1	0	0	0	0	1	1	7	6	3	2	-1	118	3.0
7/24	11	16	7	12	11	5		0	3	1	-1	1	-1	2	0	3	43	5	8	126	3.2
7/25	12	10	47	14	16	33		1	-2	-3	1	-1	0	0	-1	6	-3	1	4	135	3.4
7/26	12	25	30	30	14	4		1	5	2	0	0	0	2	1	-3	1	0	1	125	3.2
7/27	26	16	18	12	9	2		0	0	-1	1	-1	0	0	1	-2	1	5	16	103	2.6
7/28	0	10	17	16	20	5	1	-1	0	2	0	-2	0	0	-1	3	2	9	9	90	2.3
7/29	14	92	36	47	140	29		2	1	2	-1	1	1	3	4	3	0	16	1	391	10.0
7/30	15	4	11	31	24	41		-1	-1	1	1	1	2	1	-1	0	0	3	-1	131	3.4
7/31	3	13	23	9	13	9		-4	0	1	0	1	1	1	-1	3	4	0	15	91	2.3
8/01	8	32	11	41	18	1		1	2	0	0	-1	3	6	9	16	20	1	3	171	4.4
8/02	16	20	13	20	23	1		0	2	0	-1	0	0	1	1	0	3	1	11	111	2.8
8/03	7	28	12	9	20	-3		0	0	0	-2	1	1	10	0	0	1	4	22	110	2.8
8/04	6	8	12	26	16	5	1	0	0	2	0	0	-1	1	0	0	1	0	12	89	2.3
8/05	64	21	2	5	5	1		0	0	0	0	-1	0	4	0	0	0	6	12	119	3.0
8/06	12	13	12	15	21	3		0	-2	1	0	0	0	0	-1	-1	-2	-1	10	80	2.0
8/07	19	5	11	4	6	10		1	0	0	0	-1	0	0	0	2	0	0	0	57	1.5
8/08	0	4	3	5	12	-1		0	0	2	0	-1	0	2	2	0	5	-4	0	29	0.7
8/09	3	4	2	12	18	8		0	0	0	-2	-1	2	0	0	-1	5	-1	-6	43	1.1
8/10	2	9	8	0	11	7		0	0	1	1	-1	-6	-1	-1	0	1	0	3	34	0.9
8/11	0	7	6	14	-2	3	4	0	0	8	7	0	6	-10	5	-1	1	3	2	53	1.4
8/12	4	3	2	10	6	0		0	1	0	0	0	0	0	2	0	1	1	3	33	0.8
8/13	4	7	1	1	4	2		0	0	0	1	0	1	-1	-1	0	0	1	3	23	0.6
8/14	4	2	3	12	5	1		-2	0	1	-1	0	-2	0	3	-2	0	4	5	33	0.8
8/15	5	4	11	-2	9	13		-9	-24	-8	-3	-6	1	6	0	1				-2	-0.0
8/16																				0	0
8/17								-1	-2	1	0	-1	0	1	0	-1	0	1	3	1	0.0
8/18	2	4	1	1	0	1	1	0	1	0	0	-2	2	2	0	1	1	1	0	16	0.4
8/19	1	3	3	5	6	6		0	0	-1	0	-2	1	3	0	0	-1	5	1	30	0.8
8/20	-1	1	6	4	4	0		0	-1	0	0	0	1	-1	0	0	1	0	0	14	0.4
8/21	-2	-3	-6	3	3	2		0	0	1	-2	0	-1	0	1	1	3	1	0	1	0.0
8/22	1	7	2	0	7	0		0	0	0	0	-1	0	1	0	0	0	0	1	18	0.5
8/23																				0	0
8/24								0	0	-1	1	-2	0	0	-1	1	0	8	6	12	0.3
8/25	-3	2	4	4	3	2	-5			-1	-1	-1	0	0	0	0	0			4	0.1
8/26																				0	0
8/27																		1	4	5	0.1
8/28	3	1	0	1																5	0.1
8/29																		-1	0	-1	-0.0
8/30	-1	1	0	0						0	0	1	0	1	0	3	2	0	3	10	0.3
8/31	2	-1	6	2	0	1	0	0	0	1	1	0	0	1	1	3	0	0	0	17	0.4
Total		590		584		323		-2		27		-4		53		61		112		3909	
	487		637		641		25		1		4		23		44		145		238		100.
%	10.4		16.2		16.3		0.7		0.0		0.1		0.6		1.1		3.7		6.1		
		15.1		15.0		8.3		-.05		0.7		-0.1		1.4		1.6		2.9		100	

Table 6. Expanded daily salmon migration, North River, 1985.

Date	Chinook Expanded	Coho Expanded	Pink Expanded	Chum Expanded
6/27	0	0	0	0
6/28	0	0	0	0
6/29	0	0	0	0
6/30	0	0	0	0
7/01	0	0	0	0
7/02	0	0	0	0
7/03	0	0	0	0
7/04	0	0	0	0
7/05	1	0	0	0
7/06	34	0	0	15
7/07	-1	0	0	5
7/08*	0	0	0	3
7/09*	0	0	0	3
7/10	0	0	0	0
7/11	-2	0	11	13
7/12	1	0	2	14
7/13	6	0	10	312
7/14	32	0	56	93
7/15	55	0	56	115
7/16	86	0	66	60
7/17	47	0	49	61
7/18	54	0	157	133
7/19	52	0	346	251
7/20	197	0	597	653
7/21	72	0	241	104
7/22	114	0	326	151
7/23	76	0	262	141
7/24	134	0	260	151
7/25	135	0	262	137
7/26	75	0	222	126
7/27	45	0	236	104
7/28	53	0	142	90
7/29	34	8	130	395
7/30	22	23	103	132
7/31	6	26	93	92
8/01	13	40	77	173
8/02	15	43	79	112
8/03	11	53	158	111
8/04	15	23	69	89
8/05	1	49	43	120
8/06	10	54	60	81
8/07	5	54	23	58
8/08	17	45	23	31
8/09	4	81	70	47
8/10	5	36	41	37
8/11	4	109	15	53
8/12	2	40	11	36
8/13	0	39	27	25
8/14	3	57	0	36
8/15	-4	207	8	5
8/16*	0	129	4	11
8/17	-3	93	3	29
8/18	-1	61	0	19
8/19	0	73	7	32
8/20	1	64	7	15
8/21	1	98	0	1
8/22	0	62	-2	7
8/23*	0	63	1	8
8/24	0	57	4	11
8/25	0	71	1	13
8/26*	0	56	1	8
8/27*	0	56	1	6
8/28*	0	48	1	5
8/29*	0	46	1	7
8/30	0	45	1	13
8/31	0	35	0	17
Totals	1426	2045	4360	4567

Appendix Table 1. Daily total cumulative chinook salmon escapement, North River tower.

Date	1972 1/	1973 1/	1974 2/	1984 3/	1985 3/
6/25			0	0	
6/26			0	0	
6/27			1	0	0
6/28			3	0	0
6/29		1	6	55	0
6/30		1	42	101	0
7/01		1	48	513	0
7/02		6	53	642	0
7/03		10	88	745	0
7/04		16	125	984	0
7/05		19	151	1038	1
7/06		20	173	1207	35
7/07	11	22	184	1274	34
7/08	15	26	191	1341	34
7/09	30	33	191	1367	34
7/10	50	43	192	1418	34
7/11	126	71	192	1648	32
7/12	172	82	192	1957	33
7/13	194	83	193	2126	39
7/14	245	87	196	2242	71
7/15	309	94	196	2358	126
7/16	376	97	196	2481	213
7/17	406	119	196	2602	260
7/18	458	150		2674	314
7/19	466	150		2706	366
7/20	475	216		2784	563
7/21	492	231		2803	635
7/22	508	262		2825	748
7/23	521	298		2847	824
7/24	535			2845	958
7/25	544			2840	1093
7/26	551			2844	1168
7/27	556			2848	1213
7/28	561			2844	1266
7/29					1300
7/30					1322
7/31					1328
8/01					1341
8/02					1356
8/03					1366
8/04					1381
8/05					1382
8/06					1392
8/07					1397
8/08					1414
8/09					1418
8/10					1423
8/11					1427
8/12					1429
8/13					1429
8/14					1432
8/15					1428
8/16					1428
8/17					1425
8/18					1424
8/19					1424
8/20					1425
8/21					1426

1/ 24 hour counts
2/ 18 hour counts
3/ expanded counts

Appendix Table 2. Daily total cumulative coho salmon escapement, North River tower.

Date	1985 1/
7/25	0
7/26	0
7/27	0
7/28	0
7/29	8
7/30	31
7/31	57
8/01	97
8/02	140
8/03	193
8/04	216
8/05	265
8/06	319
8/07	374
8/08	419
8/09	500
8/10	536
8/11	645
8/12	686
8/13	725
8/14	781
8/15	988
8/16	1117
8/17	1211
8/18	1272
8/19	1345
8/20	1409
8/21	1507
8/22	1568
8/23	1631
8/24	1688
8/25	1759
8/26	1816
8/27	1872
8/28	1920
8/29	1966
8/30	2010
8/31	2045

1/ expanded counts

Appendix Table 3. Daily total cumulative pink salmon escapement, North River tower.

Date	1972 1/	1973 1/	1974 2/	1984 3/	1985 3/
6/25			111	27	
6/26			371	27	
6/27			2410	379	0
6/28			5366	4201	0
6/29		0	14140	30301	0
6/30		0	36909	70057	0
7/1		49	49445	141035	0
7/2		83	59699	175065	0
7/3		187	85613	213513	0
7/4		539	108778	244864	0
7/5		1004	120023	255068	0
7/6		1196	131573	261472	0
7/7	3790	1394	141361	267837	0
7/8	11743	1504	143621	274201	0
7/9	18374	1931	143692	276696	0
7/10	23589	3276	143724	283051	0
7/11	30323	6925	143764	293200	11
7/12	34836	10115	143764	303493	13
7/13	39428	12265	143772	315069	23
7/14	42550	16510	143777	330354	79
7/15	46046	19384	143783	345473	135
7/16	49000	20028	143785	368228	201
7/17	50801	21094	143789	400054	250
7/18	52079	22192		417711	407
7/19	52303	23205		426787	753
7/20	52512	24323		438645	1350
7/21	52956	25265		440167	1591
7/22	53409	25976		444602	1917
7/23	53965	26542		449037	2179
7/24	54320			451423	2439
7/25	54545			453398	2701
7/26	54710			455204	2924
7/27	54763			456875	3159
7/28	54934			458387	3301
7/29					3431
7/30					3534
7/31					3627
8/01					3704
8/02					3783
8/03					3940
8/04					4009
8/05					4052
8/06					4112
8/07					4135
8/08					4158
8/09					4228
8/10					4269
8/11					4284
8/12					4295
8/13					4322
8/14					4322
8/15					4330
8/16					4334
8/17					4337
8/18					4337
8/19					4344
8/20					4351
8/21					4351
8/22					4349
8/23					4350
8/24					4354
8/25					4355
8/26					4356
8/27					4357
8/28					4358
8/29					4359
8/30					4360
8/31					4360

1/ 24 hour counts
2/ 18 hour counts
3/ expanded counts

Appendix Table 4. Daily cumulative chum salmon escapement, North River tower.

Date	1972 1/	1973 1/	1974 2/	1984 3/	1985 3/
6/25			0	0	
6/26			0	1	
6/27			19	1	0
6/28			23	1	0
6/29		0	33	88	0
6/30		0	91	124	0
7/1		9	177	320	0
7/2		9	217	395	0
7/3		19	369	431	0
7/4		59	533	489	0
7/5		72	633	511	0
7/6		79	717	533	15
7/7	96	88	751	551	20
7/8	215	96	769	570	23
7/9	272	121	776	579	25
7/10	344	288	776	600	25
7/11	548	681	776	675	38
7/12	687	891	776	776	52
7/13	777	1041	780	952	364
7/14	958	1545	793	1184	458
7/15	1114	2144	798	1437	573
7/16	1418	2190	810	1531	633
7/17	1696	2436	826	1895	694
7/18	1742	2666		2072	826
7/19	1742	3087		2150	1077
7/20	1754	3310		2461	1730
7/21	1859	3546		2572	1834
7/22	1990	3798		2692	1985
7/23	2119	4334		2812	2126
7/24	2204			2846	2276
7/25	2241			2870	2413
7/26	2268			2896	2539
7/27	2285			2908	2643
7/28	2332			2915	2733
7/29					3129
7/30					3261
7/31					3353
8/01					3526
8/02					3638
8/03					3750
8/04					3839
8/05					3959
8/06					4040
8/07					4098
8/08					4129
8/09					4176
8/10					4212
8/11					4265
8/12					4301
8/13					4326
8/14					4362
8/15					4366
8/16					4377
8/17					4406
8/18					4425
8/19					4457
8/20					4472
8/21					4473
8/22					4480
8/23					4488
8/24					4499
8/25					4512
8/26					4520
8/27					4526
8/28					4531
8/29					4537
8/30					4550
8/31					4567

1/ 24 hour counts
2/ 18 hour counts
3/ expanded counts

Appendix Table 5. Peak Annual Aerial Surveys, North River, 1962 - 1985.

Year	Chinook	Chum	Pink	Pink and Chum	Coho
1962	162			16087	
1963 1/	287			73274	
1964	23			5981	
1965	153			16600	
1970 1/	1	20655	12400		
1971 1/	256			1047	
1973	267	3644	16590		
1975 1/	60	5237	17885		
1976 1/	66	196	10606		
1977	1275	8139	4565		
1978	321	9349	21813		
1979	735	1130	9500		
1980	61	2300	127900		204
1981	68	405	575		263
1982	8	599	173352		4145
1983	347	4135	4980		
1984	51				152
1985	703	1625	325		

1/ Poor survey conditions or partial survey.