AN ESTIMATE OF JUVENILE FISH DENSITIES IN SKILAK AND KENAI LAKES, ALASKA THROUGH THE USE OF DUAL BEAM HYDROACOUSTIC TECHNIQUES IN 1988

By: Kenneth E. Tarbox
Bruce E. King

Regional Information Report[1] No. 2S89-07

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road
Anchorage, Alaska

June 1989

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AUTHORS

Kenneth E. Tarbox is the Research Project Leader for the Alaska Department of Fish and Game, Division of Commercial Fisheries, Region II, Upper Cook Inlet, 34828 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669.

Bruce E. King is and Assistant Research Project Leader for the Alaska Department of Fish and Game, Division of Commercial Fisheries, Region II, Upper Cook Inlet, 34828 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669.

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INTRODUCTION

In 1986 the State of Alaska, Department of Fish and Game (ADF&G) began developing new methodologies (Tarbox and King 1988a and 1988b) to assess the rearing success of sockeye salmon (*Oncorhynchus nerka*) in the glacial lake systems of the Kenai River, Upper Cook Inlet, Alaska (Figure 1). The Kenai River drainage consists of a number of sockeye rearing lakes (Figure 2) and is the single largest producer of sockeye salmon in Upper Cook Inlet. Recent sockeye salmon adult returns to the Kenai River have ranged between 5 and 9 million fish and have contributed over 75% to the total Upper Cook Inlet harvest.

The 1987 adult sockeye salmon escapement to the Kenai River was estimated at 1.6 million fish. This level of escapement was the highest on record for the Kenai River and was substantially above the desired escapement range of 400,000 - 700,000 fish. The ADF&G was extremely interested in assessing production from this escapement since spawner/return data indicated that the Kenai River optimum escapement goal may be 1.0 million fish (Tarbox and Waltemyer 1986). In addition, the public was concerned that escapement goals were already too high, and that 1.6 million fish might be harmful to the system. Therefore, special funding was provided in 1988 to monitor the production from the 1987 escapement. Studies were designed to enumerate fall juvenile rearing sockeye salmon and the 1989 smolt outmigration. This report documents efforts to enumerate juvenile sockeye salmon in Kenai and Skilak lakes, the two main rearing areas in the Kenai River drainage.

Specific objectives for the 1988 field investigation were to: (1) estimate the number and spatial distribution of sockeye salmon juveniles in Kenai and Skilak Lakes; and (2) define the target strength distribution for fish targets in both lakes using dual beam hydroacoustic techniques.

METHODS

Hydroacoustic surveys of Skilak and Kenai Lakes were conducted in late September 1988 to assess the number of rearing fish that had survived the summer growth period. The surveys were conducted at night to maximize targets available to the gear because previous investigations of sockeye salmon in glacial lake systems on the Kenai Peninsula have documented strong surface orientation of juvenile sockeye salmon during daylight hours (Tarbox and King 1988a, Thorne 1981). Because of adverse weather conditions the Skilak Lake survey took more than a single night and was conducted on the 18th and 22nd of September. The Kenai Lake survey was completed on the 26th of September.

The survey design for the 1988 field season was a stratified random sample, which balanced the needs to disperse the sampling effort and provide an acceptable means of calculating sampling error (H. Gieger, Alaska Department of Fish and Game, Juneau, personal communication). Each lake was divided into subbasins or areas and survey transects were randomly selected in each area. Because of the size of Skilak Lake, only 11 transects were completed within the

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3 areas (Figure 3). A total of 20 transects were run within 5 areas of Kenai Lake (Figure 4). The total sample effort was limited to the number of transects which could be made in the hours of darkness on one night.

The hydroacoustic equipment used for data acquisition consisted of a *Biosonics Inc.* Model 105 echo sounder with dual beam receivers, a 420 kHz, 6°/15° degree dual beam transducer mounted in a towed body, a Model 171 tape recorder interface, a Sony model SL-HF400 video cassette recorder and PCM-501ES digital audio processor, a Model 115 chart recorder, and a Model 315P oscilloscope. The selected pulse width was 0.4 milliseconds (ms) and the ping rate was 5 pings/second. Additional acoustic parameters used during data collection and processing are presented in Appendix A.1. The system was calibrated by *Biosonics, Inc.* prior to and following the surveys. The entire system was powered by 12 volt batteries, and the equipment was housed in a 6.7 m vessel powered by a 150 hp outboard motor. Transect speed was estimated at 2.5 meters/second (m/s), and beginning and end points of the transects were marked with flashing lights prior to darkness. The towed body was approximately 1 m below the surface during the surveys.

Dual beam data 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 below the bottom threshold of 5000 millivolt (mV) or -36 decibels (dB) and above the counting threshold of 200 mV (-64.5 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 generated by the dual beam processor were transferred to microcomputer data files for analysis using a *Biosonics, Inc.* software program named TS112 (version 1.12). Computation of mean target strengths and backscattering cross sections were made from individual echoes and printed out in 5 m depth intervals.

Estimates of fish density were made for each transect by echo integration using a *Biosonics, Inc.* Model 120 echo integrator. Representative echograms from selected transects in each lake are presented in Appendix B.1-B.6. Correction from the 40 log(R) setting used during data collection to 20 log(R) used for data processing was accomplished by adjusting the B constant value for each depth strata (Appendix A.1). The TVG crossover for the system was 13.0 m. The depth strata selected for analysis were 5 m increments starting 2 m below the transducer (3 m below the water surface). Data were processed to 102 m below the transducer in Kenai and Skilak lakes because visual examination of oscilloscope and chart recordings indicated that few fish were present below this depth.

The data were compiled into 1-minute sequences along each transect and the integrator outputs were transferred to diskettes for further reduction and analysis using *Biosonics, Inc.* software entitled Crunch. Raw integrator outputs were edited to remove data associated with false bottoms echoes or bottom intrusions. Where this occurred, fish density estimates for the strata were imputed from an average of adjacent sequences. Overall fish density was obtained by averaging the edited integrator output values across the transect by depth strata, and multiplying the averages by the integrator scaling factor derived using the mean backscattering cross section obtained with the dual beam processor. Mean backscattering cross section values were selected by depth

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strata using data for all transects combined from Kenai or Skilak lake. Total fish abundance in each lake was calculated by summing the estimated abundance for each of the areas of each lake (Figures 3 and 4). Transects located within these areas were treated as replicates for calculation of mean fish densities and variance for each area. The total number of fish per transect consisted of the number of fish measured by hydroacoustic equipment plus fish unavailable to the hydroacoustic gear because of surface or bottom orientation. Additions for surface oriented fish (i.e., within 3 m of the surface) were imputed from measured fish densities in adjacent depth strata. Numbers of fish near the bottom were estimated by multiplying the average fish densities measured just above the bottom times the volume of water not sampled (a bottom window of 2 m was selected during data processing).

In an effort to quantify species composition of measured fish targets, tow netting was conducted in Skilak Lake on 4 and 10 October, 1988 utilizing a 2.7 m x 2.7 m Burgner tow net. A total of 290 minutes of sampling was completed. Sample locations were in areas previously identified to have relatively high fish abundance. All fish captured were enumerated and identified, and preserved in 10% formalin. In the laboratory, specimens were measured to the nearest mm (fork length), weighed (nearest 0.1 g), and aged from scale patterns (AWL data).

In addition to tow netting, samples of sockeye salmon captured in a fyke trap located at the outlet of Skilak Lake were processed for similar information. Fish collected in the trap were taken incidental to a chinook sampling program and a report on capture rates, species composition, and migratory information is in preparation (T. Bendock, Alaska Department of Fish and Game, Soldotna, personal communication).

RESULTS

During the survey a total of 9,371 and 24,482 echoes were used to estimate target strength distributions in Kenai and Skilak lakes. Mean target strength for Kenai Lake was -54.79 dB. As in past years, calculated mean target strengths decreased with depth (Appendix A.2). Near surface measurements were -52.02 dB in contrast to -56.75 dB at depths greater than 47 m. In Skilak Lake the mean target strength was -53.84 dB with the near surface mean of -51.85 dB decreasing to -55.35 dB at 37 m. However, at depths greater than 37 m target strengths were within one dB of the mean and similar to the upper strata (Appendix A.3).

Individual transect data and estimated numbers of fish for each area surveyed by hydroacoustic techniques are presented Appendix A.4 to A.34 and summarized in Table 1. Estimates of fish abundance in surface and bottom areas not available to the hydroacoustic gear are presented in Tables 2 through 4. The total estimated number of fish in both lakes was 37,165,300 fish (Table 5). Approximately 16.7%, or 6,204,300 fish were found in Kenai Lake while the remaining 30,961,000 fish inhabited Skilak Lake (Table 5).

Approximately 74% of the fish in Skilak Lake were located in Area 1, which is the western end of the lake. This area contained an estimated 26.7% of the lake volume (Table 6). In contrast, fish in Kenai Lake were more evenly distributed throughout the lake with the proportion of the total fish approximating the

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estimated contribution of each area volume. For example, 41.4% of the fish (the greatest proportion) were located in Area 4 which was 31.7% of the lake volume (Table 6). Except for Area 2 and 4, the lake volume and fish proportions were within 5% of each other.

The distribution of fish within the water column was fairly consistent within Kenai Lake with peak abundance occurring between 12 and 22 m (Figures 5 through 9). The maximum fish density of 0.02515 fish/m^3 in Kenai Lake was recorded near the surface along transect 2 of Area 5. In addition, increasing abundance of fish near surface was noted for all transects in Area 5 (Figure 9). Few fish were estimated to inhabit water depths greater than 47 m in any area (Figures 5 through 9).

In contrast to Kenai Lake, fish in Skilak Lake were more surface oriented. Seven of the 11 transects had the highest fish densities measured just below the transducer (Figures 10 through 12). The maximum density of 0.061 fish/m^3 was measured along transect 1 of Area 1 at a depth of 7 to 12 m.

A total of 110 juvenile sockeye salmon were captured by tow netting in Skilak Lake of which 109 were age-0. (Table 7). Average length and weight of age-0. sockeye salmon captured was 49.7 mm and 0.9 g. A total of 285 age-0 sockeye salmon were measured from the trap catch. Average length and weight was 55.3 mm and 2.0 g (Table 7).

DISCUSSION

The 1988 estimate of juvenile fish in the glacial lakes of the Kenai River system is the highest recorded since the project started in 1986. These fish are believed to be predominantly sockeye salmon. Previous estimates for the lakes were 25,945,800 and 10,182,400 fish for 1986 and 1987, respectively. There was a substantial increase in production in 1988 in both lakes compared to the previous 2 years of the study. In 1986 and 1987 the contribution to the total estimate from Skilak Lake was 82.6% and 88.7%, respectively. In 1988 Skilak Lake made up 83.3% of the total estimate. Thus Kenai Lake increased at a proportionally greater rate than Skilak Lake but both systems appeared to respond to a system-wide phenomena.

Of particular concern in the 1988 data set is the near surface distribution of fish. In both 1986 and 1987 the vertical distribution of fish in both lakes was ammenable to measurement with existing hydroacoustic techniques. However, in 1988 the high proportion of transects with increasing fish densities near surface in Skilak Lake and in Area 5 in Kenai Lake made the abundance estimates more subjective. Within Kenai Lake the starting time of the survey (one hour earlier than previous years) may have influenced the data. However, starting times and duration of transecting in Skilak Lake were similar to previous years.

A cursory examination of physical parameters did not explain the near surface fish distribution. Water temperatures during the survey period were nearly equal regardless of depth. For example, during early September surface water temperatures were 8.3 °C decreasing to 7.8 °C at 30 m. In mid-October, water temperatures ranged from 5.8 °C to 5.7 °C for the same depths (G. Kyle, Alaska

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Department of Fish and Game, Soldotna, personal communication). Survey conditions were not dissimilar to previous years as relatively calm conditions are required to operate. It is possible that the near surface orientation may be the result of overall fish density and associated feeding behavior. Thorne (1981) hypothesized a near surface daylight feeding response of juvenile sockeye salmon in Tustumena Lake, a glacial lake system located approximately 20 miles away in the Kasilof River drainage. He found that fish are oriented near surface during the day and must disperse downward during the hours of darkness. At higher densities of fish found in Skilak Lake, this dispersal may be altered or reduced in magnitude. Further investigation into juvenile sockeye salmon behavior in glacial lake systems is neccessary to determine if this response is a key to depth distribution.

As in previous years, a decrease in average target strength with depth was noted in 1988. This pattern has been observed regardless of fish density or location. Unfortunately, work has not progressed to solve whether this pattern is biologically related (i.e. swim bladder, orientation, or size segration) or a physical limitation of the system (glacial silt and attenuation). The target strength data for each depth interval is used to estimate fish abundance and therefore error associated with this factor is reduced. However, if attenuation is occurring then some small targets may be eliminated from the abundance estimates.

Finally, the inability to capture sufficient quantities of juvenile sockeye salmon in the lake systems remains a problem. The combination of relatively low fish densities, small vessels and limited gear handling ability, adverse fall weather, and personnel limitations have made sampling ineffective. Unfortunately, the few fish captured by tow net in 1988 were of relatively small size (49.7 mm and 0.9 g). Poor over winter survival for fish in this size range would be expected based on studies from Tustumena Lake. For example, within Tustumena Lake the size of age-0. sockeye salmon in 1986 averaged an identical 49.7 mm in length (1.3 g), and this age class had the poorest over winter survival to age 1 smolt (11%) during the 8 years of study (G. Kyle, Alaska Department of Fish and Game, Soldotna, personal communication). In addition, a greater proportion of fish rearing a second year in freshwater was observed.

In contrast to the tow net data, the size of age-0. juvenile sockeye salmon in the trap catches were larger at 55.3 mm and 2.0 g. The potential for better over winter survival of fish in this size range is higher, and based on Tustumena Lake results could approach 70%. The combination of gear selectivity, location of the traps in the river at the lake outlet, and sample sizes may have created the differences in the data sets. However, the lack of adequate sampling in the lake environment makes comparsions meaningless at this time.

The implications of these observations on the ability to forecast adult sockeye salmon returns based on juvenile studies is significant. Therefore, greater effort must be expended to insure that net sampling techniques provide representative samples.

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Table 1. Estimated number of fish available to the hydroacoustic equipment in Skilak and Kenai Lakes, Alaska in the fall of 1988.

Lake	Area	Transect	Estimated Number of Fish
Skilak	1	1	2.9300E+07
		2	2.0968E+07
		3	6.3253E+06
		4	1.8626E+07
	2	1	8.3240E+06
		2	1.8330E+06
		3	3.4951E+06
		4	4.9133E+06
	3	1	1.5247E+06
		2	1.4312E+06
		3	2.1136E+06
Kenai	1	1	1.0820E+05
		2	6.9773E+05
		3	4.0947E+05
		4	6.5946E+05
	2	1	1.9178E+05
		2	2.1735E+05
		3	1.8630E+05
		4	2.8829E+05
	3	1	1.3046E+06
		2	1.9239E+06
		3	4.1293E+05
		4	1.8690E+06
	4	1	4.3225E+06
		2	2.7793E+06
		3	1.5617E+06
		4	9.7907E+05
	5	1	7.9848E+05
		2	1.5226E+06
		3	5.4757E+05
		4	1.0961E+06

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Table 2. Estimated number of fish not available to the hydroacoustic equipment because of surface orientation in Skilak and Kenai Lakes, Alaska in the fall of 1988.

Lake	Area	Transect	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
Skilak	1	1	4.1580E-02	1.2909E+08	5.3676E+06
		2	5.9000E-03	1.2909E+08	7.6163E+05
		3	8.8290E-03	1.2909E+08	1.1397E+06
		4	4.1010E-03	1.2909E+08	5.2940E+05
	2	1	1.2730E-02	1.0038E+08	1.2778E+06
		2	2.9430E-04	1.0038E+08	2.9542E+04
		3	7.3750E-03	1.0038E+08	7.4030E+05
		4	1.2150E-02	1.0038E+08	1.2196E+06
	3	1	1.1390E-02	6.7500E+07	7.6883E+05
		2	7.6250E-03	6.7500E+07	5.1469E+05
		3	1.0420E-02	6.7500E+07	7.0335E+05
Kenai	1	1	3.4270E-05	2.3160E+07	7.9369E+02
		2	2.7170E-03	2.3160E+07	6.2926E+04
		3	4.7670E-05	2.3160E+07	1.1040E+03
		4	2.5350E-05	2.3160E+07	5.8711E+02
	2	1	1.8570E-04	3.5730E+07	6.6351E+03
		2	4.3440E-05	3.5730E+07	1.5521E+03
		3	1.2490E-04	3.5730E+07	4.4627E+03
		4	5.3760E-04	3.5730E+07	1.9208E+04
	3	1	3.7100E-04	3.1620E+07	1.1731E+04
		2	1.1520E-03	3.1620E+07	3.6426E+04
		3	0.0000E+00	3.1620E+07	0.0000E+00
		4	3.4970E-04	3.1620E+07	1.1058E+04
	4	1	2.7220E-03	4.3110E+07	1.1735E+05
		2	3.2990E-03	4.3110E+07	1.4222E+05
		3	5.6210E-03	4.3110E+07	2.4232E+05
		4	2.3830E-03	4.3110E+07	1.0273E+05
	5	1	5.7170E-03	3.2790E+07	1.8746E+05
		2	2.5150E-02	3.2790E+07	8.2467E+05
		3	8.4070E-03	3.2790E+07	2.7567E+05
		4	1.6950E-02	3.2790E+07	5.5579E+05

ACE 6208534

Table 3 . Estimated number of fish not available to the hydroacoustic equipment because of bottom orientation in Skilak Lake, Alaska in the fall of 1988.

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	1	2-7	4.1580E-02	1.4343E+07	5.9640E+05
		7-12	6.1180E-02	2.3906E+07	1.4625E+06
		12-17	4.6240E-02	1.4343E+07	6.6324E+05
		17-22	1.0590E-02	1.1953E+07	1.2658E+05
		22-27	5.7300E-03	9.5622E+06	5.4792E+04
		27-32	3.7770E-03	1.1953E+07	4.5146E+04
		32-37	1.3810E-03	1.4343E+07	1.9808E+04
		37-42	3.3840E-04	1.1953E+07	4.0448E+03
		42-47	1.4850E-04	1.4343E+07	2.1300E+03
		47-52	2.5970E-04	9.5622E+06	2.4833E+03
		52-57	2.0270E-04	4.7811E+06	9.6913E+02
		57-62	1.3950E-04	4.7811E+06	6.6697E+02
		62-67	1.6470E-04	7.1717E+06	1.1812E+03
		67-72	3.6150E-04	9.5622E+06	3.4567E+03
		72-77	5.1480E-06	4.7811E+06	2.4613E+01
		77-82	2.5840E-06	4.7811E+06	1.2354E+01
		82-87	0.0000E+00	4.7811E+06	0.0000E+00
		87-92	0.0000E+00	4.7811E+06	0.0000E+00
		92-97	1.6400E-06	9.5622E+06	1.5682E+01
		97-102	0.0000E+00	7.1717E+06	0.0000E+00
		TOTAL			2.9835E+06
1	2	2-7	1.1910E-02	2.3089E+07	2.7499E+05
		7-12	3.7640E-02	8.3961E+06	3.1603E+05
		12-17	3.7230E-02	1.6792E+07	6.2517E+05
		17-22	3.4250E-02	1.4693E+07	5.0324E+05
		22-27	1.5080E-02	6.2971E+06	9.4960E+04
		27-32	8.5750E-03	4.1980E+06	3.5998E+04
		32-37	2.3440E-03	2.0990E+06	4.9201E+03
		37-42	6.9600E-04	4.1980E+06	2.9218E+03
		42-47	4.6810E-04	4.1980E+06	1.9651E+03
		47-52	6.1750E-05	6.2971E+06	3.8884E+02
		52-57	9.5700E-05	6.2971E+06	6.0263E+02
		57-62	7.0590E-05	4.1980E+06	2.9634E+02
		62-67	3.2530E-05	4.1980E+06	1.3656E+02
		67-72	1.6230E-05	4.1980E+06	6.8134E+01
		72-77	9.7290E-05	4.1980E+06	4.0843E+02
		77-82	7.03000-06	6.2971E+06	4.4268E+01
		82-87	1.6720E-06	8.3961E+06	1.4038E+01
		87-92	4.8790E-07	1.4693E+07	7.1688E+00
		92-97	1.0830E-06	1.4693E+07	1.5913E+01
		97-102	0.0000E+00	0.0000E+00	0.0000E+00
		TOTAL			1.8622E+06

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ACE 6208535

Table 3. (p 2 of 6)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	3	2-7	8.8290E-03	2.3741E+07	2.0961E+05
		7-12	4.9920E-03	1.4838E+07	7.4071E+04
		12-17	5.9940E-03	8.9028E+06	5.3363E+04
		17-22	8.7250E-03	8.9028E+06	7.7677E+04
		22-27	3.7730E-03	5.9352E+06	2.2393E+04
		27-32	1.3150E-03	8.9028E+06	1.1707E+04
		32-37	1.2950E-03	5.9352E+06	7.6860E+03
		37-42	6.0160E-04	5.9352E+06	3.5706E+03
		42-47	3.7340E-04	5.9352E+06	2.2162E+03
		47-52	1.2140E-04	5.9352E+06	7.2053E+02
		52-57	1.9080E-04	8.9028E+06	1.6986E+03
		57-62	2.4030E-04	5.9352E+06	1.4262E+03
		62-67	2.9460E-04	1.1870E+07	3.4970E+03
		67-72	1.3770E-04	8.9028E+06	1.2259E+03
		72-77	1.8330E-03	1.1870E+07	2.1758E+04
		77-82	3.6650E-05	2.6708E+07	9.7886E+02
		82-87	2.2470E-05	2.3741E+07	5.3345E+02
		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			4.9413E+05
1	4	2-7	8.1010E-03	2.3471E+07	1.9014E+05
		7-12	2.1600E-02	2.3471E+07	5.0697E+05
		12-17	5.9370E-02	1.5647E+07	9.2898E+05
		17-22	4.4520E-02	3.1295E+07	1.3932E+06
		22-27	7.6090E-03	1.5647E+07	1.1906E+05
		27-32	1.2970E-02	1.5647E+07	2.0295E+05
		32-37	1.3270E-02	1.1735E+07	1.5573E+05
		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			3.4971E+06

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ACE 6208536

Table 3. (p 3 of 6)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
2	1	2-7	1.2730E-02	7.7215E+06	9.8295E+04
		7-12	1.2340E-02	7.7215E+06	9.5284E+04
		12-17	1.0660E-02	5.1477E+06	5.4874E+04
		17-22	9.5630E-03	5.1477E+06	4.9227E+04
		22-27	2.7170E-03	5.1477E+06	1.3986E+04
		27-32	8.8130E-04	5.1477E+06	4.5367E+03
		32-37	4.3560E-04	5.1477E+06	2.2423E+03
		37-42	3.2330E-04	5.1477E+06	1.6642E+03
		42-47	2.3580E-04	5.1477E+06	1.2138E+03
		47-52	1.5830E-04	5.1477E+06	8.1488E+02
		52-57	1.5180E-04	5.1477E+06	7.8142E+02
		57-62	1.9250E-04	5.1477E+06	9.9093E+02
		62-67	1.8710E-04	5.1477E+06	9.6313E+02
		67-72	5.4820E-05	5.1477E+06	2.8220E+02
		72-77	2.5400E-05	5.1477E+06	1.3075E+02
		77-82	1.7450E-05	5.1477E+06	8.9827E+01
		82-87	1.3690E-06	5.1477E+06	7.0472E+00
		87-92	7.0440E-07	5.1477E+06	3.6260E+00
		92-97	4.9370E-07	5.1477E+06	2.5414E+00
		97-102	1.4350E-06	7.7215E+06	1.1080E+01
		TOTAL			3.2540E+05
2	2	2-7	5.8860E-04	1.9120E+06	1.1254E+03
		7-12	3.2650E-03	1.9120E+06	6.2427E+03
		12-17	2.5410E-03	1.9120E+06	4.8584E+03
		17-22	1.4810E-03	3.8240E+06	5.6633E+03
		22-27	7.8320E-04	3.8240E+06	2.9950E+03
		27-32	6.2420E-04	5.7360E+06	3.5804E+03
		32-37	1.9620E-04	7.6480E+06	1.5005E+03
		37-42	3.7160E-04	3.8240E+06	1.4210E+03
		42-47	3.2480E-04	3.8240E+06	1.2420E+03
		47-52	1.2840E-04	3.8240E+06	4.9100E+02
		52-57	2.9150E-04	3.8240E+06	1.1147E+03
		57-62	2.1270E-04	3.8240E+06	8.1336E+02
		62-67	1.9750E-04	5.7360E+06	1.1329E+03
		67-72	1.1430E-04	5.7360E+06	6.5562E+02
		72-77	2.9700E-05	3.8240E+06	1.1357E+02
		77-82	5.8820E-06	3.8240E+06	2.2493E+01
		82-87	4.4340E-06	3.8240E+06	1.6956E+01
		87-92	8.0530E-07	3.8240E+06	3.0795E+00
		92-97	1.7870E-06	5.7360E+06	1.0250E+01
		97-102	0.0000E+00	5.7360E+06	0.0000E+00
		TOTAL			3.3003E+04

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ACE 6208537

Table 3. (p 4 of 6)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
2	3	2-7	7.3750E-03	4.6688E+06	3.4433E+04
		7-12	7.2420E-03	4.6688E+06	3.3812E+04
		12-17	4.1970E-03	7.7814E+06	3.2659E+04
		17-22	1.0890E-03	7.7814E+06	8.4739E+03
		22-27	7.7300E-04	3.1126E+06	2.4060E+03
		27-32	3.0270E-04	3.1126E+06	9.4217E+02
		32-37	1.0630E-04	3.1126E+06	3.3086E+02
		37-42	1.4940E-04	3.1126E+06	4.6502E+02
		42-47	9.1700E-05	3.1126E+06	2.8542E+02
		47-52	1.4380E-04	6.2251E+06	8.9517E+02
		52-57	1.1690E-04	1.2450E+07	1.4554E+03
		57-62	2.2240E-04	9.3377E+06	2.0767E+03
		62-67	2.2370E-04	3.1126E+06	6.9628E+02
		67-72	8.2240E-05	3.1126E+06	2.5598E+02
		72-77	4.0420E-05	3.1126E+06	1.2581E+02
		77-82	1.2470E-05	4.6688E+06	5.8220E+01
		82-87	3.0720E-06	4.6688E+06	1.4343E+01
		87-92	9.7380E-05	4.6688E+06	4.5465E+02
		92-97	6.6250E-06	6.2251E+06	4.1241E+01
		97-102	1.1000E-05	7.7814E+06	8.5595E+01
		TOTAL			1.1997E+05
2	4	2-7	1.2150E-02	1.1538E+06	1.4019E+04
		7-12	6.6730E-03	3.4615E+06	2.3099E+04
		12-17	3.4750E-03	2.3077E+06	8.0192E+03
		17-22	3.2700E-03	4.6154E+06	1.5092E+04
		22-27	2.6090E-03	4.6154E+06	1.2042E+04
		27-32	1.0780E-03	5.7692E+06	6.2192E+03
		32-37	4.3590E-04	1.0385E+07	4.5267E+03
		37-42	1.9510E-04	2.3077E+06	4.5023E+02
		42-47	7.1810E-05	3.4615E+06	2.4857E+02
		47-52	4.6200E-05	3.4615E+06	1.5992E+02
		52-57	5.1160E-05	2.3077E+06	1.1806E+02
		57-62	9.3450E-05	3.4615E+06	3.2348E+02
		62-67	4.7860E-05	3.4615E+06	1.6567E+02
		67-72	1.0960E-04	3.4615E+06	3.7938E+02
		72-77	6.3100E-06	3.4615E+06	2.1842E+01
		77-82	7.7340E-06	3.4615E+06	2.6772E+01
		82-87	1.9550E-06	3.4615E+06	6.7673E+00
		87-92	4.5520E-06	6.9231E+06	3.1514E+01
		92-97	5.2100E-08	3.4615E+06	1.8035E-01
		97-102	9.6250E-07	2.3077E+06	2.2212E+00
		TOTAL			8.4952E+04

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ACE 6208538

Table 3. (p 5 of 6)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
3	1	2-7	1.1390E-02	3.0000E+06	3.4170E+04
		7-12	1.3000E-03	3.0000E+06	3.9000E+03
		12-17	1.5990E-04	1.5000E+06	2.3985E+02
		17-22	1.9270E-04	1.5000E+06	2.8905E+02
		22-27	1.7740E-04	3.0000E+06	5.3220E+02
		27-32	3.5710E-05	4.5000E+06	1.6070E+02
		32-37	3.3350E-05	3.0000E+06	1.0005E+02
		37-42	1.0680E-04	3.0000E+06	3.2040E+02
		42-47	9.3750E-05	3.0000E+06	2.8125E+02
		47-52	9.4600E-05	3.0000E+06	2.8380E+02
		52-57	1.2200E-04	4.5000E+06	5.4900E+02
		57-62	1.1900E-04	3.0000E+06	3.5700E+02
		62-67	1.6230E-04	4.5000E+06	7.3035E+02
		67-72	1.1820E-04	3.0000E+06	3.5460E+02
		72-77	4.8890E-05	6.0000E+06	2.9334E+02
		77-82	1.9260E-05	9.0000E+06	1.7334E+02
		82-87	1.5530E-06	6.0000E+06	9.3180E+00
		87-92	6.9440E-06	6.0000E+06	4.1664E+01
		92-97	8.5100E-07	6.0000E+06	5.1060E+00
		97-102	3.0680E-08	7.5000E+06	2.3010E-01
		TOTAL			4.2791E+04
3	2	2-7	7.6250E-03	2.5000E+06	1.9063E+04
		7-12	1.6130E-03	2.5000E+06	4.0325E+03
		12-17	6.2750E-04	2.5000E+06	1.5688E+03
		17-22	4.2440E-04	2.5000E+06	1.0610E+03
		22-27	4.8950E-04	5.0000E+06	2.4475E+03
		27-32	5.1730E-04	5.0000E+06	2.5865E+03
		32-37	2.1820E-04	5.0000E+06	1.0910E+03
		37-42	2.2940E-04	5.0000E+06	1.1470E+03
		42-47	4.1500E-04	5.0000E+06	2.0750E+03
		47-52	4.0790E-04	5.0000E+06	2.0395E+03
		52-57	1.6630E-04	5.0000E+06	8.3150E+02
		57-62	1.7220E-04	5.0000E+06	8.6100E+02
		62-67	3.4450E-05	5.0000E+06	1.7225E+02
		67-72	4.5460E-05	5.0000E+06	2.2730E+02
		72-77	2.7130E-05	5.0000E+06	1.3565E+02
		77-82	2.8690E-05	5.0000E+06	1.4345E+02
		82-87	2.9680E-06	5.0000E+06	1.4840E+01
		87-92	1.7380E-06	5.0000E+06	8.6900E+00
		92-97	3.7740E-08	5.0000E+06	1.8870E-01
		97-102	8.4370E-08	2.0000E+07	1.6874E+00
		TOTAL			3.9508E+04

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ACE 6208539

Table 3. (p 6 of 6)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
3	3	2-7	1.0420E-02	2.8125E+06	2.9306E+04
		7-12	4.1970E-03	2.8125E+06	1.1804E+04
		12-17	1.0790E-03	2.8125E+06	3.0347E+03
		17-22	1.0080E-03	2.8125E+06	2.8350E+03
		22-27	2.9260E-04	2.8125E+06	8.2294E+02
		27-32	1.9020E-04	2.8125E+06	5.3494E+02
		32-37	4.2870E-04	2.8125E+06	1.2057E+03
		37-42	5.1730E-04	2.8125E+06	1.4549E+03
		42-47	2.2360E-04	2.8125E+06	6.2888E+02
		47-52	2.9970E-04	5.6250E+06	1.6858E+03
		52-57	9.1410E-05	5.6250E+06	5.1418E+02
		57-62	6.9130E-05	5.6250E+06	3.8886E+02
		62-67	9.9660E-05	5.6250E+06	5.6059E+02
		67-72	3.8770E-05	5.6250E+06	2.1808E+02
		72-77	1.2090E-05	5.6250E+06	6.8006E+01
		77-82	0.0000E+00	8.4375E+06	0.0000E+00
		82-87	0.0000E+00	5.6250E+06	0.0000E+00
		87-92	0.0000E+00	8.4375E+06	0.0000E+00
		92-97	1.9750E-06	5.6250E+06	1.1109E+01
		97-102	9.7000E-08	5.6250E+06	5.4709E-01
		TOTAL			5.5075E+04

ACE 6208540

Table 4. Estimated number of fish not available to the hydroacoustic equipment because of bottom orientation in Kenai Lake,Alaska in the fall of 1988.

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	1	2-7	6.8540E-05	1.5440E+06	1.0583E+02
		7-12	9.4460E-06	4.6320E+06	4.3754E+01
		12-17	5.2710E-04	3.0880E+06	1.6277E+03
		17-22	1.3170E-03	3.0880E+06	4.0669E+03
		22-27	8.0760E-04	3.0880E+06	2.4939E+03
		27-32	2.8780E-04	4.6320E+06	1.3331E+03
		32-37	6.0670E-05	1.5440E+06	9.3674E+01
		37-42	2.5880E-06	9.2640E+06	2.3975E+01
		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			9.7888E+03
1	2	2-7	2.7170E-03	2.2057E+06	5.9929E+03
		7-12	1.7250E-03	2.2057E+06	3.8049E+03
		12-17	2.7230E-03	2.2057E+06	6.0062E+03
		17-22	4.4550E-03	2.2057E+06	9.8265E+03
		22-27	6.8960E-03	2.2057E+06	1.5211E+04
		27-32	1.2510E-03	4.4114E+06	5.5187E+03
		32-37	0.0000E+00	6.6171E+06	0.0000E+00
		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			4.6360E+04

- Continued -

ACE 6208541

Table 4. (p 2 of 2)

Area	Transect	Bottom Depth(m)	Estimated Fish Density (number/m^3)	Estimated Volume (m^3)	Estimated Number of Fish
1	3	2-7	9.5340E-05	1.0293E+07	9.8137E+02
		7-12	1.9630E-03	1.0293E+07	2.0206E+04
		12-17	9.2430E-03	1.0293E+07	9.5141E+04
		17-22	3.4730E-03	1.5440E+07	5.3623E+04
		22-27	7.9530E-04	1.0293E+07	8.1863E+03
		27-32	0.0000E+00	5.1467E+06	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			1.7814E+05
1	4	2-7	5.0700E-05	1.9300E+06	9.7851E+01
		7-12	1.5950E-03	3.8600E+06	6.1567E+03
		12-17	7.9040E-04	3.8600E+06	3.0509E+03
		17-22	1.4760E-03	5.7900E+06	8.5460E+03
		22-27	1.6740E-02	3.8600E+06	6.4616E+04
		27-32	2.2490E-03	7.7200E+06	1.7362E+04
		32-37	3.7010E-04	5.7900E+06	2.1429E+03
		37-42	0.0000E+00	5.7900E+06	0.0000E+00
		42-47	0.0000E+00	1.9300E+06	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			1.0197E+05

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Table 5 . Estimated number of fish in Skilak and Kenai Lakes, Alaska in the fall of 1988.

Lake	Area	Transect	Estimated Number of Fish: Surface	Midwater	Bottom	Total	Area Mean	Variance
Skilak	1	1	5.3676E+06	2.9300E+07	2.9835E+06	3.7651E+07		
		2	7.6163E+05	2.0968E+07	1.8622E+06	2.3592E+07		
		3	1.1397E+06	6.3253E+06	4.9413E+05	7.9591E+06	2.2964E+07	1.4712E+14
		4	5.2940E+05	1.8626E+07	3.4971E+06	2.2653E+07		
	2	1	1.2778E+06	8.3240E+06	3.2540E+05	9.9272E+06		
		2	2.9542E+04	1.8330E+06	3.3003E+04	1.8955E+06	5.5990E+06	1.1459E+13
		3	7.4030E+05	3.4951E+06	1.1997E+05	4.3554E+06		
		4	1.2196E+06	4.9133E+06	8.4952E+04	6.2179E+06		
	3	1	7.6883E+05	1.5247E+06	4.2791E+04	2.3363E+06		
		2	5.1469E+05	1.4312E+06	3.9508E+04	1.9854E+06	2.3979E+06	1.9937E+11
		3	7.0335E+05	2.1136E+06	5.5075E+04	2.8720E+06		
	TOTAL						3.0961E+07	1.5877E+14
Kenai	1	1	7.9369E+02	1.0820E+05	9.7888E+03	1.1878E+05		
		2	6.2926E+04	6.9773E+05	4.6360E+04	8.0702E+05		
		3	1.1040E+03	4.0947E+05	1.7814E+05	5.8871E+05	5.6913E+05	9.8997E+10
		4	5.8711E+02	6.5946E+05	1.0197E+05	7.6202E+05		
	2	1	6.6351E+03	1.9178E+05	0.0000E+00	1.9842E+05		
		2	1.5521E+03	2.1735E+05	0.0000E+00	2.1890E+05		
		3	4.4627E+03	1.8630E+05	0.0000E+00	1.9076E+05	2.2889E+05	2.8871E+09
		4	1.9208E+04	2.8829E+05	0.0000E+00	3.0750E+05		
	3	1	1.1731E+04	1.3046E+06	0.0000E+00	1.3163E+06		
		2	3.6426E+04	1.9239E+06	0.0000E+00	1.9603E+06		
		3	0.0000E+00	4.1293E+05	0.0000E+00	4.1293E+05	1.3924E+06	5.0850E+11
		4	1.1058E+04	1.8690E+06	0.0000E+00	1.8801E+06		
	4	1	1.1735E+05	4.3225E+06	0.0000E+00	4.4399E+06		
		2	1.4222E+05	2.7793E+06	0.0000E+00	2.9215E+06		
		3	2.4232E+05	1.5617E+06	0.0000E+00	1.8040E+06	2.5618E+06	2.1404E+12
		4	1.0273E+05	9.7907E+05	0.0000E+00	1.0818E+06		

- Continued -

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Table 5. (p 2 of 2)

Lake	Area	Transect	Estimated Number of Fish: Surface	Midwater	Bottom	Total	Area Mean	Variance
	5	1	1.8746E+05	7.9848E+05	0.0000E+00	9.8594E+05		
		2	8.2467E+05	1.5226E+06	0.0000E+00	2.3473E+06	1.4521E+06	4.8467E+11
		3	2.7567E+05	5.4757E+05	0.0000E+00	8.2324E+05		
		4	5.5579E+05	1.0961E+06	0.0000E+00	1.6519E+06		
	TOTAL						6.2043E+06	3.2354E+12
	TOTAL FOR BOTH LAKES						3.7165E+07	1.6201E+14

ACE 6208544

Table 6. Area ($m^2 \times 10^6$) and volumes ($m^3 \times 10^6$) used for fish density estimates in Kenai and Skilak Lakes, Alaska 1988.

	Skilak Lake		
Area	Surface Area	Volume	Density of Fish(%)
1	43.03 (43.5%)	1697.8 (26.7%)	74.2
2	33.46 (33.8%)	2683.2 (42.3%)	18.1
3	22.50 (22.7%)	1967.0 (31.0%)	7.7
Total	98.99 (100.0%)	6348.0 (100.0%)	100.0

	Kenai Lake		
Area	Surface Area	Volume	Density of Fish(%)
1	7.72 (13.9%)	207.4 (5.0%)	9.1
2	11.91 (21.5%)	921.2 (22.5%)	3.6
3	10.54 (19.0%)	915.8 (22.3%)	22.4
4	14.37 (25.9%)	1300.5 (31.7%)	41.4
5	10.93 (19.7%)	753.9 (18.5%)	23.5
Total	55.47 (100.0%)	4098.8 (100.0%)	100.0

ACE 6208545

Table 7. Age, length, and weight of sockeye salmon collected in Skilak Lake, Alaska in the fall of 1988.

		Age-0					Age-1				
Date	Method	Mean Length (mm)	Standard Deviation (mm)	Mean Weight (g)	Standard Deviation (g)	Number	Mean Length (mm)	Standard Deviation	Mean Weight (g)	Standard Deviation	Number
9/16/88	Trap	54.6	7.1	1.9	1.0	50					
9/20/88	Trap	65.0	4.7	3.2	0.8	50					
9/23/88	Trap	54.5	7.7	1.9	0.9	60					
9/27/88	Trap	55.5	5.6	1.9	0.6	25					
10/3/88	Trap	53.0	5.4	1.6	0.5	50					
10/4/88	Tow	41.8	6.5	0.5	0.3	4					
10/10/88	Tow	52.8	5.3	1.2	0.6	6					
10/10/88	Tow	49.4	6.6	0.9	0.8	51					
10/10/88	Tow	50.3	4.8	0.9	0.4	48	52				1
10/17/88	Trap	49.4	4.7	1.3	0.4	50					
Total	Trap	55.3	7.8	2.0	1.0	285					
Total	Tow	49.7	5.3	0.9	0.4	109	52				1

ACE 6208546

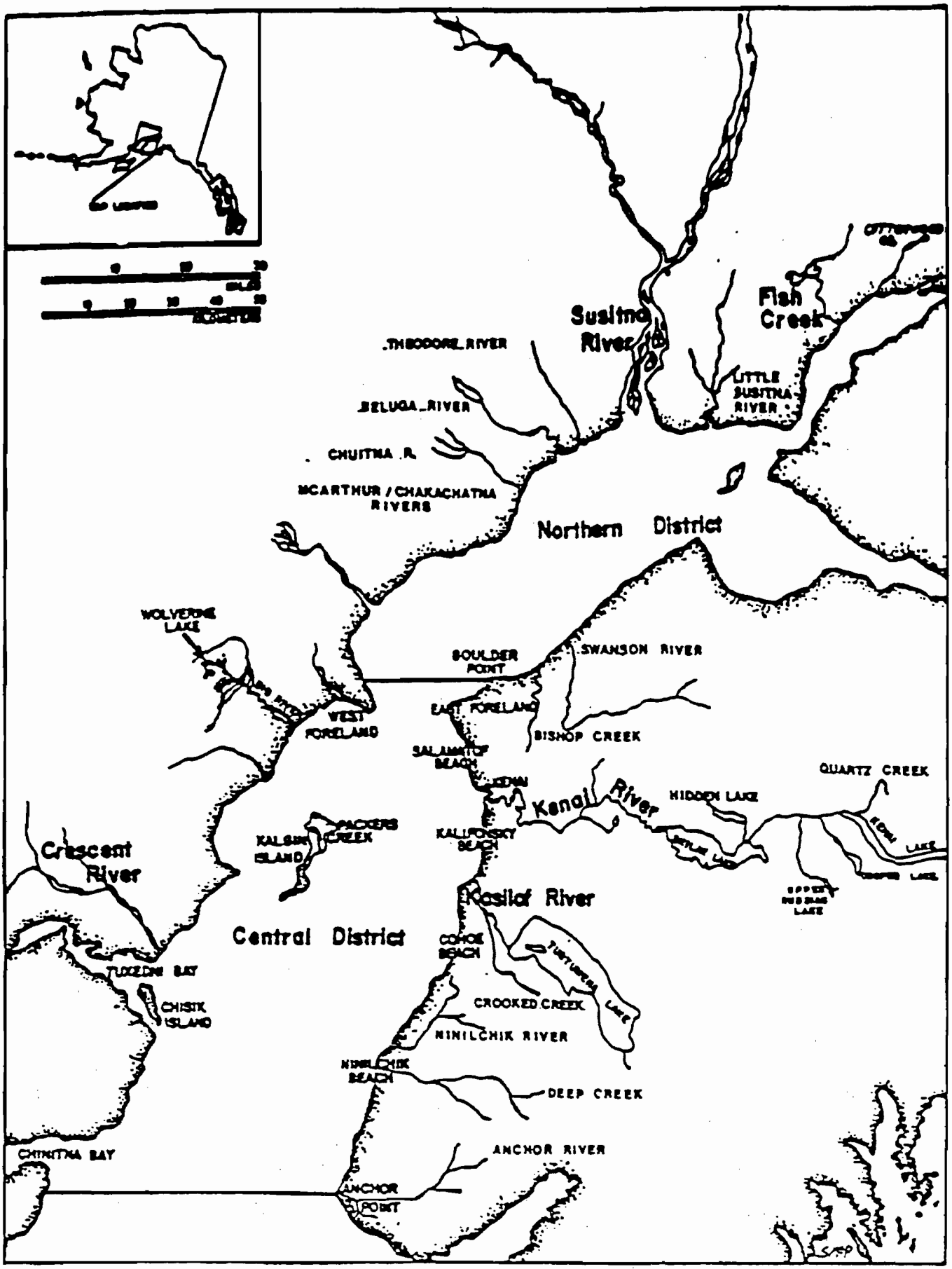

Figure 1. The Upper Cook Inlet area showing the location of the Northern and Central Districts and the major sockeye salmon spawning drainages .

ACE 6208547

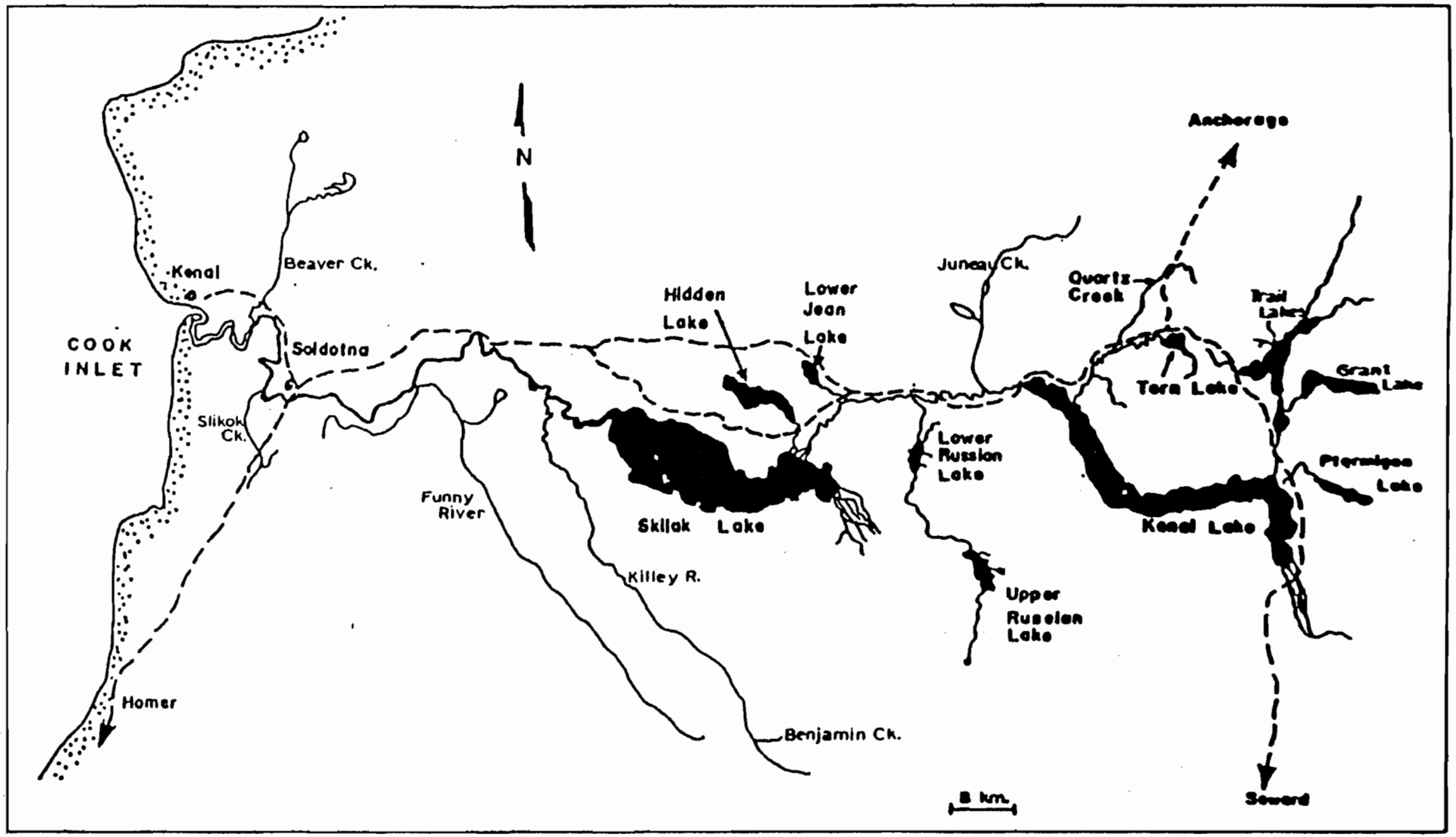

Figure 2. The Kenai River drainage, Alaska and the location of the major lake systems which are utilized by rearing sockeye salmon.

ACE 6208548

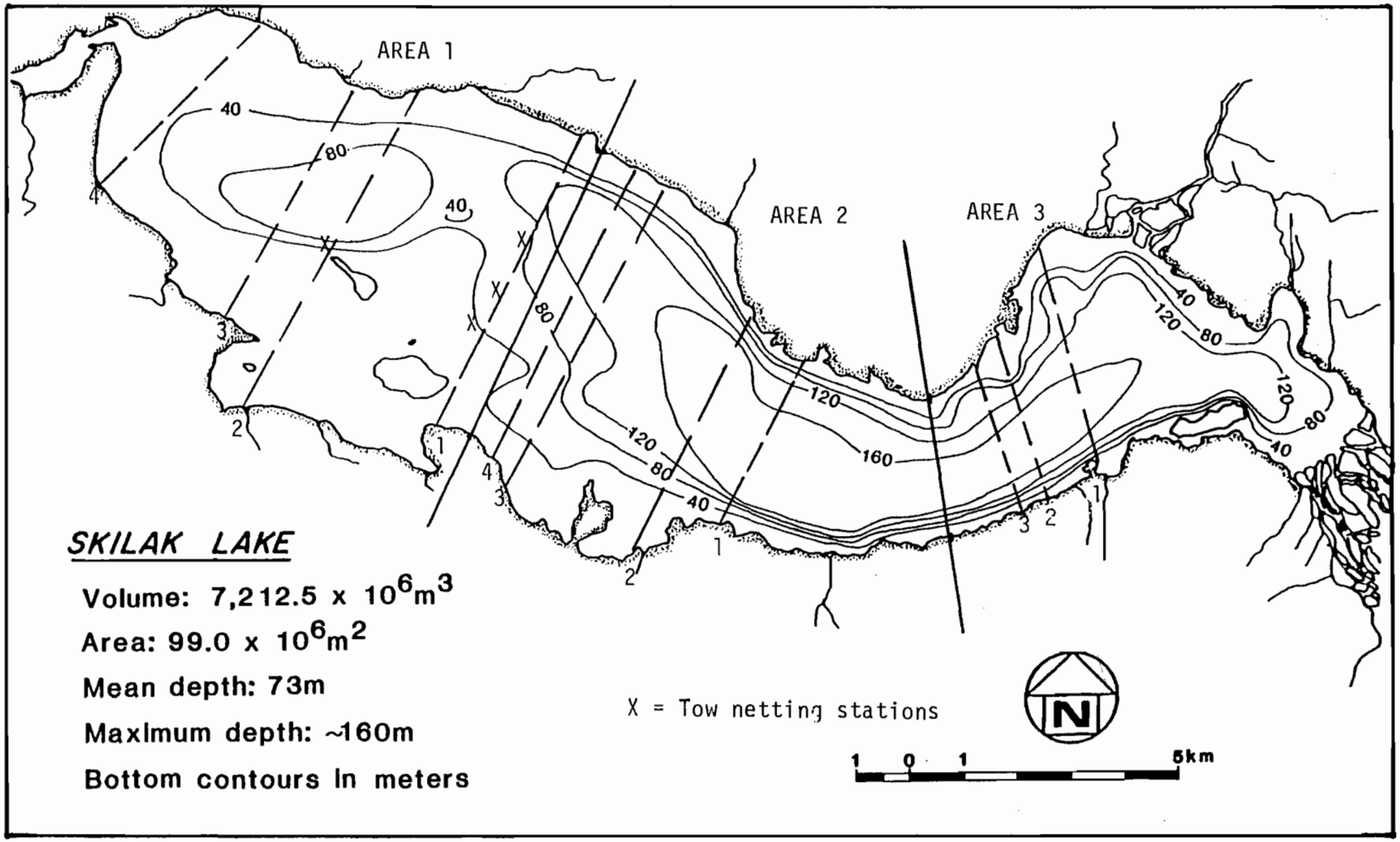

Figure 3. Skilak Lake, Alaska area designations, hydroacoustic transect locations, and tow netting stations, 1988.

ACE 6208549

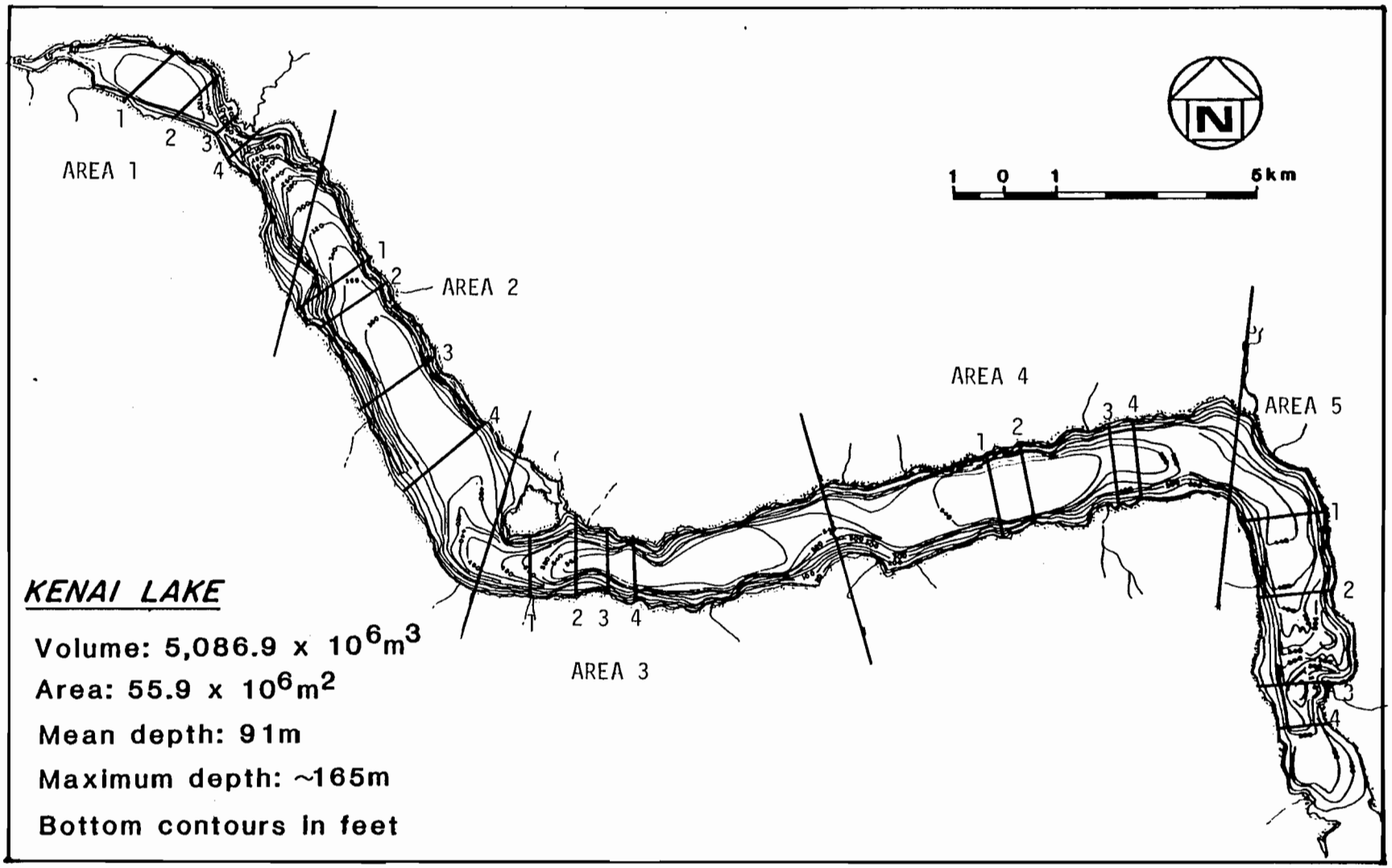

Figure 4. Kenai Lake, Alaska area designations, hydroacoustic transect locations, and tow netting stations, 1988.

ACE 6208550

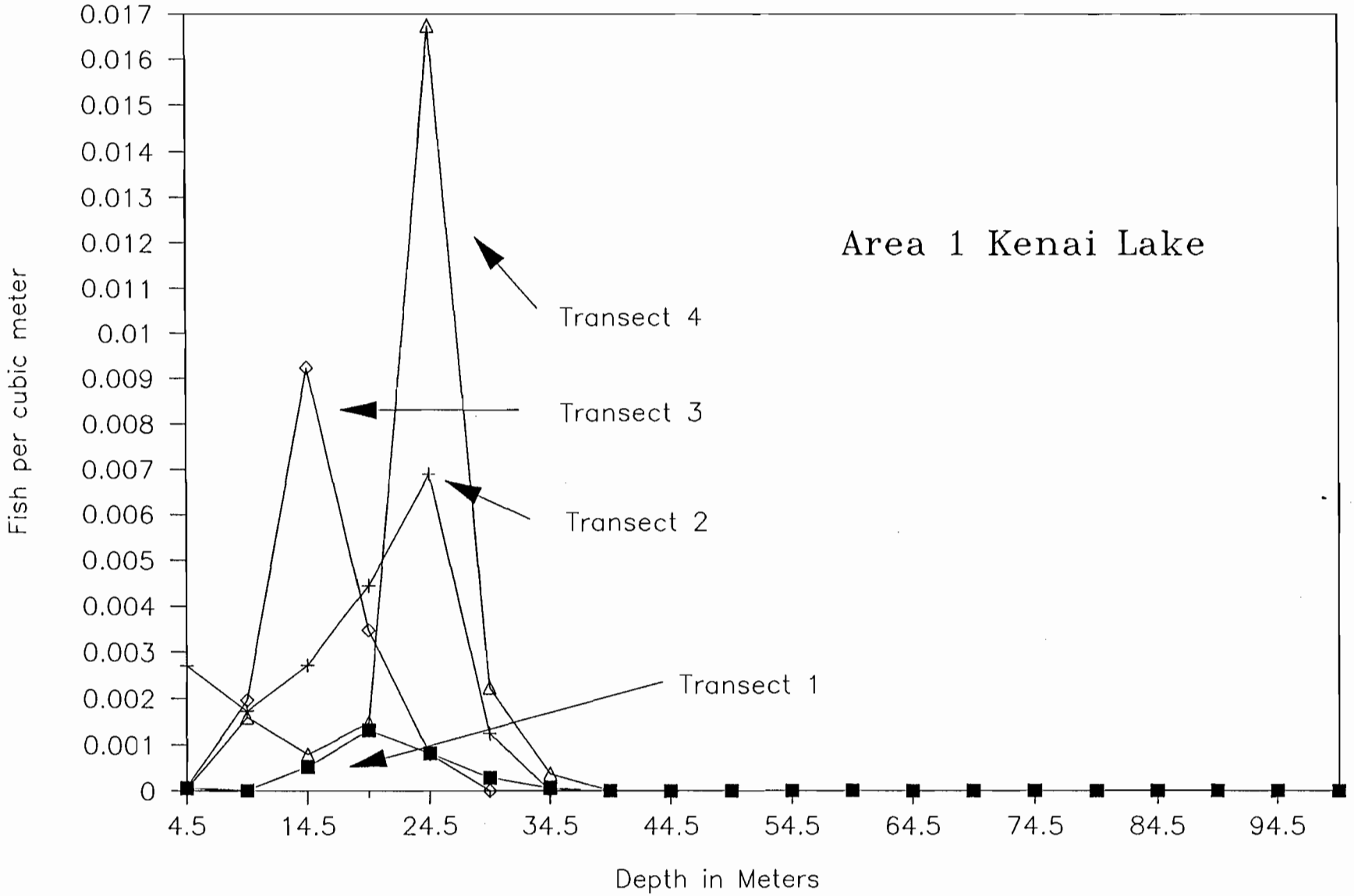

Figure 5. Vertical distribution of fish density measured during the hours of darkness in Kenai Lake, Alaska (Area 1: transects 1, 2, 3, 4) in September 1988.

ACE 6208551

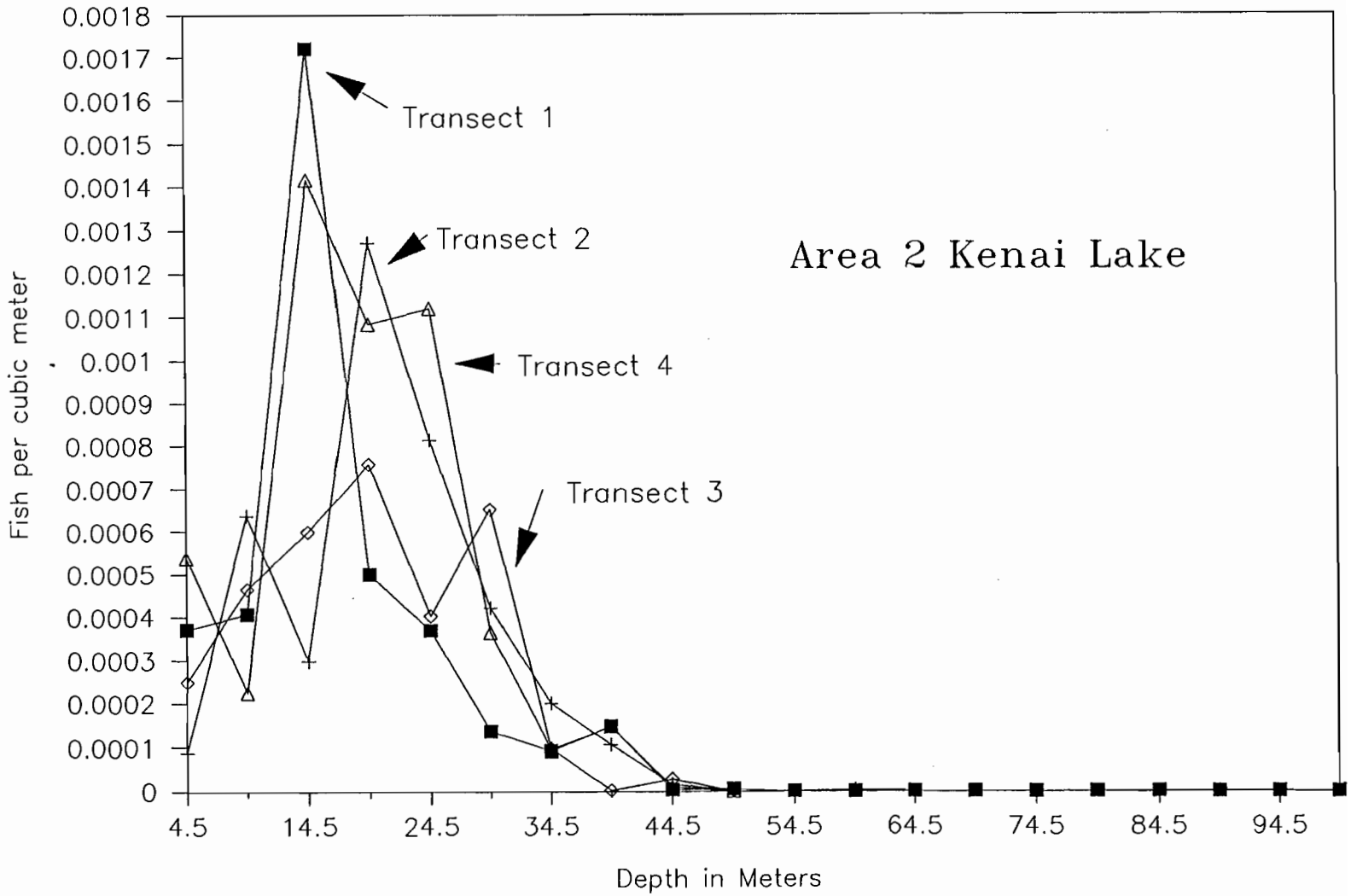

Figure 6. Vertical distribution of fish density measured during the hours of darkness in Kenai Lake, Alaska (Area 2: transects 1, 2, 3, 4) in September 1988.

ACE 6208552

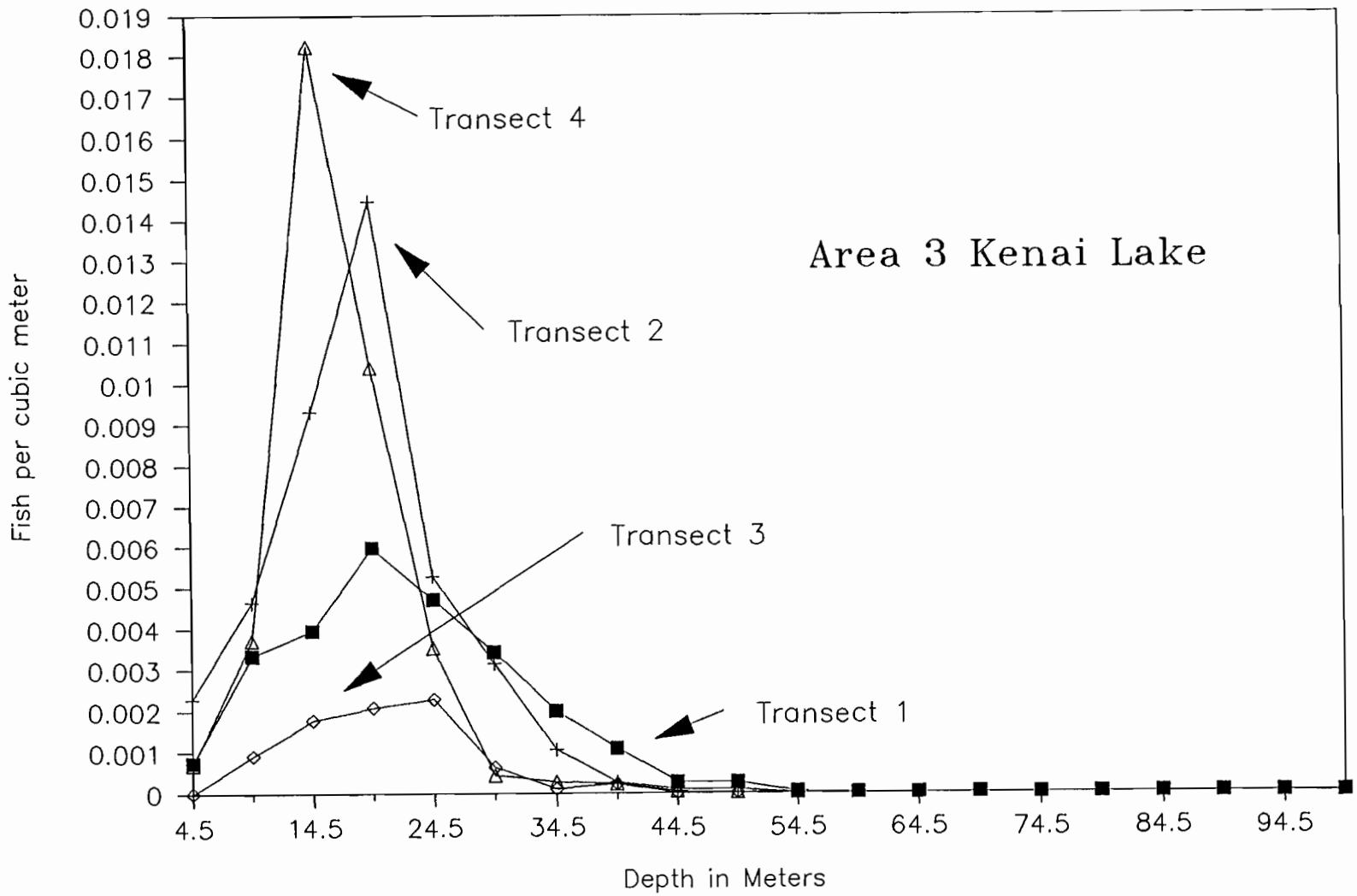

Figure 7. Vertical distribution of fish density measured during the hours of darkness in Kenai Lake, Alaska (Area 3: transects 1, 2, 3, 4) in September 1988.

ACE 6208553

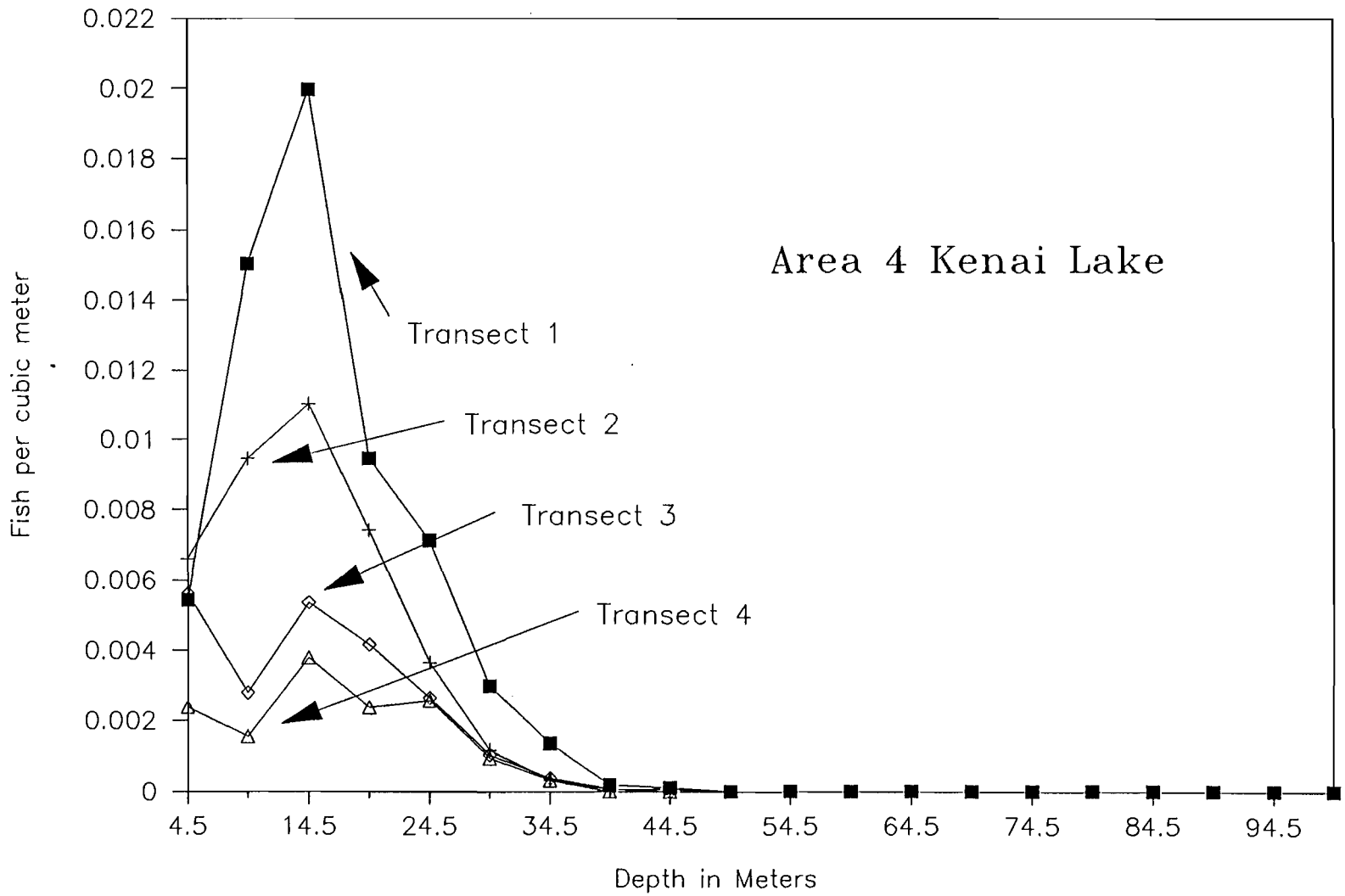

Figure 8. Vertical distribution of fish density measured during the hours of darkness in Kenai Lake, Alaska (Area 4: transects 1, 2, 3, 4) in September 1988.

ACE 6208554

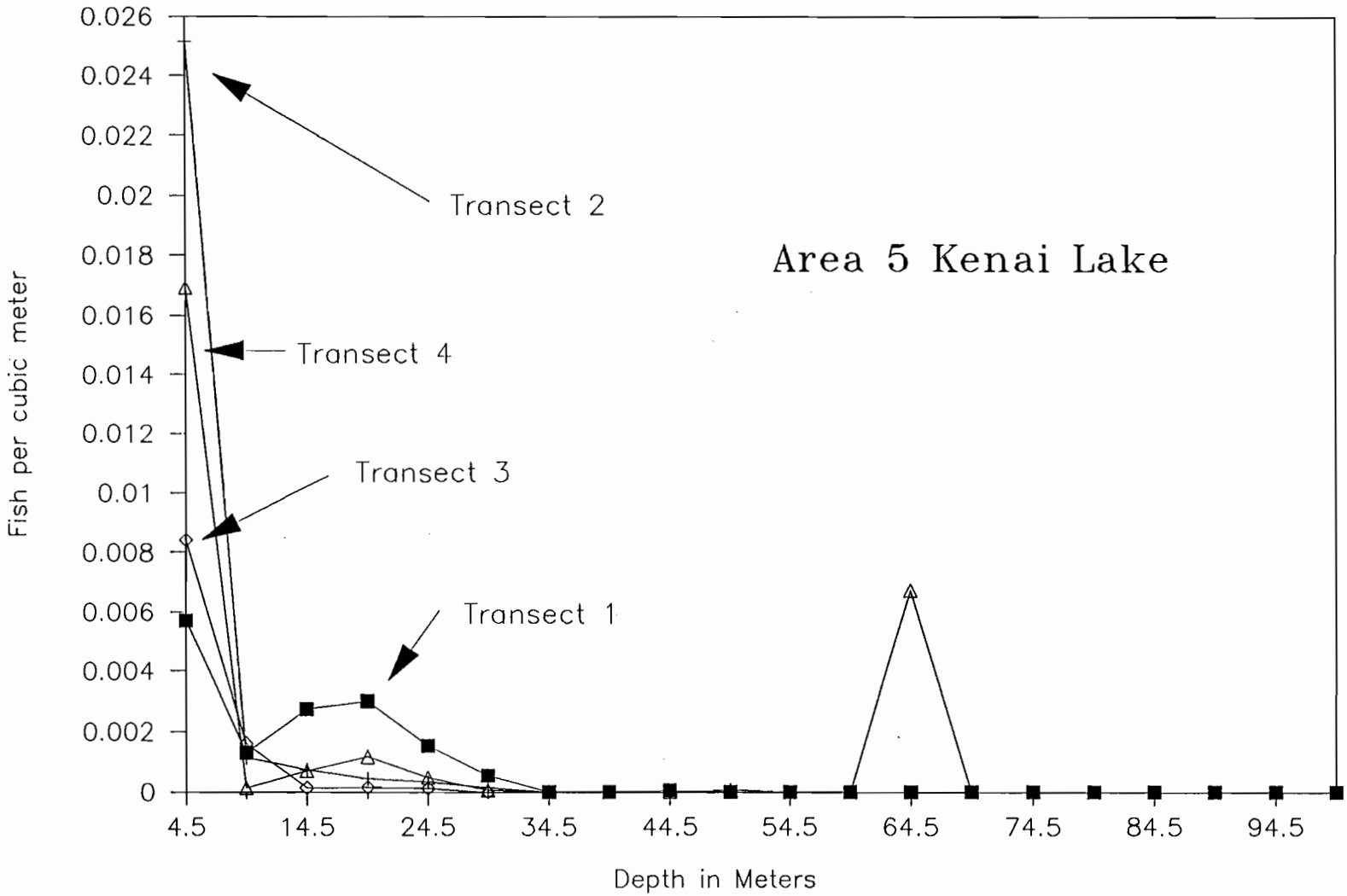

Figure 9. Vertical distribution of fish density measured during the hours of darkness in Kenai Lake, Alaska (Area 5: transects 1, 2, 3, 4) in September 1988.

ACE 6208555

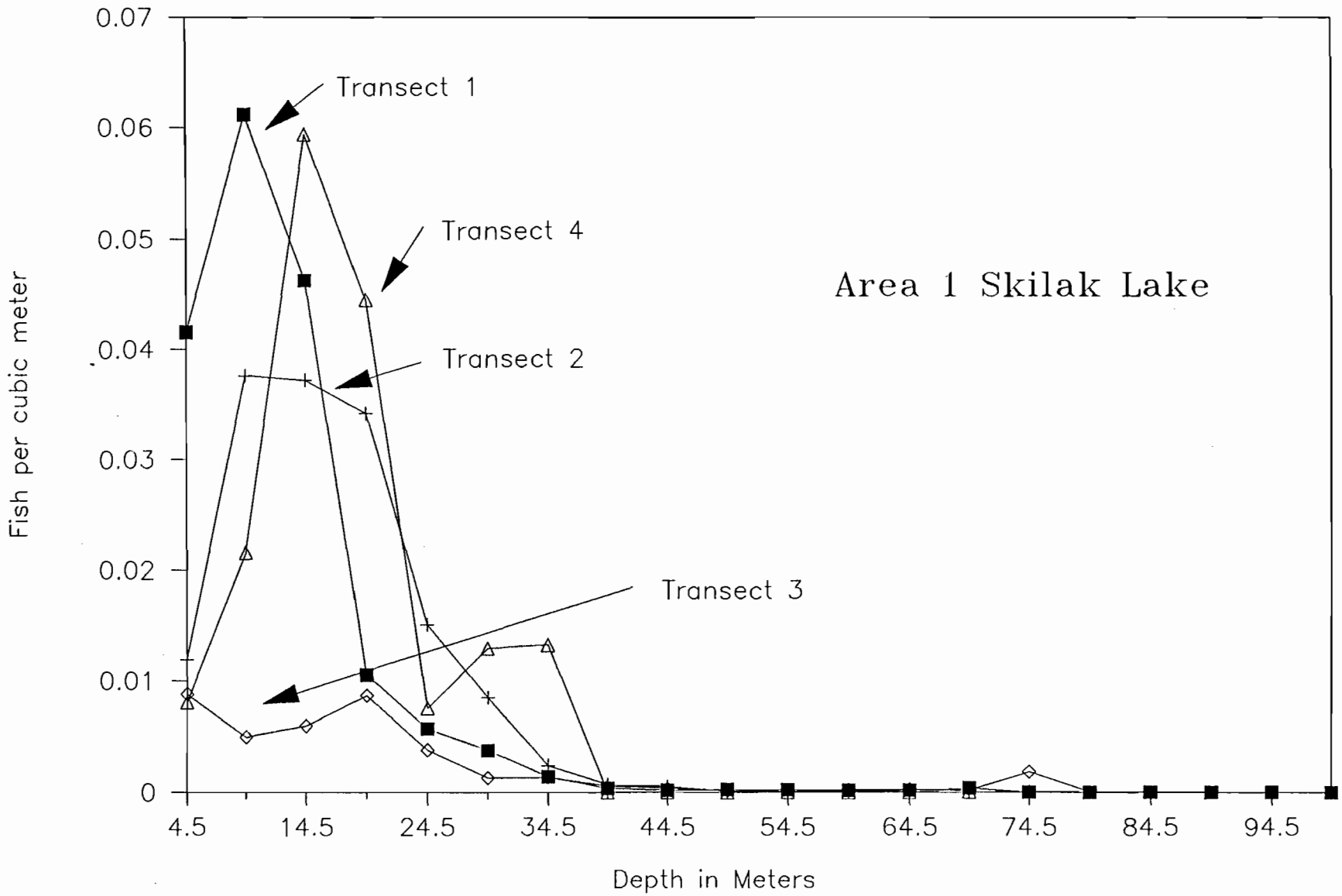

Figure 10. Vertical distribution of fish density measured during the hours of darkness in Skilak Lake, Alaska (Area 1: transects 1, 2, 3, 4) in September 1988.

ACE 6208556

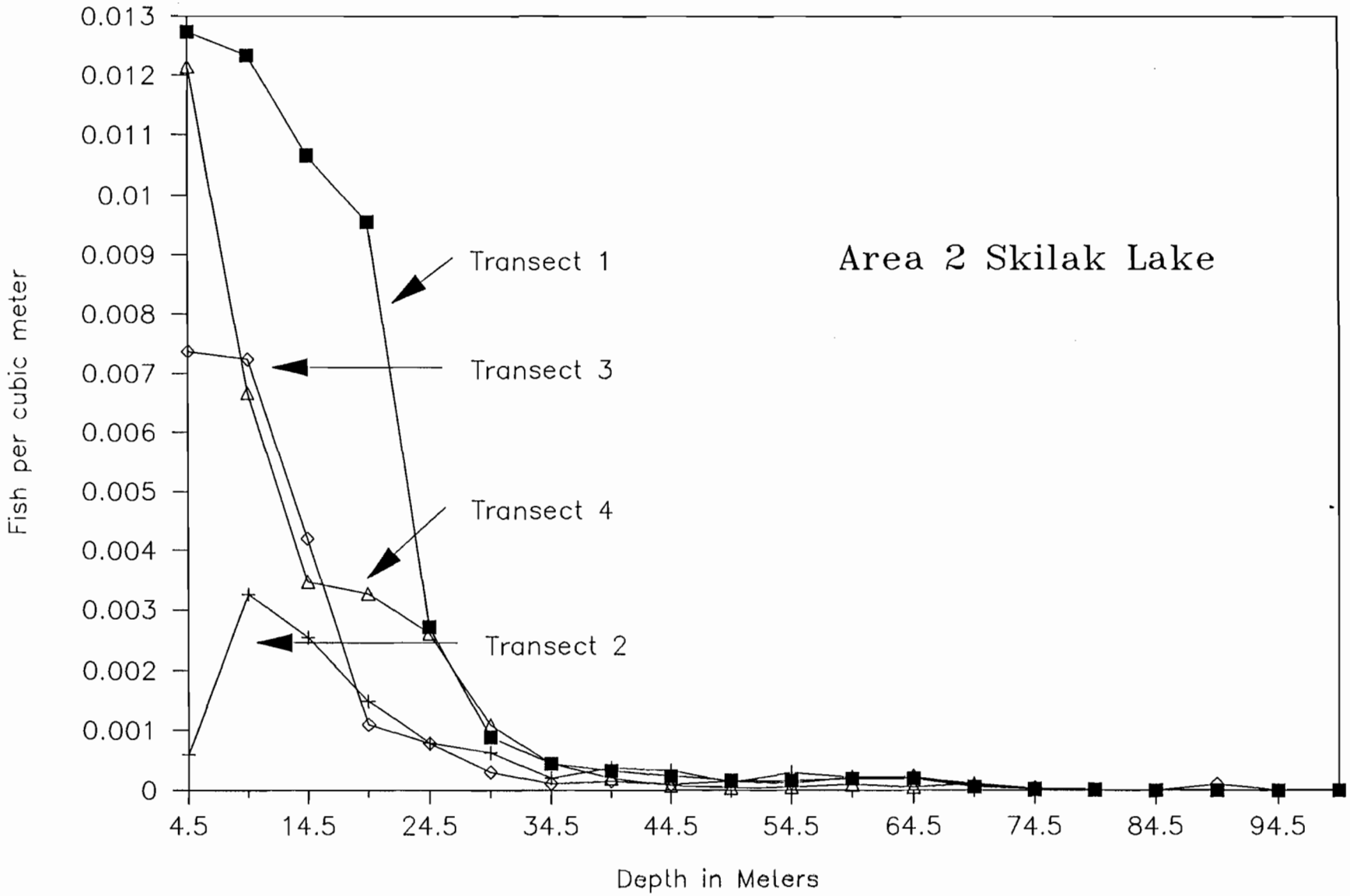

Figure 11. Vertical distribution of fish density measured during the hours of darkness in Skilak Lake, Alaska (Area 2: transects 1, 2, 3, 4) in September 1988.

ACE 6208557

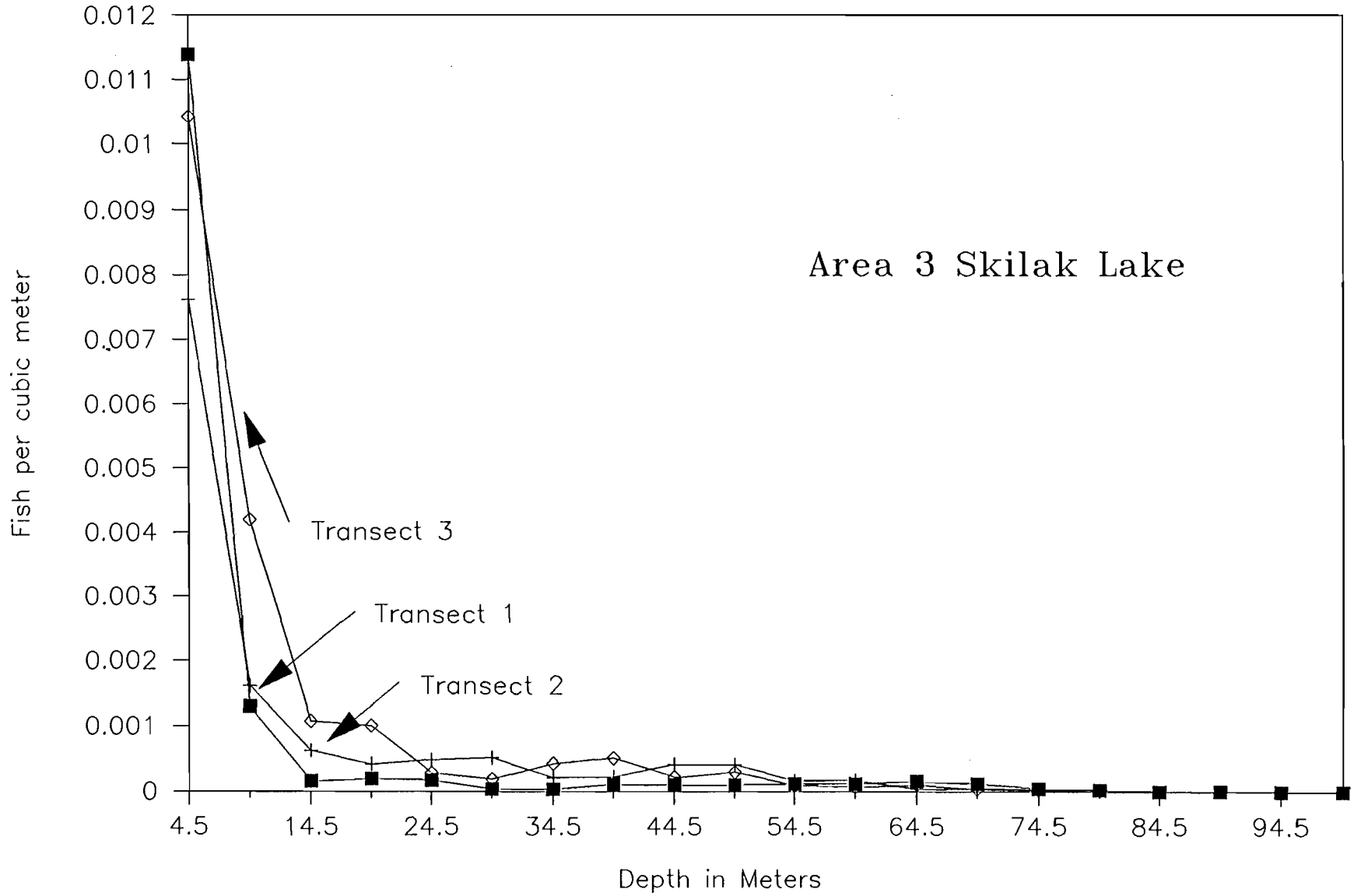

Figure 12. Vertical distribution of fish density measured during the hours of darkness in Skilak Lake, Alaska (Area 3: transects 1, 2, 3) in September 1988.

ACE 6208558

Appendix A1. Calibration and processing parameters used in collection and analysis of Kenai and Skilak Lakes, Alaska, 1988 hydroacoustic data.

Sounder	Receiving sensitivity (dB/uP@1m)	Channel 1	40 log R =	-165.90 dB
			20 log R =	-144.30 dB
		Channel 2	40 log R =	-166.25 dB
			20 log R =	-144.13 dB
	Source level (dB/uP@1m)			216.6 dB
	TVG Crossover			13.0 m
	Receiver gain			0 dB
Transducer	Beam width	Narrow		6 degree
		Wide		15 degree
	Wide beam dropoff	"A" coefficient		1.688 dB
		"B" coefficient		0.426 dB
	Beam pattern factor	Average squared value	Narrow	.0007513
Dual beam processor	Correction multiplier	Narrow beam		1.000 (0dB)
		Wide beam		1.035 (dB)
	Threshold	Narrow beam		200 mV (-64.5 dB)
		Wide beam		200 mV (-64.5 dB)
		Bottom		5000 mV (-36.7 dB)
	Maximum half angle			4°
	Pulse width criteria	-18 dB	Maximum	.7447 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, 1988.

Depth Stratum (m)	Number of Targets	Sigma Mean	Sigma Standard Deviation	Target[1] Strength Mean (dB)	Target Strength Standard Deviation (dB)
2.0 - 7.0	239	1.224E-05	3.122E-05	-52.02	4.75
7.0 - 12.0	682	8.502E-06	9.581E-06	-52.75	4.58
12.0 - 17.0	1722	6.124E-06	7.324E-06	-53.94	4.31
17.0 - 22.0	2073	4.876E-06	4.780E-06	-54.77	4.08
22.0 - 27.0	1970	4.108E-06	3.245E-06	-55.29	3.76
27.0 - 32.0	1588	4.559E-06	1.219E-06	-55.44	3.79
32.0 - 37.0	667	3.370E-06	2.501E-06	-56.02	3.58
37.0 - 42.0	257	3.182E-06	2.686E-06	-56.27	3.41
42.0 - 47.0	118	2.758E-06	1.700E-06	-56.52	3.06
47.0 - 97.0	55	2.634E-06	1.594E-06	-56.75	3.17
Total	9371	5.148E-06	8.798E-06	-54.79	4.12

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

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Appendix A.3. Average backscattering cross section (sigma) and target strength data by depth strata for all transects combined, Skilak Lake, Alaska, 1988.

Depth Stratum (m)	Number of Targets	Sigma Mean	Sigma Standard Deviation	Target[1] Strength Mean (dB)	Target Strength Standard Deviation (dB)
2.0 - 7.0	477	1.025E-05	9.898E-06	-51.85	4.40
7.0 - 12.0	2090	9.236E-06	9.869E-06	-52.33	4.42
12.0 - 17.0	4162	7.452E-06	1.257E-05	-53.45	4.47
17.0 - 22.0	4640	6.247E-06	3.656E-05	-54.18	4.10
22.0 - 27.0	3911	6.038E-06	1.547E-05	-54.51	4.16
27.0 - 32.0	2511	5.768E-06	1.891E-05	-55.02	4.26
32.0 - 37.0	1224	4.269E-06	4.089E-06	-55.35	3.91
37.0 - 42.0	646	6.395E-06	6.128E-06	-53.71	4.12
42.0 - 47.0	421	6.703E-06	5.549E-06	-53.38	4.10
47.0 - 97.0	4400	7.091E-06	6.513E-06	-53.17	4.04
Total	24482	6.767E-06	1.941E-05	-53.84	4.29

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

ACE 6208561

Appendix A.4. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1988 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"	3.8180E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.9500E-05	10	3.8040E-10	6.8540E-05	2.6167E+03	7.0340E+06	5.1980E+03
" 7.0 - 12.0"	3.6550E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	1.8670E-06	10	1.5490E-12	9.4460E-06	3.4522E+02	5.3190E+04	4.5200E+02
" 12.0 - 17.0"	3.5950E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	7.5050E-05	9	3.1780E-09	5.2710E-04	1.8952E+04	2.0300E+08	2.7920E+04
" 17.0 - 22.0"	3.5580E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.4930E-04	9	2.5040E-09	1.3170E-03	4.6860E+04	2.4770E+08	3.0840E+04
" 22.0 - 27.0"	3.5010E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	7.7130E-05	9	1.1700E-09	8.0760E-04	2.8272E+04	1.5750E+08	2.4600E+04
" 27.0 - 32.0"	3.2760E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	3.0500E-05	9	2.3450E-10	2.8780E-04	9.4277E+03	2.2810E+07	9.3610E+03
" 32.0 - 37.0"	2.8020E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	4.7540E-06	8	2.2600E-11	6.0670E-05	1.6999E+03	2.8920E+06	3.3330E+03
" 37.0 - 42.0"	1.0280E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.9150E-07	7	3.6670E-14	2.5880E-06	2.6613E+01	7.1020E+02	5.2230E+01
" 42.0 - 47.0"	4.1090E+03	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.5230E+08									1.0820E+05	"+ or -"	4.9620E+04

ACE 6208562

Appendix A.5. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1988 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"	3.5580E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	7.7320E-04	7	1.6630E-07	2.7170E-03	9.6663E+04	2.8540E+09	1.0470E+05
" 7.0 - 12.0"	3.7600E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	3.4100E-04	8	3.8740E-08	1.7250E-03	6.4870E+04	1.4100E+09	7.3590E+04
" 12.0 - 17.0"	3.6960E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	3.8770E-04	8	2.4140E-08	2.7230E-03	1.0063E+05	1.6350E+09	7.9260E+04
" 17.0 - 22.0"	3.6050E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	5.0500E-04	8	1.9610E-08	4.4550E-03	1.6058E+05	1.9950E+09	8.7540E+04
" 22.0 - 27.0"	3.4250E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	6.5860E-04	8	2.7250E-07	6.8960E-03	2.3618E+05	3.5060E+10	3.6700E+05
" 27.0 - 32.0"	3.1010E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.3260E-04	8	4.5030E-09	1.2510E-03	3.8797E+04	3.9230E+08	3.8820E+04
" 32.0 - 37.0"	2.3070E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 37.0 - 42.0"	1.2730E+06	3.1820E-06	257	2.6860E-06	1.3520E+01	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	2.7580E-06	118	1.7000E-06	1.5600E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.3580E+08									6.9773E+05	"+ or -"	4.0810E+05

ACE 6208563

Appendix A.6. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1988 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"	3.4740E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	2.7130E-05	3	7.3600E-10	9.5340E-05	3.3122E+03	1.1270E+07	6.5800E+03
" 7.0 - 12.0"	3.1150E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	3.8790E-04	3	1.5050E-07	1.9630E-03	6.1125E+04	3.7430E+09	1.1990E+05
" 12.0 - 17.0"	2.8130E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.3160E-03	3	7.3920E-07	9.2430E-03	2.6003E+05	2.8920E+10	3.3330E+05
" 17.0 - 22.0"	2.1600E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	3.9370E-04	3	7.3620E-08	3.4730E-03	7.5027E+04	2.6770E+09	1.0140E+05
" 22.0 - 27.0"	1.2540E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	7.5950E-05	2	1.2570E-09	7.9530E-04	9.9739E+03	2.1720E+07	9.1340E+03
" 27.0 - 32.0"	6.7580E+05	4.5590E-06	1588	1.2190E-05	9.4350E+00	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 32.0 - 37.0"	0.0000E+00	3.3700E-06	667	2.5010E-06	1.2760E+01	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	3.1820E-06	257	2.6860E-06	1.3520E+01	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	2.7580E-06	118	1.7000E-06	1.5600E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.2880E+08									4.0947E+05 "+ or -"		3.6860E+05

ACE 6208564

Appendix A.7. Hydroacoustic estimate of fish inhabiting Area 1, Kenai Lake, Alaska in 1988 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"	3.7740E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.4430E-05	8	2.0820E-10	5.0700E-05	1.9134E+03	3.7610E+06	3.8010E+03
" 7.0 - 12.0"	3.6770E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	3.1520E-04	8	1.5960E-08	1.5950E-03	5.8637E+04	5.5840E+08	4.6320E+04
" 12.0 - 17.0"	3.4190E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.1250E-04	8	2.5380E-09	7.9040E-04	2.7024E+04	1.4700E+08	2.3760E+04
" 17.0 - 22.0"	3.0410E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.6730E-04	8	1.8370E-09	1.4760E-03	4.4880E+04	1.3310E+08	2.2610E+04
" 22.0 - 27.0"	2.8040E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	1.5990E-03	7	8.4080E-07	1.6740E-02	4.6938E+05	7.2550E+10	5.2790E+05
" 27.0 - 32.0"	2.3160E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	2.3840E-04	6	2.5490E-08	2.2490E-03	5.2090E+04	1.2290E+09	6.8720E+04
" 32.0 - 37.0"	1.4960E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.9000E-05	5	5.5520E-10	3.7010E-04	5.5381E+03	2.0280E+07	8.8270E+03
" 37.0 - 42.0"	6.5940E+06	3.1820E-06	257	2.6860E-06	1.3520E+01	0.0000E+00	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	6.0080E+05	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.1250E+08									6.5946E+05 "+ or -"		5.3550E+05

ACE 6208565

Appendix A.8. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1988 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"	5.7740E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.0570E-04	12	9.0520E-09	3.7140E-04	2.1447E+04	3.8520E+08	3.8470E+04
" 7.0 - 12.0"	5.5450E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	8.0330E-05	12	2.0860E-09	4.0640E-04	2.2536E+04	1.6510E+08	2.5190E+04
" 12.0 - 17.0"	5.3030E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	2.4500E-04	12	8.5200E-09	1.7210E-03	9.1240E+04	1.1890E+09	6.7580E+04
" 17.0 - 22.0"	5.0680E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	5.6600E-05	11	1.3100E-09	4.9930E-04	2.5305E+04	2.6230E+08	3.1740E+04
" 22.0 - 27.0"	4.3690E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	3.5200E-05	11	2.5130E-10	3.6860E-04	1.6105E+04	5.2680E+07	1.4230E+04
" 27.0 - 32.0"	4.1300E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.4490E-05	9	6.4760E-11	1.3670E-04	5.6448E+03	9.9750E+06	6.1900E+03
" 32.0 - 37.0"	3.9470E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	7.1750E-06	8	3.8610E-11	9.1580E-05	3.6147E+03	9.8100E+06	6.1390E+03
" 37.0 - 42.0"	3.7610E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.0960E-05	8	7.2120E-11	1.4810E-04	5.5705E+03	1.8730E+07	8.4830E+03
" 42.0 - 47.0"	3.5590E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	2.9060E-07	8	8.4420E-14	4.5310E-06	1.6127E+02	2.6090E+04	3.1660E+02
" 47.0 - 52.0"	3.2780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	2.9440E-07	7	8.6690E-14	4.8080E-06	1.5760E+02	2.5000E+04	3.0990E+02
" 52.0 - 57.0"	3.0540E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	2.9480E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	2.8620E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	2.7710E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	2.7180E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	2.6470E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	2.5370E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	2.4730E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	2.4010E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	2.2590E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.1400E+08									1.9178E+05	"+ or -"	8.9660E+04

ACE 6208566

Appendix A.9. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1988 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"	5.8750E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	2.4720E-05	14	4.8110E-10	8.6880E-05	5.1042E+03	2.1220E+07	9.0280E+03
" 7.0 - 12.0"	5.7890E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	1.2570E-04	14	1.4080E-09	6.3610E-04	3.6822E+04	1.2330E+08	2.1770E+04
" 12.0 - 17.0"	5.7650E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	4.2630E-05	14	4.4080E-10	2.9940E-04	1.7262E+04	7.2520E+07	1.6690E+04
" 17.0 - 22.0"	5.7040E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.4410E-04	13	1.5880E-09	1.2710E-03	7.2493E+04	4.0440E+08	3.9420E+04
" 22.0 - 27.0"	5.6100E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	7.7600E-05	13	1.3200E-09	8.1260E-04	4.5587E+04	4.5620E+08	4.1860E+04
" 27.0 - 32.0"	5.4940E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	4.4690E-05	13	1.1700E-09	4.2170E-04	2.3167E+04	3.1670E+08	3.4880E+04
" 32.0 - 37.0"	5.2990E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	1.5670E-05	13	6.0870E-11	2.0000E-04	1.0595E+04	2.7930E+07	1.0360E+04
" 37.0 - 42.0"	5.0560E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	7.7850E-06	12	2.2680E-11	1.0520E-04	5.3204E+03	1.0670E+07	6.4030E+03
" 42.0 - 47.0"	4.8160E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	1.0900E-06	12	1.1880E-12	1.7000E-05	8.1858E+02	6.7220E+05	1.6070E+03
" 47.0 - 52.0"	4.6240E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	4.5430E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	2.5680E-08	11	6.5960E-16	4.1940E-07	1.9054E+01	3.6550E+02	3.7470E+01
" 57.0 - 62.0"	4.4580E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	2.1810E-07	11	4.7570E-14	3.5620E-06	1.5877E+02	2.5380E+04	3.1220E+02
" 62.0 - 67.0"	4.3750E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.2370E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.1430E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.0680E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	3.8600E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.0070E-08	10	1.0150E-16	1.6450E-07	6.3498E+00	4.0590E+01	1.2490E+01
" 87.0 - 92.0"	3.7540E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	3.6830E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	3.4230E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.457E+08									2.1735E+05 "+ or -"		7.4210E+04

ACE 6208567

Appendix A.10. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1988 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"	5.9120E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	7.1090E-05	13	2.8470E-09	2.4980E-04	1.4771E+04	1.2880E+08	2.2250E+04
" 7.0 - 12.0"	5.8680E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	9.1800E-05	13	2.5110E-09	4.6450E-04	2.7253E+04	2.2260E+08	2.9250E+04
" 12.0 - 17.0"	5.8080E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	8.5370E-05	13	1.0770E-09	5.9960E-04	3.4826E+04	1.8020E+08	2.6310E+04
" 17.0 - 22.0"	5.7370E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	8.5870E-05	13	1.2210E-09	7.5750E-04	4.3455E+04	3.1360E+08	3.4710E+04
" 22.0 - 27.0"	5.6510E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	3.8420E-05	13	1.8710E-10	4.0230E-04	2.2731E+04	6.5690E+07	1.5890E+04
" 27.0 - 32.0"	5.5520E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	6.9120E-05	13	7.5490E-10	6.5220E-04	3.6209E+04	2.1300E+08	2.8610E+04
" 32.0 - 37.0"	5.4580E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	7.6890E-06	13	2.4330E-11	9.8140E-05	5.3565E+03	1.1830E+07	6.7420E+03
" 37.0 - 42.0"	5.3730E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.6580E-07	13	2.7480E-14	2.2410E-06	1.2040E+02	1.4540E+04	2.3630E+02
" 42.0 - 47.0"	5.2920E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	1.8240E-06	13	3.1950E-12	2.8450E-05	1.5058E+03	2.1840E+06	2.8960E+03
" 47.0 - 52.0"	5.2110E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	13	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	5.1440E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	2.3520E-08	12	5.5300E-16	3.8400E-07	1.9752E+01	3.9270E+02	3.8840E+01
" 57.0 - 62.0"	5.0390E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	6.0270E-08	12	3.6330E-15	9.8430E-07	4.9595E+01	2.4760E+03	9.7530E+01
" 62.0 - 67.0"	4.9600E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.8260E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.5360E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.4290E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	4.2680E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	4.0410E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	3.9010E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.0390E-08	10	1.0790E-16	1.6960E-07	6.6162E+00	4.4070E+01	1.3010E+01
" 97.0 -102.0"	3.7160E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.0070E+09									1.8630E+05	"+ or -"	6.6120E+04

ACE 6208568

Appendix A.11. Hydroacoustic estimate of fish inhabiting Area 2, Kenai Lake, Alaska in 1988 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"	5.9260E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.5300E-04	13	1.4220E-08	5.3760E-04	3.1860E+04	6.4450E+08	4.9760E+04
" 7.0 - 12.0"	5.8800E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	4.4280E-05	13	7.1060E-10	2.2400E-04	1.3173E+04	6.3220E+07	1.5580E+04
" 12.0 - 17.0"	5.8280E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	2.0180E-04	13	4.6020E-09	1.4170E-03	8.2597E+04	7.7680E+08	5.4630E+04
" 17.0 - 22.0"	5.7680E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.2290E-04	12	2.2110E-09	1.0840E-03	6.2522E+04	5.7430E+08	4.6970E+04
" 22.0 - 27.0"	5.6880E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	1.0690E-04	12	1.5300E-09	1.1190E-03	6.3663E+04	5.4410E+08	4.5720E+04
" 27.0 - 32.0"	5.6180E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	3.8710E-05	12	2.5410E-10	3.6520E-04	2.0518E+04	7.3290E+07	1.6780E+04
" 32.0 - 37.0"	5.5430E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	7.4640E-06	12	1.9780E-11	9.5270E-05	5.2809E+03	9.9230E+06	6.1740E+03
" 37.0 - 42.0"	5.4740E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.0850E-05	12	6.6890E-11	1.4670E-04	8.0303E+03	3.6810E+07	1.1890E+04
" 42.0 - 47.0"	5.4070E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	6.4170E-07	12	2.3160E-13	1.0010E-05	5.4111E+02	1.6560E+05	7.9770E+02
" 47.0 - 52.0"	5.3290E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	5.2480E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	5.1810E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	5.0300E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.7260E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.4680E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.3310E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	4.2710E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	4.2340E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.1130E-07	9	1.2400E-14	1.8180E-06	7.6975E+01	5.9650E+03	1.5140E+02
" 92.0 - 97.0"	4.0580E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	4.2230E-08	9	1.7830E-15	6.8960E-07	2.7981E+01	7.8810E+02	5.5020E+01
" 97.0 -102.0"	3.8300E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.0180E+09									2.8829E+05 "+ or -"		1.0230E+05

ACE 6208569

Appendix A.12. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1988 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"	5.2390E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	2.1120E-04	9	3.7470E-08	7.4210E-04	3.8875E+04	1.3110E+09	7.0970E+04
" 7.0 - 12.0"	5.1980E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	6.6070E-04	9	5.3450E-08	3.3430E-03	1.7375E+05	3.7530E+09	1.2010E+05
" 12.0 - 17.0"	5.1460E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	5.6300E-04	9	2.4610E-08	3.9540E-03	2.0347E+05	3.2490E+09	1.1170E+05
" 17.0 - 22.0"	5.0870E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	6.7760E-04	9	2.4270E-08	5.9770E-03	3.0407E+05	4.9300E+09	1.3760E+05
" 22.0 - 27.0"	5.0270E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	4.5040E-04	9	5.4290E-09	4.7160E-03	2.3710E+05	1.5220E+09	7.6470E+04
" 27.0 - 32.0"	4.9640E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	3.6460E-04	9	1.6800E-09	3.4400E-03	1.7079E+05	5.0000E+08	4.3830E+04
" 32.0 - 37.0"	4.8850E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	1.5730E-04	9	6.0250E-10	2.0070E-03	9.8056E+04	2.4220E+08	3.0500E+04
" 37.0 - 42.0"	4.8200E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	8.0890E-05	9	2.5150E-10	1.0930E-03	5.2702E+04	1.1450E+08	2.0970E+04
" 42.0 - 47.0"	4.7380E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	1.6920E-05	9	1.4370E-11	2.6390E-04	1.2502E+04	8.3490E+06	5.6630E+03
" 47.0 - 52.0"	4.6280E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.5670E-05	9	6.2840E-11	2.5580E-04	1.1839E+04	3.6820E+07	1.1890E+04
" 52.0 - 57.0"	4.5360E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.9310E-06	9	3.0570E-12	3.1530E-05	1.4302E+03	1.6910E+06	2.5480E+03
" 57.0 - 62.0"	4.4470E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.3120E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.1740E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.0580E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.0180E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	3.9300E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	3.8460E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	3.7930E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	4.0530E-08	7	7.9120E-16	6.6190E-07	2.5110E+01	3.0780E+02	3.4390E+01
" 97.0 -102.0"	3.6780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.0520E+08									1.3046E+06 "+ or -"		2.4530E+05

ACE 6208570

Appendix A.13. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1988 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"	5.0050E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	6.5580E-04	12	5.2130E-08	2.3050E-03	1.1533E+05	1.9740E+09	8.7090E+04
" 7.0 - 12.0"	4.8500E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	9.1750E-04	12	6.3630E-08	4.6420E-03	2.2514E+05	3.9260E+09	1.2280E+05
" 12.0 - 17.0"	4.7860E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.3270E-03	12	4.9970E-08	9.3220E-03	4.4618E+05	5.8120E+09	1.4940E+05
" 17.0 - 22.0"	4.7010E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.6410E-03	11	8.5040E-08	1.4470E-02	6.8040E+05	1.4840E+10	2.3880E+05
" 22.0 - 27.0"	4.6430E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	5.0410E-04	11	2.9330E-09	5.2780E-03	2.4507E+05	7.1220E+08	5.2310E+04
" 27.0 - 32.0"	4.5950E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	3.3400E-04	11	2.1040E-08	3.1520E-03	1.4482E+05	4.0490E+09	1.2470E+05
" 32.0 - 37.0"	4.5490E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	8.2740E-05	11	3.6550E-10	1.0560E-03	4.8039E+04	1.2510E+08	2.1920E+04
" 37.0 - 42.0"	4.4830E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.9110E-05	11	2.2980E-11	2.5830E-04	1.1580E+04	8.8130E+06	5.8190E+03
" 42.0 - 47.0"	4.4350E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	5.3330E-06	11	5.9140E-12	8.3170E-05	3.6886E+03	2.8730E+06	3.3220E+03
" 47.0 - 52.0"	4.3750E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	5.1640E-06	11	1.1610E-11	8.4330E-05	3.6893E+03	6.0190E+06	4.8090E+03
" 52.0 - 57.0"	4.3180E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.2540E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.2100E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.1690E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.0180E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	3.9870E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	3.9650E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	3.6540E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	3.3390E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	3.3030E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	8.5640E+08									1.9239E+06 "+ or -"		3.4760E+05

ACE 6208571

Appendix A.15. Hydroacoustic estimate of fish inhabiting Area 3, Kenai Lake, Alaska in 1988 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"	5.2000E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.9900E-04	11	2.1900E-08	6.9940E-04	3.6372E+04	7.6760E+08	5.4300E+04
" 7.0 - 12.0"	5.1720E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	7.3330E-04	11	2.1160E-07	3.7100E-03	1.9187E+05	1.4560E+10	2.3650E+05
" 12.0 - 17.0"	4.8360E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	2.5970E-03	11	4.5070E-06	1.8240E-02	8.8228E+05	5.2070E+11	1.4140E+06
" 17.0 - 22.0"	5.1130E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.1790E-03	11	4.5250E-07	1.0400E-02	5.3160E+05	9.2180E+10	5.9510E+05
" 22.0 - 27.0"	5.0900E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	3.3680E-04	11	2.7160E-09	3.5260E-03	1.7949E+05	7.8180E+08	5.4800E+04
" 27.0 - 32.0"	5.0600E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	4.6460E-05	10	6.1910E-11	4.3840E-04	2.2182E+04	1.6330E+07	7.9200E+03
" 32.0 - 37.0"	5.0150E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.0500E-05	10	1.3730E-10	2.6170E-04	1.3123E+04	5.6420E+07	1.4720E+04
" 37.0 - 42.0"	4.9750E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.5690E-05	10	9.8660E-11	2.1210E-04	1.0551E+04	4.4920E+07	1.3140E+04
" 42.0 - 47.0"	4.9420E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	1.9870E-06	10	3.9500E-12	3.1000E-05	1.5319E+03	2.3540E+06	3.0070E+03
" 47.0 - 52.0"	4.9050E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	4.8650E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.8260E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.7950E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.7520E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.7000E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.6590E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	4.6120E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.9330E-08	10	1.6600E-16	3.1560E-07	1.4555E+01	9.5560E+01	1.9160E+01
" 87.0 - 92.0"	4.5550E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	9.7840E-09	10	9.5720E-17	1.5980E-07	7.2774E+00	5.3310E+01	1.4310E+01
" 92.0 - 97.0"	4.4950E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	9.9140E-09	10	9.8280E-17	1.6190E-07	7.2774E+00	5.3310E+01	1.4310E+01
" 97.0 -102.0"	4.3630E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.0220E-08	10	1.0430E-16	1.6680E-07	7.2774E+00	5.3310E+01	1.4310E+01
"TOTAL"	9.6930E+08									1.8690E+06	"+ or -"	1.5550E+06

ACE 6208572

Appendix A.16. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1988 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"	7.1310E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.5500E-03	11	1.7050E-07	5.4450E-03	3.8833E+05	1.4820E+10	2.3860E+05
" 7.0 - 12.0"	7.0630E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	2.9730E-03	11	9.0510E-08	1.5040E-02	1.0622E+06	1.3660E+10	2.2910E+05
" 12.0 - 17.0"	7.0140E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	2.8430E-03	11	1.4430E-07	1.9970E-02	1.4008E+06	3.6650E+10	3.7520E+05
" 17.0 - 22.0"	6.9710E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.0730E-03	11	1.0150E-08	9.4630E-03	6.5970E+05	4.0400E+09	1.2460E+05
" 22.0 - 27.0"	6.9170E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	6.8110E-04	11	1.1280E-08	7.1310E-03	4.9329E+05	5.9960E+09	1.5180E+05
" 27.0 - 32.0"	6.8580E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	3.1650E-04	11	3.5260E-09	2.9860E-03	2.0480E+05	1.6650E+09	7.9970E+04
" 32.0 - 37.0"	6.7800E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	1.0590E-04	11	5.7080E-10	1.3520E-03	9.1669E+04	4.3440E+08	4.0850E+04
" 37.0 - 42.0"	6.7140E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.4180E-05	11	3.0190E-11	1.9170E-04	1.2873E+04	2.5330E+07	9.8650E+03
" 42.0 - 47.0"	6.6640E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	7.2930E-06	11	1.8660E-11	1.1370E-04	7.5799E+03	2.0340E+07	8.8400E+03
" 47.0 - 52.0"	6.6030E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	8.4810E-07	11	7.1930E-13	1.3850E-05	9.1456E+02	8.4200E+05	1.7980E+03
" 52.0 - 57.0"	6.5530E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	2.8780E-07	11	8.2830E-14	4.7000E-06	3.0799E+02	9.5490E+04	6.0570E+02
" 57.0 - 62.0"	6.4770E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	6.3770E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	6.3040E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	6.2430E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	6.1780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	6.1110E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.8700E-08	10	3.4980E-16	3.0540E-07	1.8663E+01	3.5060E+02	3.6700E+01
" 87.0 - 92.0"	6.0430E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	5.9670E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	9.5800E-09	10	9.1780E-17	1.5640E-07	9.3347E+00	8.7720E+01	1.8360E+01
" 97.0 -102.0"	5.9160E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.3090E+09									4.3225E+06 "+ or -"		5.4500E+05

ACE 6208573

Appendix A.17. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1988 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"	7.0930E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.8780E-03	10	3.0010E-07	6.5990E-03	4.6807E+05	2.4610E+10	3.0750E+05
" 7.0 - 12.0"	7.0430E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	1.8680E-03	9	1.0080E-07	9.4490E-03	6.6545E+05	1.3620E+10	2.2880E+05
" 12.0 - 17.0"	6.9850E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.5700E-03	9	4.4150E-08	1.1030E-02	7.7052E+05	1.1120E+10	2.0670E+05
" 17.0 - 22.0"	6.9250E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	8.4030E-04	9	9.4810E-09	7.4130E-03	5.1334E+05	3.6600E+09	1.1860E+05
" 22.0 - 27.0"	6.8780E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	3.4940E-04	9	8.7120E-09	3.6590E-03	2.5165E+05	4.5380E+09	1.3200E+05
" 27.0 - 32.0"	6.8520E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.2280E-04	9	1.5990E-09	1.1590E-03	7.9384E+04	6.9640E+08	5.1720E+04
" 32.0 - 37.0"	6.8300E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.5170E-05	9	1.4300E-10	3.2130E-04	2.1942E+04	1.0910E+08	2.0470E+04
" 37.0 - 42.0"	6.8060E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	4.6700E-06	9	1.6550E-11	6.3130E-05	4.2969E+03	1.4060E+07	7.3490E+03
" 42.0 - 47.0"	6.7640E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	4.4020E-06	9	1.4920E-11	6.8660E-05	4.6438E+03	1.6670E+07	8.0020E+03
" 47.0 - 52.0"	6.6780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	6.6360E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	6.5990E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	6.5610E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	6.5450E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	6.5230E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	6.4970E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	6.4500E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	6.3760E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	6.2950E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	6.2030E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.1230E-08	9	1.2610E-16	1.8340E-07	1.1375E+01	1.3020E+02	2.2370E+01
"TOTAL"	1.3350E+09									2.7793E+06 "+ or -"		4.7360E+05

ACE 6208574

Appendix A.18. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1988 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"	7.1590E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.5990E-03	10	5.6490E-07	5.6210E-03	4.0242E+05	4.0170E+10	3.9280E+05
" 7.0 - 12.0"	7.1270E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	5.4860E-04	10	2.0130E-08	2.7760E-03	1.9782E+05	2.6900E+09	1.0160E+05
" 12.0 - 17.0"	7.0890E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	7.6390E-04	10	6.9740E-08	5.3660E-03	3.8036E+05	1.7410E+10	2.5860E+05
" 17.0 - 22.0"	7.0510E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	4.7200E-04	10	6.1520E-09	4.1640E-03	2.9361E+05	2.4200E+09	9.6420E+04
" 22.0 - 27.0"	6.9770E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	2.5250E-04	10	6.4500E-09	2.6430E-03	1.8442E+05	3.4530E+09	1.1520E+05
" 27.0 - 32.0"	6.8780E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.0950E-04	10	1.3290E-09	1.0330E-03	7.1038E+04	5.8240E+08	4.7300E+04
" 32.0 - 37.0"	6.7640E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	3.0260E-05	10	2.9380E-10	3.8630E-04	2.6128E+04	2.1960E+08	2.9040E+04
" 37.0 - 42.0"	6.6650E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	6.5770E-06	10	2.6600E-11	8.8900E-05	5.9257E+03	2.1700E+07	9.1290E+03
" 42.0 - 47.0"	6.6030E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	6.4980E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	6.4300E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	6.3570E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	6.2530E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	6.1470E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	6.0450E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	5.9230E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	5.7940E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	5.6550E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	5.5210E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.1930E-08	9	1.4240E-16	1.9490E-07	1.0758E+01	1.1650E+02	2.1160E+01
" 97.0 -102.0"	5.4310E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.2840E+09									1.5617E+06 "+ or -"		5.0720E+05

ACE 6208575

Appendix A.19. Hydroacoustic estimate of fish inhabiting Area 4, Kenai Lake, Alaska in 1988 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"	7.1660E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	6.7820E-04	11	1.7730E-07	2.3830E-03	1.7078E+05	1.2040E+10	2.1510E+05
" 7.0 - 12.0"	7.1490E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	3.0370E-04	11	2.7830E-09	1.5370E-03	1.0985E+05	3.8650E+08	3.8530E+04
" 12.0 - 17.0"	7.0870E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	5.4010E-04	11	7.8900E-09	3.7940E-03	2.6885E+05	2.0150E+09	8.7980E+04
" 17.0 - 22.0"	6.9920E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	2.6870E-04	10	2.8950E-09	2.3710E-03	1.6576E+05	1.1140E+09	6.5420E+04
" 22.0 - 27.0"	6.9070E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	2.4510E-04	10	4.0390E-09	2.5660E-03	1.7726E+05	2.1230E+09	9.0310E+04
" 27.0 - 32.0"	6.8010E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.0130E-04	10	2.8100E-10	9.5610E-04	6.5026E+04	1.3470E+08	2.2750E+04
" 32.0 - 37.0"	6.6900E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.5220E-05	10	9.6280E-11	3.2190E-04	2.1535E+04	7.0590E+07	1.6470E+04
" 37.0 - 42.0"	6.5880E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	6.5060E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	6.4120E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	6.3270E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	6.2400E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	6.1250E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	6.0070E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	5.9440E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	5.8840E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	5.8130E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	5.7190E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	5.5900E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	5.4760E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	1.1440E-08	9	1.3080E-16	1.8680E-07	1.0229E+01	1.0530E+02	2.0110E+01
"TOTAL"	1.2740E+09									9.7907E+05 "+ or -"		2.6210E+05

ACE 6208576

Appendix A.20. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1988 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"	5.4490E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	1.6270E-03	11	5.0920E-07	5.7170E-03	3.1150E+05	2.1310E+10	2.8610E+05
" 7.0 - 12.0"	5.3870E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	2.5750E-04	11	1.3350E-08	1.3030E-03	7.0176E+04	1.0010E+09	6.2000E+04
" 12.0 - 17.0"	5.3040E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	3.9130E-04	11	2.0970E-08	2.7490E-03	1.4580E+05	2.9290E+09	1.0610E+05
" 17.0 - 22.0"	5.2410E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	3.4060E-04	11	1.1020E-08	3.0040E-03	1.5746E+05	2.3670E+09	9.5360E+04
" 22.0 - 27.0"	5.1780E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	1.4820E-04	11	4.5120E-09	1.5520E-03	8.0371E+04	1.3290E+09	7.1440E+04
" 27.0 - 32.0"	5.1190E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	5.8520E-05	11	6.4080E-10	5.5210E-04	2.8262E+04	1.5310E+08	2.4250E+04
" 32.0 - 37.0"	5.0330E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	1.0790E-06	11	3.9300E-13	1.3770E-05	6.9305E+02	1.6260E+05	7.9030E+02
" 37.0 - 42.0"	4.9490E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	1.5210E-06	10	1.3930E-12	2.0560E-05	1.0172E+03	6.2610E+05	1.5510E+03
" 42.0 - 47.0"	4.8860E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	4.1190E-06	10	1.6970E-11	6.4250E-05	3.1388E+03	9.8840E+06	6.1620E+03
" 47.0 - 52.0"	4.8180E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	4.7460E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.6850E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.6240E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.5270E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.4280E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.3390E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	3.1560E-08	9	9.9620E-16	5.1540E-07	2.2362E+01	5.0340E+02	4.3980E+01
" 82.0 - 87.0"	4.1860E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	3.9780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	5.7370E-08	9	2.1060E-15	9.3690E-07	3.7266E+01	8.9800E+02	5.8730E+01
" 92.0 - 97.0"	3.8610E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	3.7780E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	9.4520E+08									7.9848E+05	"+ or -" 3.3440E+05	

ACE 6208577

Appendix A.21. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1988 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"	5.4520E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	7.1580E-03	9	3.2030E-05	2.5150E-02	1.3713E+06	1.2270E+12	2.1710E+06
" 7.0 - 12.0"	5.4150E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	2.2500E-04	9	3.4800E-08	1.1380E-03	6.1635E+04	2.6190E+09	1.0030E+05
" 12.0 - 17.0"	5.3660E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.0510E-04	9	3.9040E-09	7.3790E-04	3.9600E+04	5.5590E+08	4.6210E+04
" 17.0 - 22.0"	5.3280E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	5.1760E-05	9	2.4310E-10	4.5660E-04	2.4331E+04	5.3980E+07	1.4400E+04
" 22.0 - 27.0"	5.2800E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	3.1970E-05	9	3.7460E-10	3.3470E-04	1.7674E+04	1.1460E+08	2.0980E+04
" 27.0 - 32.0"	5.2100E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	1.5010E-05	9	1.3430E-10	1.4160E-04	7.3789E+03	3.2680E+07	1.1210E+04
" 32.0 - 37.0"	5.1620E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.1610E-07	9	2.3350E-14	2.7580E-06	1.4240E+02	1.0160E+04	1.9750E+02
" 37.0 - 42.0"	5.0820E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	7.4750E-07	9	3.9510E-13	1.0100E-05	5.1355E+02	1.8720E+05	8.4810E+02
" 42.0 - 47.0"	4.9910E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	4.9380E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	4.8640E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	4.7570E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	4.6540E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	4.5600E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	4.4350E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	4.3410E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	9	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	4.2580E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	4.1610E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	8	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	4.0290E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	3.0490E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	3.4840E-08	7	1.2140E-15	5.6900E-07	1.7350E+01	3.0300E+02	3.4120E+01
"TOTAL"	9.5330E+08									1.5226E+06 "+ or -"		2.1740E+06

ACE 6208578

Appendix A.22. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1988 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"	5.3160E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	2.3920E-03	6	6.6920E-07	8.4070E-03	4.4697E+05	2.8800E+10	3.3260E+05
" 7.0 - 12.0"	5.0510E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	3.1740E-04	6	1.7880E-08	1.6060E-03	8.1102E+04	1.1800E+09	6.7330E+04
" 12.0 - 17.0"	4.8440E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	1.8390E-05	6	1.3090E-10	1.2920E-04	6.2579E+03	1.5190E+07	7.6380E+03
" 17.0 - 22.0"	4.5780E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.8580E-05	6	1.2180E-10	1.6390E-04	7.5017E+03	1.9900E+07	8.7430E+03
" 22.0 - 27.0"	4.3660E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	1.0580E-05	6	5.0680E-11	1.1080E-04	4.8380E+03	1.0600E+07	6.3810E+03
" 27.0 - 32.0"	4.1330E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	0.0000E+00	6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 32.0 - 37.0"	3.9760E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	5.6750E-07	6	3.2200E-13	7.2430E-06	2.8800E+02	8.3010E+04	5.6470E+02
" 37.0 - 42.0"	3.8630E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	3.4440E-07	5	1.1860E-13	4.6550E-06	1.7984E+02	3.2430E+04	3.5300E+02
" 42.0 - 47.0"	3.7490E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	3.6200E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 52.0 - 57.0"	3.4480E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	7.7190E-07	5	5.9580E-13	1.2610E-05	4.3462E+02	1.9010E+05	8.5470E+02
" 57.0 - 62.0"	3.3030E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	3.1890E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 67.0 - 72.0"	3.0040E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	2.7420E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 77.0 - 82.0"	2.0930E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	4	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	1.0990E+06	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	6.1380E+08									5.4757E+05	"+ or -"	3.3960E+05

ACE 6208579

Appendix A.23. Hydroacoustic estimate of fish inhabiting Area 5, Kenai Lake, Alaska in 1988 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"	5.4520E+07	1.2240E-05	239	3.1220E-05	3.5140E+00	4.8230E-03	7	2.9340E-06	1.6950E-02	9.2415E+05	1.3100E+11	7.0930E+05
" 7.0 - 12.0"	5.4240E+07	8.5020E-06	682	9.5810E-06	5.0590E+00	2.5020E-05	7	3.5090E-10	1.2660E-04	6.8653E+03	2.6520E+07	1.0090E+04
" 12.0 - 17.0"	5.3510E+07	6.1240E-06	1722	7.3240E-06	7.0240E+00	9.9060E-05	6	4.8910E-09	6.9580E-04	3.7231E+04	6.9200E+08	5.1560E+04
" 17.0 - 22.0"	5.2260E+07	4.8760E-06	2073	4.7800E-06	8.8220E+00	1.3170E-04	6	7.4230E-09	1.1620E-03	6.0740E+04	1.5810E+09	7.7930E+04
" 22.0 - 27.0"	5.0430E+07	4.1080E-06	1970	3.2450E-06	1.0470E+01	4.5810E-05	6	6.8720E-10	4.7960E-04	2.4187E+04	1.9180E+08	2.7140E+04
" 27.0 - 32.0"	4.6970E+07	4.5590E-06	1588	1.2190E-05	9.4350E+00	6.7430E-06	6	9.5260E-12	6.3620E-05	2.9880E+03	1.9110E+06	2.7090E+03
" 32.0 - 37.0"	4.1290E+07	3.3700E-06	667	2.5010E-06	1.2760E+01	2.8250E-06	6	7.1110E-12	3.6060E-05	1.4889E+03	1.9770E+06	2.7560E+03
" 37.0 - 42.0"	3.8010E+07	3.1820E-06	257	2.6860E-06	1.3520E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 42.0 - 47.0"	3.5210E+07	2.7580E-06	118	1.7000E-06	1.5600E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 47.0 - 52.0"	3.4110E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	4.1520E-06	5	1.7240E-11	6.7800E-05	2.3125E+03	5.3830E+06	4.5470E+03
" 52.0 - 57.0"	2.5190E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	5	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 57.0 - 62.0"	1.0920E+07	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 62.0 - 67.0"	5.3680E+06	2.6340E-06	55	1.5940E-06	1.6330E+01	4.1240E-04	2	1.7010E-07	6.7350E-03	3.6156E+04	1.3160E+09	7.1100E+04
" 67.0 - 72.0"	1.2260E+06	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	2	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 72.0 - 77.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+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	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	2.6340E-06	55	1.5940E-06	1.6330E+01	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	5.0330E+08									1.0961E+06 "+ or -"		7.1950E+05

ACE 6208580

Appendix A.24. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1988 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"	2.0490E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	9.9090E-03	36	1.0760E-05	4.1580E-02	8.5193E+06	8.0970E+12	5.5770E+06
" 7.0 - 12.0"	1.8130E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	1.3140E-02	35	1.8050E-05	6.1180E-02	1.1089E+07	1.2930E+13	7.0470E+06
" 12.0 - 17.0"	1.4530E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	8.0110E-03	30	1.5940E-05	4.6240E-02	6.7210E+06	1.1290E+13	6.5870E+06
" 17.0 - 22.0"	1.3530E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	1.5380E-03	25	1.3450E-07	1.0590E-02	1.4328E+06	1.3200E+11	7.1200E+05
" 22.0 - 27.0"	1.3050E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	8.0440E-04	24	2.2610E-08	5.7300E-03	7.4777E+05	2.0470E+10	2.8040E+05
" 27.0 - 32.0"	1.2660E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	5.0650E-04	24	1.7230E-08	3.7770E-03	4.7813E+05	1.6340E+10	2.5050E+05
" 32.0 - 37.0"	1.2210E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	1.3700E-04	23	9.4650E-10	1.3810E-03	1.6858E+05	1.4720E+09	7.5190E+04
" 37.0 - 42.0"	1.1470E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	5.0320E-05	21	2.0250E-10	3.3840E-04	3.8805E+04	1.2260E+08	2.1700E+04
" 42.0 - 47.0"	9.7720E+07	6.7030E-06	421	5.5490E-06	6.4170E+00	2.3150E-05	19	6.6620E-11	1.4850E-04	1.4515E+04	2.6540E+07	1.0100E+04
" 47.0 - 52.0"	8.6390E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.2810E-05	17	1.3640E-10	2.5970E-04	2.2434E+04	3.7560E+07	1.2010E+04
" 52.0 - 57.0"	8.3890E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.3420E-05	15	1.9840E-10	2.0270E-04	1.7007E+04	5.1430E+07	1.4060E+04
" 57.0 - 62.0"	8.2280E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.3000E-05	14	1.5670E-10	1.3950E-04	1.1482E+04	3.9050E+07	1.2250E+04
" 62.0 - 67.0"	7.8120E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.7150E-05	14	6.6360E-11	1.6470E-04	1.2868E+04	1.4940E+07	7.5750E+03
" 67.0 - 72.0"	7.1270E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	5.9600E-05	14	1.7830E-10	3.6150E-04	2.5765E+04	3.3460E+07	1.1340E+04
" 72.0 - 77.0"	6.9280E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.4860E-07	12	2.5870E-13	5.1480E-06	3.5665E+02	4.5710E+04	4.1910E+02
" 77.0 - 82.0"	6.6850E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.2600E-07	12	3.6170E-14	2.5840E-06	1.7274E+02	5.9540E+03	1.5120E+02
" 82.0 - 87.0"	6.4280E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	6.2760E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	6.0760E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.7030E-07	12	7.3070E-14	1.6400E-06	9.9630E+01	9.9280E+03	1.9530E+02
" 97.0 -102.0"	5.5490E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	10	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.0400E+09									2.9300E+07	"+ or -"	1.1170E+07

ACE 6208581

Appendix A.25. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1988 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"	1.8990E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	2.8380E-03	41	3.8960E-07	1.1910E-02	2.2615E+06	2.5740E+11	9.9440E+05
" 7.0 - 12.0"	1.6540E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	8.0820E-03	33	1.3510E-05	3.7640E-02	6.2243E+06	8.0360E+12	5.5560E+06
" 12.0 - 17.0"	1.4570E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	6.4510E-03	32	3.9740E-06	3.7230E-02	5.4235E+06	2.8580E+12	3.3130E+06
" 17.0 - 22.0"	1.2290E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	4.9750E-03	27	3.2620E-06	3.4250E-02	4.2090E+06	2.4660E+12	3.0780E+06
" 22.0 - 27.0"	1.0600E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	2.1160E-03	22	9.2660E-07	1.5080E-02	1.5977E+06	5.3240E+11	1.4300E+06
" 27.0 - 32.0"	1.0250E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	1.1500E-03	20	3.2490E-07	8.5750E-03	8.7934E+05	1.9330E+11	8.6180E+05
" 32.0 - 37.0"	9.8110E+07	4.2690E-06	667	4.0890E-06	1.0080E+01	2.3260E-04	20	7.8960E-09	2.3440E-03	2.2994E+05	7.7890E+09	1.7300E+05
" 37.0 - 42.0"	9.6560E+07	6.3950E-06	646	6.1280E-06	6.7260E+00	1.0350E-04	20	1.3910E-09	6.9600E-04	6.7203E+04	5.9340E+08	4.7740E+04
" 42.0 - 47.0"	9.3590E+07	6.7030E-06	421	5.5490E-06	6.4170E+00	7.2950E-05	19	7.4600E-10	4.6810E-04	4.3814E+04	2.7220E+08	3.2340E+04
" 47.0 - 52.0"	8.9010E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.0180E-05	19	3.2200E-11	6.1750E-05	5.4962E+03	9.3930E+06	6.0070E+03
" 52.0 - 57.0"	8.5460E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.5780E-05	18	1.7730E-11	9.5700E-05	8.1791E+03	4.7780E+06	4.2840E+03
" 57.0 - 62.0"	8.3350E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.1640E-05	16	1.6410E-11	7.0590E-05	5.8837E+03	4.2020E+06	4.0180E+03
" 62.0 - 67.0"	8.1700E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	5.3620E-06	16	5.1310E-12	3.2530E-05	2.6574E+03	1.2620E+06	2.2010E+03
" 67.0 - 72.0"	8.0050E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.6760E-06	16	1.4120E-12	1.6230E-05	1.2994E+03	3.3330E+05	1.1320E+03
" 72.0 - 77.0"	7.8530E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.6040E-05	16	1.4620E-10	9.7290E-05	7.6396E+03	3.3190E+07	1.1290E+04
" 77.0 - 82.0"	7.0810E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.1590E-06	16	5.1190E-13	7.0300E-06	4.9776E+02	9.4500E+04	6.0250E+02
" 82.0 - 87.0"	6.1600E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.7570E-07	14	3.5220E-14	1.6720E-06	1.0301E+02	4.9200E+03	1.3750E+02
" 87.0 - 92.0"	4.5750E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.0420E-08	12	6.4680E-15	4.8790E-07	2.2321E+01	4.9830E+02	4.3750E+01
" 92.0 - 97.0"	1.0290E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.7850E-07	7	1.7920E-14	1.0830E-06	1.1145E+01	6.9850E+01	1.6380E+01
" 97.0 -102.0"	0.0000E+00	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	1.8070E+09									2.0968E+07	"+ or -"	7.4250E+06

ACE 6208582

Appendix A.26. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1988 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"	2.0370E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	2.1040E-03	29	5.8730E-07	8.8290E-03	1.7983E+06	4.3540E+11	1.2930E+06
" 7.0 - 12.0"	1.7030E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	1.0720E-03	25	1.6400E-07	4.9920E-03	8.4996E+05	1.0350E+11	6.3060E+05
" 12.0 - 17.0"	1.6060E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	1.0390E-03	22	1.8450E-07	5.9940E-03	9.6260E+05	1.6000E+11	7.8410E+05
" 17.0 - 22.0"	1.5410E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	1.2670E-03	21	3.0410E-07	8.7250E-03	1.3441E+06	3.5550E+11	1.1690E+06
" 22.0 - 27.0"	1.4700E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	5.2960E-04	21	7.5170E-08	3.7730E-03	5.5476E+05	8.3000E+10	5.6470E+05
" 27.0 - 32.0"	1.4280E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	1.7630E-04	20	5.5180E-09	1.3150E-03	1.8779E+05	6.4100E+09	1.5690E+05
" 32.0 - 37.0"	1.4140E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	1.2850E-04	19	4.6280E-09	1.2950E-03	1.8313E+05	9.4450E+09	1.9050E+05
" 37.0 - 42.0"	1.4050E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	8.9440E-05	19	1.6630E-09	6.0160E-04	8.4507E+04	1.4940E+09	7.5770E+04
" 42.0 - 47.0"	1.3970E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	5.8180E-05	19	7.5860E-10	3.7340E-04	5.2162E+04	6.1410E+08	4.8570E+04
" 47.0 - 52.0"	1.3890E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.0010E-05	19	3.8590E-11	1.2140E-04	1.6857E+04	2.7460E+07	1.0270E+04
" 52.0 - 57.0"	1.3410E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.1450E-05	19	7.9820E-11	1.9080E-04	2.5580E+04	5.2920E+07	1.4260E+04
" 57.0 - 62.0"	1.2890E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.9620E-05	18	7.6700E-11	2.4030E-04	3.0966E+04	4.7050E+07	1.3440E+04
" 62.0 - 67.0"	1.1530E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.8560E-05	18	1.2480E-10	2.9460E-04	3.3963E+04	6.1270E+07	1.5340E+04
" 67.0 - 72.0"	1.0700E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.2690E-05	16	6.1440E-11	1.3770E-04	1.4736E+04	2.5950E+07	9.9840E+03
" 72.0 - 77.0"	9.9340E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.0210E-04	15	8.7020E-08	1.8330E-03	1.8207E+05	3.1610E+10	3.4840E+05
" 77.0 - 82.0"	8.4660E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	6.0420E-06	13	1.0710E-11	3.6650E-05	3.1029E+03	2.8260E+06	3.2950E+03
" 82.0 - 87.0"	2.9200E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.7050E-06	8	1.3730E-11	2.2470E-05	6.5631E+02	4.3080E+05	1.2860E+03
" 87.0 - 92.0"	0.0000E+00	7.0910E-06	4400	6.5130E-06	6.0660E+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	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	2.2370E+09									6.3253E+06	"+ or -"	2.1360E+06

ACE 6208583

Appendix A.27. Hydroacoustic estimate of fish inhabiting Area 1, Skilak Lake, Alaska in 1988 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"	2.0380E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	1.9300E-03	22	6.0880E-07	8.1010E-03	1.6508E+06	4.5050E+11	1.3160E+06
" 7.0 - 12.0"	1.6550E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	4.6380E-03	19	5.0580E-06	2.1600E-02	3.5740E+06	3.0100E+12	3.4010E+06
" 12.0 - 17.0"	1.3590E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	1.0290E-02	15	1.7830E-05	5.9370E-02	8.0701E+06	1.1090E+13	6.5260E+06
" 17.0 - 22.0"	9.6670E+07	6.2470E-06	4640	3.6560E-05	6.8860E+00	6.4650E-03	14	8.1920E-06	4.4520E-02	4.3036E+06	3.7660E+12	3.8040E+06
" 22.0 - 27.0"	6.4080E+07	6.0380E-06	3911	1.5470E-05	7.1240E+00	1.0680E-03	8	5.1540E-08	7.6090E-03	4.8758E+05	1.1140E+10	2.0690E+05
" 27.0 - 32.0"	3.7570E+07	5.7680E-06	2511	1.8910E-05	7.4570E+00	1.7390E-03	6	4.7160E-07	1.2970E-02	4.8741E+05	3.8050E+10	3.8230E+05
" 32.0 - 37.0"	3.9240E+06	4.2690E-06	667	4.0890E-06	1.0080E+01	1.3170E-03	4	1.4080E-06	1.3270E-02	5.2092E+04	2.2060E+09	9.2050E+04
" 37.0 - 42.0"	0.0000E+00	6.3950E-06	646	6.1280E-06	6.7260E+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	6.7030E-06	421	5.5490E-06	6.4170E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+00	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	7.0910E-06	4400	6.5130E-06	6.0660E+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	7.0910E-06	4400	6.5130E-06	6.0660E+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	7.0910E-06	4400	6.5130E-06	6.0660E+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	7.0910E-06	4400	6.5130E-06	6.0660E+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	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 97.0 -102.0"	0.0000E+00	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	0	1.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	7.0740E+08									1.8626E+07	"+ or -" 8.3990E+06	

ACE 6208584

Appendix A.28. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1988 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"	1.6680E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	3.0330E-03	26	9.3890E-07	1.2730E-02	2.1237E+06	4.6900E+11	1.3420E+06
" 7.0 - 12.0"	1.6530E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	2.6500E-03	26	4.6140E-07	1.2340E-02	2.0393E+06	2.7560E+11	1.0290E+06
" 12.0 - 17.0"	1.6390E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	1.8470E-03	25	2.6980E-07	1.0660E-02	1.7467E+06	2.4640E+11	9.7300E+05
" 17.0 - 22.0"	1.6250E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	1.3890E-03	25	1.5700E-07	9.5630E-03	1.5545E+06	2.1450E+11	9.0770E+05
" 22.0 - 27.0"	1.6150E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	3.8140E-04	25	7.9210E-09	2.7170E-03	4.3874E+05	1.0800E+10	2.0370E+05
" 27.0 - 32.0"	1.5990E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	1.1820E-04	25	5.6040E-10	8.8130E-04	1.4090E+05	8.8160E+08	5.8200E+04
" 32.0 - 37.0"	1.5900E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	4.3230E-05	25	6.9580E-11	4.3560E-04	6.9262E+04	1.8520E+08	2.6670E+04
" 37.0 - 42.0"	1.5840E+08	8.3950E-06	646	8.1280E-06	8.7260E+00	4.8060E-05	25	1.9440E-10	3.2330E-04	5.1203E+04	2.2450E+08	2.9360E+04
" 42.0 - 47.0"	1.5800E+08	8.7030E-06	421	5.5490E-06	6.4170E+00	3.6740E-05	25	4.2210E-11	2.3580E-04	3.7239E+04	4.5630E+07	1.3240E+04
" 47.0 - 52.0"	1.5340E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.6090E-05	24	2.0070E-11	1.5830E-04	2.4276E+04	1.7480E+07	8.1950E+03
" 52.0 - 57.0"	1.5670E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.5030E-05	24	4.0900E-11	1.5180E-04	2.3794E+04	3.7070E+07	1.1930E+04
" 57.0 - 62.0"	1.5620E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.1740E-05	24	5.1370E-11	1.9250E-04	3.0075E+04	4.6300E+07	1.3340E+04
" 62.0 - 67.0"	1.5540E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.0850E-05	24	3.0270E-11	1.8710E-04	2.9078E+04	2.7060E+07	1.0200E+04
" 67.0 - 72.0"	1.5180E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	9.0370E-06	24	7.1090E-12	5.4820E-05	8.3226E+03	6.0430E+06	4.8180E+03
" 72.0 - 77.0"	1.4970E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.1870E-06	24	1.5980E-12	2.5400E-05	3.8021E+03	1.3210E+06	2.2530E+03
" 77.0 - 82.0"	1.4760E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.8770E-06	24	2.7390E-12	1.7450E-05	2.5761E+03	2.1980E+06	2.9060E+03
" 82.0 - 87.0"	1.4600E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.2570E-07	24	2.1420E-14	1.3690E-06	1.9979E+02	1.6800E+04	2.5400E+02
" 87.0 - 92.0"	1.4430E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.1610E-07	22	5.9590E-15	7.0440E-07	1.0166E+02	4.5690E+03	1.3250E+02
" 92.0 - 97.0"	1.4200E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.1380E-08	22	6.6230E-15	4.9370E-07	7.0095E+01	4.9140E+03	1.3740E+02
" 97.0 -102.0"	1.3920E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.3660E-07	22	5.5990E-14	1.4350E-06	1.9981E+02	3.9930E+04	3.9170E+02
"TOTAL"	3.0980E+09									8.3240E+06	"+ or -"	2.1630E+06

ACE 6208585

Appendix A.29. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1988 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"	1.6730E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	1.4020E-04	35	1.0070E-08	5.8860E-04	9.8437E+04	4.9770E+09	1.3830E+05
" 7.0 - 12.0"	1.6730E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	7.0100E-04	35	6.2870E-08	3.2650E-03	5.4600E+05	3.8310E+10	3.8360E+05
" 12.0 - 17.0"	1.6710E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	4.4020E-04	35	1.0930E-08	2.5410E-03	4.2450E+05	1.0460E+10	2.0050E+05
" 17.0 - 22.0"	1.6610E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	2.1500E-04	35	2.6440E-09	1.4810E-03	2.4599E+05	3.9070E+09	1.2250E+05
" 22.0 - 27.0"	1.6400E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	1.0990E-04	35	1.0070E-09	7.8320E-04	1.2842E+05	1.4020E+09	7.3390E+04
" 27.0 - 32.0"	1.6160E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	8.3700E-05	35	6.5390E-10	6.2420E-04	1.0089E+05	9.9370E+08	6.1780E+04
" 32.0 - 37.0"	1.5940E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	1.9470E-05	34	1.5540E-11	1.9620E-04	3.1277E+04	4.1430E+07	1.2620E+04
" 37.0 - 42.0"	1.5750E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	5.5250E-05	33	3.0950E-10	3.7160E-04	5.8523E+04	3.5220E+08	3.6780E+04
" 42.0 - 47.0"	1.5580E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	5.0610E-05	33	2.5770E-10	3.2480E-04	5.0609E+04	2.6180E+08	3.1710E+04
" 47.0 - 52.0"	1.5420E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.1170E-05	33	4.1950E-11	1.2840E-04	1.9809E+04	3.6800E+07	1.1890E+04
" 52.0 - 57.0"	1.5280E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.8060E-05	32	6.8040E-10	2.9150E-04	4.4531E+04	5.8470E+08	4.7390E+04
" 57.0 - 62.0"	1.5110E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.5060E-05	32	9.5930E-11	2.1270E-04	3.2126E+04	8.0740E+07	1.7610E+04
" 62.0 - 67.0"	1.4880E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.2560E-05	32	1.9020E-10	1.9750E-04	2.9377E+04	1.5500E+08	2.4400E+04
" 67.0 - 72.0"	1.4400E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.8840E-05	31	4.9610E-11	1.1430E-04	1.6457E+04	3.7920E+07	1.2070E+04
" 72.0 - 77.0"	1.4180E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.8960E-06	30	4.3960E-12	2.9700E-05	4.2098E+03	3.2540E+06	3.5360E+03
" 77.0 - 82.0"	1.4070E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	9.6970E-07	30	4.7270E-13	5.8820E-06	8.2755E+02	3.4440E+05	1.1500E+03
" 82.0 - 87.0"	1.3950E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	7.3100E-07	30	3.3250E-13	4.4340E-06	6.1838E+02	2.3800E+05	9.5630E+02
" 87.0 - 92.0"	1.3760E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.3280E-07	30	1.1100E-14	8.0530E-07	1.1082E+02	7.7380E+03	1.7240E+02
" 92.0 - 97.0"	1.3590E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.9460E-07	30	8.3020E-14	1.7870E-06	2.4289E+02	5.6460E+04	4.6570E+02
" 97.0 -102.0"	1.3190E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	28	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
"TOTAL"	3.0440E+09									1.8330E+06	"+ or -"	4.8650E+05

ACE 6208586

Appendix A.30. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1988 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"	1.6670E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	1.7570E-03	43	3.1500E-07	7.3750E-03	1.2296E+06	1.5720E+11	7.7710E+05
" 7.0 - 12.0"	1.6250E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	1.5550E-03	42	3.5130E-07	7.2420E-03	1.1771E+06	2.0200E+11	8.8100E+05
" 12.0 - 17.0"	1.5170E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	7.2710E-04	41	4.2850E-08	4.1970E-03	6.3648E+05	3.3500E+10	3.5880E+05
" 17.0 - 22.0"	1.4370E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	1.5820E-04	39	1.4240E-09	1.0890E-03	1.5645E+05	1.5740E+09	7.7770E+04
" 22.0 - 27.0"	1.3990E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	1.0850E-04	36	1.7000E-09	7.7300E-04	1.0812E+05	1.7080E+09	8.0990E+04
" 27.0 - 32.0"	1.3860E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	4.0600E-05	36	2.1700E-10	3.0270E-04	4.1967E+04	2.3940E+08	3.0330E+04
" 32.0 - 37.0"	1.3770E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	1.0550E-05	36	1.8590E-11	1.0630E-04	1.4640E+04	3.6070E+07	1.1770E+04
" 37.0 - 42.0"	1.3660E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	2.2220E-05	35	2.7250E-10	1.4940E-04	2.0413E+04	2.3070E+08	2.9770E+04
" 42.0 - 47.0"	1.3470E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	1.4290E-05	35	2.7660E-11	9.1700E-05	1.2351E+04	2.0910E+07	8.9630E+03
" 47.0 - 52.0"	1.3200E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.3700E-05	34	4.7150E-11	1.4380E-04	1.8978E+04	3.0300E+07	1.0790E+04
" 52.0 - 57.0"	1.1880E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.9270E-05	34	2.4090E-11	1.1690E-04	1.3880E+04	1.2540E+07	6.9410E+03
" 57.0 - 62.0"	9.9650E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.6660E-05	30	1.0500E-10	2.2240E-04	2.2159E+04	3.8460E+07	1.2160E+04
" 62.0 - 67.0"	9.3610E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.6880E-05	25	2.5640E-10	2.2370E-04	2.0942E+04	8.2760E+07	1.7830E+04
" 67.0 - 72.0"	9.2880E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.3560E-05	25	1.4060E-11	8.2240E-05	7.6380E+03	4.4740E+06	4.1460E+03
" 72.0 - 77.0"	9.2450E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	6.6640E-06	24	5.2200E-12	4.0420E-05	3.7369E+03	1.6440E+06	2.5130E+03
" 77.0 - 82.0"	9.1710E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.0560E-06	24	1.5950E-12	1.2470E-05	1.1436E+03	4.9390E+05	1.3770E+03
" 82.0 - 87.0"	8.8620E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	5.0640E-07	23	1.2130E-13	3.0720E-06	2.7220E+02	3.5050E+04	3.6700E+02
" 87.0 - 92.0"	8.2590E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.6050E-05	22	2.5410E-10	9.7380E-05	8.0424E+03	6.3790E+07	1.5650E+04
" 92.0 - 97.0"	7.3100E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.0920E-06	21	4.1060E-13	6.6250E-06	4.8427E+02	8.0780E+04	5.5710E+02
" 97.0 -102.0"	6.5380E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.8130E-06	19	9.7410E-13	1.1000E-05	7.1904E+02	1.5330E+05	7.6740E+02
"TOTAL"	2.3430E+09									3.4951E+06 "+ or -"		1.2350E+06

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Appendix A.31. Hydroacoustic estimate of fish inhabiting Area 2, Skilak Lake, Alaska in 1988 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"	1.6670E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	2.8960E-03	39	1.1490E-06	1.2150E-02	2.0260E+06	5.7050E+11	1.4800E+06
" 7.0 - 12.0"	1.6470E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	1.4330E-03	39	6.0360E-07	6.6730E-03	1.0992E+06	3.5590E+11	1.1690E+06
" 12.0 - 17.0"	1.6270E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	6.0210E-04	39	5.2210E-08	3.4750E-03	5.6548E+05	4.6590E+10	4.2300E+05
" 17.0 - 22.0"	1.6060E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	4.7490E-04	39	1.0680E-08	3.2700E-03	5.2535E+05	1.5110E+10	2.4090E+05
" 22.0 - 27.0"	1.5580E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	3.6620E-04	38	4.1840E-09	2.6090E-03	4.0641E+05	5.4300E+09	1.4440E+05
" 27.0 - 32.0"	1.5050E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	1.4450E-04	37	1.4640E-09	1.0780E-03	1.6219E+05	1.9570E+09	8.6700E+04
" 32.0 - 37.0"	1.3830E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	4.3270E-05	36	9.0400E-11	4.3590E-04	6.0298E+04	1.8060E+08	2.6340E+04
" 37.0 - 42.0"	1.1920E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	2.9000E-05	29	7.1530E-11	1.9510E-04	2.3255E+04	4.6750E+07	1.3400E+04
" 42.0 - 47.0"	1.1510E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	1.1190E-05	29	2.6480E-11	7.1810E-05	8.2632E+03	1.4550E+07	7.4760E+03
" 47.0 - 52.0"	1.1040E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	7.6160E-06	27	2.9350E-11	4.6200E-05	5.0990E+03	1.3160E+07	7.1110E+03
" 52.0 - 57.0"	1.0660E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.4340E-06	26	1.7450E-11	5.1160E-05	5.4560E+03	7.3080E+06	5.2980E+03
" 57.0 - 62.0"	1.0400E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.5400E-05	26	3.6770E-11	9.3450E-05	9.7166E+03	1.4650E+07	7.5010E+03
" 62.0 - 67.0"	9.7890E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	7.8900E-06	24	6.2920E-12	4.7860E-05	4.6852E+03	2.2230E+06	2.9220E+03
" 67.0 - 72.0"	9.3490E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.8080E-05	23	5.2940E-11	1.0960E-04	1.0251E+04	1.7050E+07	8.0930E+03
" 72.0 - 77.0"	8.9390E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.0400E-06	22	3.9000E-13	6.3100E-06	5.6406E+02	1.1470E+05	6.6380E+02
" 77.0 - 82.0"	8.4130E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.2750E-06	21	3.5230E-13	7.7340E-06	6.5064E+02	9.1830E+04	5.9400E+02
" 82.0 - 87.0"	7.7890E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.2220E-07	20	3.6730E-14	1.9550E-06	1.5225E+02	8.2040E+03	1.7750E+02
" 87.0 - 92.0"	6.8400E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	7.5040E-07	18	3.1100E-13	4.5520E-06	3.1137E+02	5.3560E+04	4.5360E+02
" 92.0 - 97.0"	4.4170E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.5890E-09	13	7.3780E-17	5.2100E-08	2.3015E+00	5.2980E+00	4.5110E+00
" 97.0 -102.0"	3.8370E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.5870E-07	11	2.5180E-14	9.6250E-07	3.6935E+01	1.3640E+03	7.2400E+01
"TOTAL"	2.2480E+09									4.9133E+06 "+ or -"		1.9560E+06

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Appendix A.32. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1988 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"	1.0860E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	2.7130E-03	30	4.9310E-06	1.1390E-02	1.2370E+06	1.0280E+12	1.9870E+06
" 7.0 - 12.0"	1.0790E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	2.7900E-04	30	3.9250E-08	1.3000E-03	1.4016E+05	9.9140E+09	1.9520E+05
" 12.0 - 17.0"	1.0750E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	2.7700E-05	29	3.3430E-10	1.5990E-04	1.7180E+04	1.2910E+08	2.2270E+04
" 17.0 - 22.0"	1.0660E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	2.7980E-05	29	3.1300E-10	1.9270E-04	2.0549E+04	1.7190E+08	2.5700E+04
" 22.0 - 27.0"	1.0560E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	2.4910E-05	29	3.6490E-10	1.7740E-04	1.8736E+04	2.0710E+08	2.8200E+04
" 27.0 - 32.0"	1.0330E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	4.7890E-06	29	6.4610E-12	3.5710E-05	3.6898E+03	3.8940E+06	3.8680E+03
" 32.0 - 37.0"	1.0180E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	3.3100E-06	27	3.6420E-12	3.3350E-05	3.3933E+03	3.8440E+06	3.8430E+03
" 37.0 - 42.0"	1.0100E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	1.5880E-05	27	3.2870E-11	1.0680E-04	1.0789E+04	1.5340E+07	7.6750E+03
" 42.0 - 47.0"	9.9480E+07	6.7030E-06	421	5.5490E-06	6.4170E+00	1.4610E-05	27	3.7470E-11	9.3750E-05	9.3258E+03	1.5410E+07	7.6940E+03
" 47.0 - 52.0"	9.7870E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.5590E-05	27	3.5810E-11	9.4600E-05	9.2586E+03	1.2640E+07	6.9680E+03
" 52.0 - 57.0"	9.6280E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.0100E-05	27	7.4290E-11	1.2200E-04	1.1742E+04	2.5370E+07	9.8720E+03
" 57.0 - 62.0"	9.4180E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.9620E-05	26	3.0280E-11	1.1900E-04	1.1210E+04	9.9070E+06	6.1690E+03
" 62.0 - 67.0"	9.1110E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.6760E-05	25	4.7050E-11	1.6230E-04	1.4788E+04	1.4410E+07	7.4410E+03
" 67.0 - 72.0"	8.8540E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.9480E-05	24	2.9190E-11	1.1820E-04	1.0465E+04	8.4430E+06	5.6950E+03
" 72.0 - 77.0"	8.5720E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	8.0590E-06	24	7.8220E-12	4.8890E-05	4.1905E+03	2.1180E+06	2.8530E+03
" 77.0 - 82.0"	8.0240E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.1740E-06	24	2.6690E-12	1.9260E-05	1.5450E+03	6.3280E+05	1.5590E+03
" 82.0 - 87.0"	7.3760E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.5590E-07	22	2.1710E-14	1.5530E-06	1.1452E+02	4.3490E+03	1.2930E+02
" 87.0 - 92.0"	7.0460E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.1450E-06	21	9.1840E-13	6.9440E-06	4.8929E+02	1.6780E+05	8.0290E+02
" 92.0 - 97.0"	6.8560E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.4030E-07	20	1.5840E-14	8.5100E-07	5.8343E+01	2.7400E+03	1.0260E+02
" 97.0 -102.0"	6.5580E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	5.0570E-09	20	2.5570E-17	3.0680E-08	2.0118E+00	4.0480E+00	3.9430E+00
"TOTAL"	1.8540E+09									1.5247E+06 "+ or -"		1.9970E+06

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Appendix A.33. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1988 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"	1.1210E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	1.8170E-03	18	1.0500E-06	7.6250E-03	8.5507E+05	2.3390E+11	9.4780E+05
" 7.0 - 12.0"	1.1100E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	3.4630E-04	18	4.6810E-08	1.6130E-03	1.7896E+05	1.2520E+10	2.1930E+05
" 12.0 - 17.0"	1.0780E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	1.0870E-04	17	2.7170E-09	6.2750E-04	6.7674E+04	1.0600E+09	6.3830E+04
" 17.0 - 22.0"	1.0590E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	6.1630E-05	17	2.1880E-09	4.2440E-04	4.4941E+04	1.1780E+09	6.7280E+04
" 22.0 - 27.0"	1.0560E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	6.8710E-05	17	1.6900E-09	4.8950E-04	5.1687E+04	9.6050E+08	6.0740E+04
" 27.0 - 32.0"	1.0500E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	6.9370E-05	17	1.0130E-09	5.1730E-04	5.4307E+04	6.3360E+08	4.9340E+04
" 32.0 - 37.0"	1.0440E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	2.1660E-05	17	1.3680E-10	2.1820E-04	2.2776E+04	1.5190E+08	2.4160E+04
" 37.0 - 42.0"	1.0350E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	3.4110E-05	17	4.6860E-11	2.2940E-04	2.3751E+04	2.3520E+07	9.5060E+03
" 42.0 - 47.0"	1.0260E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	6.4680E-05	16	1.3680E-10	4.1500E-04	4.2580E+04	6.2240E+07	1.5460E+04
" 47.0 - 52.0"	1.0200E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	6.7250E-05	16	2.2330E-10	4.0790E-04	4.1602E+04	8.5810E+07	1.8160E+04
" 52.0 - 57.0"	1.0120E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.7420E-05	16	1.5410E-10	1.6630E-04	1.6840E+04	5.8170E+07	1.4950E+04
" 57.0 - 62.0"	1.0020E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.8390E-05	16	1.6860E-10	1.7220E-04	1.7265E+04	6.2400E+07	1.5480E+04
" 62.0 - 67.0"	9.9220E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	5.6790E-06	16	8.1620E-12	3.4450E-05	3.4181E+03	2.9590E+06	3.3710E+03
" 67.0 - 72.0"	9.8010E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	7.4940E-06	16	1.3760E-11	4.5460E-05	4.4557E+03	4.8680E+06	4.3240E+03
" 72.0 - 77.0"	9.7090E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.4730E-06	16	4.4650E-12	2.7130E-05	2.6344E+03	1.5500E+06	2.4400E+03
" 77.0 - 82.0"	9.5810E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.7300E-06	15	7.7510E-12	2.8690E-05	2.7489E+03	2.6190E+06	3.1720E+03
" 82.0 - 87.0"	9.5170E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.8930E-07	15	9.2330E-14	2.9680E-06	2.8247E+02	3.0790E+04	3.4390E+02
" 87.0 - 92.0"	9.4180E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	2.8650E-07	15	8.2060E-14	1.7380E-06	1.6366E+02	2.6790E+04	3.2080E+02
" 92.0 - 97.0"	9.2460E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	6.2210E-09	15	3.8710E-17	3.7740E-08	3.4892E+00	1.2180E+01	6.8390E+00
" 97.0 -102.0"	8.2680E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.3910E-08	15	1.9350E-16	8.4370E-08	6.9760E+00	4.8670E+01	1.3670E+01
"TOTAL"	2.0160E+09									1.4312E+06	"+ or -" 9.8130E+05	

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Appendix A.34. Hydroacoustic estimate of fish inhabiting Area 3, Skilak Lake, Alaska in 1988 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"	1.1210E+08	1.0250E-05	477	9.8980E-06	4.1960E+00	2.4820E-03	16	3.0140E-06	1.0420E-02	1.1679E+06	6.7000E+11	1.6040E+06
" 7.0 - 12.0"	1.1170E+08	9.2360E-06	2090	9.8690E-06	4.6570E+00	9.0120E-04	16	2.9670E-07	4.1970E-03	4.6865E+05	8.0350E+10	5.5560E+05
" 12.0 - 17.0"	1.1160E+08	7.4520E-06	1722	1.2570E-05	5.7720E+00	1.8690E-04	16	3.7340E-09	1.0790E-03	1.2037E+05	1.5730E+09	7.7730E+04
" 17.0 - 22.0"	1.1110E+08	6.2470E-06	4640	3.6560E-05	6.8860E+00	1.4640E-04	16	1.0360E-09	1.0080E-03	1.1194E+05	6.9860E+08	5.1800E+04
" 22.0 - 27.0"	1.1060E+08	6.0380E-06	3911	1.5470E-05	7.1240E+00	4.1070E-05	16	1.4760E-10	2.9260E-04	3.2366E+04	9.3450E+07	1.8950E+04
" 27.0 - 32.0"	1.1020E+08	5.7680E-06	2511	1.8910E-05	7.4570E+00	2.5510E-05	16	1.5660E-10	1.9020E-04	2.0969E+04	1.0770E+08	2.0340E+04
" 32.0 - 37.0"	1.0980E+08	4.2690E-06	667	4.0890E-06	1.0080E+01	4.2550E-05	16	4.2540E-10	4.2870E-04	4.7050E+04	5.2330E+08	4.4840E+04
" 37.0 - 42.0"	1.0840E+08	6.3950E-06	646	6.1280E-06	6.7260E+00	7.6900E-05	16	3.5840E-10	5.1730E-04	5.6077E+04	1.9510E+08	2.7370E+04
" 42.0 - 47.0"	1.0790E+08	6.7030E-06	421	5.5490E-06	6.4170E+00	3.4840E-05	16	1.3030E-10	2.2360E-04	2.4136E+04	6.3450E+07	1.5610E+04
" 47.0 - 52.0"	1.0710E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	4.9410E-05	16	3.6710E-10	2.9970E-04	3.2105E+04	1.5520E+08	2.4420E+04
" 52.0 - 57.0"	1.0500E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.5070E-05	15	1.8280E-11	9.1410E-05	9.6014E+03	7.4380E+06	5.3460E+03
" 57.0 - 62.0"	1.0290E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.1400E-05	15	1.3520E-11	6.9130E-05	7.1096E+03	5.2730E+06	4.5010E+03
" 62.0 - 67.0"	1.0140E+08	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.6430E-05	15	3.7740E-11	9.9660E-05	1.0103E+04	1.4290E+07	7.4100E+03
" 67.0 - 72.0"	9.9170E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	6.3920E-06	15	8.5970E-12	3.8770E-05	3.8447E+03	3.1140E+06	3.4580E+03
" 72.0 - 77.0"	9.5940E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.9930E-06	14	9.2250E-13	1.2090E-05	1.1597E+03	3.1270E+05	1.0960E+03
" 77.0 - 82.0"	9.2560E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	14	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 82.0 - 87.0"	8.7630E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	13	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 87.0 - 92.0"	8.3180E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	0.0000E+00	13	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
" 92.0 - 97.0"	8.1900E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	3.2560E-07	12	1.0600E-13	1.9750E-06	1.6174E+02	2.6170E+04	3.1700E+02
" 97.0 -102.0"	8.1110E+07	7.0910E-06	4400	6.5130E-06	6.0660E+00	1.6030E-08	12	2.5710E-16	9.7260E-08	7.8884E+00	6.2240E+01	1.5460E+01
"TOTAL"	2.0310E+09									2.1136E+06 "+ or -"		1.7020E+06

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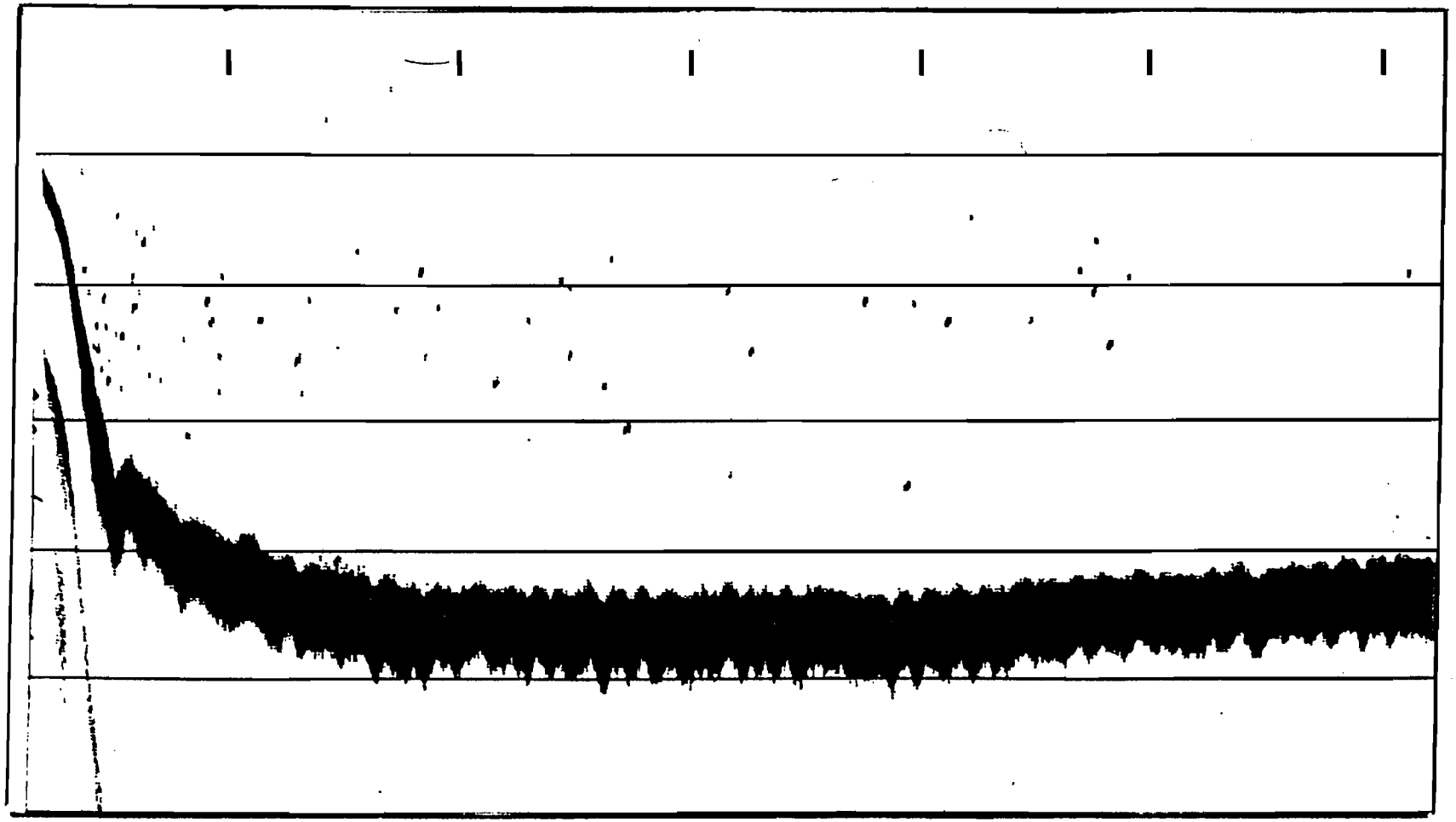
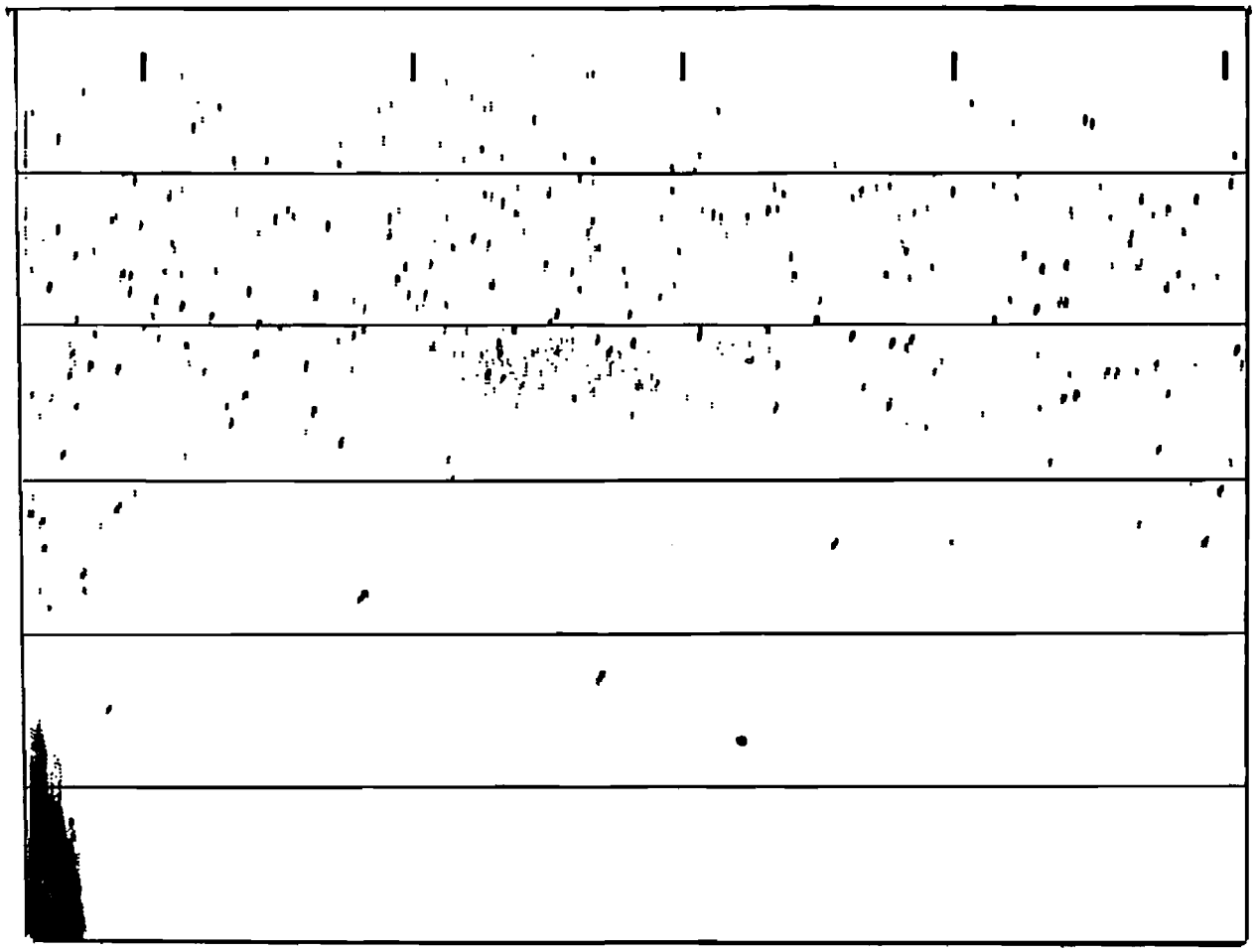


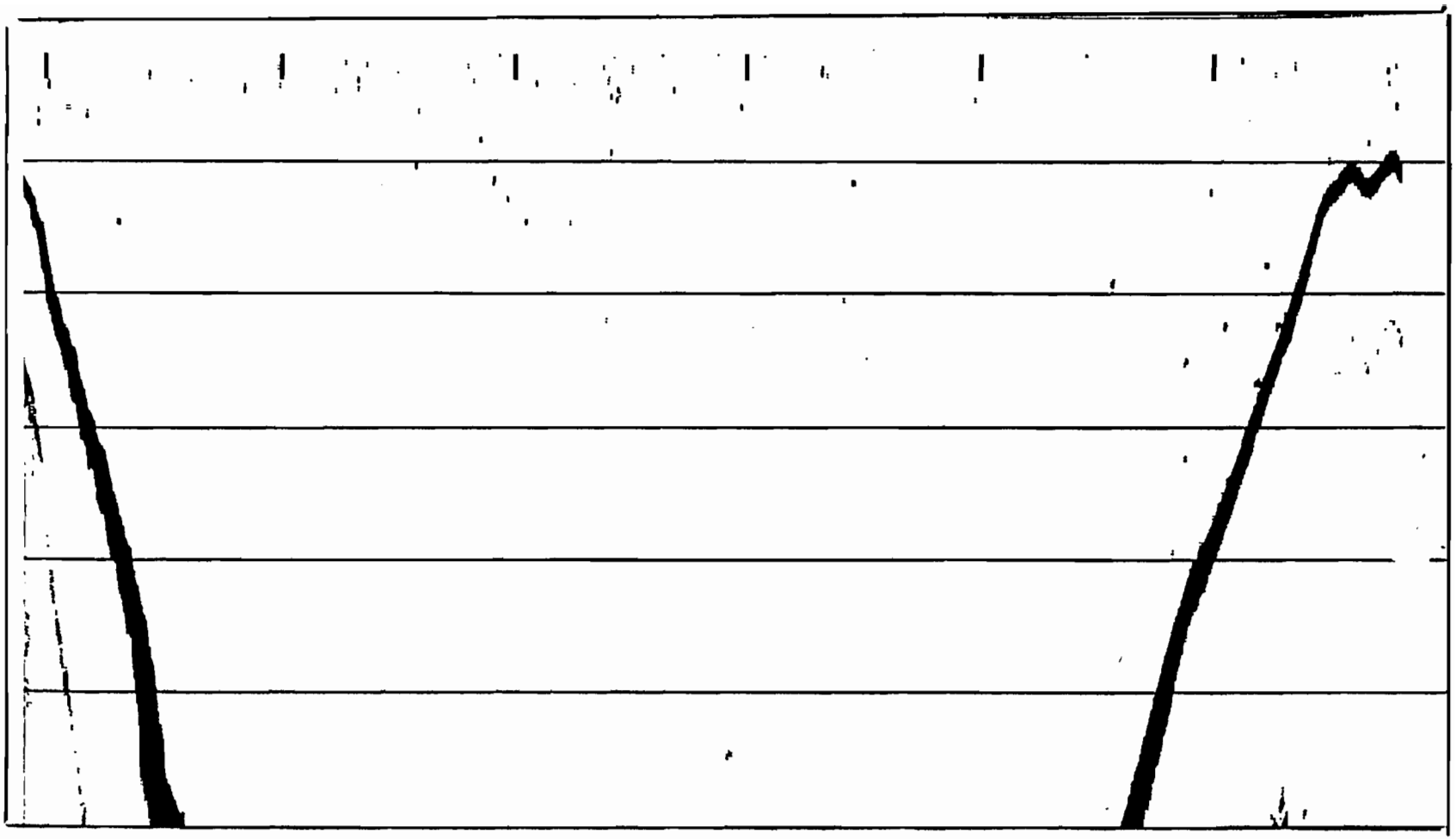
Appendix B.1. Representative echogram of Kenai Lake transect 1, Area 1 taken in September of 1988.

ACE 6208592



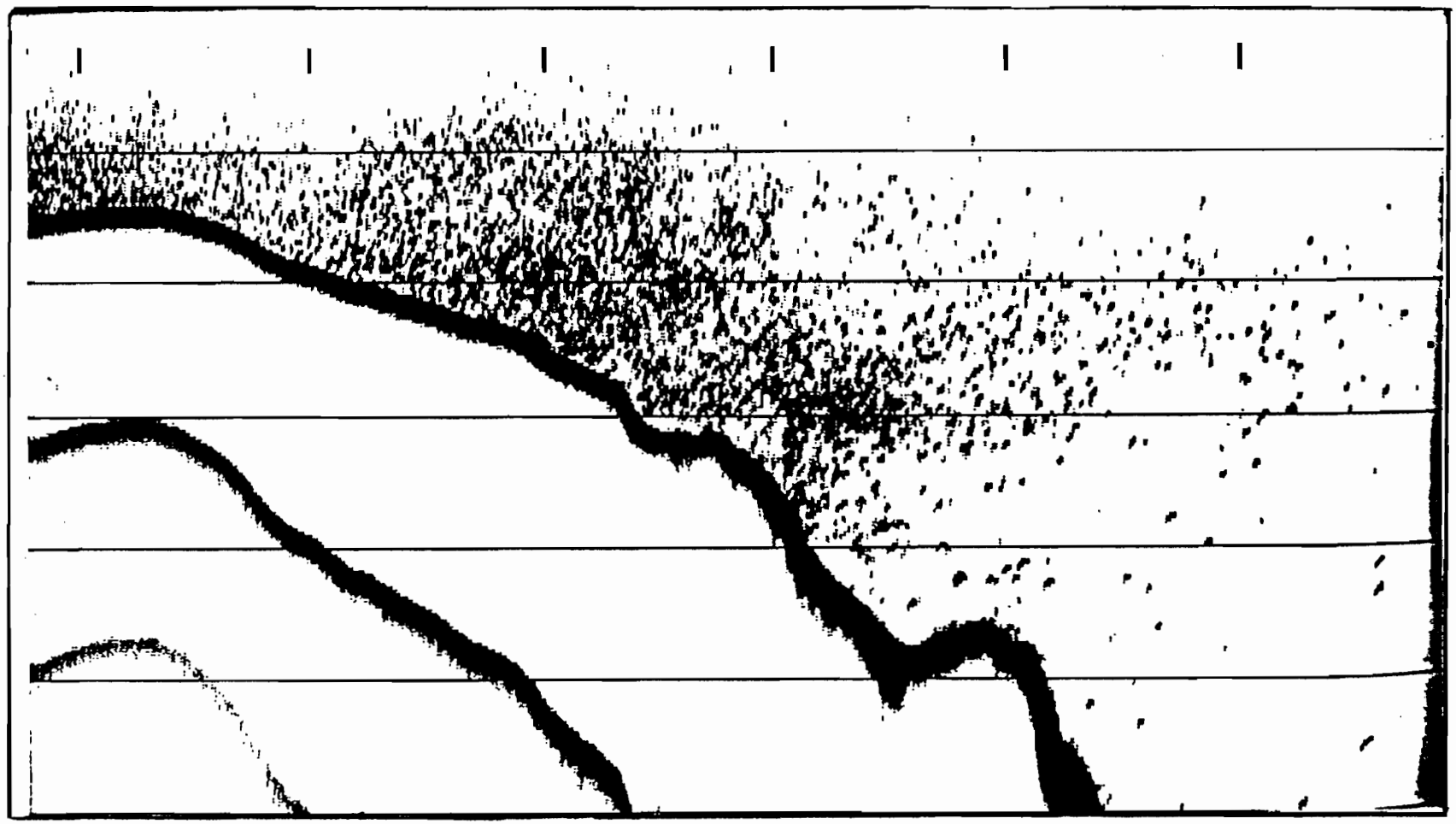
Appendix B.2. Representative echogram of Kenai Lake transect 2, Area 4 taken in September of 1988.

ACE 6208593



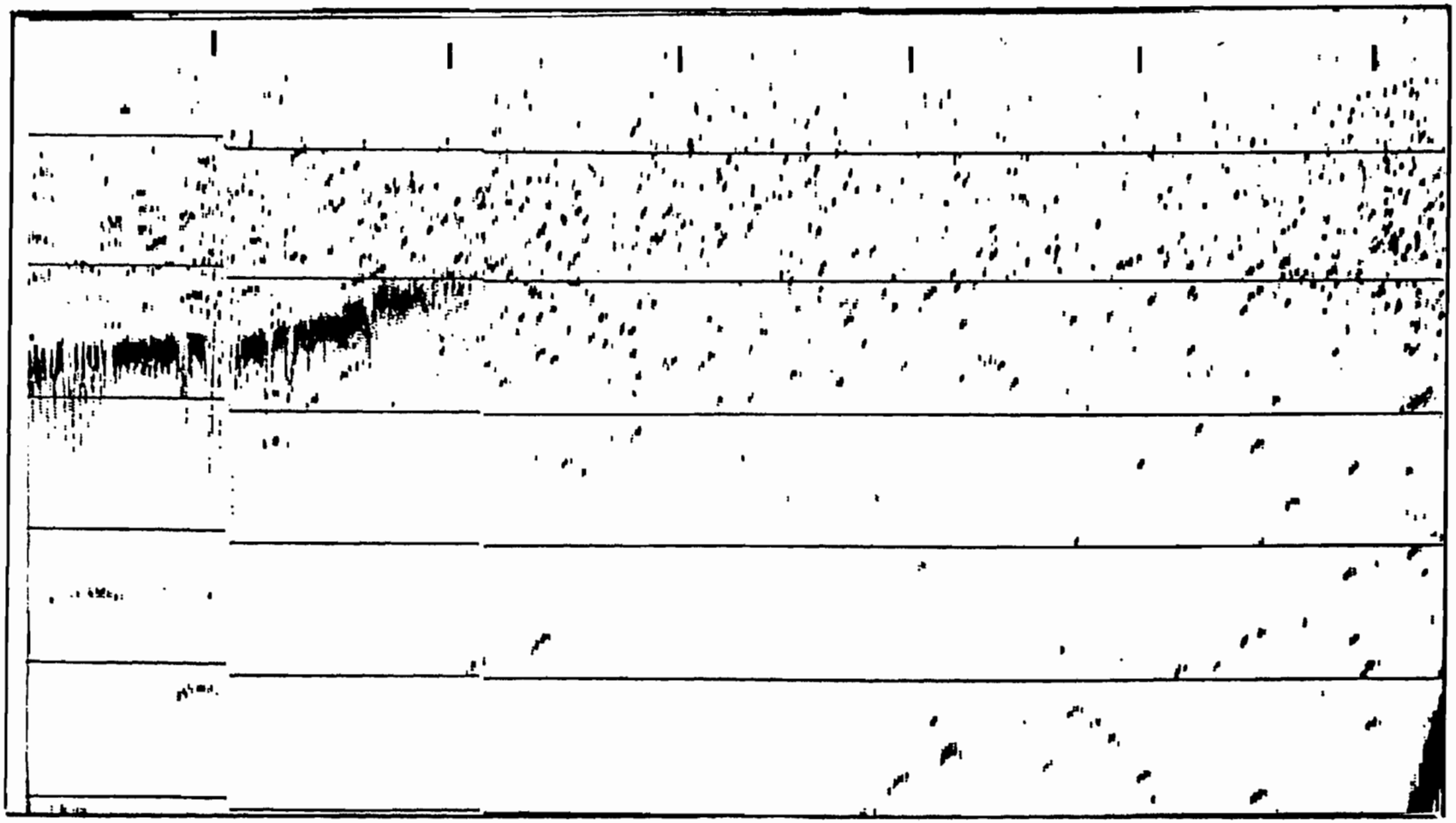
Appendix B.3. Representative echogram of Kenai Lake transect 3, Area 5 taken in September of 1988.

ACE 6208594



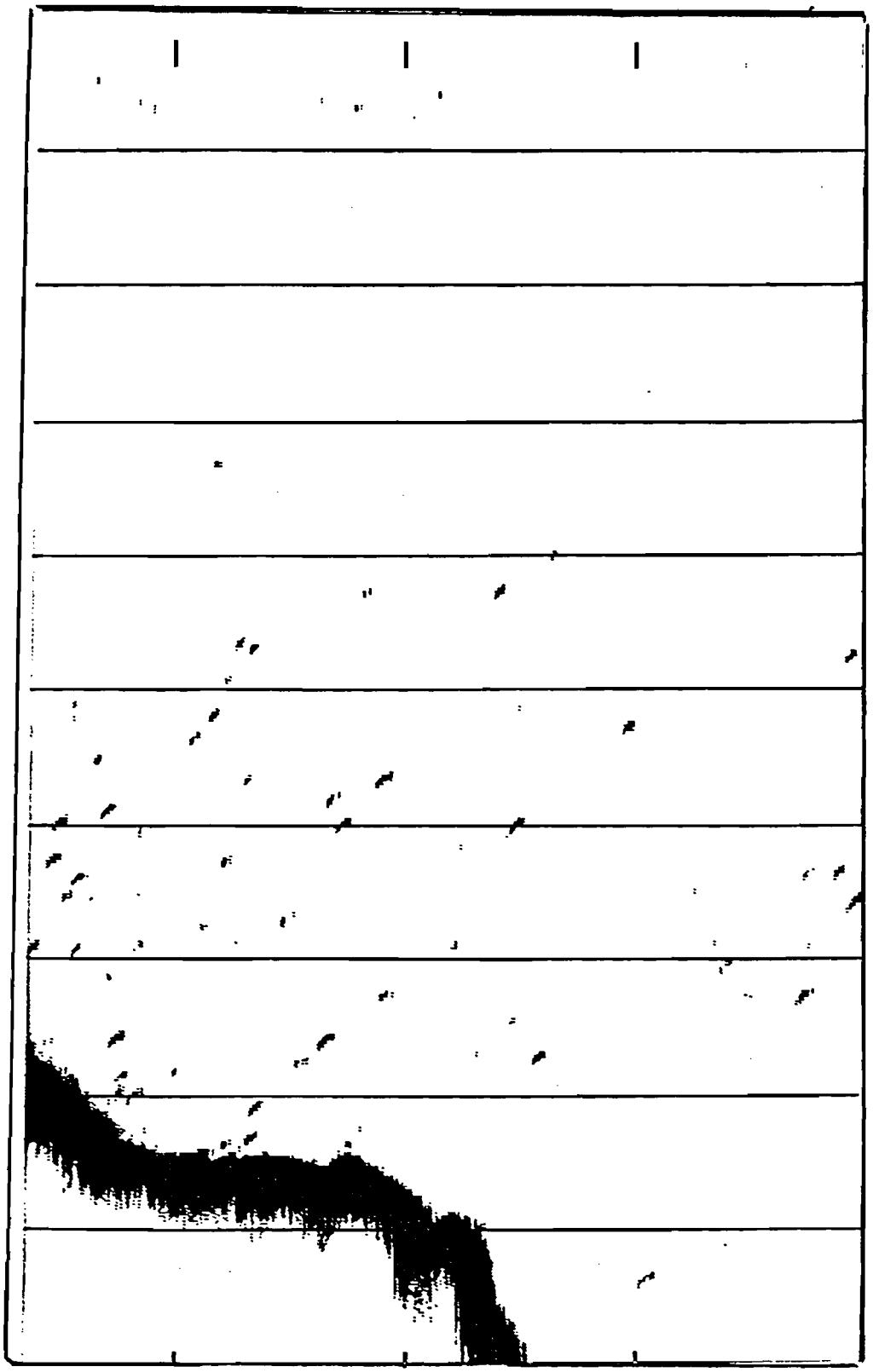
Appendix B.4. Representative echogram of Skilak Lake transect 2, Area 1 taken in September of 1988.

ACE 6208595



Appendix B.5. Representative echogram of Skilak Lake transect 1, Area 2 taken in September of 1988.

ACE 6208596



Appendix B.6. Representative echogram of Skilak Lake transect 1, Area 3 taken in September of 1988.

ACE 6208597

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