SOUTHEAST ALASKA SOCKEYE SALMON (*Oncorhynchus nerka*)

ESCAPEMENT WEIRS, 1988

By

Fred Bergander

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ABSTRACT

Escapement enumeration weirs were operated on the outlets of 7 sockeye salmon (*Oncorhynchus nerka*) spawning systems in Southeast Alaska during the 1988 salmon season. Sockeye salmon escapements to these systems ranged from 938 fish to Speel Lake to 22,210 fish to Salmon Bay Lake. Sockeye escapements to all weirs but Salmon Bay were below average. Spawning stream surveys at McDonald Lake were used to provide estimates of the spawning escapement; in 1988 these surveys produced an estimated escapement of 69,361 sockeye salmon.

INTRODUCTION

Southeast Alaska encompasses approximately 114 sockeye salmon spawning systems. Many of these systems, such as Crescent and Speel Lakes which are located near the transboundary Taku River, contribute to fisheries harvesting sockeye salmon bound for both Alaskan and Canadian spawning systems. Salmon Bay sockeye are intercepted coincidentally with stocks originating from the Stikine River in Canada. Karta and Naha Rivers, and Hugh Smith Lake, in Southern Southeast Alaska produce fish that are harvested by both U.S. and Canadian fisheries while intercepting fish bound for the Nass and Skeena Rivers in Canada. Little documentation of sockeye escapements to these systems has been conducted where these stocks contribute to fisheries that are involved in the interception of international stocks. Information related to the magnitude and timing of escapements to these systems is essential to the estimation of their production potential and contribution to these fisheries.

The first major effort to document escapements to Southeast Alaska sockeye systems that contribute to fisheries that intercept Canadian as well as Alaskan stocks was initiated in 1982 through a cooperative effort with the National Marine Fisheries Service, Southern Southeast Aquaculture Association, and the Alaska Department of Fish and Game (Eiler, et. al. 1984). The focus of these efforts was directed towards Southern Southeast Alaska and included 11 sockeye systems. Beginning in 1983 the Alaska Department of Fish and Game assumed responsibility for escapement enumeration for sockeye systems in Snettisham Inlet in Northern Southeast Alaska (McPherson 1983) and eventually expanded its efforts to the Southern Southeast systems.

This report documents the results of the 1988 sockeye salmon escapement enumeration activities in Southeast Alaska.

METHODS AND PROCEDURES

Picket weirs supported by wooden tripods were constructed on the outlet streams of Speel, Crescent, Salmon Bay, Hugh Smith, and Klawock Lakes, and Naha and Karta Rivers (Figure 1). The starting dates for each of the weirs were established from earlier observations at these locations. Each weir had a trap built into it to facilitate the collection of scale samples and associated length and sex data from the escapement. Daily escapements were recorded on field data sheets which included water level and temperature measurements. Fish were passed through openings in the weirs created by removing 3 or more pickets. Fish were counted visually as they passed through a "counting gate". The counting gates were opened whenever a concentration of fish began to crowd the weir and appeared anxious to move upstream.

Scale samples collected at the weir sites were mounted on gum cards containing 40 sequentially numbered positions (Clutter and Whitesel 1956); one scale was taken from the preferred location (INPFC 1961) of each fish sampled. The targeted sample size was approximately 3%, or 300 samples per week, which ever was larger. The mideye-to-fork-of-tail measurement (mm) was recorded for each fish sampled on a mark sense form on a position that corresponded with the position number on the gummed card. Scale samples were submitted to the department's Stock Biology Group for age and stock identification analysis. The results of these analyses are reported in McPherson et. al. 1989.

Escapement enumeration at McDonald Lake was initiated by ADF&G's FRED Division in 1981 with the installation of a picket weir (Mike Haddix, unpublished). The majority of the McDonald Lake escapement spawns in the inlet stream at the head of the lake. This stream is broad, shallow, and readily facilitates escapement surveys by foot. FRED Division personnel conducted foot surveys in conjunction with their weir operations in 1981 and found that the foot surveys accounted for approximately 80% of the fish counted at the weir (Haddix, unpublished). This percentage has been used in subsequent years as an expansion factor applied to the foot surveys to estimate the total escapement to McDonald Lake.

RESULTS AND DISCUSSION

Sockeye salmon escapements to all of the study systems except Salmon Bay and Klawock Lake were below the previous years' levels. Table 1 presents the sockeye weir escapements for the years of record for all of the weired systems. Salmon Bay was the only system of the seven that exceeded its previous 7 year average of 17,188 sockeye.

The 1988 escapement of 1,199 sockeye salmon to Crescent Lake lagged approximately 76% behind the previous 5 year average of 8,879 fish (Figure 2). The 1988 daily cumulative escapements relative to the average escapement for the previous years of record are presented in Figures 2 through 8. The peak daily escapement occurred on 22 August, at which time 92% of the seasons escapement had been counted through the weir (Appendix Table 2).

Observed escapements to Speel Lake have ranged from 938 (1988) to 10,362 (1983). The 1988 Speel Lake escapement was 74% below the previous 5 year average of 8,443 fish (Figure 3). The peak daily escapement occurred on 21 August and represented 12.9% of the season's total escapement. Approximately 67% of the season's escapement had passed by that date (Appendix Table 1).

Salmon Bay was the only system of the 7 that achieved higher than average escapements during the 1988 season. The 1988 sockeye salmon escapement through the Salmon Bay weir was 22,210 fish and approximately 129% of the recorded average escapement (Figure 4). The peak escapement occurred on August 8 and represented 18% of the season's total escapement.

Karta River sockeye salmon escapements have shown major declines since 1986 (Table 1). The escapement of 3,151 realized in 1988 was the lowest of record; however, late in the season it was discovered that sockeye were escaping through the weir below the bottom stringer. Figure 5 shows the timing of the 1988 escapement to Karta River in relation to the average of the previous years of record. The initiation of the run conformed with the average timing, but flattened out by June 28; there is reason to suspect that the fault in the weir may have been allowing fish to escape undetected by this time. It was not determined how long this situation existed or how many fish escaped undetected, however, the recorded escapement should be regarded as a minimum.

The 1988 sockeye salmon escapement of 1,340 fish to the Naha River was the lowest in the 4 year record (Table 1) of the weir and approximately 12% of the recorded average escapement of 11,680 fish (Figure 6). The peak

daily escapement of 111 fish occurred on 10 July and represented 8.3% of the season's total escapement (Appendix Table 6).

Escapements to Klawock Lake have been collected by the Department intermittently since 1968, Figure 7 (Simpson 1968, Bergander 1971, Haddix 1982). The sockeye salmon escapement to Klawock Lake in 1988 was 3,426 fish (Table 1). Timing records for the Klawock run through the weir show peak escapements occurring between 30 August and 12 September (Appendix Table 4,). The Klawock Weir was used by the FRED Division in 1988 as an egg take facility and fish were held below the weir until ripe. This practice is reflected in the timing exhibited by the daily weir counts in which peak passage rates for sockeye occurred during the second week of September. Peak timing prior to using the weir as an egg collection site occurred between 1 and 15 August (Bergander 1971).

An escapement weir was operated at Hugh Smith Lake in 1967-71 (Johnston 1967, Bergander 1972, 1981-84, and 1986-88). Escapements have been highly variable, ranging from 56,956 (1982) to 2,312 (1986)[2]. Figure 8 shows the 1988 escapement in comparison to the 1984-87 average escapement; 1989 was significantly lower than the average of 21,832 fish.

Table 2 presents the sockeye salmon escapement counts of record for McDonald Lake. The 1982 weir count was believed to be incomplete due to the discovery of a hole in the weir; a subsequent stream survey provided an estimated escapement of 50,000 fish. Spawning ground surveys conducted at McDonald Lake during the 1988 sockeye salmon season (Table 2) provided the basis for an estimated escapement of 73,281 fish. The peak survey was conducted on 7 September and represented 34% of the season's escapement. FRED Division personnel used 2,946 adult sockeye from this escapement for an egg take. Earlier studies conducted by the Department (Blankenbeckler 1985) showed that, due to the stream spawning characteristics of this stock, spawning ground surveys are a viable means of acquiring a reliable estimate of the escapement to this system.

[2] Near the end of the season it was discovered that a hole had developed in the weir and fish had escaped undetected. Fish had been tagged at the weir providing an opportunity to develop a tag untagged ratio. The resulting estimated sockeye escapement was 6,968 fish.

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Table 1. Summary of sockeye salmon weir counts to seven spawning systems in Southeastern Alaska, 1982-1988.

	Spawning System						
Year	Klawock	Hugh Smith	Karta	Naha	Salmon Bay	Speel	Crescent
1982	4,812	56,956	41,492		16,041		
1983	859	10,036	22,455	4,580	14,023	10,362	19,476
1984		16,191				9,764	6,807
1985		12,298	31,564		34,308	7,063	7,249
1986	14,697	2,312[a]	5,929	10,612	8,967	5,860	3,405
1987	2,715	33,204	5,888	19,849	12,601	9,169	7,459
1988	3,426	4,960	3,151	1,340	22,210	938	1,199

[a] A hole in the weir was discovered late in the season of 1986 at Hugh Smith which had allowed fish to escape uncounted into the lake. A subsequent tag recovery on the spawning grounds estimated 6,800 sockeye in the escapement.

Table 2. Spawning ground survey and expanded counts of sockeye salmon escapements to McDonald Lake, 1988.

Survey Date	Sockeye - Live	Sockeye - Dead	Sockeye - Expanded
08/23	20	0	28
08/30	5,780	3	8,034
09/07	25,000	200	34,750
09/21	12,500	5,300	17,375
10/01	6,600	5,000	9,174
10/10			
Total	49,900	10,503	69,361

Table 3. Sockeye salmon escapement counts at McDonald Lake by visual counts of fish in the inlet stream and weir on the outlet stream, 1979-88.

Year	Escapement	Type
1979	30,900	Expanded Escapement
1980	77,344	Expanded Escapement count
1981	129,653	Weir
1982	16,587	Weir
1983	56,142	Weir
1984	121,224	Weir
1985	103,555	Expanded Escapement count
1986	98,134	Expanded Escapement count
1987	170,000	Expanded Escapement count
1988	70,335	Expanded Escapement count

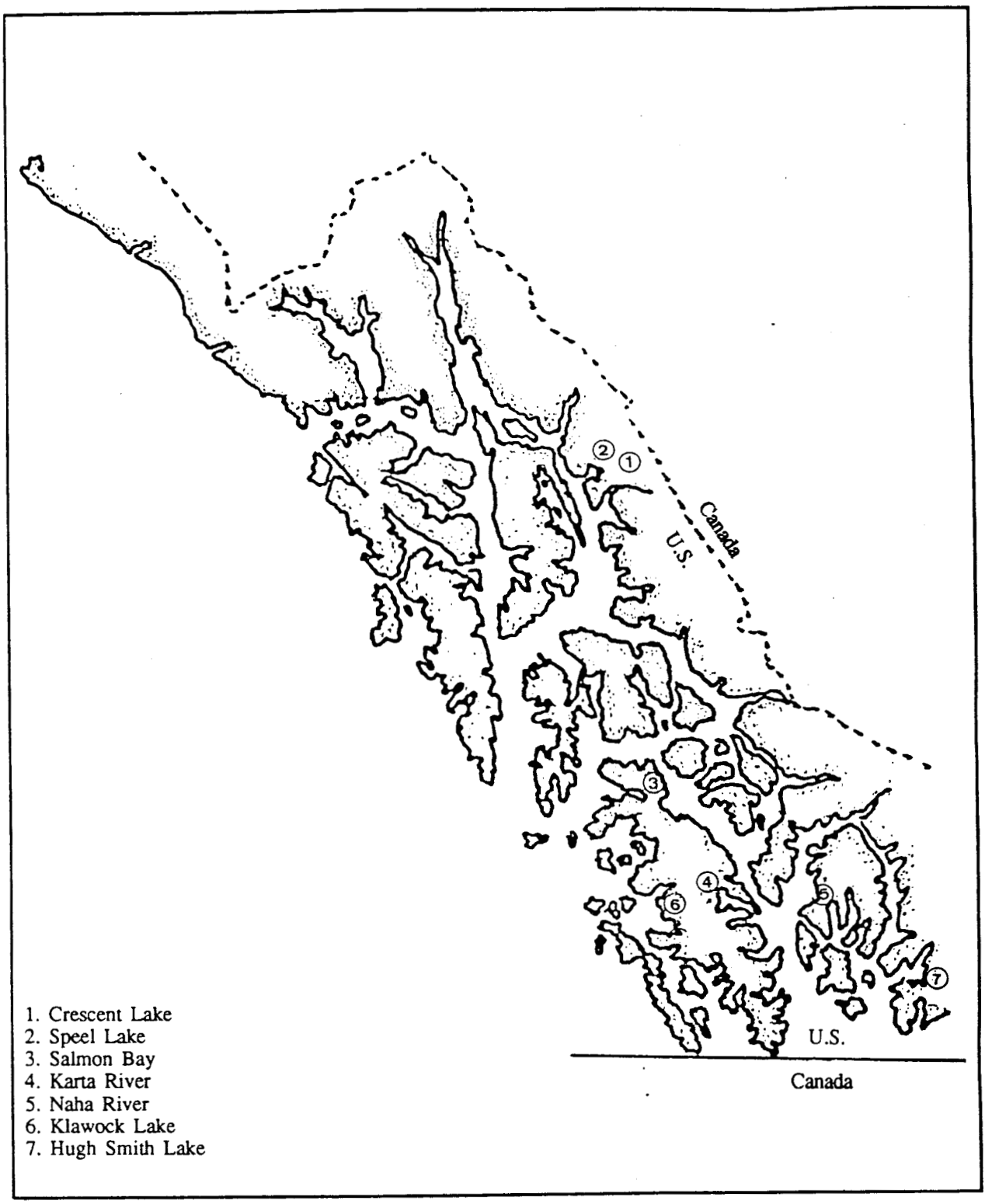

Figure 1. Southeast Alaska sockeye salmon weir sites funded by U.S./Canada Salmon Interception Treaty funds.

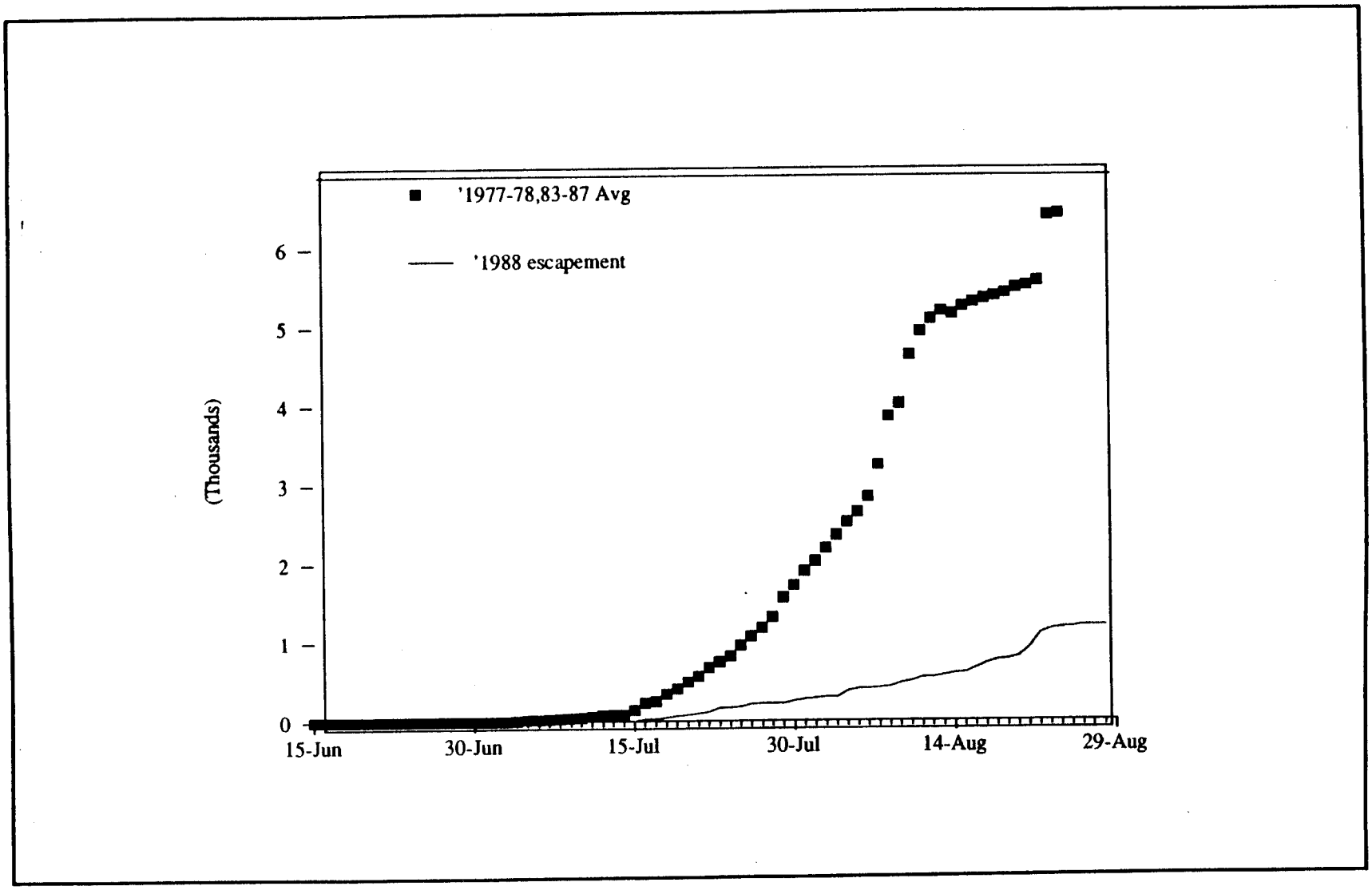

Figure 2. Crescent Lake sockeye salmon average daily cumulative escapement 1977-78, 1983-87 vs 1988.

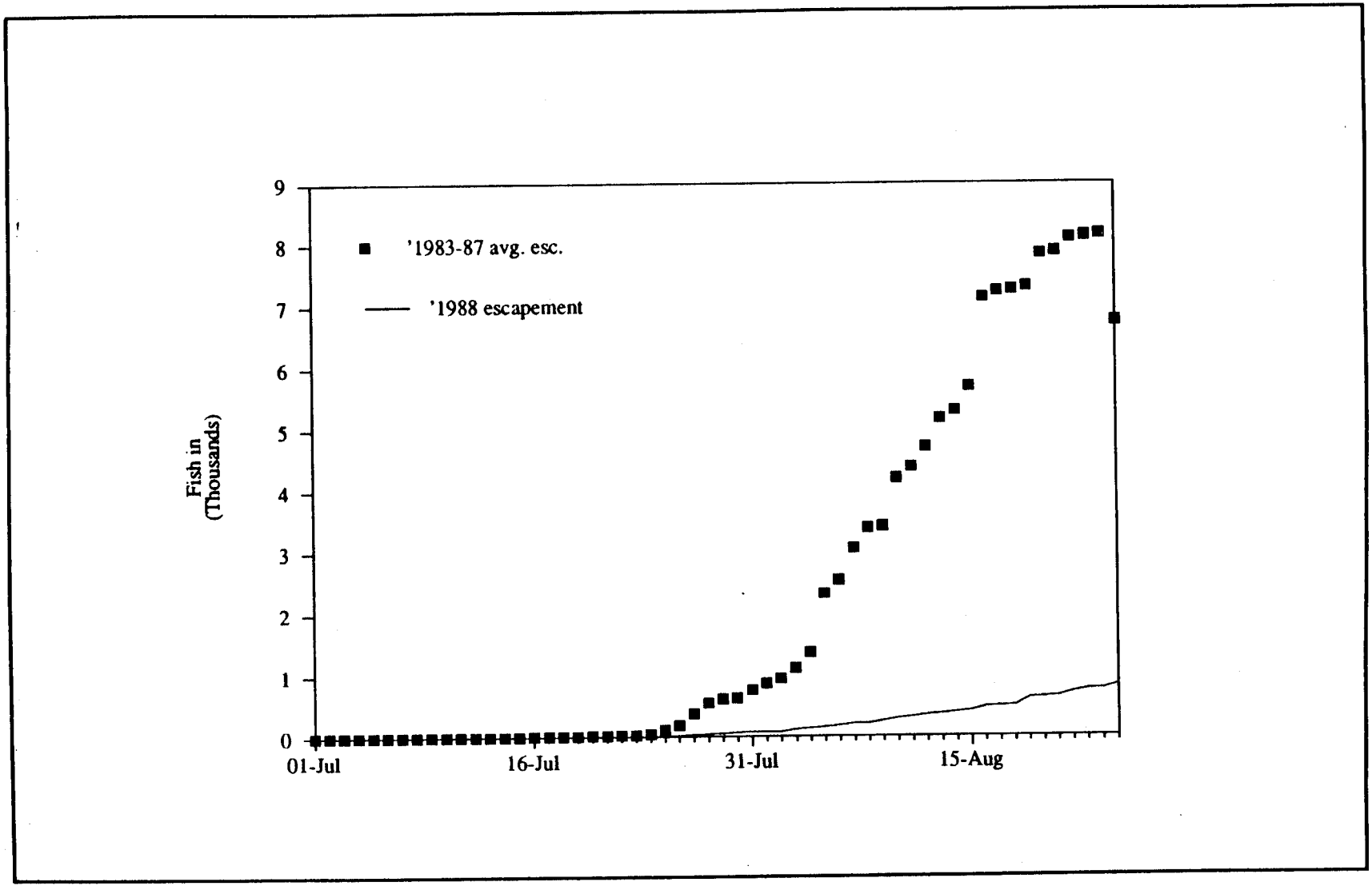

Figure 3. Speel Lake sockeye salmon average daily cumulative escapement 1983-87 vs 1988.

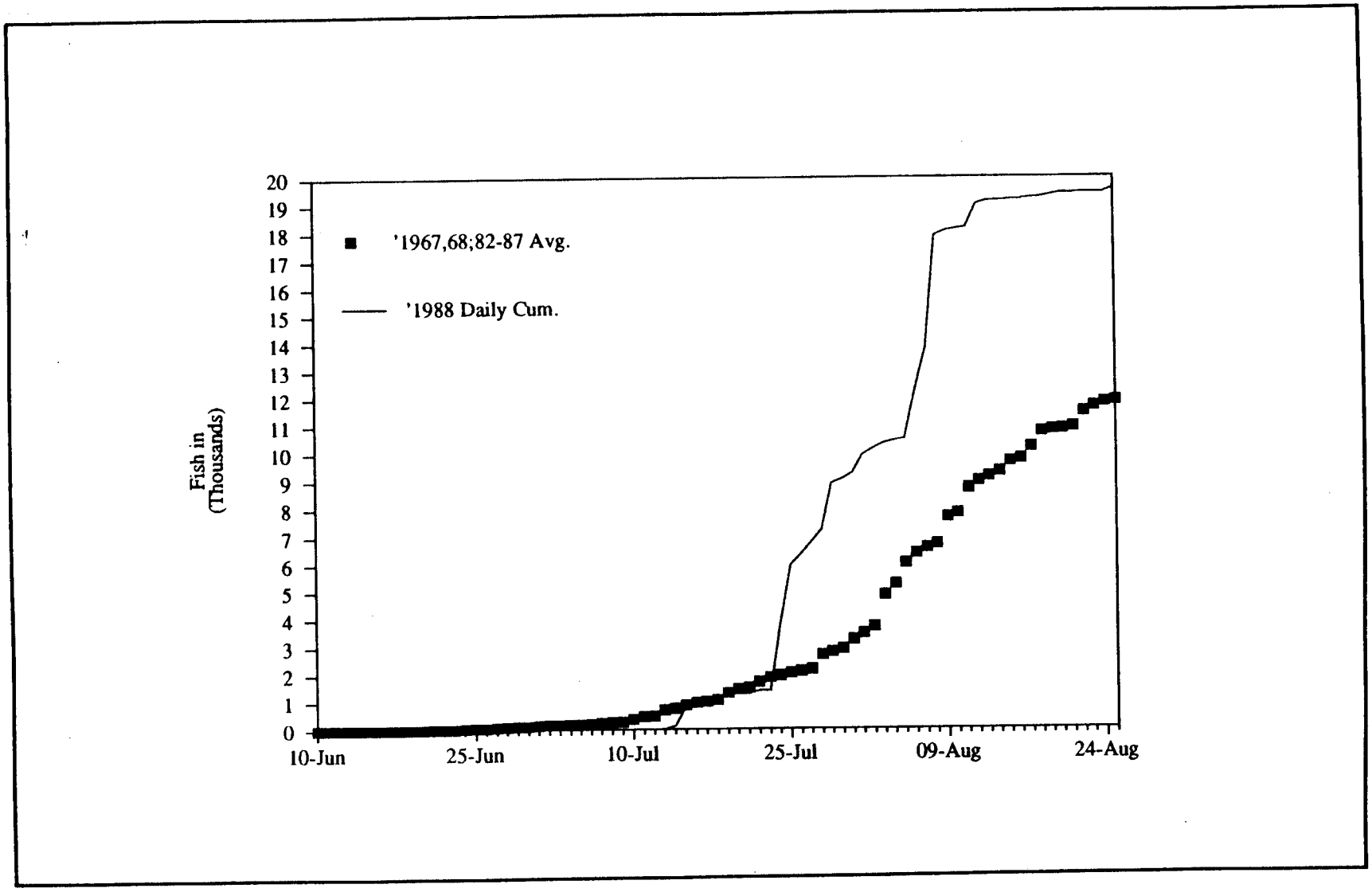

Figure 4. Salmon Bay sockeye salmon average daily cumulative escapement 1967-68; 1982-87 vs 1988.

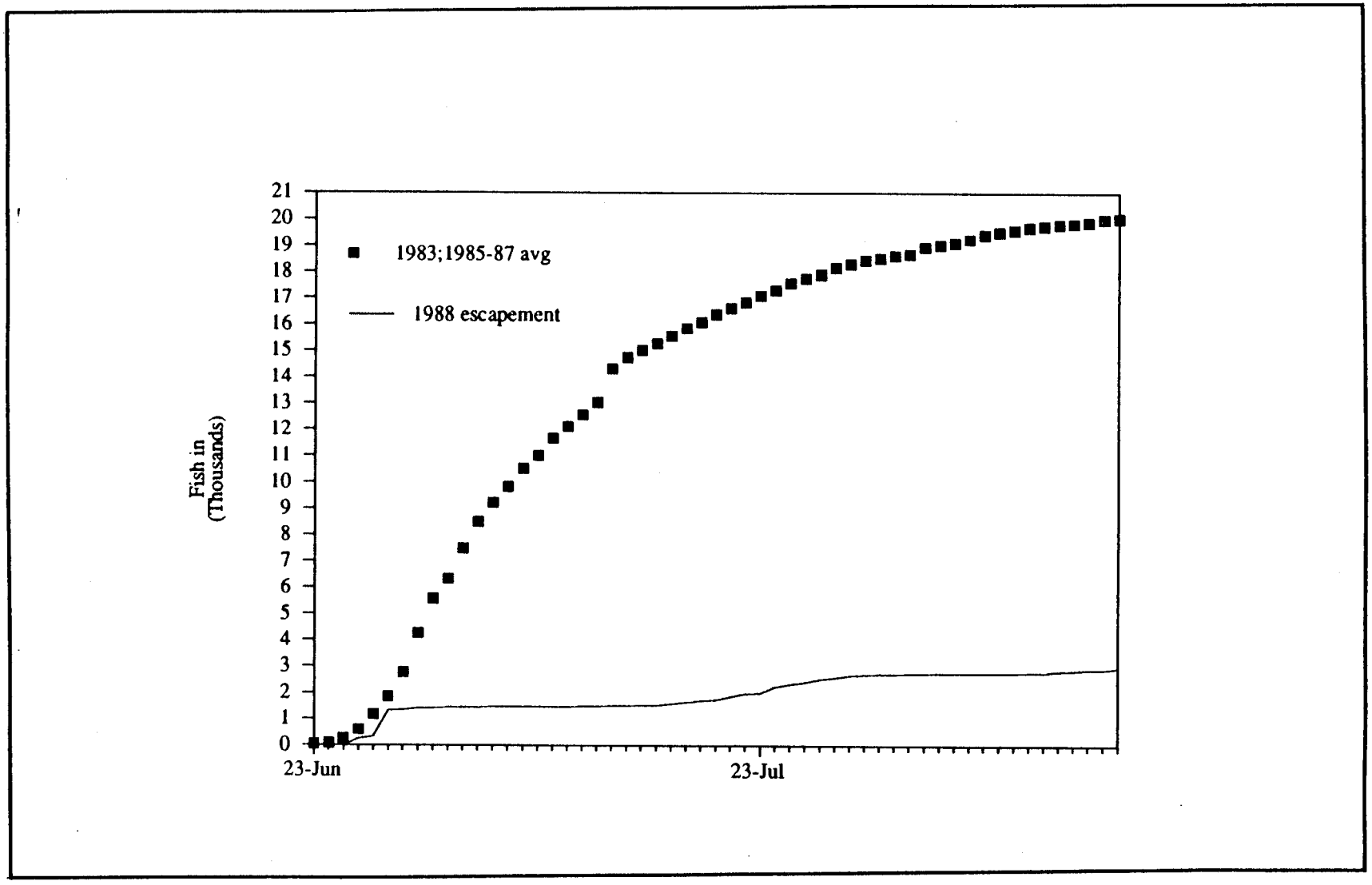

Figure 5. Karta River sockeye salmon average daily cumulative escapement 1983; 1985-87 vs 1988.

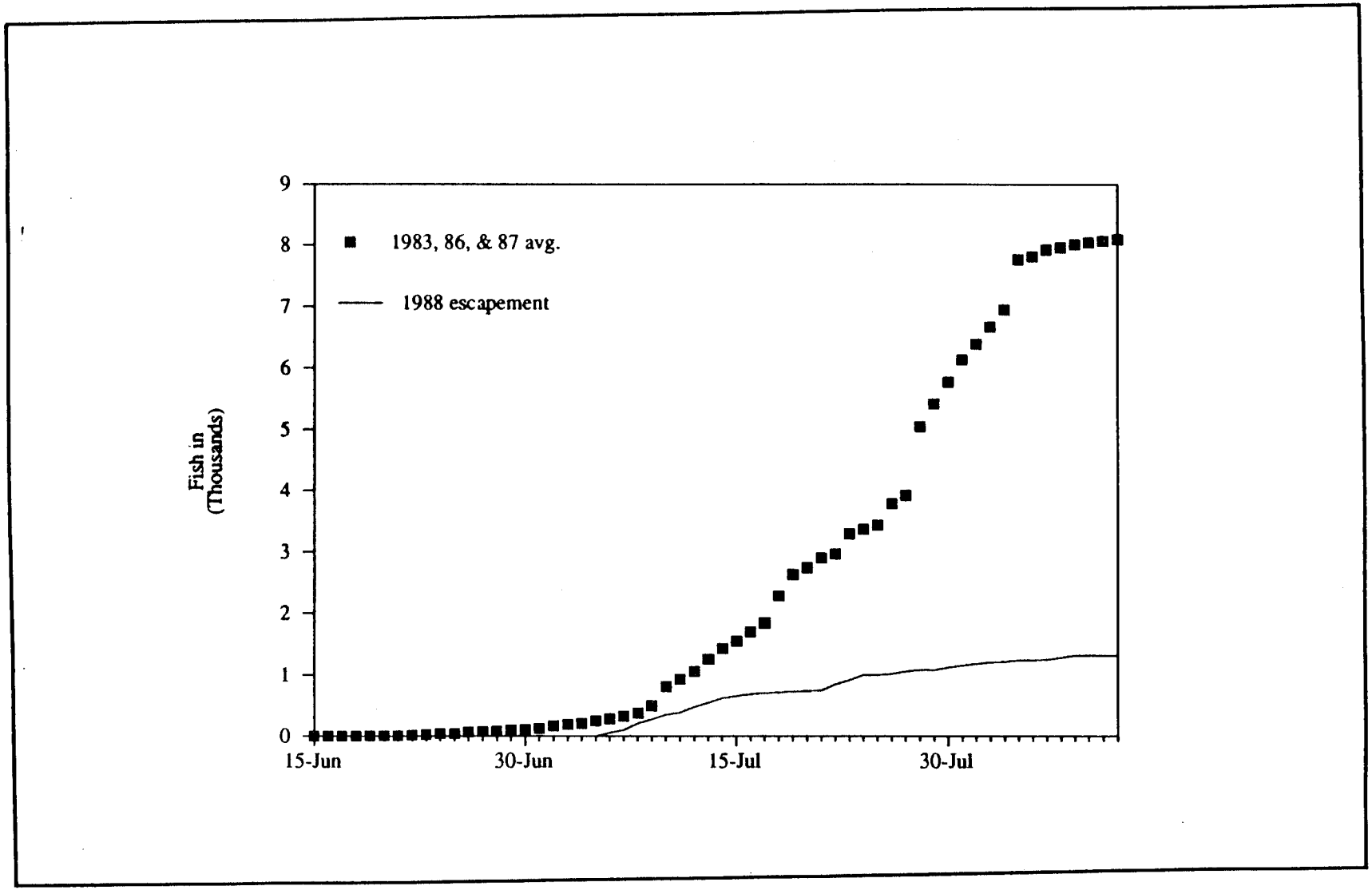

Figure 6. Naha River sockeye salmon average daily cumulative escapement 1983; 1986-87 vs 1988.

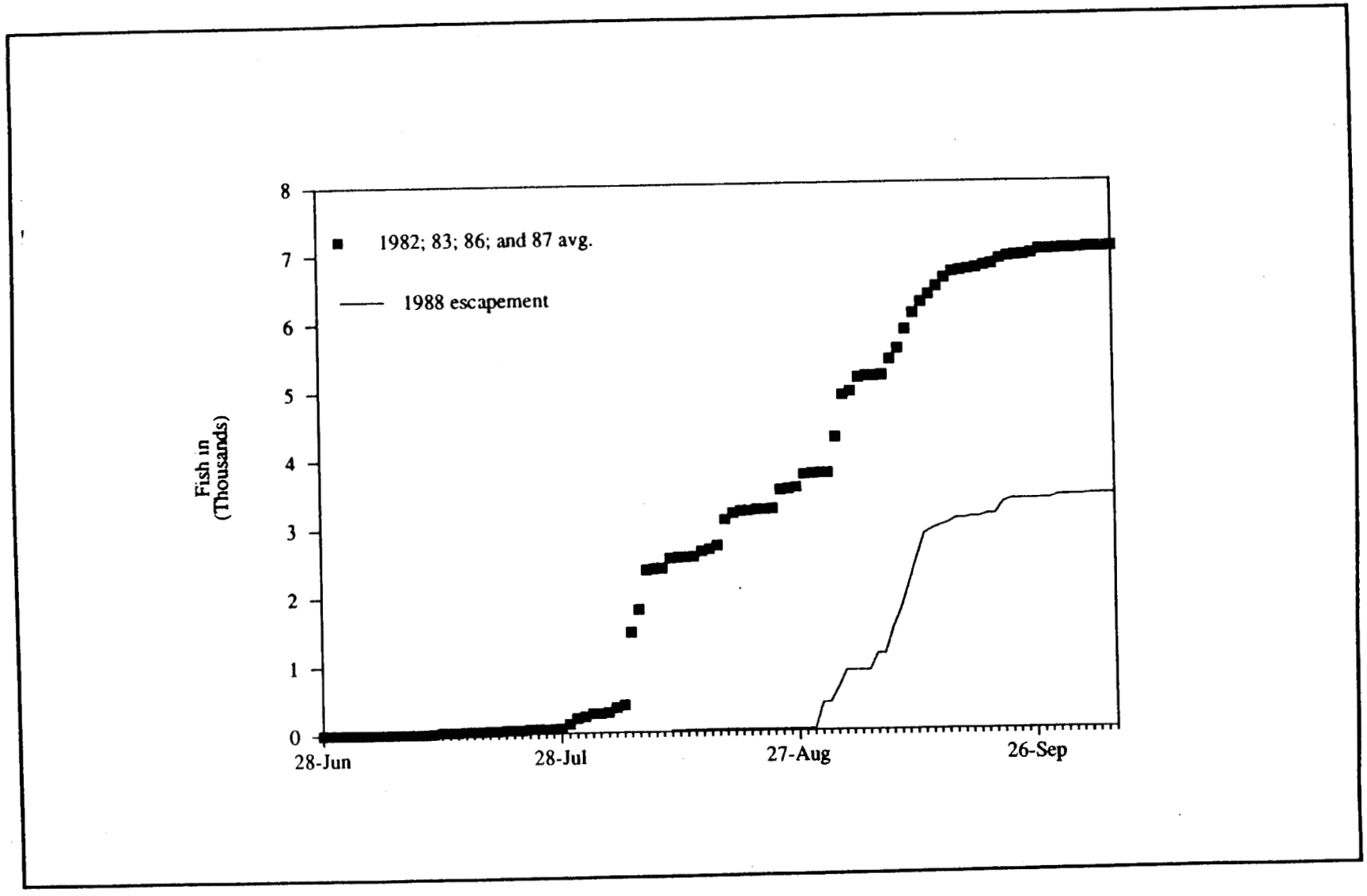

Figure 7. Klawock Lake sockeye salmon average daily cumulative escapement 1982; 83; 86; 87 vs 1988.

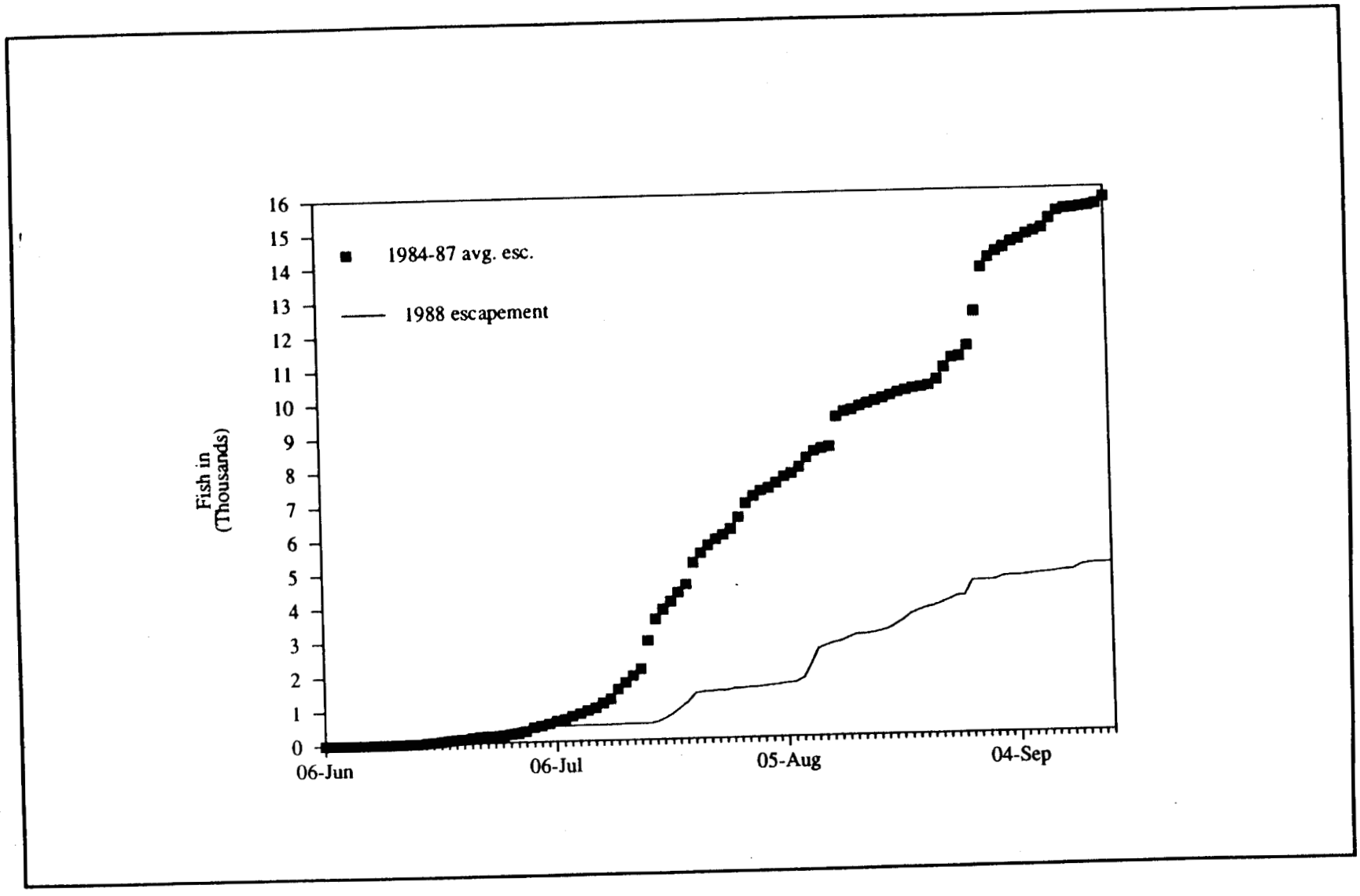

Figure 8. Hugh Smith Lake sockeye salmon average daily cumulative escapement 1984-87 vs 1988.

APPENDICES

Appendix A.1. Daily and cumulative sockeye salmon weir counts from Crescent Lake, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 11	0	0	0.0000	0.0000
July 12	0	0	0.0000	0.0000
July 13	0	0	0.0000	0.0000
July 14	5	5	0.0042	0.0042
July 15	0	5	0.0000	0.0042
July 16	22	27	0.0183	0.0225
July 17	0	27	0.0000	0.0225
July 18	19	46	0.0158	0.0384
July 19	22	68	0.0183	0.0567
July 20	14	82	0.0117	0.0684
July 21	20	102	0.0167	0.0851
July 22	21	123	0.0175	0.1026
July 23	49	172	0.0409	0.1435
July 24	2	174	0.0017	0.1451
July 25	10	184	0.0083	0.1535
July 26	36	220	0.0300	0.1835
July 27	3	223	0.0025	0.1860
July 28	0	223	0.0000	0.1860
July 29	3	226	0.0025	0.1885
July 30	26	252	0.0217	0.2102
July 31	24	276	0.0200	0.2302
Aug. 1	16	292	0.0133	0.2435
Aug. 2	9	301	0.0075	0.2510
Aug. 3	0	301	0.0000	0.2510
Aug. 4	80	381	0.0667	0.3178
Aug. 5	25	406	0.0209	0.3386
Aug. 6	0	406	0.0000	0.3386
Aug. 7	13	419	0.0108	0.3495
Aug. 8	10	429	0.0083	0.3578
Aug. 9	48	477	0.0400	0.3978
Aug. 10	25	502	0.0209	0.4187
Aug. 11	49	551	0.0409	0.4595
Aug. 12	0	551	0.0000	0.4595
Aug. 13	23	574	0.0192	0.4787
Aug. 14	22	596	0.0183	0.4971
Aug. 15	11	607	0.0092	0.5063
Aug. 16	56	663	0.0467	0.5530
Aug. 17	63	726	0.0525	0.6055
Aug. 18	37	763	0.0309	0.6364
Aug. 19	17	780	0.0142	0.6505
Aug. 20	31	811	0.0259	0.6764
Aug. 21	110	921	0.0917	0.7681
Aug. 22	180	1101	0.1501	0.9183
Aug. 23	50	1151	0.0417	0.9600
Aug. 24	21	1172	0.0175	0.9775
Aug. 25	8	1180	0.0067	0.9842
Aug. 26	19	1199	0.0158	1.0000
Aug. 27	0	1199	0.0000	1.0000
Aug. 28	0	1199	0.0000	1.0000

Mean Day of Migration = Aug. 11 Variance = 141.8 Days squared

Appendix A.2. Daily and cumulative sockeye salmon weir counts from Speel Lake, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 14	0	0	0.0000	0.0000
July 15	0	0	0.0000	0.0000
July 16	0	0	0.0000	0.0000
July 17	0	0	0.0000	0.0000
July 18	0	0	0.0000	0.0000
July 19	0	0	0.0000	0.0000
July 20	0	0	0.0000	0.0000
July 21	0	0	0.0000	0.0000
July 22	0	0	0.0000	0.0000
July 23	0	0	0.0000	0.0000
July 24	1	1	0.0011	0.0011
July 25	0	1	0.0000	0.0011
July 26	0	1	0.0000	0.0011
July 27	0	1	0.0000	0.0011
July 28	16	17	0.0171	0.0181
July 29	16	33	0.0171	0.0352
July 30	14	47	0.0149	0.0501
July 31	9	56	0.0096	0.0597
Aug. 1	17	73	0.0181	0.0778
Aug. 2	3	76	0.0032	0.0810
Aug. 3	0	76	0.0000	0.0810
Aug. 4	1	77	0.0011	0.0821
Aug. 5	45	122	0.0480	0.1301
Aug. 6	12	134	0.0128	0.1429
Aug. 7	23	157	0.0245	0.1674
Aug. 8	21	178	0.0224	0.1898
Aug. 9	33	211	0.0352	0.2249
Aug. 10	0	211	0.0000	0.2249
Aug. 11	41	252	0.0437	0.2687
Aug. 12	42	294	0.0448	0.3134
Aug. 13	26	320	0.0277	0.3412
Aug. 14	31	351	0.0330	0.3742
Aug. 15	21	372	0.0224	0.3966
Aug. 16	20	392	0.0213	0.4179
Aug. 17	30	422	0.0320	0.4499
Aug. 18	55	477	0.0586	0.5085
Aug. 19	12	489	0.0128	0.5213
Aug. 20	7	496	0.0075	0.5288
Aug. 21	121	617	0.1290	0.6578
Aug. 22	15	632	0.0160	0.6738
Aug. 23	16	648	0.0171	0.6908
Aug. 24	69	717	0.0736	0.7644
Aug. 25	34	751	0.0362	0.8006
Aug. 26	11	762	0.0117	0.8124
Aug. 27	66	828	0.0704	0.8827
Aug. 28	29	857	0.0309	0.9136
Aug. 29	18	875	0.0192	0.9328
Aug. 30	29	904	0.0309	0.9638
Aug. 31	34	938	0.0362	1.0000

Mean Day of Migration = Aug. 17 Variance = 81.2 Days squared

Appendix A.3. Daily and cumulative sockeye salmon weir counts from Salmon Bay, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 3	0	0	0.0000	0.0000
July 4	4	4	0.0002	0.0002
July 5	0	4	0.0000	0.0002
July 6	3	7	0.0001	0.0003
July 7	4	11	0.0002	0.0005
July 8	0	11	0.0000	0.0005
July 9	0	11	0.0000	0.0005
July 10	0	11	0.0000	0.0005
July 11	2	13	0.0001	0.0006
July 12	0	13	0.0000	0.0006
July 13	9	22	0.0004	0.0010
July 14	128	150	0.0058	0.0068
July 15	691	841	0.0311	0.0379
July 16	168	1009	0.0076	0.0454
July 17	133	1142	0.0060	0.0514
July 18	57	1199	0.0026	0.0540
July 19	44	1243	0.0020	0.0560
July 20	35	1278	0.0016	0.0575
July 21	0	1278	0.0000	0.0575
July 22	122	1400	0.0055	0.0630
July 23	4	1404	0.0002	0.0632
July 24	2381	3785	0.1072	0.1704
July 25	2160	5945	0.0973	0.2677
July 26	412	6357	0.0186	0.2862
July 27	414	6771	0.0186	0.3049
July 28	454	7225	0.0204	0.3253
July 29	1673	8898	0.0753	0.4006
July 30	150	9048	0.0068	0.4074
July 31	226	9274	0.0102	0.4176
Aug. 1	642	9916	0.0289	0.4465
Aug. 2	240	10156	0.0108	0.4573
Aug. 3	190	10346	0.0086	0.4658
Aug. 4	90	10436	0.0041	0.4699
Aug. 5	83	10519	0.0037	0.4736
Aug. 6	1762	12281	0.0793	0.5529
Aug. 7	1506	13787	0.0678	0.6208
Aug. 8	4090	17877	0.1842	0.8049
Aug. 9	161	18038	0.0072	0.8122
Aug. 10	79	18117	0.0036	0.8157
Aug. 11	41	18158	0.0018	0.8176
Aug. 12	842	19000	0.0379	0.8555
Aug. 13	108	19108	0.0049	0.8603
Aug. 14	15	19123	0.0007	0.8610
Aug. 15	20	19143	0.0009	0.8619
Aug. 16	24	19167	0.0011	0.8630
Aug. 17	53	19220	0.0024	0.8654
Aug. 18	30	19250	0.0014	0.8667
Aug. 19	71	19321	0.0032	0.8699
Aug. 20	70	19391	0.0032	0.8731

--Continued--

Appendix A.3. (page 2 of 2.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Aug. 21	6	19397	0.0003	0.8733
Aug. 22	6	19403	0.0003	0.8736
Aug. 23	6	19409	0.0003	0.8739
Aug. 24	10	19419	0.0005	0.8743
Aug. 25	143	19562	0.0064	0.8808
Aug. 26	16	19578	0.0007	0.8815
Aug. 27	86	19664	0.0039	0.8854
Aug. 28	1780	21444	0.0801	0.9655
Aug. 29	247	21691	0.0111	0.9766
Aug. 30	13	21704	0.0006	0.9772
Aug. 31	119	21823	0.0054	0.9826
Sept. 1	1	21824	0.0000	0.9826
Sept. 2	211	22035	0.0095	0.9921
Sept. 3	32	22067	0.0014	0.9936
Sept. 4	33	22100	0.0015	0.9950
Sept. 5	26	22126	0.0012	0.9962
Sept. 6	15	22141	0.0007	0.9969
Sept. 7	5	22146	0.0002	0.9971
Sept. 8	6	22152	0.0003	0.9974
Sept. 9	9	22161	0.0004	0.9978
Sept.10	3	22164	0.0001	0.9979
Sept.11	0	22164	0.0000	0.9979
Sept.12	46	22210	0.0021	1.0000
Sept.13	0	22210	0.0000	1.0000
Sept.14	0	22210	0.0000	1.0000

Mean Day of Migration = Aug. 4 Variance = 142.3 Days squared

Appendix A.4. Daily and cumulative sockeye salmon weir counts from Klawock Lake, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Aug. 11	26	26	0.0076	0.0076
Aug. 12	0	26	0.0000	0.0076
Aug. 13	0	26	0.0000	0.0076
Aug. 14	0	26	0.0000	0.0076
Aug. 15	0	26	0.0000	0.0076
Aug. 16	0	26	0.0000	0.0076
Aug. 17	0	26	0.0000	0.0076
Aug. 18	0	26	0.0000	0.0076
Aug. 19	0	26	0.0000	0.0076
Aug. 20	0	26	0.0000	0.0076
Aug. 21	0	26	0.0000	0.0076
Aug. 22	0	26	0.0000	0.0076
Aug. 23	0	26	0.0000	0.0076
Aug. 24	0	26	0.0000	0.0076
Aug. 25	0	26	0.0000	0.0076
Aug. 26	0	26	0.0000	0.0076
Aug. 27	0	26	0.0000	0.0076
Aug. 28	0	26	0.0000	0.0076
Aug. 29	0	26	0.0000	0.0076
Aug. 30	375	401	0.1095	0.1170
Aug. 31	8	409	0.0023	0.1194
Sept. 1	209	618	0.0610	0.1804
Sept. 2	259	877	0.0756	0.2560
Sept. 3	0	877	0.0000	0.2560
Sept. 4	0	877	0.0000	0.2560
Sept. 5	0	877	0.0000	0.2560
Sept. 6	239	1116	0.0698	0.3257
Sept. 7	0	1116	0.0000	0.3257
Sept. 8	371	1487	0.1083	0.4340
Sept. 9	270	1757	0.0788	0.5128
Sept.10	354	2111	0.1033	0.6162
Sept.11	399	2510	0.1165	0.7326
Sept.12	349	2859	0.1019	0.8345
Sept.13	67	2926	0.0196	0.8541
Sept.14	45	2971	0.0131	0.8672
Sept.15	37	3008	0.0108	0.8780
Sept.16	65	3073	0.0190	0.8970
Sept.17	0	3073	0.0000	0.8970
Sept.18	28	3101	0.0082	0.9051
Sept.19	0	3101	0.0000	0.9051
Sept.20	31	3132	0.0090	0.9142
Sept.21	0	3132	0.0000	0.9142
Sept.22	175	3307	0.0511	0.9653
Sept.23	40	3347	0.0117	0.9769
Sept.24	0	3347	0.0000	0.9769
Sept.25	0	3347	0.0000	0.9769
Sept.26	0	3347	0.0000	0.9769
Sept.27	8	3355	0.0023	0.9793
Sept.28	0	3355	0.0000	0.9793

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Appendix A.4. (page 2 of 2.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Sept.29	48	3403	0.0140	0.9933
Sept.30	0	3403	0.0000	0.9933
Oct. 1	0	3403	0.0000	0.9933
Oct. 2	0	3403	0.0000	0.9933
Oct. 3	12	3415	0.0035	0.9968
Oct. 4	0	3415	0.0000	0.9968
Oct. 5	0	3415	0.0000	0.9968
Oct. 6	0	3415	0.0000	0.9968
Oct. 7	0	3415	0.0000	0.9968
Oct. 8	0	3415	0.0000	0.9968
Oct. 9	0	3415	0.0000	0.9968
Oct. 10	0	3415	0.0000	0.9968
Oct. 11	0	3415	0.0000	0.9968
Oct. 12	11	3426	0.0032	1.0000
Oct. 13	0	3426	0.0000	1.0000

Mean Day of Migration = Sept. 9 Variance = 53.8 Days squared

Appendix A.5. Daily and cumulative sockeye salmon weir counts from Karta River, 1988.

Date		Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
June	25	9	9	0.0029	0.0029
June	26	255	264	0.0810	0.0838
June	27	81	345	0.0257	0.1095
June	28	993	1338	0.3152	0.4248
June	29	6	1344	0.0019	0.4267
June	30	55	1399	0.0175	0.4441
July	1	20	1419	0.0063	0.4505
July	2	17	1436	0.0054	0.4559
July	3	13	1449	0.0041	0.4600
July	4	4	1453	0.0013	0.4613
July	5	6	1459	0.0019	0.4632
July	6	5	1464	0.0016	0.4648
July	7	3	1467	0.0010	0.4657
July	8	2	1469	0.0006	0.4663
July	9	3	1472	0.0010	0.4673
July	10	5	1477	0.0016	0.4689
July	11	5	1482	0.0016	0.4705
July	12	4	1486	0.0013	0.4717
July	13	20	1506	0.0063	0.4781
July	14	6	1512	0.0019	0.4800
July	15	9	1521	0.0029	0.4829
July	16	5	1526	0.0016	0.4844
July	17	59	1585	0.0187	0.5032
July	18	54	1639	0.0171	0.5203
July	19	59	1698	0.0187	0.5390
July	20	52	1750	0.0165	0.5556
July	21	119	1869	0.0378	0.5933
July	22	101	1970	0.0321	0.6254
July	23	31	2001	0.0098	0.6352
July	24	240	2241	0.0762	0.7114
July	25	92	2333	0.0292	0.7406
July	26	69	2402	0.0219	0.7625
July	27	106	2508	0.0337	0.7962
July	28	76	2584	0.0241	0.8203
July	29	80	2664	0.0254	0.8457
July	30	28	2692	0.0089	0.8546
July	31	26	2718	0.0083	0.8629
Aug.	1	13	2731	0.0041	0.8670
Aug.	2	7	2738	0.0022	0.8692
Aug.	3	3	2741	0.0010	0.8702
Aug.	4	6	2747	0.0019	0.8721
Aug.	5	2	2749	0.0006	0.8727
Aug.	6	4	2753	0.0013	0.8740
Aug.	7	2	2755	0.0006	0.8746
Aug.	8	4	2759	0.0013	0.8759
Aug.	9	4	2763	0.0013	0.8771
Aug.	10	7	2770	0.0022	0.8794
Aug.	11	8	2778	0.0025	0.8819
Aug.	12	49	2827	0.0156	0.8975
Aug.	13	42	2869	0.0133	0.9108

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Appendix A.5. (page 2 of 2.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Aug. 14	20	2889	0.0063	0.9171
Aug. 15	19	2908	0.0060	0.9232
Aug. 16	44	2952	0.0140	0.9371
Aug. 17	45	2997	0.0143	0.9514
Aug. 18	11	3008	0.0035	0.9549
Aug. 19	4	3012	0.0013	0.9562
Aug. 20	3	3015	0.0010	0.9571
Aug. 21	13	3028	0.0041	0.9613
Aug. 22	9	3037	0.0029	0.9641
Aug. 23	52	3089	0.0165	0.9806
Aug. 24	61	3150	0.0194	1.0000

Mean Day of Migration = July 15 Variance = 318.5 Days squared

Appendix A.6. Daily and cumulative sockeye salmon weir counts from the Naha River, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 4	0	0	0.0000	0.0000
July 5	0	0	0.0000	0.0000
July 6	0	0	0.0000	0.0000
July 7	0	0	0.0000	0.0000
July 8	66	66	0.0493	0.0493
July 9	35	101	0.0261	0.0754
July 10	111	212	0.0828	0.1582
July 11	67	279	0.0500	0.2082
July 12	79	358	0.0590	0.2672
July 13	25	383	0.0187	0.2858
July 14	99	482	0.0739	0.3597
July 15	64	546	0.0478	0.4075
July 16	77	623	0.0575	0.4649
July 17	30	653	0.0224	0.4873
July 18	40	693	0.0299	0.5172
July 19	13	706	0.0097	0.5269
July 20	8	714	0.0060	0.5328
July 21	19	733	0.0142	0.5470
July 22	6	739	0.0045	0.5515
July 23	4	743	0.0030	0.5545
July 24	100	843	0.0746	0.6291
July 25	74	917	0.0552	0.6843
July 26	85	1002	0.0634	0.7478
July 27	0	1002	0.0000	0.7478
July 28	19	1021	0.0142	0.7619
July 29	38	1059	0.0284	0.7903
July 30	17	1076	0.0127	0.8030
July 31	8	1084	0.0060	0.8090
Aug. 1	42	1126	0.0313	0.8403
Aug. 2	26	1152	0.0194	0.8597
Aug. 3	25	1177	0.0187	0.8784
Aug. 4	30	1207	0.0224	0.9007
Aug. 5	11	1218	0.0082	0.9090
Aug. 6	24	1242	0.0179	0.9269
Aug. 7	4	1246	0.0030	0.9299
Aug. 8	2	1248	0.0015	0.9313
Aug. 9	35	1283	0.0261	0.9575
Aug. 10	30	1313	0.0224	0.9799
Aug. 11	5	1318	0.0037	0.9836
Aug. 12	0	1318	0.0000	0.9836
Aug. 13	1	1319	0.0007	0.9843
Aug. 14	0	1319	0.0000	0.9843
Aug. 15	5	1324	0.0037	0.9881
Aug. 16	1	1325	0.0007	0.9888
Aug. 17	0	1325	0.0000	0.9888
Aug. 18	1	1326	0.0007	0.9896
Aug. 19	0	1326	0.0000	0.9896
Aug. 20	0	1326	0.0000	0.9896
Aug. 21	3	1329	0.0022	0.9918
Aug. 22	4	1333	0.0030	0.9948

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Appendix A.6. (page 2 of 2.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Aug. 23	1	1334	0.0007	0.9955
Aug. 24	5	1339	0.0037	0.9993
Aug. 25	0	1339	0.0000	0.9993
Aug. 26	1	1340	0.0007	1.0000
Aug. 27	0	1340	0.0000	1.0000
Mean Day of Migration = July 21		Variance = 104.9 Days squared		

Appendix A.7. Daily and cumulative sockeye salmon weir counts form the Hugh Smith Lake, 1988.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
June 5	0	0	0.0000	0.0000
June 6	0	0	0.0000	0.0000
June 7	0	0	0.0000	0.0000
June 8	0	0	0.0000	0.0000
June 9	0	0	0.0000	0.0000
June 10	0	0	0.0000	0.0000
June 11	0	0	0.0000	0.0000
June 12	1	1	0.0002	0.0002
June 13	0	1	0.0000	0.0002
June 14	2	3	0.0004	0.0006
June 15	0	3	0.0000	0.0006
June 16	0	3	0.0000	0.0006
June 17	0	3	0.0000	0.0006
June 18	4	7	0.0008	0.0014
June 19	8	15	0.0016	0.0030
June 20	14	29	0.0028	0.0058
June 21	15	44	0.0030	0.0089
June 22	15	59	0.0030	0.0119
June 23	25	84	0.0050	0.0169
June 24	20	104	0.0040	0.0210
June 25	30	134	0.0060	0.0270
June 26	25	159	0.0050	0.0321
June 27	27	186	0.0054	0.0375
June 28	65	251	0.0131	0.0506
June 29	92	343	0.0185	0.0692
June 30	40	383	0.0081	0.0772
July 1	36	419	0.0073	0.0845
July 2	28	447	0.0056	0.0901
July 3	2	449	0.0004	0.0905
July 4	11	460	0.0022	0.0927
July 5	0	460	0.0000	0.0927
July 6	0	460	0.0000	0.0927
July 7	0	460	0.0000	0.0927
July 8	0	460	0.0000	0.0927
July 9	10	470	0.0020	0.0948
July 10	0	470	0.0000	0.0948
July 11	0	470	0.0000	0.0948
July 12	0	470	0.0000	0.0948
July 13	0	470	0.0000	0.0948
July 14	0	470	0.0000	0.0948
July 15	4	474	0.0008	0.0956
July 16	0	474	0.0000	0.0956
July 17	0	474	0.0000	0.0956
July 18	0	474	0.0000	0.0956
July 19	47	521	0.0095	0.1050
July 20	89	610	0.0179	0.1230
July 21	156	766	0.0315	0.1544
July 22	150	916	0.0302	0.1847
July 23	175	1091	0.0353	0.2200
July 24	248	1339	0.0500	0.2700

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Appendix A.7. (page 2 of 3.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 25	29	1368	0.0058	0.2758
July 26	12	1380	0.0024	0.2782
July 27	19	1399	0.0038	0.2821
July 28	13	1412	0.0026	0.2847
July 29	36	1448	0.0073	0.2919
July 30	10	1458	0.0020	0.2940
July 31	15	1473	0.0030	0.2970
Aug. 1	11	1484	0.0022	0.2992
Aug. 2	24	1508	0.0048	0.3040
Aug. 3	17	1525	0.0034	0.3075
Aug. 4	26	1551	0.0052	0.3127
Aug. 5	27	1578	0.0054	0.3181
Aug. 6	18	1596	0.0036	0.3218
Aug. 7	120	1716	0.0242	0.3460
Aug. 8	387	2103	0.0780	0.4240
Aug. 9	461	2564	0.0929	0.5169
Aug. 10	92	2656	0.0185	0.5355
Aug. 11	80	2736	0.0161	0.5516
Aug. 12	40	2776	0.0081	0.5597
Aug. 13	97	2873	0.0196	0.5792
Aug. 14	81	2954	0.0163	0.5956
Aug. 15	23	2977	0.0046	0.6002
Aug. 16	26	3003	0.0052	0.6054
Aug. 17	37	3040	0.0075	0.6129
Aug. 18	61	3101	0.0123	0.6252
Aug. 19	104	3205	0.0210	0.6462
Aug. 20	149	3354	0.0300	0.6762
Aug. 21	185	3539	0.0373	0.7135
Aug. 22	99	3638	0.0200	0.7335
Aug. 23	65	3703	0.0131	0.7466
Aug. 24	50	3753	0.0101	0.7567
Aug. 25	95	3848	0.0192	0.7758
Aug. 26	88	3936	0.0177	0.7935
Aug. 27	88	4024	0.0177	0.8113
Aug. 28	32	4056	0.0065	0.8177
Aug. 29	430	4486	0.0867	0.9044
Aug. 30	9	4495	0.0018	0.9062
Aug. 31	0	4495	0.0000	0.9062
Sept. 1	16	4511	0.0032	0.9095
Sept. 2	87	4598	0.0175	0.9270
Sept. 3	10	4608	0.0020	0.9290
Sept. 4	10	4618	0.0020	0.9310
Sept. 5	14	4632	0.0028	0.9339
Sept. 6	27	4659	0.0054	0.9393
Sept. 7	13	4672	0.0026	0.9419
Sept. 8	20	4692	0.0040	0.9460
Sept. 9	35	4727	0.0071	0.9530
Sept.10	23	4750	0.0046	0.9577
Sept.11	3	4753	0.0006	0.9583
Sept.12	121	4874	0.0244	0.9827

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Appendix A.7. (page 3 of 3.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Sept.13	46	4920	0.0093	0.9919
Sept.14	11	4931	0.0022	0.9942
Sept.15	2	4933	0.0004	0.9946
Sept.16	8	4941	0.0016	0.9962
Sept.17	2	4943	0.0004	0.9966
Sept.18	0	4943	0.0000	0.9966
Sept.19	0	4943	0.0000	0.9966
Sept.20	3	4946	0.0006	0.9972
Sept.21	0	4946	0.0000	0.9972
Sept.22	0	4946	0.0000	0.9972
Sept.23	0	4946	0.0000	0.9972
Sept.24	1	4947	0.0002	0.9974
Sept.25	0	4947	0.0000	0.9974
Sept.26	3	4950	0.0006	0.9980
Sept.27	7	4957	0.0014	0.9994
Sept.28	0	4957	0.0000	0.9994
Sept.29	0	4957	0.0000	0.9994
Sept.30	0	4957	0.0000	0.9994
Oct. 1	0	4957	0.0000	0.9994
Oct. 2	0	4957	0.0000	0.9994
Oct. 3	0	4957	0.0000	0.9994
Oct. 4	3	4960	0.0006	1.0000

Mean Day of Migration = Aug. 9 Variance = 402.7 Days squared