AN ESTIMATE OF ADULT SOCKEYE SALMON (*Oncorhynchus nerka*) PRODUCTION, BASED ON EUPHOTIC VOLUME, FOR THE SUSITNA RIVER DRAINAGE, ALASKA.

by

Kenneth E. Tarbox

and

Gary B. Kyle

Regional Information Report No. 2S89-01

Alaska Department of Fish and Game
Division of Commercial Fisheries
Division of Fisheries Rehabilitation, Enhancement, and Development
333 Raspberry Road
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INTRODUCTION

During the early 1970's the Alaska Department of Fish and Game (ADF&G) began developing techniques to enumerate adult sockeye salmon (*Oncorhynchus nerka*) migrating into the Susitna River drainage, Upper Cook Inlet, Alaska (Figure 1). This diverse drainage, which encompasses over 49,000 km^2 and is approximately 443 km long, is known to have at least 20 sockeye salmon producing lakes. The major tributaries of the river are the Yentna, Talkeetna, and Chulitna Rivers. All are glacial in origin and heavily silt laden during the ice-free season. In addition to being the third major producer of sockeye salmon in Upper Cook Inlet, the Susitna river is also the major producer of pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), and chinook salmon (*O. tshawytscha*) returning to Upper Cook Inlet.

In 1978, the technological success of using side scan sonar to count migrating adult sockeye salmon in glacial river systems, specifically the Kenai and Kasilof Rivers, prompted a similar effort in the lower Susitna River. Although a sockeye salmon escapement goal was established for the Susitna River system in 1979, the goal was based on non-system specific characteristics. This has naturally led to questions of the appropriateness of the goal by both the public and professional staff.

Concurrent with the questions surrounding the Susitna River sockeye salmon escapement goal is the issue of sockeye salmon enhancement within this drainage. With over 20 lake systems the potential for enhancement would superficially appear high. However, the resultant impact on the mixed stock commercial fisheries of Upper Cook Inlet are not well defined nor is the impact on wild stocks within the Susitna River drainage. In order to address these issues lake-specific production data are needed.

Unfortunately, the decline in State of Alaska revenues has limited the ability of the ADF&G to significantly increase data gathering programs in the Susitna River drainage. However, Koenings and Burkett (1987) suggested that a first-order approximation of potential sockeye salmon production can be made from measurements of euphotic volume (EV). This lake measurement is relatively easy to obtain and provides a production estimate independent of spawner/return data.

The purpose of this report is to present the results of using EV measurements to estimate adult sockeye salmon production in selected lakes of the Susitna River drainage.

METHODS

Euphotic volume was estimated for 24 salmon producing lakes located within the Susitna River drainage (Figure 2). A total of 16 lakes were sampled between July and September, 1988 which complimented data collected from the remaining eight lakes in previous years. Sampling was conducted in conjunction with other scheduled tasks and therefore sampling was not done on

a consistent basis. This resulted in some lakes being sampled more frequently than others.

Sampling consisted of using a secchi disk or a Protomatic submersible photometer to measure the euphotic zone depth (depth at which 1% of the subsurface photosynthetically active radiation penetrates; EZD). An effort was made to sample at least one station in the major basin of each lake. In most cases, two or three stations were sampled on each trip. Light readings were taken at 0.5 m increments from the surface to 5 m and 1 m increments to the 1% depth. Secchi disk readings were averaged for measurements taken as the disk was lowered and retrieved.

Data analysis consisted of converting secchi disk readings to equivalent 1% light penetration readings (Koenings et al. 1987). A mean EZD was calculated for each sample trip by station. The EV was calculated by multiplying the seasonal mean EZD for each lake times the lake surface area. Published surface areas of all lakes were verified and/or estimated using planimetry of topographical maps. Finally, the estimated total return of adult sockeye salmon for each lake was calculated using 2,500 adults per euphotic volume unit (10^6 m^3) after Koenings and Burkett (1987).

RESULTS

Light penetration measurements collected during 1988 are presented in Appendix A.1 to A.34. As expected, the wide diversity of lake types and productivity levels within the Susitna River drainage was evident in these measurements. Lake types ranged from clear to organically stained to semi-glacial. Measured EZD ranged from a low of 1.5 m in Bunco Lake to 22 m in Judd Lake (Table 1). Total surface acres of all lakes surveyed was 13,618, with 17 of the 24 lakes being less than 400 acres in size (Table 2). Chelatna Lake was the largest lake measuring 4,181 acres. Euphotic volume calculations indicated that the total EV for all lakes was 403.5 x 10^6 m^3, with Chelatna Lake contributing approximately 38.5% to the total (Table 2). The Yentna River drainage, a major tributary to the Susitna River (Figure 2), contributed 68% to the total EV.

Total adult sockeye salmon production, based on EV units, was estimated at 1,009,100 fish (Table 2) for the 24 Susitna River drainage lakes examined.

DISCUSSION

The validity of the above analysis is difficult to assess because site specific data on most of the lakes within the Susitna River drainage are lacking. However, examination of system wide data would tend to support the EV production figures for adult sockeye salmon. For example, Waltemyer (ADF&G, personal communication) has incorporated data from Cross et. al. (1983) to estimate total sockeye salmon returns for the Susitna River (Table 3). These data indicated adult sockeye salmon returns have ranged from

180,579 fish to 1,206,470 fish and averaged 608,131 fish during 1968-82. This is approximately 60% of the estimated average production estimated by EV.

One explanation for a lower average return for the period 1968-82 is that one or more lakes within the Susitna River drainage are not producing at their juvenile rearing potential. For example, production from Chelatna Lake should average 389,200 adult sockeye salmon based on EV units. However, peak aerial and ground counts of adult sockeye salmon escapements into Chelatna Lake indicated substantial differences between years and substantially fewer fish than hypothesized by EV units. Aerial escapement counts have ranged from a few hundred fish to over 23,000 fish (1982) between 1981-87 (King, ADF&G, personal communication). Assuming peak counts represent 50% of the total escapement, the total spawning population in 1982 would be 46,000 fish. As the Upper Cook Inlet commercial fishery harvested 51% of the Susitna River sockeye salmon return in 1982 (Cross et al. 1985), the total return to Chelatna Lake would have been 90,000 fish. Thus, Chelatna Lake production could be as much as 300,000 fish below its potential (based on rearing). This could explain the difference between the total measured Susitna River system production and estimated production based on EV units.

Larson Lake, located in the northern portion of the Susitna River drainage, has consistent site-specific data. Between 1984 and 1987 an adult sockeye salmon counting weir was operated in this system. Escapement counts ranged from a low of 17,585 fish in 1987 to a high of 37,879 fish in 1985 and averaged 30,760 fish. The Upper Cook Inlet commercial fishery harvested between 71% and 82% of the total Susitna River return during this time frame. Utilizing these data, the total return to Larson Lake between 1984 and 1987 would average approximately 141,000 fish. This is approximately three times the average production estimate of 45,100 fish based on EV units (Table 2). However, for the brood years 1979 through 1982 the total return to the Susitna River was 2.5 times higher than the average return, which suggests that the Larson Lake estimate of adult production, based on EV, may more closely parallel the weir data than a superficial examination might conclude.

In addition to the above, a third measure of sub-system production might be inferred from the distribution and abundance of adult sockeye spawning populations. Fortunately, between 1981 and 1985 escapement counts were made in the Susitna River and the Yentna River drainages using side scan sonar or mark/recapture estimates. During this period, the Yentna River sockeye salmon escapement counts averaged between 49% and 62% of the total sockeye salmon escapement counts for the Susitna River system (average values vary depending on whether sonar or mark/recapture estimates are used). The Yentna River drainage EV totals were approximately 68% of the entire Susitna River drainage. If Chelatna Lake is not producing at its rearing potential, as evidenced by peak aerial escapement counts during 1981-85, then the documented adult sockeye salmon distribution in the Susitna River and the proportion of EV units for the Yentna River drainage are in close agreement.

Furthermore, the Susitna River EV data appear consistent with adult production estimates known for other Upper Cook Inlet systems. For example, within the Kenai River system, the total EV estimate for Kenai and Skilak Lakes, the major sockeye salmon producing lakes, is 1,234 x 10^6 m^3 (Koenings, ADF&G, personal communication). Total return of sockeye salmon to the Kenai

River has averaged over 2 million fish since 1968, with a record 9 million fish returning from the 1982 brood year. The Susitna River total sockeye salmon return has averaged 608,131 fish which is approximately 30% of the Kenai River average return. In contrast, the total EV units for the Susitna River are 32.7% of the Kenai River EV estimate.

In summary, adult sockeye salmon production based on EV measurements appear to be consistent with observed production within the Susitna River drainage. However, a significant amount of additional work remains to be done before escapement goals and enhancement projects can be altered or implemented. In the above analysis, no corrections were made in the production estimate for mainstem spawning and slough rearing, age 0 component of the total production, or lakes not surveyed. In addition, limitations other than rearing should be evaluated. For example, available spawning area, number of fish presently entering and rearing in these lakes, predator/prey relationships and environmental variables affecting sockeye production are only a few of the many production parameters needing further evaluation.

LITERATURE CITED

Cross, B.A., D.R. Bernard, and S.L. Marshall. 1983. Returns-per-spawner ratios for sockeye salmon in Upper Cook Inlet, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 221, Juneau.

Cross, B.A., D.L. Hicks, and W.E. Goshert. 1985. Origins of sockeye salmon in the fisheries of Upper Cook Inlet in 1982. Alaska Department of Fish and Game, Division of Commercial Fisheries, Alaska Department of Fish and Game Technical Data Report 139, Juneau.

Koenings, J.P. and R.D. Burkett. 1982. Population characteristics of sockeye salmon (*Oncorhynchus nerka*) smolts relative to temperature regimes, euphotic volume, fry density, and forage base within Alaskan Lakes. In H.D. Smith, L. Margolis, and C.C. Wood [ed.], Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Canadian Special Publication of Fisheries and Aquatic Sciences 96.

Koenings, J.P.,J.E. Edmundson, G.B. Kyle, and J.M. Edmundson. 1987. Limnology field and laboratory manual: methods for assessing aquatic production. Alaska Department of Fish and Game, FRED Division, Report Series 71, Juneau.

Table 1. Euphotic zone and secchi depth measurements for selected lakes of the Susitna River drainage, Alaska in 1988.

Lake	Secchi Disk depth (m)	Euphotic Zone depth (m)	Sample Date
Byers	6.6	10.9	7/14/88
	6.7	11.1	7/14/88
	5.75	10.2	8/15/88
	5.75	9.5	
	5.7	8.1	9/7/88
Bunco	1.25	1.5	8/16/88
Caswell	4.2	8.1	7/6/88
	3.8	7.9	
	4.2	9.1	
	2.75	11.8	7/13/88
	4.25	8.3	8/15/88
	4.25	8.8	
	5.5	8.8	9/12/88
	5.5	8.6	
Chelatna		8.5	7/27/88
		7.4	8/24/88
	3.25	11.9	9/25/88
Eightmile	4.0	4.8	7/28/88
Fish Creek	3.25	8.2	8/16/88
Fish	2.75	8.0	8/16/88
Judd	8.5	22.0	7/15/88
	9.0	16.4[a]	
	9.0	16.4[a]	
	9.6	18.5	7/18/88
	9.5	17.0[a]	8/12/88
	7.2	21.2	9/6/88

continued

Table 1. (p 2 of 3).

Lake	Secchi Disk depth (m)	Euphotic Zone depth (m)	Sample Date
Lockwood	2.5	5.0	7/15/88
	2.5	3.5[a]	
	4.3	4.6	7/18/88
	3.4	4.5	
	2.5	3.5[a]	8/12/88
	3.0	4.0[a]	
	3.0	5.5	9/6/88
	3.5	7.3	
Movie	3.5	8.5	7/15/88
	3.5	7.3	
	3.5	4.5[a]	8/12/88
	3.5	4.5[a]	
	4.0	5.0[a]	
Neil	3.75	6.3	8/16/88
	3.75	6.7	
Puntilla	3.0	8.0	7/15/88
	3.5	9.6[a]	
	3.0	8.9[a]	
	3.5	9.6[a]	8/12/88
	5.0	11.5[a]	
	4.5	10.8[a]	
Spink	4.75	8.5	8/16/88
	5.25	9.9	
Sucker	2.0	3.0[a]	8/12/88
Swan	0.87	2.8	8/16/88
	0.87	2.8	

continued

Table 1. (p 3 of 3)

Lake	Secchi Disk depth (m)	Euphotic Zone depth (m)	Sample Date
Trinity	2.5	5.9	7/15/88
	2.5	6.9	
	3.4	7.5	7/18/88
	3.0	6.0	
	3.5	6.7	7/27/88
	4.0	5.0[a]	8/12/88
	3.75	4.8[a]	
	2.8	6.5	9/6/88
	2.8	6.4	

[a] Denotes value calculated from secchi disk reading.

Table 2. Estimated adult sockeye salmon production based on euphotic volume for selected lakes of the Susitna River drainage lakes, Alaska.

Lake	Surface Area (acres)	Euphotic Depth[a] (m)	Euphotic Volume (10^6 m^3)	Adult Production[b] (fish)
Bunco	106	1.5	0.64	1,600
Byers	368	10.0	14.89	37,200
Caswell	159	8.5	5.47	13,700
Chelatna	4,181	9.2	155.67	389,200
Eightmile	115	4.8	2.23	5,600
Fish Creek	111	8.2	3.61	9,000
Fish	132	8.0	4.24	10,600
Hewitt	697	8.6	24.25	60,600
Judd	316	18.6	23.79	59,500
Larson	437	10.2	18.04	45,100
Lockwood	233	4.7	4.43	11,000
Movie	110	6.0	2.67	6,700
Neil	115	6.5	3.03	7,600
Puntilla	90	9.7	3.53	8,800
Red Salmon	113	3.0	1.37	3,400
Red Shirt	1,272	5.4	27.80	69,500
Shell	1,487	6.9	41.52	103,800
Spink	252	9.2	9.38	23,500
Stephan	899	7.0	25.47	63,700

continued

Table 2. (p 2 of 2).

Lake	Surface Area (acres)	Euphotic Depth[a] (m)	Euphotic Volume (10^6 m^3)	Adult Production[b] (fish)
Sucker	273	3.0	3.31	8,300
Swan	385	2.8	4.36	11,000
Trapper	1,188	1.4	6.73	16,800
Trinity	308	6.2	7.73	19,300
Whiskey	271	8.6	9.43	23,600
TOTAL	13,618		403.50	1,009,100

[a] This value represents a seasonal mean.
[b] Estimated adult sockeye salmon production was calculated by using a total return of 2500 adults per euphotic volume unit ($10^6 m^3$).

Table 3. An estimate of the total return of sockeye salmon by brood year to the Susitna River drainage, Alaska 1968 - 1982.

Brood year	Escapement	Total Return
1968	61,010	186,393
1969	41,346	180,579
1970	44,371	261,389
1971	114,707	473,437
1972	91,927	677,688
1973	116,093	341,614
1974	71,849	334,863
1975	108,000	482,304
1976	111,000	959,981
1977	232,724	458,041
1978	93,429	802,583
1979	153,049	1,141,178
1980	187,910	1,206,470
1981	338,542	943,538
1982	262,687	671,909
Average	135,242	608,131

Source: Waltemyer (ADF&G, personal communication).

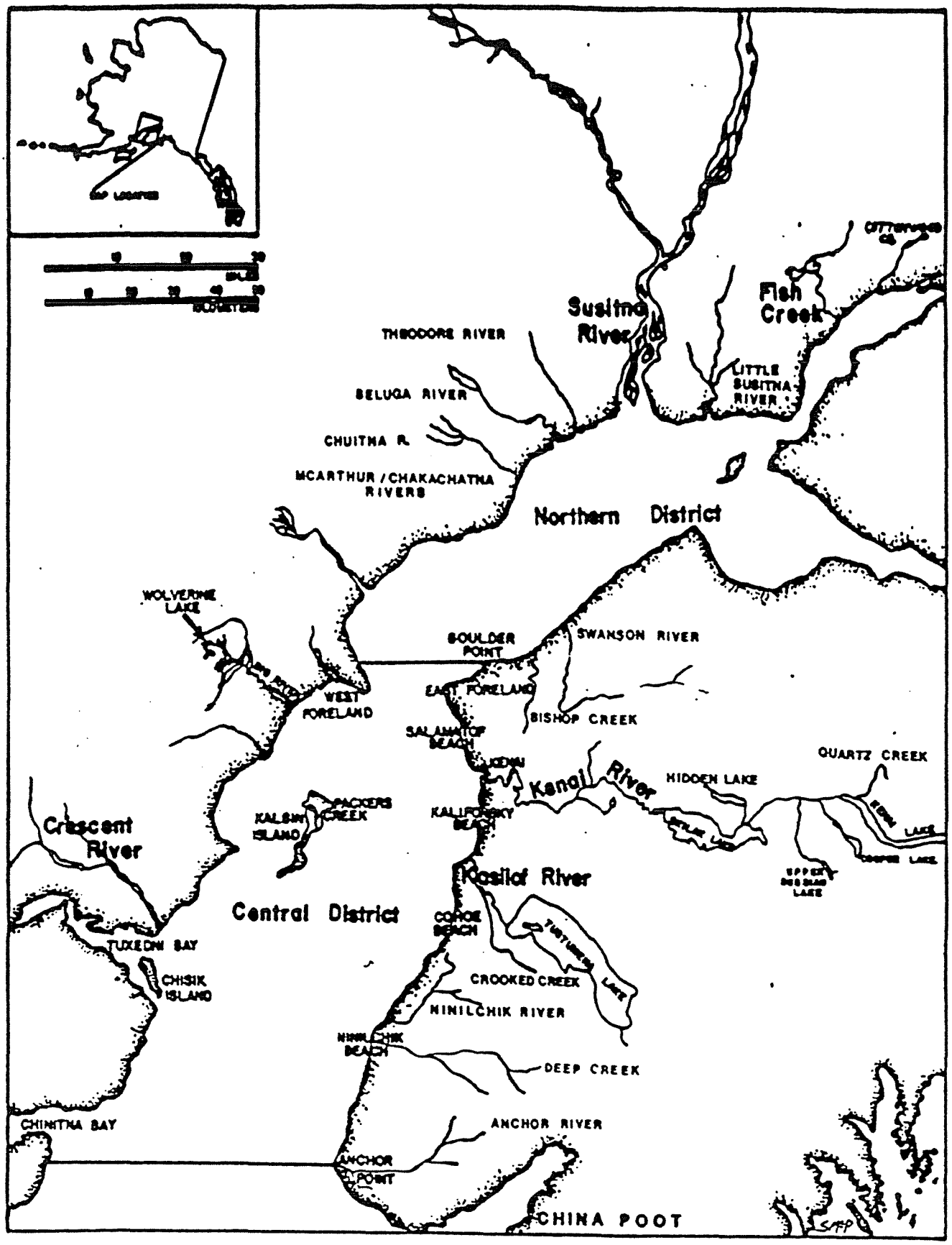

Figure 1. The Upper Cook Inlet area showing the locations of the Northern and Central Districts and the major sockeye salmon spawning drainages.

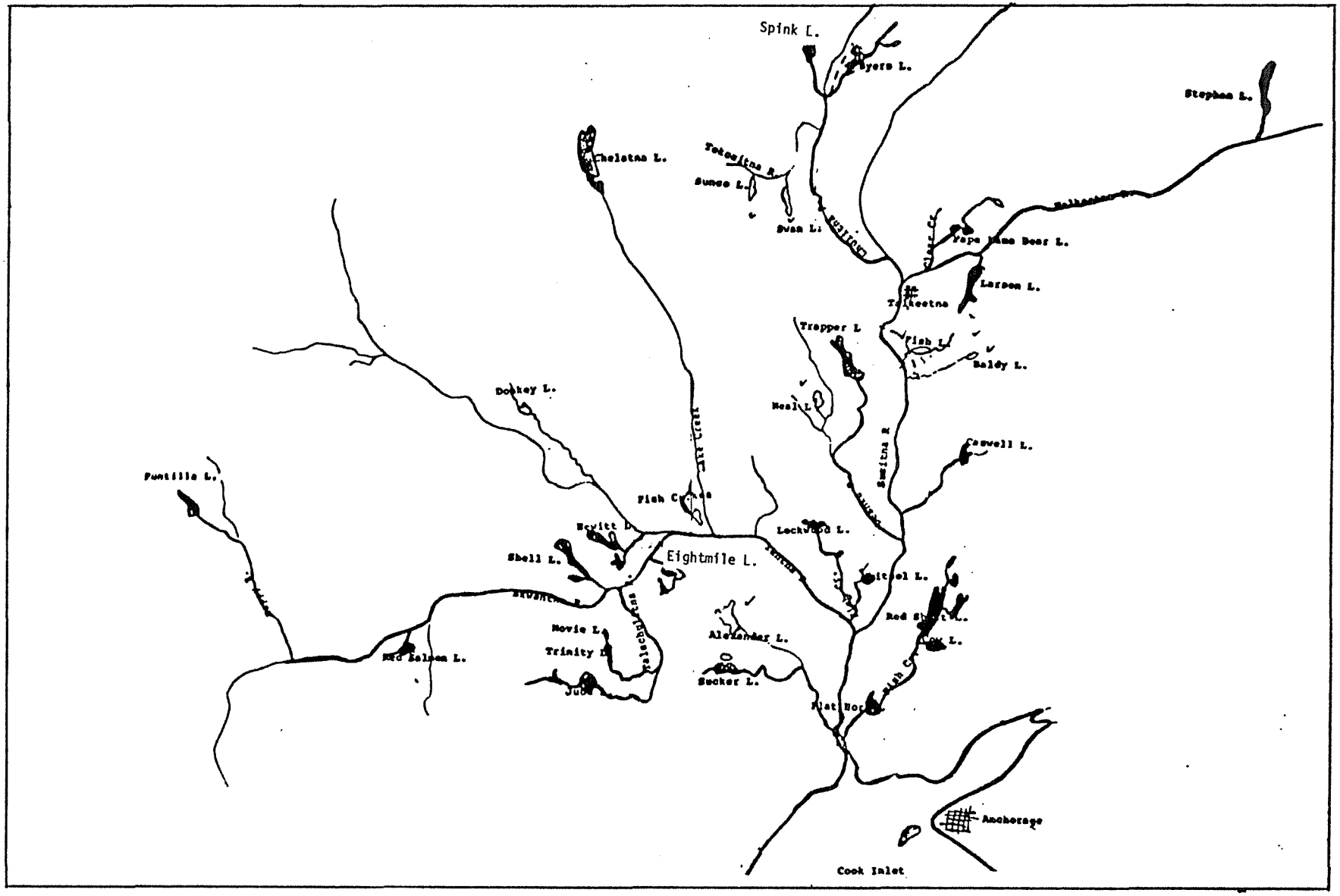

Figure 2. Location of select lakes within the Susitna River drainage, Alaska.

Appendix A.1

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

BUNCO LAKE, CHULITNA RIVER

Clear and calm

Station A		Station B	Station B	Station B
Secchi Disk = 1.25 m		Secchi Disk =		Secchi Disk =
Depth = 1.5 m		Depth =		Depth =
I	6000	I		I
SS	2000	SS		SS
0.5	900	0.5		0.5
1.0	450	1.0		1.0
1.5	130	1.5		1.5
2.0		2.0		2.0
2.5		2.5		2.5
3.0		3.0		3.0
3.5		3.5		3.5
4.0		4.0		4.0
4.5		4.5		4.5
5.0		5.0		5.0
6.0		6.0		6.0
7.0		7.0		7.0
8.0		8.0		8.0
9.0		9.0		

Appendix A.2

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
THRUSDAY - 7/14/88

BYERS LAKE

Station A		Station B		
Secchi Disk = 6.6 m		Secchi Disk = 6.7 m		Secchi Disk =
Depth = 54 m		Depth = 24 m		Depth =
I	2600	I	2900	I
SS	1200	SS	1400	SS
0.5	880	0.5	1100	0.5
1.0	660	1.0	740	1.0
1.5	550	1.5	620	1.5
2.0	450	2.0	550	2.0
2.5	360	2.5	470	2.5
3.0	310	3.0	400	3.0
3.5	250	3.5	330	3.5
4.0	210	4.0	280	4.0
4.5	170	4.5	220	4.5
5.0	140	5.0	180	5.0
6.0	91	6.0	120	6.0
7.0	60	7.0	81	7.0
8.0	39	8.0	55	8.0
9.0	26	9.0	36	
		10.0	23	
		11.00		
		12.00		

Appendix A.3

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY - 8/15/88

BYERS LAKE

Station A		Station B		
Secchi Disk = 5.75 m		Secchi Disk =5.75 m		Secchi Disk =
Depth = 30 m		Depth = 26 m		Depth =
I	7500	I	5000	I
SS	2500	SS	2500	SS
0.5	2200	0.5	2000	0.5
1.0	1900	1.0	1800	1.0
1.5	1500	1.5	1600	1.5
2.0	1000	2.0	1200	2.0
2.5	950	2.5	800	2.5
3.0	850	3.0	680	3.0
3.5	500	3.5	400	3.5
4.0	450	4.0	350	4.0
4.5	390	4.5	300	4.5
5.0	250	5.0	250	5.0
6.0	210	6.0	150	6.0
7.0	140	7.0	70	7.0
8.0	90	8.0	45	8.0
9.0	45	9.0	30	
10.00	27	10.0	20	
11.00	19	11.00	13	
12.00	12	12.00	8	
13.00	8	13.00	5	
14.00	6	14.00	3	
15.00	3	15.00	3	
16.00	2	16.00	2	
17.00	2	17.00	1	
18.00	1	18.00	1	
19.00	1	19.00	1	
20.00	0	20.00	0	
21.00	0	21.00		

Appendix A.4

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
WEDNESDAY - 9/7/88

BYERS LAKE

Station A		Station B			
Secchi Disk = 5.7 m		Secchi Disk =		Secchi Disk =	
Depth = 54 m		Depth =		Depth =	
I	6000	I		I	
SS	2900	SS		SS	
0.5	2100	0.5		0.5	
1.0	1300	1.0		1.0	
1.5	1100	1.5		1.5	
2.0	900	2.0		2.0	
2.5	580	2.5		2.5	
3.0	500	3.0		3.0	
3.5	370	3.5		3.5	
4.0	280	4.0		4.0	
4.5	210	4.5		4.5	
5.0	150	5.0		5.0	
6.0	97	6.0		6.0	
7.0	58	7.0		7.0	
8.0	30	8.0		8.0	
9.0		9.0			
		10.0			
		11.00			
		12.00			

Appendix A.5

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
WEDNESDAY - 7/6/88

CASWELL LAKE

Station A		Station B		Station C	
Secchi Disk = 4.2 m		Secchi Disk = 3.8 m		Secchi Disk = 4.2 m	
Depth =		Depth =		Depth = 5.5 M	
I	2300	I	2200	I	2000
SS	1000	SS	1000	SS	950
0.5	600	0.5	610	0.5	540
1.0	490	1.0	490	1.0	410
1.5	390	1.5	390	1.5	330
2.0	310	2.0	320	2.0	280
2.5	260	2.5	260	2.5	230
3.0	200	3.0	200	3.0	180
3.5	160	3.5	160	3.5	140
4.0	120	4.0	120	4.0	110
4.5	90	4.5	94	4.5	86
5.0	66	5.0	71	5.0	62
6.0	35	6.0	35	6.0	39
7.0	19	7.0	18	7.0	
8.0		8.0		8.0	

Appendix A.6

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
WEDNESDAY 7/13/88

CASWELL LAKE

overcast

Station A	Station B		Station B
Secchi Disk =	Secchi Disk = 2.75 m		Secchi Disk =
Depth =	Depth = 15 m		Depth =
I	I	1800	I
SS	SS	700	SS
0.5	0.5	350	0.5
1.0	1.0	160	1.0
1.5	1.5	130	1.5
2.0	2.0	120	2.0
2.5	2.5	118	2.5
3.0	3.0	115	3.0
3.5	3.5	110	3.5
4.0	4.0	105	4.0
4.5	4.5	100	4.5
5.0	5.0	90	5.0
6.0	6.0	80	6.0
7.0	7.0	70	7.0
8.0	8.0	60	8.0
9.0	9.0	50	
	10.0	35	
	11.00	16	
	12.00	5	

Appendix A.7

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY 8/15/88

CASWELL LAKE

cloudy

Station A		Station B		
Secchi Disk = 4.25 m		Secchi Disk = 4.25 m		Secchi Disk =
Depth = 25 m		Depth = 15 m		Depth =
I	5500	I	5500	I
SS	3500	SS	4200	SS
0.5	3300	0.5	3500	0.5
1.0	2500	1.0	2000	1.0
1.5	1800	1.5	1300	1.5
2.0	1200	2.0	1200	2.0
2.5	1100	2.5	750	2.5
3.0	650	3.0	600	3.0
3.5	570	3.5	550	3.5
4.0	560	4.0	500	4.0
4.5	420	4.5	420	4.5
5.0	230	5.0	330	5.0
6.0	130	6.0	200	6.0
7.0	75	7.0	111	7.0
8.0	40	8.0	60	8.0
9.0	26	9.0	38	
		10.0	20	

Appendix A.8

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY 9/12/88

CASWELL LAKE

Rain/cloudy

Station A		Station B			
Secchi Disk = 5.5 m		Secchi Disk = n/a		Secchi Disk = 5.5 m	
Depth =		Depth =		Depth = 7.2 m	
I	1000	I		I	1100
SS	480	SS		SS	570
0.5	330	0.5		0.5	430
1.0	260	1.0		1.0	320
1.5	210	1.5		1.5	250
2.0	170	2.0		2.0	210
2.5	130	2.5		2.5	160
3.0	110	3.0		3.0	140
3.5	98	3.5		3.5	110
4.0	80	4.0		4.0	93
4.5	64	4.5		4.5	76
5.0	51	5.0		5.0	63
6.0	31	6.0		6.0	46
7.0	16	7.0		7.0	21
8.0	7	8.0		8.0	

Appendix A.8a

LIMNOLOGICAL OBSERVATIONS - SUSITNA RIVER DRAINAGE LAKES
WEDENSDAY - 7/27/88

CHELATNA LAKE

Calm and overcast

Station A		Station B			
Secchi Disk =		Secchi Disk =		Secchi Disk =	
Depth = 122 m		Depth =		Depth =	
I	2400	I		I	
SS	1500	SS		SS	
0.5	1200	0.5		0.5	
1.0	875	1.0		1.0	
1.5	620	1.5		1.5	
2.0	500	2.0		2.0	
2.5	375	2.5		2.5	
3.0	290	3.0		3.0	
3.5	270	3.5		3.5	
4.0	180	4.0		4.0	
4.5	150	4.5		4.5	
5.0	110	5.0		5.0	
6.0	74	6.0		6.0	
7.0	40	7.0		7.0	
8.0	18	8.0		8.0	
9.0	12	9.0			
10.0	7				
11.0	4				
12.0	3				
13.0	2				
14.0	2				
15.0	1				

Appendix A.8b

LIMNOLOGICAL OBSERVATIONS - SUSITNA RIVER DRAINAGE LAKES
WEDENSDAY - 8/24/88

CHELATNA LAKE

Partly cloudy and slight wind

Station A		Station B	Station B
Secchi Disk =		Secchi Disk =	Secchi Disk =
Depth = 125 m		Depth =	Depth =
I	8300	I	I
SS	4200	SS	SS
0.5	3000	0.5	0.5
1.0	2500	1.0	1.0
1.5	1700	1.5	1.5
2.0	1100	2.0	2.0
2.5	700	2.5	2.5
3.0	600	3.0	3.0
3.5	300	3.5	3.5
4.0	250	4.0	4.0
4.5	140	4.5	4.5
5.0	120	5.0	5.0
6.0	77	6.0	6.0
7.0	52	7.0	7.0
8.0	25	8.0	8.0
9.0	13	9.0	
10.0	6		
11.0	4		
12.0	2		
13.0	2		
14.0	1		
15.0	1		

Appendix A.8c

LIMNOLOGICAL OBSERVATIONS - SUSITNA RIVER DRAINAGE LAKES
SUNDAY - 9/25/88

CHELATNA LAKE

Partly cloudy and windy

Station A		Station B			
Secchi Disk = 3.25 m		Secchi Disk =		Secchi Disk =	
Depth =		Depth =		Depth =	
I	3000	I		I	
SS	1300	SS		SS	
0.5	1000	0.5		0.5	
1.0	850	1.0		1.0	
1.5	650	1.5		1.5	
2.0	450	2.0		2.0	
2.5	250	2.5		2.5	
3.0	200	3.0		3.0	
3.5	175	3.5		3.5	
4.0	150	4.0		4.0	
4.5	125	4.5		4.5	
5.0	100	5.0		5.0	
6.0	75	6.0		6.0	
7.0	55	7.0		7.0	
8.0	43	8.0		8.0	
9.0	32	9.0			
10.0	24				
11.0	18				
12.0	14				
13.0	10				
14.0	8				
15.0	6				

Appendix A.9

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
THRUSDAY - 7/28/88

EIGHTMILE LAKE, SKWENTNA AREA

Station A		Station B			
Secchi Disk = 4.0 m		Secchi Disk =		Secchi Disk =	
Depth = 11 m		Depth =		Depth =	
I	2900	I		I	
SS	1300	SS		SS	
0.5	600	0.5		0.5	
1.0	400	1.0		1.0	
1.5	280	1.5		1.5	
2.0	190	2.0		2.0	
2.5	140	2.5		2.5	
3.0	100	3.0		3.0	
3.5	52	3.5		3.5	
4.0	32	4.0		4.0	
4.5	18	4.5		4.5	
5.0	11	5.0		5.0	
6.0	4	6.0		6.0	
7.0	2	7.0		7.0	
8.0	1	8.0		8.0	
9.0	1	9.0			

Appendix A.10

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

FISH CREEK LAKE, SKWENTNA RIVER

Station A		Station B			
Secchi Disk = 3.25 m		Secchi Disk =		Secchi Disk =	
Depth = 8 m		Depth =		Depth =	
I	3000	I		I	
SS	1500	SS		SS	
0.5	1000	0.5		0.5	
1.0	600	1.0		1.0	
1.5	450	1.5		1.5	
2.0	320	2.0		2.0	
2.5	200	2.5		2.5	
3.0	140	3.0		3.0	
3.5	100	3.5		3.5	
4.0	70	4.0		4.0	
4.5	45	4.5		4.5	
5.0	34	5.0		5.0	
6.0	30	6.0		6.0	
7.0	22	7.0		7.0	
8.0		8.0		8.0	
9.0		9.0			

Appendix A.11

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

FISH LAKE, SUSITNA RIVER NEAR TALKEETNA

Windy and Overcast

Station A		Station B		
Secchi Disk = 2.75 m		Secchi Disk =		Secchi Disk =
Depth = 9 m		Depth =		Depth =
I	2300	I		I
SS	1300	SS		SS
0.5	1000	0.5		0.5
1.0	700	1.0		1.0
1.5	600	1.5		1.5
2.0	450	2.0		2.0
2.5	350	2.5		2.5
3.0	200	3.0		3.0
3.5	165	3.5		3.5
4.0	115	4.0		4.0
4.5	90	4.5		4.5
5.0	70	5.0		5.0
6.0	68	6.0		6.0
7.0	34	7.0		7.0
8.0	13	8.0		8.0
9.0		9.0		

Appendix A.12

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
SATURDAY - 7/15/88

JUDD LAKE

Sunny 2:21 PM

Station 1		Station 2	Station 3
Secchi Disk = 8.5 m		Secchi Disk = 9 m	Secchi Disk = 9
Depth = 29 m		Depth = 35 m	Depth = 24 m
I	5000	I	I
SS	3500	SS	SS
0.5	3000	0.5	0.5
1.0	3000	1.0	1.0
1.5	2500	1.5	1.5
2.0	2000	2.0	2.0
2.5	1800	2.5	2.5
3.0	2000	3.0	3.0
3.5	1700	3.5	3.5
4.0	1500	4.0	4.0
4.5	1300	4.5	4.5
5.0	1100	5.0	5.0
6.0	850	6.0	6.0
7.0	700	7.0	7.0
8.0	570	8.0	8.0
9.0	470		
10.0	400		
11.0	350		
12.0	270		
13.0	350		
14.0	190		
15.0	160		
16.0	140		
17.0	95		
18.0	75		
19.0	61		
20.0	45		
21.0	40		

comments: water is very clear.

Appendix A. 13

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY - 7/18/88

JUDD LAKE

Scattered clouds

Station 1	Station 2		Station 3
Secchi Disk =	Secchi Disk = 9.6 m		Secchi Disk =
Depth =	Depth = 32.5 m		Depth =
I	I	3400	I
SS	SS	1500	SS
0.5	0.5	1200	0.5
1.0	1.0	970	1.0
1.5	1.5	880	1.5
2.0	2.0	850	2.0
2.5	2.5	810	2.5
3.0	3.0	750	3.0
3.5	3.5	700	3.5
4.0	4.0	640	4.0
4.5	4.5	570	4.5
5.0	5.0	520	5.0
6.0	6.0	400	6.0
7.0	7.0	330	7.0
8.0	8.0	260	8.0
9.0	9.0	200	
10.0	10.0	150	
11.0	11.0	120	
12.0	12.0	93	
13.0	13.0	72	
14.0	14.0	55	
15.0	15.0	43	
16.0	16.0	32	

Appendix A.14

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - 8/12/88

JUDD LAKE

5:45PM

Station 1	Station 2	Station 3
Secchi Disk =	Secchi Disk = 9.5m	Secchi Disk =
Depth =	Depth =	Depth =

comments: An additional two stations were added on either side of station 2 during this survey. The station nearest the Talachulitna River had a secchi disk reading of 10.0m. The station on the opposite side had 11.0m.

Appendix A.15

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 9/6/88

JUDD LAKE

Scattered clouds

Station 1	Station 2		Station 3
Secchi Disk =	Secchi Disk = 7.2 m		Secchi Disk =
Depth =	Depth =		Depth =
I	I	1100	I
SS	SS	560	SS
0.5	0.5	470	0.5
1.0	1.0	400	1.0
1.5	1.5	320	1.5
2.0	2.0	300	2.0
2.5	2.5	290	2.5
3.0	3.0	280	3.0
3.5	3.5	250	3.5
4.0	4.0	220	4.0
4.5	4.5	200	4.5
5.0	5.0	180	5.0
6.0	6.0	140	6.0
7.0	7.0	120	7.0
8.0	8.0	100	8.0
9.0	9.0	85	
10.0	10.0	69	
11.0	11.0	56	
12.0	12.0	45	
13.0	13.0	36	
14.0	14.0	29	
15.0	15.0	24	
16.0	16.0	19	
17.0	17.0	15	
18.0	18.0	13	
19.0	19.0	10	
20.0			
21.0			

Appendix A.16

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
SATURDAY - 7/15/88

LOCKWOOD LAKE

Sunny 3:15 PM

Station 1		Station 2	Station 3
Secchi Disk = 2.5 m		Secchi Disk = 2.5 m	Secchi Disk =
Depth = 15 m		Depth = 13 m	Depth =
I	6000	I	I
SS	3000	SS	SS
0.5	1000	0.5	0.5
1.0	950	1.0	1.0
1.5	800	1.5	1.5
2.0	450	2.0	2.0
2.5	270	2.5	2.5
3.0	200	3.0	3.0
3.5	130	3.5	3.5
4.0	90	4.0	4.0
4.5	50	4.5	4.5
5.0	30	5.0	5.0
6.0		6.0	6.0
7.0		7.0	7.0
8.0		8.0	8.0

comments: water is very black, expected low light penetration.
time too short for third secchi disk reading.

Appendix A.17

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY - 7/18/88

LOCKWOOD LAKE

Partial clouds

Station A		Station B		
Secchi Disk = 4.3 m		Secchi Disk = 3.4 m		Secchi Disk =
Depth = 14 m		Depth = 15.5 m		Depth =
I	6100	I	6000	I
SS	3000	SS	3300	SS
0.5	1700	0.5	1600	0.5
1.0	900	1.0	950	1.0
1.5	670	1.5	540	1.5
2.0	350	2.0	350	2.0
2.5	230	2.5	220	2.5
3.0	140	3.0	140	3.0
3.5	88	3.5	87	3.5
4.0	55	4.0	55	4.0
4.5		4.5		4.5
5.0		5.0		5.0
6.0		6.0		6.0
7.0		7.0		7.0
8.0		8.0		8.0

Appendix A.18

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - 8/12/88

LOCKWOOD LAKE

7:30PM

Station 1	Station 2	Station 3
Secchi Disk = 2.5m	Secchi Disk =	Secchi Disk = 3.0m
Depth =	Depth =	Depth =

comments: A fourth station (station A on data sheets) was added in east basin of the lake. Secchi disk was 2.75 m and depth was 3.0 m.

Appendix A.19

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 9/6/88

LOCKWOOD LAKE

Cloudy

Station A		Station B		
Secchi Disk = 3.0 m		Secchi Disk = 3.5 m		Secchi Disk =
Depth = 14 m		Depth = 15.5 m		Depth =
I	1400	I	1500	I
SS	640	SS	710	SS
0.5	280	0.5	430	0.5
1.0	170	1.0	240	1.0
1.5	110	1.5	160	1.5
2.0	75	2.0	100	2.0
2.5	55	2.5	77	2.5
3.0	40	3.0	53	3.0
3.5	26	3.5	39	3.5
4.0	16	4.0	27	4.0
4.5	11	4.5	19	4.5
5.0		5.0	13	5.0
6.0		6.0		6.0
7.0		7.0		7.0
8.0		8.0		8.0

Appendix A.20

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
SATURDAY - 7/15/88

MOVIE LAKE

Sunny with small clouds 1:53 PM

Station 1		Station 2		Station 3	
Secchi Disk = 3.5 m		Secchi Disk = 3.5 m		Secchi Disk =	
Depth = 9 m		Depth = 18 m		Depth =	
I	7500	I	6500	I	
SS	3700	SS	4000	SS	
0.5	3000	0.5	3000	0.5	
1.0	2000	1.0	2000	1.0	
1.5	1500	1.5	1500	1.5	
2.0	900	2.0	1300	2.0	
2.5	700	2.5	750	2.5	
3.0	500	3.0	600	3.0	
3.5	350	3.5	420	3.5	
4.0	270	4.0	300	4.0	
4.5	200	4.5	220	4.5	
5.0	170	5.0	180	5.0	
6.0	120	6.0	95	6.0	
7.0	73	7.0	48	7.0	
8.0		8.0		8.0	

comments: water is very black, expected low light penetration.
north end of lake is deep end.

Appendix A.21

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - 8/12/88

MOVIE LAKE

4:30PM

Station 1	Station 2	Station 3
Secchi Disk = 3.5m	Secchi Disk = 3.5m	Secchi Disk = 4.0m
Depth =	Depth =	Depth =

comments: An additional station 3 was added after the July 15th survey. Location of this station was between stations 1 and 2 in middle of the lake.

Appendix A.22

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

NEIL LAKE, DESHKA RIVER

Clear and calm

Station A		Station B		
Secchi Disk = 3.75 m		Secchi Disk =3.75 m		Secchi Disk =
Depth = 7 m		Depth = 8 m		Depth =
I	6500	I	5500	I
SS	3600	SS	2800	SS
0.5	420	0.5	2600	0.5
1.0	300	1.0	1500	1.0
1.5	260	1.5	1400	1.5
2.0	250	2.0	1100	2.0
2.5	210	2.5	800	2.5
3.0	200	3.0	620	3.0
3.5	180	3.5	350	3.5
4.0	160	4.0	260	4.0
4.5	150	4.5	190	4.5
5.0	130	5.0	160	5.0
6.0	42	6.0	55	6.0
7.0	25	7.0	15	7.0
8.0		8.0		8.0
9.0		9.0		

Appendix A.23

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
SATURDAY - 7/15/88

PUNTILLA LAKE

Sunny 12:15 PM

Station 1		Station 2		Station 3	
Secchi Disk = 3 m		Secchi Disk = 3.5 m		Secchi Disk = 3 m	
Depth = 7.5 m		Depth = 9.0 m		Depth = 8 m	
I	5500	I		I	6200
SS	2700	SS		SS	3000
0.5	2000	0.5		0.5	2700
1.0	1700	1.0		1.0	2000
1.5	1300	1.5		1.5	2000
2.0	700	2.0		2.0	1800
2.5	500	2.5		2.5	1800
3.0	500	3.0		3.0	450
3.5	320	3.5		3.5	
4.0	600	4.0		4.0	
4.5	470	4.5		4.5	
5.0	350	5.0		5.0	
6.0	230	6.0		6.0	
7.0	150	7.0		7.0	
8.0	bottom	8.0		8.0	

comments: lake is green inb color, deepest spot is near center of lake, wind blowing plane too fast to use light meter accurately, so stopped

Appendix A. 24

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - 8/12/88

PUNTILLA LAKE

2:30 PM

Station 1	Station 2	Station 3
Secchi Disk = 3.5m	Secchi Disk = 5.0m	Secchi Disk = 4.5m
Depth = 7.5 m	Depth = 9.0 m	Depth = 8 m

comments:

Appendix A.25

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY- 8/12/88

RED SALMON

3:15 PM

Station 1	Station 2	Station 3
Secchi Disk = n/a	Secchi Disk = n/a	Secchi Disk = n/a
Depth = 3.5 m	Depth =	Depth =

comments: No readings made. Organic stained water with vegetated bottom.

Appendix A.26

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

SPINK LAKE, CHULITNA RIVER

Clear and calm

Station A		Station B		
Secchi Disk = 4.75 m		Secchi Disk =5.25 m		Secchi Disk =
Depth = 33 m		Depth = 26.5 m		Depth =
I	6000	I	4500	I
SS	3500	SS	2700	SS
0.5	3000	0.5	2500	0.5
1.0	2300	1.0	1800	1.0
1.5	1400	1.5	1300	1.5
2.0	1000	2.0	1100	2.0
2.5	750	2.5	920	2.5
3.0	550	3.0	750	3.0
3.5	475	3.5	600	3.5
4.0	320	4.0	525	4.0
4.5	250	4.5	450	4.5
5.0	200	5.0	350	5.0
6.0	160	6.0	210	6.0
7.0	75	7.0	130	7.0
8.0	42	8.0	78	8.0
9.0	28	9.0	38	
10.0	22	10.0	26	
11.0	16	11.0	19	
12.0	12	12.0	13	
13.0	8	13.0	9	
14.0	6	14.0	6	
15.0	5	15.0	4	
16.0	4	16.0	4	
17.0	3	17.0	3	
18.0	2	18.0	2	
19.0	2	19.0	2	
20.0	2	20.0	1	
21.0	1	21.0		
22.0	1	22.0		

Appendix A.27

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - 8/12/88

SUCKER LAKE

8:15PM

Station 1	Station 2	Station 3
Secchi Disk = Depth = 1.0m	Secchi Disk = Depth = 1.0m	Secchi Disk = 2.0 m Depth = 2.25m

comments: Vegetation throughout lake and the lake is organic in color. Very shallow and may freeze all the way to the bottom in winter.

Appendix A.28

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 8/16/88

SWAN LAKE, CHULITNA RIVER

Clear and calm

Station A		Station B		
Secchi Disk = 0.87 m		Secchi Disk =0.87 m		Secchi Disk =
Depth = 8 m		Depth = 3 m		Depth =
I	6000	I	5500	I
SS	3300	SS	3100	SS
0.5	1500	0.5	1500	0.5
1.0	640	1.0	550	1.0
1.5	250	1.5	220	1.5
2.0	120	2.0	110	2.0
2.5	56	2.5	45	2.5
3.0	22	3.0	20	3.0
3.5	5	3.5		3.5
4.0	3	4.0		4.0
4.5	0	4.5		4.5
5.0		5.0		5.0
6.0		6.0		6.0
7.0		7.0		7.0
8.0		8.0		8.0
9.0		9.0		

Appendix A.29

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
SATURDAY - 7/15/88

TRINITY LAKE

Sunny with small clouds 1:22 PM

Station 1		Station 2		Station 3	
Secchi Disk = 2.5 m		Secchi Disk = 2.5 m		Secchi Disk =2.5 m	
Depth = 10 m		Depth = 5.5 m		Depth = 4.5 m	
I	2100	I	7700	I	7300
SS	830	SS	3700	SS	3000
0.5	470	0.5	3000	0.5	2300
1.0	320	1.0	1700	1.0	1800
1.5	230	1.5	1400	1.5	1200
2.0	200	2.0	1100	2.0	830
2.5	110	2.5	700	2.5	470
3.0	90	3.0	500	3.0	350
3.5	40	3.5	330	3.5	290
4.0	25	4.0	250	4.0	180
4.5	17	4.5	200	4.5	160
5.0		5.0	140	5.0	bottom
6.0		6.0	65	6.0	
7.0		7.0	35	7.0	
8.0		8.0		8.0	

comments: water is very black, expected low light penetration. cloud in front of sun, especially during station 1 wind blowing plane makinf light meter depths erroneous especially at station 2.

Appendix A.30

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
MONDAY - 7/18/88

TRINITY LAKE

Scattered Clouds

Station A		Station B		
Secchi Disk = 3.0 m		Secchi Disk = 3.4 m		
Depth = 10 m		Depth = 11.2 m		
I	7300	I	3500	I
SS	3800	SS	1500	SS
0.5	2100	0.5	800	0.5
1.0	1400	1.0	510	1.0
1.5	820	1.5	350	1.5
2.0	550	2.0	250	2.0
2.5	420	2.5	170	2.5
3.0	300	3.0	120	3.0
3.5	220	3.5	88	3.5
4.0	150	4.0	67	4.0
4.5	100	4.5	45	4.5
5.0	77	5.0	33	5.0
6.0	37	6.0		6.0
7.0		7.0		7.0
8.0		8.0		8.0

Appendix A.31

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
WEDNESDAY - 7/27/88

TRINITY LAKE

Overcast

Station 1	Station A (near station 2 of other survey)		
Secchi Disk =	Secchi Disk = 3.5 m		Secchi Disk =
Depth =	Depth = 12m		Depth =
I	I	2300	I
SS	SS	1100	SS
0.5	0.5	640	0.5
1.0	1.0	450	1.0
1.5	1.5	300	1.5
2.0	2.0	210	2.0
2.5	2.5	160	2.5
3.0	3.0	110	3.0
3.5	3.5	65	3.5
4.0	4.0	54	4.0
4.5	4.5	36	4.5
5.0	5.0	29	5.0
6.0	6.0	15	6.0
7.0	7.0	9	7.0
8.0	8.0	5	8.0
	9.00	3	
	10.00	1	

Appendix A.32

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
FRIDAY - -8/12/88

TRINITY LAKE

3:45 PM

Station 1	Station 2	Station 3
Secchi Disk = n/a	Secchi Disk = 4.0m	Secchi Disk = 3.75m
Depth =	Depth =	Depth =

comments: An additional station (number 4) not completed in first survey was added at lake outlet. Secchi Disk reading = 2.5m

Appendix A.33

LIMNOLOGICAL OBSERVATIONS - SUSITNA DRAINAGE LAKES
TUESDAY - 9/6/88

TRINITY LAKE

Cloudy

Station A		Station B		
Secchi Disk = 2.8 m		Secchi Disk = 2.8 m		
Depth = 10 m		Depth = 11.2 m		
I	1700	I	1400	I
SS	870	SS	640	SS
0.5	570	0.5	380	0.5
1.0	320	1.0	210	1.0
1.5	210	1.5	140	1.5
2.0	150	2.0	98	2.0
2.5	100	2.5	71	2.5
3.0	71	3.0	53	3.0
3.5	49	3.5	41	3.5
4.0	37	4.0	29	4.0
4.5	29	4.5	22	4.5
5.0	21	5.0	16	5.0
6.0	11	6.0	8	6.0
7.0		7.0		7.0
8.0		8.0		8.0

Appendix A.34

LIMNOLOGICAL OBSERVATIONS - BELUGA RIVER DRAINAGE LAKES
FRIDAY - 7/8/88

COAL CREEK LAKE

Clear and calm

Station A		Station B			
Secchi Disk =		Secchi Disk =		Secchi Disk =	
Depth = 18.5 m		Depth =		Depth =	
I	7800	I		I	
SS	3200	SS		SS	
0.5	2500	0.5		0.5	
1.0	1500	1.0		1.0	
1.5	1000	1.5		1.5	
2.0	700	2.0		2.0	
2.5	650	2.5		2.5	
3.0	490	3.0		3.0	
3.5	400	3.5		3.5	
4.0	320	4.0		4.0	
4.5	240	4.5		4.5	
5.0	170	5.0		5.0	
6.0	120	6.0		6.0	
7.0	110	7.0		7.0	
8.0	60	8.0		8.0	
9.0	26	9.0			
10.0	14				
11.0	7				
12.0	4				