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An Estimate of Juvenile Fish Densities in Skilak and Kenai Lakes, Alaska Through the Use of Dual-Beam Hydroacoustic Techniques in 1990

by

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State of Alaska Walter J. Hickel, Governor

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ABSTRACT

The number and distribution of sockeye salmon *Oncorhynchus nerka* rearing in two glacial lakes of the Kenai River drainage was estimated from hydroacoustic surveys. Using dual-beam acoustic techniques we collected *in situ* target strength information for scaling of the echo integrator. The average target strength of fish was -55.45 dB in Skilak Lake and -55.93 dB in Kenai Lake. A decrease in target strength with depth was observed. Approximately 25.4 million sockeye salmon juveniles were estimated to reside in the lakes. The majority of fish were located in Skilak Lake. Trawl samples indicated that 97% of the sockeye salmon were age-0. The size of both age classes were small; the mean length and weight of age-0 sockeye salmon in Skilak Lake were 49.4 mm and 1.3 g. Age-1 fish in Skilak Lake had a mean length of 72.8 mm and 4.0 g.

KEY WORDS: hydroacoustic survey, sockeye salmon, target strength, glacial lake, Alaska, *Oncorhynchus nerka*

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) began investigations in 1972 to assess juvenile sockeye salmon *Oncorhynchus nerka* populations rearing in the major lakes of the Kenai River drainage (Figures 1, 2; Davis et al. 1973). As part of these investigations, juvenile sockeye salmon were collected from Skilak and Kenai Lakes using tow nets to estimate relative abundance, age structure, and growth (Davis et al. 1974, Namtvedt and Friese 1976). However, the inefficiency of tow netting restricted the usefulness of these data for abundance estimates (Waltemyer 1981). Therefore, in 1986 ADF&G began developing new methods using hydroacoustic equipment (Tarbox and King 1988a, 1988b).

Since 1986 annual fall hydroacoustic surveys have been conducted in Kenai and Skilak Lakes to develop a time series of juvenile sockeye salmon population estimates. Program objectives for the 1990 field investigation were to (1) estimate the number and spatial distribution of sockeye salmon juveniles in Kenai and Skilak Lakes, (2) determine the target strength distribution in both lakes using dual-beam hydroacoustic techniques, and (3) document the relative condition of juvenile sockeye salmon through length and weight measurements.

METHODS

Hydroacoustic surveys of Skilak and Kenai Lakes were conducted between late September and early October 1990 to assess the number of rearing sockeye salmon that had survived the summer. Because previous investigations of glacial lake systems on the Kenai Peninsula have shown that most sockeye salmon juveniles occur near the surface during daylight hours (Tarbox and King 1988a; Thorne 1981), surveys were conducted at night to maximize the available targets.

We used a stratified random sampling design for 1990 surveys to distribute sampling effort and provide an acceptable means of calculating sampling error (H. Geiger, ADF&G, Juneau, personal communication). We divided each lake into sub-basins and established survey transects randomly within each area. In 1990 the number of transects was increased to reduce the relative error to 0.25 for Skilak Lake and 0.3 for Kenai Lake (L.K. Brannian, ADF&G, Anchorage, personal communication). Our sample size was based on the average coefficient of variation observed from 1986 to 1989. Because of the configuration of Skilak Lake, a total of 13 transects perpendicular to shore were surveyed within three sub-basins (Figure 3). In Kenai Lake, a total of 27 transects were surveyed within five sub-basins (Figure 4). The Kenai Lake survey was conducted on 4 and 9 October. The Skilak Lake survey was completed on 26 and 27 September.

The hydroacoustic equipment used for data acquisition consisted of a Biosonics Inc.[1] Model 105 echo sounder with dual-beam receivers, a 420 kHz 6°/15° dual-beam transducer mounted in a body for towing,

[1]Use of a company's name does not constitute endorsement by ADF&G.

a Model 171 tape recorder interface, a Sony model SL-HF400 video cassette recorder and PCM-501ES digital audio processor, a chart recorder, and an oscilloscope. The selected pulse width was 0.4 ms and the pulse repetition rate was 5 pulses/s. Additional acoustic parameters used during data collection and processing are presented in Appendix A.1. Biosonics, Inc. calibrated the system prior to and following the surveys. The entire system was powered by 12 v batteries and carried in a 6.7 m vessel powered by a 150 hp outboard motor. Vessel speed along each transect was estimated to be 2.5 m/s. Both ends of each transect were marked with flashing lights prior to darkness. The transducer remained approximately 1 m below the water surface during surveys.

Dual-beam data recorded on video cassette tape were processed through a Biosonics, Inc. Model 181 dual-beam processor (King and Tarbox 1988). A returning pulse was accepted as a valid target if the amplitude was either below the bottom threshold of 9999 mV (-31.3 dB) or above the counting threshold of 200 mV (-65.3 dB). Single targets were separated from multiple targets if the pulse width was within 20% of the transmitted pulse width at -6 dB and -18 dB. The maximum half angle selected was 4°. Data were stratified by depth for analysis by 5-m increments starting 2 m below the transducer or 3 m below the water surface. Data were accepted for processing to a maximum depth of 102 m below the transducer in Kenai and Skilak Lakes because visual examination of oscilloscope traces and chart recordings indicated that few fish were present below this depth.

Data generated by the dual-beam processor were transferred to microcomputer data files for analysis using the Biosonics, Inc. software TS112 (version 1.116). Computations of mean target strength and backscattering cross section were made from individual echoes, and a hard copy was printed for each 5-m depth interval. Threshold effects on the target strength distribution were evaluated: Skilak Lake target strength data at 14.5 m and 24.5 m from -60 dB to the peak of the distribution were subjected to linear regression analysis. The dependent variable was number of targets and the independent variable was target strength. An estimate of the proportion of targets eliminated by the threshold criteria was then made by comparing this hypothetical distribution to the observed distribution.

Estimates of fish density were made for each transect by echo integration using a Biosonics, Inc. Model 120 echo integrator. Correction from the 40 log(R) setting used during data collection to the 20 log(R) used for data processing was accomplished by adjusting the B constant value for each depth stratum (Appendix A.1). The time varied gain (TVG) crossover for the system was 13.0 m.

The echo integrator compiled data in 1-min sequences along each transect and sent outputs to computer files for further reduction and analysis using the Biosonics, Inc. software Crunch (version 2.45). Raw integrator outputs were edited to remove data which resulted from false bottom echoes. Where this occurred, fish densities were estimated using the average densities of adjacent sequences at the same depth. Overall fish density was obtained by calculating the average edited integrator output value across the transect for each depth strata. These averages were multiplied by the integrator scaling factor derived from the mean backscattering cross section value obtained from the TS112 program. Mean backscattering cross section values were calculated for each depth strata using data from those transects where false bottom did not occur or did not influence the target strength data.

The total number of fish (N_{ij}) for area stratum i based on transect j was estimated across depth stratum k and consisted of the number of fish estimated by hydroacoustic gear in the midwater section (M_{ij}) plus an estimate of fish unavailable to the hydroacoustic gear because of their location near the surface (S_{ij}) or bottom (B_{ij}), or

$$N_{ij} = S_{ij} + M_{ij} + B_{ij} \quad . \tag{1}$$

The midwater component was estimated as

$$M_{ij} = \sum_{k=1}^{k} a_i \, w_{ijk} \, m_{ijk} \quad , \tag{2}$$

where a_i represented the surface area (m^2) of area stratum i, estimated using a planimeter and USGS maps of Skilak and Kenai Lakes, and w_{ijk} was the average depth (≤5m) of depth stratum k measured along transect j in area i. This depth would be less than the maximum 5 m if the bottom was detected within depth stratum k anytime along the transect. The mean fish density in area i depth k across transect j was m_{ijk} in number per m^3.

The estimated number of fish near the surface (0-3 m) in area i was

$$S_{ij} = a_{is} \, m_{ij1} \quad , \tag{3}$$

where a_{is} was the estimated volume (m^3) of the surface area stratum, or 0-3 m, and m_{ij1} was the mean fish density for the first ensonified depth strata (2-7 m below transducer) of transect j.

The estimated number of fish near the bottom was

$$B_{ij} = \sum_{k=1}^{k} b_{ijk} \, m_{ijk} \quad , \tag{4}$$

where b_{ijk} was the estimated volume (m^3) in area i of depth k which could not be ensonified due to the proximity of the bottom along transect j; and m_{ijk} was the estimated fish density (number per m^3) along transect j in area i depth k which was ensonified. In cases where all of depth strata k was along the bottom, the mean density m_{ijk-1} from the next shallower depth strata (k-1) was used.

The abundance in area i (N_i) became the mean across total abundance estimated by each transect j, or

$$N_i = J^{-1} \sum_{j=1}^{J} N_{ij} \quad , \tag{5}$$

and its variance was estimated as

$$V(N_i) = \sum_{j=1}^{j} (N_{ij} - N_i)^2 (J-1)^{-1} \quad . \tag{6}$$

Total abundance for each lake became the sum of its area estimates. Its variance became the sum of the area variances of equation (6).

In an effort to quantify species composition of measured fish targets, a midwater trawl sampling program was conducted during the day in Skilak Lake on 25 and 28 September 1990. A similar program was conducted in Kenai Lake between 2 and 11 October 1990. A total of 322 min were spent towing in Skilak Lake and 1,010 min in Kenai Lake. The trawl mouth opening was 6.1 m by 3.1 m, and trawl length was 14.9 m. Mesh size decreased from 7.62 cm at the mouth to 0.32 cm at the cod end liner. The gear was towed between two boats at approximately 2 m/s, and the majority of the tows were near the surface. The sampling methods were designed to collect a minimum of 300 fish from each sample area stratum of each lake. All captured fish were enumerated, identified, and preserved in 10% formalin. In the laboratory juvenile sockeye salmon were measured to the nearest mm (fork length), weighed to the nearest 0.1 g, and aged from scale samples using criteria outlined by Mosher (1969). Differences in age and species composition between areas were tested with chi-square analysis.

RESULTS

A total of 8,586 echoes in Kenai Lake and 16,700 in Skilak Lake were used to estimate target strength distributions. Mean target strength for Kenai Lake was -55.93 dB (Appendix A.2). As in past years, calculated mean target strengths decreased with depth. Near-surface measurements were -50.25 dB in contrast to -56.77 dB at a depth of 47 m. In Skilak Lake the mean target strength was -55.45 dB; the near-surface mean of -52.18 dB decreased to -56.27 dB at 47 m. At depths greater than 47 m target strengths were within 1 dB of the mean (Appendix A.3).

Individual transect data and estimated numbers of fish for each area surveyed by hydroacoustic techniques are presented in Appendices A.4 to A.43. Estimates of fish abundance in surface (Appendix A.44) and bottom areas (Appendices A.45, A.46) which were not available to the hydroacoustic gear contributed a maximum of 36% to an individual transect estimate (Kenai Lake, Area 1, transect 4); the Kenai Lake surface estimates contributed on average 4.1% and bottom estimates 3.5%. In Skilak Lake surface estimates contributed on average <5.8% and the bottom estimates <6.0%.

The total estimated number of fish in both lakes was 25,565,000 (Table 1). Approximately 11%, or 2,912,700 fish were found in Kenai Lake; the remaining 22,652,000 fish inhabited Skilak Lake. Approximately 61.2% of the fish in Skilak Lake were located in Area 2 which composed 39.0% of the

lake volume (Table 2). Within Kenai Lake 42.5% of the fish were located in Area 5 which composed 18.2% of the lake volume.

The depth distribution of fish between transects and areas was variable in Kenai Lake (Figures 5-10). The maximum density of fish observed in Kenai Lake was 0.0152 fish/m^3 between 7 and 12 m along transect 1 of Area 5 (Figure 10). Maximum density of fish observed varied from the 2-7 m strata to the 42-47 m strata along the remaining transects. Ten transects had maximum densities at the 22-27 m strata and six at 17-22 m.

Depth distribution of fish in Skilak Lake was more consistent than Kenai Lake (Figures 11-13). The maximum fish density observed in Skilak Lake was 0.021 fish/m^3 between 22-27 m along transect 3 of Area 2 (Figure 12). Maximum densities of fish were recorded in the 12-17 m depth range for 5 of the 13 transects. Seven transects had maximum densities deeper and one shallower in the water column.

A total of 5,153 fish were captured during netting operations in Skilak Lake and 3,127 in Kenai Lake. Sockeye salmon dominated both catches, representing 99.4% of the total catch for Skilak Lake. Analysis of individual area catches indicated no significant difference (*chi-square* = *5.00, P<0.005, df* = *2*) in sockeye salmon proportion between areas. Within Kenai Lake a significant difference (*chi-square* = *100.4, P<0.005, df* = *4*) was noted; individual area catches were used to apportion estimated targets to sockeye salmon (Table 3). The percentage of sockeye salmon in the catches ranged from 93.6% in Area 1 to 99.9% in Area 4. Other fish captured from both lakes included 39 sticklebacks (Gasterosteidae), 4 sculpins (Cottidae), 5 coho salmon *O. kisutch*, 13 Dolly Varden *Salvelinus malma*, 6 round whitefish *Prosopium cylindraceum*, 2 lake trout *S. namaycush*, and 1 lamprey (Petromyzontidae).

In Kenai Lake age-1. sockeye salmon made up 4.2% and age-0. 95.8% of the sample (N = 1546; Table 3). Within Skilak Lake a difference in age composition among areas was observed (*chi-square* = 13.7, P<0.005, df = 2), although, Area 1 and 2 were not significantly different: age-0 sockeye salmon were 97.9% of the sample for Area 1 and 2 (N = 645), but 93.4% in Area 3 (N = 317; Table 3).

Length and weight frequencies for each age class were well defined and quite distinct in both Skilak Lake (Figure 14) and Kenai Lake (Figure 15). In general, the size of both age classes was small: the mean length of age-0 sockeye salmon in Skilak Lake was 49.4 mm; the mean weight was 1.3 g. Age-1 fish in Skilak Lake had a mean length of 72.8 mm and weight of 4.0 g. Kenai Lake sockeye salmon at age were similar in size to those collected in Skilak Lake (Table 4).

Based on species and age composition data from trawl samples, the number of juvenile sockeye salmon in both lakes was estimated to be 25,387,000. Of this total, 24,619,000 were age-0 sockeye salmon produced by the 1989 spawning population and 768,000 were age-1 sockeye salmon produced by the 1988 spawning population (Table 3).

DISCUSSION

During the previous 5 years of investigation the authors have noted that target strengths have decreased with depth in both Skilak and Kenai Lake (Tarbox and King, 1988a, 1988b). Examination of Skilak Lake data (Figure 16) has revealed a relatively consistent pattern of decrease. Linear regression analysis of target strength to depth has resulted in R^2 values of 0.86 to 0.98. Coefficients of X have ranged from -0.11 to -0.12. In an effort to explain this phenomenon the sounder was recalibrated and the TVG verified to assure stability, precision, and accuracy (BioSonics, Inc., Seattle, personal communication). In the absence of equipment-related explanations, it appears that a decrease in signal strength could occur in these glacial lake systems and that some small targets at depth will not be counted. Evaluation of target strength data and counting threshold values at two depths (Figure 17) indicated that below-threshold targets could compose up to 10% of the population. However, biological factors such as gas bladder compression and fish orientation could also influence the measured values and should be evaluated.

Comparisons of Kenai River smolt abundance from the 1987 and 1988 brood years with fall juvenile estimates suggested that a reasonable relationship exists. In 1987 37 million age-0 sockeye were estimated in the two lakes (Figure 18). Smolt data including Hidden and Russian Lakes production indicated that approximately 30 million smolt exited the system from this brood year (King et al. 1990). In contrast, only 13 million age-0 sockeye salmon were estimated in the lakes from the 1988 brood year. Preliminary smolt data suggest only 5.4 million age-1 fish exited the system. Results from 1990 indicate <800,000 age-1 sockeye in the lakes. This reinforces the hypothesis that the 1988 brood year suffered extremely poor production for the level of escapement of 1 million adults. Kyle (ADF&G, Soldotna, personal communication) has observed that fall juvenile-to-smolt survival in Tustumena Lake 15 km south of the Kenai River averaged 70% from 1980 to 1990.

The relative distribution of juvenile sockeye salmon between Kenai and Skilak Lakes has been fairly consistent from 1986 to the present. Kenai Lake contribution has ranged from 11% to 17% during this period; mean contribution has been 14%. Because of ADF&G budget reductions and the United States Forest Service's commitments to other tasks, no consistent spawner distribution surveys are available to compare with production data. However, in 1982 and 1983 counting weir and ground surveys on Quartz and Ptarmigan Creek -- the major spawning areas above Kenai Lake -- estimated that 12% and 13% of the total drainage escapement spawned in these systems.

Juvenile sockeye distribution within Kenai Lake has been variable between years. During 1990, 42.5% of juvenile sockeye salmon were found in Area 5 in Kenai Lake. In previous years, on the other hand, highest densities were noted in Area 2 for 3 years and in Area 4 the remaining year. Hydrological and limnological data are presently being analyzed and will be included in the evaluation of rearing limitations (Koenings, ADF&G, Soldotna, personal communication). Distribution within Skilak Lake has been more even: most fish have historically been located in Areas 1 and 2, and this is consistent with the 1990 data.

Fish size in both lake systems in 1990 showed little variation from the previous 2 years of data. Juvenile sockeye salmon have averaged <50 mm (Figure 19) and weighed <13 g (Figure 20) despite the significant

variation in total fry numbers rearing in the system of 13 to 37 million fry. The potential for brood year interaction may be present, but analysis of this issue is beyond the scope of this report.

In summary, the hydroacoustic data appear to be providing useful information on the primary rearing environs of the Kenai River drainage. Data analysis from studies conducted during the winter of 1990 which may help clarify the signal loss issue will be published at a later date. Concern for fall juvenile sockeye salmon size and ultimate survival remains. The authors caution, however, that limnological data must be analyzed prior to reaching any conclusions about the cause and effect relationships and the influence of fish size on survival.

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Table 1 . Estimated number of fish available in Skilak and Kenai Lakes, Alaska in the fall of 1990.

Lake	Area	Transect	Estimated Number of Fish: Surface	Midwater	Bottom	Total	Area Mean	Variance
Skilak	1	1	6.8560E+05	5.6795E+06	6.1855E+05	6.9837E+06		
		2	7.0122E+05	5.3660E+06	8.0187E+05	6.8691E+06		
		3	1.5672E+05	3.9212E+06	3.8122E+05	4.4591E+06	4.8881E+06	2.8861E+12
		4	3.0956E+05	4.0847E+06	2.6556E+05	4.6598E+06		
		5	9.1564E+04	2.7157E+06	2.4176E+05	3.0490E+06		
		6	1.5246E+05	2.8209E+06	3.3477E+05	3.3081E+06		
	2	1	3.1499E+05	1.1596E+07	3.1596E+05	1.2227E+07		
		2	4.0142E+05	1.4218E+07	5.1278E+05	1.5132E+07	1.3855E+07	2.2023E+12
		3	4.3715E+05	1.3196E+07	5.7230E+05	1.4205E+07		
	3	1	2.5724E+05	2.2195E+06	9.9509E+04	2.5762E+06		
		2	2.0230E+05	2.1412E+06	6.6529E+04	2.4100E+06	3.9090E+06	5.7150E+12
		3	1.2683E+05	2.9433E+06	1.2028E+05	3.1904E+06		
		4	4.9761E+05	6.5713E+06	3.9050E+05	7.4594E+06		
	TOTAL						2.2652E+07	1.0803E+13
Kenai	1	1	1.9318E+04	5.3034E+05	6.4882E+04	6.1454E+05		
		2	0.0000E+00	6.7510E+05	6.0957E+04	7.3606E+05		
		3	4.5903E+04	3.8275E+05	7.1542E+04	5.0020E+05	4.7828E+05	2.6442E+10
		4	5.2960E+04	3.0670E+05	1.1556E+05	4.7522E+05		
		5	4.9748E+03	2.9336E+05	6.1651E+04	3.5999E+05		
		6	2.2820E+04	3.5270E+05	4.4253E+04	4.1977E+05		
		7	0.0000E+00	2.1982E+05	2.2394E+04	2.4221E+05		
	2	1	0.0000E+00	1.2462E+05	0.0000E+00	1.2462E+05		
		2	0.0000E+00	7.7334E+05	0.0000E+00	7.7334E+05		
		3	1.1209E+04	1.6922E+05	0.0000E+00	1.8043E+05	3.5403E+05	8.6284E+10
		4	2.6633E+04	3.1110E+05	0.0000E+00	3.3773E+05		
	3	1	5.2489E+02	3.7091E+05	0.0000E+00	3.7143E+05		
		2	2.1612E+04	1.3708E+05	0.0000E+00	1.5869E+05		
		3	2.8603E+03	6.8339E+04	0.0000E+00	7.1199E+04	1.6521E+05	1.4858E+10
		4	1.2177E+03	1.4606E+05	0.0000E+00	1.4728E+05		
		5	0.0000E+00	7.7458E+04	0.0000E+00	7.7458E+04		
	4	1	0.0000E+00	6.4827E+05	0.0000E+00	6.4827E+05		
		2	7.5356E+02	5.2795E+05	0.0000E+00	5.2870E+05		
		3	0.0000E+00	9.6224E+05	0.0000E+00	9.6224E+05	6.7698E+05	2.8432E+10
		4	0.0000E+00	6.6576E+05	0.0000E+00	6.6576E+05		
		5	0.0000E+00	5.7992E+05	0.0000E+00	5.7992E+05		
	5	1	3.6462E+05	1.8589E+06	0.0000E+00	2.2235E+06		
		2	9.2763E+04	1.6015E+06	0.0000E+00	1.6943E+06	1.2382E+06	4.1261E+11
		3	2.0461E+05	1.0088E+06	0.0000E+00	1.2134E+06		
		4	2.2396E+04	7.4055E+05	0.0000E+00	7.6295E+05		
		5	2.8858E+03	4.3707E+05	0.0000E+00	4.3996E+05		
		6	6.2334E+04	1.0326E+06	0.0000E+00	1.0949E+06		
	TOTAL						2.9127E+06	5.6863E+11
TOTAL FOR BOTH LAKES							2.5565E+07	1.1372E+13

Table 2. Areas and volumes used for fish density estimates in Kenai and Skilak Lakes, Alaska 1990.

	Skilak Lake		
Area	Surface Area ($m^3 \times 10^6$)	Volume ($m^3 \times 10^6$)	Density of Fish (%)
1	43.03 (43.5%)	1869.7 (34.0%)	21.6
2	33.46 (33.8%)	2145.0 (39.0%)	61.2
3	22.50 (22.7%)	1480.8 (27.0%)	17.2
Total	98.99 (100.0%)	5495.5 (100.0%)	100.0

	Kenai Lake		
Area	Surface Area ($m^3 \times 10^6$)	Volume ($m^3 \times 10^6$)	Density of Fish (%)
1	7.72 (13.9%)	246.5 (7.6%)	16.4
2	11.91 (21.5%)	727.3 (22.5%)	12.2
3	10.54 (19.0%)	701.7 (21.7%)	5.7
4	14.37 (25.9%)	972.4 (30.0%)	23.2
5	10.93 (19.7%)	590.4 (18.2%)	42.5
Total	55.47 (100.0%)	3238.3 (100.0%)	100.0

Table 3. Estimated contributions of age-0 and age-1 sockeye salmon to the total fish population in Kenai and Skilak Lakes, Alaska, in the fall of 1990.

Location	Total Fish	Estimated Sockeye Salmon	Percent Age-0	Total Age-0	Percent Age-1	Total Age-1
Skilak Lake						
Areas 1 & 2	18,743,100	18,630,641	97.9	18,239,397	2.1	391,244
Area 3	3,909,000	3,885,546	93.4	3,629,100	6.6	256,446
Total	22,652,100	22,516,187		21,868,497		647,690
Kenai Lake						
Area 1	478,280	447,670	95.8	428,868	4.2	18,802
Area 2	354,030	348,720	95.8	334,074	4.2	14,646
Area 3	165,210	162,567	95.8	155,739	4.2	6,828
Area 4	676,980	676,303	95.8	647,898	4.2	28,405
Area 5	1,238,200	1,235,724	95.8	1,183,824	4.2	51,900
Total	2,912,700	2,870,984		2,750,403		120,581
Total[1]	25,565,000	25,387,000		24,619,000		768,000

[1] Rounded to nearest 1000 fish.

Table 4. Age, length, and weight of sockeye salmon collected in Skilak and Kenai Lake, Alaska, in the fall of 1990.

		Age-0				Age-1			
Location	Date	Mean[1] Length (mm)	Standard Deviation (mm)	Mean Weight (g)	Standard Deviation (g)	Mean[1] Length (mm)	Standard Deviation (mm)	Mean Weight (g)	Standard Deviation (g)
Skilak Lake									
	9/26-28/90	49.4 (n=928)	4.3	1.3 (n=290)	0.3	72.8 (n=34)	3.3	4.0 (n=20)	0.4
Kenai Lake									
	10/9-11/90	52.0 (n=1484)	4.6	1.5 (n=490)	0.4	69.4 (n=62)	4.2	3.6 (n=22)	0.6

[1] Fork length.

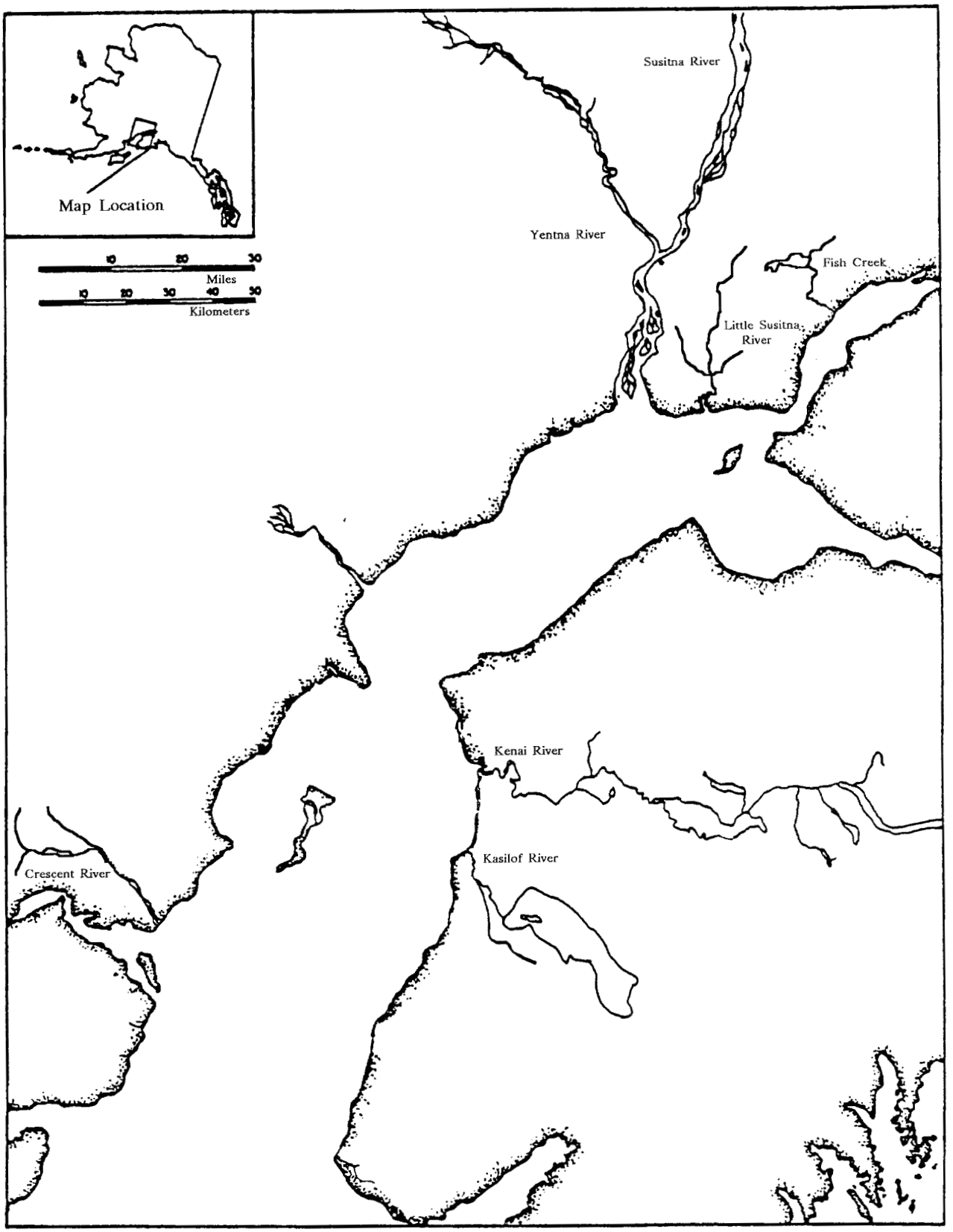

Figure 1. The Upper Cook Inlet area showing the locations of the Northern and Central Districts and the major sockeye salmon spawning drainages.

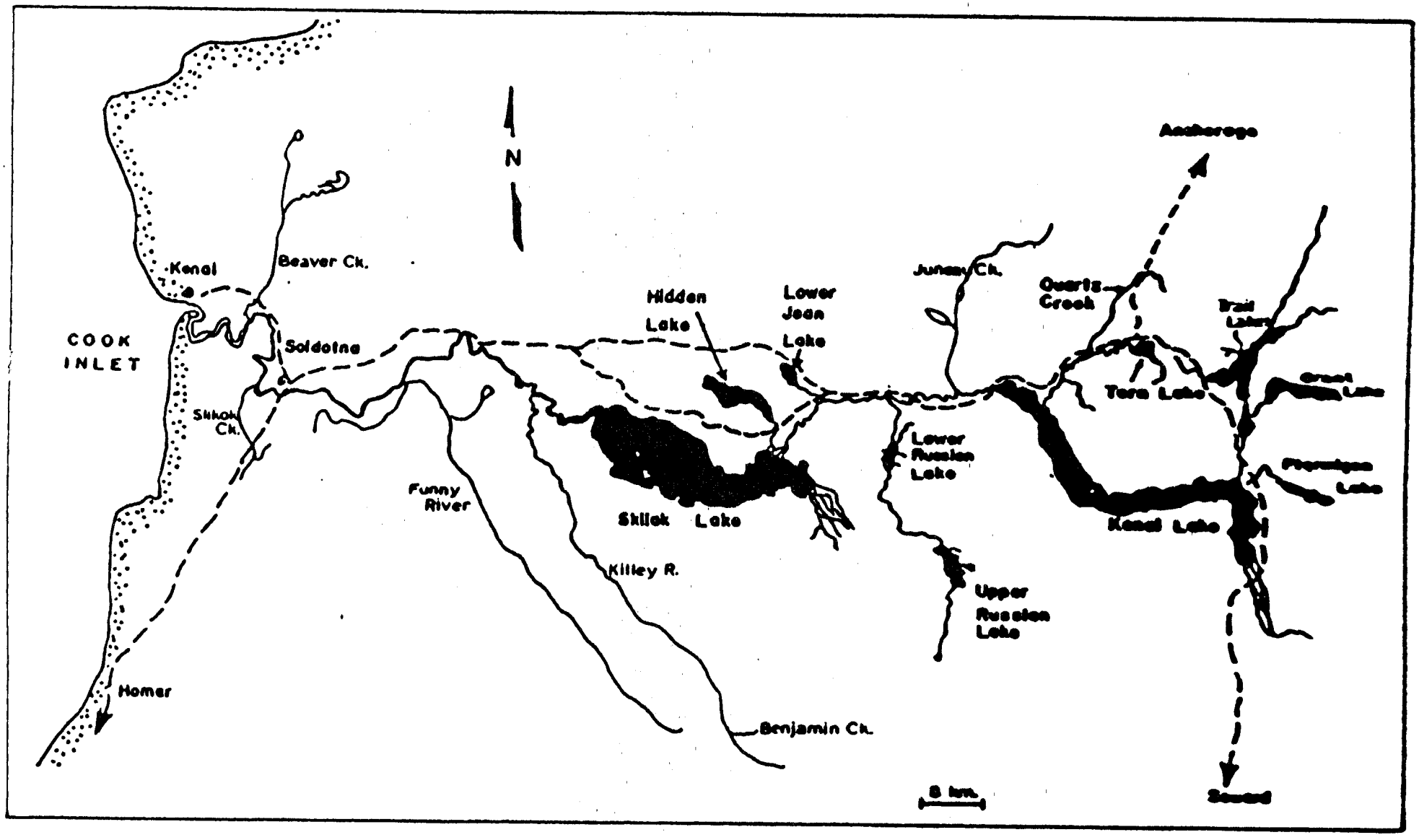

Figure 2. The location of the major lake systems, which are utilized by rearing sockeye salmon of the Kenai River, Alaska, drainage.

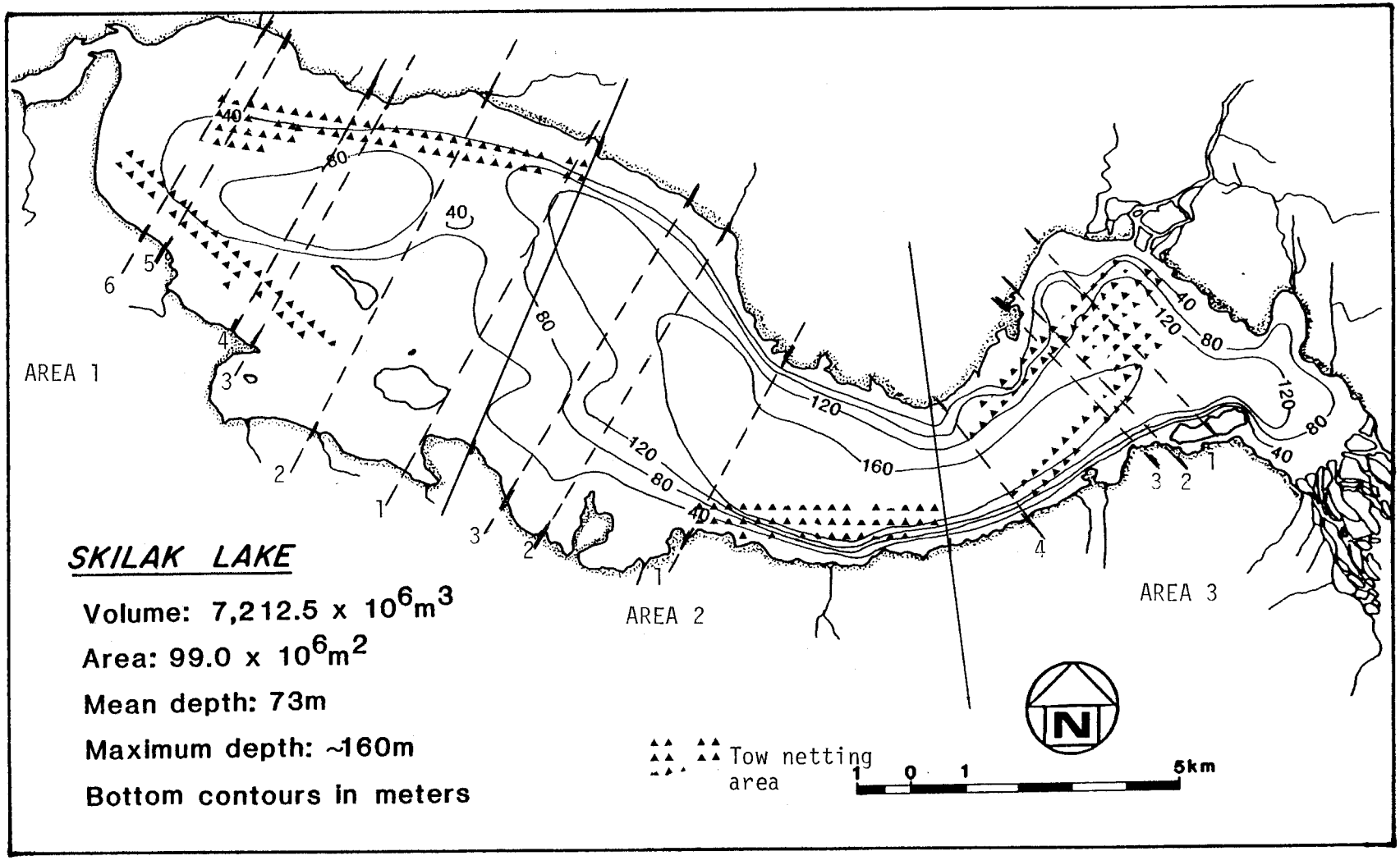

Figure 3. Skilak Lake, Alaska, area designations, hydroacoustic transect locations, and tow netting stations, 1990.

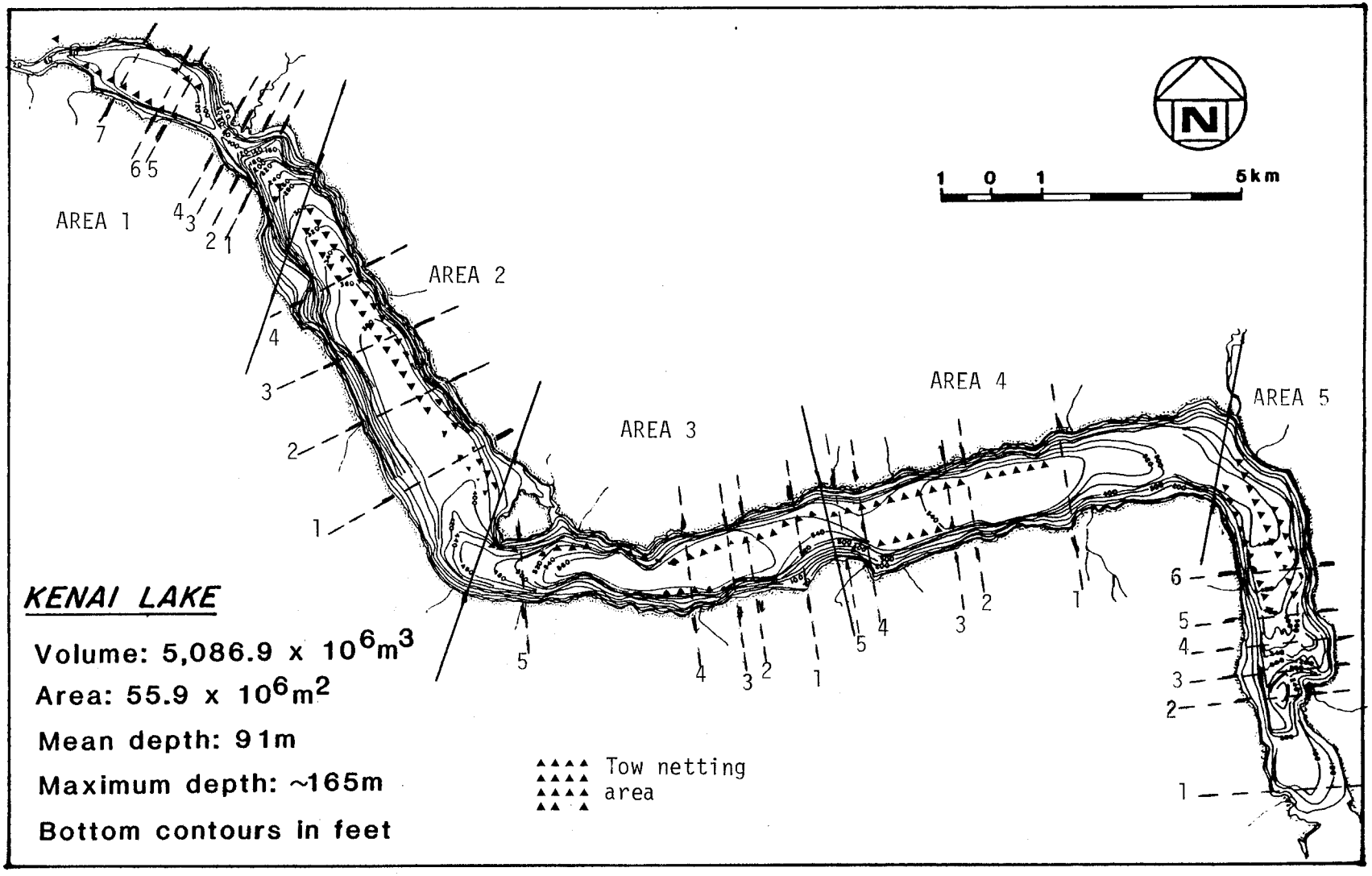

Figure 4. Kenai Lake, Alaska, area designations, hydroacoustic transect locations, and tow netting stations, 1990.

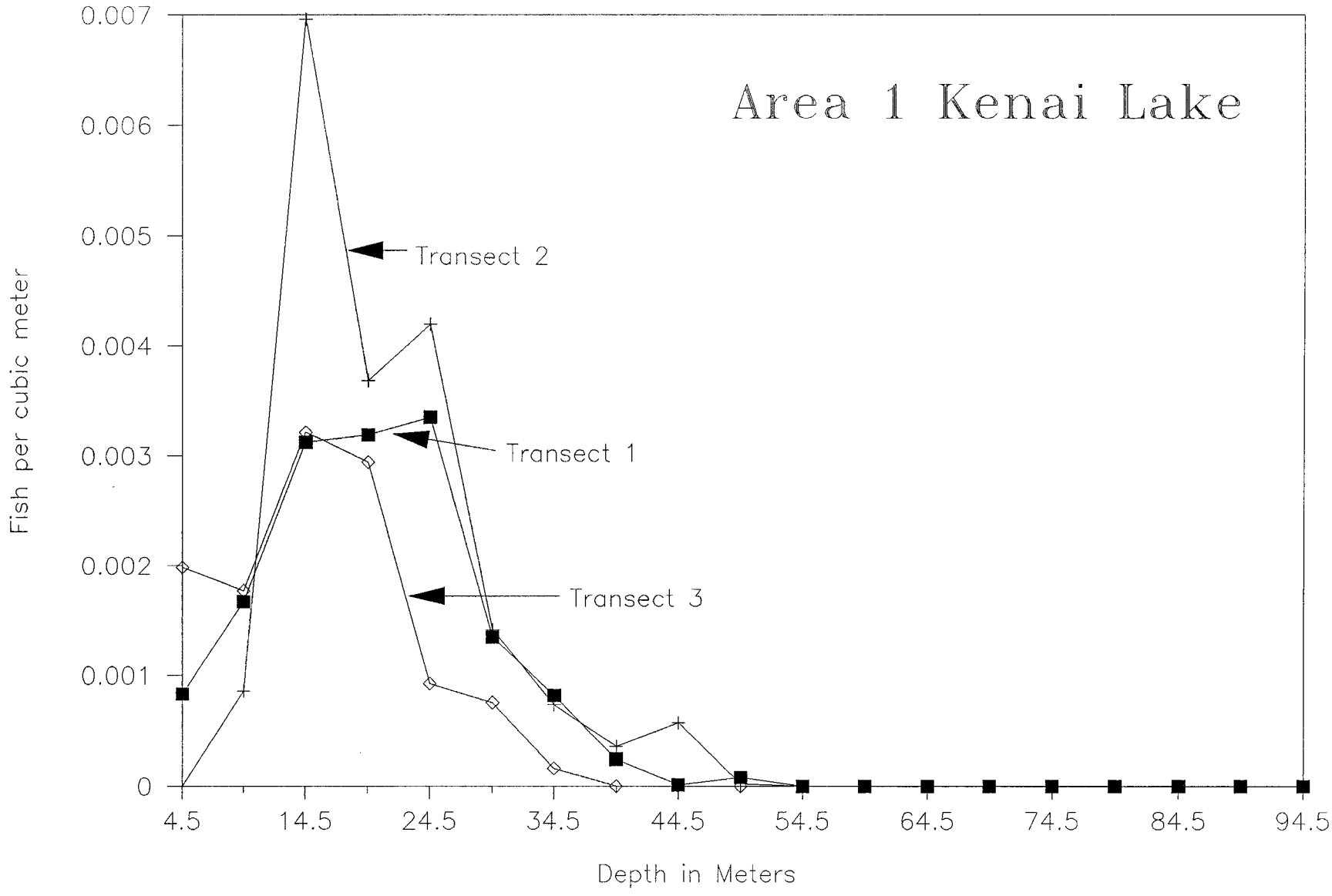

Figure 5. Fish density measured by depth in Area 1, Kenai Lake, Alaska. 1990. (transects 1 – 3)

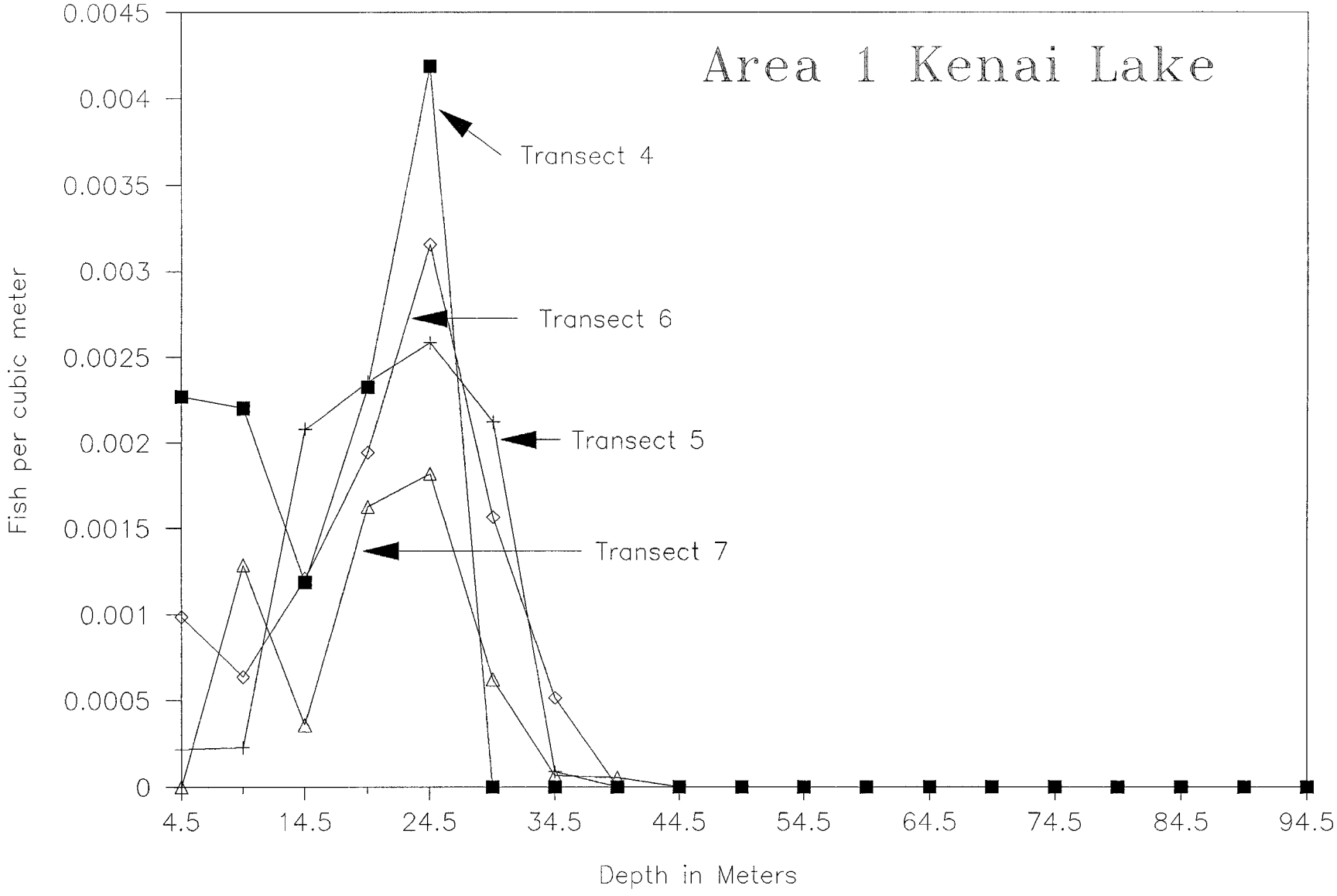

Figure 6. Fish density measured by depth in Area 1, Kenai Lake, Alaska. 1990. (Transects 4 through 7).

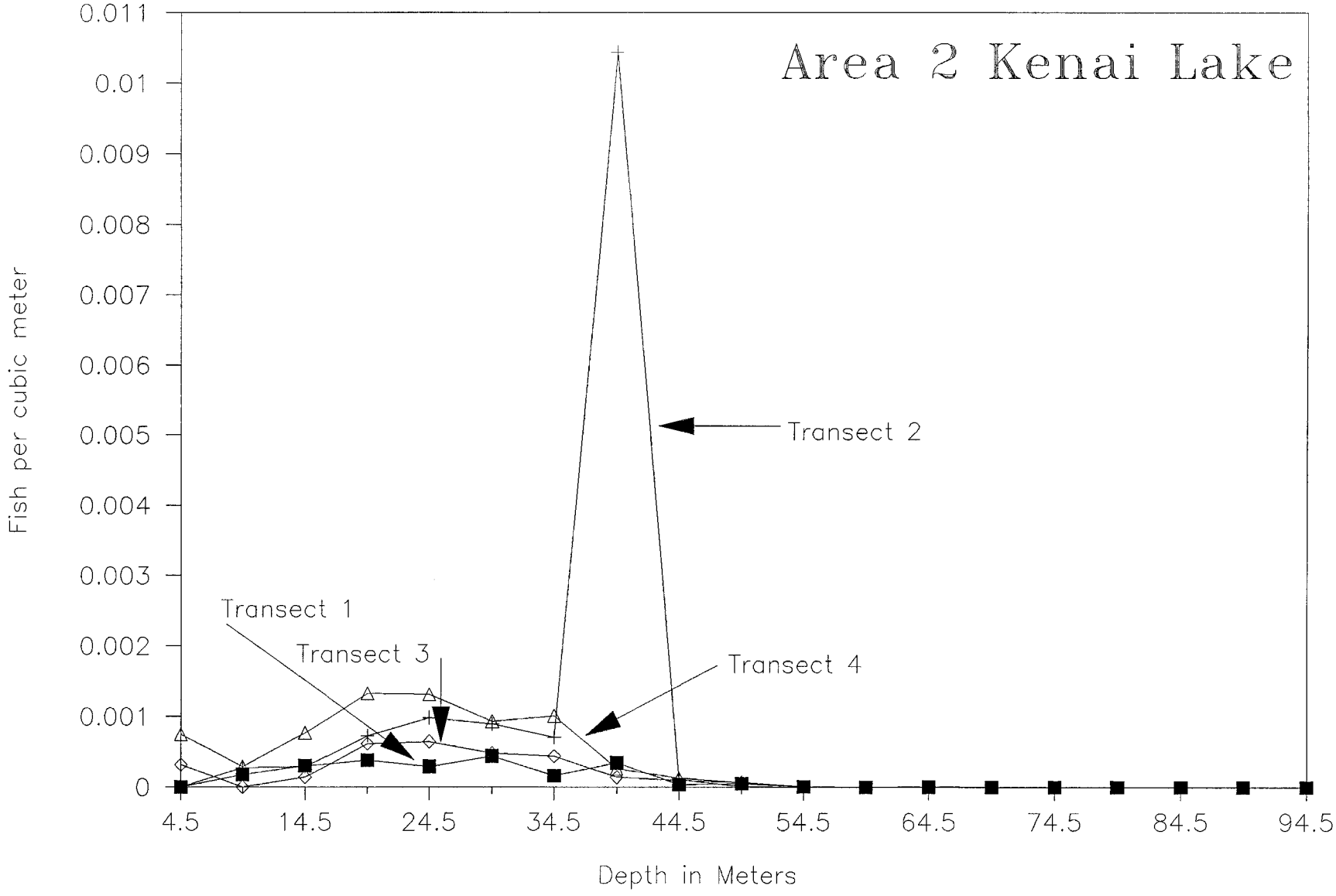

Figure 7. Fish density measured by depth in Area 2, Kenai Lake, Alaska. 1990.

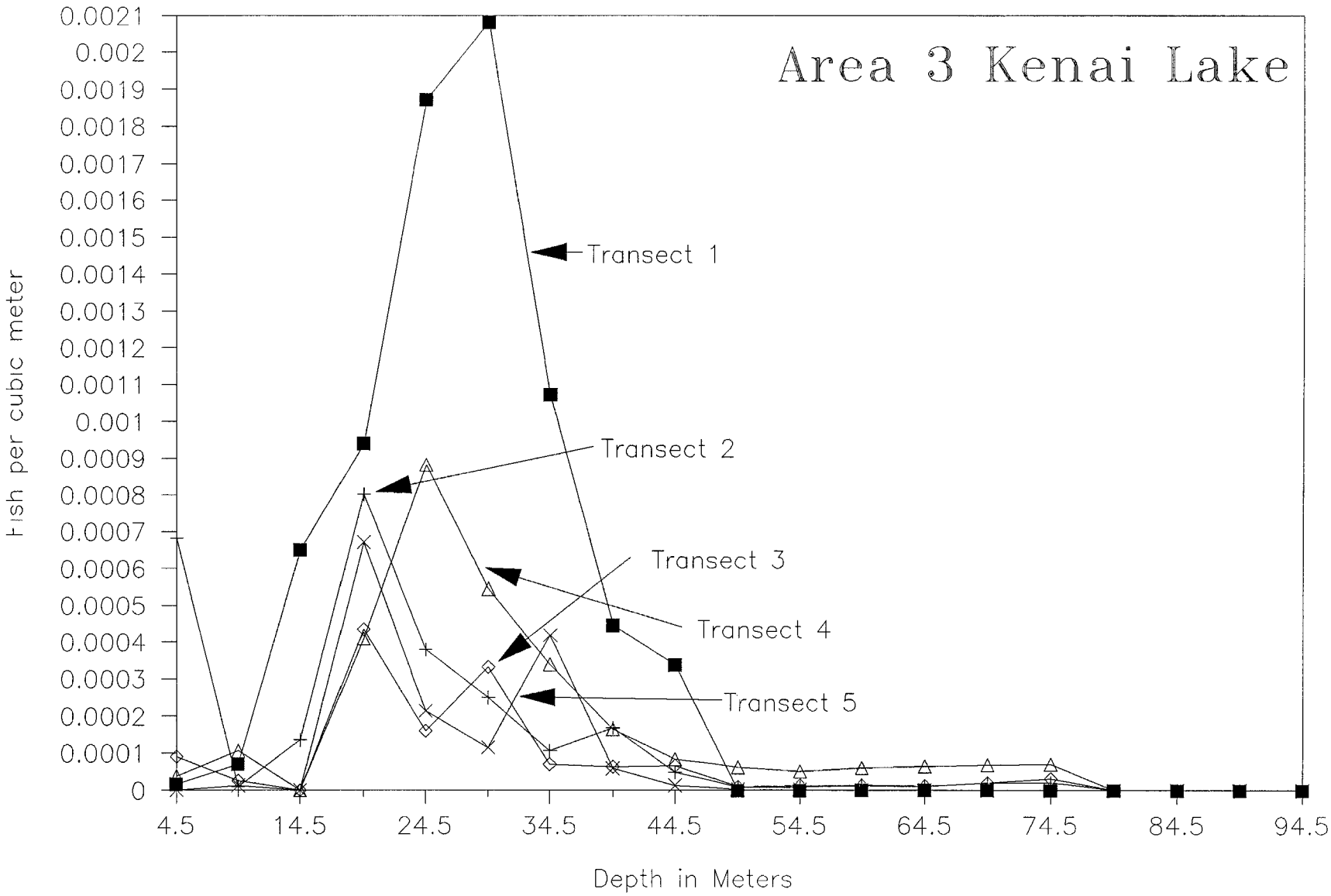

Figure 8. Fish density measured by depth in Area 3, Kenai Lake, Alaska. 1990.

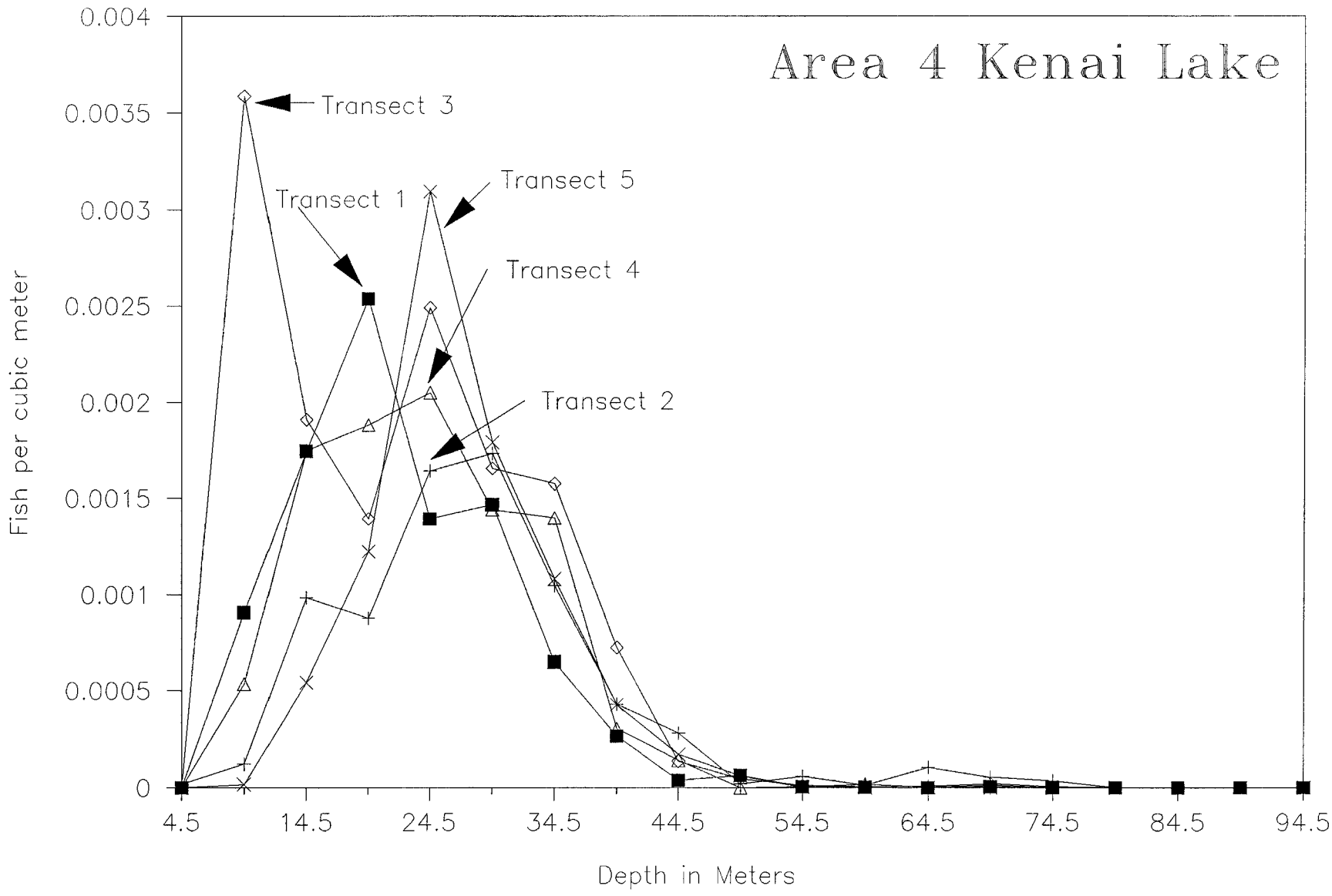

Figure 9. Fish density measured by depth in Area 4, Kenai Lake, Alaska. 1990.

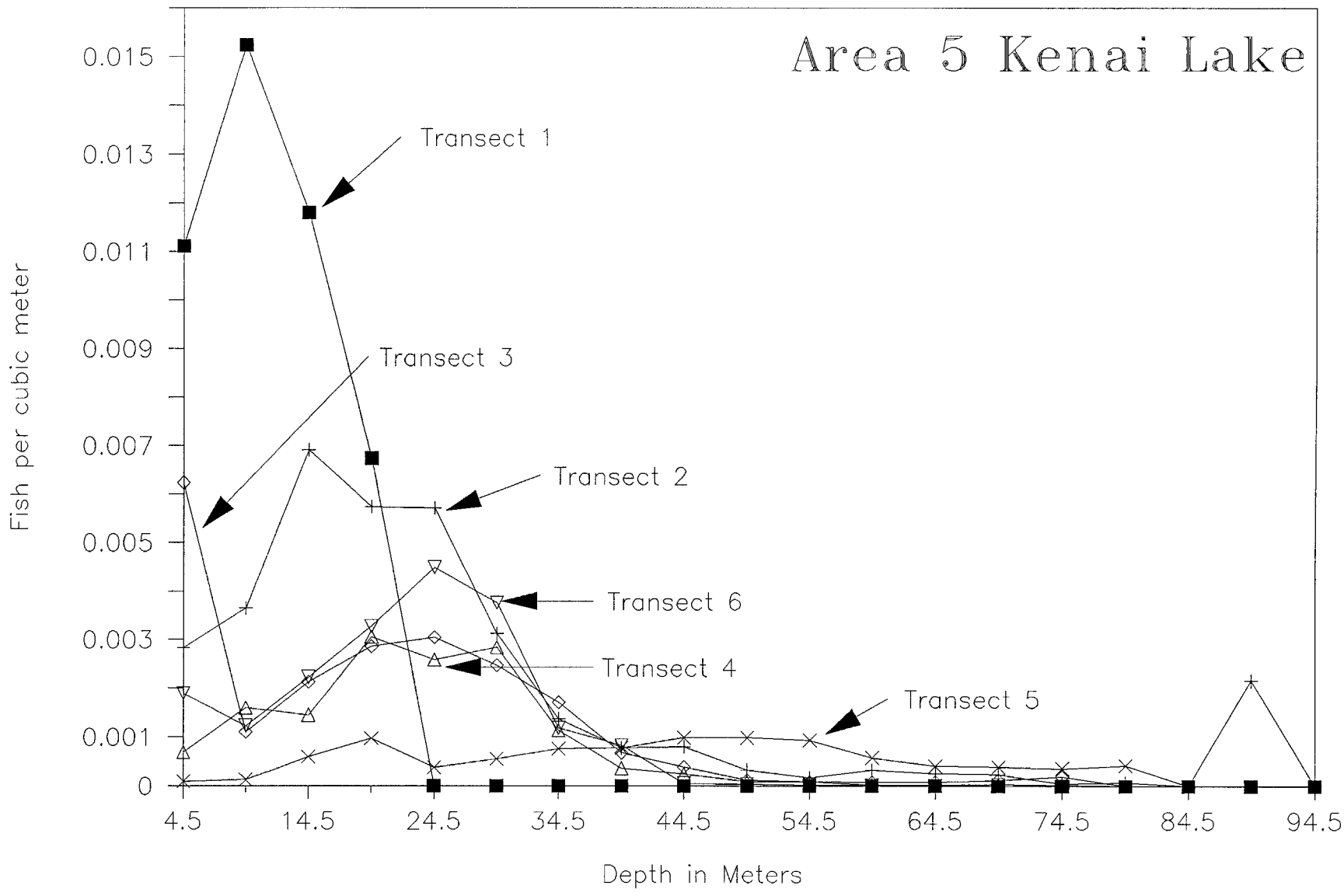

Figure 10. Fish density measured by depth in Area 5, Kenai Lake, Alaska. 1990.

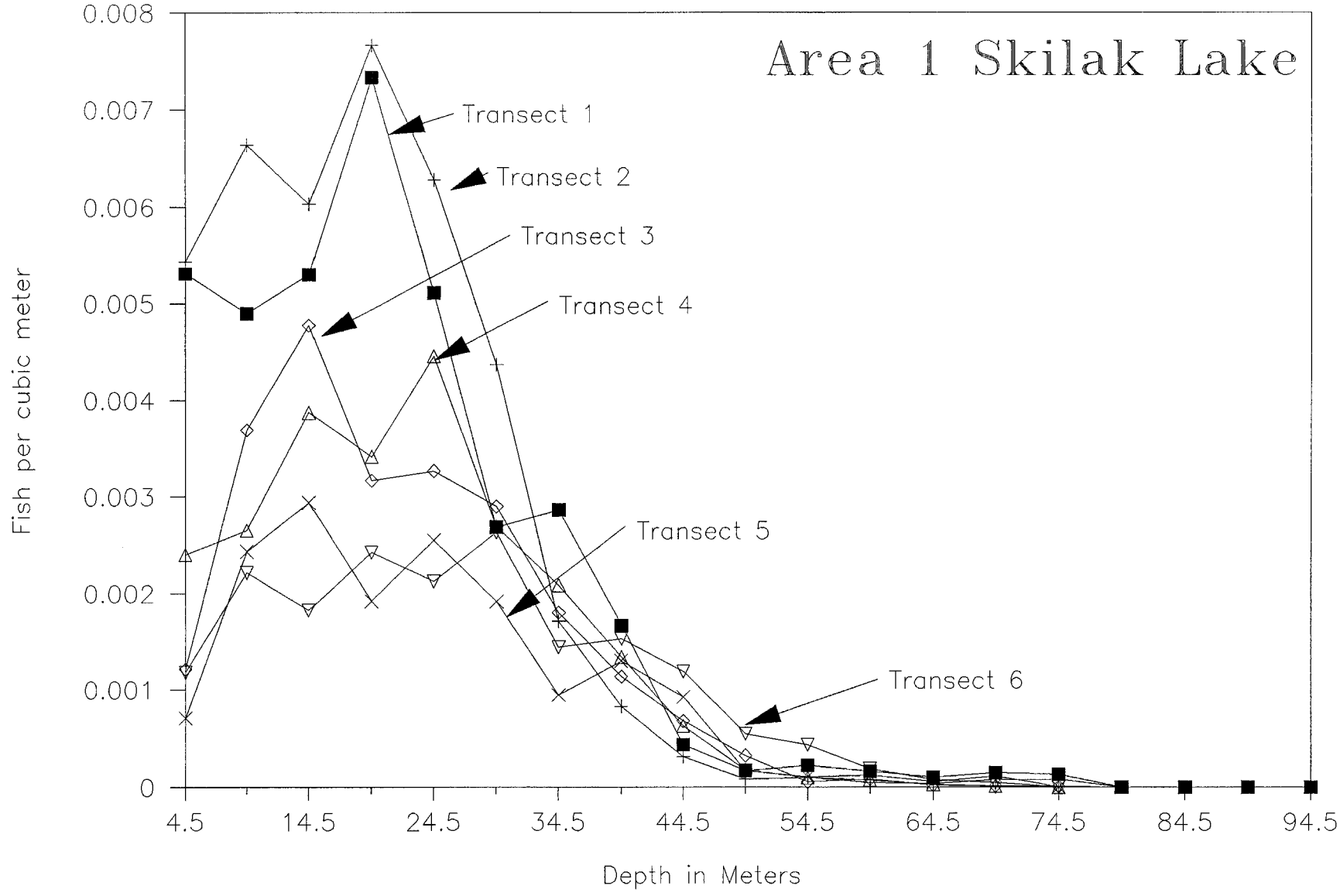

Figure 11. Fish density measured by depth in Area 1, Skilak Lake, Alaska.1990.

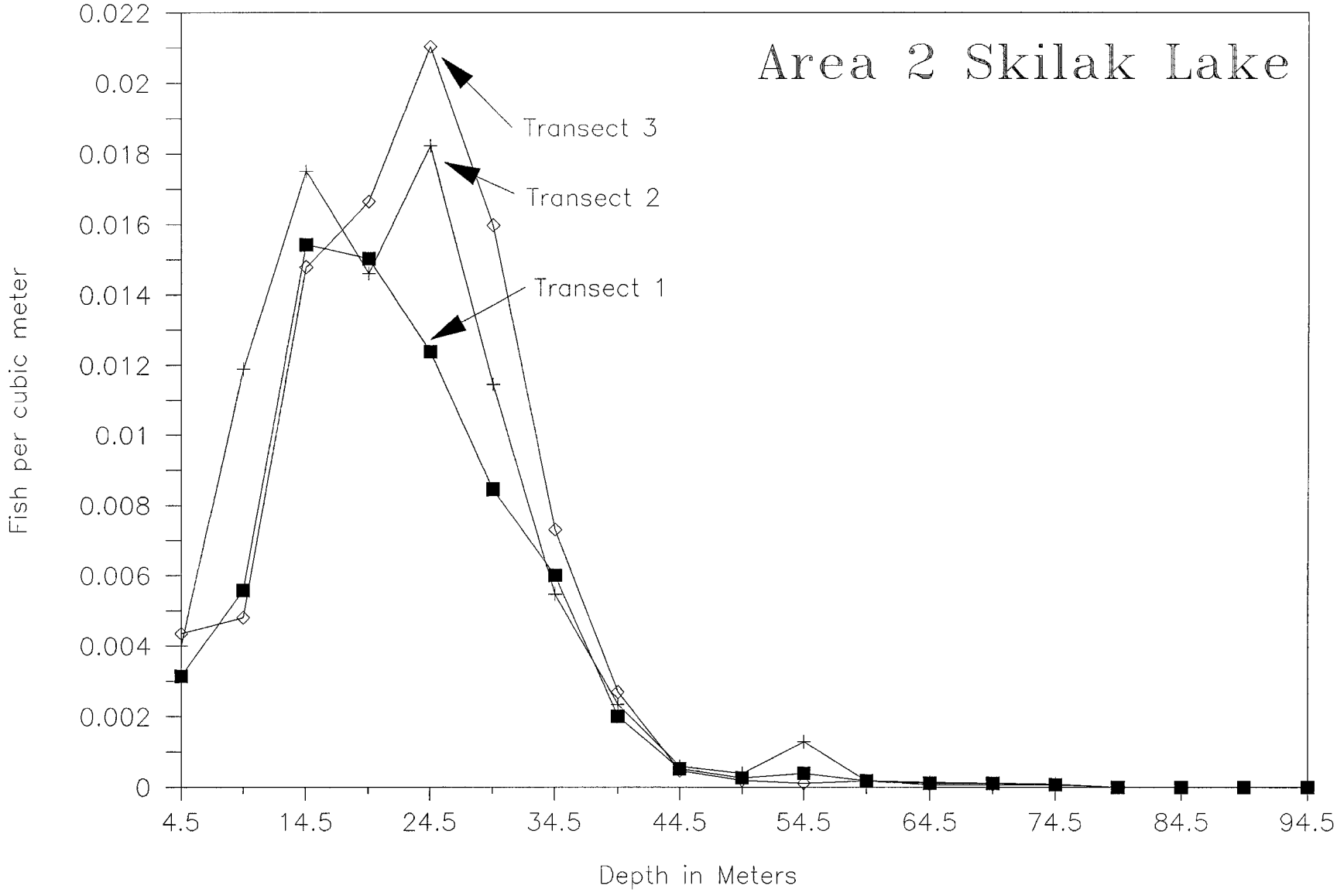

Figure 12. Fish density measured by depth in Area 2, Skilak Lake, Alaska.1990.

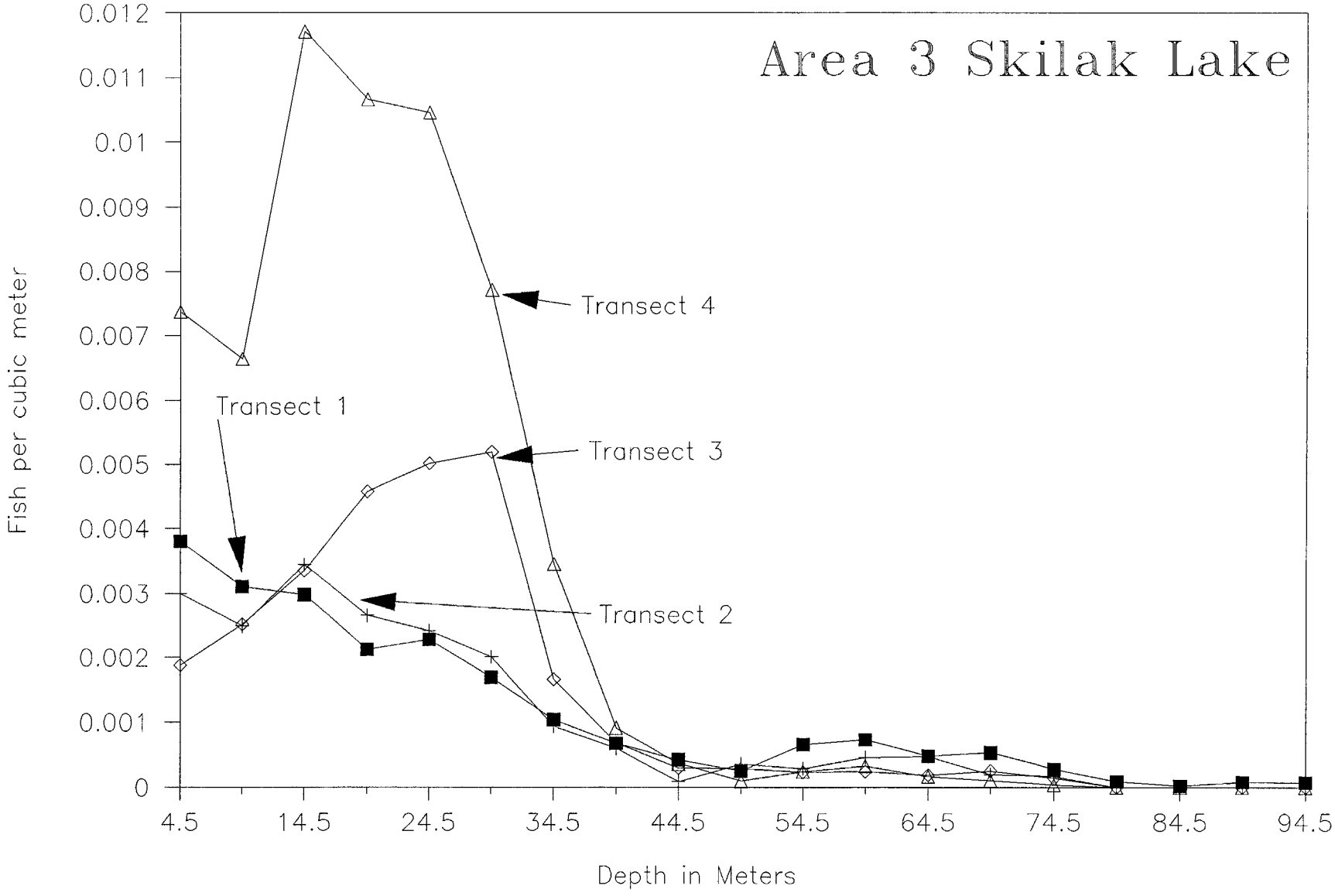

Figure 13. Fish density measured by depth in Area 3, Skilak Lake, Alaska.1990.

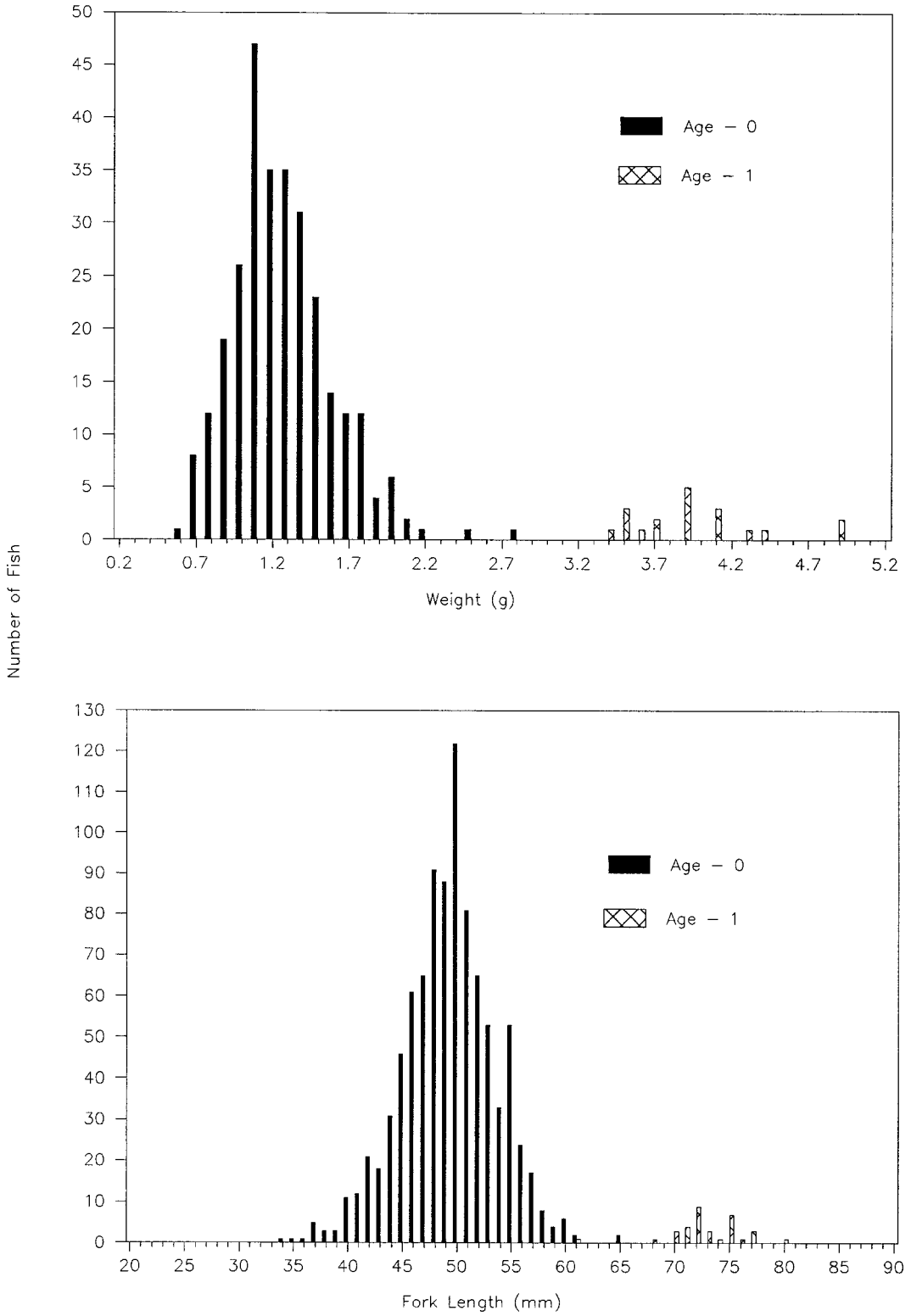

Figure 14. Weight (upper) and fork length (lower) of sockeye salmon in Skilak Lake, Alaska, 1990.

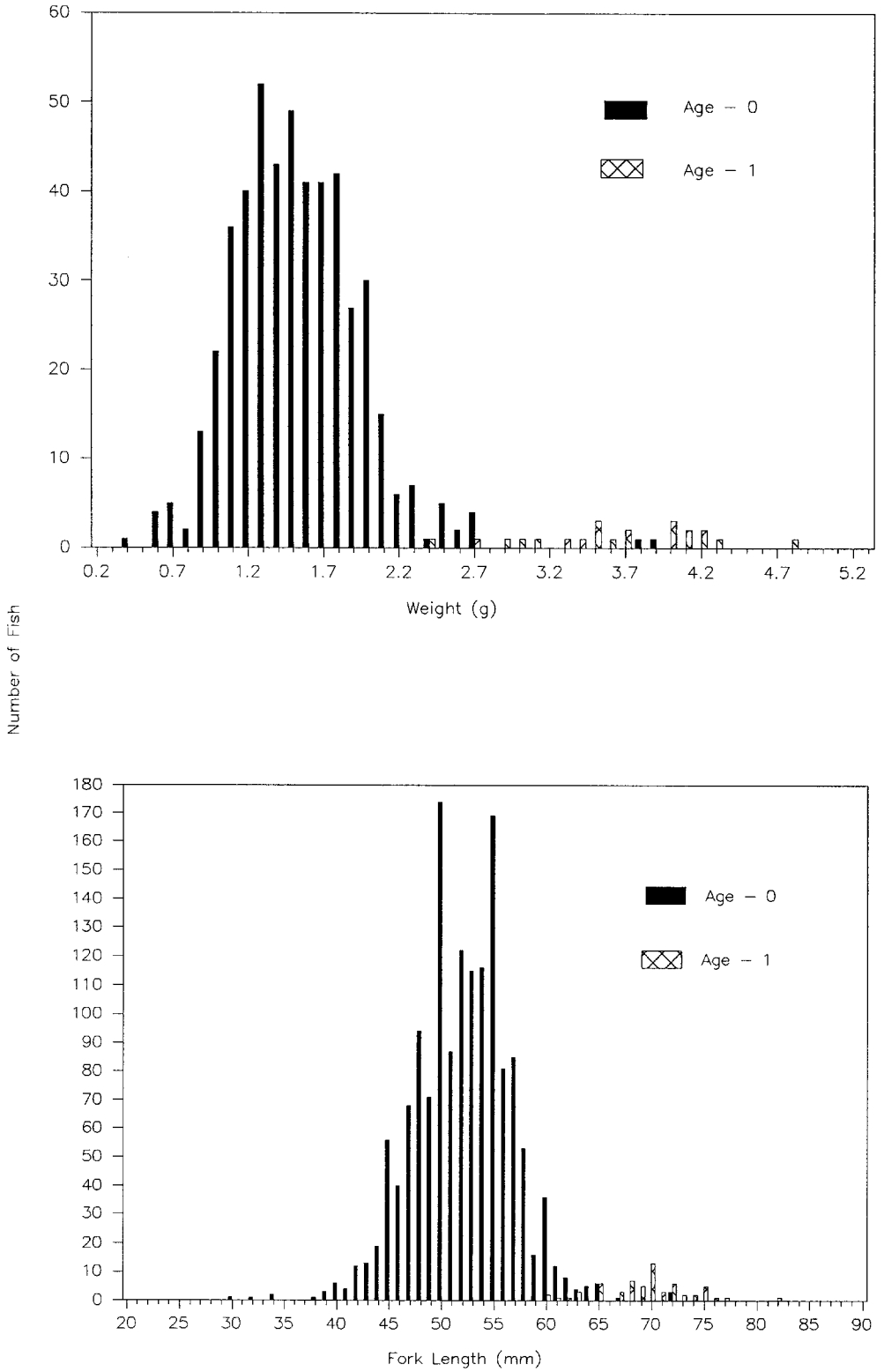

Figure 15. Weight (upper) and fork length (lower) of sockeye salmon in Kenai Lake, Alaska, 1990.

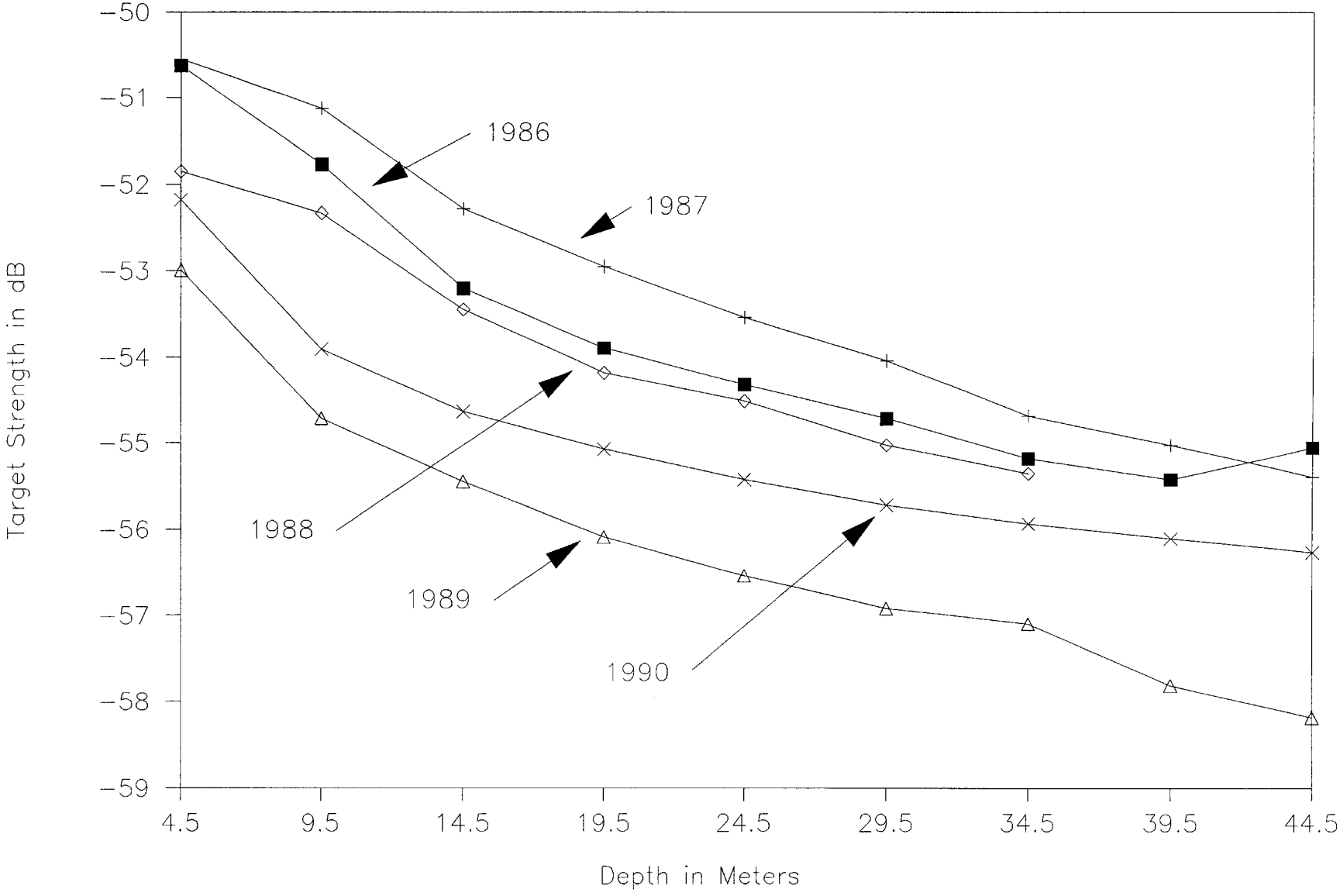

Figure 16. Target strengths measured in Skilak Lake, Alaska.

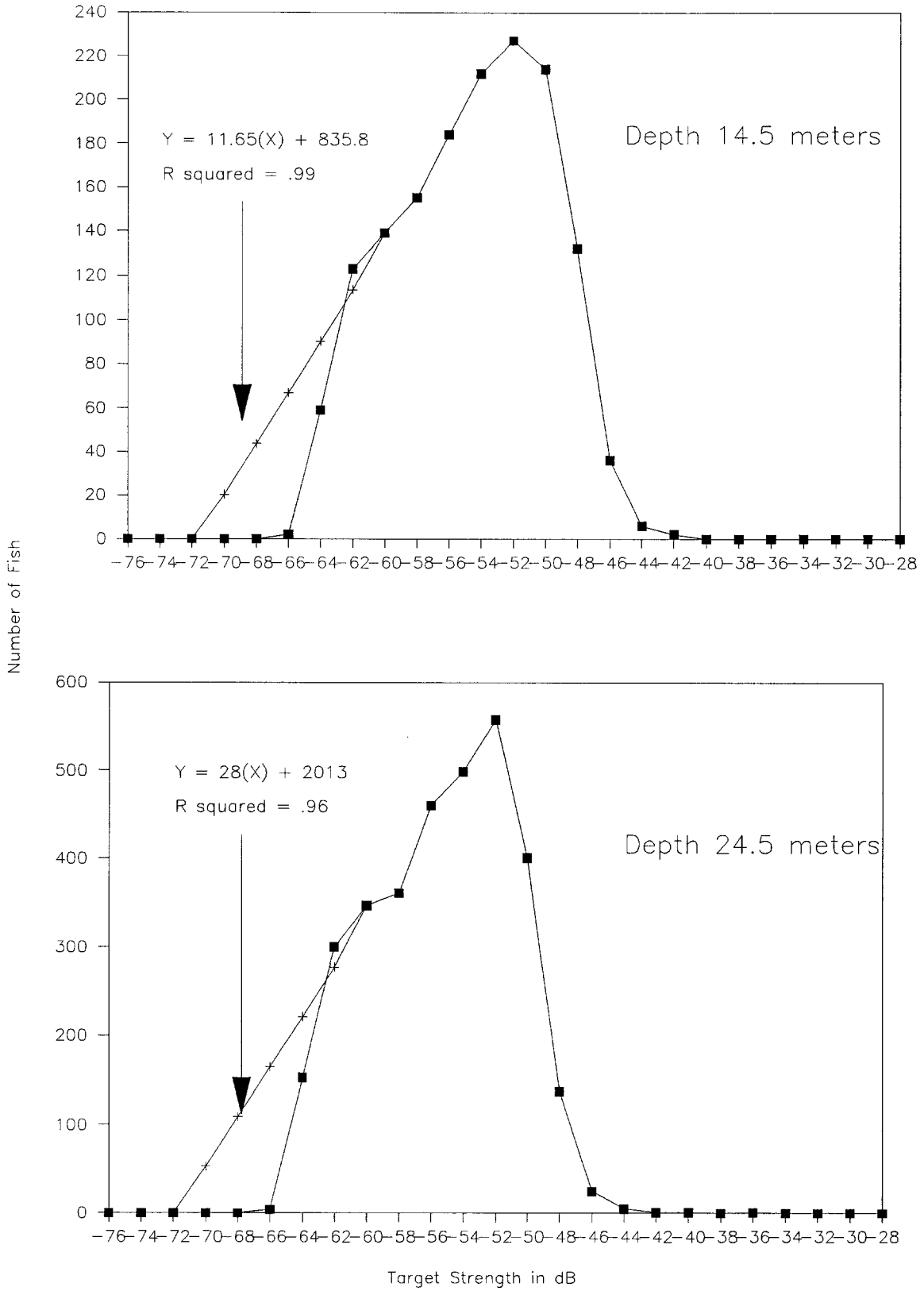

Figure 17. Target strength distribution measured in Skilak Lake with correction for threshold influence.

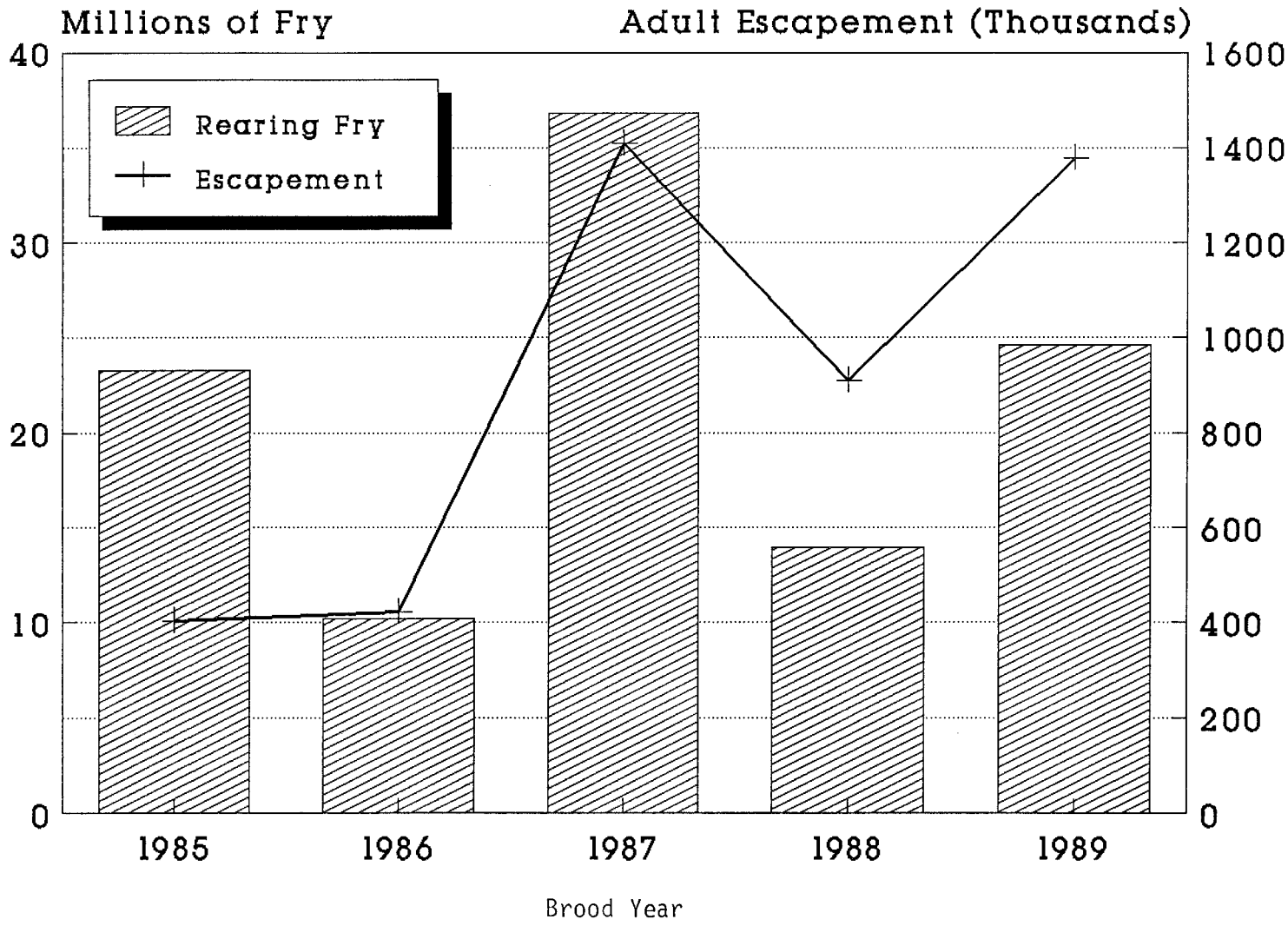

Figure 18. Estimated number of age-0 sockeye salmon rearing in Kenai and Skilak Lakes, Alaska, by brood year.

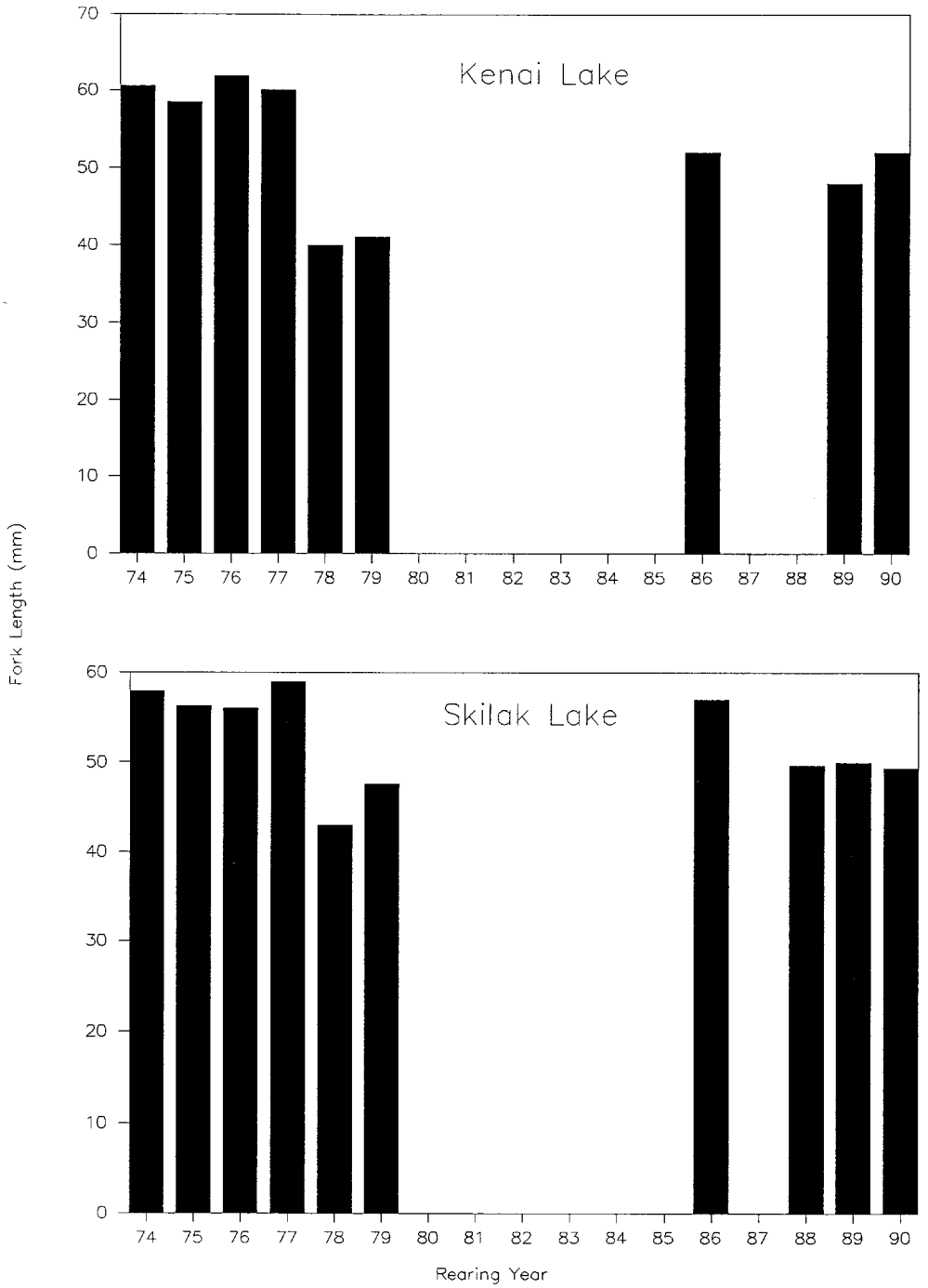

Figure 19. Length of age-0 sockeye salmon collected in Kenai (upper) and Skilak (lower) lakes, Alaska (sample period usually September/October).

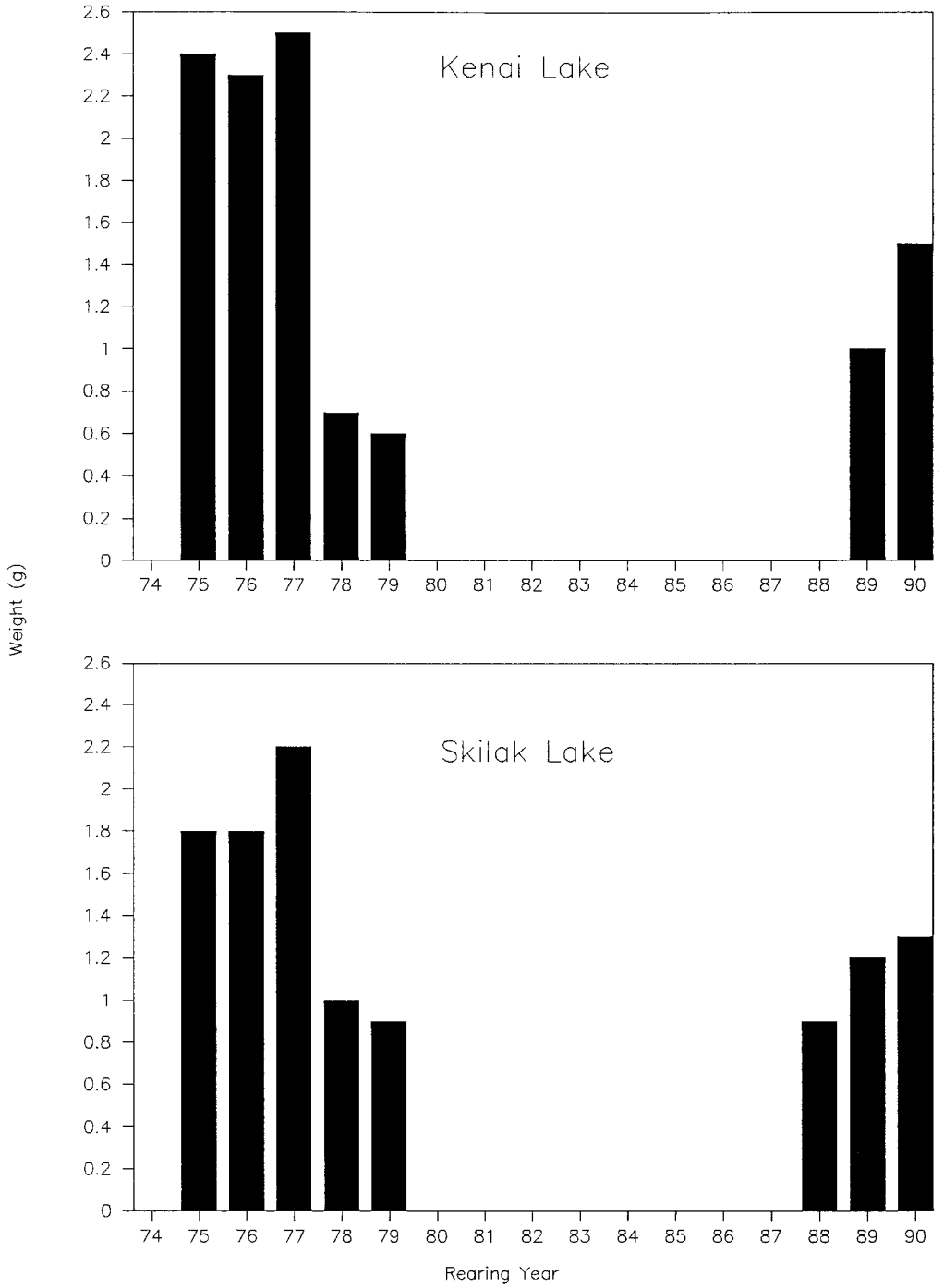

Figure 20. Weight of age-0 sockeye salmon collected in Kenai (upper) and Skilak (lower) lakes, Alaska (sample period usually September/October).

APPENDIX

Appendix A1. Calibration and processing parameters used in collection and analysis of Kenai and Skilak Lakes, Alaska, 1990 hydroacoustic data.

Sounder	Receiving sensitivity (dB/uP@1m)	Channel 1	40 log R =	-166.00 dB
			20 log R =	-144.40 dB
		Channel 2	40 log R =	-166.70 dB
			20 log R =	-144.50 dB
	Source level (dB/uP@1m)			217.30dB
	TVG Crossover			13.0 m
	Receiver gain			0 dB
Transducer	Beam width	Narrow		6 degree
		Wide		15 degree
	Wide beam dropoff	"A" coefficient		1.614 dB
		"B" coefficient		0.500 dB
	Beam pattern factor	Average squared value	Narrow	.0009146
Dual beam processor	Correction multiplier	Narrow beam		1.000 (0dB)
		Wide beam		1.084 (dB)
	Threshold	Narrow beam		200 mV (-65.3 dB)
		Wide beam		200 mV (-64.6 dB)
		Bottom		9999 mV (-31.3 dB)
	Maximum half angle			4°
	Pulse width criteria	-18 dB	Maximum	.9478 mS
		-6 dB	Minimum	.2668 mS
		-6 dB	Maximum	.5336 mS
	Bottom window			2.0 meters
	Start depth			2.0 meters
		Depth		
Echo integrator	B constant value	2.0 - 7.0 m		8.3
		7.0 - 12.0 m		1.9
		12.0 - 17.0 m		0.8
		17.0 - 22.0 m		0.44
		22.0 - 27.0 m		0.28
		27.0 - 32.0 m		0.19
		32.0 - 37.0 m		0.14
		37.0 - 42.0 m		0.11
		42.0 - 47.0 m		0.09
		47.0 - 52.0 m		0.07
		52.0 - 57.0 m		0.06
		57.0 - 62.0 m		0.05
		62.0 - 67.0 m		0.04
		67.0 - 72.0 m		0.04
		72.0 - 77.0 m		0.03
		77.0 - 82.0 m		0.03
		82.0 - 97.0 m		0.02

Appendix A.2. Average backscattering cross section (sigma) and target strength data by depth strata for all transects combined, Kenai Lake, Alaska, 1990.

Depth Stratum (m)	Number of Targets	Sigma Mean	Sigma Standard Deviation	Target[a] Strength Mean (dB)	Target Strength Standard Deviation (dB)
2.0 - 7.0	41	.1568E-04	.1901E-04	-50.25	4.78
7.0 - 12.0	173	.1147E-04	.3408E-04	-53.32	5.67
12.0 - 17.0	486	.5827E-05	.5671E-05	-54.35	4.50
17.0 - 22.0	990	.4938E-05	.4721E-05	-55.15	4.60
22.0 - 27.0	1474	.3930E-05	.3274E-05	-55.82	4.24
27.0 - 32.0	1548	.3623E-05	.3034E-05	-56.04	4.05
32.0 - 37.0	1241	.3388E-05	.2566E-05	-56.10	3.77
37.0 - 42.0	951	.3141E-05	.2666E-05	-56.49	3.74
42.0 - 47.0	516	.3054E-05	.3134E-05	-56.77	3.76
47.0 -102.0	1166	.3059E-05	.2942E-05	-56.79	3.80
Total	8586	.3970E-05	.6224E-05	-55.93	4.18

[a] Target strength determined from dual beam data collected in situ.

Appendix A.3. Average backscattering cross section (sigma) and target strength data by depth strata for all transects combined, Skilak Lake, Alaska, 1990.

Depth Stratum (m)	Number of Targets	Sigma Mean	Sigma Standard Deviation	Target[a] Strength Mean (dB)	Target Strength Standard Deviation (dB)
2.0 - 7.0	125	1.022E-05	1.030E-05	-52.18	4.88
7.0 - 12.0	584	7.202E-06	8.690E-05	-53.91	4.91
12.0 - 17.0	1491	5.795E-06	6.027E-06	-54.63	4.73
17.0 - 22.0	2386	5.224E-06	5.570E-06	-55.07	4.74
22.0 - 27.0	3254	4.637E-06	6.297E-06	-55.42	4.44
27.0 - 32.0	2873	4.004E-06	3.668E-06	-55.72	4.15
32.0 - 37.0	2491	4.247E-06	1.378E-05	-55.93	4.11
37.0 - 42.0	1545	3.550E-06	3.304E-06	-56.11	3.89
42.0 - 47.0	745	3.428E-06	3.494E-06	-56.27	3.80
47.0 -102.0	1206	4.594E-06	4.970E-06	-55.40	4.29
Total	16700	4.631E-06	7.326E-06	-55.45	4.39

[a] Target strength determined from dual beam data collected in situ.

Appendix A.4. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8580E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	4.2500E-04	7	8.8100E-08	8.3410E-04	3.2178E+04	5.4220E+08	4.5640E+04
" 7.0 - 12.0"	3.8150E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	6.2360E-04	7	5.1640E-08	1.6730E-03	6.3836E+04	7.4910E+08	5.3640E+04
" 12.0 - 17.0"	3.7490E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	5.9110E-04	7	4.6920E-08	3.1220E-03	1.1704E+05	1.8660E+09	8.4670E+04
" 17.0 - 22.0"	3.6630E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	5.1190E-04	7	1.9750E-08	3.1900E-03	1.1685E+05	1.0410E+09	6.3250E+04
" 22.0 - 27.0"	3.5460E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	4.2800E-04	7	1.6510E-08	3.3510E-03	1.1883E+05	1.2790E+09	7.0100E+04
" 27.0 - 32.0"	3.4270E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.5870E-04	7	1.1140E-09	1.3480E-03	4.6189E+04	9.5360E+07	1.9140E+04
" 32.0 - 37.0"	3.2010E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	9.0470E-05	7	1.1590E-09	8.2180E-04	2.6306E+04	9.8340E+07	1.9440E+04
" 37.0 - 42.0"	2.8360E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	2.4750E-05	6	1.2710E-10	2.4250E-04	6.8764E+03	9.8510E+06	6.1520E+03
" 42.0 - 47.0"	2.6040E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.3320E-06	6	7.0980E-13	1.3420E-05	3.4951E+02	4.9110E+04	4.3440E+02
" 47.0 - 52.0"	2.3900E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.8260E-06	6	5.2560E-11	7.8730E-05	1.8817E+03	3.0410E+06	3.4180E+03
" 52.0 - 57.0"	1.8360E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	1.0370E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	1.1300E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	3.6070E+08									5.3034E+05	"+ or -"	1.4780E+05

Appendix A.5. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8590E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	3.8480E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	3.2130E-04	7	2.0410E-08	8.6190E-04	3.3168E+04	2.7370E+08	3.2420E+04
" 12.0 - 17.0"	3.7650E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.3180E-03	7	7.0250E-07	6.9620E-03	2.6213E+05	2.7910E+10	3.2750E+05
" 17.0 - 22.0"	3.6660E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	5.9120E-04	7	3.7800E-08	3.6850E-03	1.3508E+05	1.9900E+09	8.7440E+04
" 22.0 - 27.0"	3.5850E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	5.3610E-04	7	7.3210E-08	4.1980E-03	1.5049E+05	5.7790E+09	1.4900E+05
" 27.0 - 32.0"	3.4210E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.6680E-04	7	2.2140E-09	1.4170E-03	4.8478E+04	1.8800E+08	2.6870E+04
" 32.0 - 37.0"	3.1750E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	8.0860E-05	7	9.7460E-10	7.3440E-04	2.3316E+04	8.1300E+07	1.7670E+04
" 37.0 - 42.0"	2.7420E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	3.6660E-05	6	1.4000E-10	3.5910E-04	9.8494E+03	1.0180E+07	6.2550E+03
" 42.0 - 47.0"	2.1510E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	5.6860E-05	6	2.7310E-09	5.7290E-04	1.2324E+04	1.2860E+08	2.2230E+04
" 47.0 - 52.0"	1.3240E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9680E-06	4	1.3930E-12	1.9800E-05	2.6210E+02	2.4770E+04	3.0850E+02
" 52.0 - 57.0"	9.2550E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	5.1900E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	2.5580E+05	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	3.3010E+08									6.7510E+05	"+ or -"	3.7380E+05

Appendix A.6. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8230E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.0100E-03	4	2.9430E-07	1.9820E-03	7.5794E+04	1.8630E+09	8.4610E+04
" 7.0 - 12.0"	3.6300E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	6.6110E-04	4	7.6610E-08	1.7740E-03	6.4378E+04	9.3810E+08	6.0030E+04
" 12.0 - 17.0"	3.4500E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	6.0840E-04	4	1.2490E-07	3.2130E-03	1.1085E+05	4.1690E+09	1.2660E+05
" 17.0 - 22.0"	3.1570E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	4.7180E-04	4	3.7150E-08	2.9410E-03	9.2844E+04	1.4460E+09	7.4540E+04
" 22.0 - 27.0"	2.6050E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	1.1860E-04	4	2.4500E-09	9.2910E-04	2.4204E+04	1.0220E+08	1.9820E+04
" 27.0 - 32.0"	1.8310E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	8.9070E-05	3	2.0480E-09	7.5660E-04	1.3855E+04	4.9630E+07	1.3810E+04
" 32.0 - 37.0"	5.1200E+06	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.7840E-05	2	3.1830E-10	1.6210E-04	8.2978E+02	6.8880E+05	1.6270E+03
" 37.0 - 42.0"	0.0000E+00	3.1410E-06	951	2.6660E-06	9.7980E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.9010E+08									3.8275E+05	"+ or -"	1.8140E+05

Appendix A.7. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.7560E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.1570E-03	4	1.3390E-06	2.2710E-03	8.5309E+04	7.5390E+09	1.7020E+05
" 7.0 - 12.0"	3.5240E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	8.2030E-04	4	1.0660E-07	2.2010E-03	7.7567E+04	1.2600E+09	6.9580E+04
" 12.0 - 17.0"	2.9880E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.2520E-04	3	2.0590E-08	1.1890E-03	3.5538E+04	5.1530E+08	4.4490E+04
" 17.0 - 22.0"	2.2930E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	3.7270E-04	2	4.5440E-08	2.3230E-03	5.3251E+04	9.3020E+08	5.9780E+04
" 22.0 - 27.0"	1.3140E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	5.3490E-04	2	5.5880E-08	4.1890E-03	5.5029E+04	5.9280E+08	4.7720E+04
" 27.0 - 32.0"	0.0000E+00	3.6230E-06	1548	3.0340E-06	8.4940E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 32.0 - 37.0"	0.0000E+00	3.3880E-06	1241	2.5660E-06	9.0830E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 37.0 - 42.0"	0.0000E+00	3.1410E-06	951	2.6660E-06	9.7980E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.3870E+08									3.0670E+05	"+ or -"	2.0400E+05

Appendix A.8. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 5 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8510E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.0940E-04	6	1.1980E-08	2.1480E-04	8.2712E+03	7.0870E+07	1.6500E+04
" 7.0 - 12.0"	3.8320E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	8.4940E-05	6	4.5480E-09	2.2790E-04	8.7342E+03	5.1980E+07	1.4130E+04
" 12.0 - 17.0"	3.7900E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	3.9370E-04	6	1.6320E-08	2.0800E-03	7.8804E+04	6.6590E+08	5.0580E+04
" 17.0 - 22.0"	3.4380E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	3.7750E-04	6	6.0410E-08	2.3530E-03	8.0892E+04	2.7800E+09	1.0330E+05
" 22.0 - 27.0"	2.8280E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.2990E-04	5	1.6250E-08	2.5830E-03	7.3051E+04	7.9950E+08	5.5420E+04
" 27.0 - 32.0"	2.0320E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.4960E-04	4	2.1900E-08	2.1210E-03	4.3088E+04	6.5320E+08	5.0090E+04
" 32.0 - 37.0"	5.9500E+06	3.3880E-06	1241	2.5660E-06	9.0830E+00	9.6900E-06	3	2.3880E-11	8.8020E-05	5.2372E+02	6.9890E+04	5.1810E+02
" 37.0 - 42.0"	0.0000E+00	3.1410E-06	951	2.6660E-06	9.7980E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.0370E+08									2.9336E+05	"+ or -"	1.3890E+05

Appendix A.9. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 6 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8540E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	5.0200E-04	7	2.5200E-07	9.8530E-04	3.7975E+04	1.4940E+09	7.5750E+04
" 7.0 - 12.0"	3.8240E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	2.3720E-04	7	3.1550E-08	6.3650E-04	2.4343E+04	3.6240E+08	3.7310E+04
" 12.0 - 17.0"	3.7350E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.2830E-04	6	6.6370E-09	1.2060E-03	4.5035E+04	2.6230E+08	3.1740E+04
" 17.0 - 22.0"	3.6140E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	3.1200E-04	6	8.4010E-09	1.9440E-03	7.0281E+04	4.3090E+08	4.0680E+04
" 22.0 - 27.0"	3.4980E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	4.0300E-04	6	9.7120E-09	3.1560E-03	1.1038E+05	7.3420E+08	5.3110E+04
" 27.0 - 32.0"	3.2580E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.8440E-04	6	4.0330E-09	1.5660E-03	5.1035E+04	3.1010E+08	3.4510E+04
" 32.0 - 37.0"	2.6510E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	5.6700E-05	6	1.6890E-09	5.1510E-04	1.3654E+04	9.8030E+07	1.9410E+04
" 37.0 - 42.0"	4.1880E+06	3.1410E-06	951	2.6660E-06	9.7980E+00	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.4850E+08									3.5270E+05	"+ or -"	1.1910E+05

Appendix A.10. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1990 based on transect 7 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	3.8570E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	3.8520E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.8010E-04	7	1.9430E-07	1.2880E-03	4.9614E+04	2.2010E+09	9.1950E+04
" 12.0 - 17.0"	3.8480E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	6.7780E-05	7	1.7030E-09	3.5800E-04	1.3774E+04	7.0680E+07	1.6480E+04
" 17.0 - 22.0"	3.8430E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	2.6140E-04	7	8.5280E-09	1.6290E-03	6.2617E+04	4.9280E+08	4.3510E+04
" 22.0 - 27.0"	3.8390E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.3220E-04	7	2.3720E-09	1.8190E-03	6.9808E+04	2.1660E+08	2.8850E+04
" 27.0 - 32.0"	3.5920E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	7.3150E-05	7	3.7990E-10	6.2130E-04	2.2317E+04	3.5590E+07	1.1690E+04
" 32.0 - 37.0"	2.4960E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	7.3330E-06	6	1.3700E-11	6.6610E-05	1.6629E+03	7.0590E+05	1.6470E+03
" 37.0 - 42.0"	4.7500E+05	3.1410E-06	951	2.6660E-06	9.7980E+00	5.5360E-06	2	3.0640E-11	5.4240E-05	2.5761E+01	6.6410E+02	5.0510E+01
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.5370E+08									2.1982E+05	"+ or -"	1.0770E+05

Appendix A.11. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.9550E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	5.9510E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	6.3620E-05	12	3.8480E-09	1.7070E-04	1.0158E+04	1.0340E+08	1.9930E+04
" 12.0 - 17.0"	5.9230E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	5.7230E-05	12	1.3300E-09	3.0220E-04	1.7901E+04	1.3070E+08	2.2410E+04
" 17.0 - 22.0"	5.8500E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	6.0820E-05	12	6.5480E-10	3.7900E-04	2.2172E+04	8.7480E+07	1.8330E+04
" 22.0 - 27.0"	5.7590E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.7300E-05	12	1.7770E-10	2.9210E-04	1.6822E+04	3.6260E+07	1.1800E+04
" 27.0 - 32.0"	5.6960E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	5.1570E-05	12	3.1380E-10	4.3800E-04	2.4949E+04	7.3730E+07	1.6830E+04
" 32.0 - 37.0"	5.5930E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.8010E-05	12	8.7450E-11	1.6350E-04	9.1465E+03	2.2610E+07	9.3190E+03
" 37.0 - 42.0"	5.4980E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	3.4820E-05	12	1.4580E-10	3.4110E-04	1.8756E+04	4.2570E+07	1.2790E+04
" 42.0 - 47.0"	5.4260E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	3.0770E-06	12	2.8860E-12	3.1000E-05	1.6822E+03	8.6850E+05	1.8270E+03
" 47.0 - 52.0"	5.3510E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.8250E-06	12	1.9440E-11	4.8540E-05	2.5973E+03	5.6410E+06	4.6550E+03
" 52.0 - 57.0"	5.2760E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.1670E-07	12	1.5150E-13	4.1920E-06	2.2120E+02	4.2710E+04	4.0510E+02
" 57.0 - 62.0"	5.1830E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1050E-07	11	5.7580E-15	1.1110E-06	5.7601E+01	1.5680E+03	7.7620E+01
" 62.0 - 67.0"	5.0270E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.0980E-07	10	9.5990E-14	3.1170E-06	1.5667E+02	2.4570E+04	3.0720E+02
" 67.0 - 72.0"	4.9340E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	1.6700E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.9090E+08									1.2462E+05	"+ or -"	4.3970E+04

Appendix A.12. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.9520E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	5.9150E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	1.0020E-04	10	4.6910E-09	2.6900E-04	1.5910E+04	1.3110E+08	2.2440E+04
" 12.0 - 17.0"	5.7780E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	5.4590E-05	10	3.8070E-10	2.8830E-04	1.6659E+04	3.5990E+07	1.1760E+04
" 17.0 - 22.0"	5.6460E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.1590E-04	10	2.3450E-09	7.2210E-04	4.0764E+04	2.9190E+08	3.3490E+04
" 22.0 - 27.0"	5.5770E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	1.2540E-04	10	2.1530E-09	9.8200E-04	5.4767E+04	4.1210E+08	3.9790E+04
" 27.0 - 32.0"	5.4940E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.0550E-04	10	8.3160E-10	8.9640E-04	4.9250E+04	1.8220E+08	2.6460E+04
" 32.0 - 37.0"	5.3920E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	7.7890E-05	10	7.0010E-10	7.0750E-04	3.8151E+04	1.6860E+08	2.5450E+04
" 37.0 - 42.0"	5.2890E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	1.0650E-03	10	1.0620E-06	1.0440E-02	5.5196E+05	2.8550E+11	1.0470E+06
" 42.0 - 47.0"	5.2170E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.0720E-05	9	4.0820E-11	1.0800E-04	5.6365E+03	1.1350E+07	6.6020E+03
" 47.0 - 52.0"	5.1140E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.6830E-07	9	8.3770E-14	3.7060E-06	1.8949E+02	2.2200E+04	2.9200E+02
" 52.0 - 57.0"	5.0040E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.6800E-08	9	4.6850E-15	9.7380E-07	4.8731E+01	1.1890E+03	6.7590E+01
" 57.0 - 62.0"	4.9020E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.7790E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.7130E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	2.5290E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.7300E+08									7.7334E+05	"+ or -"	1.0490E+06

Appendix A.13. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.9500E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.5980E-04	11	2.2050E-08	3.1370E-04	1.8666E+04	3.1330E+08	3.4690E+04
" 7.0 - 12.0"	5.9430E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 12.0 - 17.0"	5.9260E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.6810E-05	11	4.2570E-10	1.4160E-04	8.3920E+03	4.1840E+07	1.2680E+04
" 17.0 - 22.0"	5.8980E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	9.8250E-05	11	1.7670E-09	6.1230E-04	3.6112E+04	2.4000E+08	3.0360E+04
" 22.0 - 27.0"	5.8750E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	8.1890E-05	11	1.0450E-09	6.4120E-04	3.7670E+04	2.2190E+08	2.9200E+04
" 27.0 - 32.0"	5.7750E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	5.6110E-05	11	6.1400E-10	4.7670E-04	2.7529E+04	1.4810E+08	2.3850E+04
" 32.0 - 37.0"	5.7010E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	4.7800E-05	11	4.6910E-10	4.3420E-04	2.4754E+04	1.2610E+08	2.2010E+04
" 37.0 - 42.0"	5.5930E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	1.4070E-05	11	5.7990E-11	1.3790E-04	7.7115E+03	1.7460E+07	8.1890E+03
" 42.0 - 47.0"	5.4890E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	8.8080E-06	11	1.9950E-11	8.8760E-05	4.8717E+03	6.1510E+06	4.8610E+03
" 47.0 - 52.0"	5.3660E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.5100E-06	11	1.7350E-11	6.5490E-05	3.5143E+03	5.0650E+06	4.4110E+03
" 52.0 - 57.0"	5.2250E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.9920E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.7970E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.6860E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.3250E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.7650E+08									1.6922E+05	"+ or -"	6.5590E+04

Appendix A.14. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.8750E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	3.7980E-04	10	1.4420E-07	7.4540E-04	4.3791E+04	1.9860E+09	8.7360E+04
" 7.0 - 12.0"	5.6360E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	1.0740E-04	10	4.2250E-09	2.8820E-04	1.6245E+04	1.1010E+08	2.0570E+04
" 12.0 - 17.0"	5.3790E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.4500E-04	9	7.7260E-09	7.6560E-04	4.1179E+04	6.2670E+08	4.9070E+04
" 17.0 - 22.0"	4.7110E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	2.1220E-04	9	3.8730E-09	1.3220E-03	6.2292E+04	3.3750E+08	3.6010E+04
" 22.0 - 27.0"	4.1520E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	1.6760E-04	8	1.8600E-09	1.3120E-03	5.4488E+04	1.9800E+08	2.7580E+04
" 27.0 - 32.0"	3.9750E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.0880E-04	7	1.1690E-09	9.2430E-04	3.6744E+04	1.3390E+08	2.2680E+04
" 32.0 - 37.0"	3.8980E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.1120E-04	7	1.9130E-09	1.0100E-03	3.9387E+04	2.4050E+08	3.0400E+04
" 37.0 - 42.0"	3.8300E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	2.6580E-05	7	1.4470E-10	2.6040E-04	9.9744E+03	2.0450E+07	8.8630E+03
" 42.0 - 47.0"	3.7080E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.2310E-05	7	5.7680E-11	1.2400E-04	4.5990E+03	8.0970E+06	5.5770E+03
" 47.0 - 52.0"	3.6230E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.8870E-06	7	1.3400E-11	5.9220E-05	2.1457E+03	1.7840E+06	2.6180E+03
" 52.0 - 57.0"	3.5480E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.0280E-07	6	4.9400E-13	7.0710E-06	2.5089E+02	6.3000E+04	4.9190E+02
" 57.0 - 62.0"	3.4940E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	3.0460E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	1.9460E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.7580E+05	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	5.6870E+08									3.1110E+05	"+ or -"	1.1860E+05

Appendix A.15. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.1970E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	8.4560E-06	9	7.1510E-11	1.6600E-05	8.6250E+02	7.7060E+05	1.7210E+03
" 7.0 - 12.0"	5.1190E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	2.6530E-05	9	1.1730E-10	7.1170E-05	3.6434E+03	2.8900E+06	3.3320E+03
" 12.0 - 17.0"	5.0800E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.2330E-04	9	5.8440E-10	6.5140E-04	3.3093E+04	4.4210E+07	1.3030E+04
" 17.0 - 22.0"	5.0460E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.5090E-04	9	3.1780E-09	9.4060E-04	4.7461E+04	3.1640E+08	3.4860E+04
" 22.0 - 27.0"	5.0040E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.3900E-04	9	2.3890E-09	1.8720E-03	9.3659E+04	3.7110E+08	3.7760E+04
" 27.0 - 32.0"	4.9300E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.4500E-04	9	3.9120E-09	2.0810E-03	1.0262E+05	6.9080E+08	5.1520E+04
" 32.0 - 37.0"	4.8640E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.1800E-04	9	5.6040E-10	1.0720E-03	5.2154E+04	1.1060E+08	2.0620E+04
" 37.0 - 42.0"	4.7900E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	4.5520E-05	9	3.0140E-10	4.4600E-04	2.1362E+04	6.6730E+07	1.6010E+04
" 42.0 - 47.0"	4.6910E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	3.3580E-05	9	1.3090E-10	3.3840E-04	1.5875E+04	2.9760E+07	1.0690E+04
" 47.0 - 52.0"	4.6330E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.0000E-08	9	1.6000E-15	4.0240E-07	1.8643E+01	3.4780E+02	3.6550E+01
" 52.0 - 57.0"	4.5460E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.4750E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.8740E-08	9	3.9370E-15	8.9270E-07	3.9949E+01	7.9930E+02	5.5410E+01
" 62.0 - 67.0"	4.4140E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.4390E-07	9	2.0700E-14	1.4470E-06	6.3890E+01	4.0850E+03	1.2530E+02
" 67.0 - 72.0"	4.3610E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.4560E-07	9	1.0590E-14	1.4640E-06	6.3857E+01	2.0410E+03	8.8550E+01
" 72.0 - 77.0"	8.7100E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	6.8020E+08									3.7091E+05	"+ or -"	7.9210E+04

Appendix A.16. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.2600E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	3.4830E-04	8	1.2130E-07	6.8350E-04	3.5952E+04	1.3390E+09	7.1720E+04
" 7.0 - 12.0"	5.2410E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	3.4770E-06	8	1.2090E-11	9.3300E-06	4.8903E+02	2.5140E+05	9.8260E+02
" 12.0 - 17.0"	5.2110E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.5780E-05	8	2.3940E-10	1.3620E-04	7.0952E+03	1.8230E+07	8.3680E+03
" 17.0 - 22.0"	5.1780E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.2860E-04	8	4.9690E-09	8.0170E-04	4.1510E+04	5.1900E+08	4.4650E+04
" 22.0 - 27.0"	5.1430E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	4.8520E-05	8	2.8800E-10	3.8000E-04	1.9540E+04	4.6880E+07	1.3420E+04
" 27.0 - 32.0"	5.1150E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.9460E-05	8	1.9680E-10	2.5020E-04	1.2801E+04	3.7220E+07	1.1960E+04
" 32.0 - 37.0"	5.0740E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.1740E-05	8	3.9000E-11	1.0660E-04	5.4093E+03	8.3000E+06	5.6470E+03
" 37.0 - 42.0"	5.0350E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	1.7190E-05	8	2.5350E-10	1.6840E-04	8.4796E+03	6.1740E+07	1.5400E+04
" 42.0 - 47.0"	5.0140E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	4.7640E-06	8	1.4130E-11	4.8010E-05	2.4073E+03	3.6180E+06	3.7280E+03
" 47.0 - 52.0"	4.9940E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.5180E-07	8	2.8910E-13	8.5690E-06	4.2793E+02	7.3120E+04	5.3000E+02
" 52.0 - 57.0"	4.9670E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.1120E-07	8	3.1360E-13	8.1610E-06	4.0540E+02	7.8460E+04	5.4900E+02
" 57.0 - 62.0"	4.9180E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.5280E-06	8	1.0640E-12	1.5370E-05	7.5597E+02	2.6090E+05	1.0010E+03
" 62.0 - 67.0"	4.8910E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.0730E-06	8	1.9470E-13	1.0790E-05	5.2770E+02	4.7350E+04	4.2650E+02
" 67.0 - 72.0"	4.8520E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.1090E-06	8	9.9960E-13	2.1220E-05	1.0297E+03	2.3900E+05	9.5830E+02
" 72.0 - 77.0"	1.2550E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9800E-06	8	1.6800E-12	1.9920E-05	2.4988E+02	2.6810E+04	3.2090E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.2150E+08									1.3708E+05	"+ or -"	8.8410E+04

Appendix A.17. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.2670E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	4.6090E-05	8	2.1240E-09	9.0460E-05	4.7648E+03	2.3520E+07	9.5050E+03
" 7.0 - 12.0"	5.2590E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	9.5110E-06	8	7.0040E-11	2.5520E-05	1.3421E+03	1.4870E+06	2.3900E+03
" 12.0 - 17.0"	5.2490E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 17.0 - 22.0"	5.2320E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	6.9850E-05	8	3.1550E-09	4.3530E-04	2.2777E+04	3.3600E+08	3.5930E+04
" 22.0 - 27.0"	5.1960E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.0550E-05	8	6.7210E-11	1.6090E-04	8.3602E+03	1.1160E+07	6.5470E+03
" 27.0 - 32.0"	5.1650E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	3.9120E-05	8	2.8720E-10	3.3230E-04	1.7162E+04	5.5420E+07	1.4590E+04
" 32.0 - 37.0"	5.1280E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	7.7440E-06	8	1.0620E-11	7.0340E-05	3.6076E+03	2.3100E+06	2.9790E+03
" 37.0 - 42.0"	5.0860E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	6.5180E-06	8	2.2480E-11	6.3860E-05	3.2476E+03	5.5900E+06	4.6340E+03
" 42.0 - 47.0"	5.0530E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	6.5120E-06	8	3.2020E-11	6.5620E-05	3.3159E+03	8.3240E+06	5.6550E+03
" 47.0 - 52.0"	5.0200E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.7760E-07	8	3.0300E-13	9.8350E-06	4.9367E+02	7.7450E+04	5.4550E+02
" 52.0 - 57.0"	4.9870E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.2660E-06	8	5.9680E-13	1.2740E-05	6.3541E+02	1.5060E+05	7.6050E+02
" 57.0 - 62.0"	4.9440E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.3310E-06	8	5.3380E-13	1.3390E-05	6.6186E+02	1.3240E+05	7.1310E+02
" 62.0 - 67.0"	4.9070E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1680E-06	8	2.4850E-13	1.1750E-05	5.7663E+02	6.0840E+04	4.8350E+02
" 67.0 - 72.0"	4.8810E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.1570E-06	8	1.9300E-12	2.1700E-05	1.0589E+03	4.6620E+05	1.3380E+03
" 72.0 - 77.0"	1.0910E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.0510E-06	8	2.2950E-12	3.0700E-05	3.3503E+02	2.7750E+04	3.2650E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.2470E+08									6.8339E+04	"+ or -"	4.1330E+04

Appendix A.18. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.2700E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.9620E-05	8	3.8500E-10	3.8510E-05	2.0295E+03	4.2660E+06	4.0480E+03
" 7.0 - 12.0"	5.2470E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	3.9480E-05	8	5.6110E-10	1.0590E-04	5.5583E+03	1.2700E+07	6.9840E+03
" 12.0 - 17.0"	5.2230E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 17.0 - 22.0"	5.1950E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	6.5630E-05	8	2.4070E-10	4.0900E-04	2.1249E+04	2.5640E+07	9.9260E+03
" 22.0 - 27.0"	5.1620E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	1.1260E-04	8	1.1930E-09	8.8200E-04	4.5527E+04	1.9590E+08	2.7430E+04
" 27.0 - 32.0"	5.1170E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	6.4230E-05	8	8.0400E-10	5.4560E-04	2.7918E+04	1.5230E+08	2.4190E+04
" 32.0 - 37.0"	5.0640E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	3.7360E-05	8	2.2310E-10	3.3930E-04	1.7185E+04	4.7340E+07	1.3490E+04
" 37.0 - 42.0"	4.9740E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	1.6800E-05	8	3.3750E-11	1.6460E-04	8.1887E+03	8.0670E+06	5.5670E+03
" 42.0 - 47.0"	4.8700E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	8.3460E-06	8	1.2310E-11	8.4100E-05	4.0954E+03	2.9990E+06	3.3940E+03
" 47.0 - 52.0"	4.7750E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.1620E-06	8	2.3650E-12	6.1990E-05	2.9603E+03	5.5270E+05	1.4570E+03
" 52.0 - 57.0"	4.7060E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.2030E-06	8	3.5680E-12	5.2340E-05	2.4629E+03	8.0450E+05	1.7580E+03
" 57.0 - 62.0"	4.6130E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.0770E-06	8	6.1830E-12	6.1130E-05	2.8203E+03	1.3380E+06	2.2670E+03
" 62.0 - 67.0"	4.2380E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.4950E-06	8	3.9170E-12	6.5340E-05	2.7689E+03	7.1810E+05	1.6610E+03
" 67.0 - 72.0"	3.7980E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.8860E-06	7	1.0280E-11	6.9270E-05	2.6311E+03	1.5070E+06	2.4060E+03
" 72.0 - 77.0"	9.4420E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.0120E-06	6	1.5360E-11	7.0540E-05	6.6600E+02	1.3900E+05	7.3060E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	6.9200E+08									1.4606E+05	"+ or -"	4.1770E+04

Appendix A.19. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1990 based on transect 5 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.2680E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	5.2600E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.7940E-06	9	2.2990E-11	1.2860E-05	6.7665E+02	4.8120E+05	1.3600E+03
" 12.0 - 17.0"	5.2520E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 17.0 - 22.0"	5.2110E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.0780E-04	9	1.6930E-09	6.7170E-04	3.5000E+04	1.7970E+08	2.6280E+04
" 22.0 - 27.0"	5.1540E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.7430E-05	9	1.6130E-10	2.1480E-04	1.1071E+04	2.6330E+07	1.0060E+04
" 27.0 - 32.0"	5.0780E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.3600E-05	9	5.8070E-11	1.1550E-04	5.8661E+03	1.0820E+07	6.4470E+03
" 32.0 - 37.0"	5.0120E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	4.6070E-05	9	5.7880E-10	4.1850E-04	2.0972E+04	1.2020E+08	2.1480E+04
" 37.0 - 42.0"	4.9080E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	6.0660E-06	9	1.3330E-11	5.9430E-05	2.9172E+03	3.0880E+06	3.4440E+03
" 42.0 - 47.0"	4.8070E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.3420E-06	9	1.8000E-12	1.3520E-05	6.4987E+02	4.2320E+05	1.2750E+03
" 47.0 - 52.0"	4.7060E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9740E-07	9	1.7930E-14	1.9860E-06	9.3475E+01	4.0260E+03	1.2440E+02
" 52.0 - 57.0"	4.5580E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.0960E-07	9	4.3950E-14	2.1090E-06	9.6129E+01	9.2480E+03	1.8850E+02
" 57.0 - 62.0"	4.5010E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.8450E-08	9	7.8230E-15	8.8980E-07	4.0054E+01	1.6060E+03	7.8540E+01
" 62.0 - 67.0"	4.4580E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.1470E-08	9	2.5540E-15	7.1900E-07	3.2055E+01	5.1460E+02	4.4460E+01
" 67.0 - 72.0"	4.4270E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.5950E-08	9	9.2060E-15	9.6530E-07	4.2732E+01	1.8270E+03	8.3790E+01
" 72.0 - 77.0"	4.2310E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	6.9020E+08									7.7458E+04	"+ or -"	3.6200E+04

Appendix A.20. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	7.1850E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	7.1850E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	3.3780E-04	9	3.2240E-08	9.0640E-04	6.5125E+04	1.4150E+09	7.3720E+04
" 12.0 - 17.0"	7.1780E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	3.3060E-04	9	3.5820E-09	1.7460E-03	1.2534E+05	5.4530E+08	4.5770E+04
" 17.0 - 22.0"	7.1740E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	4.0710E-04	9	9.1990E-09	2.5370E-03	1.8204E+05	1.8700E+09	8.4750E+04
" 22.0 - 27.0"	7.1630E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	1.7780E-04	9	1.6750E-09	1.3920E-03	9.9735E+04	5.3170E+08	4.5200E+04
" 27.0 - 32.0"	7.0940E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.7270E-04	9	4.0720E-09	1.4670E-03	1.0409E+05	1.4840E+09	7.5500E+04
" 32.0 - 37.0"	7.0360E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	7.1390E-05	9	3.8550E-10	6.4850E-04	4.5627E+04	1.5840E+08	2.4670E+04
" 37.0 - 42.0"	6.9730E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	2.7120E-05	9	9.8600E-11	2.6580E-04	1.8531E+04	4.6280E+07	1.3330E+04
" 42.0 - 47.0"	6.9270E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	3.6900E-06	9	2.1120E-12	3.7180E-05	2.5754E+03	1.0430E+06	2.0010E+03
" 47.0 - 52.0"	6.8850E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.2470E-06	9	3.0080E-11	6.2850E-05	4.3271E+03	1.4450E+07	7.4500E+03
" 52.0 - 57.0"	6.8340E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.0520E-07	9	1.3790E-13	4.0760E-06	2.7858E+02	6.5280E+04	5.0080E+02
" 57.0 - 62.0"	6.7880E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.6150E-07	9	3.3000E-14	2.6310E-06	1.7859E+02	1.5420E+04	2.4340E+02
" 62.0 - 67.0"	6.7390E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.4230E-08	9	3.1040E-15	8.4740E-07	5.7107E+01	1.4290E+03	7.4100E+01
" 67.0 - 72.0"	6.7000E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.5060E-07	9	1.0940E-13	5.5390E-06	3.7116E+02	4.9820E+04	4.3750E+02
" 72.0 - 77.0"	1.7340E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.9600E+08									6.4827E+05	"+ or -"	1.5260E+05

Appendix A.21. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	7.1850E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	8.9050E-06	9	7.9310E-11	1.7480E-05	1.2558E+03	1.6340E+06	2.5050E+03
" 7.0 - 12.0"	7.1840E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.4850E-05	9	5.5980E-10	1.2030E-04	8.6454E+03	2.4610E+07	9.7240E+03
" 12.0 - 17.0"	7.1730E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.8640E-04	9	4.0570E-09	9.8430E-04	7.0604E+04	5.9200E+08	4.7690E+04
" 17.0 - 22.0"	7.1630E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.4050E-04	9	9.8020E-10	8.7550E-04	6.2715E+04	1.9900E+08	2.7650E+04
" 22.0 - 27.0"	7.1590E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.0970E-04	9	4.7520E-09	1.6420E-03	1.1758E+05	1.5000E+09	7.5910E+04
" 27.0 - 32.0"	7.1520E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.0390E-04	9	1.4870E-09	1.7320E-03	1.2388E+05	5.5590E+08	4.6210E+04
" 32.0 - 37.0"	7.1470E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.1520E-04	9	8.1610E-10	1.0460E-03	7.4788E+04	3.4650E+08	3.6490E+04
" 37.0 - 42.0"	7.1440E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	4.3730E-05	9	2.8030E-10	4.2850E-04	3.0610E+04	1.3800E+08	2.3020E+04
" 42.0 - 47.0"	7.1360E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	2.7790E-05	9	1.1770E-10	2.8000E-04	1.9981E+04	6.1650E+07	1.5390E+04
" 47.0 - 52.0"	7.1310E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9290E-06	9	9.0430E-13	1.9410E-05	1.3840E+03	4.6690E+05	1.3390E+03
" 52.0 - 57.0"	7.1120E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.9180E-06	9	1.2520E-11	5.9530E-05	4.2340E+03	6.4230E+06	4.9670E+03
" 57.0 - 62.0"	7.0710E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.3350E-06	9	3.4450E-13	1.3430E-05	9.4993E+02	1.7500E+05	8.2000E+02
" 62.0 - 67.0"	7.0240E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.0440E-05	9	2.2720E-11	1.0510E-04	7.3804E+03	1.1390E+07	6.6140E+03
" 67.0 - 72.0"	6.9970E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.4090E-06	9	1.2280E-11	5.4410E-05	3.8073E+03	6.0960E+06	4.8390E+03
" 72.0 - 77.0"	3.5660E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.5660E-06	9	1.2720E-11	3.5880E-05	1.2793E+02	1.6380E+04	2.5080E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.0010E+09									5.2795E+05	"+ or -"	1.1500E+05

Appendix A.22. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	7.1850E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	7.1850E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	1.3370E-03	9	5.3790E-07	3.5870E-03	2.5772E+05	2.3380E+10	2.9970E+05
" 12.0 - 17.0"	7.1850E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	3.6190E-04	9	2.5840E-09	1.9110E-03	1.3732E+05	4.0880E+08	3.9630E+04
" 17.0 - 22.0"	7.1840E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	2.2340E-04	9	1.2030E-09	1.3920E-03	1.0002E+05	2.5050E+08	3.1020E+04
" 22.0 - 27.0"	7.1190E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.1840E-04	9	8.3640E-09	2.4930E-03	1.7751E+05	2.6150E+09	1.0020E+05
" 27.0 - 32.0"	6.9940E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.9510E-04	9	1.3210E-09	1.6570E-03	1.1589E+05	4.7230E+08	4.2590E+04
" 32.0 - 37.0"	6.9280E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.7350E-04	9	9.4540E-10	1.5760E-03	1.0920E+05	3.7990E+08	3.8200E+04
" 37.0 - 42.0"	6.8690E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	7.3800E-05	9	2.8900E-10	7.2300E-04	4.9668E+04	1.3280E+08	2.2580E+04
" 42.0 - 47.0"	6.7730E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.3470E-05	9	2.1310E-11	1.3570E-04	9.1917E+03	1.0100E+07	6.2280E+03
" 47.0 - 52.0"	6.6390E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.5340E-06	9	3.6870E-12	4.5610E-05	3.0285E+03	1.6520E+06	2.5190E+03
" 52.0 - 57.0"	6.5270E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.0310E-06	9	5.2800E-13	1.0370E-05	6.7695E+02	2.2800E+05	9.3600E+02
" 57.0 - 62.0"	6.4160E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.9210E-07	9	3.5180E-14	3.9450E-06	2.5311E+02	1.4710E+04	2.3770E+02
" 62.0 - 67.0"	6.3430E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.5110E-07	9	6.8960E-14	7.5570E-06	4.7932E+02	2.8260E+04	3.2950E+02
" 67.0 - 72.0"	6.2370E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9120E-06	9	5.7440E-13	1.9230E-05	1.1996E+03	2.2730E+05	9.3440E+02
" 72.0 - 77.0"	1.3810E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.4850E-07	8	8.5800E-14	5.5180E-06	7.6231E+01	1.6620E+03	7.9900E+01
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.6970E+08									9.6224E+05	"+ or -"	3.2590E+05

Appendix A.23. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	7.1740E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	7.1620E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	1.9970E-04	8	3.6280E-09	5.3570E-04	3.8371E+04	2.0910E+08	2.8340E+04
" 12.0 - 17.0"	7.1450E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	3.3110E-04	8	1.7360E-08	1.7490E-03	1.2494E+05	2.5020E+09	9.8050E+04
" 17.0 - 22.0"	7.0790E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	3.0190E-04	8	5.2470E-09	1.8810E-03	1.3317E+05	1.0380E+09	6.3140E+04
" 22.0 - 27.0"	6.9850E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	2.6180E-04	8	4.5530E-09	2.0500E-03	1.4318E+05	1.3720E+09	7.2600E+04
" 27.0 - 32.0"	6.8950E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	1.6950E-04	8	1.1040E-09	1.4400E-03	9.9267E+04	3.8320E+08	3.8370E+04
" 32.0 - 37.0"	6.7890E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.5390E-04	8	5.6490E-09	1.3980E-03	9.4884E+04	2.1520E+09	9.0930E+04
" 37.0 - 42.0"	6.7040E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	3.1060E-05	8	1.4040E-10	3.0440E-04	2.0404E+04	6.0870E+07	1.5290E+04
" 42.0 - 47.0"	6.6090E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.4080E-05	7	1.0900E-10	1.4180E-04	9.3750E+03	4.8530E+07	1.3650E+04
" 47.0 - 52.0"	6.5090E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.6600E-08	7	2.1720E-15	4.6880E-07	3.0517E+01	9.3200E+02	5.9840E+01
" 52.0 - 57.0"	6.4090E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.0550E-07	7	7.2350E-14	4.0800E-06	2.6146E+02	3.0130E+04	3.4020E+02
" 57.0 - 62.0"	6.3110E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.7160E-06	7	1.6610E-12	1.7260E-05	1.0895E+03	6.7060E+05	1.6050E+03
" 62.0 - 67.0"	6.1820E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9620E-07	7	1.6490E-14	1.9730E-06	1.2199E+02	6.3900E+03	1.5670E+02
" 67.0 - 72.0"	5.9180E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1130E-06	7	2.9990E-13	1.1190E-05	6.6246E+02	1.0670E+05	6.4010E+02
" 72.0 - 77.0"	9.4140E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	2.9360E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.5110E+08									6.6576E+05	"+ or -"	1.7270E+05

Appendix A.24. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1990 based on transect 5 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	7.1820E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 7.0 - 12.0"	7.1700E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	5.5450E-06	7	4.3930E-12	1.4880E-05	1.0667E+03	2.2060E+05	9.2060E+02
" 12.0 - 17.0"	7.1340E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.0280E-04	7	1.5020E-09	5.4290E-04	3.8732E+04	2.1620E+08	2.8820E+04
" 17.0 - 22.0"	7.0610E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.9630E-04	7	9.6350E-09	1.2230E-03	8.6376E+04	1.8730E+09	8.4820E+04
" 22.0 - 27.0"	6.9520E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.9520E-04	7	5.0820E-09	3.0940E-03	2.1513E+05	1.5280E+09	7.6620E+04
" 27.0 - 32.0"	6.8270E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.1100E-04	7	2.2450E-09	1.7920E-03	1.2235E+05	7.6180E+08	5.4100E+04
" 32.0 - 37.0"	6.7200E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.1910E-04	7	5.4710E-10	1.0820E-03	7.2714E+04	2.0630E+08	2.8150E+04
" 37.0 - 42.0"	6.6090E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	4.3550E-05	7	2.4780E-10	4.2670E-04	2.8199E+04	1.0450E+08	2.0040E+04
" 42.0 - 47.0"	6.5150E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	1.7030E-05	7	9.3160E-11	1.7160E-04	1.1182E+04	4.0400E+07	1.2460E+04
" 47.0 - 52.0"	6.4030E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	6.1280E-06	7	2.9180E-11	6.1650E-05	3.9471E+03	1.2120E+07	6.8240E+03
" 52.0 - 57.0"	6.2670E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.0040E-07	7	3.8660E-14	3.0220E-06	1.8938E+02	1.5400E+04	2.4320E+02
" 57.0 - 62.0"	6.1110E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.3380E-08	7	5.3850E-15	7.3820E-07	4.5115E+01	2.0370E+03	8.8460E+01
" 62.0 - 67.0"	5.9640E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	5.8710E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	1.5310E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	1.0160E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.4420E+08									5.7992E+05	"+ or -"	1.3500E+05

Appendix A.25. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.3630E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	5.6650E-03	3	1.2110E-05	1.1120E-02	5.9634E+05	1.4690E+11	7.5130E+05
" 7.0 - 12.0"	4.9460E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	5.6810E-03	3	7.3290E-06	1.5240E-02	7.5380E+05	1.5810E+11	7.7920E+05
" 12.0 - 17.0"	3.5190E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.2340E-03	3	7.5460E-07	1.1800E-02	4.1526E+05	2.6400E+10	3.1850E+05
" 17.0 - 22.0"	1.3860E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.0820E-03	3	1.0070E-06	6.7420E-03	9.3461E+04	7.5270E+09	1.7000E+05
" 22.0 - 27.0"	0.0000E+00	3.9300E-06	1474	3.2740E-06	7.8310E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 27.0 - 32.0"	0.0000E+00	3.6230E-06	1548	3.0340E-06	8.4940E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 32.0 - 37.0"	0.0000E+00	3.3880E-06	1241	2.5660E-06	9.0830E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 37.0 - 42.0"	0.0000E+00	3.1410E-06	951	2.6660E-06	9.7980E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	0.0000E+00	3.0540E-06	516	3.1340E-06	1.0080E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.5210E+08									1.8589E+06	"+ or -"	1.1410E+06

Appendix A.26. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.4540E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	1.4410E-03	5	6.9670E-07	2.8290E-03	1.5430E+05	8.8360E+09	1.8420E+05
" 7.0 - 12.0"	5.3070E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	1.3590E-03	5	1.1410E-06	3.6470E-03	1.9354E+05	2.5050E+10	3.1020E+05
" 12.0 - 17.0"	5.1570E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.3090E-03	5	2.9240E-07	6.9130E-03	3.5650E+05	2.1940E+10	2.9030E+05
" 17.0 - 22.0"	5.0200E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	9.2170E-04	5	6.5020E-08	5.7440E-03	2.8835E+05	6.4400E+09	1.5730E+05
" 22.0 - 27.0"	4.8760E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	7.2940E-04	5	2.2880E-08	5.7110E-03	2.7849E+05	3.3720E+09	1.1380E+05
" 27.0 - 32.0"	4.7260E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	3.6850E-04	5	1.3440E-08	3.1300E-03	1.4795E+05	2.1760E+09	9.1430E+04
" 32.0 - 37.0"	4.5700E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.5130E-04	5	2.1270E-09	1.3750E-03	6.2825E+04	3.6840E+08	3.7620E+04
" 37.0 - 42.0"	4.3670E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	7.9280E-05	5	1.1150E-09	7.7670E-04	3.3922E+04	2.0510E+08	2.8070E+04
" 42.0 - 47.0"	4.2470E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	7.9730E-05	5	3.1140E-10	8.0340E-04	3.4123E+04	5.9420E+07	1.5110E+04
" 47.0 - 52.0"	4.0860E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.1750E-05	5	2.9030E-10	3.1940E-04	1.3054E+04	4.9200E+07	1.3750E+04
" 52.0 - 57.0"	3.9820E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.6980E-05	5	2.9410E-11	1.7080E-04	6.8010E+03	4.7570E+06	4.2750E+03
" 57.0 - 62.0"	3.8770E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.1940E-05	5	4.0220E-10	3.2130E-04	1.2457E+04	6.1310E+07	1.5350E+04
" 62.0 - 67.0"	3.6290E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.5460E-05	5	1.5690E-10	2.5610E-04	9.2941E+03	2.0980E+07	8.9780E+03
" 67.0 - 72.0"	3.4430E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.3310E-05	5	1.6880E-10	2.3460E-04	8.0752E+03	2.0300E+07	8.8310E+03
" 72.0 - 77.0"	1.0600E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.4950E-06	3	1.3210E-11	5.5290E-05	5.8604E+02	1.5050E+05	7.6030E+02
" 77.0 - 82.0"	3.3150E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.4670E-06	1	0.0000E+00	7.5120E-05	2.4899E+02	4.9180E+01	1.3750E+01
" 82.0 - 87.0"	1.4240E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	4.6720E+05	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.1460E-04	1	0.0000E+00	2.1590E-03	1.0086E+03	8.0690E+02	5.5680E+01
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	6.4320E+08									1.6015E+06	"+ or -"	5.1340E+05

Appendix A.27. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.2450E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	3.1790E-03	9	6.0280E-06	6.2400E-03	3.2729E+05	6.7710E+10	5.1000E+05
" 7.0 - 12.0"	5.0940E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.1120E-04	9	4.4240E-08	1.1030E-03	5.6205E+04	9.8770E+08	6.1600E+04
" 12.0 - 17.0"	4.9960E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	4.0300E-04	9	1.3380E-08	2.1280E-03	1.0633E+05	9.5340E+08	6.0520E+04
" 17.0 - 22.0"	4.8750E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	4.5900E-04	9	1.3630E-08	2.8610E-03	1.3947E+05	1.2760E+09	7.0010E+04
" 22.0 - 27.0"	4.6470E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.8920E-04	8	8.0240E-09	3.0480E-03	1.4164E+05	1.0720E+09	6.4180E+04
" 27.0 - 32.0"	4.4150E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	2.9090E-04	8	1.6500E-08	2.4710E-03	1.0911E+05	2.3260E+09	9.4520E+04
" 32.0 - 37.0"	4.2340E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.8820E-04	8	3.6380E-09	1.7100E-03	7.2391E+04	5.4060E+08	4.5570E+04
" 37.0 - 42.0"	4.0140E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	6.8780E-05	8	4.8400E-10	6.7390E-04	2.7050E+04	7.5420E+07	1.7020E+04
" 42.0 - 47.0"	3.7410E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	3.8420E-05	8	1.1130E-10	3.8720E-04	1.4483E+04	1.6240E+07	7.8980E+03
" 47.0 - 52.0"	3.4470E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1820E-05	8	2.3140E-11	1.1890E-04	4.0989E+03	2.7950E+06	3.2770E+03
" 52.0 - 57.0"	3.0930E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.1430E-06	8	1.9970E-11	9.1980E-05	2.8450E+03	1.9400E+06	2.7300E+03
" 57.0 - 62.0"	2.7460E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.4240E-06	8	2.1590E-11	8.4740E-05	2.3273E+03	1.6520E+06	2.5190E+03
" 62.0 - 67.0"	2.6060E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.9980E-06	5	1.2700E-11	8.0460E-05	2.0971E+03	8.7650E+05	1.8350E+03
" 67.0 - 72.0"	2.5240E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1680E-05	5	1.3480E-11	1.1750E-04	2.9670E+03	8.7640E+05	1.8350E+03
" 72.0 - 77.0"	2.5960E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.9170E-05	5	2.1360E-10	1.9280E-04	5.0055E+02	1.4590E+05	7.4870E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	5.5940E+08									1.0088E+06	"+ or -"	5.3670E+05

Appendix A.28. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.4420E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	3.4800E-04	10	2.3090E-08	6.8300E-04	3.7169E+04	3.1300E+08	3.4670E+04
" 7.0 - 12.0"	5.3760E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	5.9590E-04	10	3.0480E-08	1.5990E-03	8.5944E+04	1.0110E+09	6.2320E+04
" 12.0 - 17.0"	5.3160E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	2.7430E-04	10	4.9990E-09	1.4490E-03	7.7019E+04	4.0560E+08	3.9470E+04
" 17.0 - 22.0"	5.2450E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	4.9070E-04	10	1.2890E-08	3.0580E-03	1.6037E+05	1.4010E+09	7.3360E+04
" 22.0 - 27.0"	5.1940E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	3.2930E-04	10	4.6720E-09	2.5790E-03	1.3395E+05	7.8130E+08	5.4790E+04
" 27.0 - 32.0"	5.1370E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	3.3470E-04	9	3.9620E-09	2.8430E-03	1.4606E+05	7.6410E+08	5.4180E+04
" 32.0 - 37.0"	5.0750E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.2490E-04	9	1.2470E-09	1.1340E-03	5.7569E+04	2.6660E+08	3.2000E+04
" 37.0 - 42.0"	5.0170E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	3.6660E-05	9	6.6360E-11	3.5920E-04	1.8023E+04	1.6280E+07	7.9080E+03
" 42.0 - 47.0"	4.9530E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	2.4520E-05	9	1.6990E-10	2.4710E-04	1.2239E+04	4.2630E+07	1.2800E+04
" 47.0 - 52.0"	4.8760E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	8.6970E-06	9	1.2480E-11	8.7490E-05	4.2663E+03	3.0170E+06	3.4040E+03
" 52.0 - 57.0"	4.7940E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.1990E-06	9	1.6380E-11	9.2540E-05	4.4368E+03	3.8260E+06	3.8340E+03
" 57.0 - 62.0"	4.7260E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.4750E-06	9	6.4810E-13	1.4840E-05	7.0122E+02	1.4690E+05	7.5120E+02
" 62.0 - 67.0"	4.6380E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.8580E-06	9	5.3990E-13	1.8690E-05	8.6690E+02	1.1810E+05	6.7360E+02
" 67.0 - 72.0"	4.5270E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.6280E-06	9	1.8800E-12	3.6500E-05	1.6524E+03	3.9210E+05	1.2270E+03
" 72.0 - 77.0"	1.3110E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.1450E-06	8	1.5590E-12	2.1580E-05	2.8286E+02	2.7190E+04	3.2320E+02
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.1630E+08									7.4055E+05	"+ or -"	1.3870E+05

Appendix A.29. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 5 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.4350E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	4.4840E-05	9	8.9810E-10	8.8010E-05	4.7836E+03	1.1040E+07	6.5120E+03
" 7.0 - 12.0"	5.3920E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.6870E-05	9	7.1180E-10	1.2570E-04	6.7800E+03	1.7240E+07	8.1390E+03
" 12.0 - 17.0"	5.3450E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	1.1160E-04	9	6.1780E-09	5.8940E-04	3.1504E+04	4.9430E+08	4.3580E+04
" 17.0 - 22.0"	5.3020E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	1.5550E-04	9	6.0260E-09	9.6890E-04	5.1369E+04	6.6040E+08	5.0370E+04
" 22.0 - 27.0"	5.2800E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	4.8450E-05	9	3.0100E-10	3.7940E-04	2.0031E+04	5.1640E+07	1.4080E+04
" 27.0 - 32.0"	5.2270E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	6.4470E-05	9	8.1570E-10	5.4760E-04	2.8624E+04	1.6120E+08	2.4880E+04
" 32.0 - 37.0"	5.1390E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	8.3120E-05	9	8.1790E-10	7.5500E-04	3.8801E+04	1.7890E+08	2.6220E+04
" 37.0 - 42.0"	5.0790E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	7.8630E-05	9	3.2000E-10	7.7030E-04	3.9127E+04	8.0400E+07	1.7570E+04
" 42.0 - 47.0"	5.0320E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	9.7820E-05	9	7.4680E-10	9.8570E-04	4.9600E+04	1.9700E+08	2.7510E+04
" 47.0 - 52.0"	4.9940E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.8370E-05	9	1.0030E-09	9.8960E-04	4.9422E+04	2.5510E+08	3.1300E+04
" 52.0 - 57.0"	4.9550E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	9.3140E-05	9	5.5150E-10	9.3700E-04	4.6429E+04	1.3880E+08	2.3090E+04
" 57.0 - 62.0"	4.9170E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	5.7280E-05	9	1.3670E-10	5.7630E-04	2.8338E+04	3.4090E+07	1.1440E+04
" 62.0 - 67.0"	4.8810E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.0550E-05	9	1.9700E-10	4.0790E-04	1.9911E+04	4.7830E+07	1.3560E+04
" 67.0 - 72.0"	4.8310E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.8590E-05	9	8.2980E-11	3.8820E-04	1.8755E+04	1.9880E+07	8.7400E+03
" 72.0 - 77.0"	8.3010E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.5940E-05	9	1.8560E-10	3.6160E-04	3.0019E+03	1.3020E+06	2.2360E+03
" 77.0 - 82.0"	1.4160E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	4.1750E-05	2	1.7430E-09	4.2000E-04	5.9458E+02	3.5380E+05	1.1660E+03
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.2780E+08									4.3707E+05	"+ or -"	9.5000E+04

Appendix A.30. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1990 based on transect 6 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	5.4640E+07	1.5680E-05	41	1.9010E-05	1.9630E+00	9.6850E-04	7	4.4150E-07	1.9010E-03	1.0387E+05	5.4650E+09	1.4490E+05
" 7.0 - 12.0"	5.4540E+07	1.1470E-05	173	3.4080E-05	2.6830E+00	4.6010E-04	7	5.2220E-08	1.2340E-03	6.7325E+04	1.3500E+09	7.2000E+04
" 12.0 - 17.0"	5.4490E+07	5.8270E-06	486	5.6710E-06	5.2810E+00	4.2210E-04	7	1.3060E-08	2.2290E-03	1.2145E+05	1.1100E+09	6.5310E+04
" 17.0 - 22.0"	5.4370E+07	4.9380E-06	990	4.7210E-06	6.2320E+00	5.2640E-04	7	1.4140E-08	3.2810E-03	1.7836E+05	1.6520E+09	7.9670E+04
" 22.0 - 27.0"	5.4180E+07	3.9300E-06	1474	3.2740E-06	7.8310E+00	5.7270E-04	7	1.2070E-08	4.4850E-03	2.4299E+05	2.2000E+09	9.1940E+04
" 27.0 - 32.0"	5.4020E+07	3.6230E-06	1548	3.0340E-06	8.4940E+00	4.4180E-04	7	3.5550E-08	3.7530E-03	2.0271E+05	7.5030E+09	1.6980E+05
" 32.0 - 37.0"	5.3720E+07	3.3880E-06	1241	2.5660E-06	9.0830E+00	1.3020E-04	7	6.9760E-10	1.1830E-03	6.3535E+04	1.6800E+08	2.5400E+04
" 37.0 - 42.0"	5.3440E+07	3.1410E-06	951	2.6660E-06	9.7980E+00	8.4190E-05	7	4.3990E-10	8.2490E-04	4.4082E+04	1.2210E+08	2.1650E+04
" 42.0 - 47.0"	5.3100E+07	3.0540E-06	516	3.1340E-06	1.0080E+01	4.9710E-06	7	2.9680E-12	5.0090E-05	2.6599E+03	8.6420E+05	1.8220E+03
" 47.0 - 52.0"	5.2490E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	3.6380E-06	7	6.5010E-12	3.6600E-05	1.9213E+03	1.8160E+06	2.6410E+03
" 52.0 - 57.0"	5.1780E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.0150E-06	7	3.6690E-13	2.0270E-05	1.0496E+03	1.0040E+05	6.2120E+02
" 57.0 - 62.0"	5.0740E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.5790E-06	7	6.4710E-13	1.5890E-05	8.0600E+02	1.6910E+05	8.0600E+02
" 62.0 - 67.0"	4.9580E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	1.1280E-06	7	1.0310E-13	1.1350E-05	5.6247E+02	2.5910E+04	3.1550E+02
" 67.0 - 72.0"	4.6840E+07	3.0590E-06	1166	2.9420E-06	1.0060E+01	2.5330E-06	7	7.6360E-13	2.5490E-05	1.1938E+03	1.7070E+05	8.0980E+02
" 72.0 - 77.0"	5.6910E+06	3.0590E-06	1166	2.9420E-06	1.0060E+01	7.1870E-07	5	5.1650E-13	7.2300E-06	4.1151E+01	1.6950E+03	8.0690E+01
" 77.0 - 82.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	3.0590E-06	1166	2.9420E-06	1.0060E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.4360E+08									1.0326E+06	"+ or -"	2.7420E+05

Appendix A.31. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.0070E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.7640E-03	29	8.6660E-08	5.3110E-03	1.0660E+06	4.0900E+10	3.9640E+05
" 7.0 - 12.0"	1.8760E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	1.1460E-03	28	2.0570E-08	4.8970E-03	9.1870E+05	1.5320E+10	2.4260E+05
" 12.0 - 17.0"	1.6660E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	9.9830E-04	26	2.1460E-08	5.3020E-03	8.8329E+05	1.7370E+10	2.5830E+05
" 17.0 - 22.0"	1.4900E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	1.2450E-03	24	7.9850E-08	7.3330E-03	1.0930E+06	6.2130E+10	4.8850E+05
" 22.0 - 27.0"	1.4000E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	7.6970E-04	21	4.0450E-08	5.1080E-03	7.1532E+05	3.5230E+10	3.6790E+05
" 27.0 - 32.0"	1.3060E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	3.4920E-04	19	3.1920E-09	2.6840E-03	3.5041E+05	3.2510E+09	1.1170E+05
" 32.0 - 37.0"	1.2480E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	3.9540E-04	19	2.7920E-08	2.8650E-03	3.5757E+05	2.3380E+10	2.9970E+05
" 37.0 - 42.0"	1.1510E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.9240E-04	19	5.4880E-09	1.6680E-03	1.9208E+05	5.4890E+09	1.4520E+05
" 42.0 - 47.0"	9.6940E+07	3.4280E-06	745	3.4940E-06	8.9770E+00	4.8320E-05	16	1.6790E-10	4.3380E-04	4.2055E+04	1.2960E+08	2.2310E+04
" 47.0 - 52.0"	8.6140E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.5400E-05	15	6.6130E-11	1.7020E-04	1.4658E+04	2.2230E+07	9.2410E+03
" 52.0 - 57.0"	7.9070E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.3510E-05	13	9.2510E-11	2.2440E-04	1.7747E+04	2.6260E+07	1.0040E+04
" 57.0 - 62.0"	7.0890E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.4480E-05	12	3.9550E-11	1.6400E-04	1.1625E+04	9.0490E+06	5.8960E+03
" 62.0 - 67.0"	5.9340E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.4450E-05	11	2.1000E-11	9.6780E-05	5.7432E+03	3.3500E+06	3.5880E+03
" 67.0 - 72.0"	5.6240E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.2330E-05	9	7.4480E-11	1.4960E-04	8.4141E+03	1.0640E+07	6.3940E+03
" 72.0 - 77.0"	2.1380E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.9360E-05	9	6.2630E-11	1.2970E-04	2.7732E+03	1.2920E+06	2.2280E+03
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.6850E+09									5.6795E+06	"+ or -"	8.8370E+05

Appendix A.32. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.0450E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.8040E-03	30	2.4300E-07	5.4320E-03	1.1106E+06	1.0210E+11	6.2630E+05
" 7.0 - 12.0"	1.6970E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	1.5530E-03	30	9.4200E-08	6.6380E-03	1.1263E+06	5.2680E+10	4.4990E+05
" 12.0 - 17.0"	1.4360E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	1.1360E-03	24	3.5820E-08	6.0330E-03	8.6634E+05	2.1370E+10	2.8650E+05
" 17.0 - 22.0"	1.1700E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	1.3020E-03	22	6.2250E-08	7.6680E-03	8.9724E+05	2.9960E+10	3.3930E+05
" 22.0 - 27.0"	1.0600E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	9.4590E-04	17	4.0470E-08	6.2780E-03	6.6568E+05	2.0300E+10	2.7920E+05
" 27.0 - 32.0"	9.8420E+07	4.0040E-06	2873	3.6680E-06	7.6860E+00	5.6820E-04	17	2.2310E-08	4.3670E-03	4.2983E+05	1.2820E+10	2.2190E+05
" 32.0 - 37.0"	8.5520E+07	4.2470E-06	2491	1.3780E-05	7.2460E+00	2.3660E-04	14	1.4180E-09	1.7140E-03	1.4662E+05	6.3550E+08	4.9410E+04
" 37.0 - 42.0"	8.3500E+07	3.5500E-06	1545	3.3040E-06	8.6690E+00	9.5810E-05	12	4.4700E-10	8.3050E-04	6.9350E+04	2.3690E+08	3.0170E+04
" 42.0 - 47.0"	8.2660E+07	3.4280E-06	745	3.4940E-06	8.9770E+00	3.4320E-05	12	2.1720E-10	3.0810E-04	2.5466E+04	1.2050E+08	2.1520E+04
" 47.0 - 52.0"	8.1660E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.2400E-05	12	1.8610E-11	8.3080E-05	6.7847E+03	5.6130E+06	4.6440E+03
" 52.0 - 57.0"	8.0490E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.5100E-05	12	1.8030E-11	1.0110E-04	8.1401E+03	5.3040E+06	4.5140E+03
" 57.0 - 62.0"	7.9290E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	6.8940E-06	12	5.1730E-12	4.6180E-05	3.6619E+03	1.4730E+06	2.3780E+03
" 62.0 - 67.0"	7.8100E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	5.0860E-06	12	2.1450E-12	3.4070E-05	2.6607E+03	5.9400E+05	1.5110E+03
" 67.0 - 72.0"	7.4760E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.1460E-05	12	7.2200E-12	7.6750E-05	5.7380E+03	1.8430E+06	2.6610E+03
" 72.0 - 77.0"	1.8860E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.2210E-05	12	3.7920E-11	8.1780E-05	1.5424E+03	6.0770E+05	1.5280E+03
" 77.0 - 82.0"	1.5780E+05	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.5040E+09									5.3660E+06	"+ or -"	9.6070E+05

Appendix A.33. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.1380E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	4.0300E-04	21	1.7670E-08	1.2140E-03	2.5945E+05	7.8680E+09	1.7390E+05
" 7.0 - 12.0"	2.0970E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	8.6400E-04	21	5.4020E-08	3.6920E-03	7.7420E+05	4.4880E+10	4.1520E+05
" 12.0 - 17.0"	1.9580E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	8.9920E-04	21	2.5890E-08	4.7750E-03	9.3512E+05	2.8640E+10	3.3170E+05
" 17.0 - 22.0"	1.6890E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	5.3760E-04	20	9.1770E-09	3.1670E-03	5.3493E+05	9.2230E+09	1.8820E+05
" 22.0 - 27.0"	1.5240E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	4.9210E-04	18	4.4700E-09	3.2660E-03	4.9777E+05	4.7140E+09	1.3460E+05
" 27.0 - 32.0"	1.3610E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	3.7700E-04	14	2.8210E-09	2.8970E-03	3.9436E+05	3.1330E+09	1.0970E+05
" 32.0 - 37.0"	1.3010E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	2.4820E-04	14	2.9790E-09	1.7990E-03	2.3408E+05	2.8810E+09	1.0520E+05
" 37.0 - 42.0"	1.2830E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.3110E-04	13	8.8300E-10	1.1370E-03	1.4587E+05	1.1050E+09	6.5140E+04
" 42.0 - 47.0"	1.2680E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	7.5420E-05	13	4.6820E-10	6.7710E-04	8.5822E+04	6.1650E+08	4.8670E+04
" 47.0 - 52.0"	1.2390E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	4.8510E-05	13	2.3870E-10	3.2500E-04	4.0265E+04	1.6600E+08	2.5260E+04
" 52.0 - 57.0"	1.2020E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	8.1400E-06	13	8.0270E-12	5.4530E-05	6.5529E+03	5.2440E+06	4.4880E+03
" 57.0 - 62.0"	1.1790E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.2370E-05	12	1.5710E-11	8.2860E-05	9.7703E+03	9.8950E+06	6.1660E+03
" 62.0 - 67.0"	1.1600E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.6220E-06	12	1.6000E-12	1.7570E-05	2.0384E+03	9.7080E+05	1.9310E+03
" 67.0 - 72.0"	1.0370E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.3970E-06	12	1.0950E-12	9.3570E-06	9.7026E+02	5.2900E+05	1.4260E+03
" 72.0 - 77.0"	1.3320E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	9.9940E-07	4	9.9890E-13	6.6950E-06	8.9171E+00	7.9590E+01	1.7490E+01
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.0450E+09									3.9212E+06	"+ or -"	6.2970E+05

Appendix A.34. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.0570E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	7.9640E-04	20	1.3220E-07	2.3980E-03	4.9330E+05	5.2690E+10	4.4990E+05
" 7.0 - 12.0"	1.8930E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	6.2020E-04	20	2.1850E-08	2.6500E-03	5.0170E+05	1.4920E+10	2.3940E+05
" 12.0 - 17.0"	1.7880E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	7.2930E-04	17	1.1470E-08	3.8730E-03	6.9249E+05	1.0690E+10	2.0260E+05
" 17.0 - 22.0"	1.7250E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	5.7960E-04	17	1.3520E-08	3.4150E-03	5.8899E+05	1.4130E+10	2.3300E+05
" 22.0 - 27.0"	1.6310E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	6.7140E-04	16	4.2160E-08	4.4560E-03	7.2674E+05	4.9690E+10	4.3690E+05
" 27.0 - 32.0"	1.5450E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	3.5020E-04	16	4.7970E-09	2.6910E-03	4.1590E+05	6.8180E+09	1.6180E+05
" 32.0 - 37.0"	1.5130E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	2.8750E-04	15	2.6110E-09	2.0830E-03	3.1531E+05	3.5600E+09	1.1690E+05
" 37.0 - 42.0"	1.5030E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.5450E-04	15	1.4100E-09	1.3390E-03	2.0121E+05	2.4160E+09	9.6330E+04
" 42.0 - 47.0"	1.4950E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	7.0050E-05	15	1.9220E-10	6.2890E-04	9.4015E+04	3.5850E+08	3.7110E+04
" 47.0 - 52.0"	1.4850E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.6080E-05	15	5.4480E-11	1.7470E-04	2.5937E+04	5.4540E+07	1.4470E+04
" 52.0 - 57.0"	1.4740E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.4500E-05	15	2.2750E-11	9.7110E-05	1.4316E+04	2.2390E+07	9.2730E+03
" 57.0 - 62.0"	1.4620E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.0900E-05	15	9.6440E-12	7.3040E-05	1.0678E+04	9.3600E+06	5.9970E+03
" 62.0 - 67.0"	1.4180E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.7380E-06	14	1.0280E-12	2.5040E-05	3.5499E+03	9.3890E+05	1.8990E+03
" 67.0 - 72.0"	6.8720E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.0940E-06	14	6.1000E-14	7.3290E-06	5.0361E+02	1.3170E+04	2.2500E+02
" 72.0 - 77.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.1680E+09									4.0847E+06	"+ or -"	7.7260E+05

Appendix A.35. Hydroacoustic estimate of fish inhabiting Area 1, Skilak, Alaska in 1990 based on transect 5 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.1330E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	2.3560E-04	18	1.5250E-08	7.0930E-04	1.5132E+05	6.4770E+09	1.5770E+05
" 7.0 - 12.0"	1.9970E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	5.6950E-04	18	1.2350E-08	2.4330E-03	4.8595E+05	9.5850E+09	1.9190E+05
" 12.0 - 17.0"	1.8220E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	5.5390E-04	17	8.8950E-09	2.9410E-03	5.3584E+05	8.5340E+09	1.8110E+05
" 17.0 - 22.0"	1.7450E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	3.2610E-04	16	2.3420E-09	1.9210E-03	3.3518E+05	2.5280E+09	9.8550E+04
" 22.0 - 27.0"	1.7030E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	3.8400E-04	16	8.9930E-09	2.5480E-03	4.3389E+05	1.1590E+10	2.1100E+05
" 27.0 - 32.0"	1.5180E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	2.4910E-04	15	2.7930E-09	1.9150E-03	2.9075E+05	3.8290E+09	1.2130E+05
" 32.0 - 37.0"	1.3910E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	1.3090E-04	13	1.6830E-09	9.4860E-04	1.3195E+05	1.7830E+09	8.2760E+04
" 37.0 - 42.0"	1.3380E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.4970E-04	13	1.0740E-09	1.2980E-03	1.7362E+05	1.4610E+09	7.4930E+04
" 42.0 - 47.0"	1.2990E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	1.0330E-04	12	5.4090E-10	9.2700E-04	1.2045E+05	7.5620E+08	5.3900E+04
" 47.0 - 52.0"	1.2780E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.5140E-05	12	4.7750E-11	1.6840E-04	2.1524E+04	3.5460E+07	1.1670E+04
" 52.0 - 57.0"	1.2400E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6170E-05	12	2.6690E-11	1.0830E-04	1.3427E+04	1.8580E+07	8.4490E+03
" 57.0 - 62.0"	1.2090E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.7900E-05	12	4.3590E-11	1.1990E-04	1.4498E+04	2.8780E+07	1.0520E+04
" 62.0 - 67.0"	1.0670E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	7.9750E-06	12	2.3130E-12	5.3430E-05	5.7020E+03	1.2140E+06	2.1590E+03
" 67.0 - 72.0"	1.4280E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6950E-05	10	5.1960E-11	1.1360E-04	1.6222E+03	4.7830E+05	1.3560E+03
" 72.0 - 77.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.9880E+09									2.7157E+06	"+ or -"	4.2320E+05

Appendix A.36. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1990 based on transect 6 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	2.1500E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	3.9220E-04	16	2.5280E-08	1.1810E-03	2.5388E+05	1.1120E+10	2.0670E+05
" 7.0 - 12.0"	2.0520E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	5.1730E-04	16	4.6370E-08	2.2100E-03	4.5368E+05	3.6180E+10	3.7280E+05
" 12.0 - 17.0"	1.8580E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	3.4330E-04	15	9.5260E-09	1.8230E-03	3.3880E+05	9.3610E+09	1.8960E+05
" 17.0 - 22.0"	1.7060E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	4.1120E-04	15	1.7420E-08	2.4220E-03	4.1326E+05	1.7680E+10	2.6060E+05
" 22.0 - 27.0"	1.5970E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	3.1970E-04	14	8.3090E-09	2.1220E-03	3.3895E+05	9.4030E+09	1.9010E+05
" 27.0 - 32.0"	1.4610E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	3.4200E-04	13	8.6200E-09	2.6280E-03	3.8405E+05	1.0910E+10	2.0480E+05
" 32.0 - 37.0"	1.3050E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	1.9860E-04	11	3.3550E-09	1.4390E-03	1.8783E+05	3.1480E+09	1.1000E+05
" 37.0 - 42.0"	1.2380E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.7630E-04	10	1.8820E-09	1.5280E-03	1.8916E+05	2.1870E+09	9.1650E+04
" 42.0 - 47.0"	1.1530E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	1.3240E-04	10	1.0370E-09	1.1890E-03	1.3704E+05	1.1370E+09	6.6090E+04
" 47.0 - 52.0"	1.0510E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	8.2050E-05	9	6.4990E-10	5.4970E-04	5.7769E+04	3.2540E+08	3.5360E+04
" 52.0 - 57.0"	9.9480E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	6.4810E-05	9	3.5140E-10	4.3420E-04	4.3193E+04	1.5790E+08	2.4630E+04
" 57.0 - 62.0"	9.0690E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.8220E-05	9	1.3760E-10	1.8900E-04	1.7141E+04	5.1050E+07	1.4000E+04
" 62.0 - 67.0"	7.3530E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.1690E-05	8	9.0410E-12	7.8310E-05	5.7578E+03	2.2260E+06	2.9240E+03
" 67.0 - 72.0"	7.2880E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	7.0320E-06	6	1.9780E-11	4.7110E-05	3.4333E+02	4.7260E+04	4.2610E+02
" 72.0 - 77.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.8280E+09									2.8209E+06	"+ or -"	6.2490E+05

Appendix A.37. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.6720E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.0420E-03	15	1.0950E-07	3.1380E-03	5.2472E+05	3.0000E+10	3.3950E+05
" 7.0 - 12.0"	1.6710E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	1.3070E-03	15	1.0320E-07	5.5850E-03	9.3311E+05	5.4780E+10	4.5870E+05
" 12.0 - 17.0"	1.6690E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	2.9050E-03	15	1.5610E-07	1.5420E-02	2.5749E+06	1.2750E+11	6.9990E+05
" 17.0 - 22.0"	1.6690E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	2.5520E-03	15	1.3740E-07	1.5030E-02	2.5088E+06	1.3580E+11	7.2220E+05
" 22.0 - 27.0"	1.6670E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	1.8660E-03	15	5.8290E-08	1.2380E-02	2.0644E+06	7.3770E+10	5.3240E+05
" 27.0 - 32.0"	1.6640E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	1.1020E-03	15	1.9450E-08	8.4670E-03	1.4093E+06	3.2420E+10	3.5290E+05
" 32.0 - 37.0"	1.6580E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	8.2970E-04	15	3.0700E-08	6.0120E-03	9.9692E+05	4.8530E+10	4.3180E+05
" 37.0 - 42.0"	1.6420E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	2.3120E-04	15	1.8190E-09	2.0050E-03	3.2913E+05	3.7450E+09	1.1990E+05
" 42.0 - 47.0"	1.6290E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	5.8100E-05	15	9.6930E-11	5.2160E-04	8.4962E+04	2.1730E+08	2.8890E+04
" 47.0 - 52.0"	1.6230E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.8040E-05	15	2.4050E-11	2.5480E-04	4.1365E+04	3.0110E+07	1.0750E+04
" 52.0 - 57.0"	1.6170E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	5.9070E-05	15	5.4680E-11	3.9570E-04	6.3997E+04	6.8150E+07	1.6180E+04
" 57.0 - 62.0"	1.6000E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.6070E-05	15	8.6190E-11	1.7460E-04	2.7942E+04	9.9780E+07	1.9580E+04
" 62.0 - 67.0"	1.5750E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6040E-05	15	2.7480E-11	1.0750E-04	1.6921E+04	3.0840E+07	1.0890E+04
" 67.0 - 72.0"	1.5280E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6820E-05	15	2.7190E-11	1.1270E-04	1.7219E+04	2.8780E+07	1.0510E+04
" 72.0 - 77.0"	3.0740E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	9.9320E-06	15	2.4810E-11	6.6530E-05	2.0450E+03	1.0560E+06	2.0140E+03
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.3190E+09									1.1596E+07	"+ or -"	1.3960E+06

Appendix A.38. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.6710E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.3280E-03	27	8.0930E-07	3.9990E-03	6.6836E+05	2.0860E+11	8.9520E+05
" 7.0 - 12.0"	1.6510E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	2.7800E-03	27	5.3470E-07	1.1880E-02	1.9619E+06	2.7580E+11	1.0290E+06
" 12.0 - 17.0"	1.6390E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	3.2980E-03	27	2.7610E-07	1.7510E-02	2.8699E+06	2.1510E+11	9.0890E+05
" 17.0 - 22.0"	1.6230E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	2.4800E-03	27	9.3300E-08	1.4610E-02	2.3707E+06	8.7920E+10	5.8120E+05
" 22.0 - 27.0"	1.6150E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	2.7460E-03	27	8.7950E-08	1.8230E-02	2.9432E+06	1.0590E+11	6.3790E+05
" 27.0 - 32.0"	1.5990E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	1.4880E-03	27	1.6320E-08	1.1440E-02	1.8290E+06	2.5620E+10	3.1370E+05
" 32.0 - 37.0"	1.5550E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	7.5610E-04	27	1.1000E-08	5.4790E-03	8.5183E+05	1.7030E+10	2.5580E+05
" 37.0 - 42.0"	1.4940E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	2.6950E-04	26	2.6920E-09	2.3370E-03	3.4904E+05	4.5840E+09	1.3270E+05
" 42.0 - 47.0"	1.4540E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	6.6570E-05	26	8.5850E-11	5.9760E-04	8.6872E+04	1.5670E+08	2.4540E+04
" 47.0 - 52.0"	1.4030E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	5.9160E-05	25	1.0850E-10	3.9630E-04	5.5589E+04	9.8800E+07	1.9480E+04
" 52.0 - 57.0"	1.3550E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.9260E-04	24	2.3000E-08	1.2900E-03	1.7485E+05	1.8980E+10	2.7000E+05
" 57.0 - 62.0"	1.3190E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.7590E-05	23	3.6680E-11	1.8480E-04	2.4382E+04	2.9220E+07	1.0590E+04
" 62.0 - 67.0"	1.2920E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.9900E-05	23	3.2880E-11	1.3330E-04	1.7223E+04	2.4910E+07	9.7830E+03
" 67.0 - 72.0"	1.2560E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.5690E-05	21	1.8290E-11	1.0510E-04	1.3200E+04	1.3120E+07	7.0990E+03
" 72.0 - 77.0"	2.7070E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.3330E-05	21	8.5410E-11	8.9300E-05	2.4176E+03	2.8150E+06	3.2880E+03
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.1200E+09									1.4218E+07	"+ or -"	1.9200E+06

Appendix A.39. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.6690E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.4460E-03	28	6.8640E-07	4.3550E-03	7.2671E+05	1.7760E+11	8.2600E+05
" 7.0 - 12.0"	1.6480E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	1.1240E-03	28	6.3060E-08	4.8020E-03	7.9127E+05	3.2820E+10	3.5510E+05
" 12.0 - 17.0"	1.6010E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	2.7850E-03	28	1.6690E-07	1.4790E-02	2.3669E+06	1.2470E+11	6.9200E+05
" 17.0 - 22.0"	1.5260E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	2.8270E-03	27	1.1300E-07	1.6650E-02	2.5414E+06	9.4350E+10	6.0210E+05
" 22.0 - 27.0"	1.4150E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	3.1710E-03	24	1.7280E-07	2.1040E-02	2.9777E+06	1.5740E+11	7.7760E+05
" 27.0 - 32.0"	1.4060E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	2.0790E-03	24	8.7670E-08	1.5980E-02	2.2468E+06	1.0380E+11	6.3160E+05
" 32.0 - 37.0"	1.3990E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	1.0080E-03	24	1.4480E-08	7.3060E-03	1.0225E+06	1.9310E+10	2.7240E+05
" 37.0 - 42.0"	1.3920E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	3.1060E-04	24	1.3670E-09	2.6930E-03	3.7486E+05	2.0690E+09	8.9160E+04
" 42.0 - 47.0"	1.3850E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	5.2050E-05	24	1.0140E-10	4.6730E-04	6.4732E+04	1.6270E+08	2.5000E+04
" 47.0 - 52.0"	1.3690E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.9370E-05	24	3.5920E-11	1.9680E-04	2.6947E+04	3.0940E+07	1.0900E+04
" 52.0 - 57.0"	1.3330E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6790E-05	24	1.9820E-11	1.1250E-04	1.4994E+04	1.6030E+07	7.8470E+03
" 57.0 - 62.0"	1.2400E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.7640E-05	22	4.4360E-11	1.8510E-04	2.2963E+04	3.1130E+07	1.0940E+04
" 62.0 - 67.0"	1.1670E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.0620E-05	21	3.1900E-12	7.1160E-05	8.3043E+03	2.0160E+06	2.7830E+03
" 67.0 - 72.0"	1.0800E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.0640E-05	20	7.1950E-12	7.1300E-05	7.6979E+03	3.8210E+06	3.8310E+03
" 72.0 - 77.0"	3.3390E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	8.4800E-06	19	3.8490E-12	5.6800E-05	1.8969E+03	1.9610E+05	8.6800E+02
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.9960E+09									1.3196E+07	"+ or -"	1.6540E+06

Appendix A.40. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1990 based on transect 1 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.1230E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	1.2650E-03	18	1.8760E-07	3.8110E-03	4.2777E+05	2.2920E+10	2.9670E+05
" 7.0 - 12.0"	1.1180E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	7.2780E-04	18	6.1370E-08	3.1100E-03	3.4773E+05	1.4310E+10	2.3450E+05
" 12.0 - 17.0"	1.1140E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	5.6120E-04	18	4.0810E-08	2.9800E-03	3.3196E+05	1.4360E+10	2.3490E+05
" 17.0 - 22.0"	1.1090E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	3.6130E-04	18	5.7280E-09	2.1280E-03	2.3603E+05	2.4710E+09	9.7430E+04
" 22.0 - 27.0"	1.1060E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	3.4470E-04	18	1.0100E-08	2.2880E-03	2.5307E+05	5.4830E+09	1.4510E+05
" 27.0 - 32.0"	1.0840E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	2.2080E-04	18	2.8750E-09	1.6970E-03	1.8404E+05	2.0070E+09	8.7820E+04
" 32.0 - 37.0"	1.0360E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	1.4460E-04	18	1.7310E-09	1.0480E-03	1.0860E+05	1.0260E+09	6.2790E+04
" 37.0 - 42.0"	9.5640E+07	3.5500E-06	1545	3.3040E-06	8.6690E+00	7.7910E-05	17	5.9890E-10	6.7540E-04	6.4598E+04	4.1400E+08	3.9880E+04
" 42.0 - 47.0"	9.0030E+07	3.4280E-06	745	3.4940E-06	8.9770E+00	4.7050E-05	15	2.5620E-10	4.2240E-04	3.8032E+04	1.6940E+08	2.5510E+04
" 47.0 - 52.0"	8.9450E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.7960E-05	15	1.6020E-10	2.5430E-04	2.2748E+04	5.8010E+07	1.4930E+04
" 52.0 - 57.0"	8.8850E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	9.8400E-05	15	1.9160E-09	6.5920E-04	5.8567E+04	6.8190E+08	5.1180E+04
" 57.0 - 62.0"	8.8110E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.1010E-04	15	1.4440E-09	7.3750E-04	6.4975E+04	5.0710E+08	4.4140E+04
" 62.0 - 67.0"	7.9670E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	7.1980E-05	15	4.1750E-10	4.8220E-04	3.8417E+04	1.2040E+08	2.1500E+04
" 67.0 - 72.0"	6.0620E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	7.9690E-05	12	5.3760E-10	5.3390E-04	3.2365E+04	8.9680E+07	1.8560E+04
" 72.0 - 77.0"	3.3460E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	4.2730E-05	11	2.3680E-10	2.8630E-04	9.5795E+03	1.1990E+07	6.7860E+03
" 77.0 - 82.0"	4.7940E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.2810E-05	3	1.2250E-10	8.5810E-05	4.1135E+02	1.2650E+05	6.9710E+02
" 82.0 - 87.0"	4.0500E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.4990E-06	2	2.6040E-12	2.3440E-05	9.4920E+01	1.9260E+03	8.6010E+01
" 87.0 - 92.0"	3.5380E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.2030E-05	2	9.6450E-14	8.0600E-05	2.8511E+02	1.3310E+02	2.2610E+01
" 92.0 - 97.0"	3.0130E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.1380E-05	2	1.1710E-11	7.6230E-05	2.2965E+02	4.8210E+03	1.3610E+02
"TOTAL"	1.4100E+09									2.2195E+06	"+ or -"	4.9830E+05

Appendix A.41. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1990 based on transect 2 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.1230E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	9.9520E-04	15	1.6980E-07	2.9970E-03	3.3667E+05	2.0360E+10	2.7970E+05
" 7.0 - 12.0"	1.1190E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	5.8390E-04	15	2.5870E-08	2.4950E-03	2.7910E+05	6.1050E+09	1.5310E+05
" 12.0 - 17.0"	1.1130E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	6.4840E-04	15	1.3950E-08	3.4430E-03	3.8323E+05	4.9790E+09	1.3830E+05
" 17.0 - 22.0"	1.1020E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	4.5090E-04	15	2.4170E-09	2.6560E-03	2.9270E+05	1.0590E+09	6.3800E+04
" 22.0 - 27.0"	1.0990E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	3.6470E-04	15	6.0150E-09	2.4200E-03	2.6608E+05	3.2420E+09	1.1160E+05
" 27.0 - 32.0"	1.0940E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	2.6240E-04	15	6.2650E-09	2.0170E-03	2.2056E+05	4.4390E+09	1.3060E+05
" 32.0 - 37.0"	1.0790E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	1.2990E-04	15	2.0570E-09	9.4110E-04	1.0155E+05	1.3010E+09	7.0690E+04
" 37.0 - 42.0"	1.0740E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	6.9150E-05	15	6.0090E-10	5.9950E-04	6.4370E+04	5.2300E+08	4.4820E+04
" 42.0 - 47.0"	1.0610E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	9.6670E-06	15	1.4940E-11	8.6780E-05	9.2082E+03	1.3680E+07	7.2490E+03
" 47.0 - 52.0"	1.0490E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	5.2990E-05	15	9.0370E-10	3.5500E-04	3.7254E+04	4.4800E+08	4.1490E+04
" 52.0 - 57.0"	1.0440E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	4.3090E-05	14	1.5200E-10	2.8860E-04	3.0144E+04	7.5260E+07	1.7000E+04
" 57.0 - 62.0"	1.0380E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	6.8630E-05	14	4.9320E-10	4.5970E-04	4.7728E+04	2.4070E+08	3.0410E+04
" 62.0 - 67.0"	1.0330E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	7.0340E-05	14	3.7260E-10	4.7120E-04	4.8669E+04	1.8070E+08	2.6340E+04
" 67.0 - 72.0"	1.0230E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.0110E-05	14	1.0840E-10	2.0170E-04	2.0634E+04	5.1310E+07	1.4040E+04
" 72.0 - 77.0"	1.9540E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.5480E-05	14	4.1370E-10	1.7070E-04	3.3354E+03	7.0970E+06	5.2210E+03
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.5250E+09									2.1412E+06	"+ or -"	4.0650E+05

Appendix A.42. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1990 based on transect 3 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.1250E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	6.2400E-04	14	2.9220E-08	1.8790E-03	2.1136E+05	3.7150E+09	1.1950E+05
" 7.0 - 12.0"	1.1240E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	5.9070E-04	14	3.0970E-08	2.5240E-03	2.8376E+05	7.3480E+09	1.6800E+05
" 12.0 - 17.0"	1.1240E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	6.3080E-04	14	2.1870E-08	3.3500E-03	3.7646E+05	7.8920E+09	1.7410E+05
" 17.0 - 22.0"	1.1230E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	7.7790E-04	14	4.0730E-08	4.5830E-03	5.1461E+05	1.7950E+10	2.6260E+05
" 22.0 - 27.0"	1.1220E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	7.5650E-04	14	5.4570E-08	5.0210E-03	5.6350E+05	3.0460E+10	3.4210E+05
" 27.0 - 32.0"	1.1190E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	6.7590E-04	14	2.0510E-08	5.1950E-03	5.8122E+05	1.5270E+10	2.4220E+05
" 32.0 - 37.0"	1.1100E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	2.2960E-04	14	3.3180E-09	1.6640E-03	1.8470E+05	2.2910E+09	9.3820E+04
" 37.0 - 42.0"	1.0990E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	7.8320E-05	14	9.7820E-10	6.7900E-04	7.4644E+04	8.9160E+08	5.8520E+04
" 42.0 - 47.0"	1.0920E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	3.2830E-05	14	5.9640E-11	2.9470E-04	3.2192E+04	5.8800E+07	1.5030E+04
" 47.0 - 52.0"	1.0790E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	4.2930E-05	14	2.3480E-10	2.8760E-04	3.1040E+04	1.2370E+08	2.1800E+04
" 52.0 - 57.0"	1.0610E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.5330E-05	14	7.8610E-11	2.3660E-04	2.5101E+04	4.0300E+07	1.2440E+04
" 57.0 - 62.0"	1.0340E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.5910E-05	14	7.3640E-11	2.4060E-04	2.4885E+04	3.5960E+07	1.1750E+04
" 62.0 - 67.0"	9.8490E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.8230E-05	14	5.8220E-11	1.8910E-04	1.8622E+04	2.5680E+07	9.9320E+03
" 67.0 - 72.0"	8.1590E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.8070E-05	14	1.0210E-10	2.5500E-04	2.0807E+04	3.0930E+07	1.0900E+04
" 72.0 - 77.0"	2.7960E+06	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.1000E-05	3	2.7900E-10	1.4070E-04	3.9339E+02	9.8060E+04	6.1380E+02
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.5040E+09									2.9433E+06	"+ or -"	5.7520E+05

Appendix A.43. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1990 based on transect 4 integrator output.

Depth Stratum (m)	Stratum Volume (m^3)	Mean Sigma	Number of Echoes	Standard Deviation Sigma	A Constant	Integrator Output	Number of Sequences	Mean Integrator Variance	Fish Density (no./m^3)	Estimated Number of Fish	Variance	Confidence Limits (95%)
" 2.0 - 7.0"	1.1240E+08	1.0220E-05	125	1.0300E-05	3.0110E+00	2.4480E-03	11	1.1880E-06	7.3720E-03	8.2835E+05	1.4150E+11	7.3740E+05
" 7.0 - 12.0"	1.1180E+08	7.2020E-06	584	8.6900E-06	4.2730E+00	1.5550E-03	11	1.7100E-07	6.6450E-03	7.4320E+05	4.0430E+10	3.9410E+05
" 12.0 - 17.0"	1.1040E+08	5.7950E-06	1491	6.0270E-06	5.3110E+00	2.2040E-03	11	2.3740E-07	1.1710E-02	1.2925E+06	8.2820E+10	5.6410E+05
" 17.0 - 22.0"	1.0900E+08	5.2240E-06	2386	5.5700E-06	5.8910E+00	1.8100E-03	11	5.7060E-08	1.0660E-02	1.1628E+06	2.4190E+10	3.0480E+05
" 22.0 - 27.0"	1.0800E+08	4.6370E-06	3254	6.2970E-06	6.6370E+00	1.5750E-03	11	5.8890E-08	1.0460E-02	1.1294E+06	3.0990E+10	3.4500E+05
" 27.0 - 32.0"	1.0650E+08	4.0040E-06	2873	3.6680E-06	7.6860E+00	1.0030E-03	11	5.9180E-08	7.7110E-03	8.2131E+05	3.9850E+10	3.9130E+05
" 32.0 - 37.0"	1.0570E+08	4.2470E-06	2491	1.3780E-05	7.2460E+00	4.7650E-04	11	1.2120E-08	3.4530E-03	3.6479E+05	7.6650E+09	1.7160E+05
" 37.0 - 42.0"	1.0480E+08	3.5500E-06	1545	3.3040E-06	8.6690E+00	1.0570E-04	11	3.1700E-09	9.1630E-04	9.6031E+04	2.6220E+09	1.0040E+05
" 42.0 - 47.0"	1.0410E+08	3.4280E-06	745	3.4940E-06	8.9770E+00	4.0680E-05	11	6.3890E-10	3.6520E-04	3.8030E+04	5.6030E+08	4.6390E+04
" 47.0 - 52.0"	1.0330E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.3620E-05	11	9.5250E-11	9.1220E-05	9.4273E+03	4.5740E+07	1.3260E+04
" 52.0 - 57.0"	1.0250E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	3.6170E-05	11	2.2290E-10	2.4230E-04	2.4831E+04	1.0560E+08	2.0140E+04
" 57.0 - 62.0"	1.0130E+08	4.5940E-06	1206	4.9700E-06	6.6990E+00	4.9660E-05	11	2.8300E-10	3.3260E-04	3.3684E+04	1.3130E+08	2.2460E+04
" 62.0 - 67.0"	9.9480E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	2.5220E-05	11	7.5220E-11	1.6900E-04	1.6809E+04	3.3680E+07	1.1370E+04
" 67.0 - 72.0"	8.9540E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	1.6140E-05	11	2.4040E-11	1.0810E-04	9.6819E+03	8.7410E+06	5.7950E+03
" 72.0 - 77.0"	1.4670E+07	4.5940E-06	1206	4.9700E-06	6.6990E+00	5.1970E-06	8	2.5950E-11	3.4820E-05	5.1062E+02	2.5070E+05	9.8140E+02
" 77.0 - 82.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	0.0000E+00	4.5940E-06	1206	4.9700E-06	6.6990E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.4840E+09									6.5713E+06	"+ or -"	1.1940E+06

Appendix A.44. Estimated number of fish not available to the hydroacoustic equipment because of surface orientation in Skilak and Kenai Lakes, Alaska during the fall of 1990.

Lake	Area	Transect	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
Skilak	1	1	5.3110E-03	1.2909E+08	6.8560E+05
		2	5.4320E-03	1.2909E+08	7.0122E+05
		3	1.2140E-03	1.2909E+08	1.5672E+05
		4	2.3980E-03	1.2909E+08	3.0956E+05
		5	7.0930E-04	1.2909E+08	9.1564E+04
		6	1.1810E-03	1.2909E+08	1.5246E+05
	2	1	3.1380E-03	1.0038E+08	3.1499E+05
		2	3.9990E-03	1.0038E+08	4.0142E+05
		3	4.3550E-03	1.0038E+08	4.3715E+05
	3	1	3.8110E-03	6.7500E+07	2.5724E+05
		2	2.9970E-03	6.7500E+07	2.0230E+05
		3	1.8790E-03	6.7500E+07	1.2683E+05
		4	7.3720E-03	6.7500E+07	4.9761E+05
Kenai	1	1	8.3410E-04	2.3160E+07	1.9318E+04
		2	0.0000E+00	2.3160E+07	0.0000E+00
		3	1.9820E-03	2.3160E+07	4.5903E+04
		4	2.2710E-03	2.3160E+07	5.2596E+04
		5	2.1480E-04	2.3160E+07	4.9748E+03
		6	9.8530E-04	2.3160E+07	2.2820E+04
		7	0.0000E+00	2.3160E+07	0.0000E+00
	2	1	0.0000E+00	3.5730E+07	0.0000E+00
		2	0.0000E+00	3.5730E+07	0.0000E+00
		3	3.1370E-04	3.5730E+07	1.1209E+04
		4	7.4540E-04	3.5730E+07	2.6633E+04
	3	1	1.6600E-05	3.1620E+07	5.2489E+02
		2	6.8350E-04	3.1620E+07	2.1612E+04
		3	9.0460E-05	3.1620E+07	2.8603E+03
		4	3.8510E-05	3.1620E+07	1.2177E+03
		5	0.0000E+00	3.1620E+07	0.0000E+00
	4	1	0.0000E+00	4.3110E+07	0.0000E+00
		2	1.7480E-05	4.3110E+07	7.5356E+02
		3	0.0000E+00	4.3110E+07	0.0000E+00
		4	0.0000E+00	4.3110E+07	0.0000E+00
		5	0.0000E+00	4.3110E+07	0.0000E+00
	5	1	1.1120E-02	3.2790E+07	3.6462E+05
		2	2.8290E-03	3.2790E+07	9.2763E+04
		3	6.2400E-03	3.2790E+07	2.0461E+05
		4	6.8300E-04	3.2790E+07	2.2396E+04
		5	8.8010E-05	3.2790E+07	2.8858E+03
		6	1.9010E-03	3.2790E+07	6.2334E+04

Appendix A.45. Estimated number of fish not available to the hydroacoustic equipment because of bottom orientation in Skilak Lake,Alaska during the fall of 1990.

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	1	2-7	5.3110E-03	1.4838E+07	7.8804E+04
		7-12	4.8970E-03	2.3741E+07	1.1626E+05
		12-17	5.3020E-03	2.3741E+07	1.2587E+05
		17-22	7.3330E-03	1.4838E+07	1.0881E+05
		22-27	5.1080E-03	1.4838E+07	7.5792E+04
		27-32	2.6840E-03	8.9028E+06	2.3895E+04
		32-37	2.8650E-03	1.1870E+07	3.4009E+04
		37-42	1.6680E-03	2.0773E+07	3.4650E+04
		42-47	4.3380E-04	2.0773E+07	9.0114E+03
		47-52	1.7020E-04	1.7806E+07	3.0305E+03
		52-57	2.2440E-05	1.4838E+07	3.3296E+02
		57-62	1.6400E-04	1.4838E+07	2.4334E+03
		62-67	9.6780E-05	8.9028E+06	8.6161E+02
		67-72	1.4960E-04	8.9028E+06	1.3319E+03
		72-77	1.2970E-04	2.6708E+07	3.4641E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			6.1855E+05
1	2	2-7	5.4320E-03	2.2949E+07	1.2466E+05
		7-12	6.6380E-03	3.4424E+07	2.2851E+05
		12-17	6.0330E-03	2.0081E+07	1.2115E+05
		17-22	7.6680E-03	2.0081E+07	1.5398E+05
		22-27	6.2780E-03	1.1475E+07	7.2038E+04
		27-32	4.3670E-03	1.7212E+07	7.5165E+04
		32-37	1.7140E-03	8.6060E+06	1.4751E+04
		37-42	8.3050E-04	5.7373E+06	4.7649E+03
		42-47	3.0810E-04	5.7373E+06	1.7677E+03
		47-52	8.3080E-05	5.7373E+06	4.7666E+02
		52-57	1.0110E-04	5.7373E+06	5.8004E+02
		57-62	4.6180E-05	5.7373E+06	2.6495E+02
		62-67	3.4070E-05	8.6060E+06	2.9321E+02
		67-72	7.6750E-05	8.6060E+06	6.6051E+02
		72-77	8.1780E-05	3.4424E+07	2.8152E+03
		77-82	0.0000E+00	2.8687E+06	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			8.0187E+05

continued

Appendix A.45. (p.2 of 7).

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	3	2-7	1.2140E-03	8.1962E+06	9.9502E+03
		7-12	3.6920E-03	8.1962E+06	3.0260E+04
		12-17	4.7750E-03	2.4589E+07	1.1741E+05
		17-22	3.1670E-03	2.4589E+07	7.7872E+04
		22-27	3.2660E-03	2.4589E+07	8.0306E+04
		27-32	2.8970E-03	8.1962E+06	2.3744E+04
		32-37	1.7990E-03	1.2294E+07	2.2117E+04
		37-42	1.1370E-03	8.1962E+06	9.3191E+03
		42-47	6.7710E-04	8.1962E+06	5.5496E+03
		47-52	3.2500E-04	8.1962E+06	2.6638E+03
		52-57	5.4530E-05	1.2294E+07	6.7041E+02
		57-62	8.2860E-05	8.1962E+06	6.7914E+02
		62-67	1.7570E-05	8.1962E+06	1.4401E+02
		67-72	9.3570E-06	4.5079E+07	4.2180E+02
		72-77	6.6950E-06	1.6392E+07	1.0975E+02
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			3.8122E+05
1	4	2-7	2.3980E-03	1.2909E+07	3.0956E+04
		7-12	2.6500E-03	1.7212E+07	4.5612E+04
		12-17	3.8730E-03	8.6060E+06	3.3331E+04
		17-22	3.4150E-03	1.2909E+07	4.4084E+04
		22-27	4.4560E-03	8.6060E+06	3.8348E+04
		27-32	2.6910E-03	1.2909E+07	3.4738E+04
		32-37	2.0830E-03	8.6060E+06	1.7926E+04
		37-42	1.3390E-03	8.6060E+06	1.1523E+04
		42-47	6.2890E-04	8.6060E+06	5.4123E+03
		47-52	1.7470E-04	8.6060E+06	1.5035E+03
		52-57	9.7110E-05	8.6060E+06	8.3573E+02
		57-62	7.3040E-05	8.6060E+06	6.2858E+02
		62-67	2.5040E-05	8.6060E+06	2.1549E+02
		67-72	7.3290E-06	6.0242E+07	4.4151E+02
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			2.6556E+05

continued

Appendix A.45. (p.3 of 7).

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	5	2-7	7.0930E-04	1.9124E+07	1.3565E+04
		7-12	2.4330E-03	1.9124E+07	4.6530E+04
		12-17	2.9410E-03	1.4343E+07	4.2184E+04
		17-22	1.9210E-03	9.5622E+06	1.8369E+04
		22-27	2.5480E-03	1.4343E+07	3.6547E+04
		27-32	1.9150E-03	1.9124E+07	3.6623E+04
		32-37	9.4860E-04	9.5622E+06	9.0707E+03
		37-42	1.2980E-03	1.4343E+07	1.8618E+04
		42-47	9.2700E-04	9.5622E+06	8.8642E+03
		47-52	1.6840E-04	9.5622E+06	1.6103E+03
		52-57	1.0830E-04	9.5622E+06	1.0356E+03
		57-62	1.1990E-04	1.9124E+07	2.2930E+03
		62-67	5.3430E-05	1.9124E+07	1.0218E+03
		67-72	1.1360E-04	4.7811E+07	5.4313E+03
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL	0.0000E+00		2.4176E+05
1	6	2-7	1.1810E-03	1.0758E+07	1.2705E+04
		7-12	2.2100E-03	2.1515E+07	4.7548E+04
		12-17	1.8230E-03	2.1515E+07	3.9222E+04
		17-22	2.4220E-03	1.6136E+07	3.9082E+04
		22-27	2.1220E-03	2.1515E+07	4.5655E+04
		27-32	2.6280E-03	2.6894E+07	7.0677E+04
		32-37	1.4390E-03	1.6136E+07	2.3220E+04
		37-42	1.5280E-03	1.0758E+07	1.6437E+04
		42-47	1.1890E-03	1.6136E+07	1.9186E+04
		47-52	5.4970E-04	1.0758E+07	5.9134E+03
		52-57	4.3420E-04	1.6136E+07	7.0064E+03
		57-62	1.8900E-04	2.1515E+07	4.0663E+03
		62-67	7.8310E-05	3.2273E+07	2.5273E+03
		67-72	4.7110E-05	3.2273E+07	1.5204E+03
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			3.3477E+05

continued

Appendix A.45. (p.4 of 7)

Area	Transect	Bottom Depth(m)	Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
2	1	2-7	3.1380E-03	4.4613E+06	1.4000E+04
		7-12	5.5850E-03	4.4613E+06	2.4917E+04
		12-17	1.5420E-02	4.4613E+06	6.8794E+04
		17-22	1.5030E-02	4.4613E+06	6.7054E+04
		22-27	1.2380E-02	4.4613E+06	5.5231E+04
		27-32	8.4670E-03	4.4613E+06	3.7774E+04
		32-37	6.0120E-03	4.4613E+06	2.6822E+04
		37-42	2.0050E-03	4.4613E+06	8.9450E+03
		42-47	5.2160E-04	4.4613E+06	2.3270E+03
		47-52	2.5480E-04	4.4613E+06	1.1367E+03
		52-57	3.9570E-04	4.4613E+06	1.7653E+03
		57-62	1.7460E-04	4.4613E+06	7.7895E+02
		62-67	1.0750E-04	8.9227E+06	9.5919E+02
		67-72	1.1270E-04	8.9227E+06	1.0056E+03
		72-77	6.6530E-05	6.6920E+07	4.4522E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			3.1596E+05
2	2	2-7	3.9990E-03	2.4785E+06	9.9116E+03
		7-12	1.1880E-02	2.4785E+06	2.9445E+04
		12-17	1.7510E-02	4.9570E+06	8.6798E+04
		17-22	1.4610E-02	4.9570E+06	7.2422E+04
		22-27	1.8230E-02	4.9570E+06	9.0367E+04
		27-32	1.1440E-02	7.4356E+06	8.5063E+04
		32-37	5.4790E-03	1.4871E+07	8.1479E+04
		37-42	2.3370E-03	1.2393E+07	2.8961E+04
		42-47	5.9760E-04	1.2393E+07	7.4058E+03
		47-52	3.9630E-04	9.9141E+06	3.9289E+03
		52-57	1.2900E-03	7.4356E+06	9.5919E+03
		57-62	1.8480E-04	4.9570E+06	9.1606E+02
		62-67	1.3330E-04	9.9141E+06	1.3215E+03
		67-72	1.0510E-04	4.9570E+06	5.2098E+02
		72-77	8.9300E-05	5.2049E+07	4.6480E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL	0.0000E+00		5.1278E+05

continued

Appendix A.45. (p.5 of 7).

Area	Transect	Bottom Depth(m)	Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
2	3	2-7	4.3550E-03	2.3900E+06	1.0408E+04
		7-12	4.8020E-03	4.7800E+06	2.2954E+04
		12-17	1.4790E-02	7.1700E+06	1.0604E+05
		17-22	1.6650E-02	1.1950E+07	1.9897E+05
		22-27	2.1040E-02	4.7800E+06	1.0057E+05
		27-32	1.5980E-02	4.7800E+06	7.6384E+04
		32-37	7.3060E-03	4.7800E+06	3.4923E+04
		37-42	2.6930E-03	4.7800E+06	1.2873E+04
		42-47	4.6730E-04	4.7800E+06	2.2337E+03
		47-52	1.9680E-04	4.7800E+06	9.4070E+02
		52-57	1.1250E-04	9.5600E+06	1.0755E+03
		57-62	1.8510E-04	7.1700E+06	1.3272E+03
		62-67	7.1160E-05	7.1700E+06	5.1022E+02
		67-72	7.1300E-05	7.1700E+06	5.1122E+02
		72-77	5.6800E-05	4.5410E+07	2.5793E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			5.7230E+05
3	1	2-7	3.8110E-03	2.5000E+06	9.5275E+03
		7-12	3.1100E-03	2.5000E+06	7.7750E+03
		12-17	2.9800E-03	2.5000E+06	7.4500E+03
		17-22	2.1280E-03	2.5000E+06	5.3200E+03
		22-27	2.2880E-03	5.0000E+06	1.1440E+04
		27-32	1.6970E-03	5.0000E+06	8.4850E+03
		32-37	1.0480E-03	7.5000E+06	7.8600E+03
		37-42	6.7540E-04	1.0000E+07	6.7540E+03
		42-47	4.2240E-04	5.0000E+06	2.1120E+03
		47-52	2.5430E-04	5.0000E+06	1.2715E+03
		52-57	6.5920E-04	5.0000E+06	3.2960E+03
		57-62	7.3750E-04	5.0000E+06	3.6875E+03
		62-67	4.8220E-04	1.7500E+07	8.4385E+03
		67-72	5.3390E-04	1.2500E+07	6.6738E+03
		72-77	2.8630E-04	2.7500E+07	7.8733E+03
		77-82	8.5810E-05	7.5000E+06	6.4358E+02
		82-87	2.3440E-05	5.0000E+06	1.1720E+02
		87-92	8.0600E-05	5.0000E+06	4.0300E+02
		92-97	7.6230E-05	5.0000E+06	3.8115E+02
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			9.9509E+04

continued

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
3	2	2-7	2.9970E-03	3.0000E+06	8.9910E+03
		7-12	2.4950E-03	3.0000E+06	7.4850E+03
		12-17	3.4430E-03	3.0000E+06	1.0329E+04
		17-22	2.6560E-03	3.0000E+06	7.9680E+03
		22-27	2.4200E-03	3.0000E+06	7.2600E+03
		27-32	2.0170E-03	3.0000E+06	6.0510E+03
		32-37	9.4110E-04	3.0000E+06	2.8233E+03
		37-42	5.9950E-04	3.0000E+06	1.7985E+03
		42-47	8.6780E-05	3.0000E+06	2.6034E+02
		47-52	3.5500E-04	6.0000E+06	2.1300E+03
		52-57	2.8860E-04	3.0000E+06	8.6580E+02
		57-62	4.5970E-04	3.0000E+06	1.3791E+03
		62-67	4.7120E-04	3.0000E+06	1.4136E+03
		67-72	2.0170E-04	3.0000E+06	6.0510E+02
		72-77	1.7070E-04	4.2000E+07	7.1694E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			6.6529E+04
3	3	2-7	1.8790E-03	0.0000E+00	0.0000E+00
		7-12	2.5240E-03	3.2143E+06	8.1129E+03
		12-17	3.3500E-03	3.2143E+06	1.0768E+04
		17-22	4.5830E-03	3.2143E+06	1.4731E+04
		22-27	5.0210E-03	3.2143E+06	1.6139E+04
		27-32	5.1950E-03	6.4286E+06	3.3396E+04
		32-37	1.6640E-03	6.4286E+06	1.0697E+04
		37-42	6.7900E-04	6.4286E+06	4.3650E+03
		42-47	2.9470E-04	6.4286E+06	1.8945E+03
		47-52	2.8760E-04	6.4286E+06	1.8489E+03
		52-57	2.3660E-04	6.4286E+06	1.5210E+03
		57-62	2.4060E-04	6.4286E+06	1.5467E+03
		62-67	1.8910E-04	1.2857E+07	2.4313E+03
		67-72	2.5500E-04	4.5000E+07	1.1475E+04
		72-77	1.4070E-04	9.6429E+06	1.3568E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			1.2028E+05

continued

Appendix A.45. (p.7 of 7).

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
3	4	2-7	7.3720E-03	4.0909E+06	3.0158E+04
		7-12	6.6450E-03	4.0909E+06	2.7184E+04
		12-17	1.1710E-02	4.0909E+06	4.7905E+04
		17-22	1.0660E-02	8.1818E+06	8.7218E+04
		22-27	1.0460E-02	8.1818E+06	8.5582E+04
		27-32	7.7110E-03	8.1818E+06	6.3090E+04
		32-37	3.4530E-03	8.1818E+06	2.8252E+04
		37-42	9.1630E-04	8.1818E+06	7.4970E+03
		42-47	3.6520E-04	8.1818E+06	2.9880E+03
		47-52	9.1220E-05	8.1818E+06	7.4635E+02
		52-57	2.4230E-04	8.1818E+06	1.9825E+03
		57-62	3.3260E-04	8.1818E+06	2.7213E+03
		62-67	1.6900E-04	8.1818E+06	1.3827E+03
		67-72	1.0810E-04	2.4545E+07	2.6534E+03
		72-77	3.4820E-05	3.2727E+07	1.1396E+03
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			3.9050E+05

Appendix A.46. Estimated number of fish not available to the hydroacoustic equipment because of bottom orientation in Kenai Lake,Alaska during the fall of 1990.

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	1	2-7	8.3410E-04	2.2057E+06	1.8398E+03
		7-12	1.6730E-03	4.4114E+06	7.3803E+03
		12-17	3.1220E-03	4.4114E+06	1.3772E+04
		17-22	3.1900E-03	4.4114E+06	1.4072E+04
		22-27	3.3510E-03	4.4114E+06	1.4783E+04
		27-32	1.3480E-03	4.4114E+06	5.9466E+03
		32-37	8.2180E-04	6.6171E+06	5.4380E+03
		37-42	2.4250E-04	4.4114E+06	1.0698E+03
		42-47	1.3420E-05	4.4114E+06	5.9201E+01
		47-52	7.8730E-05	6.6171E+06	5.2097E+02
		52-57	0.0000E+00	4.4114E+06	0.0000E+00
		57-62	0.0000E+00	6.6171E+06	0.0000E+00
		62-67	0.0000E+00	4.4114E+06	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			6.4882E+04
1	2	2-7	0.0000E+00	0.0000E+00	0.0000E+00
		7-12	8.6190E-04	2.2057E+06	1.9011E+03
		12-17	6.9620E-03	2.2057E+06	1.5356E+04
		17-22	3.6850E-03	2.2057E+06	8.1281E+03
		22-27	4.1980E-03	4.4114E+06	1.8519E+04
		27-32	1.4170E-03	4.4114E+06	6.2510E+03
		32-37	7.3440E-04	4.4114E+06	3.2398E+03
		37-42	3.5910E-04	6.6171E+06	2.3762E+03
		42-47	5.7290E-04	8.8229E+06	5.0546E+03
		47-52	1.9800E-05	6.6171E+06	1.3102E+02
		52-57	0.0000E+00	6.6171E+06	0.0000E+00
		57-62	0.0000E+00	4.4114E+06	0.0000E+00
		62-67	0.0000E+00	2.2057E+06	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			6.0957E+04

continued

Appendix A.46. (p.2 of 4).

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	3	2-7	1.9820E-03	0.0000E+00	0.0000E+00
		7-12	1.7740E-03	3.8600E+06	6.8476E+03
		12-17	3.2130E-03	7.7200E+06	2.4804E+04
		17-22	2.9410E-03	7.7200E+06	2.2705E+04
		22-27	9.2910E-04	7.7200E+06	7.1727E+03
		27-32	7.5660E-04	1.1580E+07	8.7614E+03
		32-37	1.6210E-04	7.7200E+06	1.2514E+03
		37-42	0.0000E+00	0.0000E+00	0.0000E+00
		42-47	0.0000E+00	0.0000E+00	0.0000E+00
		47-52	0.0000E+00	0.0000E+00	0.0000E+00
		52-57	0.0000E+00	0.0000E+00	0.0000E+00
		57-62	0.0000E+00	0.0000E+00	0.0000E+00
		62-67	0.0000E+00	0.0000E+00	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			7.1542E+04
1	4	2-7	2.2710E-03	7.7200E+06	1.7532E+04
		7-12	2.2010E-03	1.5440E+07	3.3983E+04
		12-17	1.1890E-03	1.1580E+07	1.3769E+04
		17-22	2.3230E-03	7.7200E+06	1.7934E+04
		22-27	4.1890E-03	7.7200E+06	3.2339E+04
		27-32	0.0000E+00	0.0000E+00	0.0000E+00
		32-37	0.0000E+00	0.0000E+00	0.0000E+00
		37-42	0.0000E+00	0.0000E+00	0.0000E+00
		42-47	0.0000E+00	0.0000E+00	0.0000E+00
		47-52	0.0000E+00	0.0000E+00	0.0000E+00
		52-57	0.0000E+00	0.0000E+00	0.0000E+00
		57-62	0.0000E+00	0.0000E+00	0.0000E+00
		62-67	0.0000E+00	0.0000E+00	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			1.1556E+05

continued

Appendix A.46. (p. 3 of 4).

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	5	2-7	2.1480E-04	2.5733E+06	5.5275E+02
		7-12	2.2790E-04	2.5733E+06	5.8646E+02
		12-17	2.0800E-03	2.5733E+06	5.3525E+03
		17-22	2.3530E-03	7.7200E+06	1.8165E+04
		22-27	2.5830E-03	7.7200E+06	1.9941E+04
		27-32	2.1210E-03	7.7200E+06	1.6374E+04
		32-37	8.8020E-05	7.7200E+06	6.7951E+02
		37-42	0.0000E+00	0.0000E+00	0.0000E+00
		42-47	0.0000E+00	0.0000E+00	0.0000E+00
		47-52	0.0000E+00	0.0000E+00	0.0000E+00
		52-57	0.0000E+00	0.0000E+00	0.0000E+00
		57-62	0.0000E+00	0.0000E+00	0.0000E+00
		62-67	0.0000E+00	0.0000E+00	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			6.1651E+04
1	6	2-7	9.8530E-04	2.2057E+06	2.1733E+03
		7-12	6.3650E-04	4.4114E+06	2.8079E+03
		12-17	1.2060E-03	4.4114E+06	5.3202E+03
		17-22	1.9440E-03	4.4114E+06	8.5758E+03
		22-27	3.1560E-03	4.4114E+06	1.3922E+04
		27-32	1.5660E-03	4.4114E+06	6.9083E+03
		32-37	5.1510E-04	8.8229E+06	4.5447E+03
		37-42	0.0000E+00	8.8229E+06	0.0000E+00
		42-47	0.0000E+00	0.0000E+00	0.0000E+00
		47-52	0.0000E+00	0.0000E+00	0.0000E+00
		52-57	0.0000E+00	0.0000E+00	0.0000E+00
		57-62	0.0000E+00	0.0000E+00	0.0000E+00
		62-67	0.0000E+00	0.0000E+00	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			4.4253E+04

continued

Appendix A.46. (p. 4 of 4).

Area	Transect	Bottom Depth(m)	Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	7	2-7	0.0000E+00	2.2057E+06	0.0000E+00
		7-12	1.2880E-03	2.2057E+06	2.8410E+03
		12-17	3.5800E-04	2.2057E+06	7.8965E+02
		17-22	1.6290E-03	2.2057E+06	3.5931E+03
		22-27	1.8190E-03	4.4114E+06	8.0244E+03
		27-32	6.2130E-04	1.1029E+07	6.8521E+03
		32-37	6.6610E-05	4.4114E+06	2.9385E+02
		37-42	5.4240E-05	0.0000E+00	0.0000E+00
		42-47	0.0000E+00	0.0000E+00	0.0000E+00
		47-52	0.0000E+00	0.0000E+00	0.0000E+00
		52-57	0.0000E+00	0.0000E+00	0.0000E+00
		57-62	0.0000E+00	0.0000E+00	0.0000E+00
		62-67	0.0000E+00	0.0000E+00	0.0000E+00
		67-72	0.0000E+00	0.0000E+00	0.0000E+00
		72-77	0.0000E+00	0.0000E+00	0.0000E+00
		77-82	0.0000E+00	0.0000E+00	0.0000E+00
		82-87	0.0000E+00	0.0000E+00	0.0000E+00
		87-92	0.0000E+00	0.0000E+00	0.0000E+00
		92-97	0.0000E+00	0.0000E+00	0.0000E+00
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			2.2394E+04

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