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COPPER RIVER HYDROACOUSTIC SALMON ENUMERATION STUDIES,

1995 AND 1996



by

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ABSTRACT

To estimate annual salmon escapement in to the Copper River, the Miles Lake hydroacoustic project was begun in 1978. Studies conducted during 1995 and 1996 used Bendix Corporation single beam side-scanning sonar equipment deployed on the north and south banks of the Copper River near the outlet of Miles Lake, approximately 53 km upriver from the commercial fishing district. In 1995, salmon escapement was estimated to be 599,265 during the time period of May 15 through August 2. In 1996, salmon escapement was estimated to be 906,867, the largest estimate since project inception. Although it has not been possible to collect information at the site on species composition, most of the salmon passing the site are assumed to be sockeye salmon *Oncorhynchus nerka* since this species comprises more than 95 percent of the salmon harvest in Copper River subsistence, commercial, recreational and personal use fisheries.

KEY WORDS: Copper River, hydroacoustics, migration, Miles Lake, *Oncorhynchus nerka*, Pacific salmon, riverine sonar, sockeye salmon, side-scanning sonar, spawning escapement

INTRODUCTION

The Copper River drainage (Figure 1) has supported a commercial fishery since the early 1890's and a subsistence life style for the residents of this drainage for many years before that. Five species of Pacific salmon spawn in the Copper River. The most abundant species is sockeye salmon which makes up more than 95 percent of the total run. Coho salmon *Oncorhynchus kisutch* comprise approximately five percent and chinook salmon *O. tshawytscha* make up about three percent of the total run. Populations of pink *O. gorbuscha* and chum *O. keta* salmon are not abundant.

There are three major sockeye salmon spawning components in the Copper River system. The most abundant component, referred to as upper Copper River stocks, spawn in Copper River tributaries above Miles Lake. The second component, derived from upper Copper River stocks, is an artificially propagated Gulkana River hatchery stock. The hatchery, which has operated since the early 1970's, produces approximately 350,000 returning adult sockeye salmon. The third component, referred to as lower delta stocks, spawn in systems below the Chugach Mountains, between Eyak Lake and Katalla River.

Management of Copper River salmon resources is difficult due to several factors. The Copper River is a cold turbid system draining extensive glaciers originating in the Alaska, Chugach, Wrangell, and St. Elias mountain ranges. Enumerating the escapement within this drainage has been difficult since the main stem Copper River is too turbid to allow visual counting of salmon. While it is possible to survey clear tributary streams, sockeye and chinook salmon reach these months after they have passed through the commercial fishery. Such surveys have little value for inseason management decisions and make it impossible to ensure that minimum escapement levels are achieved. However, post season escapement estimates do provide data to forecast subsequent runs and to establish escapement goals.

Inseason escapement estimates first became possible in 1978, with the deployment of a single side scanning sonar salmon counter on the south bank of the Copper River at the outlet of Miles Lake (Mile 49 of the Copper River Highway) approximately 53 km upstream from the commercial fishing zone. In 1979 an additional side scanning unit was installed on the north bank of the river. Information from this project has been used for real time management of both the commercial and personal use fisheries. The Copper River management plan, 5AAC 29.360, specifies minimum escapement goals which are based on data obtained from this sonar project (ADF&G 1995). Emergency order regulation of the multi-million dollar commercial fishery as well as subsistence, personal use, and sport fisheries is based on escapement information collected at the Miles Lake sonar site.

METHODS

To estimate total escapement, the sonar system must be placed in an area of the river where salmon do not mill and all salmon traveling upriver have a high probability of passing through the sounding beam. An area of the river with a single channel, uniform slope, smooth bottom and adequate current velocity is most desirable. The most suitable location, closest to the river mouth, was found just downstream of Miles Lake. This site is 53 km above the upper commercial district boundary. This section of the river is influenced by two glaciers: Childs Glacier, which is below Miles Lake, and Miles Glacier, which is on the eastern shore of Miles Lake (Figure 2). Although the Copper River Highway provides access to the site, deep snow drifts historically have rendered the highway impassable well into June most years. Since 1994, the Department of Transportation has opened the road for vehicle travel to the sonar site.

Sonar Operations

The basic adult salmon counter system consists of four main elements: an electronic counting unit, a transducer, an artificial bottom substrate, and an oscilloscope for calibration. The system is powered by a 12 volt battery continuously recharged by a solar panel.

Electronic counting units used on this project varied within and between years. Two 16 sector, 1985 Bendix units with adjustable hit criteria by sector are currently used. Two 12 sector 1981, Bendix units with rock inhibiting functions are available to replace 16 sector units which malfunction or are damaged.

Transducers operate at 515 KHz and have alternating beam widths of 2 and 4 degrees. Each transducer is mounted on an underwater stand near the river bank and aimed horizontally across the river so that the beam is perpendicular to the current and slightly off the bottom. This allows monitoring of that portion of river most frequently used by migrating sockeye salmon. On the south bank the transducer is aimed over an artificial bottom substrate with a smooth straight surface. On the north bank the natural river bottom is used where the slope is smooth and uniform. The south bank permanent artificial substrate is constructed of concrete with a steel rail embedded in the concrete to form a uniform surface along the river bottom. The rail also serves as a guide along which the transducer stand is moved in response to water level fluctuations. Through 1995, a minimum water level of 40.1 m above mean sea level was needed for use of the permanent substrate. When water levels are lower, a portable tripod is used to hold and aim the transducer. However, during the high water period in 1995 the lower portion of the rail was damaged by an iceberg and the required water level to move to the permanent substrate is now 40.9 m above sea level.

Each transducer stand has an adjustment wheel at the top which is manually turned to aim the sonar beam along the river bottom or substrate. To position the beam up- or downriver, the entire tripod must be shifted in the desired direction (Morstad 1992). These manually adjustable stands are less prone to damage by large pieces of ice and debris than remote controlled pan and tilt rotator units.

Calibrations

Each year, frequent adjustments of transducers have been required on both river banks because of large fluctuations in river level, wave action caused by strong winds, and periods of heavy ice passage. The north bank sonar unit was calibrated every four hours for 30 minutes or until 100 salmon were counted. Do to the low frequency of fish passage calibrating the north bank during most instances is difficult. Low fish passage less than 10 fish per hour is common and makes sonar adjustments difficult.

During 1995 and 1996, when the south bank unit was on permanent substrate, calibrations were conducted every three hours for 30 minutes or until 100 salmon were counted (Morstad 1992). When the south bank transducer was mounted on the tripod, visual counting with the aid of the oscilloscope were conducted every hour for 30 minutes and then expanded to obtain a cumulative hourly count. During this period, the firing rate of the sonar counter was increased, aiding in visual counting. There were no adjustments to the sonar counter and all hourly printouts from the counter were discarded when the transducer was attached to the tripod. The basis for visual counting versus the sonar counts while using the tripod is that during the low water periods in May and early June large amounts of shore, lake and glacial ice are drifting down river on the surface causing high counts in the inshore sectors. Interpolations of the inshore sectors were constant thereby producing data based on averages (Morstad 1992).

Species Apportionment

Test fishing programs using gill nets and beach seines were attempted in the vicinity of the sonar site from 1985 through 1987, but lack of good sampling locations and small catches indicated that this was not a viable way to collect data on species composition (Morstad 1992). No species apportionment information was collected at the site in either 1995 or 1996. However, based on information from subsistence, commercial, recreational and personal use harvests, as well as aerial surveys, most salmon migrating up the Copper River are sockeye salmon. Therefore, it was assumed that most sonar counts could be attributed to this species.

RESULTS and DISCUSSION

In 1995, the sonar project operated from 15 May to 2 August. Estimated escapement during that time period was 599,265 salmon, 7 percent above the escapement goal (Table 1). Daily passage was above the anticipated level from May 15 through May 23 and then fell below. It wasn't until June 23 that actual cumulative passage exceeded the projected total (Figure 3). The south bank transducer was mounted on a tripod from 15 May to 29 May and then from 7 June until 11 June (Tables 2-4) when water level dropped below 40.1 m (Figure 4).

In 1996, the sonar project operated from 18 May to 6 August. Estimated passage during that time period was 906,867 salmon, 62 percent above the goal (Table 5). This was the largest run of sockeye salmon to the Copper River system. Daily passage rates were below anticipated values at the start of the project but surpassed anticipated values on 28 May and remained above them the rest of the season (Figure 5). The south bank sonar was mounted on the tripod from 18 May through 8 June (Tables 6-8) when water level dropped below 40.1 m (Figure 6).

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TABLES

Table 1. Daily sockeye salmon escapement estimates at Miles Lake sonar, 1995.

Date	Water Level ^a	Estimate				Escapement		0600 Count	Projected Daily
		North Bank	South Bank	Daily	Cumulative	Daily	Cumulative		
15-May	40.71	23 ^b	476 ^c	499	499				
16-May		22	457	479	978	107	107		
17-May		25	522	547	1,525	1,411	1,518		
18-May	40.27	25	497	522	2,047	1,844	3,362		
19-May	40.09	63	1,232	1,295	3,342	2,117	5,479		
20-May	39.65	144	2,884	3,028	6,370	2,542	8,021		
21-May	39.87	167	3,337	3,504	9,874	2,494	10,515		
22-May	39.90	134	2,674	2,808	12,682	3,231	13,746		
23-May	39.98	205	4,096	4,301	16,983	3,211	16,957		
24-May	40.08	118	2,355	2,473	19,456	5,687	22,644		
25-May	40.31	88	1,753	1,841	21,297	5,292	27,936		
26-May	40.71	144	2,888	3,032	24,329	6,564	34,500		
27-May	41.06	181	3,625	3,806	28,135	7,328	41,828		
28-May	41.04	341	6,827	7,168	35,303	8,918	50,746		
29-May	41.04	470	9,408	9,878	45,181	7,016	57,762		
30-May	40.88	609	12,170 ^d	12,779	57,960	7,109	64,871	4,506	18,024
31-May	40.69	512	10,243	10,755	68,715	10,130	75,001	1,132	4,528
01-Jun	40.54	428	8,552	8,980	77,695	10,032	85,033	2,761	11,044
02-Jun	40.45	449	8,979	9,428	87,123	10,570	95,603	1,609	6,436
03-Jun	40.37	269	5,378	5,647	92,770	10,170	105,773	1,710	6,840
04-Jun	40.26	321	6,424	6,745	99,515	11,042	116,815	2,100	8,400
05-Jun	40.22	281	5,614	5,895	105,410	13,181	129,996	1,418	5,672
06-Jun	40.22	440	8,796	9,236	114,646	11,110	141,106	1,886	7,544
07-Jun	40.29	383	7,661 ^c	8,044	122,690	10,598	151,704	2,501	10,004
08-Jun	40.45	273 ^e	5,465	5,738	128,428	12,189	163,893	1,711	6,844
09-Jun	40.63	261	5,218	5,479	133,907	11,074	174,967	864	3,456
10-Jun	40.81	384	7,670	8,054	141,961	11,356	186,323	1,056	4,224
11-Jun	41.35	569	11,381	11,950	153,911	11,311	197,634	2,496	9,984
12-Jun	42.09	462	6,812 ^d	7,274	161,185	10,606	208,240	2,131	8,524
13-Jun	42.71	622	8,323	8,945	170,130	9,091	217,331	2,157	8,628
14-Jun	43.04	247	13,774	14,021	184,151	8,657	225,988	4,309	17,236
15-Jun	43.22	252	11,601	11,853	196,004	10,179	236,167	3,701	14,804
16-Jun	43.33	887	18,845	19,732	215,736	8,218	244,385	3,368	13,472
17-Jun	43.09	667	19,251	19,918	235,654	8,070	252,455	4,489	17,956
18-Jun	42.67	1,832	16,106	17,938	253,592	7,064	259,519	4,284	17,136
19-Jun	42.62	1,467	14,558	16,025	269,617	6,660	266,179	3,456	13,824
20-Jun	42.65	1,216	15,647	16,863	286,480	6,490	272,669	4,014	16,056
21-Jun	42.68	2,089	13,341	15,430	301,910	6,387	279,056	4,533	18,132
22-Jun	42.65	746	9,116	9,862	311,772	6,348	285,404	3,117	12,468
23-Jun	42.67	866	4,454	5,320	317,092	6,188	291,592	1,420	5,680
24-Jun	42.85	395	6,962	7,357	324,449	5,872	297,464	1,204	4,816
25-Jun	42.60	256	8,955	9,211	333,660	6,579	304,043	2,476	9,904
26-Jun	42.22	298	9,691	9,989	343,649	5,813	309,856	2,087	8,348
27-Jun	42.35	608	15,417	16,025	359,674	5,566	315,422	2,986	11,944
28-Jun	42.11	709	12,964	13,673	373,347	5,443	320,865	4,642	18,568
29-Jun	42.20	514	9,209	9,723	383,070	5,655	326,520	3,260	13,040
30-Jun	42.35	222	4,180	4,402	387,472	5,655	332,175	961	3,844

-Continued-

Table 1. (page 2 of 2)

Date	Water Level ^a	North Bank	Estimate		Escapement Objective		0600 Count	Projected Daily	
			South Bank	Daily	Cumulative	Daily			Cumulative
01-Jul	42.53	214	5,516	5,730	393,202	4,811	336,986	1,371	5,484
02-Jul	42.76	267	4,951	5,218	398,420	4,997	341,983	1,434	5,736
03-Jul	42.98	248	4,603	4,851	403,271	5,766	347,749	1,219	4,876
04-Jul	43.16	201	4,090	4,291	407,562	6,013	353,762	870	3,480
05-Jul	43.23	231	7,556	7,787	415,349	5,958	359,720	1,114	4,456
06-Jul	43.40	483	7,689	8,172	423,521	5,197	364,917	2,027	8,108
07-Jul	43.60	474	6,146	6,620	430,141	5,248	370,165		
08-Jul	43.75	557	3,715	4,272	434,413	5,651	375,816	1,219	4,876
09-Jul	43.71	910	5,935	6,845	441,258	5,623	381,439	1,163	4,652
10-Jul	43.58	852	13,994	14,846	456,104	6,714	388,153	4,559	18,236
11-Jul	43.53	401	8,967	9,368	465,472	6,035	394,188	2,259	9,036
12-Jul	43.61	346	6,121	6,467	471,939	6,417	400,605	1,759	7,036
13-Jul	43.51	368	5,610	5,978	477,917	6,564	407,169	1,624	6,496
14-Jul	43.40	897	8,705	9,602	487,519	7,715	414,884	1,879	1,883
15-Jul	43.35	1,196	10,391	11,587	499,106	7,749	422,633	2,481	9,924
16-Jul	43.30	764	5,171	5,935	505,041	7,700	430,333	1,177	4,708
17-Jul	43.01	1,022	9,836	10,858	515,899	7,338	437,671	1,736	6,944
18-Jul	43.01	853	9,789	10,642	526,541	8,255	445,926	2,906	11,624
19-Jul	43.12	382	7,782	8,164	534,705	8,268	454,194	2,378	9,512
20-Jul	43.10	312	6,691	7,003	541,708	8,299	462,493	1,925	7,700
21-Jul	43.17	342	5,012	5,354	547,062	7,984	470,477	1,267	5,068
22-Jul	43.32	282	4,314	4,596	551,658	7,188	477,665	919	3,676
23-Jul	43.59	351	3,905	4,256	555,914	6,103	483,768	1,142	4,568
24-Jul	43.74	412	3,843	4,255	560,169	5,814	489,582	1,101	4,404
25-Jul	43.42	442	2,868	3,310	563,479	5,945	495,527	691	2,764
26-Jul	43.16	469	2,721	3,190	566,669	5,766	501,293	673	2,692
27-Jul	42.89	969	4,227	5,196	571,865	4,930	506,223	688	2,752
28-Jul	42.72	664	4,429	5,093	576,958	5,583	511,806	1,399	5,596
29-Jul	42.38	629	5,344	5,973	582,931	6,137	517,943	1,441	5,764
30-Jul	42.31	343	5,938	6,281	589,212	5,726	523,669	1,932	7,728
31-Jul	42.33	673	4,366	5,039	594,251	4,961	528,630	1,287	5,148
01-Aug	42.33	r	3,425	3,425	597,676	4,792	533,422	939	3,756
02-Aug	42.33		1,589	1,589	599,265		533,422	801	3,204
Total									

a Meters above sea level.

b North bank counts are derived from an average of five percent of north bank counts versus south bank counts based on past performance from 1988-1993.

c South bank transducer was deployed on the tripod

d South bank transducer was deployed on the permanent substrate at midnight.

e North bank tripod was deployed.

f North banks counter was pulled at 12:00 midnight.

Table 2. The number of minutes each hour the oscilloscope was monitored on the south bank tripod, Miles Lake sonar, 1995.

HOURL	15-May	16-May	17-May	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	07-Jun	08-Jun	09-Jun	10-Jun	11-Jun
0000-0100																	30	30	30	30
0100-0200																	25	30	30	30
0200-0300																	30	30	30	30
0300-0400																	30	30	30	30
0400-0500																	15	15		15
0500-0600			24		30	30	30	30	30	15	30	30	20	30	30		30	20	30	30
0600-0700		30	30	30	30	30	30	30	30	30	30	30	30	30	30			30	30	30
0700-0800		30	30	30	30	30	30	30	30	30	30	30	30	30	30		30	30	15	30
0800-0900		30	30	30	30	30	30	30	30	30	30	30	30	30	30	26	30	30	30	30
0900-1000	30	20	20	20	20	20	20	20	13	20	15	20	20	20	20	20	20	27	20	20
1000-1100	30	30	30	30	30	30	30	30	30	30	30	30	15	30	30	30			30	30
1100-1200	30	18	30	30	30	30	30	30	30	30	20	30	30	30	30	30	30		30	30
1200-1300	20	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
1300-1400	30	30	30	30	30	30	30	20	30	30	30	30	30	30	30	30	30	30	30	30
1400-1500	18	30	30	30	16	30	30	30	30	30	30	30		30	30	30	30	30	28	30
1500-1600	30	30	30	30	30	30	30	30	30	30	30	30		30	30	20		30	32	30
1600-1700	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
1700-1800		30	30	30	30	30	30	30	30	30	30	30	30	30	30	28	30	30	30	24
1800-1900		30	30	30	30	30	30	25	30	30	15	30	30	30	30	30	30	30	30	30
1900-2000		30	30	30	30	30	30	30	0	30	30	30	30	30	30	30	24	30	0	30
2000-2100		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	25	
2100-2200			30	30	30	30	30	30	30	30	15	30	30	30	30	30		30	30	30
2200-2300			30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
2300-2400			30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	15	30	30
TOTAL	218	428	554	530	546	560	560	545	523	545	530	545	475	560	560	454	564	617	630	659

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Table 3. The number of fish observed passing the south bank tripod during visual monitoring of the oscilloscope, Miles Lake sonar, 1995.

HOUR	15-May	16-May	17-May	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	07-Jun	08-Jun	09-Jun	10-Jun	11-Jun
0000-0100																	44	65	48	144
0100-0200																	95	19	91	87
0200-0300																	83	44	66	123
0300-0400																	131	111	144	258
0400-0500																	73	50		195
0500-0600			8		1	16	86	22	151	16	58	37	29	87	250		265	62	83	246
0600-0700		8	2	6	6	26	68	72	120	44	50	41	42	171	206			98	91	325
0700-0800		9	9	2	5	21	37	42	132	42	36	52	110	170	115		126	71	24	264
0800-0900		7	8	11	2	22	74	45	129	67	14	74	69	136	237	133	92	161	123	191
0900-1000	9	6	10	5	3	11	28	18	71	40	15	44	65	103	126	105	13	82	133	150
1000-1100	11	9	14	6	1	17	28	53	91	46	47	63	57	238	237	128			236	171
1100-1200	12	10	8	12	31	15	83	11	101	53	12	105	70	244	263	195	106		201	189
1200-1300	12	18	7	9	28	45	96	99	88	40	21	63	93	117	194	135	141	155	179	235
1300-1400	13	2	8	14	28	99	61	42	78	66	37	6	88	102	145	107	162	161	315	242
1400-1500	5	4	8	16	14	45	59	67	73	56	73	80		130	250	175	188	48	291	413
1500-1600	6	20	8	8	38	52	169	66	47	84	82	98		171	315	107		87	202	424
1600-1700	2	11	16	5	53	169	62	88	11	57	34	110	64	132	180	127	114	156	19	196
1700-1800		4	13	16	50	69	166	53	44	44	18	60	95	142	69	235	171	238	176	234
1800-1900		7	7	13	58	61	29	27	85	43	6	39	64	154	334	178	96	136	193	231
1900-2000		10	14	6	41	51	63	61		57	36	45	69	174	61	148	25	175		270
2000-2100		8	10	17	33	143	60	69	55	36	29	40	59	37	168	65	95	194	63	
2100-2200			15	9	45	97	34	66	57	45	46	15	97	187	96	127		31	226	231
2200-2300			10	22	15	99	55	58	79	38	42	77	37	107	183	72	73	112	263	163
2300-2400			27	7	22	78	49	64	31	24	11	37	72	49	212	83	63	17	293	156
TOTAL	70	133	200	184	474	1,136	1,307	1,023	1,443	897	667	1,106	1,180	2,651	3,661	2,120	2,156	2,273	3,460	5,138

Table 4. Expanded hourly and daily counts from the south bank tripod , Miles Lake sonar, 1995.

HOUR	15-May	16-May	17-May	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	07-Jun	08-Jun	09-Jun	10-Jun	11-Jun
0000-0100																399	88	130	96	288
0100-0200																432	228	36	182	174
0200-0300																416	166	88	132	246
0300-0400																459	262	222	288	516
0400-0500																367	292	200	192	780
0500-0600			15		2	32	172	44	302	80	118	74	87	174	500	428	530	188	188	492
0600-0700		16	4	12	12	52	136	144	240	88	100	82	84	342	412	289	315	196	182	650
0700-0800		18	18	4	10	42	74	84	264	84	72	104	220	340	230	337	252	142	96	528
0800-0900		14	16	22	4	44	148	90	258	134	28	148	138	272	474	314	184	322	246	382
0900-1000	18	18	30	15	9	33	84	54	328	120	60	132	195	309	378	315	39	182	399	450
1000-1100	22	18	28	12	2	34	56	106	182	92	94	126	228	476	474	256	179	229	472	342
1100-1200	24	33	16	24	62	30	166	22	202	106	36	210	140	488	526	390	212	229	402	378
1200-1300	36	36	14	18	56	90	192	198	176	80	42	126	186	234	388	270	282	310	358	470
1300-1400	26	4	16	28	56	198	122	126	156	132	74	12	176	204	290	214	324	322	630	484
1400-1500	17	8	16	32	53	90	118	134	146	112	146	160		260	500	350	376	96	624	826
1500-1600	12	40	16	16	76	104	338	132	94	168	164	196		342	630	321	318	174	379	848
1600-1700	4	22	32	10	106	338	124	176	22	114	68	220	128	264	360	254	228	312	38	392
1700-1800		8	28	32	100	138	332	106	88	88	36	160	190	284	178	504	342	476	352	585
1800-1900		14	14	26	116	122	58	65	170	86	24	78	128	308	668	356	192	272	386	462
1900-2000		20	28	12	82	102	126	122		114	72	90	138	348	122	296	63	350	335	540
2000-2100		16	20	34	66	286	120	138	110	72	58	80	118	74	336	130	190	388	151	448
2100-2200			30	18	90	194	68	132	114	90	92	60	194	374	192	254	131	62	452	462
2200-2300			20	44	30	198	110	116	158	76	84	154	74	214	366	144	146	224	526	326
2300-2400			54	14	44	156	98	128	62	48	22	74	144	98	424	186	128	68	586	312
Total	159	285	413	373	976	2,283	2,642	2,117	3,072	1,864	1,388	2,286	2,568	5,405	7,448	7,661	5,465	5,218	7,670	11,381
Daily	476	457	522	497	1,232	2,884	3,337	2,674	4,096	2,355	1,753	2,888	3,625	6,827	9,408	7,661	5,465	5,218	7,670	11,381

Table 5. Daily sockeye salmon escapement estimates at Miles Lake sonar, 1996.

Date	Water Level ^a	Estimate		Daily	Cumulative	Escapement Objective		0600 Count	Projected Daily
		North Bank	South Bank			Daily	Cumulative		
15-May	40.33								
16-May	40.07					109	109		
17-May	39.77					1,048	1,157		
18-May	39.60	5 ^b	79 ^c	84	84	1,664	2,821		
19-May	39.57	3	69	72	156	2,088	4,909		
20-May	39.60	6	124	130	286	2,482	7,391		
21-May	39.55	16	322	338	624	2,371	9,762		
22-May	39.55	49	974	1,023	1,647	2,501	12,263		
23-May	39.62	84	1,682	1,766	3,413	2,858	15,121		
24-May	39.75	63	1,267	1,330	4,743	4,872	19,993		
25-May	39.85	65	1,298	1,363	6,106	4,876	24,869		
26-May	39.87	104	2,088	2,192	8,298	6,044	30,913		
27-May	39.89	228	4,562	4,790	13,088	7,142	38,055		
28-May	39.95	628	12,228	12,856	25,944	8,329	46,384		
29-May	39.98	572	11,436	12,008	37,952	6,355	52,739	4,166	16,664
30-May	40.11	531	10,330	10,861	48,813	6,636	59,375	1,722	6,888
31-May	40.29	952	19,042	19,994	68,807	9,413	68,788	3,532	14,128
01-Jun	40.51	1,216	24,314	25,530	94,337	9,368	78,156	5,526	22,104
02-Jun	40.96	1,237	24,740	25,977	120,314	10,334	88,490	5,436	21,744
03-Jun	41.08	1,298	25,967	27,265	147,579	9,809	98,299	5,114	20,456
04-Jun	41.18	1,059	21,172	22,231	169,810	10,684	108,983	4,106	16,424
05-Jun	41.22	858	17,151 ^d	18,009	187,819	12,549	121,532	5,103	20,412
06-Jun	41.08	539	10,771 ^e	11,310	199,129	10,797	132,329	3,047	12,188
07-Jun	40.90	797	15,946	16,743	215,872	10,612	142,941	2,548	10,192
08-Jun	40.97	1,266	25,319 ^d	26,585	242,457	12,296	155,237	4,022	16,088
09-Jun	41.08	755 ^e	34,929	35,684	278,141	11,750	166,987	7,784	31,136
10-Jun	41.03	475	31,317	31,792	309,933	11,565	178,552	8,677	34,708
11-Jun	40.88	428	28,657	29,085	339,018	11,371	189,923	6,368	25,472
12-Jun	40.70	581	35,056	35,637	374,655	10,727	200,650	8,815	35,260
13-Jun	40.54	1,010	26,026	27,036	401,691	9,211	209,861	10,162	40,648
14-Jun	40.51	732	14,226	14,958	416,649	8,750	218,611	3,504	14,016
15-Jun	40.47	576	14,972	15,548	432,197	10,366	228,977	3,761	15,044
16-Jun	40.43	790	13,019	13,809	446,006	8,841	237,818	3,393	13,572
17-Jun	40.50	633	9,665	10,298	456,304	8,754	246,572	2,135	8,540
18-Jun	40.72	387	6,972	7,359	463,663	7,423	253,995	1,927	7,708
19-Jun	40.97	441	14,862	15,303	478,966	6,713	260,708	2,794	11,176
20-Jun	41.14	482	11,589	12,071	491,037	6,348	267,056	3,600	14,400
21-Jun	41.35	186	7,384	7,570	498,607	6,288	273,344	2,077	8,308
22-Jun	41.48	194	10,657	10,851	509,458	6,329	279,673	3,256	13,024
23-Jun	41.70	368	15,176	15,544	525,002	6,735	286,408	4,251	17,004
24-Jun	42.03	472	9,754	10,226	535,228	6,249	292,657	3,076	12,304
25-Jun	42.28	341	7,622	7,963	543,191	6,736	299,393	2,032	8,128
26-Jun	42.43	623	8,045	8,668	551,859	5,789	305,182	2,006	8,024
27-Jun	42.43	784	9,471	10,255	562,114	5,574	310,756	2,690	10,760
28-Jun	42.25	505	8,690	9,195	571,309	5,447	316,203	2,166	8,664
29-Jun	41.82	801	11,820	12,621	583,930	5,922	322,125	2,321	9,284
30-Jun	41.51	1,099	11,992	13,091	597,021	5,977	328,102	2,448	9,792

-Continued-

Table 5. (page 2 of 2)

Date	Water Level ^a	North Bank	Estimate South Bank	Escapement Objective		0600 Count	Projected Daily		
				Daily	Cumulative				
01-Jul	41.43	1,437	14,050	15,487	612,508	4,978	333,080	4,065	16,260
02-Jul	41.44	554	12,512	13,066	625,574	5,663	338,743	4,019	16,076
03-Jul	41.56	223	12,726	12,949	638,523	6,198	344,941	2,617	10,468
04-Jul	41.71	432	12,524	12,956	651,479	6,219	351,160	2,251	9,004
05-Jul	41.90	915	7,914	8,829	660,308	6,187	357,347	2,251	9,004
06-Jul	41.95	212	8,606	8,818	669,126	6,039	363,386	2,104	8,416
07-Jul	41.99	591	8,416	9,007	678,133	5,598	368,984	2,115	8,460
08-Jul	42.11	627	7,797	8,424	686,557	5,850	374,834	1,741	6,964
09-Jul	42.21	698	7,104	7,802	694,359	6,304	381,138	1,918	7,672
10-Jul	42.28	933	8,859	9,792	704,151	7,585	388,723	1,807	7,228
11-Jul	42.24	957	9,651	10,608	714,759	6,540	395,263	2,009	8,036
12-Jul	42.03	562	11,243	11,805	726,564	6,955	402,218	3,070	12,280
13-Jul	41.98	385	10,444	10,829	737,393	7,735	409,953	2,506	10,024
14-Jul	42.02	763	9,196	9,959	747,352	8,219	418,172	3,121	12,484
15-Jul	42.11	871	8,594	9,465	756,817	7,476	425,648	2,594	10,376
16-Jul	42.01	403	10,908	11,311	768,128	8,379	434,027	4,102	16,408
17-Jul	41.91	803	10,783	11,586	779,714	8,078	442,105	3,022	12,088
18-Jul	42.10	306	6,928	7,234	786,948	7,939	450,044	2,850	11,400
19-Jul	42.30	393	5,980	6,373	793,321	8,347	458,391	1,543	6,172
20-Jul	42.44	222	5,387	5,609	798,930	9,128	467,519	1,065	4,260
21-Jul	42.47	415	7,024	7,439	806,369	7,992	475,511	1,708	6,832
22-Jul	42.53	549	6,733	7,282	813,651	6,820	482,331	1,777	7,108
23-Jul	42.53	456	6,278	6,734	820,385	6,562	488,893	1,496	5,984
24-Jul	42.46	1,383	7,500	8,883	829,268	6,175	495,068	1,206	4,824
25-Jul	42.56	560	8,560	9,120	838,388	5,385	500,453	1,881	7,524
26-Jul	42.67	1,169	6,367	7,536	845,924	5,206	505,659	2,004	8,016
27-Jul	42.65	468	4,366	4,834	850,758	4,838	510,497	712	2,848
28-Jul	42.65	1,109	7,451	8,560	859,318	4,898	515,395	1,856	7,424
29-Jul	42.75	742	6,647	7,389	866,707	5,047	520,442	2,560	10,240
30-Jul	42.88	580	4,901	5,481	872,188	4,983	525,425	1,501	6,004
31-Jul	43.21	245	3,670	3,915	876,103	4,463	529,888	1,180	4,720
01-Aug	43.13	171	3,894	4,065	880,168	4,031	533,919	820	3,280
02-Aug	42.92	270	3,983	4,253	884,421	3,548	537,467	1,373	5,492
03-Aug	42.51	392	3,991	4,383	888,804	2,762	540,229	829	3,316
04-Aug	42.35	459	4,623	5,082	893,886	2,577	542,806	1,030	4,120
05-Aug	42.29	389	6,540	6,929	900,815	2,558	545,364	1,584	6,336
06-Aug	42.11		5,424	5,424	906,239	1,841	547,205	1,391	5,564
07-Aug	41.91					1,472	548,677		
Total		45,883	860,356	906,239					

a Meters above sea level.

b North bank counts are derived from an average of five percent of north bank counts versus south bank counts based on past performance from 1988-1993.

c South bank transducer was deployed on the tripod

d South bank transducer was deployed on the permanent substrate.

e North bank tripod was deployed.

Table 6. The number of minutes each hour the oscilloscope was monitored on the south bank tripod, Miles Lake sonar, 1996.

HOUR	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May	31-May	01-Jun	02-Jun	03-Jun	04-Jun	05-Jun	06-Jun	07-Jun	08-Jun	
0000-0100																							
0100-0200																							
0200-0300																							
0300-0400																							
0400-0600																							
0600-0800																							
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1500-1600																							
1600-1700																							
1700-1800																							
1800-1900																							
1900-2000																							
2000-2100																							
2100-2200																							
2200-2300																							
2300-2400																							
TOTAL	330	435	555	600	600	600	600	600	600	600	600	720	700	720	720	700	715	720	210	690	720	300	

Table 7. The number of fish observed passing the south bank tripod during visual monitoring of the oscilloscope, Miles Lake sonar, 1996.

HOUR	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May	31-May	01-Jun	02-Jun	03-Jun	04-Jun	05-Jun	06-Jun	07-Jun	08-Jun
0000-0100											24	389	174	277	462	507	424	216			179	301
0100-0200											68	315	172	325	503	623	481	462		343	267	446
0200-0300											117	335	168	316	531	420	417	283		149	180	360
0300-0400											112	305	167	256	376	450	367	358		168	188	349
0400-0500				5	10	28	35	30	41	69	126	434	94	273	437	411	437	400		235	206	218
0500-0600			3	4	17	32	27	18	26	64	175	305	86	319	454	407	411	334		216	247	338
0600-0700			3	1	7	37	24	28	18	32	184	296	67	310	425	135	387	364		239	263	312
0700-0800			5	6	9	50	29	33	62	86	101	202	185	344	409	384	588	344		220	251	309
0800-0900	3	3	3	8	7	40	27	20	57	93	264	66	146	445	513	568	366	420		205	307	527
0900-1000	0	1	3	7	11	40	23	16	60	96	266	126	163	328	504	610	628	394		171	252	606
1000-1100	3	3	1	4	13	37	23	21	50	94	234	97	177	341	568	657	476	396		174	436	
1100-1200	2	3	3	3	21	40	28	30	27	57	235	183	252	447	683	682	513	463		195	271	
1200-1300		1	1	4	15	14	16	19	61	73	317	228	235	547	580	582	475	398		217	255	
1300-1400	1	0	1	5	21	38	35	29	42	84	352	206	271	463	525	612	527	381		238	498	
1400-1500	1	1	3	6	24	45	32	43	63	125	312	256	251	477	441	446	798	405		300	372	
1500-1600	4		3	5	37	59	25	51	49	114	357	293	39	452	519	472	833	524		307	427	
1600-1700	2	0	2	11	17	35	23	47	65	177	321	267	195	383	445	596	827	528		286	352	
1700-1800	1	1	1	17	25	38	32	41	43	141	342	194	443	334	438	401	567	646	197	293	503	
1800-1900		1	4	10	42	26	15	33	72	188	466	231	265	388	441	564	603	630	291	222	351	
1900-2000		0	4	13	16	37	18	22	37	46	319	108	267	456	519	451	463	468	378	292	242	
2000-2100	0	2	1	4	29	36	22	16	26	89	267	182	238	405	552	637	378	664	168	186	248	
2100-2200	1	0	2	7	24	22	35	12	31	109	365	179	378	504	427	395	642	496	249	195	531	
2200-2300		3	0	9	33	18	33	11	15	106	278	335	303	555	693	526	594	498	289	149	565	
2300-2400		2	3	5	28	28	28	21	25	98	512	186	351	576	712	664	638	514	458	163	578	
TOTAL	18	21	46	134	406	701	528	541	870	1,901	6,114	5,718	5,087	9,521	12,157	12,100	12,858	10,586	2,030	5,161	7,973	3,857

Table 8. Expanded hourly and daily counts from the south bank tripod , Miles Lake sonar, 1996.

HOUR	18-May	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May	31-May	01-Jun	02-Jun	03-Jun	04-Jun	05-Jun	06-Jun	07-Jun	08-Jun	
0000-0100											48	778	348	554	924	1,014	848	432				358	602
0100-0200											136	630	344	650	1,006	1,046	862	924		666	534	662	
0200-0300											234	670	336	632	1,062	840	834	566		298	378	718	
0300-0400											224	610	334	512	752	900	774	716		332	372	696	
0400-0500				10	20	56	70	60	82	138	252	868	188	546	874	822	874	800		470	412	436	
0500-0600			6	8	34	64	54	36	52	128	350	610	172	838	908	814	822	666		432	494	678	
0600-0700			12	2	14	74	48	56	36	64	368	592	134	620	850	810	774	728		478	526	624	
0700-0800			10	12	18	100	58	66	124	132	202	404	370	688	818	768	1,172	888		440	502	796	
0800-0900	6	6	6	16	14	80	54	40	114	186	528	132	292	890	1,026	1,136	732	840		410	614	1,054	
0900-1000	0	2	8	14	22	80	48	32	120	192	532	252	328	656	1,008	1,220	1,507	788		342	504	1,216	
1000-1100	6	6	2	8	26	74	46	42	100	188	468	194	354	682	1,136	1,314	952	792		348	872		
1100-1200	4	6	8	8	42	80	56	60	54	114	470	366	504	894	1,366	1,364	1,026	926		390	542		
1200-1300		2	2	8	30	28	32	38	122	146	634	456	470	1,094	1,160	1,164	950	796		434	510		
1300-1400	2	0	2	10	42	76	70	58	84	128	704	412	842	826	1,060	1,224	1,054	762		476	690		
1400-1500	2	2	6	12	48	90	64	86	126	250	624	512	502	954	882	892	1,596	810		600	744		
1500-1600	8		6	10	74	118	50	102	96	228	714	586	234	904	1,038	944	1,666	1,048		614	854		
1600-1700	4	0	4	22	34	70	46	94	130	354	642	534	390	766	890	1,192	1,654	1,056		572	704		
1700-1800	2	3	2	34	50	78	64	82	66	282	664	388	886	668	876	802	1,134	1,282	394	566	1,006		
1800-1900		2	8	20	84	52	30	66	144	376	932	462	530	776	882	1,128	1,206	1,260	582	444	702		
1900-2000		0	8	28	32	74	36	44	74	92	838	216	534	912	1,038	902	926	936	756	584	484		
2000-2100	0	4	2	8	58	72	44	32	52	178	534	364	476	810	1,104	1,274	756	1,328	336	372	496		
2100-2200	2	0	4	14	48	44	70	24	62	218	730	356	756	1,006	854	790	1,284	992	496	390	1,062		
2200-2300		6	0	18	66	36	66	22	30	212	556	670	606	1,110	1,386	1,052	1,188	996	578	298	1,130		
2300-2400		4	6	10	56	56	52	42	50	196	1,024	372	702	1,152	1,424	1,328	1,278	1,028	916	326	1,156		
Total	36	43	98	268	812	1,402	1,056	1,082	1,740	3,802	12,228	11,436	10,330	19,042	24,314	24,740	25,967	21,172	4,060	10,322	15,946	7,714	
Daily	79	69	124	322	974	1,682	1,267	1,298	2,088	4,562	12,228	11,436	10,330	19,042	24,314	24,740	25,967	21,172	4,060	10,771	15,946	7,714	

FIGURES

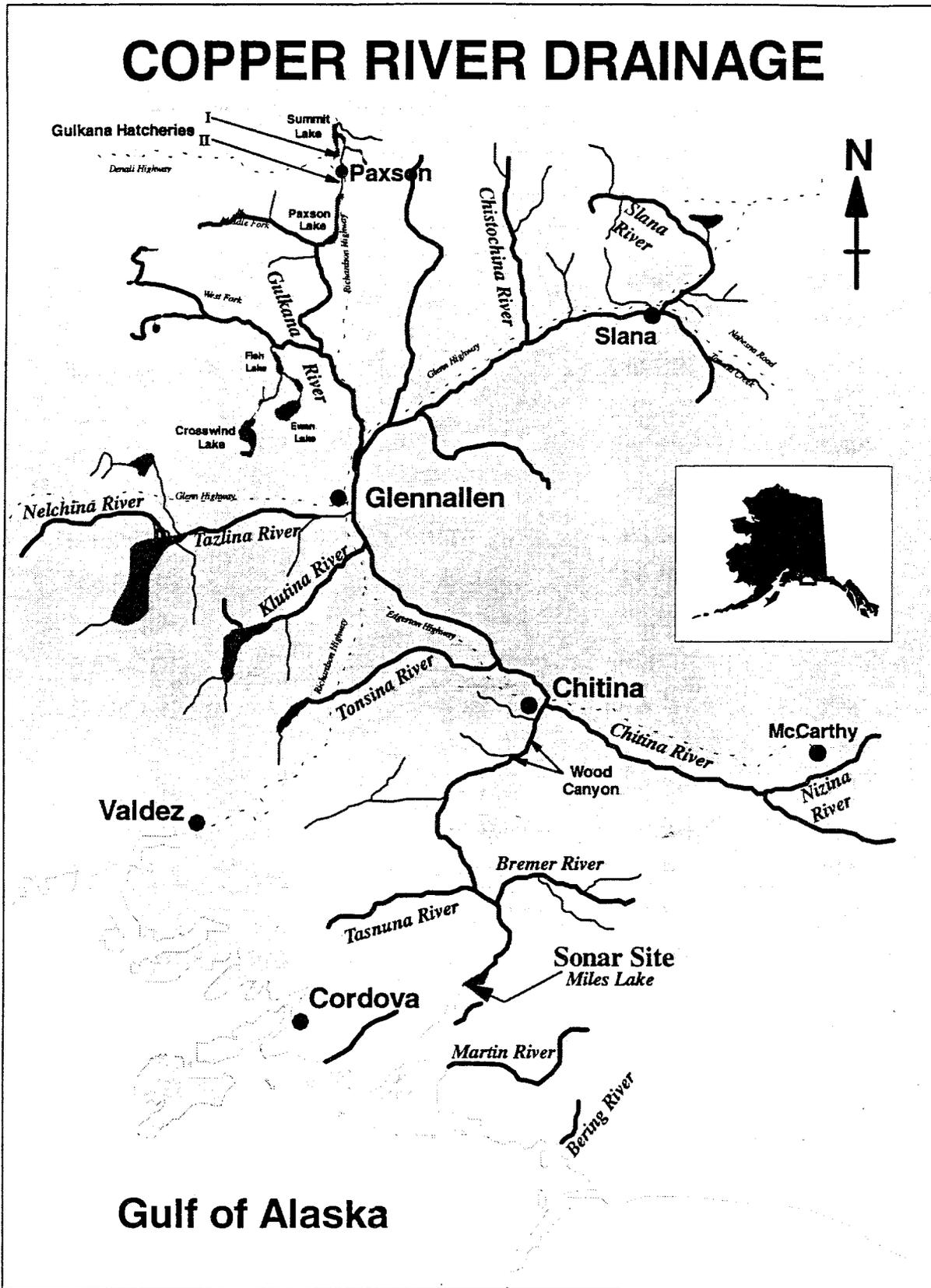


Figure 1.-The Copper River and Copper River delta area.

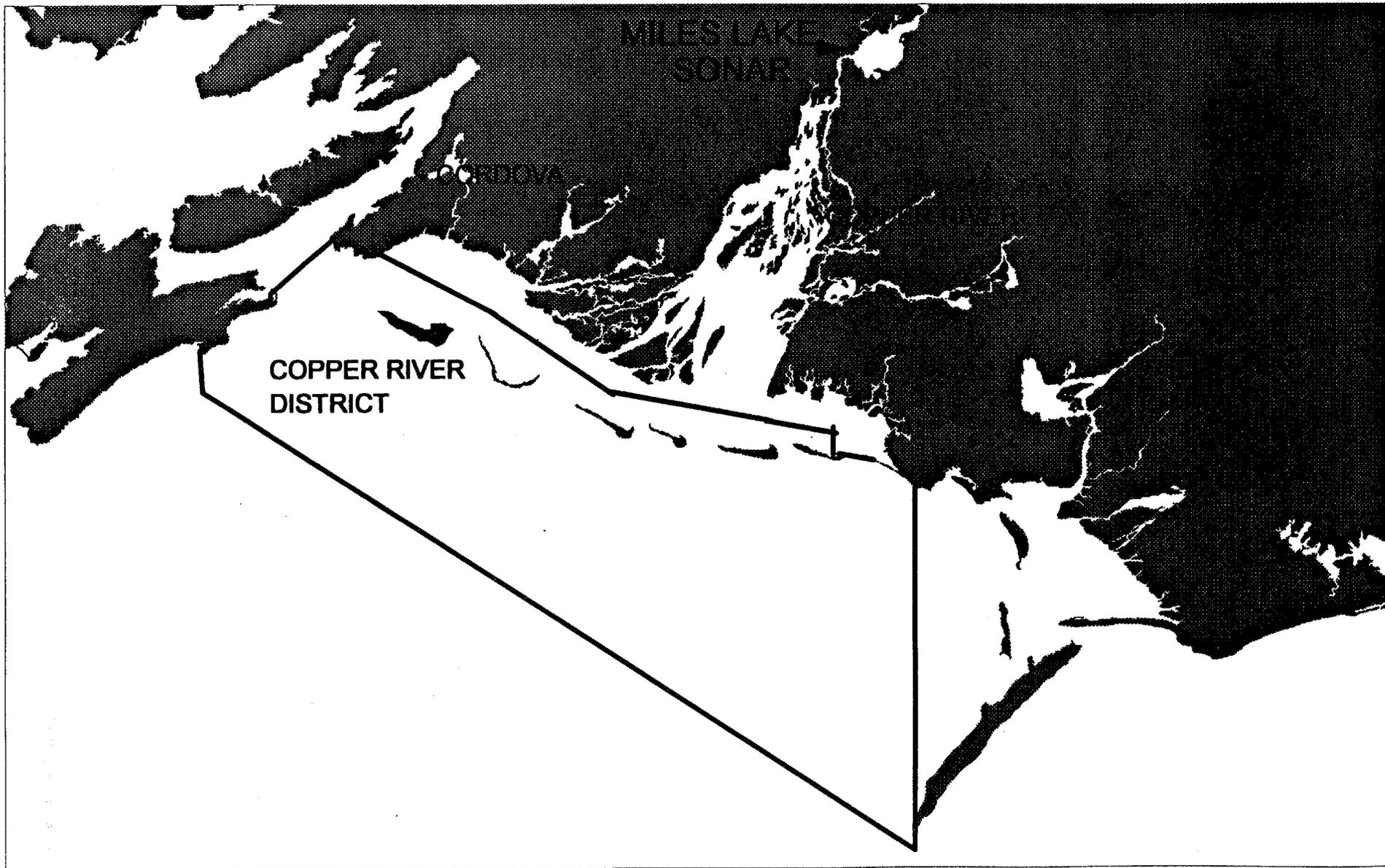


Figure 2. Commercial fishing area in relation to Miles Lake sonar, Copper River,

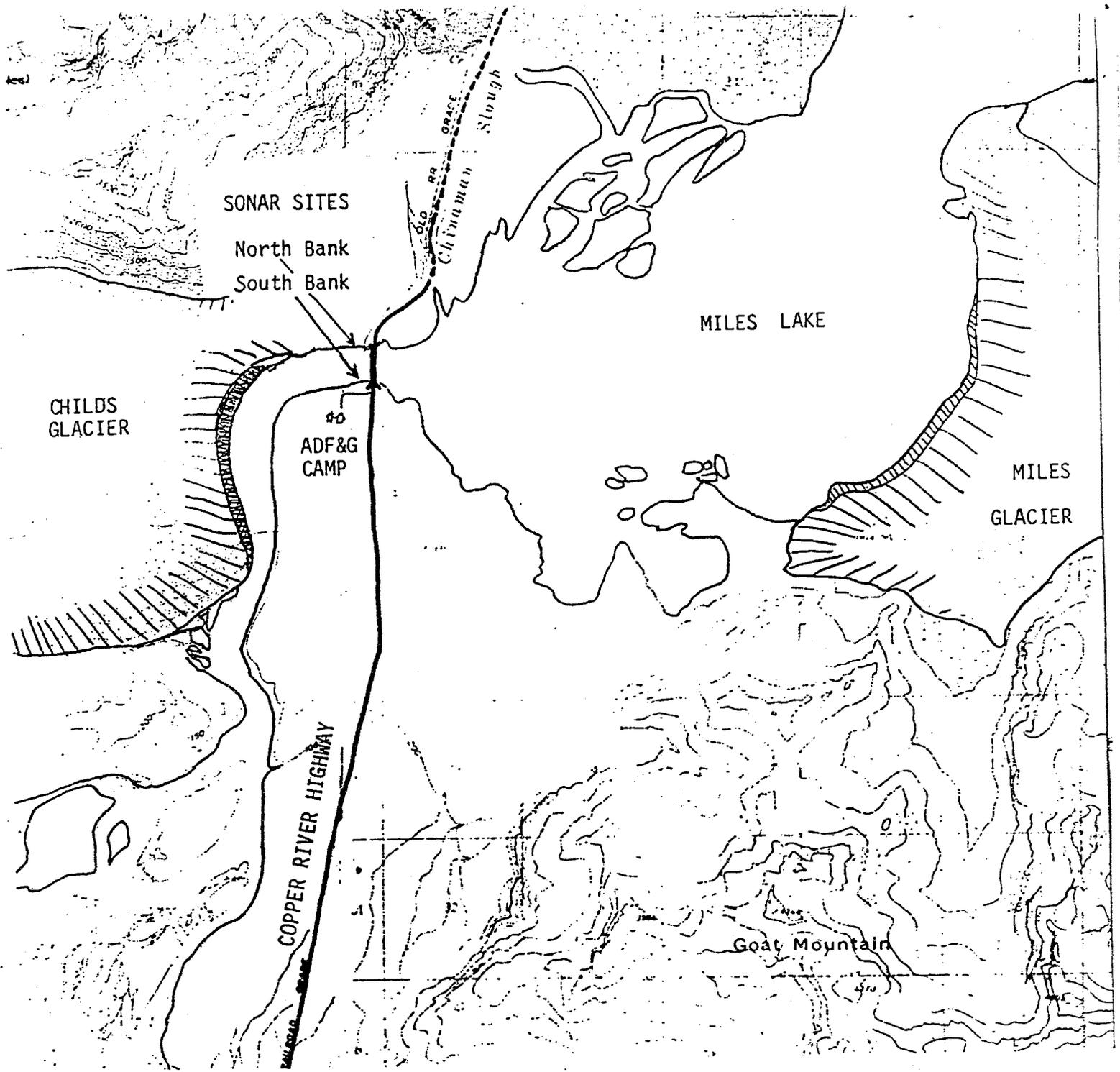


Figure 3. North and south bank sonar sites, Miles Lake area, Copper River.

1995 MILES LAKE SONAR COUNTS

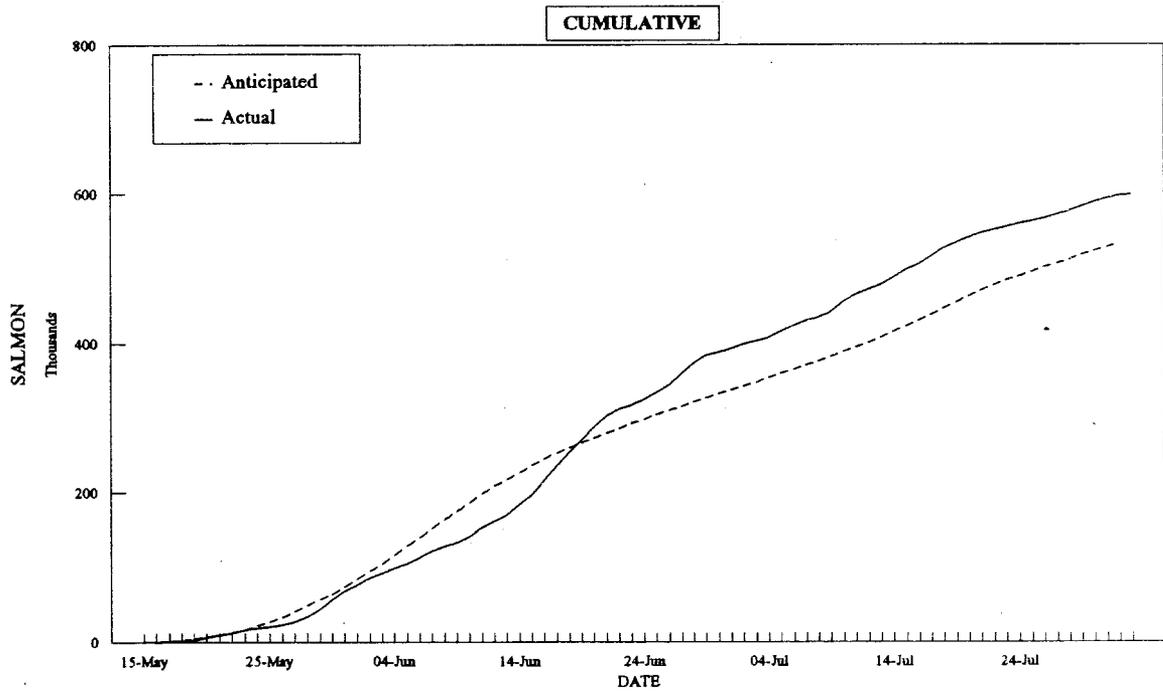
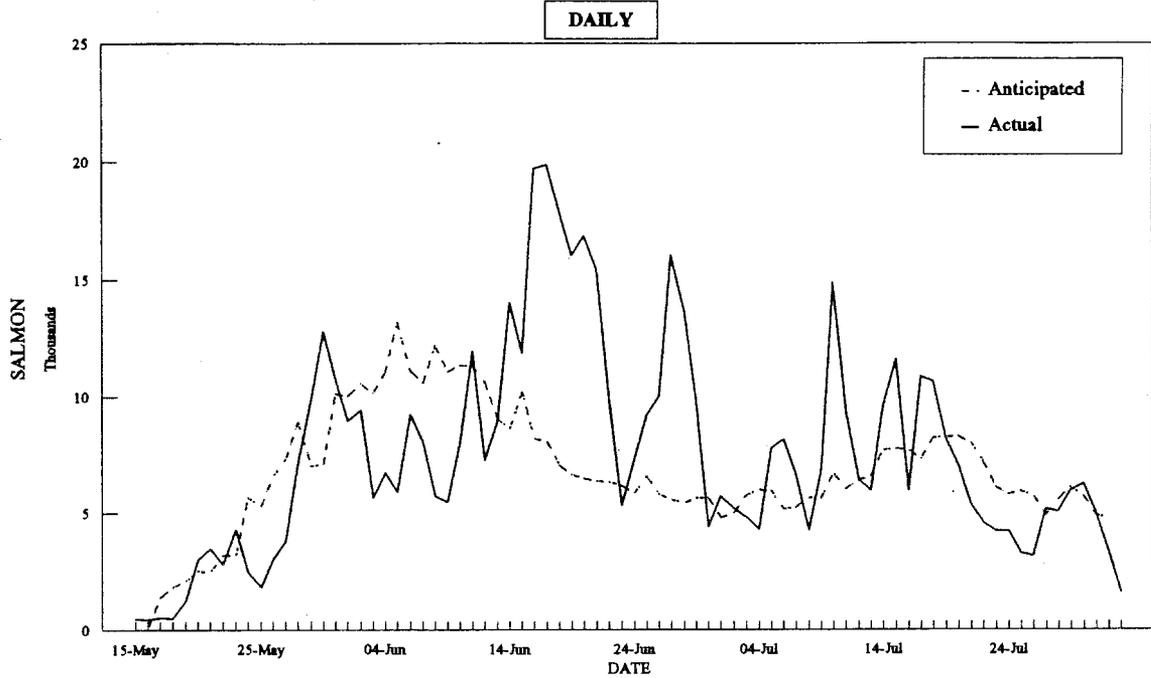


Figure 4. Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1995.

**1995 Water Level of the Copper River at
the 49 Mile Bridge.**

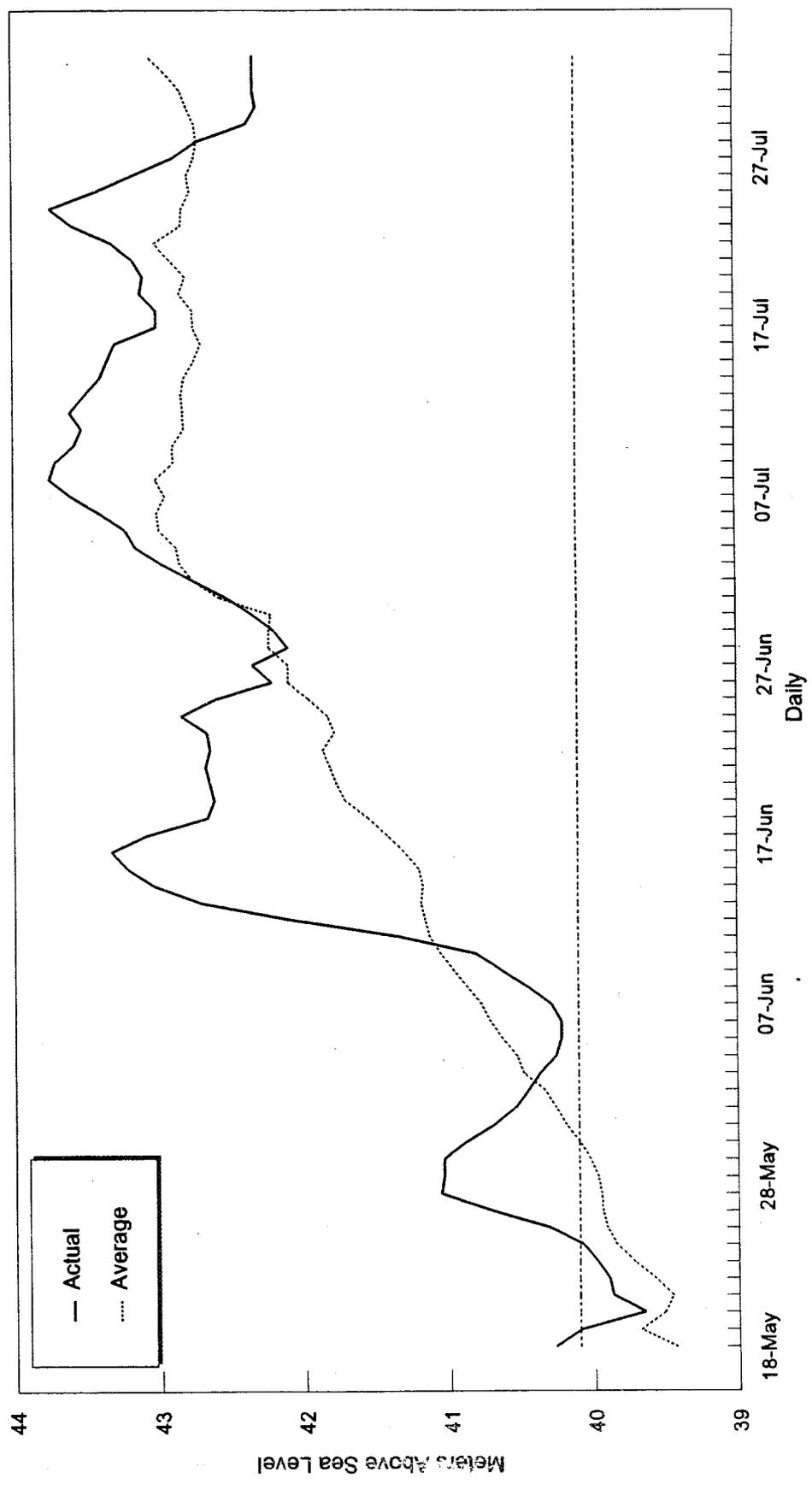


Figure 5. The 1995 daily water levels versus the average 1982 -1994, Copper River, Alaska.

1996 MILES LAKE SONAR COUNTS

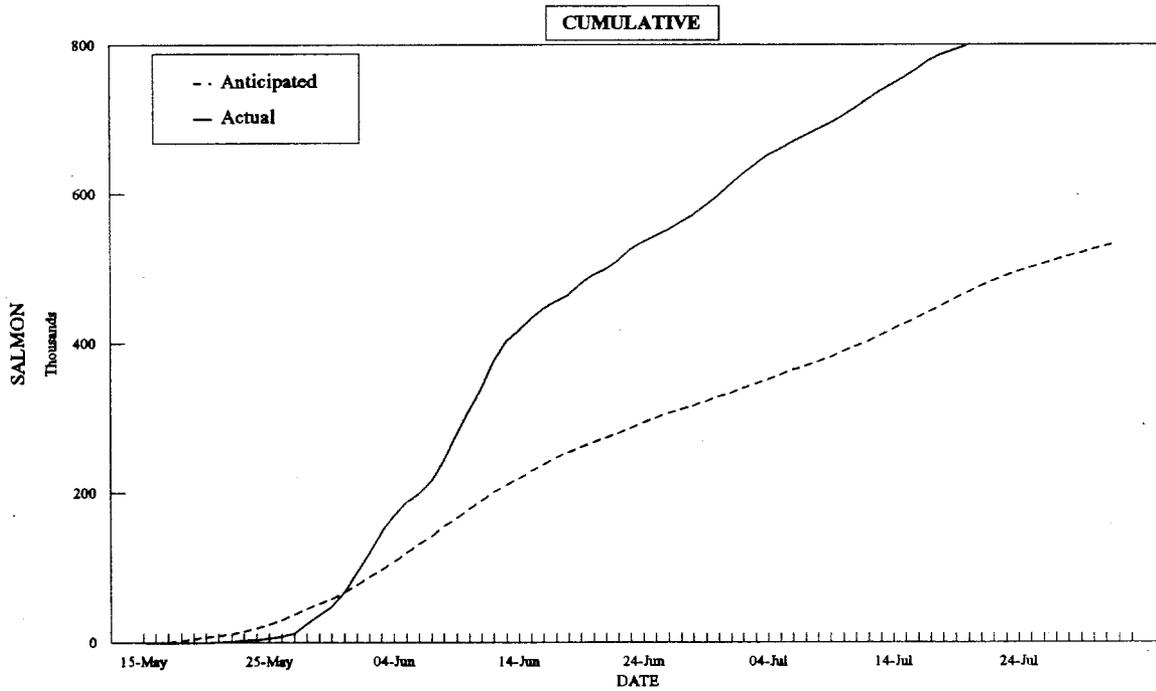
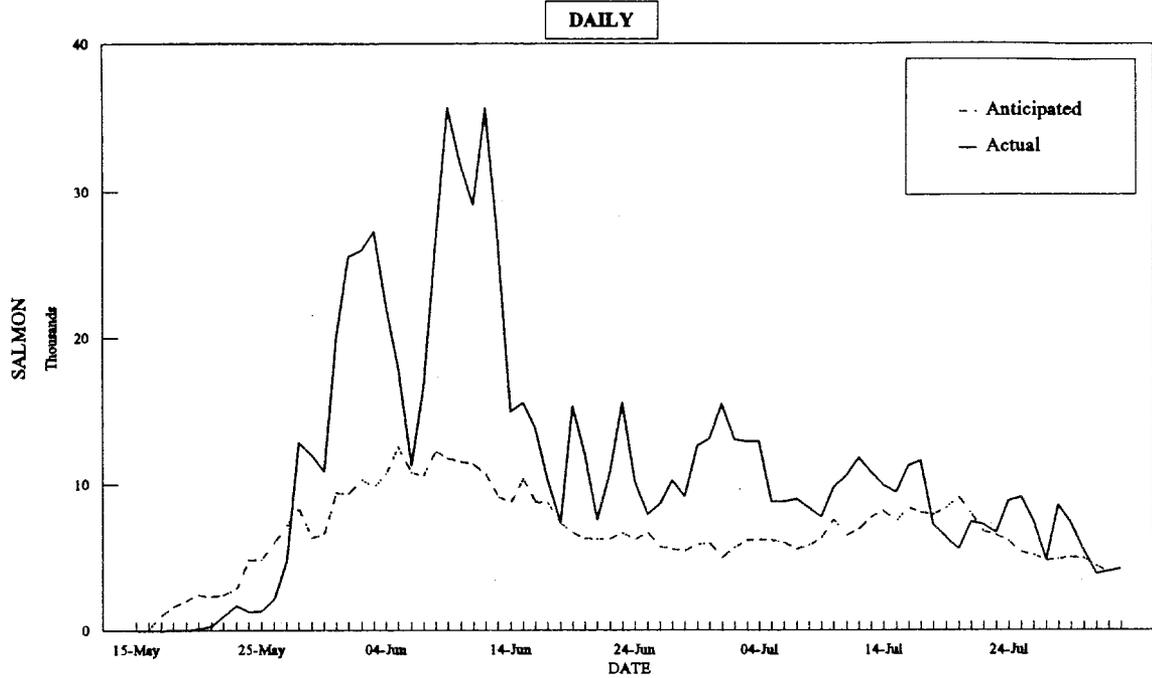


Figure 6. Anticipated and actual daily and cumulative salmon escapement estimates, Miles Lake sonar, 1996.

**1996 Water Level of the Copper River at
the 49 Mile Bridge.**

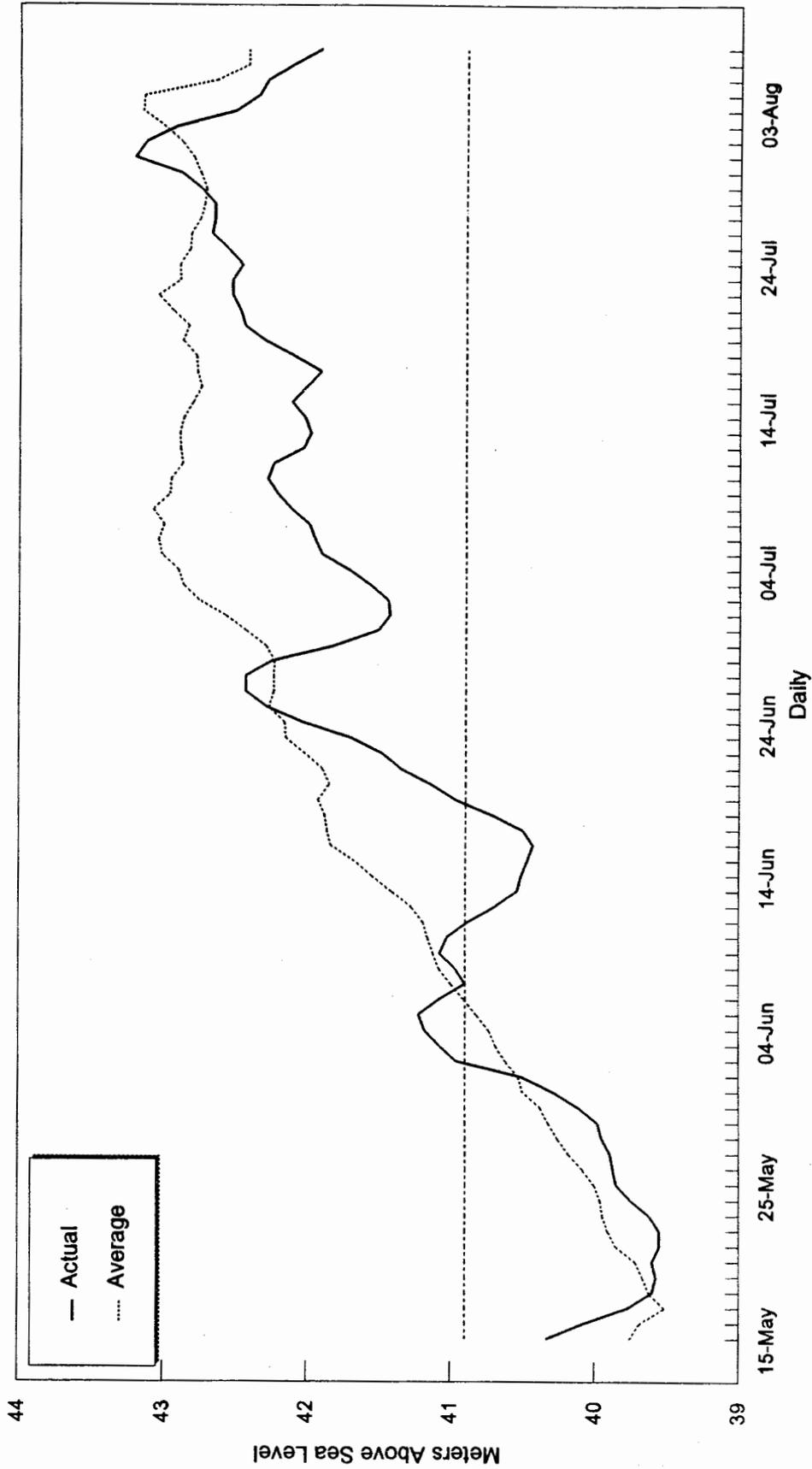


Figure 7. The 1996 daily water levels versus the average 1982 - 1995, Copper River, Alaska.

APPENDICES

Appendix 1. Daily salmon escapement estimates, Miles Lake sonar, Copper River, 1978-1996.

Date	1978	1979	1980	1981	1982	1983	1984	1985	1986
15-May									
16-May									
17-May				5,372					
18-May		381	218	9,665					
19-May		487	167	11,409			725		
20-May		847	221	10,733			1,924		
21-May		1,199	88	9,729			1,986		
22-May		1,916	391	7,558			5,124		
23-May		2,901	594	6,214		3,310	5,042		
24-May		3,402	494	12,985	90	8,620	4,486		
25-May		2,397	713	12,816	493	11,587	3,120		534
26-May	502	4,927	1,057	6,383	1,023	10,575	4,645		1,694
27-May	837	6,821	2,115	2,842	12,091	8,661	5,836		2,092
28-May	1,047	2,768	1,693	2,560	47,303	8,456	4,978	1,031	3,384
29-May	661	3,905	1,080	2,160	19,671	6,380	7,126	417	2,393
30-May	3,241	7,482	1,903	11,822	8,781	8,296	4,951	599	3,173
31-May	2,549	8,655	3,620	21,126	11,389	17,123	4,278	1,758	4,150
01-Jun	2,616	4,078	5,257	18,415	15,385	18,428	8,536	3,462	7,001
02-Jun	2,811	3,465	7,061	23,771	17,213	14,414	8,483	6,726	20,638
03-Jun	1,837	3,536	7,437	16,716	13,383	13,137	9,730	10,691	20,237
04-Jun	3,256	2,778	8,996	9,755	12,355	15,357	12,496	24,272	26,626
05-Jun	2,970	4,352	9,746	10,478	14,806	19,110	16,728	30,507	27,934
06-Jun	3,318	6,453	5,407	11,975	15,585	14,069	18,097	32,953	14,527
07-Jun	3,808	7,031	2,093	13,585	12,506	19,309	18,515	27,256	9,658
08-Jun	3,275	11,078	1,349	14,412	8,430	16,094	26,619	30,925	24,938
09-Jun	2,252	7,985	3,543	15,694	7,017	11,415	20,476	29,702	28,242
10-Jun	3,475	5,205	7,301	12,856	7,599	8,009	19,275	12,010	29,952
11-Jun	2,490	4,426	12,032	7,877	7,879	9,563	17,237	11,826	25,418
12-Jun	2,082	2,227	11,584	4,844	8,587	13,292	21,706	8,231	16,494
13-Jun	2,419	3,903	7,600	3,556	9,932	13,444	12,072	6,829	11,453
14-Jun	2,835	2,563	5,661	5,228	12,551	13,831	5,981	6,800	11,393
15-Jun	2,913	3,351	7,308	7,071	12,677	15,915	10,291	8,825	8,747
16-Jun	2,782	3,473	5,655	6,885	13,595	7,938	13,930	9,347	10,099
17-Jun	2,779	4,640	7,189	6,467	12,030	5,671	19,809	6,270	8,772
18-Jun	2,261	3,911	6,741	4,565	6,544	5,689	12,850	3,738	9,050
19-Jun	3,035	3,413	2,391	2,985	4,369	6,461	7,474	3,251	7,910
20-Jun	3,035	1,954	3,597	2,891	3,352	7,382	9,258	2,423	7,240
21-Jun	2,515	2,223	4,142	3,446	3,346	8,124	7,159	2,061	6,741
22-Jun	2,068	2,585	3,954	3,997	4,467	8,005	5,522	2,763	9,026
23-Jun	2,841	2,865	3,896	4,363	7,031	7,528	5,913	3,369	8,010
24-Jun	2,616	1,877	5,217	4,651	6,329	6,009	6,741	2,950	6,968
25-Jun	2,130	3,013	5,104	3,398	4,903	5,226	6,503	1,585	5,731
26-Jun	1,771	1,973	3,595	2,412	4,416	5,638	4,385	2,381	5,410
27-Jun	2,178	1,315	3,421	2,507	2,732	4,738	7,224	3,035	5,153
28-Jun	1,103	1,697	4,324	2,949	2,174	4,771	6,728	2,264	5,022
29-Jun	1,604	1,450	3,845	3,421	2,130	4,304	4,453	2,147	3,578
30-Jun	1,632	1,899	3,465	2,378	2,313	6,146	6,449	2,139	3,771

-Continued-

Appendix 1. (page 2 of 4)

Date	1978	1979	1980	1981	1982	1983	1984	1985	1986
01-Jul	1,587	2,651	3,559	2,723	2,190	6,106	8,226	2,620	3,584
02-Jul	2,533	2,524	3,365	2,606	4,420	6,113	7,554	2,608	3,152
03-Jul	2,527	2,859	4,104	2,548	5,751	6,026	8,581	1,819	2,311
04-Jul	2,980	3,806	2,934	4,094	5,245	6,943	6,515	3,536	1,805
05-Jul	2,269	3,008	2,879	4,256	4,995	5,347	6,662	3,254	1,499
06-Jul	1,623	1,996	3,025	3,476	6,300	3,973	5,449	4,664	2,809
07-Jul	1,152	892	3,291	3,863	6,171	4,209	4,040	3,627	2,991
08-Jul	831	2,091	2,995	3,774	3,990	4,080	3,906	3,893	2,860
09-Jul	947	3,190	2,817	3,449	2,210	3,353	3,210	6,827	3,077
10-Jul	1,252	4,209	3,642	2,942	2,070	3,644	2,927	10,607	5,435
11-Jul	841	3,684	5,763	2,271	1,980	4,454	3,608	5,457	5,115
12-Jul	341	3,262	4,788	3,468	3,420	4,541	4,280	6,329	5,042
13-Jul	167	3,144	1,725	2,265	4,032	4,543	4,582	5,252	3,696
14-Jul	290	4,124	1,679	2,596	4,339	5,819	6,573	6,113	3,530
15-Jul	275	3,535	1,743	3,691	4,714	6,496	5,521	5,024	4,699
16-Jul	538	5,175	2,515	2,580	3,561	6,970	6,755	5,339	2,227
17-Jul	304	3,555	3,419	780	2,925	6,327	4,955	5,960	4,108
18-Jul	284	3,760	5,878	8,633	3,413	4,326	4,736	5,110	4,993
19-Jul	321	3,344	5,613	20,975	4,296	3,703	3,140	4,560	6,066
20-Jul	238	2,716	5,060	20,511	3,920	3,988	3,389	8,176	5,997
21-Jul	81	2,583	3,826	15,741	4,049	4,463	3,204	4,128	4,746
22-Jul	18	2,012	3,173	6,566	3,871	4,881	3,780	3,158	3,408
23-Jul	15	1,915	2,143	5,787	3,099	3,603	3,205	2,870	2,909
24-Jul	40	2,182	1,353	5,063	3,061	3,903	2,198	2,162	2,633
25-Jul	13	1,112	1,623	3,391	3,374	4,535	1,937	2,449	2,292
26-Jul		771	1,256	2,493	2,596	3,839	1,687	1,974	1,799
27-Jul		318	1,198	2,451	2,247	3,687	1,391	2,191	1,626
28-Jul		387	698	2,785	2,375	5,234	1,004	2,839	1,797
29-Jul		365	400	3,686	1,426	4,138	891	2,813	1,563
30-Jul		491	470	3,814	963	3,512	938	2,790	1,489
31-Jul		703	353	3,802	1,176	1,835	1,093	1,848	1,259
01-Aug		758	825	3,396	511	1,912	1,047	1,070	1,172
02-Aug		379	1,034	2,304	942	2,211	1,088	703	1,045
03-Aug		227	764	1,913	494	2,088	1,213		770
04-Aug		286	708	1,297	581	2,897	1,118		814
05-Aug		173	758	1,181	122		1,009		435
06-Aug		103	877	1,170			533		416
07-Aug		76	615						192
08-Aug			166						33
09-Aug			239						47
Total	107,011	237,173	276,538	535,263	467,306	545,724	536,806	436,313	508,600

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Date	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
15-May									491	
16-May									468	
17-May			732					448	532	
18-May			3,660					686	522	84
19-May		313	6,588					952	1,331	72
20-May	167	877	6,935				9,503	955	3,028	130
21-May	36	1,140	4,834	1,121	1,087		13,677	1,610	3,504	338
22-May	482	2,256	4,030	4,843	1,717		22,706	2,422	2,808	1,023
23-May	1,732	5,078	6,472	7,177	3,161		28,425	3,558	4,301	1,766
24-May	2,040	11,033	7,448	11,923	2,465		31,980	2,897	2,473	1,330
25-May	4,263	9,979	4,658	14,333	3,046		38,581	4,083	1,841	1,363
26-May	7,115	8,946	8,318	11,337	3,274		23,647	3,282	3,032	2,192
27-May	12,176	13,247	13,143	12,060	3,893	1,226	12,885	2,855	3,806	4,790
28-May	16,392	14,201	13,880	7,434	3,389	1,431	17,476	3,047	7,168	12,856
29-May	14,485	10,022	10,677	9,176	3,933	2,362	13,156	2,888	9,878	12,008
30-May	18,196	6,806	5,375	9,541	4,417	5,736	8,478	1,966	12,779	10,861
31-May	18,540	7,586	7,316	10,343	9,362	7,931	16,686	4,616	10,755	19,994
01-Jun	16,395	5,205	7,041	10,026	16,833	6,610	16,473	9,423	8,980	25,530
02-Jun	14,385	3,558	5,234	9,909	21,151	7,919	22,831	7,767	9,428	25,977
03-Jun	17,666	4,626	6,867	8,576	17,808	11,535	14,591	3,137	5,647	27,265
04-Jun	14,632	7,877	8,555	7,572	14,557	7,921	17,585	6,143	6,745	22,231
05-Jun	10,962	6,755	7,512	10,173	18,673	9,295	25,779	5,265	5,895	18,009
06-Jun	4,322	8,895	7,719	10,410	11,688	14,552	25,643	12,100	9,236	11,310
07-Jun	5,755	9,096	12,693	11,137	8,440	16,734	18,068	16,732	8,044	16,743
08-Jun	6,366	11,322	14,565	7,637	9,471	17,729	20,762	18,022	5,738	26,585
09-Jun	7,922	14,641	9,440	9,905	11,665	20,719	24,997	18,042	5,479	35,684
10-Jun	11,553	15,216	12,126	11,660	8,565	23,430	19,794	17,588	8,054	31,792
11-Jun	11,194	16,255	9,663	16,181	8,104	18,591	11,119	12,272	11,950	29,085
12-Jun	6,506	14,959	8,256	23,929	12,688	14,096	18,322	13,008	7,274	35,637
13-Jun	4,053	10,751	10,626	24,448	9,066	18,257	12,872	9,081	8,945	27,036
14-Jun	8,053	9,382	13,548	14,302	9,236	20,456	8,357	15,639	14,021	14,958
15-Jun	5,485	9,910	9,922	8,390	14,967	23,957	13,351	11,679	11,853	15,548
16-Jun	5,516	6,484	8,889	10,112	14,367	13,914	14,247	14,227	19,732	13,809
17-Jun	5,406	4,910	10,020	12,695	10,129	14,509	7,621	11,445	19,918	10,298
18-Jun	4,815	6,469	11,131	8,052	11,051	14,893	4,921	17,223	17,938	7,359
19-Jun	3,983	7,855	8,345	9,763	12,921	12,324	6,324	19,392	16,025	15,303
20-Jun	3,933	7,952	7,575	9,315	14,146	19,480	4,900	11,498	16,863	12,071
21-Jun	3,924	5,770	7,169	10,292	8,750	16,882	3,536	11,699	15,430	7,570
22-Jun	6,379	6,985	8,868	10,157	7,830	9,452	2,864	13,305	9,862	10,851
23-Jun	10,111	7,699	5,850	10,166	6,358	7,234	5,069	18,686	5,320	15,544
24-Jun	15,708	5,582	3,927	9,340	5,963	6,319	6,071	24,282	7,357	10,226
25-Jun	16,517	5,597	2,996	10,010	7,660	6,675	4,321	14,140	9,211	7,963
26-Jun	12,500	6,378	3,426	6,812	9,500	7,180	2,718	12,204	9,989	8,668
27-Jun	7,010	6,559	3,240	9,234	10,355	6,266	3,370	14,146	16,025	10,255
28-Jun	5,644	6,259	6,302	6,881	10,810	8,084	4,361	9,213	13,673	9,195
29-Jun	6,836	8,220	6,490	4,499	10,439	9,258	4,976	15,859	9,723	12,621
30-Jun	4,636	6,497	7,354	3,975	9,113	7,416	8,384	10,845	4,402	13,091

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Date	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
01-Jul	2,012	5,602	7,930	4,323	7,303	7,120	7,639	10,359	5,730	15,487
02-Jul	3,406	4,680	5,296	5,067	5,109	5,591	5,720	9,802	5,218	13,066
03-Jul	4,096	4,222	4,976	4,682	6,335	4,641	5,145	9,965	4,851	12,949
04-Jul	7,100	3,532	7,369	5,665	6,680	5,413	5,527	8,782	4,291	12,956
05-Jul	4,351	3,304	10,739	7,998	5,845	4,424	6,339	6,196	7,787	8,829
06-Jul	3,393	3,510	10,024	7,749	6,213	6,987	6,431	9,544	8,172	8,818
07-Jul	5,617	4,324	10,236	5,700	6,222	7,361	9,229	9,921	6,620	9,007
08-Jul	6,616	8,499	11,113	5,192	7,069	5,758	10,386	7,947	4,272	8,424
09-Jul	6,352	5,167	10,761	5,153	6,453	11,937	11,105	9,391	6,845	7,802
10-Jul	8,585	6,347	9,506	6,620	4,610	9,139	9,566	14,539	14,846	9,792
11-Jul	5,322	7,620	8,453	5,402	4,477	8,380	7,364	13,656	9,368	10,608
12-Jul	5,757	7,881	11,953	9,338	4,818	7,959	6,819	16,223	6,467	11,805
13-Jul	6,583	7,087	9,329	11,432	3,969	6,741	5,615	13,924	5,978	10,829
14-Jul	6,439	7,012	10,270	8,206	7,498	8,574	7,673	13,333	9,602	9,959
15-Jul	5,722	6,924	12,283	8,309	7,550	8,971	6,112	10,161	11,587	9,465
16-Jul	6,259	5,457	10,897	6,093	9,671	7,683	6,880	7,955	5,935	11,311
17-Jul	4,467	4,877	8,903	6,259	9,668	6,718	5,175	7,642	10,858	11,586
18-Jul	4,620	3,857	11,811	5,726	7,340	8,807	5,398	7,063	10,642	7,234
19-Jul	4,127	4,583	10,567	5,975	7,513	8,615	6,782	4,675	8,164	6,373
20-Jul	3,634	4,483	10,169	4,315	10,681	7,102	7,417	3,922	7,003	5,609
21-Jul	2,441	3,964	8,639	2,534	10,268	4,898	7,844	7,756	5,354	7,439
22-Jul	1,273	2,797	8,908	2,457	9,702	4,612	9,241	13,476	4,596	7,282
23-Jul	1,002	3,429	8,103	3,901	9,017	5,426	14,012	14,447	4,256	6,734
24-Jul	625	3,900	6,250	2,883	4,245	3,821	12,723	10,424	4,255	8,883
25-Jul	2,014	4,023	5,303	2,050	3,066	2,984	9,048	13,043	3,310	9,120
26-Jul	368	4,142	5,706	2,257	4,422	3,412	6,406	5,897	3,190	7,536
27-Jul	626	3,920	5,699	2,885	3,884	3,619	7,465	4,888	5,196	4,834
28-Jul	2,494	3,452	4,926	1,934	4,793	3,205	5,972	5,467	5,093	8,560
29-Jul	2,341	3,476	4,150	2,808	5,354	3,954	6,116	3,996	5,973	7,389
30-Jul	2,075	2,423	2,519	2,462	4,711	3,872	6,503	3,156	6,281	5,481
31-Jul	2,226	1,920	1,551	2,550	2,901	3,855	5,539	3,686	5,039	3,915
01-Aug	2,726	1,438	2,299	3,839			4,560	4,014	3,425	4,065
02-Aug	1,299	1,098	1,744	5,249			4,209		1,589	4,253
03-Aug	1,702									4,383
04-Aug	1,499									5,082
05-Aug	518									6,929
06-Aug										5,424
07-Aug										
08-Aug										
09-Aug										
Total	483,478	488,098	607,797	581,859	579,435	601,952	833,387	715,577	599,267	906,239

Appendix 2. Cumulative daily salmon escapement estimates, Miles Lake sonar, Copper River, 1978-1996.

Date	1978	1979	1980	1981	1982	1983	1984	1985	1986
15-May									
16-May									
17-May				5,372					
18-May		381	218	15,037					
19-May		868	385	26,446			725		
20-May		1,715	606	37,179			2,649		
21-May		2,914	694	46,908			4,635		
22-May		4,830	1,085	54,466			9,759		
23-May		7,731	1,679	60,680		3,310	14,801		
24-May		11,133	2,173	73,665	90	11,930	19,287		
25-May		13,530	2,886	86,481	583	23,517	22,407		534
26-May	502	18,457	3,943	92,864	1,606	34,092	27,052		2,228
27-May	1,339	25,278	6,058	95,706	13,697	42,753	32,888		4,320
28-May	2,386	28,046	7,751	98,266	61,000	51,209	37,866	1,031	7,704
29-May	3,047	31,951	8,831	100,426	80,671	57,589	44,992	1,448	10,097
30-May	6,288	39,433	10,734	112,248	89,452	65,885	49,943	2,047	13,270
31-May	8,837	48,088	14,354	133,374	100,841	83,008	54,221	3,805	17,420
01-Jun	11,453	52,166	19,611	151,789	116,226	101,436	62,757	7,267	24,421
02-Jun	14,264	55,631	26,672	175,560	133,439	115,850	71,240	13,993	45,059
03-Jun	16,101	59,167	34,109	192,276	146,822	128,987	80,970	24,684	65,296
04-Jun	19,357	61,945	43,105	202,031	159,177	144,344	93,466	48,956	91,922
05-Jun	22,327	66,297	52,851	212,509	173,983	163,454	110,194	79,463	119,856
06-Jun	25,645	72,750	58,258	224,484	189,568	177,523	128,291	112,416	134,383
07-Jun	29,453	79,781	60,351	238,069	202,074	196,832	146,806	139,672	144,041
08-Jun	32,728	90,859	61,700	252,481	210,504	212,926	173,425	170,597	168,979
09-Jun	34,980	98,844	65,243	268,175	217,521	224,341	193,901	200,299	197,221
10-Jun	38,455	104,049	72,544	281,031	225,120	232,350	213,176	212,309	227,173
11-Jun	40,945	108,475	84,576	288,908	232,999	241,913	230,413	224,135	252,591
12-Jun	43,027	110,702	96,160	293,752	241,586	255,205	252,119	232,366	269,085
13-Jun	45,446	114,605	103,760	297,308	251,518	268,649	264,191	239,195	280,538
14-Jun	48,281	117,168	109,421	302,536	264,069	282,480	270,172	245,995	291,931
15-Jun	51,194	120,519	116,729	309,607	276,746	298,395	280,463	254,820	300,678
16-Jun	53,976	123,992	122,384	316,492	290,341	306,333	294,393	264,167	310,777
17-Jun	56,755	128,632	129,573	322,959	302,371	312,004	314,202	270,437	319,549
18-Jun	59,016	132,543	136,314	327,524	308,915	317,693	327,052	274,175	328,599
19-Jun	62,051	135,956	138,705	330,509	313,284	324,154	334,526	277,426	336,509
20-Jun	65,086	137,910	142,302	333,400	316,636	331,536	343,784	279,849	343,749
21-Jun	67,601	140,133	146,444	336,846	319,982	339,660	350,943	281,910	350,490
22-Jun	69,669	142,718	150,398	340,843	324,449	347,665	356,465	284,673	359,516
23-Jun	72,510	145,583	154,294	345,206	331,480	355,193	362,378	288,042	367,526
24-Jun	75,126	147,460	159,511	349,857	337,809	361,202	369,119	290,992	374,494
25-Jun	77,256	150,473	164,615	353,255	342,712	366,428	375,622	292,577	380,225
26-Jun	79,027	152,446	168,210	355,667	347,128	372,066	380,007	294,958	385,635
27-Jun	81,205	153,761	171,631	358,174	349,860	376,804	387,231	297,993	390,788
28-Jun	82,308	155,458	175,955	361,123	352,034	381,575	393,959	300,257	395,810
29-Jun	83,912	156,908	179,800	364,544	354,164	385,879	398,412	302,404	399,388
30-Jun	85,544	158,807	183,265	366,922	356,477	392,025	404,861	304,543	403,159

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Date	1978	1979	1980	1981	1982	1983	1984	1985	1986
01-Jul	87,131	161,458	186,824	369,645	358,667	398,131	413,087	307,163	406,743
02-Jul	89,664	163,982	190,189	372,251	363,087	404,244	420,641	309,771	409,895
03-Jul	92,191	166,841	194,293	374,799	368,838	410,270	429,222	311,590	412,206
04-Jul	95,171	170,647	197,227	378,893	374,083	417,213	435,737	315,126	414,011
05-Jul	97,440	173,655	200,106	383,149	379,078	422,560	442,399	318,380	415,510
06-Jul	99,063	175,651	203,131	386,625	385,378	426,533	447,848	323,044	418,319
07-Jul	100,215	176,543	206,422	390,488	391,549	430,742	451,888	326,671	421,310
08-Jul	101,046	178,634	209,417	394,262	395,539	434,822	455,794	330,564	424,170
09-Jul	101,993	181,824	212,234	397,711	397,749	438,175	459,004	337,391	427,247
10-Jul	103,245	186,033	215,876	400,653	399,819	441,819	461,931	347,998	432,682
11-Jul	104,086	189,717	221,639	402,924	401,799	446,273	465,539	353,455	437,797
12-Jul	104,427	192,979	226,427	406,392	405,219	450,814	469,819	359,784	442,839
13-Jul	104,594	196,123	228,152	408,657	409,251	455,357	474,401	365,036	446,535
14-Jul	104,884	200,247	229,831	411,253	413,590	461,176	480,974	371,149	450,065
15-Jul	105,159	203,782	231,574	414,944	418,304	467,672	486,495	376,173	454,764
16-Jul	105,697	208,957	234,089	417,524	421,865	474,642	493,250	381,512	456,991
17-Jul	106,001	212,512	237,508	418,304	424,790	480,969	498,205	387,472	461,099
18-Jul	106,285	216,272	243,386	426,937	428,203	485,295	502,941	392,582	466,092
19-Jul	106,606	219,616	248,999	447,912	432,499	488,998	506,081	397,142	472,158
20-Jul	106,844	222,332	254,059	468,423	436,419	492,986	509,470	405,318	478,155
21-Jul	106,925	224,915	257,885	484,164	440,468	497,449	512,674	409,446	482,901
22-Jul	106,943	226,927	261,058	490,730	444,339	502,330	516,454	412,604	486,309
23-Jul	106,958	228,842	263,201	496,517	447,438	505,933	519,659	415,474	489,218
24-Jul	106,998	231,024	264,554	501,580	450,499	509,836	521,857	417,636	491,851
25-Jul	107,011	232,136	266,177	504,971	453,873	514,371	523,794	420,085	494,143
26-Jul		232,907	267,433	507,464	456,469	518,210	525,481	422,059	495,942
27-Jul		233,225	268,631	509,915	458,716	521,897	526,872	424,250	497,568
28-Jul		233,612	269,329	512,700	461,091	527,131	527,876	427,089	499,365
29-Jul		233,977	269,729	516,386	462,517	531,269	528,767	429,902	500,928
30-Jul		234,468	270,199	520,200	463,480	534,781	529,705	432,692	502,417
31-Jul		235,171	270,552	524,002	464,656	536,616	530,798	434,540	503,676
01-Aug		235,929	271,377	527,398	465,167	538,528	531,845	435,610	504,848
02-Aug		236,308	272,411	529,702	466,109	540,739	532,933	436,313	505,893
03-Aug		236,535	273,175	531,615	466,603	542,827	534,146		506,663
04-Aug		236,821	273,883	532,912	467,184	545,724	535,264		507,477
05-Aug		236,994	274,641	534,093	467,306		536,273		507,912
06-Aug		237,097	275,518	535,263			536,806		508,328
07-Aug		237,173	276,133						508,520
08-Aug			276,299						508,553
09-Aug			276,538						508,600

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Date	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
15-May									491	
16-May									959	
17-May			732					448	1,491	
18-May			4,392					1,134	2,013	84
19-May		313	10,980					2,086	3,344	156
20-May	167	1,190	17,915				9,503	3,041	6,372	286
21-May	203	2,330	22,749	1,121	1,087		23,180	4,651	9,876	624
22-May	685	4,586	26,779	5,964	2,804		45,886	7,073	12,684	1,647
23-May	2,417	9,664	33,251	13,141	5,965		74,311	10,631	16,985	3,413
24-May	4,457	20,697	40,699	25,064	8,430		106,291	13,528	19,458	4,743
25-May	8,720	30,876	45,357	39,307	11,476		144,872	17,611	21,290	6,106
26-May	15,835	39,622	53,675	50,734	14,750		168,519	20,893	24,331	8,298
27-May	28,011	52,869	66,818	62,794	18,643	1,226	181,404	23,748	28,137	13,088
28-May	44,403	67,070	80,698	70,228	22,032	2,657	198,880	26,795	35,305	25,944
29-May	58,888	77,092	91,375	79,404	25,965	5,019	212,036	29,683	45,183	37,952
30-May	77,084	83,898	96,750	88,945	30,382	10,755	220,514	31,649	57,962	48,813
31-May	95,524	91,484	104,066	99,288	39,744	18,686	237,200	36,265	68,717	68,807
01-Jun	112,019	96,689	111,107	109,314	56,577	25,296	253,673	45,688	77,697	94,337
02-Jun	126,404	100,247	116,341	119,223	77,728	33,215	276,504	53,455	87,125	120,314
03-Jun	144,070	104,873	123,208	127,799	95,536	44,750	291,095	56,592	92,772	147,579
04-Jun	158,702	112,750	131,763	135,371	110,093	52,671	308,680	62,735	99,517	169,810
05-Jun	169,864	119,505	139,275	145,544	128,766	61,966	334,459	68,000	105,412	187,819
06-Jun	173,986	128,400	146,994	155,954	140,454	76,518	360,102	80,100	114,648	199,129
07-Jun	179,741	137,496	159,687	167,091	148,894	93,252	378,170	96,832	122,692	215,872
08-Jun	186,107	148,818	174,252	174,728	158,365	110,981	398,932	114,854	128,430	242,457
09-Jun	194,029	163,459	183,692	184,633	170,030	131,700	423,929	132,896	133,909	278,141
10-Jun	205,582	178,875	195,818	198,293	178,595	155,130	443,723	150,484	141,963	309,933
11-Jun	216,776	194,930	205,481	212,474	186,699	173,721	454,842	162,756	153,913	339,018
12-Jun	223,282	209,889	213,737	236,403	199,387	187,817	473,164	175,764	161,187	374,655
13-Jun	227,335	220,640	224,363	260,851	208,453	206,074	486,036	184,845	170,132	401,691
14-Jun	235,388	230,022	237,911	275,153	217,689	226,530	494,393	200,484	184,153	416,649
15-Jun	240,873	239,932	247,833	283,543	232,656	250,487	507,744	212,163	196,006	432,197
16-Jun	246,389	246,416	256,722	293,655	247,023	264,401	521,991	226,390	215,738	446,006
17-Jun	251,795	251,326	266,742	306,350	257,152	278,910	529,612	237,835	235,656	456,304
18-Jun	256,610	257,795	277,873	314,402	268,203	293,803	534,533	255,058	253,594	463,663
19-Jun	260,593	265,650	286,218	324,165	281,124	306,127	540,857	274,450	269,619	478,966
20-Jun	264,526	273,602	293,793	333,480	295,270	325,607	545,757	285,948	286,482	491,037
21-Jun	268,460	279,372	300,962	343,772	304,020	342,489	549,293	297,647	301,912	498,607
22-Jun	274,829	286,357	309,830	353,929	311,850	351,941	552,157	310,952	311,774	509,458
23-Jun	284,940	294,056	315,680	364,095	318,208	359,175	557,226	329,638	317,094	525,002
24-Jun	300,648	299,638	319,607	373,435	324,171	365,494	563,297	353,920	324,451	535,228
25-Jun	317,166	305,235	322,603	383,445	331,831	372,169	567,618	368,060	333,662	543,191
26-Jun	329,665	311,613	326,029	390,257	341,331	379,349	570,336	380,264	343,651	551,859
27-Jun	336,675	318,172	329,269	399,491	351,686	385,615	573,706	394,410	359,676	562,114
28-Jun	342,319	324,431	335,571	406,372	362,496	393,699	578,067	403,623	373,349	571,309
29-Jun	349,155	332,651	342,061	410,871	372,935	402,957	583,043	419,482	383,072	583,930
30-Jun	353,791	339,148	349,415	414,846	382,048	410,373	591,427	430,327	387,474	597,021

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Date	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
01-Jul	355,803	344,750	357,345	419,169	389,351	417,493	599,066	440,686	393,204	612,508
02-Jul	359,209	349,430	362,641	424,236	394,460	423,084	604,786	450,488	398,422	625,574
03-Jul	363,305	353,652	367,617	428,918	400,795	427,725	609,931	460,453	403,273	638,523
04-Jul	370,405	357,184	374,986	434,583	407,475	433,138	615,458	469,235	407,564	651,479
05-Jul	374,756	360,488	385,725	442,561	413,320	437,562	621,797	475,431	415,351	660,308
06-Jul	378,149	363,998	395,749	450,330	419,533	444,549	628,228	484,975	423,523	669,126
07-Jul	383,766	368,322	405,985	456,030	425,755	451,910	637,457	494,896	430,143	678,133
08-Jul	390,382	376,821	417,098	461,222	432,824	457,668	647,843	502,843	434,415	686,557
09-Jul	396,734	381,988	427,859	466,375	439,277	469,605	658,948	512,234	441,260	694,359
10-Jul	405,319	388,335	437,365	472,995	443,887	478,744	668,514	526,773	456,106	704,151
11-Jul	410,641	395,955	445,818	478,397	448,364	487,124	675,878	540,429	465,474	714,759
12-Jul	416,398	403,836	457,771	487,735	453,182	495,083	682,697	556,652	471,941	726,564
13-Jul	422,981	410,923	467,100	499,167	457,151	501,824	688,312	570,576	477,919	737,393
14-Jul	429,420	417,935	477,370	507,373	464,649	510,398	695,985	583,909	487,521	747,352
15-Jul	435,142	424,859	489,653	515,682	472,199	519,369	702,097	594,070	499,108	756,817
16-Jul	441,401	430,316	500,550	521,775	481,870	527,052	708,977	602,025	505,043	768,128
17-Jul	445,868	435,193	509,453	528,034	491,538	533,770	714,152	609,667	515,901	779,714
18-Jul	450,488	439,050	521,264	533,760	498,878	542,577	719,550	616,730	526,543	786,948
19-Jul	454,615	443,633	531,831	539,735	506,391	551,192	726,332	621,405	534,707	793,321
20-Jul	458,249	448,116	542,000	544,050	517,072	558,294	733,749	625,327	541,710	798,930
21-Jul	460,690	452,080	550,639	546,584	527,340	563,192	741,593	633,083	547,064	806,369
22-Jul	461,963	454,877	559,547	549,041	537,042	567,804	750,834	646,559	551,660	813,651
23-Jul	462,965	458,306	567,650	552,942	546,059	573,230	764,846	661,006	555,916	820,385
24-Jul	463,590	462,206	573,900	555,825	550,304	577,051	777,569	671,430	560,171	829,268
25-Jul	465,604	466,229	579,203	557,875	553,370	580,035	786,617	684,473	563,481	838,388
26-Jul	465,972	470,371	584,909	560,132	557,792	583,447	793,023	690,370	566,671	845,924
27-Jul	466,598	474,291	590,608	563,017	561,676	587,066	800,488	695,258	571,867	850,758
28-Jul	469,092	477,743	595,534	564,951	566,469	590,271	806,460	700,725	576,960	859,318
29-Jul	471,433	481,219	599,684	567,759	571,823	594,225	812,576	704,721	582,933	866,707
30-Jul	473,508	483,642	602,203	570,221	576,534	598,097	819,079	707,877	589,214	872,188
31-Jul	475,734	485,562	603,754	572,771	579,435	601,952	824,618	711,563	594,253	876,103
01-Aug	478,460	487,000	606,053	576,610			829,178	715,577	597,678	880,168
02-Aug	479,759	488,098	607,797	581,859			833,387		599,267	884,421
03-Aug	481,461								599,267	888,804
04-Aug	482,960								599,267	893,886
05-Aug	483,478								599,267	900,815
06-Aug									599,267	906,239
07-Aug									599,267	906,239
08-Aug									599,267	906,239
09-Aug										

Appendix 3. Daily water levels in meters above sea level, at Mile 49 Bridge, Copper River, 1982 - 1996.

Elevation Above Sea Level

Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
11-May													39.03		
12-May															
13-May													39.12		
14-May													39.18		
15-May						38.99		40.05					39.26	40.71	40.33
16-May								40.04					39.33		40.07
17-May						39.09		40.01					39.43		39.77
18-May					39.19	39.10		40.01					39.53	40.27	39.60
19-May					39.31	39.05	39.70	40.06					39.76	40.09	39.57
20-May			39.05		39.97	39.05	39.62	40.07				41.12	40.17	39.65	39.60
21-May			39.08		39.95	39.10	39.65	40.02	40.79	39.42		41.26	40.35	39.87	39.55
22-May			39.31		39.19	39.14	39.65	40.14	40.92	39.52	39.62	41.40	40.19	39.90	39.55
23-May			39.45		39.29	39.21	39.60	40.23	40.81	39.70	39.68	41.39	40.07	39.98	39.62
24-May		39.39	39.48		39.37	39.28	39.61	40.27	40.63	39.96		41.38	40.12	40.08	39.75
25-May		39.39	39.57		39.38	39.29	39.64	40.16	40.48	40.17	39.92	41.54	40.17	40.31	39.85
26-May		39.36	39.61		39.46	39.36	39.67	40.17	40.48	40.33	40.10	41.68	40.05	40.71	39.87
27-May		39.37	39.71		39.54	39.46	39.75	40.27	40.58	40.41	40.30	41.67	40.03	41.06	39.89
28-May		39.39	39.75	40.28	39.60	39.46	39.78	40.42	40.77	40.51	40.55	41.65	40.11	41.04	39.95
29-May		39.38	39.61	40.34	39.77	39.48	39.82	40.60	41.00	40.55	40.73	41.77	40.08	41.04	39.96
30-May	39.62	39.44	39.55	40.31	39.97	39.45	39.87	41.00	41.47	40.58	40.94	41.93	40.22	40.88	40.11
31-May		39.58	39.47	40.18	39.96	39.48	40.00	41.49	41.72	40.58	40.97	42.11	40.23	40.69	40.29
01-Jun		39.94	39.46	40.03	39.97	39.76	40.12	41.82	41.00	40.51	41.13	42.35	40.21	40.54	40.51
02-Jun	40.03	40.64	39.42	39.90	39.96	39.98	40.14	41.87	42.03	40.42	41.22	42.37	40.22	40.45	40.96
03-Jun	40.31	41.00	39.39	39.88	39.97	40.33	40.16	41.70	42.18	40.32	41.34	42.40	40.27	40.37	41.08
04-Jun	40.60	40.94	39.45	39.95	39.90	40.36	40.26	41.70	42.26	40.31	41.50	42.49	40.30	40.26	41.18
05-Jun	40.72	40.94	39.61	40.18	39.88	40.30	40.32	42.02	42.45	40.38	41.56	42.53	40.40	40.22	41.22
06-Jun	40.83	40.89	39.75	40.44	39.98	40.43	40.35	42.11	42.67	40.42	41.52	42.60	40.52	40.22	41.08
07-Jun	40.71	40.82	40.04	40.36	40.19	40.73	40.61	42.06	42.81	40.47	41.38	42.74	40.75	40.29	40.90
08-Jun	40.69	40.82	40.34	40.11	40.43	40.88	40.82	42.00	42.98	40.55	41.53	42.68	40.88	40.45	40.97
09-Jun		40.85	40.36	40.03	40.46	40.69	41.15	41.89	42.96	40.60	41.62	42.35	40.97	40.63	41.08
10-Jun	41.50	40.84	40.36	40.06	40.36	40.64	41.48	41.92	42.85	40.58	41.73	42.03	41.10	40.81	41.03
11-Jun		40.82	40.43	40.01	40.24	40.54	41.80	41.80	42.63	40.71	41.91	41.84	41.38	41.35	40.88
12-Jun		40.84	40.56	40.01	40.13	40.38	42.00	41.65	42.47	40.87	42.17	41.84	41.55	42.09	40.70
13-Jun		40.81	40.68	40.11	40.22	40.34	42.19	41.73	42.44	41.06	42.48	41.86	41.74	42.71	40.54
14-Jun		40.67	40.84	40.13	40.33	40.37	42.36	41.78	42.61	41.31	42.74	41.94	42.00	43.04	40.51
15-Jun	41.27	40.71	40.97	40.16	40.62	40.36	42.45	42.03	42.66	41.53	42.89	42.08	42.44	43.22	40.47
16-Jun		40.60	41.07	40.13	41.05	40.36	42.64	42.13	42.58	41.77	43.01	42.35	42.82	43.33	40.43
17-Jun	41.06	40.75	41.05	40.13	41.58	40.44	42.80	42.02	42.52	42.00	42.97	42.58	43.11	43.09	40.50
18-Jun	40.93	40.88	40.89	40.36	41.83	40.57	42.99	41.94	42.39	42.10	42.85	42.61	43.26	42.67	40.72
19-Jun		40.97	40.97	40.49	41.88	40.51	42.90	42.02	42.15	42.04	42.63	42.57	43.25	42.62	40.97
20-Jun	41.16	41.31	41.15	40.49	41.89	40.43	42.56	42.09	42.03	42.05	42.47	42.60	43.02	42.65	41.14
21-Jun	41.50	41.58	41.31	40.51	41.71	40.36	42.32	42.15	41.91	42.53	42.58	42.46	42.89	42.68	41.35
22-Jun	41.54	41.85	41.66	40.34	41.54	40.70	42.53	42.22	41.92	43.14	42.91	42.50	42.72	42.65	41.48
23-Jun		41.95	41.76	40.39	41.43	41.18	42.25	42.34	41.93	43.69	42.99	42.52	42.85	42.67	41.70
24-Jun	41.35	42.01	41.99	40.46	41.29	41.27	41.82	42.48	42.01	44.02	42.90	42.58	43.16	42.85	42.03
25-Jun		42.19	42.35	40.74	41.11	41.23	41.73	42.84	42.02	44.03	42.66	42.64	43.34	42.60	42.28
26-Jun	41.62	42.43	42.60	40.79	41.00	41.10	41.68	43.13	42.09	43.83	42.42	43.00	43.39	42.22	42.43
27-Jun		42.44	42.75	40.77	40.97	40.98	41.68	43.11	42.31	43.64	42.26	42.75	43.06	42.35	42.43
28-Jun	42.39	42.43	42.58	40.97	41.17	41.28	41.55	43.01	42.59	43.57	42.44	42.61	42.54	42.11	42.25
29-Jun		42.60	42.37	41.20	41.52	41.00	41.79	42.98	42.96	43.66	42.68	42.57	42.20	42.20	41.82
30-Jun	42.90	42.55	42.14	41.43	41.62	41.53	41.79	43.03	43.27	43.78	42.99	42.60	42.05	42.35	41.51

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Elevation Above Sea Level

Date	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
01-Jul	42.81	42.43	41.88	41.86	41.96	42.37	41.73	43.10	43.49	43.87	43.28	42.65	42.08	42.53	41.43
02-Jul		42.24	41.94	42.32	42.37	42.83	41.82	43.31	43.78	43.90	43.61	42.61	42.34	42.76	41.44
03-Jul	42.57	42.33	41.91	42.55	42.61	42.85	41.99	43.49	43.76	43.77	44.15	42.62	42.47	42.98	41.56
04-Jul	42.18	42.51	41.91	42.62	42.70	42.91	42.29	43.41	43.71	43.76	44.35	42.55	42.48	43.16	41.71
05-Jul		42.60	41.96	42.62	42.85	43.04	42.51	43.43	43.71	43.53	44.53	42.63	42.55	43.23	41.90
06-Jul		42.67	41.86	42.67	43.03	43.16	42.66	43.38	43.74	43.24	44.55	42.59	42.55	43.40	41.95
07-Jul	41.92	42.70	42.06	42.85	43.11	43.12	42.95	43.42	43.85	43.07	44.38	42.53	42.44	43.60	41.99
08-Jul		42.84	42.29	42.93	43.13	42.93	43.08	43.43	43.75	43.08	44.19	42.34	42.23	43.75	42.11
09-Jul		42.81	42.52	42.75	43.03	42.33	43.06	43.50	43.51	43.22	43.71	42.08	42.24	43.71	42.21
10-Jul		42.82	42.72	42.55	42.70	42.52	42.94	43.63	43.14	43.49	43.39	42.50	42.38	43.58	42.28
11-Jul	42.72	42.72	42.62	42.52	42.62	42.49	42.72	43.74	42.81	43.22	43.34	42.82	42.34	43.53	42.24
12-Jul		42.55	42.47	42.55	42.76	42.50	42.53	43.95	42.58	43.04	43.48	43.07	42.43	43.61	42.03
13-Jul		42.14	42.32	42.62	42.80	42.53	42.72	44.07	42.51	42.94	43.72	43.16	42.52	43.51	41.98
14-Jul		41.98	42.19	42.60	42.78	42.41	42.73	44.03	42.42	42.92	43.65	43.45	42.63	43.40	42.02
15-Jul		41.80	42.16	42.55	42.51	42.47	42.68	43.82	42.37	42.85	43.42	43.61	42.78	43.35	42.11
16-Jul	42.44	41.95	42.06	42.44	42.35	42.43	42.64	43.51	42.28	42.82	43.41	43.76	42.98	43.30	42.01
17-Jul		42.10	41.96	42.42		42.47	42.72	43.20	42.12	42.96	43.27	44.04	42.99	43.01	41.91
18-Jul	42.35	42.23	41.83	42.49		42.35	43.03	43.14	42.50	42.86	43.19	44.14	42.97	43.01	42.10
19-Jul		42.46	41.96	42.49		42.36	43.18	43.30	42.78	42.50	43.16	44.07	43.06	43.12	42.30
20-Jul	42.39	42.55	41.99	42.60		42.63	43.18	43.47	43.06	42.17	43.16	43.82	42.68	43.10	42.44
21-Jul		42.53	41.76	42.90		42.78	43.24	43.58	43.28	42.11	43.31	43.85	42.73	43.17	42.47
22-Jul		42.48	41.83	42.88	43.53	43.36	43.53	43.32	43.57	42.27	43.34	43.87	42.44	43.32	42.53
23-Jul	42.09	42.27	41.81	42.62	43.41	43.51	43.40	43.14	43.62	42.41	43.14	43.44	42.21	43.59	42.53
24-Jul	42.58	42.30	41.66	42.37	43.34	43.39	43.38	43.00	43.72	42.70	42.92	43.29	42.13	43.74	42.46
25-Jul	42.72	42.30	41.86	42.24		43.17	43.04	42.91	43.83	42.87	42.84	43.19	42.26	43.42	42.56
26-Jul	42.98	42.20	42.06	42.24	42.77	43.01	42.70	42.86	43.75	42.97	43.11	43.21	42.40	43.16	42.67
27-Jul	43.13	42.10	42.19	41.99	42.45	43.02	42.54	42.81	43.25	42.95	43.26	43.29	42.68	42.89	42.65
28-Jul	43.09	42.23	42.29	41.99	42.22	43.16	42.58	42.75	42.90	42.90	43.18	43.33	42.76	42.72	42.65
29-Jul		42.51	42.29	42.11	42.01	43.23	42.58	42.87	43.15	42.82	42.99	43.43	42.83	42.38	42.75
30-Jul		42.68	42.39	42.24	41.94	43.29	42.43	42.96	43.46	42.77	42.88	43.49	42.94	42.31	42.88
31-Jul		42.76	42.34	42.39	41.98	43.26	42.38	43.13	43.51	42.65	42.81	43.53	43.28	42.33	43.21
01-Aug		42.79	42.39	42.55		43.07	42.31	43.29	43.51			43.60	42.96	42.33	43.13
02-Aug	43.90	42.66	42.32	42.98		42.98	42.33	43.37	43.51			43.40	43.17	42.33	42.92
03-Aug	43.84	42.61	42.34	44.35		42.92	42.48						43.52		42.51
04-Aug		42.55	42.34	45.09		42.93	42.81								42.35
05-Aug		42.62	42.42			42.88									42.29
06-Aug			42.42												42.11
07-Aug			42.42												41.91
08-Aug			42.42												