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Southeast Alaska Sockeye Salmon Escapement Determination: Port Snettisham and Hugh Smith Weirs, 1990

by

Fred Bergander

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ABSTRACT

The 1990 sockeye salmon *Oncorynchus nerka* escapement to Crescent Lake was 23%, and Hugh Smith Lake 7%, of the historical average. The Speel Lake sockeye salmon escapement was 229% of the average of the previous 7 years. Escapement estimates for sockeye salmon returning to McDonald Lake in 1990 were 98% of the 1979-89 average.

KEY WORDS: sockeye salmon, *Oncorynchus nerka*, escapement, Crescent Lake, Hugh Smith Lake, McDonald Lake

INTRODUCTION

Accurate sockeye salmon *Oncorynchus nerka* stock status information is used for U.S./Canada Treaty allocations and special management actions. This project documents escapements into Southeast Alaska sockeye salmon systems that contribute to fisheries intercepting mixed U.S. and Canadian stocks in the District 11 B, Taku Inlet, District 1, and Tree Point drift gillnet fisheries and purse seine fisheries in Districts 1, 2, 3, and 4. Knowledge of the annual escapements is necessary to (1) determine if escapement goals are being attained, (2) assess the effects of various management decisions on the escapements to these systems, and (3) to develop a time series of run-reconstruction statistics necessary for developing spawner-recruit relationships, estimating optimum sustained yield and optimal escapement, and improving forecasting.

The 1990 work was a continuation of escapement documentation that has been conducted since 1982 (Bergander 1989, 1990; Bergander et al. 1988). In most cases aerial and foot surveys have been proven to be an ineffective means of enumerating sockeye salmon escapements due to the lake-spawning characteristics of the species. Conversely, weirs provide accurate run timing information and a means of collecting needed biological samples.

The specific objectives of this study were as follows:

1. Monitor and enumerate the escapements of sockeye salmon to Crescent, Speel, Hugh Smith, and McDonald Lakes.

2. Document the timing of sockeye salmon escapements to Crescent, Speel, and Hugh Smith Lakes. Document the relative timing of the arrival of sockeye salmon in the spawning stream at McDonald Lake.

3. For stock identification and age composition purposes, collect sockeye salmon scale samples and age, length, and sex data throughout the period of escapement.

Crescent and Speel Lakes are tributaries of Snettisham Inlet, immediately south of the Taku Inlet, and contribute to sockeye harvests in the District 11-B drift gillnet fishery. Hugh Smith Lake is a tributary of Boca de Quadra Inlet near Alaska's southern boundary with Canada; its stocks are harvested by the District 1 drift gillnet and Districts 1, 2, 3, and 4 purse seine fisheries. McDonald Lake sockeye are harvested primarily by the District 6 drift gillnet fishery and Districts 1 and 2 seine fisheries (Zadina 1990).

METHODS

Sockeye salmon escapements were enumerated at Crescent, Speel, and Hugh Smith Lakes (Figure 1). Steel picket weirs were used to control the movement of salmon into Crescent, Speel, and Hugh Smith Lakes

and allowed visual counting of the escapement. Fish were counted as they passed through an opening in the weir created by the removal of one or more of the pickets. Pickets were removed daily or as often as fish were present and willing to pass through the weir. Escapement data were collected at McDonald Lake by foot stream surveys and the total escapement was estimated by using the weir count to stream survey ratio developed during years of weir operation (Haddix, M.H., Alaska Department of Fish and Game, FRED Division, Ketchikan, personal communication). Surveys of Hatchery Creek, the main tributary to McDonald Lake, were conducted on 23 and 31 August; 10, 20, and 28 September; and 10 and 20 October.

An upstream trap was incorporated in each of the weirs to allow capture of adults for collection of scales length, and sex data. Scale samples were used for age determination and documentation of scale characteristics for stock identification purposes. Scales were mounted on gum cards and the data recorded on mark/sense forms as described by Clutter and Whitsel (1956). The mounted scales and data forms were analyzed; results were reported by Rowse (1990).

RESULTS AND DISCUSSION

Historical salmon escapements to Crescent, Speel, and Hugh Smith Lakes are presented in Appendix A.1 and Figures 2-4. The 1990 sockeye escapement to Speel Lake was 229% of the historical average for the preceding 7 years. The 1990 Crescent Lake escapement was 23% of the average for all previously recorded years (Appendix A.1). The 1990 Hugh Smith escapement was 7% of the average for the previous 8 years. The average sockeye escapement to McDonald Lake since 1979 was 86,563 fish; the 1990 escapement was approximately 98% of that average (Appendix A.2). Peak escapements to Speel Lake occurred on 31 July, in Crescent Lake on 4 July, and in Hugh smith Lake on 28 August (Appendix B.1, B.2, B.3). These peak escapements represented approximately 18%, 11%, and 8%, respectively, of the season's escapement of sockeye salmon to these systems.

In an effort to rebuild the Crescent Lake stocks, management has effected time and area closures to reduce the harvest of Snettisham sockeye in the District 11-B fishery. These efforts have apparently benefitted the Speel Lake stocks, which have shown relatively strong returns in all years except 1988. Crescent Lake stocks continued to demonstrate a negative response to conservation measures and have failed to reach expected escapement levels.

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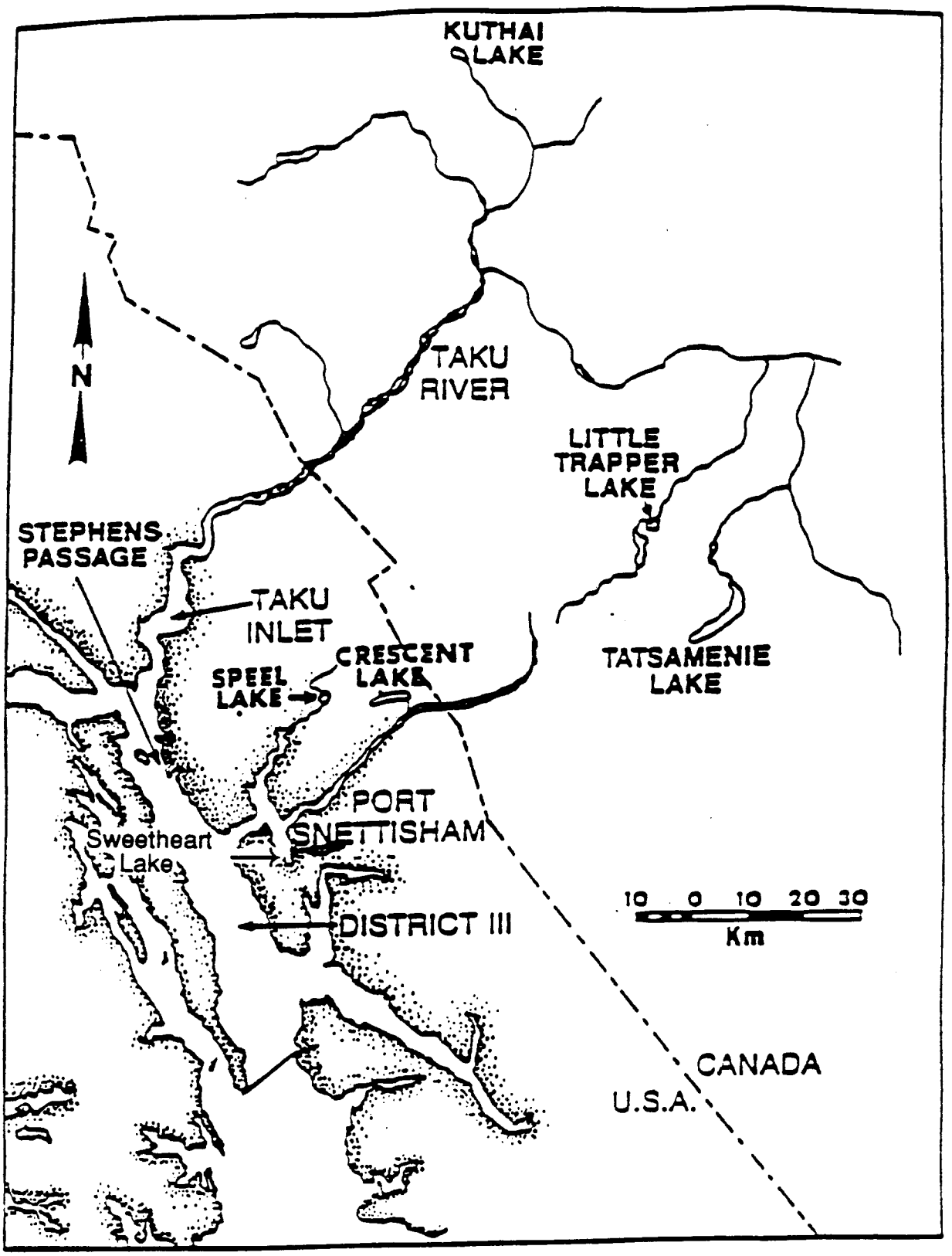

Figure 1. The Taku River and Port Snettisham sockeye salmon spawning systems.

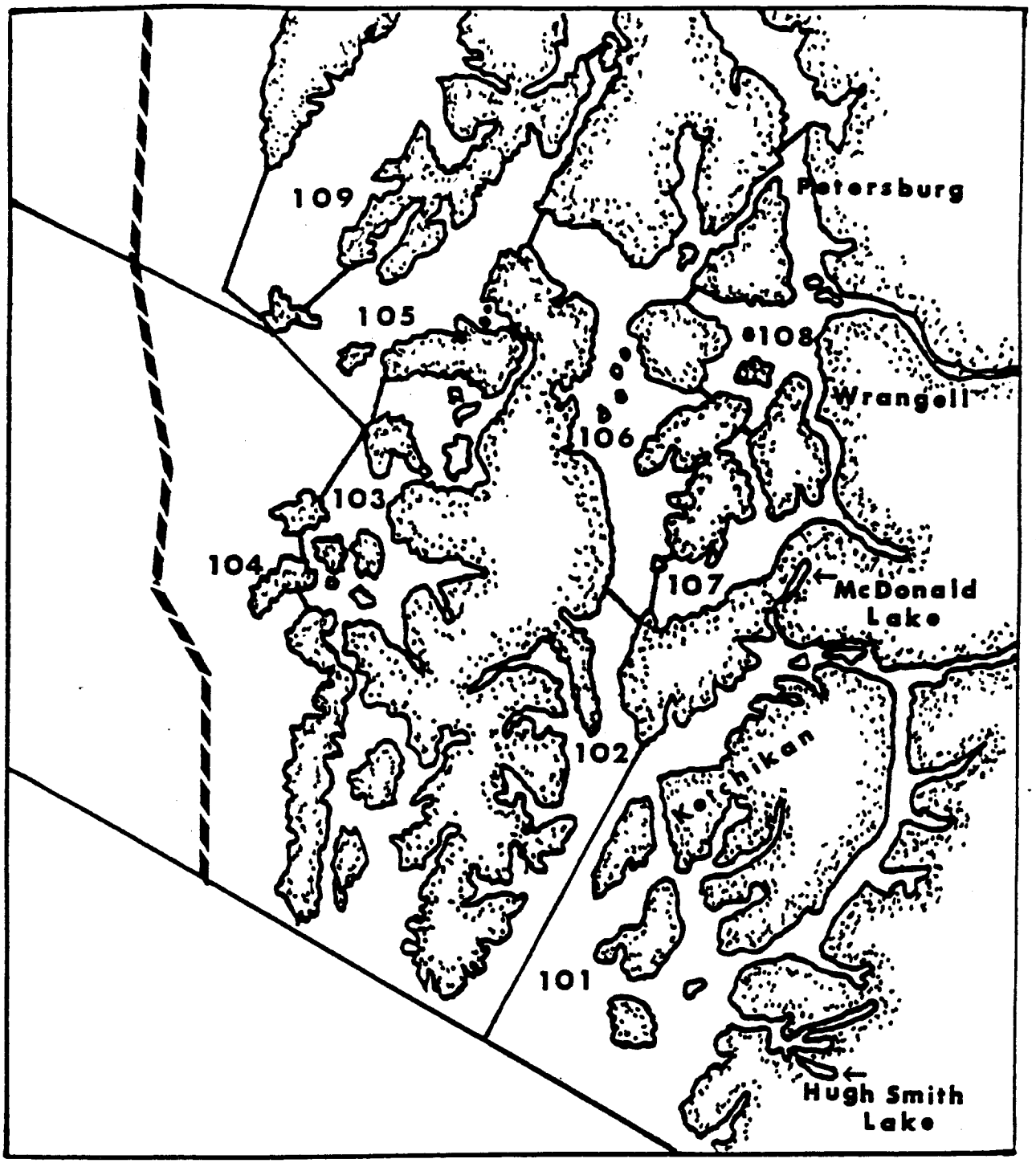

Figure 2. Study area showing the locations of McDonald and Hugh Smith Lakes and associated ADF&G regulatory fishing districts.

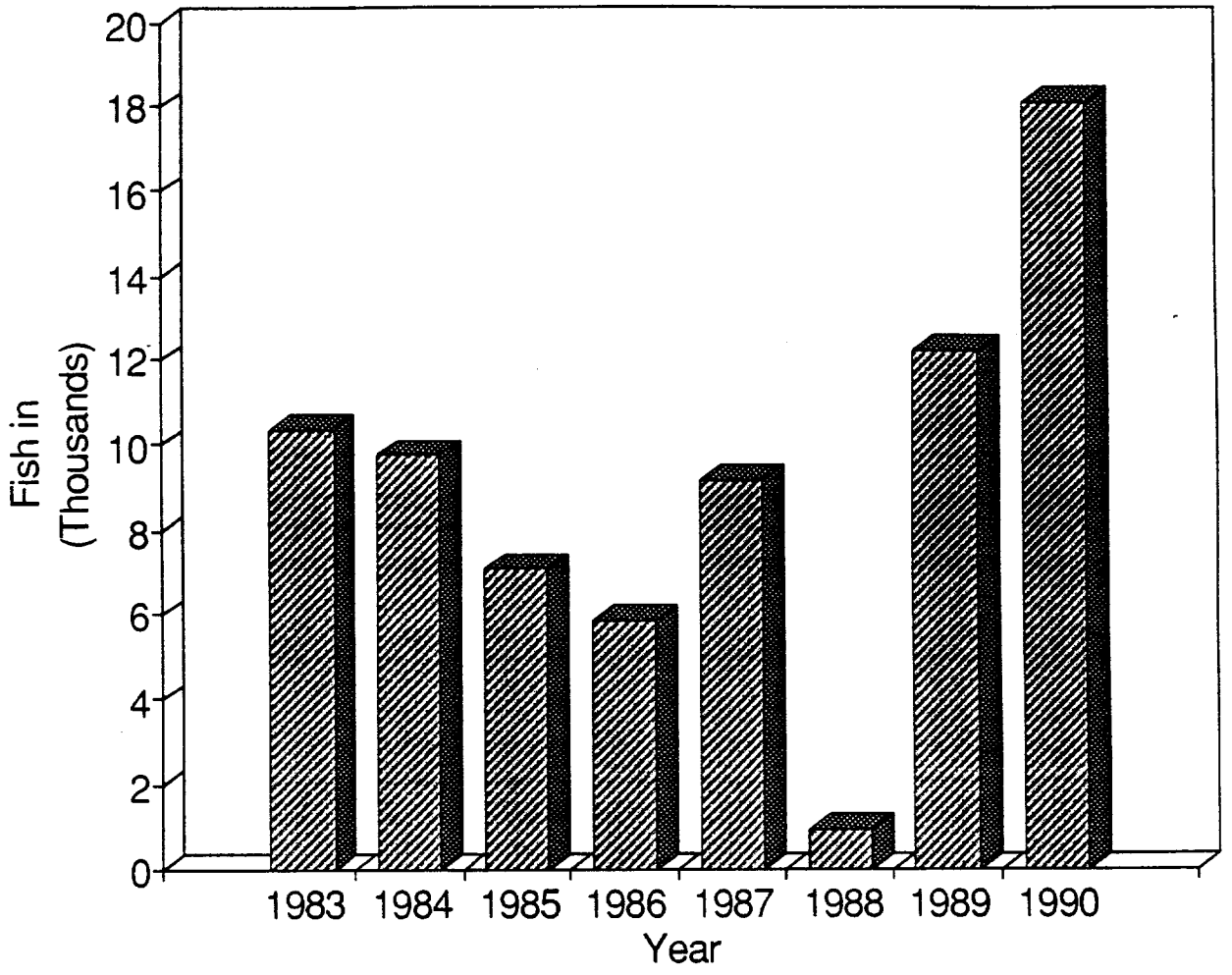

Figure 3. Speel Lake annual sockeye salmon escapements, 1983-1990.

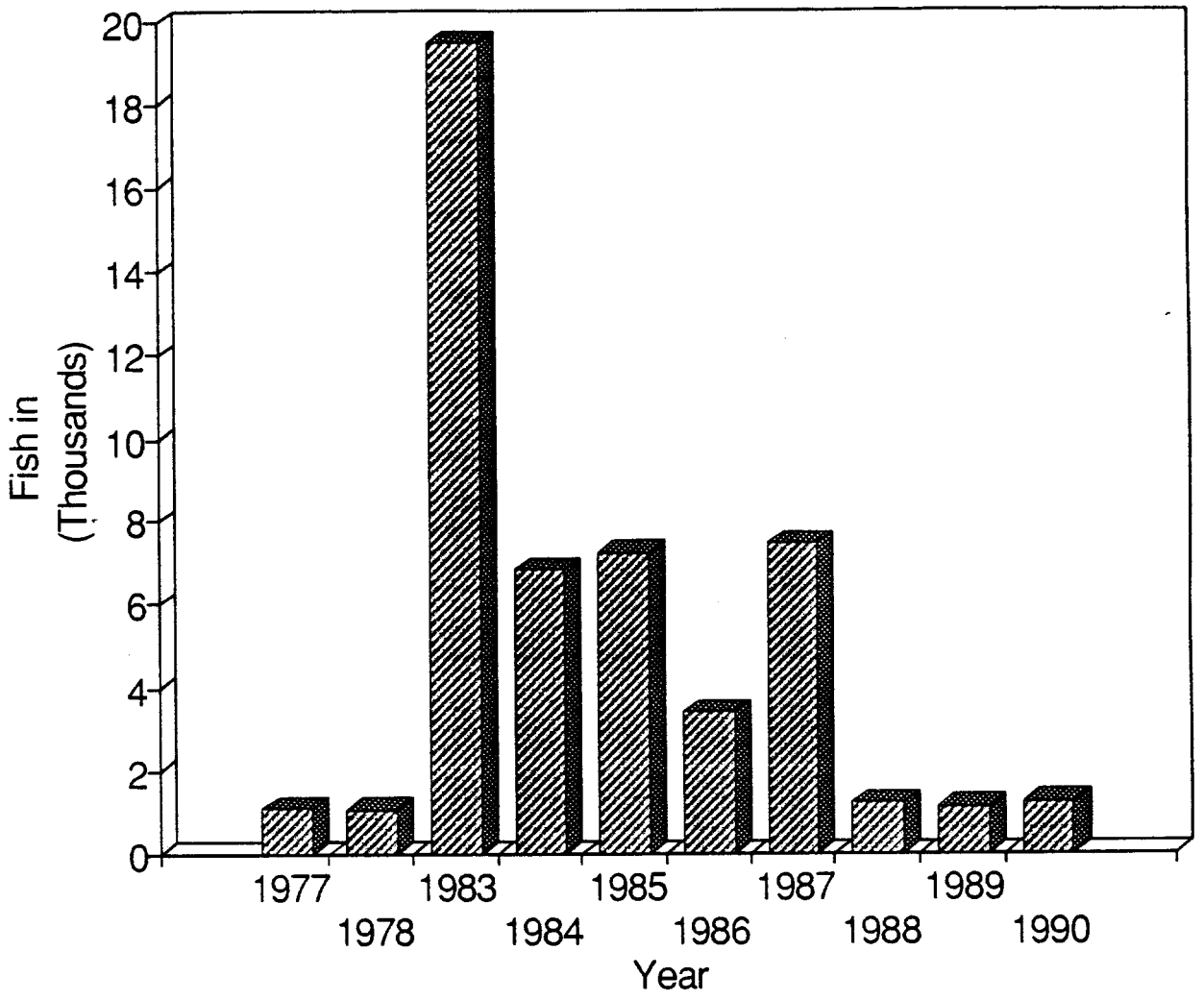

Figure 4. Crescent Lake annual sockeye salmon escapements, 1977-1978, 1983-1990.

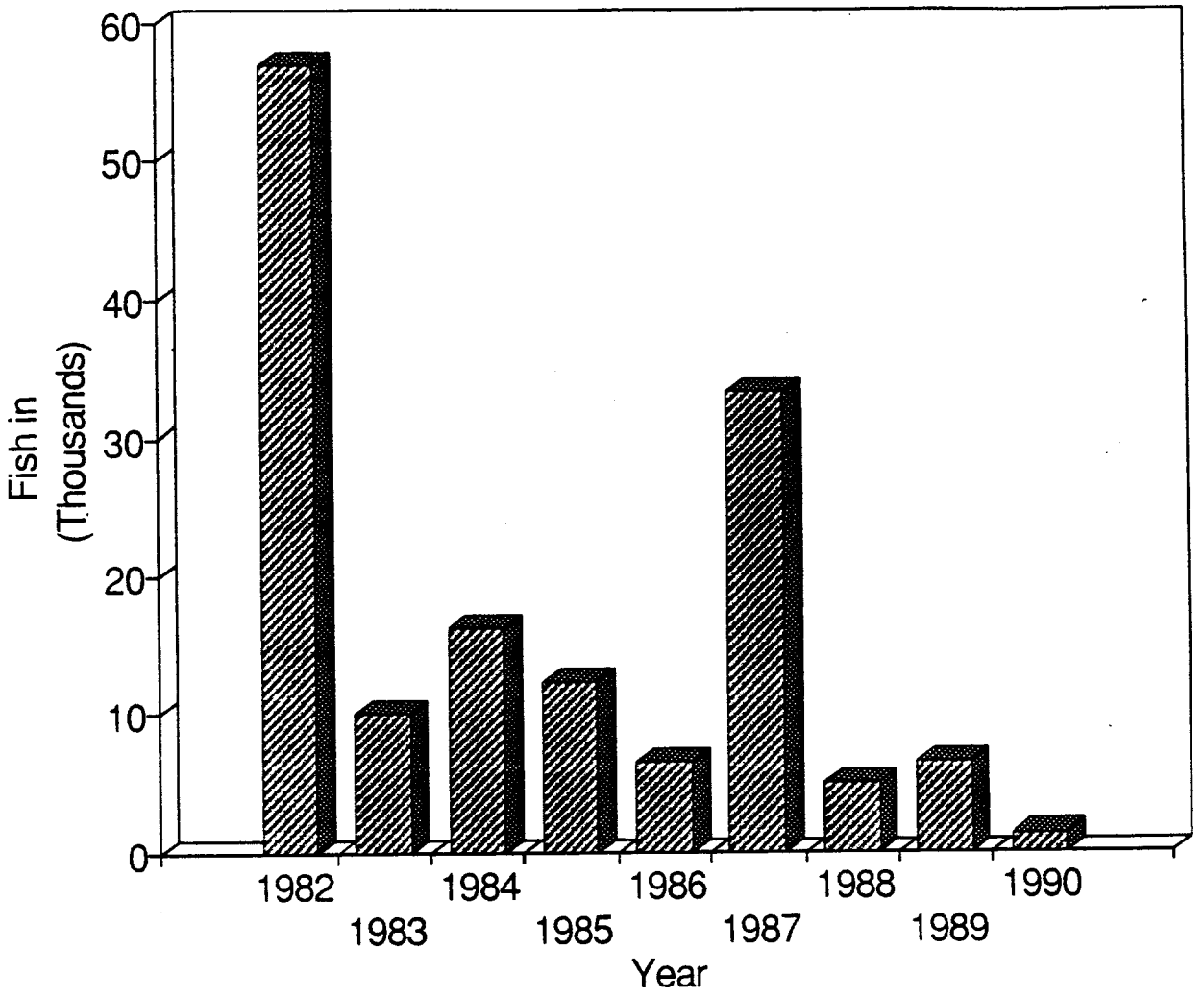

Figure 5. Hugh Smith Lake annual sockeye salmon escapements, 1982-1990.

APPENDIX

Appendix A.1. Annual salmon escapements through Speel, Crescent, and Hugh Smith Lakes, 1977-90.

Year	Sockeye	Coho	Pink	Chum	King	Total	Period Operated
Speel							
1983	10,362	43	143	0	0	10,548	7/01-9/22
1984	9,764	6	26	0	0	9,796	7/15-9/08
1985	7,073	0	0	2	0	7,075	7/15-8/29
1986	5,860	0	7	0	0	5,867	7/13-8/29
1987	9,161	0	31	0	0	9,161	7/15-8/28
1988	934	0	0	0	0	934	7/14-8/29
1989	12,229	0	0	0	1	12,230	7/12-9/5
Average	7,912	7	30	0	0		
1990	18,095	0	0	0	0	18,095	7/12-8/31
Crescent							
1977	1,079	10	3,449	115	5	4,658	7/07-8/29
1978	1,049	62	1,958	13	0	3,082	6/28-8/13
1983	19,476		no record		1	19,477	6/20-8/24
1984	6,807	33	6,047	685	4	13,576	7/10-9/12
1985	7,249	108	9,691	746	1	17,795	7/16-8/30
1986	3,405	28	1,046	228	4	4,711	7/12-8/29
1987	7,459	33	6,159	261	5	7,451	7/13-8/28
1988	1,199	0	no record		0	1,199	7/11-8/28
1989	1,099	8	1,596	142	33	2,878	7/16-8/27
Average	5,425	31	3,327	243	6		
1990	1,262	23	998	757	19	3,059	7/13-8/29
Hugh Smith							
1982	56,956						6/7-10/27
1983	10,036						6/1-9/30
1984	16,191						6/6-11/25
1985	12,298						6/16-11/8
1986	6,500 *						6/9-10/28
1987	33,204						6/8-9/16
1988	4,960						6/5-10/4
1989	6,512						6/2-10/24
Average	18,332						
1990	1,287						6/8-10/22

* A hole had developed near the bottom of the weir and subsequent surveys indicated that approximately 6,500 sockeye escaped to the lake;however, only 2312 had been counted.

Appendix A.2. Sockeye salmon escapement counts at McDonald Lake by visual counts of fish in the inlet stream and weir on outlet stream, 1979-90.

Year	Escapement	Type
1979	30,900	Expanded Escapement count
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
1989	78,324	Expanded Escapement count
1979-89 Average	86,563	Expanded Escapement count
1990	84,708	Expanded Escapement count

Appendix B.1. Daily sockeye salmon counts and associated statistics from Speel Lake, 1990.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 12	0	0	0.0000	0.0000
July 13	0	0	0.0000	0.0000
July 14	0	0	0.0000	0.0000
July 15	0	0	0.0000	0.0000
July 16	3	3	0.0002	0.0002
July 17	10	13	0.0006	0.0007
July 18	9	22	0.0005	0.0012
July 19	24	46	0.0013	0.0025
July 20	40	86	0.0022	0.0048
July 21	19	105	0.0011	0.0058
July 22	15	120	0.0008	0.0066
July 23	21	141	0.0012	0.0078
July 24	36	177	0.0020	0.0098
July 25	46	223	0.0025	0.0123
July 26	55	278	0.0030	0.0154
July 27	39	317	0.0022	0.0175
July 28	580	897	0.0321	0.0496
July 29	140	1037	0.0077	0.0573
July 30	524	1561	0.0290	0.0863
July 31	3331	4892	0.1841	0.2704
Aug. 1	94	4986	0.0052	0.2755
Aug. 2	93	5079	0.0051	0.2807
Aug. 3	123	5202	0.0068	0.2875
Aug. 4	101	5303	0.0056	0.2931
Aug. 5	2912	8215	0.1609	0.4540
Aug. 6	37	8252	0.0020	0.4560
Aug. 7	65	8317	0.0036	0.4596
Aug. 8	53	8370	0.0029	0.4626
Aug. 9	56	8426	0.0031	0.4657
Aug. 10	2239	10665	0.1237	0.5894
Aug. 11	23	10688	0.0013	0.5907
Aug. 12	522	11210	0.0288	0.6195
Aug. 13	305	11515	0.0169	0.6364
Aug. 14	56	11571	0.0031	0.6395
Aug. 15	1042	12613	0.0576	0.6970
Aug. 16	415	13028	0.0229	0.7200
Aug. 17	825	13853	0.0456	0.7656
Aug. 18	176	14029	0.0097	0.7753
Aug. 19	208	14237	0.0115	0.7868
Aug. 20	818	15055	0.0452	0.8320
Aug. 21	677	15732	0.0374	0.8694
Aug. 22	93	15825	0.0051	0.8746
Aug. 23	170	15995	0.0094	0.8839
Aug. 24	476	16471	0.0263	0.9103
Aug. 25	488	16959	0.0270	0.9372
Aug. 26	162	17121	0.0090	0.9462
Aug. 27	139	17260	0.0077	0.9539
Aug. 28	91	17351	0.0050	0.9589
Aug. 29	713	18064	0.0394	0.9983
Aug. 30	31	18095	0.0017	1.0000
Aug. 31	0	18095	0.0000	1.0000
Sept. 1	0	18095	0.0000	1.0000

Mean Day of Migration = Aug. 10 Variance = 89.6 Days squared

Appendix B.2. Daily sockeye salmon counts and associated statistics from Crescent Lake, 1990.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
July 13	0	0	0.0000	0.0000
July 14	0	0	0.0000	0.0000
July 15	2	2	0.0016	0.0016
July 16	0	2	0.0000	0.0016
July 17	0	2	0.0000	0.0016
July 18	0	2	0.0000	0.0016
July 19	0	2	0.0000	0.0016
July 20	23	25	0.0182	0.0198
July 21	143	168	0.1133	0.1331
July 22	64	232	0.0507	0.1838
July 23	85	317	0.0674	0.2512
July 24	45	362	0.0357	0.2868
July 25	52	414	0.0412	0.3281
July 26	49	463	0.0388	0.3669
July 27	17	480	0.0135	0.3803
July 28	8	488	0.0063	0.3867
July 29	32	520	0.0254	0.4120
July 30	97	617	0.0769	0.4889
July 31	11	628	0.0087	0.4976
Aug. 1	14	642	0.0111	0.5087
Aug. 2	5	647	0.0040	0.5127
Aug. 3	9	656	0.0071	0.5198
Aug. 4	144	800	0.1141	0.6339
Aug. 5	56	856	0.0444	0.6783
Aug. 6	15	871	0.0119	0.6902
Aug. 7	7	878	0.0055	0.6957
Aug. 8	38	916	0.0301	0.7258
Aug. 9	48	964	0.0380	0.7639
Aug. 10	0	964	0.0000	0.7639
Aug. 11	0	964	0.0000	0.7639
Aug. 12	0	964	0.0000	0.7639
Aug. 13	0	964	0.0000	0.7639
Aug. 14	0	964	0.0000	0.7639
Aug. 15	2	966	0.0016	0.7655
Aug. 16	15	981	0.0119	0.7773
Aug. 17	36	1017	0.0285	0.8059
Aug. 18	68	1085	0.0539	0.8597
Aug. 19	7	1092	0.0055	0.8653
Aug. 20	0	1092	0.0000	0.8653
Aug. 21	0	1092	0.0000	0.8653
Aug. 22	3	1095	0.0024	0.8677
Aug. 23	36	1131	0.0285	0.8962
Aug. 24	37	1168	0.0293	0.9255
Aug. 25	39	1207	0.0309	0.9564
Aug. 26	27	1234	0.0214	0.9778
Aug. 27	19	1253	0.0151	0.9929
Aug. 28	9	1262	0.0071	1.0000
Aug. 29	0	1262	0.0000	1.0000
Aug. 30	0	1262	0.0000	1.0000

Mean Day of Migration = Aug. 3 Variance = 139.5 Days squared

Appendix B.3. Daily sockeye salmon counts and associated statistics from Hugh Smith Lake, 1990.

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
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	0	0	0.0000	0.0000
June 13	0	0	0.0000	0.0000
June 14	1	1	0.0008	0.0008
June 15	0	1	0.0000	0.0008
June 16	0	1	0.0000	0.0008
June 17	0	1	0.0000	0.0008
June 18	0	1	0.0000	0.0008
June 19	0	1	0.0000	0.0008
June 20	0	1	0.0000	0.0008
June 21	1	2	0.0008	0.0016
June 22	3	5	0.0023	0.0039
June 23	2	7	0.0016	0.0054
June 24	0	7	0.0000	0.0054
June 25	0	7	0.0000	0.0054
June 26	0	7	0.0000	0.0054
June 27	0	7	0.0000	0.0054
June 28	0	7	0.0000	0.0054
June 29	0	7	0.0000	0.0054
June 30	3	10	0.0023	0.0078
July 1	4	14	0.0031	0.0109
July 2	51	65	0.0396	0.0505
July 3	23	88	0.0179	0.0684
July 4	8	96	0.0062	0.0746
July 5	22	118	0.0171	0.0917
July 6	4	122	0.0031	0.0948
July 7	3	125	0.0023	0.0971
July 8	0	125	0.0000	0.0971
July 9	8	133	0.0062	0.1033
July 10	28	161	0.0218	0.1251
July 11	15	176	0.0117	0.1368
July 12	36	212	0.0280	0.1647
July 13	5	217	0.0039	0.1686
July 14	8	225	0.0062	0.1748
July 15	14	239	0.0109	0.1857
July 16	2	241	0.0016	0.1873
July 17	3	244	0.0023	0.1896
July 18	7	251	0.0054	0.1950
July 19	11	262	0.0085	0.2036
July 20	3	265	0.0023	0.2059
July 21	13	278	0.0101	0.2160
July 22	7	285	0.0054	0.2214
July 23	7	292	0.0054	0.2269
July 24	33	325	0.0256	0.2525
July 25	5	330	0.0039	0.2564
July 26	67	397	0.0521	0.3085
July 27	14	411	0.0109	0.3193
July 28	3	414	0.0023	0.3217
July 29	0	414	0.0000	0.3217
July 30	0	414	0.0000	0.3217
July 31	11	425	0.0085	0.3302
Aug. 1	3	428	0.0023	0.3326
Aug. 2	5	433	0.0039	0.3364
Aug. 3	0	433	0.0000	0.3364
Aug. 4	3	436	0.0023	0.3388
Aug. 5	0	436	0.0000	0.3388
Aug. 6	3	439	0.0023	0.3411

--Continued--

Appendix B.3. (Page 2 of 3.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Aug. 7	5	444	0.0039	0.3450
Aug. 8	31	475	0.0241	0.3691
Aug. 9	11	486	0.0085	0.3776
Aug. 10	3	489	0.0023	0.3800
Aug. 11	4	493	0.0031	0.3831
Aug. 12	2	495	0.0016	0.3846
Aug. 13	10	505	0.0078	0.3924
Aug. 14	5	510	0.0039	0.3963
Aug. 15	7	517	0.0054	0.4017
Aug. 16	10	527	0.0078	0.4095
Aug. 17	8	535	0.0062	0.4157
Aug. 18	2	537	0.0016	0.4172
Aug. 19	2	539	0.0016	0.4188
Aug. 20	1	540	0.0008	0.4196
Aug. 21	1	541	0.0008	0.4204
Aug. 22	2	543	0.0016	0.4219
Aug. 23	14	557	0.0109	0.4328
Aug. 24	5	562	0.0039	0.4367
Aug. 25	5	567	0.0039	0.4406
Aug. 26	0	567	0.0000	0.4406
Aug. 27	14	581	0.0109	0.4514
Aug. 28	98	679	0.0761	0.5276
Aug. 29	73	752	0.0567	0.5843
Aug. 30	4	756	0.0031	0.5874
Aug. 31	64	820	0.0497	0.6371
Sept. 1	32	852	0.0249	0.6620
Sept. 2	12	864	0.0093	0.6713
Sept. 3	0	864	0.0000	0.6713
Sept. 4	2	866	0.0016	0.6729
Sept. 5	21	887	0.0163	0.6892
Sept. 6	34	921	0.0264	0.7156
Sept. 7	42	963	0.0326	0.7483
Sept. 8	4	967	0.0031	0.7514
Sept. 9	5	972	0.0039	0.7552
Sept.10	42	1014	0.0326	0.7879
Sept.11	96	1110	0.0746	0.8625
Sept.12	4	1114	0.0031	0.8656
Sept.13	7	1121	0.0054	0.8710
Sept.14	0	1121	0.0000	0.8710
Sept.15	0	1121	0.0000	0.8710
Sept.16	24	1145	0.0186	0.8897
Sept.17	22	1167	0.0171	0.9068
Sept.18	1	1168	0.0008	0.9075
Sept.19	5	1173	0.0039	0.9114
Sept.20	0	1173	0.0000	0.9114
Sept.21	12	1185	0.0093	0.9207
Sept.22	14	1199	0.0109	0.9316
Sept.23	5	1204	0.0039	0.9355
Sept.24	1	1205	0.0008	0.9363
Sept.25	8	1213	0.0062	0.9425
Sept.26	2	1215	0.0016	0.9441
Sept.27	0	1215	0.0000	0.9441
Sept.28	5	1220	0.0039	0.9479
Sept.29	30	1250	0.0233	0.9713
Sept.30	0	1250	0.0000	0.9713
Oct. 1	3	1253	0.0023	0.9736
Oct. 2	0	1253	0.0000	0.9736
Oct. 3	0	1253	0.0000	0.9736
Oct. 4	1	1254	0.0008	0.9744
Oct. 5	0	1254	0.0000	0.9744
Oct. 6	13	1267	0.0101	0.9845
Oct. 7	1	1268	0.0008	0.9852

--Continued--

Appendix B.3. (Page 3 of 3.)

Date	Daily Count	Cumulative Count	Daily Proportion of Total	Cumulative Proportion of Total
Oct. 8	1	1269	0.0008	0.9860
Oct. 9	1	1270	0.0008	0.9868
Oct. 10	8	1278	0.0062	0.9930
Oct. 11	1	1279	0.0008	0.9938
Oct. 12	1	1280	0.0008	0.9946
Oct. 13	0	1280	0.0000	0.9946
Oct. 14	0	1280	0.0000	0.9946
Oct. 15	0	1280	0.0000	0.9946
Oct. 16	1	1281	0.0008	0.9953
Oct. 17	0	1281	0.0000	0.9953
Oct. 18	0	1281	0.0000	0.9953
Oct. 19	4	1285	0.0031	0.9984
Oct. 20	1	1286	0.0008	0.9992
Oct. 21	1	1287	0.0008	1.0000
Oct. 22	0	1287	0.0000	1.0000
Oct. 23	0	1287	0.0000	1.0000

Mean Day of Migration = Aug. 18 Variance = 765.3 Days squared