Shaktoolik River Salmon Counting Tower
Project Summary Report, 1998

by

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INTRODUCTION

The Shaktoolik River flows southwest approximately 95 miles from it's source in the Nulato Hills to Shaktoolik Bay. The Shaktoolik River is the major salmon producing stream in the Shaktoolik subdistrict of Norton Sound. The village of Shaktoolik is located near the mouth of the river. The Shaktoolik River supports both subsistence and sport fisheries, as well as a commercial fishery in the subdistrict.

The project is operated by the Alaska Department of Fish & Game (ADF&G) to obtain more timely and accurate escapement information required for the active management of salmon stocks throughout the season. Previous attempts by other agencies to operate a counting tower project on the Shaktoolik River have been unsuccessful (Charles Lean, ADF&G, personal communication). This was the third consecutive year of counting tower operation that produced usable data (Rob 1997 and 1998).

OBJECTIVES

1. Obtain daily and seasonal estimates of the timing and magnitude of the salmon escapement, by species, to the Shaktoolik River.

2. Obtain daily and seasonal estimates of the timing and magnitude of the Dolly Varden escapement to the Shaktoolik River.

METHODS

The Shaktoolik River tower camp is located approximately 5 miles upstream from the village of Shaktoolik (Figure 1). A letter of understanding from the Shaktoolik Native Corporation authorizes the tower operation on Corporation lands.

Equipment, materials and supplies for the project were stored in the villages of Shaktoolik and Unalakleet. The crewmembers traveled to Unalakleet to begin work on 8 June 1998. They, along with Nome ADF&G staff, began moving equipment to Shaktoolik and upriver to the tower site. The camp was set up. Two counting towers were erected, one on each side of the river. A flash panel was deployed across the entire river. The towers and flash panel were located approximately 100 feet downstream from the previous year location. To ensure that the counts made from each tower only counted the nearest half of the river, a section of panel was deployed vertically in the middle of the river to divide the river into half.

A 120 volt lighting system was installed to illuminate the flash panel during dark periods. These lights were powered by a portable generator.

The ADF&G, Commercial Fisheries Division (CFD) provided operational funding for the Shaktoolik River counting tower. Counts began on 16 June and ended on 22 July, 1998. The counting schedule was 16 hourly shifts each day from 1300 hours to 0400 hours the following day; during each hourly shift the crew counted a twenty minute shift on each side of the river. A 24 hour count and two days off were scheduled weekly. The two twenty minute counts from each hour were added together to give a subtotal for each species. These subtotals were tripled to produce the reported hourly total for each species. Each day the reported hourly totals were added to produce an unexpanded daily total for each species. Every day the daily and cumulative unexpanded totals for each species were relayed to the Nome office by radio and telephone via the Unalakleet office.

The expanded counts for this report were calculated using the following methods. The 16 hour counts for days off, or for days missed, were estimated by adding the counts of each hour of the day before to the counts of each hour of the day following and dividing the result by two, giving hourly counts for 16 hours of the day off. Next an expansion factor was calculated to expand for the 8 hours not normally counted. This factor was derived from the weekly 24 hour count by dividing the total count from 0500 hours to 1200 hours during the 24 hour count day by the total normal 16 hour count during the 24 hour count day. Then each 16 hour count for the remaining days was expanded to 24 hour counts by applying the expansion factor from the nearest 24 hour count day and multiplying each day's 16 hour total by the 24 hour expansion factor, and adding that number to the 16 hour count for each day. This expansion was done for all species counted.

RESULTS

Table 1 shows the expanded daily and cumulative totals for each species. The counting season ended early because of continuing high water (Table 12).

The reported net upstream total hourly counts were: 3,381 chum salmon, 92,384 pink salmon, 877 king salmon, 0 coho salmon, and 963 Dolly Varden (Tables 7-11). The expanded counts were: 5,789 chum salmon, 159,567 pink salmon, 1,755 king salmon, 0 coho salmon, and 2,355 Dolly Varden (Tables 2-6). Figure 2 shows a graph of the daily cumulative expanded passage of all salmonid species, except pink salmon, counted. Figures 3-10 show graphs of the expanded daily totals and the cumulative daily totals for each species.

King salmon were observed on 16 June, the first day of counting, Dolly Varden were first observed on 17 June, pink salmon were first observed on 19 June, chum salmon were first observed on 25 June and no coho salmon were observed (Table 1). The daily peak count of 918 chum salmon occurred on 7 July, the daily peak count of 16,109 pink salmon occurred on 7 July, the daily peak count of 222 king salmon occurred on 30 June and the daily peak count of 144 Dolly Varden occurred on 24 June (Table 1).

All species counted exhibited a diurnal pattern of migration past the counting tower. The greatest hourly chum salmon migration occurred during the hour from 1800 to 1900, when 10.1% passed the tower. During the twelve hour period from 1500 through 0200 hours, 75% of the chum salmon passed the tower (Table 2 and Figure 11). The greatest hourly pink salmon migration occurred during the hour from 2100 to 2200 hours, when 11.9% passed the tower. During the ten hour period from 1600 through 0100 hours, 76% of the pink salmon passed the tower (Table 3 and Figure 12). The greatest hourly king salmon migration occurred during the hour from 2300 to 2400, when 8.7% passed the tower. During the eight hour period from 2000 through 0300 hours, 50% of the king salmon passed the tower (Table 4 and Figure 13). The greatest hourly Dolly Varden migration occurred during the hour from 2200 to 2300, when 8.3% passed the tower. During the eight hour period from 0500 through 1200 hours 39% of the Dolly Varden passed the tower and during the eight hour period from 2000 through 0300 hours 42% of the Dolly Varden passed the tower (Table 6 and Figure 14).

An aerial survey of the Shaktoolik River counted 1,557 chum salmon on 20 July, 1998. The total season expanded tower count of chum salmon was 5,789. The aerial survey counted 27% of the total season expanded tower count of chum salmon. The aerial survey counted 1,557 chum salmon above the counting tower on 20 July, when the cumulative tower count of chum salmon was 5,424. The aerial survey counted 29% of the cumulative tower count of chum salmon on 20 July (Table 1). An aerial survey count of 89,010 pink salmon was made on 20 July, 1998. The total season expanded tower count of pink salmon was 159,567. The aerial survey counted 56% of the total season expanded tower count of pink salmon. The aerial survey counted 82,710 pink salmon above the counting tower on 20 July, when the cumulative tower count of pink salmon was 140,725. The aerial survey counted 59% of the cumulative tower count of pink salmon on 20 July (Table 1).

An aerial survey of the Shaktoolik River counted 1,404 coho salmon on 8 September, 1998. No coho salmon were counted at the counting tower this year because the project ended before the coho salmon escapement began.

Climatological and stream observations are shown in Table 12.

DISCUSSION

A counting tower project that focused on counting coho salmon was conducted by the U.S. Bureau of Land Management on the Shaktoolik River in the early 1990's. That project was washed out by flooding and no useable data was collected (Charles Lean, ADF&G, personal communication).

Counting began on 16 June in 1998. This was early enough to observe the beginning of the escapement of all salmon species, except king salmon.

Shortcomings in the expansion technique are illustrated by the king salmon data during the first 10 days of counting. The downstream migration of 12 king salmon during the 0600 hour of the 24 hour count on 22 June had a major impact on the expansion for nine other days and produced an illogical daily total downstream migration for the first 10 days of the king salmon escapement (Tables 1, 4 and 9). More scheduled counts during the 0500 - 1200 hours time period would help mitigate this problem, but budget and personnel constraints make increasing the number of hours counted difficult.

High water and very poor visibility beginning on 22 July made any further counting impossible. This was the third consecutive year of high water and visibility problems severe enough to end the project ahead of schedule (Rob 1997 and 1998).

The tower crew reported heavy subsistence king salmon catches in the lower river near Shaktoolik Village on 22 and 23 June. These catches exceeded the total reported tower count to date. In prior years reports of subsistence catches have been used to gauge run strength. The counting tower is an important tool for assessing total run strength and provides fisheries managers significant additional inseason information.

ACKNOWLEDGEMENTS

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Table 1. Expanded daily and cumulative migration of all salmonid species past the Shaktoolik River counting tower, Norton Sound, 1998

Date	Daily chum salmon	Cumulative chum salmon	Daily pink salmon	Cumulative pink salmon	Daily king salmon	Cumulative king salmon	Daily coho salmon	Cumulative coho salmon	Daily Dolly Varden	Cumulative Dolly Varden
16-Jun	0	0	0	0	-3	-3	0	0	0	0
17-Jun	0	0	0	0	-6	-9	0	0	81	81
18-Jun	0	0	0	0	-14	-23	0	0	0	81
19-Jun	0	0	2	2	-2	-25	0	0	99	180
20-Jun	0	0	3	5	-11	-36	0	0	72	252
21-Jun	0	0	8	13	-8	-44	0	0	51	303
22-Jun	0	0	12	25	-3	-47	0	0	9	312
23-Jun	0	0	48	73	-5	-52	0	0	135	447
24-Jun	0	0	27	100	-8	-60	0	0	144	591
25-Jun	2	2	90	190	-13	-73	0	0	117	708
26-Jun	4	6	240	430	52	-21	0	0	34	742
27-Jun	83	89	617	1,047	118	97	0	0	26	768
28-Jun	61	150	602	1,649	82	179	0	0	48	816
29-Jun	30	180	573	2,222	33	212	0	0	60	876
30-Jun	165	345	1,562	3,784	222	434	0	0	56	932
1-Jul	420	765	5,554	9,338	132	566	0	0	34	966
2-Jul	260	1,025	2,979	12,317	94	660	0	0	26	992
3-Jul	209	1,234	1,536	13,853	128	788	0	0	12	1,004
4-Jul	60	1,294	261	14,114	56	844	0	0	13	1,017
5-Jul	108	1,402	1,087	15,201	56	900	0	0	41	1,058
6-Jul	132	1,534	1,917	17,118	24	924	0	0	66	1,124
7-Jul	918	2,452	16,109	33,227	88	1,012	0	0	6	1,130
8-Jul	158	2,610	6,368	39,595	8	1,020	0	0	28	1,158
9-Jul	189	2,799	5,820	45,415	37	1,057	0	0	53	1,211
10-Jul	230	3,029	5,487	50,902	23	1,080	0	0	99	1,310
11-Jul	361	3,390	11,705	62,607	53	1,133	0	0	77	1,387
12-Jul	305	3,695	12,806	75,413	54	1,187	0	0	74	1,461
13-Jul	237	3,932	13,896	89,309	45	1,232	0	0	63	1,524
14-Jul	38	3,970	1,652	90,961	23	1,255	0	0	81	1,605
15-Jul	323	4,293	5,327	96,288	56	1,311	0	0	99	1,704
16-Jul	270	4,563	6,835	103,123	65	1,376	0	0	95	1,799
17-Jul	206	4,769	8,338	111,461	65	1,441	0	0	81	1,880
18-Jul	247	5,016	10,078	121,539	79	1,520	0	0	59	1,939
19-Jul	215	5,231	9,740	131,279	68	1,588	0	0	102	2,041
20-Jul	193	5,424	9,446	140,725	59	1,647	0	0	87	2,128
21-Jul	193	5,617	9,446	150,171	59	1,706	0	0	87	2,215
22-Jul	172	5,789	9,396	159,567	49	1,755	0	0	140	2,355

Table 2. Expanded daily hourly chum salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500-1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
17-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
18-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
20-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
21-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
22-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
25-Jun	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0%
26-Jun	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0.1%
27-Jun	18	0	0	0	0	17	0	3	0	0	0	9	15	6	3	12	0	83	1.4%
28-Jun	12	2	2	0	0	12	0	2	2	0	0	8	8	3	3	5	2	61	1.1%
29-Jun	6	3	3	0	0	6	0	0	3	0	0	6	0	0	3	-3	3	30	0.5%
30-Jun	9	3	3	0	0	33	9	0	0	0	0	0	3	3	0	21	81	165	2.9%
1-Jul	15	21	18	15	9	84	6	18	12	57	75	6	12	12	3	21	36	420	7.3%
2-Jul	6	17	18	15	11	52	5	9	6	29	39	5	8	8	5	9	18	260	4.5%
3-Jul	-3	12	18	15	12	14	5	9	6	29	39	5	8	8	5	9	18	209	3.6%
4-Jul	-2	6	14	9	11	4	3	0	0	0	3	3	3	3	6	-3	0	60	1.0%
5-Jul	-2	6	14	9	11	7	2	6	2	3	3	8	5	3	9	11	11	108	1.9%
6-Jul	0	0	9	3	9	9	0	12	3	6	3	12	6	3	12	24	21	132	2.3%
7-Jul	18	81	51	54	36	63	15	24	12	12	66	108	84	102	72	81	39	918	15.9%
8-Jul	39	18	24	3	3	11	0	6	3	15	6	9	6	6	3	6	0	158	2.7%
9-Jul	30	21	21	5	6	13	0	18	9	11	12	9	3	3	6	8	14	189	3.3%
10-Jul	21	24	18	6	9	29	0	30	15	6	18	9	0	0	9	9	27	230	4.0%
11-Jul	18	15	21	30	24	46	9	9	12	3	3	36	45	18	18	12	42	361	6.2%
12-Jul	20	9	9	14	12	39	5	11	23	17	6	20	26	18	33	17	26	305	5.3%
13-Jul	21	3	-3	-3	0	30	0	12	33	30	9	3	6	18	48	21	9	237	4.1%
14-Jul	0	0	3	3	0	5	0	0	0	0	0	6	3	0	3	6	9	38	0.7%
15-Jul	0	-3	9	12	0	41	0	0	3	9	6	138	81	12	0	6	9	323	5.6%
16-Jul	3	6	8	8	3	34	2	5	8	14	9	74	48	21	2	17	8	270	4.7%
17-Jul	6	15	6	3	6	26	3	9	12	18	12	9	15	30	3	27	6	206	3.6%
18-Jul	27	9	15	3	9	31	12	9	9	18	12	18	9	12	9	18	27	247	4.3%
19-Jul	20	8	9	3	6	27	12	9	14	11	11	20	12	20	5	14	14	215	3.7%
20-Jul	12	6	3	3	3	24	12	9	14	11	11	20	12	20	5	14	14	193	3.3%
21-Jul	12	6	3	3	3	24	12	9	14	11	11	20	12	20	5	14	14	193	3.3%
22-Jul	12	6	3	3	3	22	12	9	18	3	9	21	15	27	0	9	0	172	3.0%
Total	323	294	299	216	186	704	124	228	233	313	363	582	445	376	270	385	448	5,789	
	5.6%	5.1%	5.2%	3.7%	3.2%	12.2%	2.1%	3.9%	4.0%	5.4%	6.3%	10.1%	7.7%	6.5%	4.7%	6.7%	7.7%	100.0%	

Tal. Expanded daily hourly pink salmon migration past the Shaktoolik River c[illegible] tower, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500-1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
17-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
18-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0.0%
20-Jun	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0.0%
21-Jun	0	3	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	8	0.0%
22-Jun	0	6	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	12	0.0%
23-Jun	0	0	0	0	6	0	0	0	6	6	18	0	0	0	3	0	9	48	0.0%
24-Jun	0	0	9	0	0	0	0	0	0	0	0	0	0	0	9	3	6	27	0.0%
25-Jun	3	8	9	3	2	0	0	0	3	0	2	2	0	6	17	2	33	90	0.1%
26-Jun	6	15	9	6	3	93	0	0	6	0	3	3	0	12	24	0	60	240	0.2%
27-Jun	30	-3	18	3	18	239	12	0	6	0	3	33	36	24	75	75	48	617	0.4%
28-Jun	32	15	30	23	33	233	18	14	6	8	5	17	18	14	44	44	48	602	0.4%
29-Jun	33	33	42	42	48	222	24	27	6	15	6	0	0	3	12	12	48	573	0.4%
30-Jun	45	27	57	54	54	605	9	3	6	0	3	6	6	24	0	228	435	1,562	1.0%
1-Jul	177	180	198	135	123	2,152	9	27	30	138	366	96	273	105	138	741	666	5,554	3.5%
2-Jul	102	119	113	65	63	1,154	6	15	20	72	191	62	149	62	74	365	347	2,979	1.9%
3-Jul	27	57	27	-5	3	65	6	15	20	72	191	62	149	62	74	365	347	1,536	1.0%
4-Jul	39	45	21	8	8	11	3	3	9	6	15	27	24	18	9	-12	27	261	0.2%
5-Jul	39	45	21	8	8	46	11	20	21	41	83	77	80	75	105	140	267	1,087	0.7%
6-Jul	51	33	15	21	12	81	18	36	33	75	150	126	135	132	201	291	507	1,917	1.2%
7-Jul	375	468	342	348	225	681	195	198	276	285	660	1,641	2,268	1,352	2,502	2,529	1,764	16,109	10.1%
8-Jul	1,242	480	336	186	156	269	84	195	273	591	483	289	402	276	495	423	189	6,388	4.0%
9-Jul	897	474	371	209	140	246	92	492	249	362	551	255	263	180	318	351	390	5,820	3.6%
10-Jul	552	468	405	231	123	447	99	768	225	132	618	222	123	84	141	279	570	5,487	3.4%
11-Jul	375	420	369	282	324	953	243	138	237	144	459	1,335	4,137	426	447	423	993	11,705	7.3%
12-Jul	659	722	437	189	218	1,042	168	131	629	443	404	761	2,151	341	3,555	378	578	12,806	8.0%
13-Jul	942	1,023	504	96	111	1,131	93	123	1,020	741	348	186	165	255	6,663	333	162	13,896	8.7%
14-Jul	105	9	9	18	27	134	51	72	69	102	54	168	138	150	135	213	198	1,652	1.0%
15-Jul	207	72	114	84	105	434	132	87	99	279	102	1,215	1,440	363	156	294	144	5,327	3.3%
16-Jul	419	216	143	84	129	556	176	476	279	294	339	792	1,061	524	456	555	336	6,835	4.3%
17-Jul	630	360	171	84	153	679	219	864	459	309	576	369	681	684	756	816	528	8,338	5.2%
18-Jul	831	456	513	141	225	820	132	156	279	816	720	363	441	951	990	852	1,389	10,078	6.3%
19-Jul	669	522	390	144	174	793	132	156	350	669	1,196	1,188	717	747	506	542	845	9,740	6.1%
20-Jul	507	588	267	147	120	769	132	156	350	669	1,196	1,188	717	747	506	542	845	9,446	5.9%
21-Jul	507	588	267	147	120	769	132	156	350	669	1,196	1,188	717	747	506	542	845	9,446	5.9%
22-Jul	507	588	267	147	120	765	132	156	420	522	1,671	2,013	993	543	21	231	300	9,396	5.9%
Total	10,008	8,037	5,479	2,899	2,854	15,389	2,328	4,485	5,736	7,460	11,609	13,683	17,284	8,907	18,938	11,557	12,914	159,567	
	6.3%	5.0%	3.4%	1.8%	1.8%	9.6%	1.5%	2.8%	3.6%	4.7%	7.3%	8.6%	10.8%	5.6%	11.9%	7.2%	8.1%	100.0%	

Table 4. Expanded daily hourly king salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500-1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	3	0	-9	0	0	0	0	0	0	0	0	0	0	3	-3	-0.2%
17-Jun	0	0	0	0	0	-18	3	0	0	0	6	0	0	0	3	0	0	-6	-0.3%
18-Jun	0	0	0	0	0	-41	0	0	0	0	0	0	9	18	0	0	0	-14	-0.8%
19-Jun	0	0	0	0	0	-5	0	0	0	0	0	3	0	0	0	0	0	-2	-0.1%
20-Jun	0	0	0	0	0	-32	0	0	0	0	0	0	0	0	0	15	6	-11	-0.6%
21-Jun	0	0	0	0	-3	-23	0	2	0	0	0	0	0	2	3	8	3	-8	-0.5%
22-Jun	0	0	0	0	-6	-9	0	3	0	0	0	0	0	3	6	0	0	-3	-0.2%
23-Jun	0	0	0	6	0	-14	0	0	0	0	0	0	0	0	0	3	0	-5	-0.3%
24-Jun	0	0	0	6	0	-23	0	0	0	0	6	0	0	0	0	0	3	-8	-0.5%
25-Jun	2	0	0	5	0	-39	0	0	0	2	3	0	0	5	6	0	3	-13	-0.7%
26-Jun	3	0	0	3	0	19	0	0	0	3	0	0	0	9	12	0	3	52	3.0%
27-Jun	18	9	6	0	3	43	0	3	0	0	0	3	6	0	18	0	9	118	6.7%
28-Jun	11	9	3	2	2	30	0	2	0	0	0	2	5	0	9	2	5	82	4.7%
29-Jun	3	9	0	3	0	12	0	0	0	0	0	0	3	0	0	3	0	33	1.9%
30-Jun	9	21	15	3	9	81	6	0	0	0	0	0	0	9	0	18	51	222	12.6%
1-Jul	9	15	6	6	6	45	3	15	0	9	12	0	3	0	0	0	0	132	7.5%
2-Jul	5	12	5	6	5	34	2	8	0	5	6	2	2	0	0	2	0	94	5.4%
3-Jul	0	9	3	6	3	80	2	8	0	5	6	2	2	0	0	2	0	128	7.3%
4-Jul	2	5	3	3	2	35	0	0	0	0	0	3	0	0	0	3	0	56	3.2%
5-Jul	2	5	3	3	2	35	0	0	0	0	0	2	0	0	2	2	0	56	3.2%
6-Jul	3	0	3	0	0	15	0	0	0	0	0	0	0	0	3	0	0	24	1.4%
7-Jul	0	15	3	9	0	55	0	0	0	0	6	0	0	0	0	0	0	88	5.0%
8-Jul	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	3	8	0.5%
9-Jul	0	0	2	2	-2	23	0	2	0	0	2	2	0	2	0	2	2	37	2.1%
10-Jul	0	0	3	3	-3	5	0	3	0	0	3	3	0	3	0	3	0	23	1.3%
11-Jul	3	9	0	6	6	11	3	0	3	3	0	0	0	0	0	0	9	53	3.0%
12-Jul	2	6	2	3	6	11	2	0	2	5	3	5	2	0	0	0	5	54	3.1%
13-Jul	0	3	3	0	6	9	0	0	0	6	6	9	3	0	0	0	0	45	2.6%
14-Jul	0	0	0	0	0	5	3	6	3	0	0	0	0	6	0	0	0	23	1.3%
15-Jul	0	0	0	6	3	11	6	0	0	3	6	6	0	9	0	3	3	56	3.2%
16-Jul	6	0	2	6	2	13	3	2	0	2	3	3	2	5	0	10	6	65	3.7%
17-Jul	12	0	3	6	0	13	0	3	0	0	0	0	3	0	0	16	9	65	3.7%
18-Jul	9	9	6	0	6	16	3	6	0	3	0	3	0	3	3	0	12	79	4.5%
19-Jul	8	6	6	2	3	14	3	6	2	2	0	2	2	3	3	0	6	68	3.9%
20-Jul	6	3	6	3	0	12	3	6	2	2	0	2	2	3	3	0	6	59	3.4%
21-Jul	6	3	6	3	0	12	3	6	2	2	0	2	2	3	3	0	6	59	3.4%
22-Jul	6	3	6	3	0	10	3	6	3	0	0	0	3	3	3	0	0	49	2.8%
Total	125	151	95	107	50	444	48	87	17	52	68	54	49	86	77	92	153	1,755	
	7.1%	8.6%	5.4%	6.1%	2.8%	25.3%	2.7%	5.0%	1.0%	3.0%	3.9%	3.1%	2.8%	4.9%	4.4%	5.2%	8.7%	100.0%	

5. Expanded daily hourly coho salmon migration past the Shaktoolik F ounting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500-1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total
16-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6. Expanded daily hourly Dolly Varden migration past the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted. Numbers in outlined areas indicate estimated passage.

Date	0000	0100	0200	0300	0400	0500-1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	3	0	0	0	0	0	0	0	0	0	0	0	0	-3	0	0	0	0.0%
17-Jun	3	0	0	0	3	54	9	0	0	0	0	0	0	0	6	3	3	81	3.4%
18-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun	2	0	0	2	0	66	0	0	2	0	0	6	0	21	0	0	0	99	4.2%
20-Jun	3	0	0	3	0	48	0	0	3	0	3	0	3	3	0	0	6	72	3.1%
21-Jun	2	0	0	2	0	34	0	0	2	0	2	0	2	2	0	2	3	51	2.2%
22-Jun	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	3	0	9	0.4%
23-Jun	0	0	0	15	0	90	0	3	0	0	0	0	0	0	0	6	21	135	5.7%
24-Jun	21	3	3	6	6	96	0	0	0	0	0	0	0	0	0	-3	12	144	6.1%
25-Jun	12	3	3	5	3	78	0	2	0	0	0	0	0	2	3	-2	8	117	5.0%
26-Jun	3	3	3	3	0	7	0	3	0	0	0	0	0	3	6	0	3	34	1.4%
27-Jun	3	0	0	0	0	5	0	3	0	0	0	3	0	9	0	0	3	26	1.1%
28-Jun	5	3	5	2	0	10	0	2	3	0	0	2	2	6	0	3	5	48	2.0%
29-Jun	6	6	9	3	0	12	0	0	6	0	0	0	3	3	0	6	6	60	2.5%
30-Jun	9	3	6	6	3	11	0	0	6	0	0	0	0	6	0	0	6	56	2.4%
1-Jul	3	0	3	6	3	7	0	0	6	0	0	0	3	3	0	0	0	34	1.4%
2-Jul	0	0	2	3	2	5	2	2	3	0	0	2	2	3	0	0	0	26	1.1%
3-Jul	-3	0	0	0	0	1	2	2	3	0	0	2	2	3	0	0	0	12	0.5%
4-Jul	-2	0	2	0	0	1	3	3	0	0	0	3	0	3	0	0	0	13	0.6%
5-Jul	-2	0	2	0	0	2	2	5	3	3	5	5	2	6	5	3	0	41	1.7%
6-Jul	0	0	3	0	0	3	0	6	6	6	9	6	3	9	9	6	0	66	2.8%
7-Jul	0	0	0	0	[illegible]	0	[illegible]	3	0	0	0	0	0	0	0	0	3	6	0.3%
8-Jul	0	[illegible]	0	0	[illegible]	1	3	3	0	0	3	0	0	0	6	6	6	28	1.2%
9-Jul	2	0	5	2	5	2	3	5	2	0	2	0	0	0	5	8	6	53	2.3%
10-Jul	3	12	9	3	9	33	3	6	3	0	0	0	0	0	3	9	6	99	4.2%
11-Jul	9	9	3	3	12	26	3	3	0	0	0	0	0	0	3	0	6	77	3.3%
12-Jul	9	6	3	2	8	25	5	3	0	0	6	0	0	2	2	0	3	74	3.1%
13-Jul	9	3	3	0	3	21	6	3	0	0	12	0	0	3	0	0	0	63	2.7%
14-Jul	0	0	0	6	3	27	0	6	0	6	3	6	9	0	3	3	9	81	3.4%
15-Jul	3	6	0	6	6	33	0	0	3	0	6	6	0	0	18	9	3	99	4.2%
16-Jul	5	6	2	6	5	32	0	0	2	0	3	3	0	3	15	8	5	95	4.0%
17-Jul	6	6	3	6	3	27	0	0	0	0	0	0	0	6	12	6	6	81	3.4%
18-Jul	3	6	3	0	12	20	0	0	0	0	0	6	0	0	0	0	9	59	2.5%
19-Jul	2	5	3	0	6	34	0	0	3	0	0	6	2	0	8	24	9	102	4.3%
20-Jul	0	3	3	0	0	29	0	0	3	0	0	6	2	0	8	24	9	87	3.7%
21-Jul	0	3	3	0	0	29	0	0	3	0	0	6	2	0	8	24	9	87	3.7%
22-Jul	0	3	3	0	0	47	0	0	6	0	0	6	3	0	15	48	9	140	5.9%
Total	116	98	84	90	92	922	41	63	68	15	54	74	40	96	132	196	174	2,355	
	4.9%	4.2%	3.6%	3.8%	3.9%	39.2%	1.7%	2.7%	2.9%	[illegible]%	2.3%	3.1%	1.7%	4.1%	5.6%	8.3%	7.4%	100.0%	

7. Reported hourly chum salmon observations at the Shaktoolik River cour ver, Norton Sound, 1998.

Outlined areas indicate hours not counted

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	0	0									0	0	0				0	0	0	0	0	0	0.0%
17-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
18-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun																	0	0	0	0	0	0	0	0	0	0.0%
20-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
21-Jun																									0	0.0%
22-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
23-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
24-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
25-Jun																									0	0.0%
26-Jun	3	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	3	0.1%
27-Jun	18	0	0	0	0									0	3	0	0	0	9	15	6	3	12	0	66	2.0%
28-Jun																									0	0.0%
29-Jun	6	3	3	0	0	6	0	0	0	0	0	0	0	0	0	3	0	0	6	0	0	3	-3	3	30	0.9%
30-Jun	9	3	3	0	0									9	0	0	0	0	0	3	3	0	21	81	132	3.9%
1-Jul	15	21	18	15	9									6	18	12	57	75	6	12	12	3	21	36	336	9.9%
2-Jul																									0	0.0%
3-Jul	-3	12	18	15	12																				54	1.6%
4-Jul														3	0	0	0	3	3	3	3	6	-3	0	18	0.5%
5-Jul																									0	0.0%
6-Jul	0	0	9	3	9	6	0	0	3	0	0	0	0	0	12	3	6	3	12	6	3	12	24	21	132	3.9%
7-Jul	18	81	51	54	36									15	24	12	12	66	108	84	102	72	81	39	855	25.3%
8-Jul	39	18	24	3	3									0	6	3	15	6	9	6	6	3	6	0	147	4.3%
9-Jul																									0	0.0%
10-Jul	21	24	18	6	9									0	30	15	6	18	9	0	0	9	9	27	201	5.9%
11-Jul	18	15	21	30	24									9	9	12	3	3	36	45	18	18	12	42	315	9.3%
12-Jul																									0	0.0%
13-Jul	21	3	-3	-3	0	0	0	0	0	9	9	9	3	0	12	39	30	9	3	6	18	48	21	9	237	7.0%
14-Jul	0	0	3	3	0									0	0	0	0	0	6	3	0	3	6	9	33	1.0%
15-Jul	0	-3	9	12	0									0	0	3	9	6	138	81	12	0	6	9	282	8.3%
16-Jul																									0	0.0%
17-Jul	6	15	6	3	6									3	9	12	18	12	9	15	30	3	27	6	180	5.3%
18-Jul	27	9	15	3	9									12	9	9	18	12	18	9	12	9	18	27	216	6.4%
19-Jul																									0	0.0%
20-Jul	12	6	3	3	3	3	0	0	3	3	0	6													42	1.2%
21-Jul																									0	0.0%
22-Jul																18	3	9	21	15	27	0	9	0	102	3.0%
	210	207	198	147	120	15	0	0	6	12	9	15	3	57	132	135	177	222	393	303	252	192	267	309	3,381	
	6.2%	6.1%	5.9%	4.3%	3.5%	0.4%	0.0%	0.0%	0.2%	0.4%	0.3%	0.4%	0.1%	1.7%	3.9%	4.0%	5.2%	6.6%	11.6%	9.0%	7.5%	5.7%	7.9%	9.1%	100.0%	

Table 8. Reported hourly pink salmon observations at the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	0	0									0	0	0				0	0	0	0	0	0	0.0%
17-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
18-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun																	0	0	0	0	0	0	0	0	0	0.0%
20-Jun	0	0	0	0	0									0	3	0	0	0	0	0	0	0	0	0	3	0.0%
21-Jun																									0	0.0%
22-Jun	0	6	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	12	0.0%
23-Jun	0	0	0	0	6									0	0	6	6	18	0	0	0	3	0	9	48	0.1%
24-Jun	0	0	9	0	0									0	0	0	0	0	0	0	0	9	3	6	27	0.0%
25-Jun																									0	0.0%
26-Jun	6	15	9	6	3									0	0	6	0	3	3	0	12	24	0	60	147	0.2%
27-Jun	30	3	18	3	18									12	0	6	0	3	33	36	24	75	75	48	378	0.4%
28-Jun																									0	0.0%
29-Jun	33	33	42	42	48	42	39	18	24	21	39	15	24	24	27	6	15	6	0	0	3	12	12	48	573	0.6%
30-Jun	45	27	57	54	54									9	3	6	0	3	6	6	24	0	228	435	957	1.0%
1-Jul	177	180	198	135	123									9	27	30	138	366	96	273	105	138	741	666	3,402	3.7%
2-Jul																									0	0.0%
3-Jul	27	57	27	6	3																				108	0.1%
4-Jul														3	3	9	6	15	27	24	18	9	12	27	129	0.1%
5-Jul																									0	0.0%
6-Jul	51	33	15	21	12	12	0	21	3	0	12	9	24	18	36	33	75	150	126	135	132	201	291	507	1,917	2.1%
7-Jul	375	468	342	348	225									195	198	276	285	660	1,641	2,268	1,352	2,502	2,529	1,764	15,428	16.7%
8-Jul	1,242	480	336	186	156									84	195	273	591	483	288	402	276	495	423	189	6,099	6.6%
9-Jul																									0	0.0%
10-Jul	552	468	405	231	123									99	768	225	132	618	222	123	84	141	279	570	5,040	5.5%
11-Jul	375	420	369	282	324									243	138	237	144	459	1,335	4,137	426	447	423	993	10,752	11.6%
12-Jul																									0	0.0%
13-Jul	942	1,023	804	96	111	171	99	123	132	102	153	162	189	93	123	1,020	741	348	186	165	255	6,663	333	162	13,896	15.0%
14-Jul	105	9	9	18	27									51	72	69	102	54	168	138	150	135	213	198	1,518	1.6%
15-Jul	207	72	114	84	105									132	87	99	279	102	1,215	1,440	363	156	294	144	4,893	5.3%
16-Jul																									0	0.0%
17-Jul	630	360	171	84	153									219	864	459	309	576	369	681	684	756	816	528	7,659	8.3%
18-Jul	831	456	513	141	228									132	156	279	816	720	363	441	951	990	852	1,389	9,258	10.0%
19-Jul																									0	0.0%
20-Jul	507	588	267	147	120	345	453	288	258	240	114	99													3,426	3.7%
21-Jul																									0	0.0%
22-Jul																420	522	1,671	2,013	993	543	21	231	300	6,714	7.3%
	6,135	4,692	3,408	1,872	1,839	570	591	450	417	363	318	285	237	1,323	2,703	3,459	4,161	6,255	8,091	11,262	5,402	12,777	7,731	8,043	92,384	
	6.6%	5.1%	3.7%	2.0%	2.0%	0.6%	0.6%	0.5%	0.5%	0.4%	0.3%	0.3%	0.3%	1.4%	2.9%	3.7%	4.5%	6.8%	8.8%	12.2%	5.8%	13.8%	8.4%	8.7%	100.0%	

Table 9. F ·d hourly king salmon observations at the Shaktoolik River counting to· ·rton Sound, 1998.

Outlined areas indicate hours not counted

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	0	0	3	0									0	0	0				0	0	0	0	3	6	0.7%
17-Jun	0	0	0	0	0									3	0	0	0	6	0	0	0	3	0	0	12	1.4%
18-Jun	0	0	0	0	0									0	0	0	0	0	0	9	18	0	0	0	27	3.1%
19-Jun																	0	0	3	0	0	0	0	0	3	0.3%
20-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	15	6	21	2.4%
21-Jun																									0	0.0%
22-Jun	0	0	0	0	-6	0	-12	0	0	0	3	0	0	0	3	0	0	0	0	0	3	6	0	0	-3	-0.3%
23-Jun	0	0	0	6	0									0	0	0	0	0	0	0	0	0	3	0	9	1.0%
24-Jun	0	0	0	6	6									0	0	0	0	6	0	0	0	0	0	3	15	1.7%
25-Jun																									0	0.0%
26-Jun	3	0	0	3	0									0	0	0	3	0	0	0	9	12	0	3	33	3.8%
27-Jun	18	9	6	0	3									0	3	0	0	0	3	6	0	18	0	9	75	8.6%
28-Jun																									0	0.0%
29-Jun	3	9	0	3	0	6	0	0	0	0	6	0	0	0	0	0	0	0	0	3	0	0	3	0	33	3.8%
30-Jun	9	21	15	3	9									6	0	0	0	0	0	0	9	0	18	51	141	16.1%
1-Jul	9	15	6	6	6									3	15	0	9	12	0	3	0	0	0	0	84	9.6%
2-Jul																									0	0.0%
3-Jul	0	9	3	6	3																				21	2.4%
4-Jul														0	0	0	0	0	3	0	0	0	3	0	6	0.7%
5-Jul																									0	0.0%
6-Jul	3	0	3	0	0	6	6	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0	24	2.7%
7-Jul	0	15	3	9	0									0	0	0	0	6	0	0	0	0	0	0	33	3.8%
8-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	3	3	0.3%
9-Jul																									0	0.0%
10-Jul	0	0	3	3	-3									0	3	0	0	3	3	0	3	0	3	0	18	2.1%
11-Jul	3	9	0	6	6									3	0	3	3	0	0	0	0	0	0	9	42	4.8%
12-Jul																									0	0.0%
13-Jul	0	3	3	0	6	0	3	0	3	0	3	0	0	0	0	0	6	6	9	3	0	0	0	0	45	5.1%
14-Jul	0	0	0	0	0									3	6	3	0	0	0	0	6	0	0	0	18	2.1%
15-Jul	0	0	0	6	3									6	0	0	3	6	6	0	9	0	3	3	45	5.1%
16-Jul																									0	0.0%
17-Jul	12	0	3	6	0									0	3	0	0	0	0	3	0	0	16	9	52	5.9%
18-Jul	9	9	6	0	6									3	6	0	3	0	3	0	3	3	0	12	63	7.2%
19-Jul																									0	0.0%
20-Jul	6	3	6	3	0	9	3	0	6	3	0	0													39	4.4%
21-Jul																									0	0.0%
22-Jul																3	0	0	0	3	3	3	0	0	12	1.4%
	75	102	57	69	33	21	0	0	9	3	12	3	0	27	39	9	27	45	30	30	63	48	64	111	877	
	8.6%	11.6%	6.5%	7.9%	3.8%	2.4%	0.0%	0.0%	1.0%	0.3%	1.4%	0.3%	0.0%	3.1%	4.4%	1.0%	3.1%	5.1%	3.4%	3.4%	7.2%	5.5%	7.3%	12.7%	100.0%	

Table 10. Reported hourly coho salmon observations at the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total
16-Jun	0	0	0	0	0									0	0	0				0	0	0	0	0	0
17-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
18-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
19-Jun																	0	0	0	0	0	0	0	0	0
20-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
21-Jun																									0
22-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
25-Jun																									0
26-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
27-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
28-Jun																									0
29-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
1-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
2-Jul																									0
3-Jul	0	0	0	0	0																				0
4-Jul														0	0	0	0	0	0	0	0	0	0	0	0
5-Jul																									0
6-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
8-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
9-Jul																									0
10-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
11-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
12-Jul																									0
13-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
15-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
16-Jul																									0
17-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
18-Jul	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0
19-Jul																									0
20-Jul	0	0	0	0	0	0	0	0	0	0	0	0													0
21-Jul																									0
22-Jul																0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11. Reported hourly Dolly Varden observations at the Shaktoolik River counting tower, Norton Sound, 1998.

Outlined areas indicate hours not counted

Date	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	Total	% of Total
16-Jun	0	3	0	0	0									0	0	0				0	0	-3	0	0	0	0.0%
17-Jun	3	0	0	0	3									9	0	0	0	0	0	0	0	6	3	3	27	2.8%
18-Jun	0	0	0	0	0									0	0	0	0	0	0	0	0	0	0	0	0	0.0%
19-Jun																	0	0	6	0	21	0	0	0	27	2.8%
20-Jun	3	0	0	3	0									0	0	3	0	3	0	3	3	0	0	6	24	2.5%
21-Jun																									0	0.0%
22-Jun	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	3	0	9	0.9%
23-Jun	0	0	0	15	0									0	3	0	0	0	0	0	0	0	6	21	45	4.7%
24-Jun	21	3	3	6	6									0	0	0	0	0	0	0	0	0	-3	12	48	5.0%
25-Jun																									0	0.0%
26-Jun	3	3	3	3	0									0	3	0	0	0	0	0	3	6	0	3	27	2.8%
27-Jun	3	0	0	0	0									0	3	0	0	0	3	0	9	0	0	3	21	2.2%
28-Jun																									0	0.0%
29-Jun	6	6	9	3	0	3	0	0	6	3	3	-3	0	0	0	6	0	0	0	3	3	0	6	6	60	6.2%
30-Jun	9	3	6	6	3									0	0	6	0	0	0	0	6	0	0	6	45	4.7%
1-Jul	3	0	3	6	3									0	0	6	0	0	0	3	3	0	0	0	27	2.8%
2-Jul																									0	0.0%
3-Jul	-3	0	0	0	0																				-3	-0.3%
4-Jul														3	3	0	0	0	3	0	3	0	0	0	12	1.2%
5-Jul																									0	0.0%
6-Jul	0	0	3	0	0	0	0	0	0	0	0	0	3	0	6	6	6	9	6	3	9	9	6	0	66	6.9%
7-Jul	0	0	0	0	0									0	3	0	0	0	0	0	0	0	0	3	6	0.6%
8-Jul	0	0	0	0	0									3	3	0	0	3	0	0	0	6	6	6	27	2.8%
9-Jul																									0	0.0%
10-Jul	3	12	9	3	9									3	6	3	0	0	0	0	0	3	9	6	66	6.9%
11-Jul	9	9	3	3	12									3	3	0	0	0	0	0	0	3	0	6	51	5.3%
12-Jul																									0	0.0%
13-Jul	9	3	3	0	3	9	0	0	0	-3	6	3	6	6	3	0	0	12	0	0	3	0	0	0	63	6.5%
14-Jul	0	0	0	6	3									0	6	0	6	3	6	9	0	3	3	9	54	5.6%
15-Jul	3	6	0	6	6									0	0	3	0	6	6	0	0	18	9	3	66	6.9%
16-Jul																									0	0.0%
17-Jul	6	6	3	6	3									0	0	0	0	0	0	0	6	12	6	6	54	5.6%
18-Jul	3	6	3	0	12									0	0	0	0	0	6	0	0	0	0	9	39	4.0%
19-Jul																									0	0.0%
20-Jul	0	3	3	0	0	6	3	0	0	0	0	0													15	1.6%
21-Jul																									0	0.0%
22-Jul																6	0	0	6	3	0	15	48	9	87	9.0%
	81	63	51	66	63	18	3	0	6	0	9	0	15	27	42	39	12	36	42	24	69	78	102	117	963	
	8.4%	6.5%	5.3%	6.9%	6.5%	1.9%	0.3%	0.0%	0.6%	0.0%	0.9%	0.0%	1.6%	2.8%	4.4%	4.0%	1.2%	3.7%	4.4%	2.5%	7.2%	8.1%	10.6%	12.1%	100.0%	

Table 12. Shaktoolik River counting tower climatological and stream observations, Norton Sound 1998.

Date	Time	Air Temperature (°C)	Water Temperature (°C)	Percent Cloud Cover	Water Guage (")	Water Visibility	Remarks
15-Jun	12:00	13	11	Clear		Clear	
16-Jun	12:00	16	10	Clear		Clear	
17-Jun	12:00	15	11	Clear		Clear	
18-Jun							
19-Jun			12				
20-Jun	12:00		12	100%	21		
21-Jun	9:00		11		20.7		
22-Jun	9:00		11		19.5		
23-Jun	12:00	11	12	100%	20	Clearing	
24-Jun	12:00	11	12	100%	18	Clearing	
25-Jun							
26-Jun	12:00	10	11	100%	18	Clearing	
27-Jun	12:00	15	12	70%	17	Clearing	
28-Jun							
29-Jun	12:00	13	14	Rain	15	Clearing	
30-Jun	12:00	16	15		15	Clearing	
1-Jul	12:00	14	15		14	Clearing	
2-Jul							
3-Jul	12:00	15	13		31	Poor	
4-Jul	12:00	14	12		27	Clearing	
5-Jul							
6-Jul	12:00	15	14		24	Clearing	
7-Jul	12:00	15	14		21	Clearing	
8-Jul	12:00	10	14		20	Clearing	
9-Jul						Clearing	
10-Jul	12:00	14	13		19	Clearing	
11-Jul	12:00	17	14		18	Clearing	
12-Jul							
13-Jul	12:00	13	13		15	Clearing	
14-Jul	12:00	15	12		15	Clearing	
15-Jul	12:00	14	12		15	Cloudy	
16-Jul							
17-Jul	12:00	15	14		17	Murky	
18-Jul	12:00	17	15		16	Clearing	
19-Jul							
20-Jul							
21-Jul							
22-Jul	21:00	18	16		14	Murky	
23-Jul	12:00	16	15		16	Murky	
24-Jul	7:00	14	14		23	Murky	
25-Jul	12:00	15	11		39	Poor	
26-Jul	9:30				71		

Figure 1. Area location map of the Shaktoolik River counting tower project site, Norton Sound, 1998.

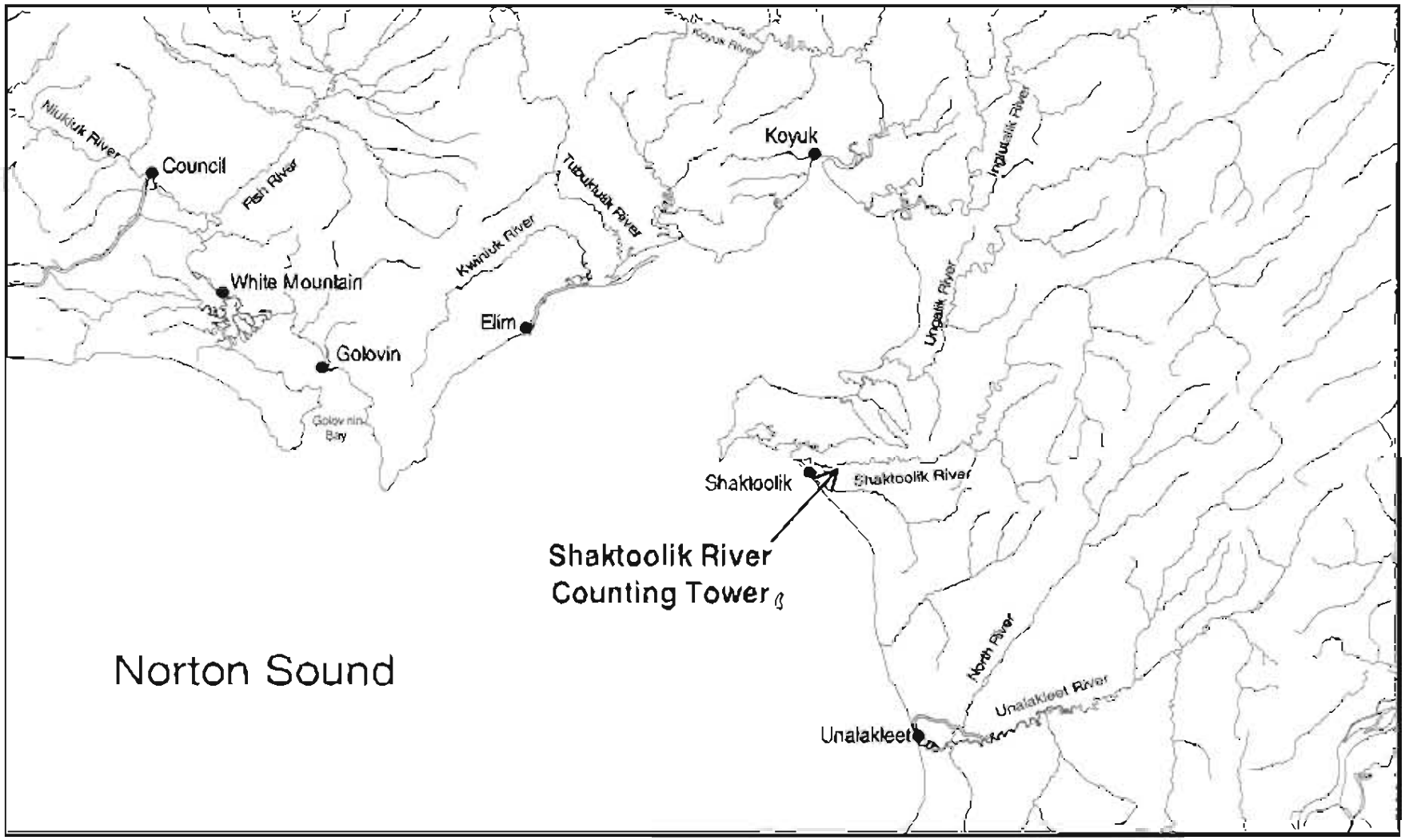


Figure 2. Cumulative passage of all salmonid species, except pink salmon, past the Shaktoolik River counting tower, Norton Sound, 1998.

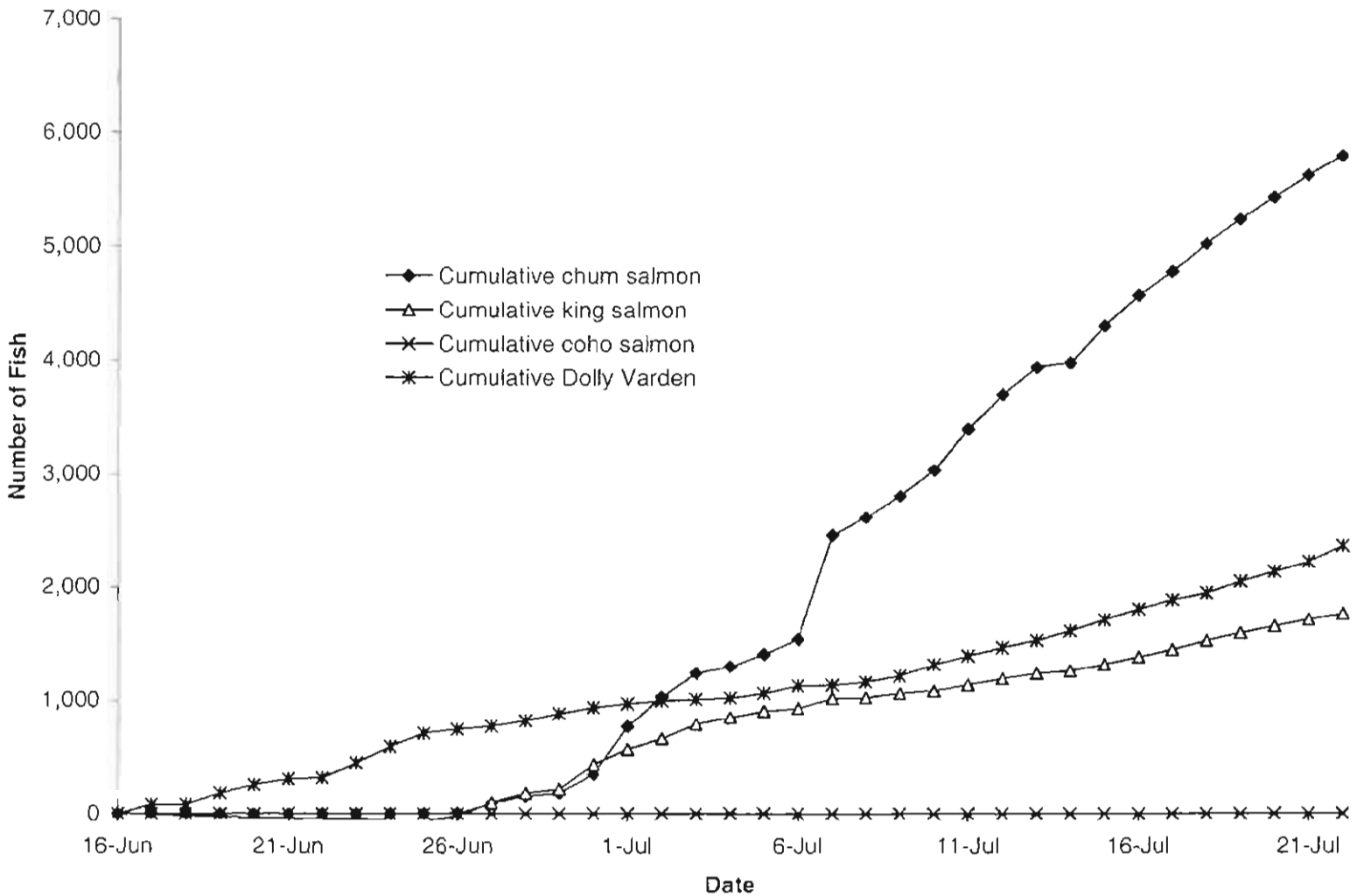


Figure 3. Daily chum salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

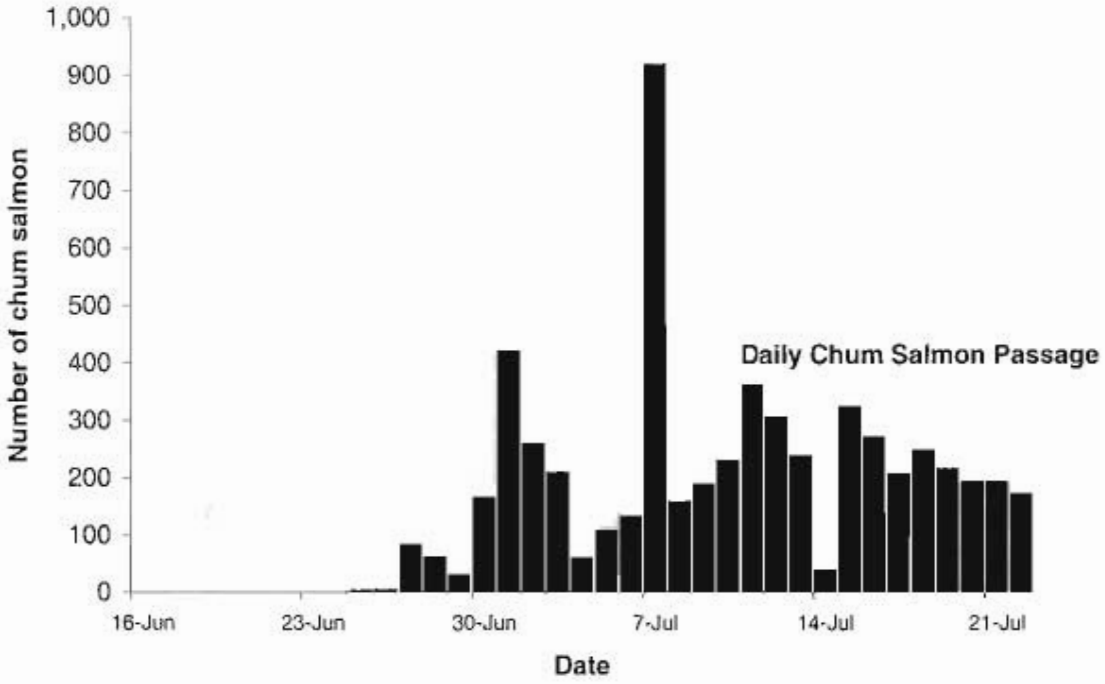


Figure 4. Cumulative chum salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

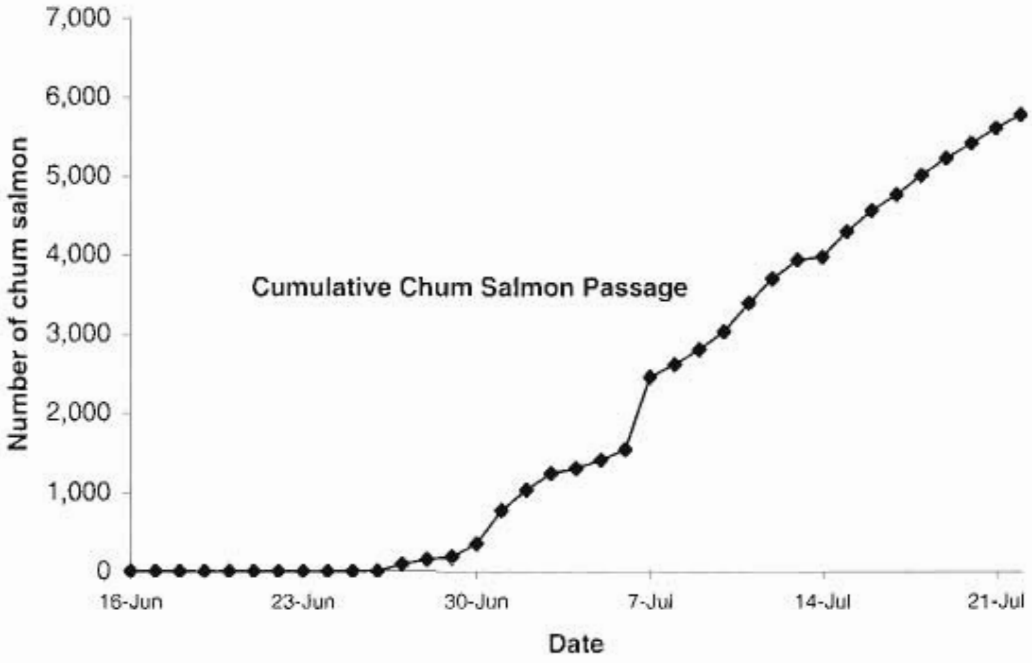


Figure 5. Daily pink salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

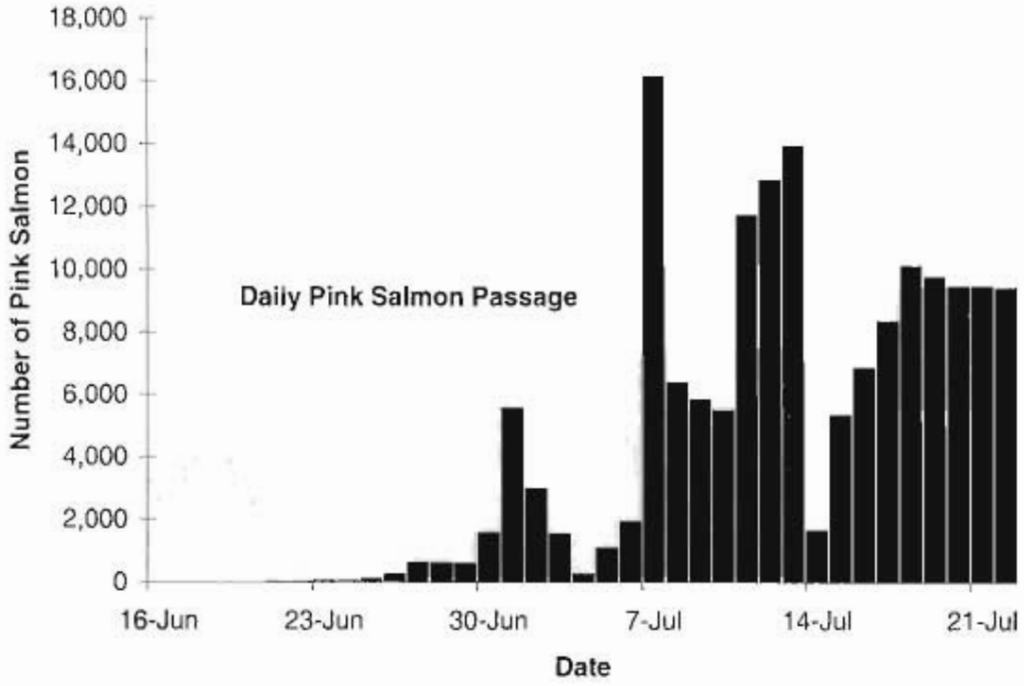


Figure 6. Cumulative pink salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

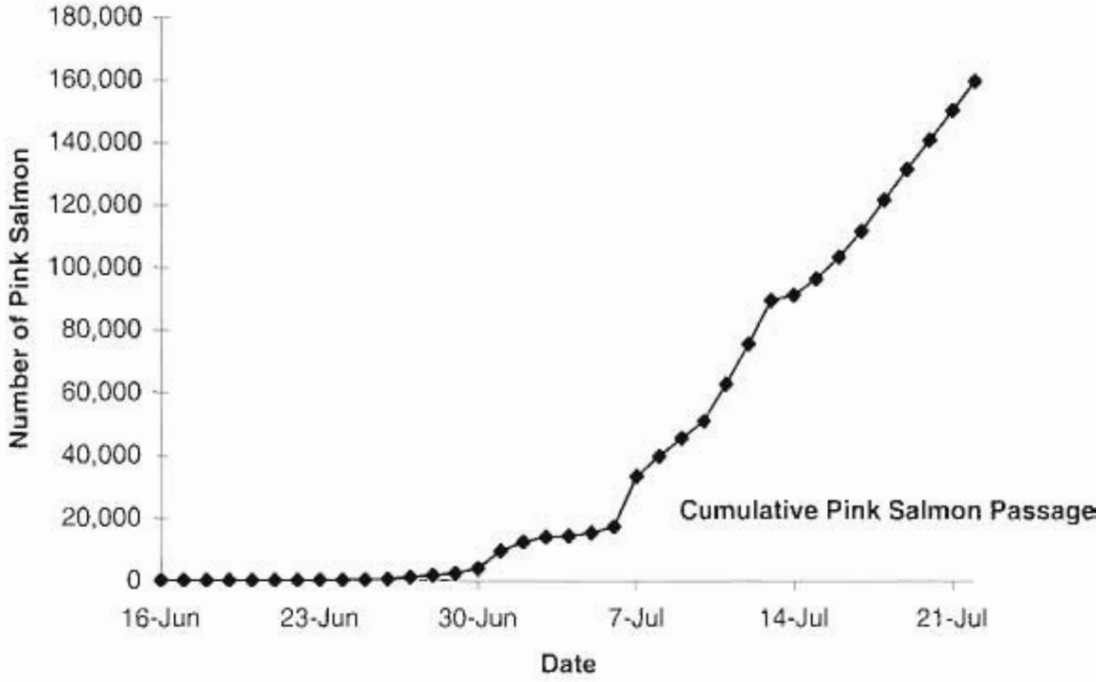


Figure 7. Daily king salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

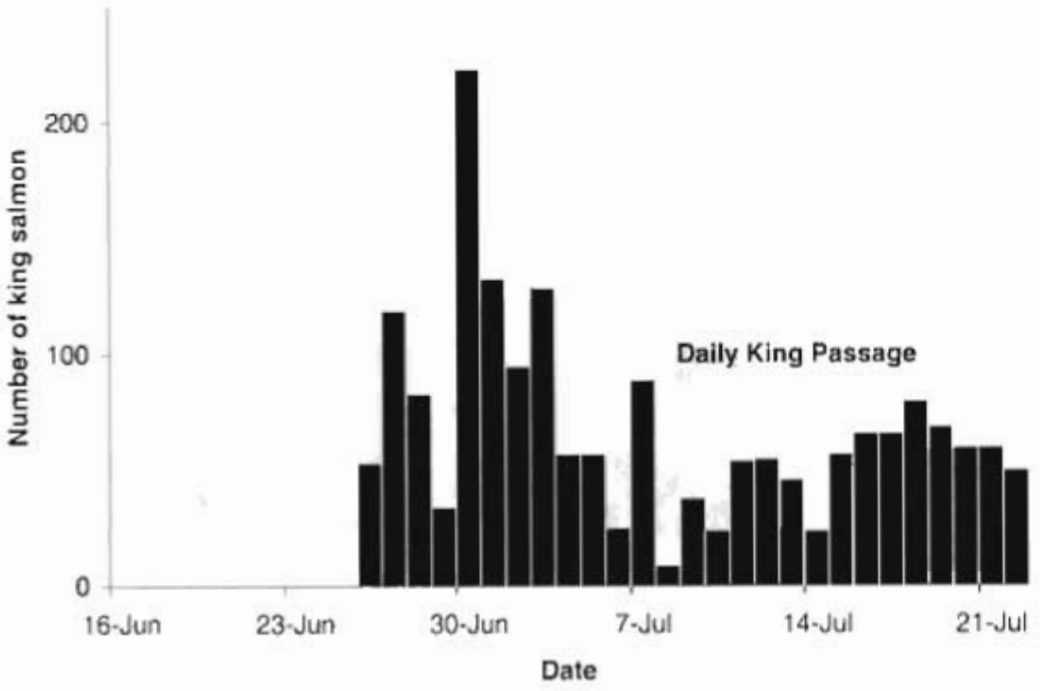


Figure 8. Cumulative king salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

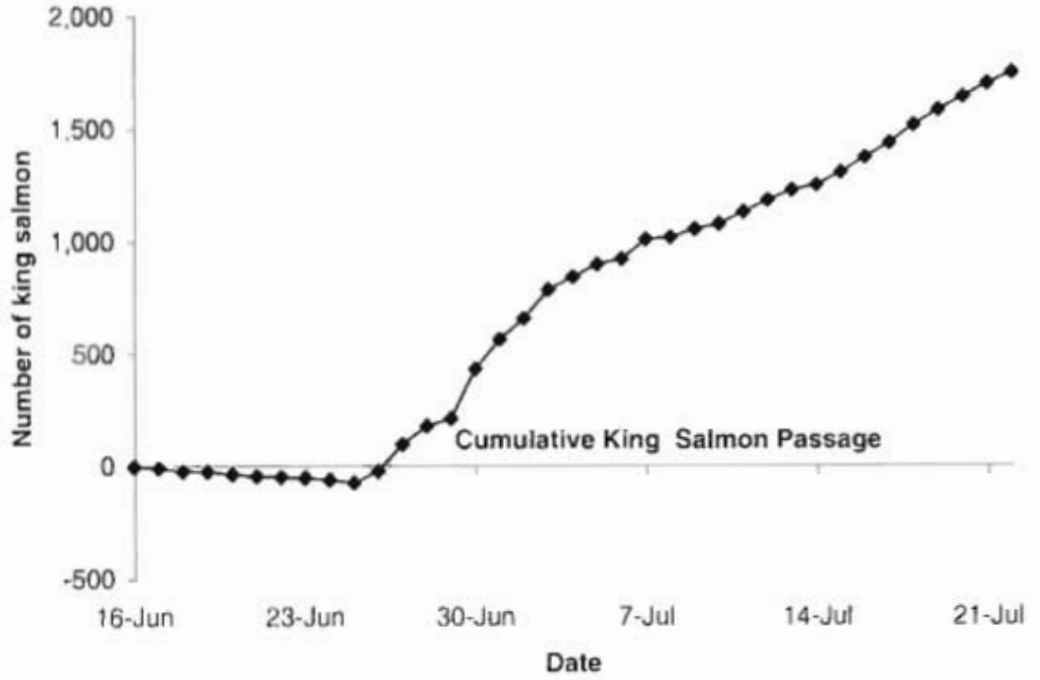


Figure 9. Daily Dolly Varden migration past the Shaktoolik River counting tower, Norton Sound, 1998.

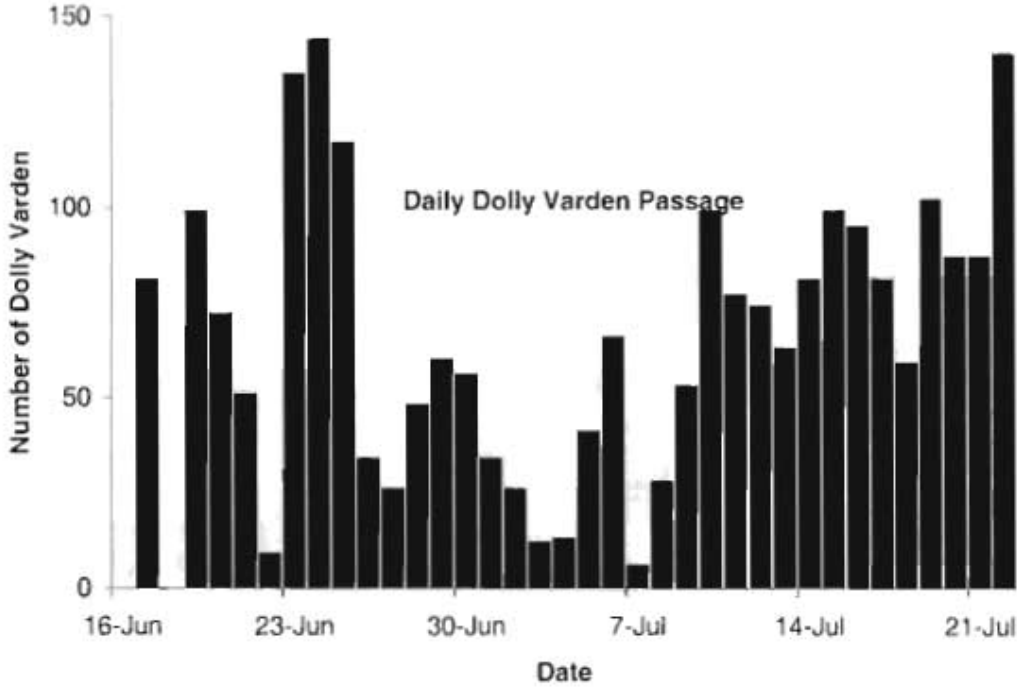


Figure 10. Cumulative Dolly Varden migration past the Shaktoolik River counting tower, Norton Sound, 1998.

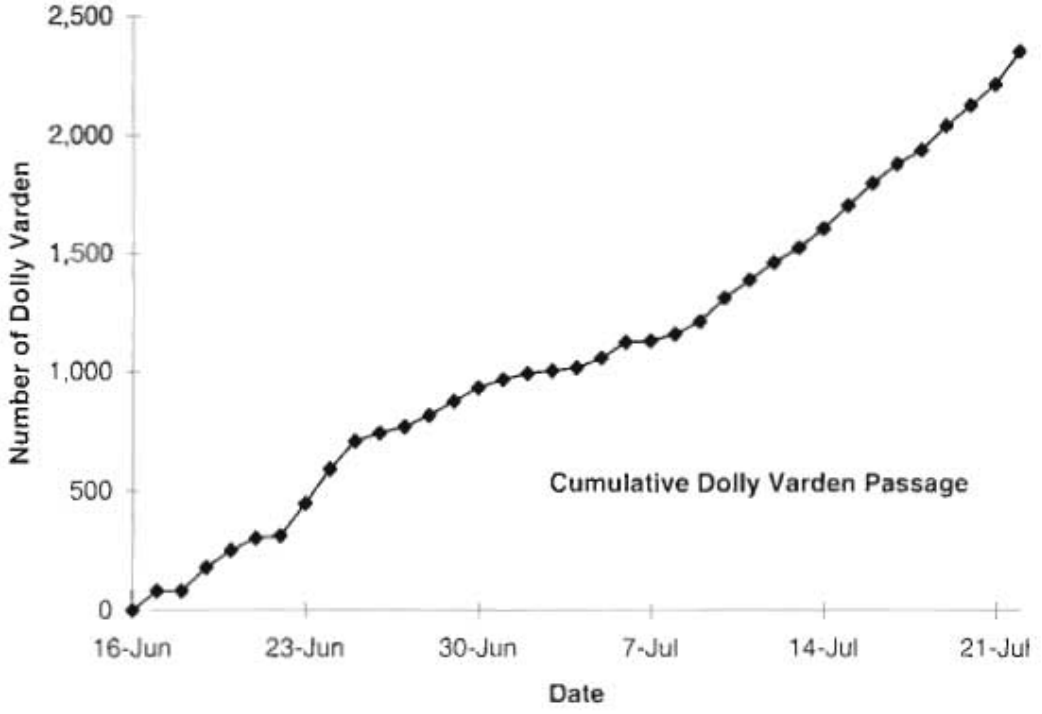
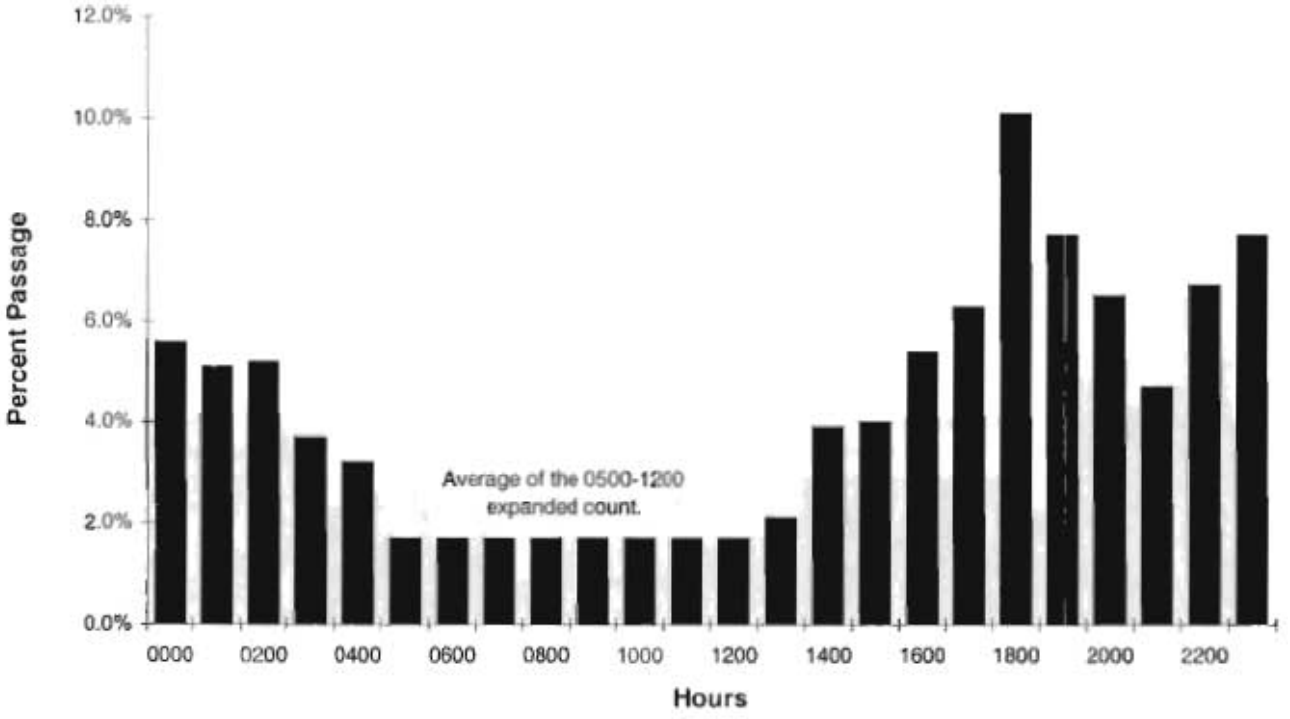


Figure 11. Diurnal pattern of chum salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.



. igure 12. Diurnal pattern of pink salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

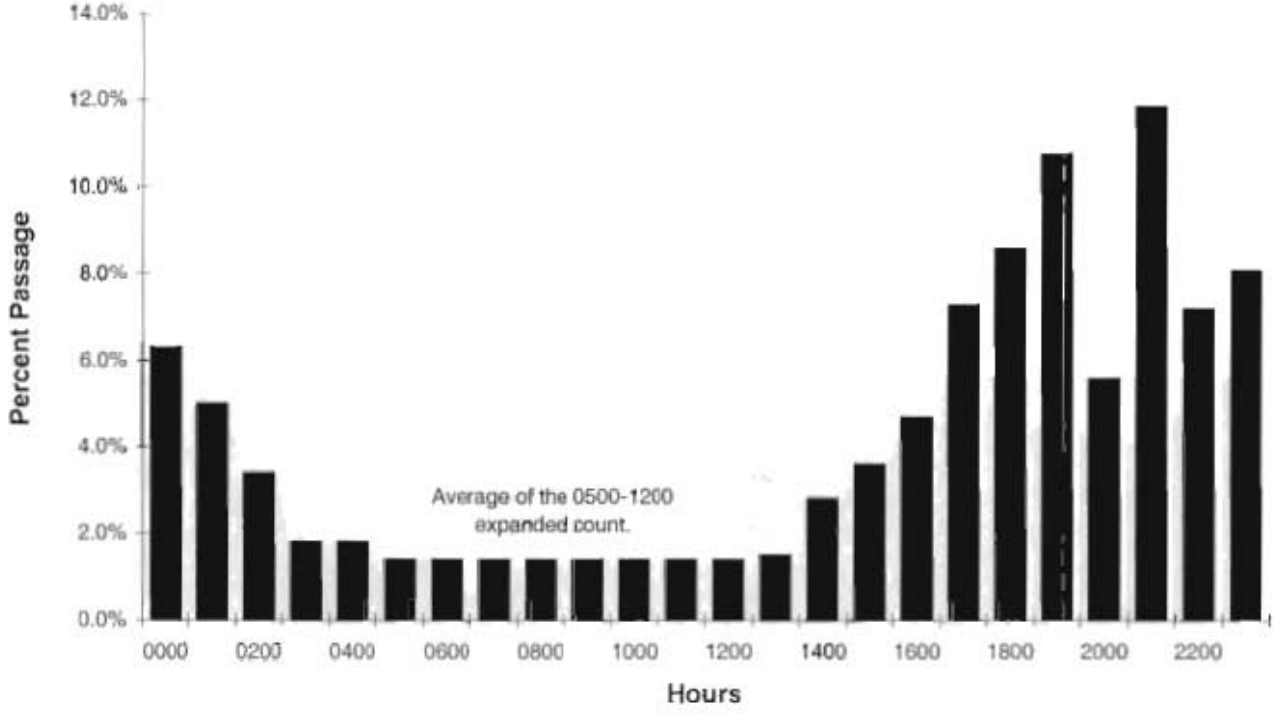


Figure 13. Diurnal pattern of king salmon migration past the Shaktoolik River counting tower, Norton Sound, 1998.

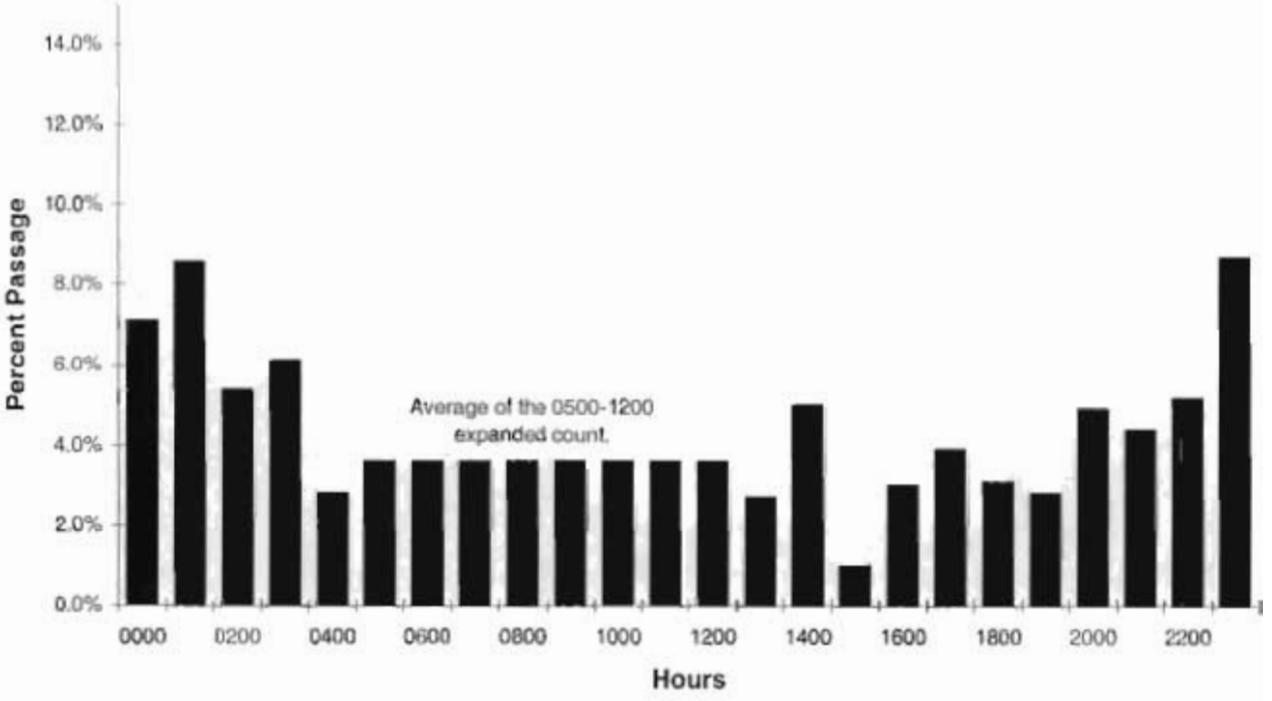


Figure 14. Diurnal pattern of Dolly Varden migration past the Shaktoolik River counting tower, Norton Sound, 1998.

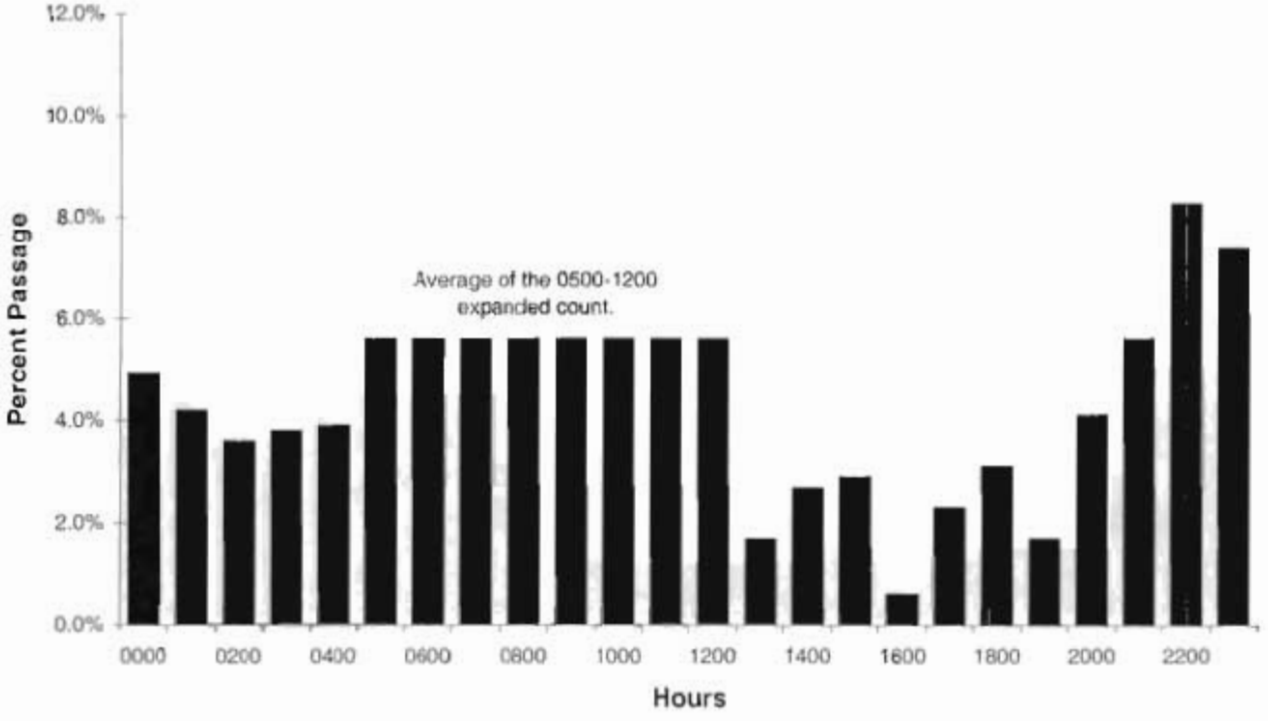


Figure 15. Cumulative migration of chum salmon past the Shaktoolik River counting tower, Norton Sound, 1996-1998.

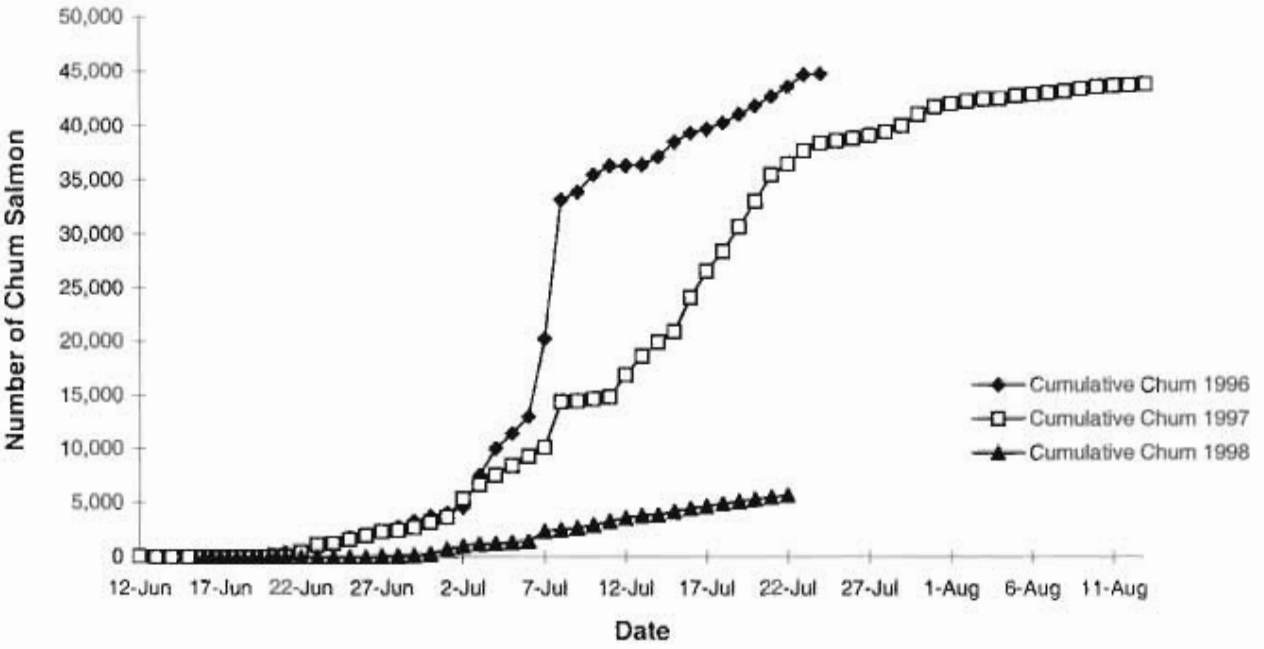


Figure 16. Cumulative migration of pink salmon past the Shaktoolik River counting tower, Norton Sound, 1996-1998.

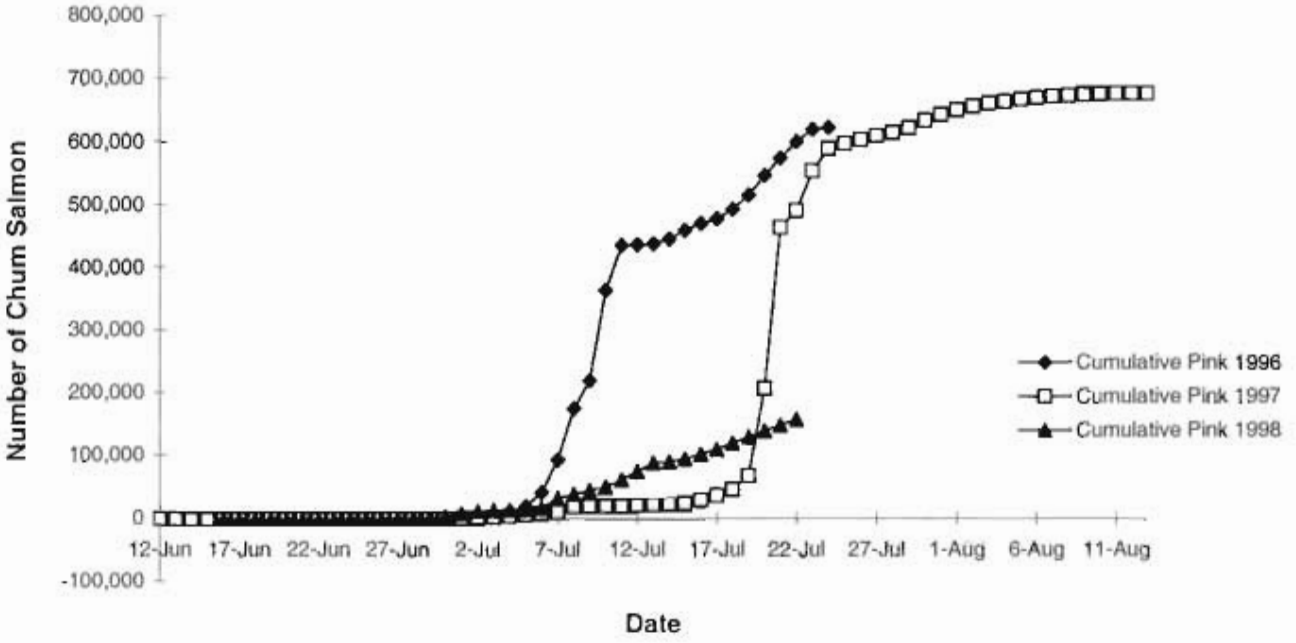


Figure 17. Cumulative migration of king salmon past the Shaktoolik River counting tower, Norton Sound, 1996-1998.

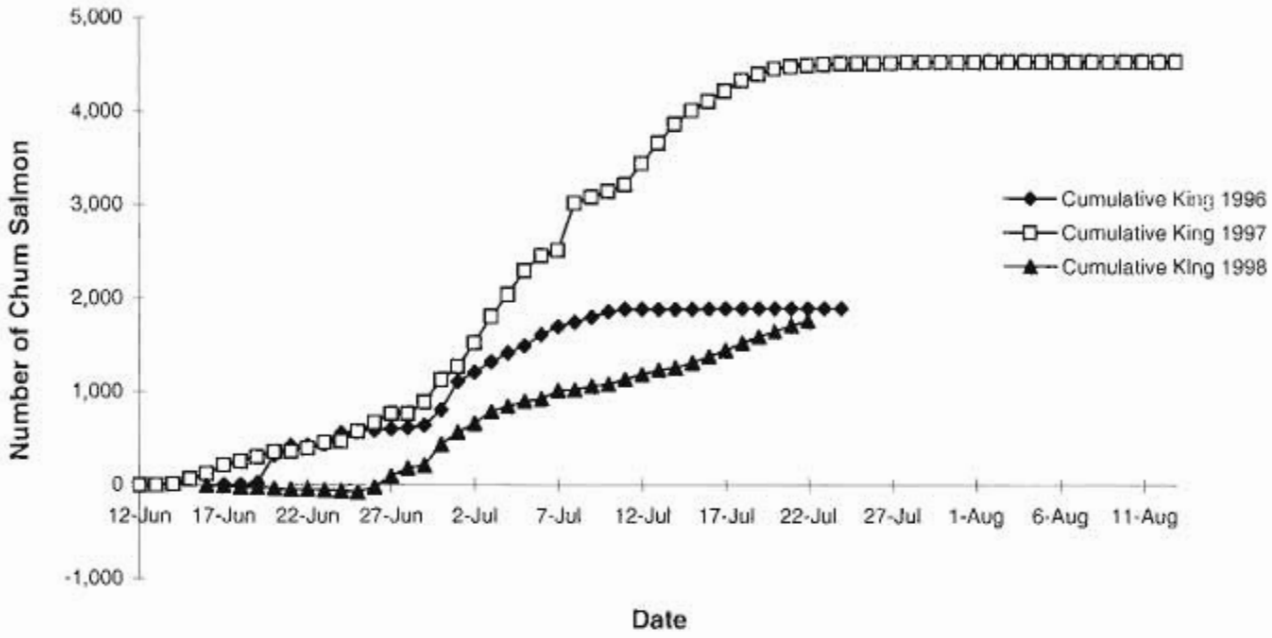


Figure 18. Cumulative migration of coho salmon past the Shaktoolik River counting tower, Norton Sound, 1996-1998.

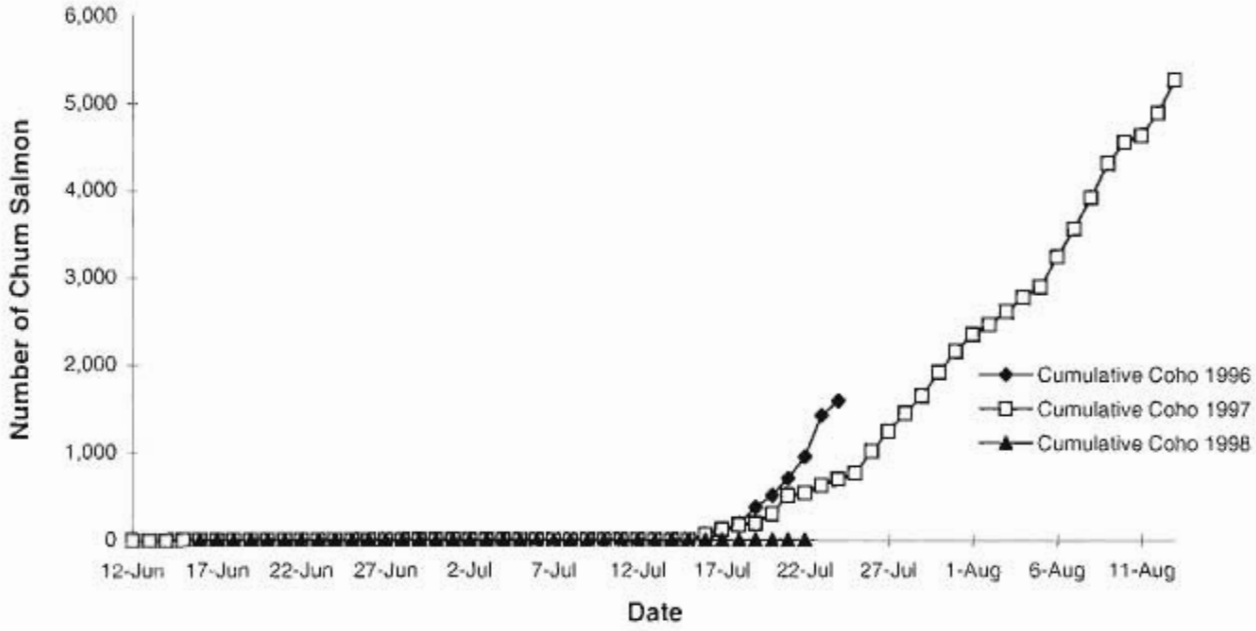
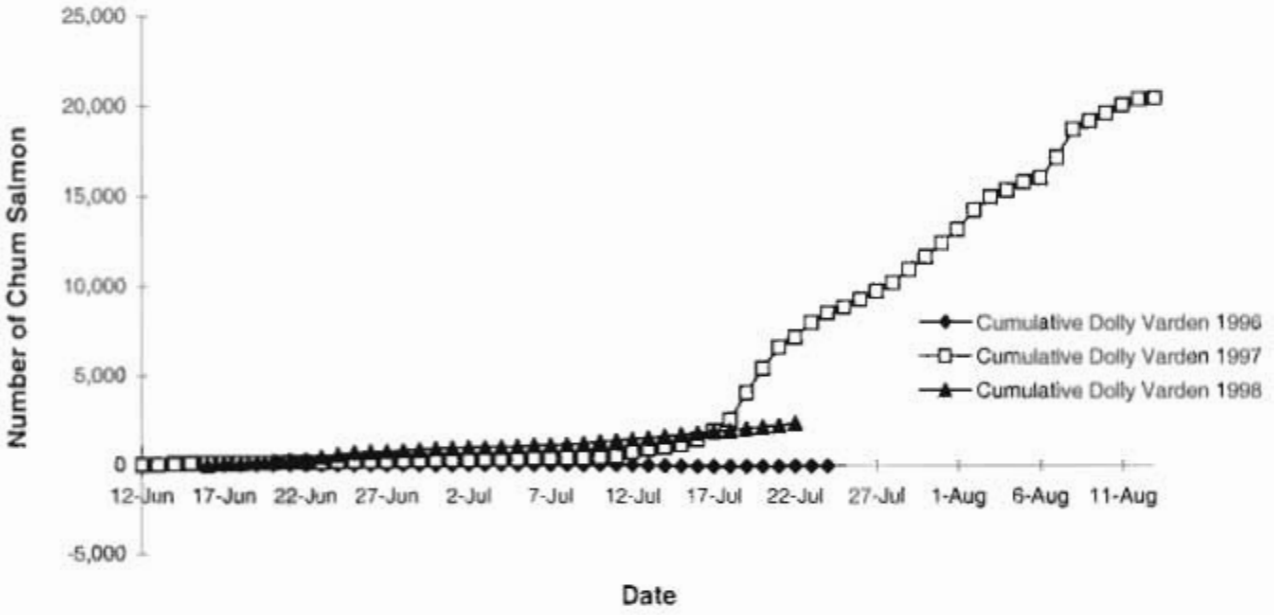



Figure 19. Cumulative migration of Dolly Varden past the Shaktoolik River counting tower, Norton Sound, 1996-1998.