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CHIGNIK SOCKEYE STUDIES

Final Report - Anadromous Fish Project

Project No. AFC-48-1
Grant No. 04-4-208-31
Project Period: July 1, 1973-June 30, 1974

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Date: June 28, 1974

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This project was financed in part with Anadromous Fish Act
(P.L. 89-304) funds through the National Marine Fisheries Service.

Approved

Submitted June 27, 1974


Director

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CHIGNIK SOCKEYE STUDIES

(Final Report for the Period July 1, 1973 through June 30, 1974)

INTRODUCTION

Scope of the Present Study

This report summarizes research conducted by the Fisheries Research Institute (FRI) on Chignik sockeye salmon during the seventh year of Anadromous Fish Act support (P.L. 89-304). Additional funds were provided by Columbia Wards Fisheries and Alaska Packers Association for research and by the University of Washington for maintenance of the field facilities located at Chignik Lake.

The objectives of the FY 1974 study emphasized a review, analysis, and summary of data and reports on Chignik sockeye completed to date.

Field work concentrated on tow-netting to monitor the distribution, abundance, and age composition of juvenile sockeye and associated species in Chignik and Black Lakes. In Chignik Lake echosounding was conducted both in conjunction with and independent of tow-netting. Fyke-netting was continued on Black River to time the emigration and determine its species composition. A field party returned to Chignik during October and November to obtain additional townet and fyke net samples. Stream surveys were also conducted.

Acknowledgments

As in previous years our research has been coordinated with biologists of the Alaska Department of Fish and Game (ADF&G). In particular we would like to acknowledge the assistance provided by Messrs. Arnold Shaul and Philip Rigby.

Common and Scientific names of Fish Studied

Sockeye salmon	<i>Oncorhynchus nerka</i> (Walbaum)
Coho salmon	<i>Oncorhynchus kisutch</i> (Walbaum)
Dolly Varden	<i>Salvelinus malma</i> (Walbaum)
Pygmy whitefish	<i>Prosopium coulteri</i> (Eigenmann and Eigenmann)
Pond smelt	<i>Hypomesus olidus</i> (Pallas)
Threespine stickleback	<i>Gasterosteus aculeatus</i> Linnaeus
Ninespine stickleback	<i>Pungitius pungitius</i> (Linnaeus)
Coastrange sculpin	<i>Cottus aleuticus</i> Gilbert

ADULT SALMON STUDIES

Techniques of Run SeparationBackground

From 1962 to 1968 extensive tagging studies were conducted at Chignik to determine the time of entry of the major stocks. From these studies Dahlberg (1968) developed a mathematical model to assign the catch and escapement by age to either the Black Lake or Chignik Lake stocks. For years in which tagging studies were not conducted, the average time-of-entry curve was used to separate the run. These data were subsequently used to develop spawner-recruit relationships and forecasting methods.

In 1969 the extensive tagging studies were discontinued due to the large amount of manpower required to conduct them. Additionally, it was felt that the average time-of-entry curve provided an acceptable technique of run separation for the management and research programs being conducted at Chignik.

The age compositions of the early and late spawning stocks are presented in Table 1 for the years 1969-1973. Method A is the expected age composition calculated from the average time-of-entry curve and commercial catch scale-age determination. Method B is the observed unweighted age composition of the stocks as determined from otolith samples collected on the spawning grounds.

Discrepancies in these two methods may be due to the representativeness of the samples collected in the spawning grounds (Burgner and Marshall, 1974), variability of and overlap in the timing of the run to the two lakes and Black River (Wells and Parr, 1971) or problems in properly interpreting the age from scales of returning adults (Burgner and Marshall, 1974).

The belief that the variability of the timing of the run is contributing unacceptable errors in some years has prompted us to investigate alternative methods for separating the run.

Alternative Methods

The most precise method to separate the run would require that an enumeration and sampling program of the Black Lake stock be initiated. With this additional information, the magnitude and age composition of the Chignik Lake stock could be determined by subtracting the Black Lake run from weir counts and age composition determinations made at the established weir or in the adjacent fisheries.

Table 1. Percent of the four major age groups in the early and late spawning stocks as determined by (A) fishery samples and the average time-of-entry curve and by (B) spawning ground samples, 1969-1973¹

Year	Method	Early run (%)				Late run (%)				
		1.2	2.2	1.3	2.3	1.2	2.2	1.3	2.3	3.3
1969	A	16.5	21.5	29.2	32.1	6.8	17.8	6.8	66.3	
	B	35.8	34.3	24.4	4.6	0.3	3.3	0.3	86.0	
1970	A	3.1	3.8	73.1	19.5	3.8	15.4	42.4	36.8	0
	B	3.5	0.4	78.6	17.4	3.5	27.3	15.0	26.3	26.0
1971	A	1.3	1.2	80.7	16.4	0.6	3.0	30.2	65.2	
	B	1.5	1.0	90.0	8.0	3.0	6.0	16.0	70.0	
1972	A	3.5	1.6	26.9	61.1	0.6	5.0	12.5	66.0	
	B	2.9	0.0	58.6	28.6	0.5	4.1	11.8	82.2	
1973	A	1.2	0.4	88.1	8.8	0.2	3.2	18.0	75.0	
	B	2.0	1.0	96.0	1.0	0.0	10.0	7.0	76.0	

¹Age data provided by Alaska Department of Fish and Game.

Enumeration could be accomplished in Black River near Chiaktuak Creek with the aid of either a sonar counter or weir. Tower counting could not be done due to the turbidity of Black River. Fish could be captured by beach seine at the outlet of Black Lake to obtain scale and length data for the Black River run.

A second possibility would be to reinitiate the extensive tagging studies. Problems inherent with this technique have been discussed in Burgner and Marshall (1974).

A third method would be to separate the stocks using age data. Because there exist two uniquely different freshwater environments at Chignik, there is a relationship between the time of entry of the two stocks and the freshwater age structure of the run through time. This approach seems feasible in light of the strong propensity of Chignik Lake to produce age II smolts and Black Lake to produce age I smolts. These general tendencies are, of course, subject to yearly variations in the age structure of the run and the problem of interpreting the freshwater age of the fish.

Figure 1 shows the relationship between the time-of-entry curve as determined by tagging studies for the year 1966 and the freshwater age composition of the run in that year. Similar graphs for the years in which age data are available indicate that the pattern of predominance of freshwater age I fish in the early run followed by the buildup of freshwater age II fish is apparent for most years. However, variations in the general pattern of the age structure through time need further investigation.

The real importance of determining if use of the seasonal age change relationship is a valid method is best illustrated by an example. In 1971 no time-of-entry tagging studies were conducted; therefore, the apportionment of the run to Black and Chignik Lakes was calculated using the average time-of-entry curve. This resulted in an estimated total return of 1.17 million early fish and 1.02 million late-spawning fish. Apportionment of the run using the change in the age composition yields an early run of about 1.51 million fish and 0.68 million late-spawning fish. This constitutes a difference of about 0.5 million fish (Fig. 2). The timing of the midpoint of division of the runs in 1971 as indicated by the change in the age composition falls two days later than the latest observed pattern as determined from tagging studies (Wells and Parr, 1971). If this method proves more accurate than the average time-of-entry curve for separating the run, then a significant amount of historical data (prior to 1961) and more recent data (after 1969) should to be reanalyzed.

Our field plans for 1974 call for a significant amount of time to be spent sampling the early run at the outlet of Black Lake as a preliminary step in evaluating the feasibility of sampling and enumeration of the Black Lake run en route to the spawning grounds.

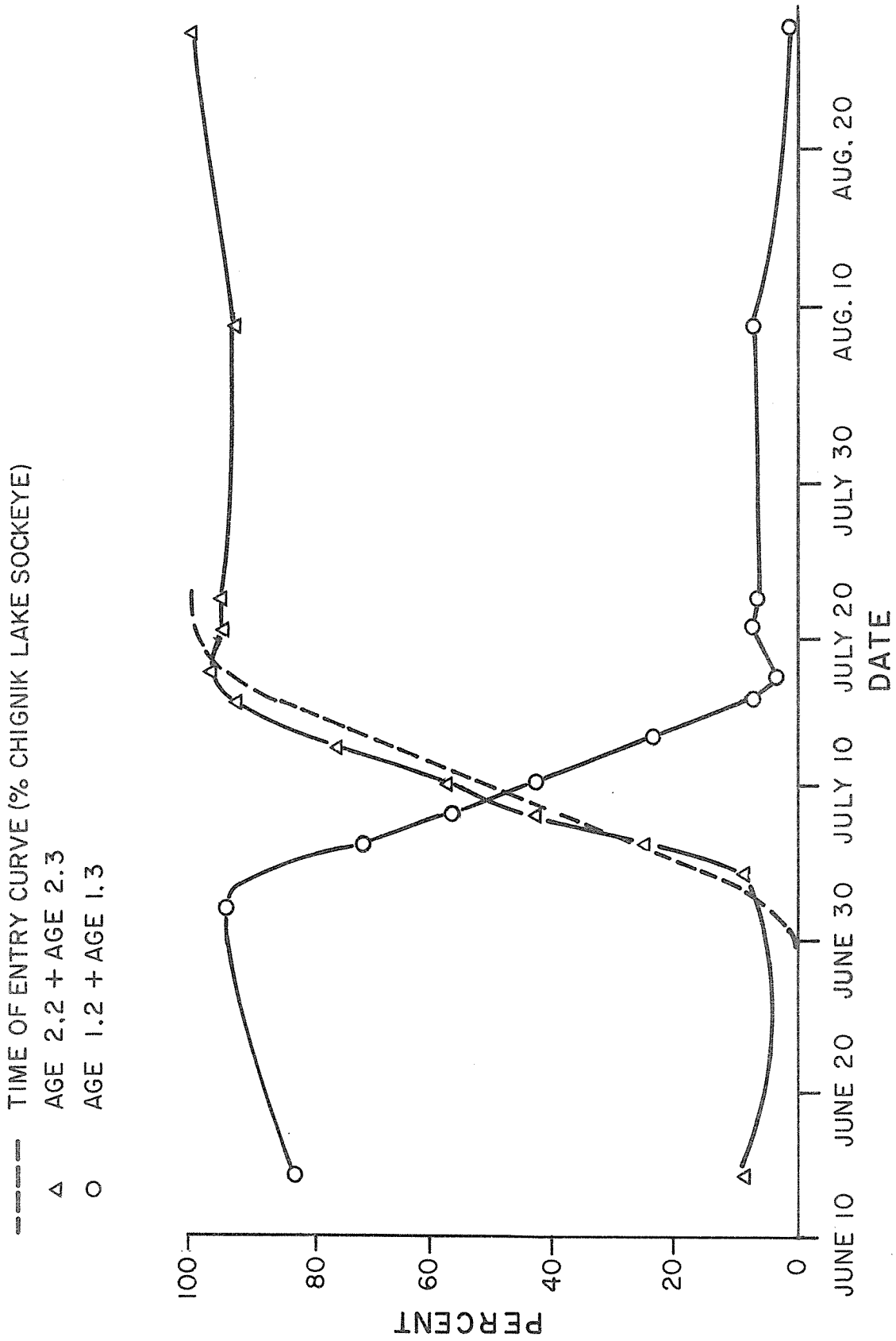


Fig. 1. Seasonal freshwater age composition change in Chignik sockeye catch samples, 1966.

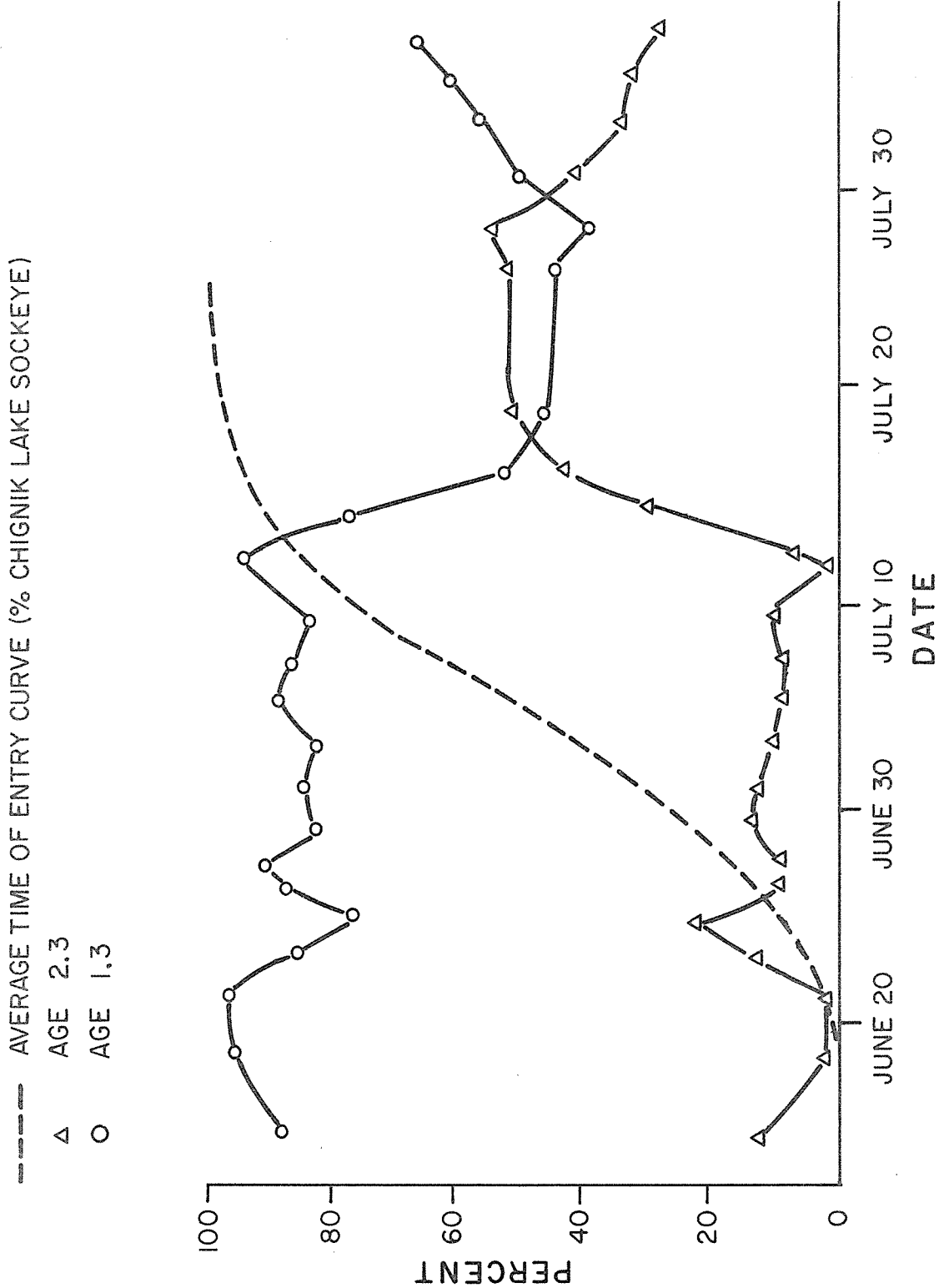


Fig. 2. Seasonal age composition change in Chignik sockeye catch samples, 1971.

Late Fall Spawning Surveys

Biologists of FRI and ADF&G returned to Chignik during late October and early November to assess the late spawning of sockeye at Chignik. The information collected during the surveys has been analyzed by ADF&G personnel. The importance of Clark River as a late season spawning tributary of Chignik Lake was again noted. Plans are being formulated to tag during the Chignik Lake run to determine the time of entry of Clark River sockeye relative to other Chignik Lake populations.

Summary and Recommendations

Inconsistencies in calculated age composition for the two stocks in some years in relation to spawning ground age data indicate that there is much room for improvement in methods of collection and analysis of annual run statistics. Inaccurate run separation can have serious ramifications in determining escapement goals, and in forecasting. We must, therefore, determine the reliability of this method and search for alternative methods. We recommend, therefore, that the escapement and age composition of the early spawning run be monitored at the outlet of Black Lake. When the precise statistics for the run are available, the relative accuracy of the other methods can be determined empirically and the most feasible method chosen for further use given the level of accuracy desired and budgetary constraints.

NURSERY LAKE STUDIES

Black Lake

Townet Catch-Effort Relationships

An analysis of the historical townet catches on Black Lake immediately points out that the catch of a standard haul in any area on a given day is usually highly variable. It is important therefore to establish a level of effort which will produce a reliable estimate of the expected mean catch per haul for each area. The amount of effort required to meet this criterion can be empirically determined by analyzing the relationship between the catch per minute and effort in successively pooled hauls.

Two years, 1970 and 1973, were chosen for this analysis because a large number of tows were conducted over a short period of time in each year. A reasonable level of effort would be indicated when the variability in the catch per minute in successively pooled hauls was reduced to an acceptable minimum. This can be expected to occur after trends (either increasing or decreasing) are eliminated as the variability of the first few catches due to distributional phenomena is reduced.

Tables 2 and 3 show the catches of sockeye by haul, the cumulative catches, cumulative effort, catch per minute, and changes in the catch per minute by each area for the years 1970 and 1973 respectively.

During the eight-day period between tow-netting sessions in 1970 there seems to have been a movement of young sockeye out of the shallower, near-shore areas B, C, and D (Fig. 3) into area A which is more limnetic in nature. This could account for the observed trends in the catch of sockeye per minute since towing is concentrated in the nearshore areas and any movement out of those areas could be reflected in a drop in the index. The index did, in fact, drop from 48.8 to 22.8 between August 22 and August 30. This apparent redistribution makes it impossible to determine empirically the required effort necessary to obtain a reasonable estimate of the abundance with these data.

The data collected during the 1973 field season indicate an increase in the overall catch per minute from 18.6 on September 3 to 33.2 on September 4. This is primarily due to the increased catches in area A. If the distribution of sockeye did not change during this period then the index of abundance derived from townetting seems to be especially susceptible to the variability of the catches in area A. This point is critically important because the index for the lake has historically been derived by summing the weighted geometric mean catch per area by the proportional volume in each area (area A contains 77.95 percent of the volume sampled in Black Lake¹).

During the 1974 field season we plan to conduct an extensive series of tows to assess the variability of the catches by area. This should also help to determine the most appropriate method to analyze the historical data.

Seasonal Patterns of Sockeye Towner Catches

That the availability of sockeye fry is not constant through the season is apparent from Fig. 4. The plotted points represent the average catch per minute of age 0 sockeye by periods for each year in which studies were conducted. The periods are defined as: early, June 1 through July 15; middle, July 16 through August 15; and late, August 16 through September 15. These periods roughly coincide with conditions in the lake (1) during the period prior to the emigration of fish to Chignik Lake, (2) the period during which the emigration generally occurs, and (3) the period after which the emigration occurs.

¹Weighting factors for Black Lake were derived by dividing the volume in each area by the total volume in all areas. Approximately 16.85 percent of the lake is not sampled because of shallowness and therefore is not included in the calculation.

Table 2. The relationship between the catch of age 0 sockeye salmon and effort for townet samples collected in Black Lake, 1970

Area	Date	Catch	Cumulative catch	Cumulative effort (minutes)	Catch per minute	Change in catch per minute
A	8/22	76	76	5	15.2	
	8/22	100	176	10	17.6	+2.4
	8/30	75	251	15	16.7	-0.9
	8/30	357	608	20	30.4	+13.7
	8/30	123	731	25	29.2	-1.2
B	8/22	831	831	5	166.2	
	8/22	153	984	10	98.4	-67.8
	8/30	141	1125	15	75.0	-23.4
	8/30	157	1282	20	64.1	-10.9
	8/30	59	1341	25	53.6	-10.5
C	8/22	299	299	5	59.8	
	8/22	203	502	10	50.2	-9.6
	8/30	118	620	15	41.3	-8.9
	8/30	68	688	20	34.4	-6.9
	8/30	140	828	25	33.1	-1.3
D	8/22	150	150	5	30.0	
	8/22	141	291	10	29.1	-0.9
	8/30	42	333	15	22.2	-6.9
	8/30	30	363	20	18.2	-4.0
	8/30	59	422	25	16.9	-1.3

Table 3. The relationship between the catch of age 0 sockeye salmon and effort for townet samples collected in Black Lake, 1973

Area	Date	Catch	Cumulative catch	Cumulative effort (minutes)	Catch per minute	Change in catch per minute
A	3/9	80	80	5	16.0	
	3/9	116	196	10	19.6	+3.4
	4/9	289	485	15	32.3	+12.7
	4/9	299	784	20	39.2	+6.9
B	3/9	130	130	5	26.0	
	3/9	151	281	10	28.1	+2.1
	4/9	92	373	15	24.9	-3.2
	4/9	186	559	20	28.0	+3.1
C	3/9	24	24	5	4.8	
	3/9	17	41	10	4.1	-0.7
	4/9	8	49	15	3.3	-0.8
	4/9	7	56	20	2.8	-0.5
D	3/9	132	132	5	26.4	
	4/9	165	297	10	29.7	+3.3
	4/9	116	413	15	27.5	-2.2

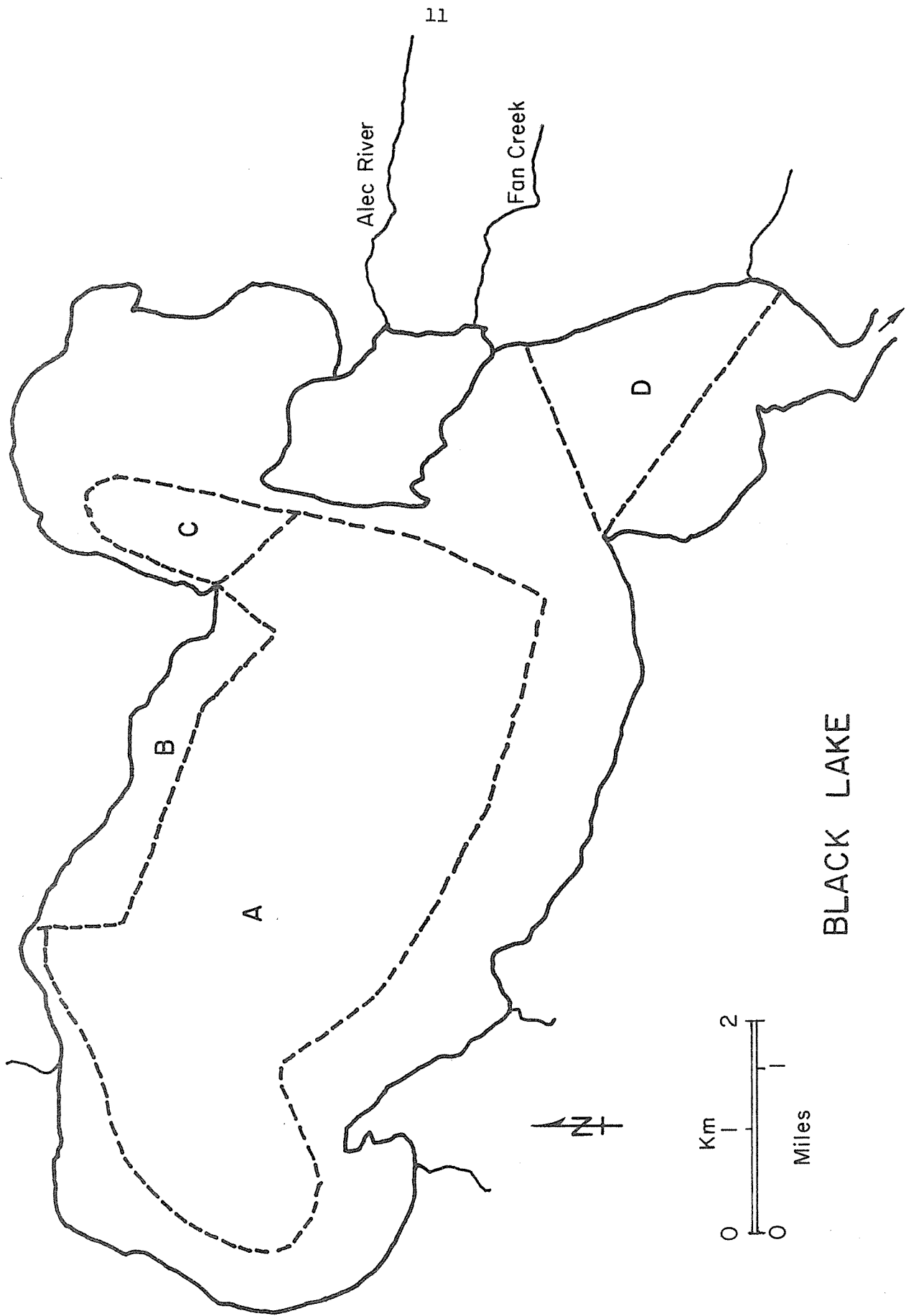
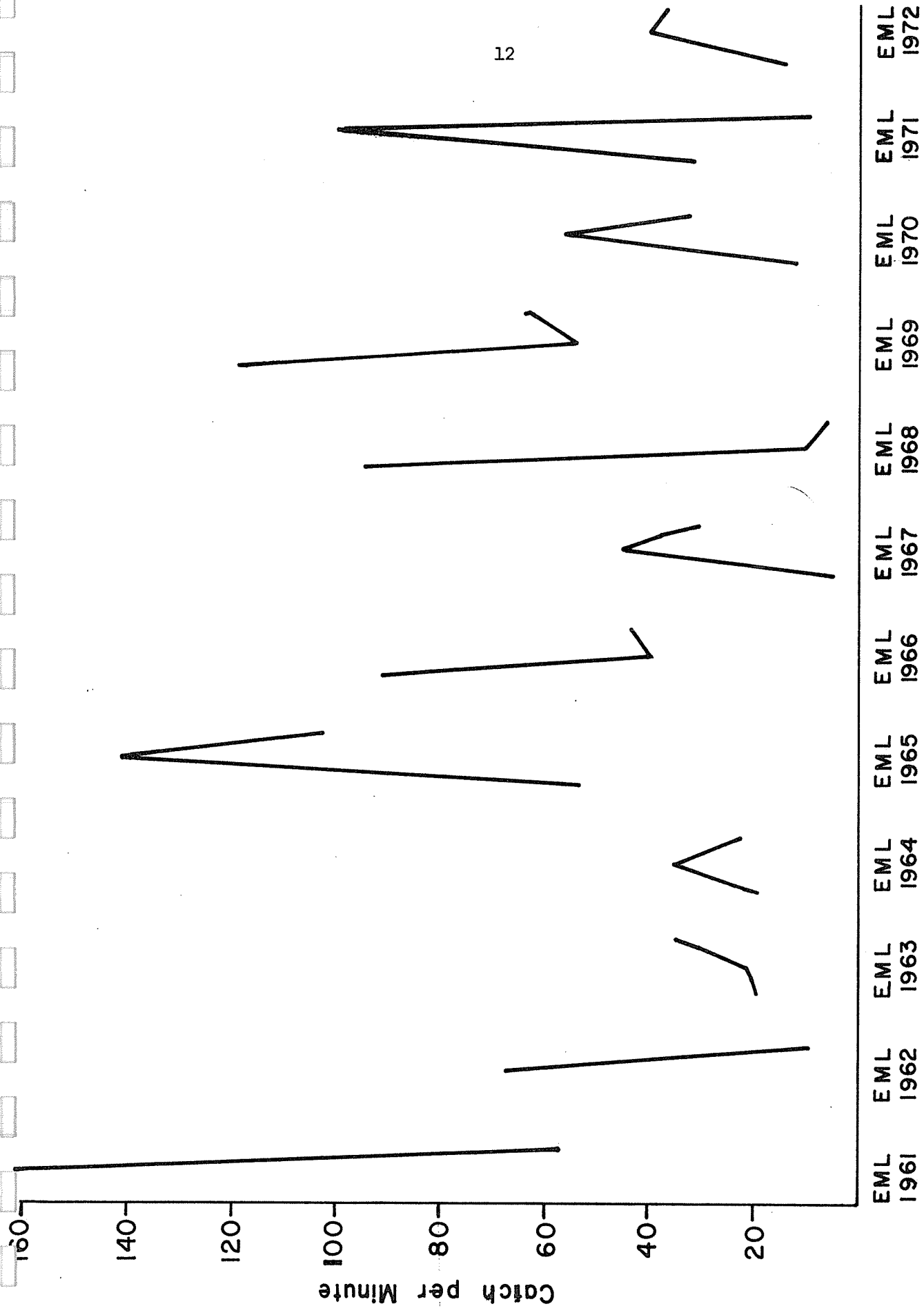


Fig. 3. Map of Black Lake, showing sampling areas discussed in text.



Period and Year

Fig 4. Catch per minute of age 0 sockeye in Black Lake by period, 1961-1972. Early, middle, and late season catches are graphed for each year except for 1961 and 1962, when only mid- and late-season data are available.

In six out of ten years studied, catches increased from the early to the middle indexing period, five out of the six decreased from the middle to the late indexing period and one remained fairly stable. In three out of ten years, catches decreased from the early to middle indexing period. Of those three years, two years remained relatively stable between the middle and late periods while one increased. The one year which remained constant from the early to middle period increased from the middle to late period. In summary, the most commonly observed pattern is for catches to rise from the early summer months, reach a maximum during late July and early August, and fall off during the late summer months.

This general pattern can probably be explained by increased availability of young sockeye to the townet as they move out of the inshore areas during the early summer months followed by a competitive displacement and emigration during the late summer months. The variations of this general pattern may be indicative of yearly difference in the emergence and dispersion of the young fish and fluctuations in the timing and magnitude of the emigration.

Late Fall Townet Sampling

The abundance indices derived from townetting on Black Lake in 1973 are summarized in Table 4. The data indicate a substantial decline in the abundance of age 0 sockeye, age 0 pond smelt, and, to a lesser extent, age 0 three-spine sticklebacks between early September and early November. The abundance indices for the age 0 ninespine sticklebacks, and age I and I+ of the other species, remained fairly stable during this same period.

This phenomenon could be explained through three mechanisms: (1) a second emigration which would have had to occur between September 5 and November 5; (2) changing availability to the townet due to a redistribution to the inshore areas; or (3) substantial differential mortality of the age 0's of these species. Without any data for the intervening period, any discussion would be speculative in nature. This problem therefore awaits further study.

Black River Fyke Net Sampling

Fyke nets were fished in Black River during the periods July 28-August 6, August 12-September 5, and November 3-November 6. The sampling was conducted approximately 1 mile up from the Black River delta. A map illustrating the location of the various sites is presented in Fig. 5.

One net was fished in channel A while the other net was rotated between the other channels and sites. Swift currents and depth restricted fishing sites in channel A and B, while channels C and D were characterized by sand bars, pot holes, and slack water.

The catches by species are presented in Table 5.

Table 4. Fish abundance indices for Black Lake in 1973 expressed as average catch per minute

Date	<u>Sockeye</u>	<u>Threespine stickleback</u>			<u>Ninespine stickleback</u>		<u>Pond smelt</u>			<u>Sculpin</u>
	0	0	I	I+	0	I+	0	I	I+	
9/3-4	24.2	16.7	1.6	T ¹	3.0	1.6	52.0	5.1	T	1.5
11/5	2.0	3.8	T	T	2.6	0.5	1.4	4.6	T	2.0

¹T < 0.5.

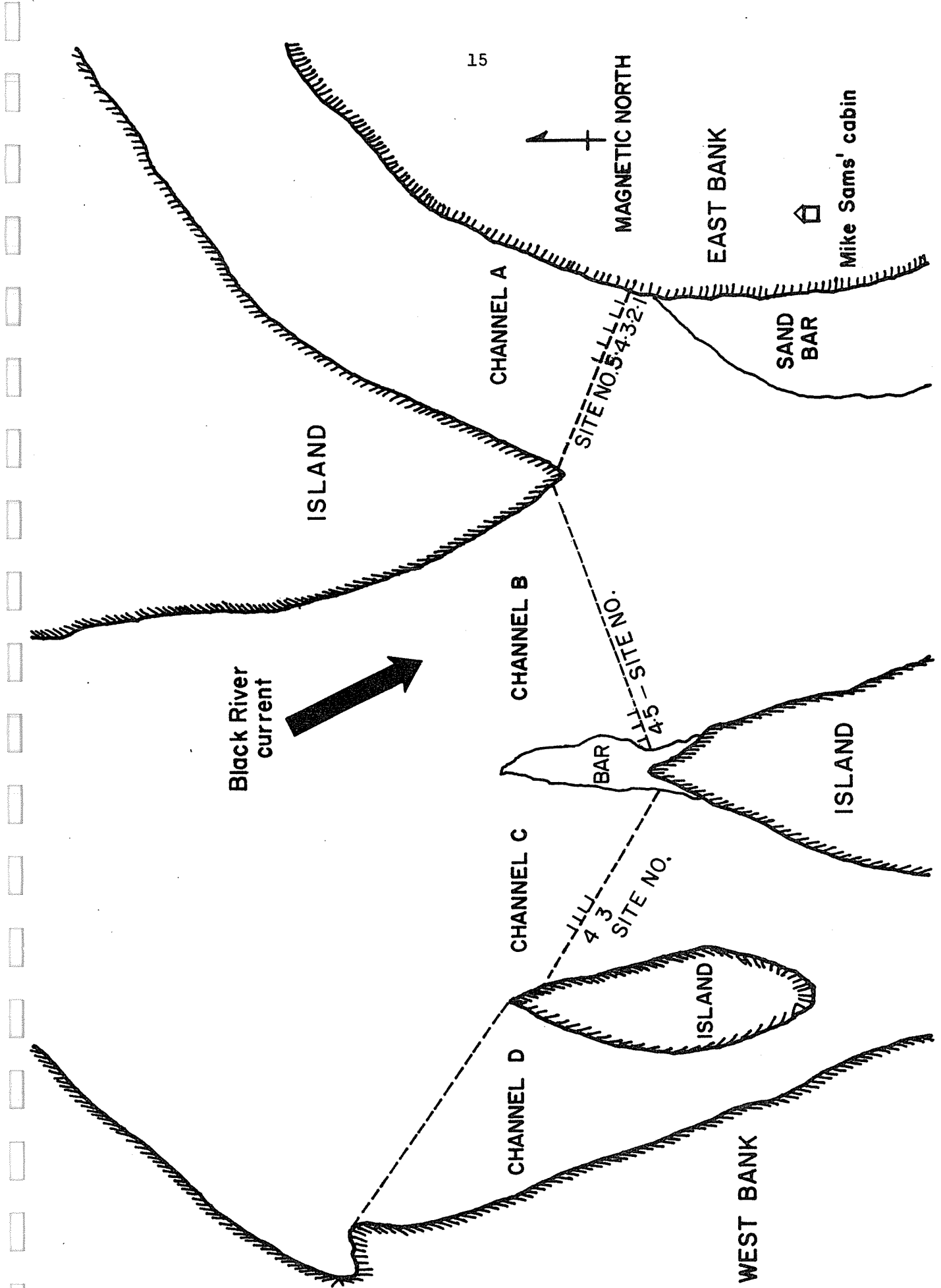


Fig. 5. Map of fyke net sites on Black River.

The catches indicate that the emigration of age 0 sockeye had subsided by August 18. The data do suggest, however, a prolonged emigration of three-spine sticklebacks and ninespine sticklebacks. The displacement of all the species present in Black Lake is of interest and confirms findings from fyke net sampling at Black Lake outlet in 1969-1972. However, the proportion of coho salmon in the catches was much lower in 1973 at the lower river sites than in 1972 at the Black Lake outlet.

To date there has been no attempt to elucidate the mechanisms which trigger this emigration. If the emigration is a competitive displacement related to the spacial requirements of the fish, then the recruitments of age 0 pond smelt and sticklebacks which appear to occur in midsummer may provide a point of departure for studying the triggering mechanisms. The historical townet and beach seine data were analyzed to determine if the emigration coincides with the appearance of the new year classes in the sampling. Because of the limited number of sampling dates in most years, it was not possible to determine precisely when the new year classes hatched each year. The possible validity of this hypothesis awaits further study.

Chignik Lake

Acoustical Program

Comparison of Acoustical and Townet Data. Echosounding was conducted in conjunction with townetting on August 28 and 29 to compare indices of abundance derived from townet samples obtained in the upper two meters with indices of abundance derived acoustically below two meters. The acoustical index was derived by integrating the acoustical returns stored on magnetic tape and summing the resulting density estimates throughout the water column to calculate relative biomass per unit of surface area. Since the amplitude of the returning signal is proportional to the weight of the fish, the index is indicative of biomass.

Townet data indicate that the majority of the small fish were sockeye and that they were of relatively uniform size (Fig. 10). It is reasonable to assume, therefore, that the index is proportional to numbers of fish. The acoustic index used herein is based on the sums of relative densities (fish/unit volume and some factor K) or relative number of fish per hectare. If the boat speed were known, a true density could be calculated from the acoustically derived relative density estimates. This density could then be applied to the lake volume to estimate total numbers of fish.

In addition it is assumed that large numbers of Dolly Varden or adult sockeye were not present in the transect areas. If present their contribution to the acoustic index would be more proportional to their numbers than biomass since the electronic equipment was adjusted to record echoes returning from juvenile sockeye. Larger target strengths from adult fish would be artificially reduced by the electronics.

The data are presented by tow in Table 6 and by area in Table 7. A graphical representation of the data, Fig. 6 illustrates a lack of any consistent relationship between densities in the upper two meters and densities below two meters.

Vertical Distribution of Juvenile Sockeye. Vertical density profiles for depths greater than two meters are presented for each area (Fig. 7) in Figs. 8 and 9. Very few fish occurred below 20 meters in areas D and E, while peak densities were noted at 25 meters in areas A, B, and C.

The density at or near the surface appears to decrease toward the outlet of the lake while midwater densities tend to increase. Densities are lowest in areas A and D. High densities in most areas were associated with the shore or bottom in relatively shallow areas (less than 20 meters).

Vertical Migration Patterns of Juvenile Sockeye. To determine the vertical migration patterns of juvenile sockeye, an acoustical survey was conducted over a 24-hr period on August 24 and 25. All transects were made in the same area which ran from Seal Point north to the opposite shore (Fig. 7). The migratory pattern was determined by visual inspection of the echograms.

During the daytime the fish exhibited typical schooled behavior. As the light intensity dropped, schools began to disperse and move inshore. This occurred well before it was fully dark. The fish remained dispersed throughout the night and appeared to maintain the pattern almost until direct sunlight was on the lake surface. As the light intensity increased, the shoreward (and possibly surface) biases began to decrease. At this time schools reformed in midlake at a depth of 4-10 meters. The schooling behavior observed in Chignik Lake may be associated with quite high light intensity levels and appears to be inhibited by cloud cover.

The vertical migration studies were made in tow area E only, where the vertical distribution had a single mode toward the surface. The bimodal vertical distributions seen earlier in other areas of the lake indicate the need for studies of vertical migration patterns in several areas of the lake. Analysis of the behavior of each mode of the distribution might give some clue as to the species present.

Townet Sampling

The abundance indices derived from townetting on Chignik Lake in 1973 are presented in Table 8. The catch per minute of age 0 sockeye increased from 7.8 on July 26 to 17.1 on August 6. This may indicate the influx of Black Lake fry. The index on August 6 was similar to August 28, but dropped substantially between August 28 and November 9.

The catches of age I sockeye increased progressively on the first three sampling dates and dropped substantially between August 28 and November 9.

Table 6. Comparison by tow of fish abundance indices derived from tow-netting and sonar surveys on Chignik Lake, August 28, 1973

Tow number	Area	Duration in minutes	Acoustical density (Fish per unit area)	Townet catch per minute						
				Sockeye	Threespine stickleback	Ninespine stickleback	Pond smelt	Isopoda	Coho	All species
1	A	5	4.70	4.4	0	0.4	0	1.0	0	5.8
3	A	5	1.66	2.4	0	0.6	0.2	0.6	0	3.8
4	E	10	21.60	16.4	0	1.4	0	0.6	0	18.4
5	E	10	17.60	15.6	0.2	0.5	0	1.2	0	17.5
6	D	5	4.67	6.2	0	0.4	0	1.2	0	7.8
7	D	5	2.44	12.2	1.2	0.4	0	1.4	0	15.2
8	C	5	1.04	81.6	1.2	0.6	0	2.0	0	85.4
9	C	5	2.48	77.4	0.4	0.4	0	0.6	0	78.8
10	B	10	6.80	66.4	0.2	0.3	0	0.3	0	67.2
11	B	5	8.52	86.8	0	1.0	0.8	0.8	0.2	89.6

Table 7. Comparison by area of fish abundance indices derived from tow-netting and sonar surveys on Chignik Lake, August 28, 1973

Tow number	Area	Duration in minutes	Acoustical density (Fish per unit area)	Townet catch per minute						
				Sockeye	Threespine stickleback	Ninespine stickleback	Pond smelt	Isopoda	Coho	All species
1,3	A	10	3.18	3.4	0	0.5	0.1	0.8	0	4.8
10,11	B	15	7.66	73.2	1.3	0.5	0.3	0.5	0.1	74.7
8,9	C	10	1.76	79.5	0.8	0.5	0	1.3	0	82.1
6,7	D	10	3.55	9.2	0.6	0.4	0	1.3	0	11.5
4,5	E	20	19.60	16.0	0.1	1.0	0	0.9	0	18.0

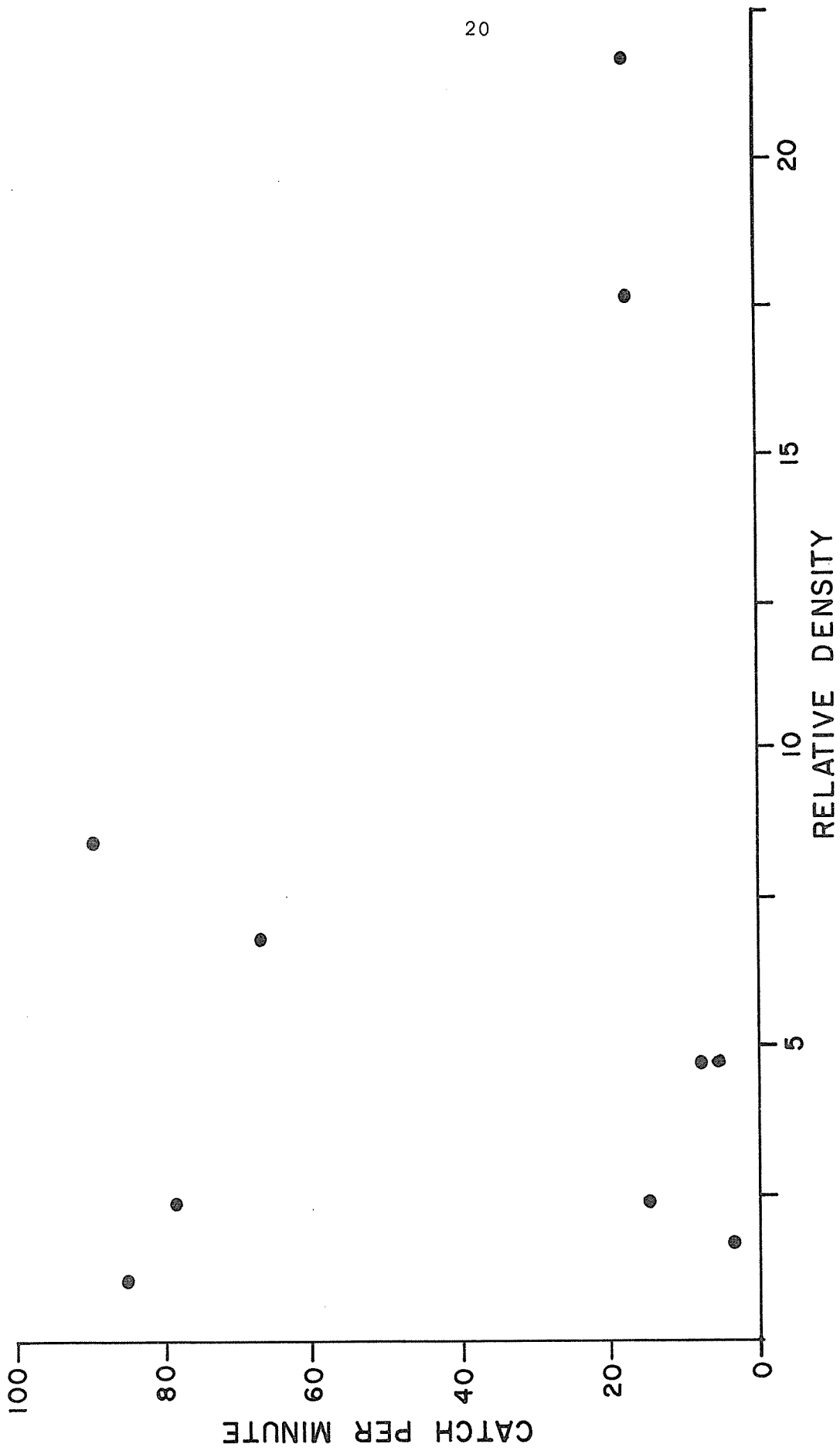


Fig. 6. Acoustical density estimates vs. tow net abundance estimates, Chignik Lake, 1973.

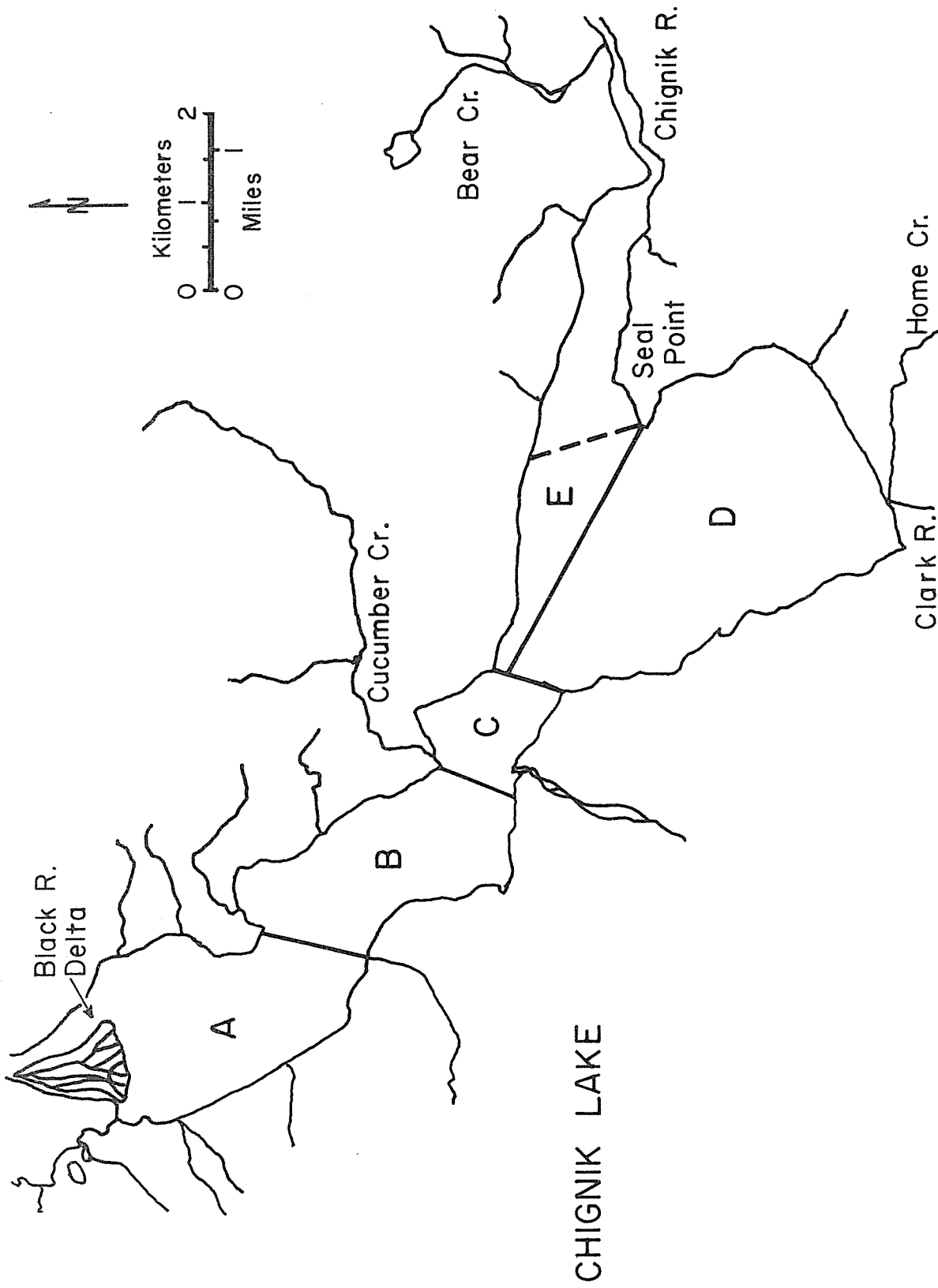


Fig. 7. Map of Chignik Lake, showing sampling areas. Broken line indicates transect course used to study diel vertical distribution.

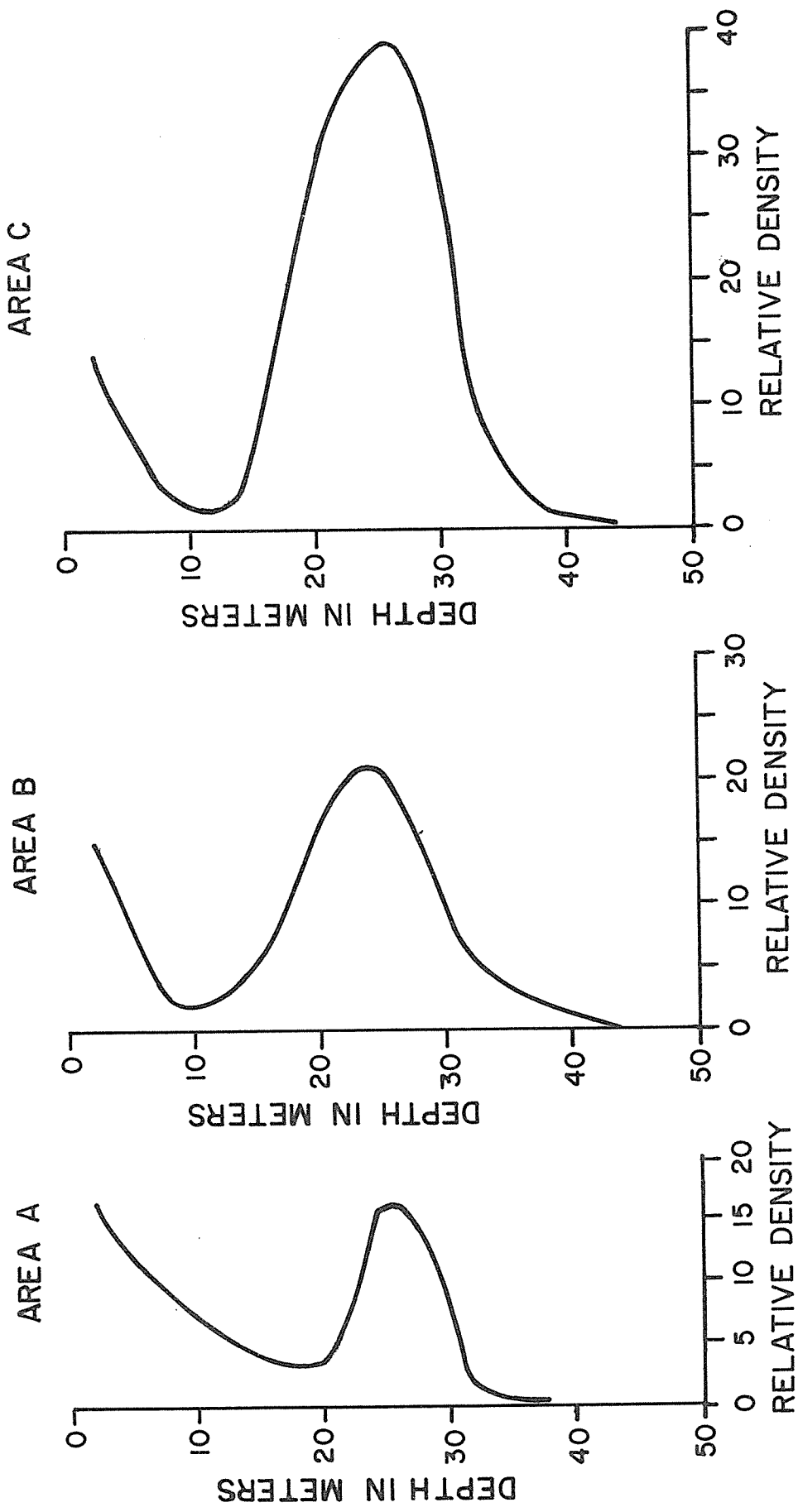
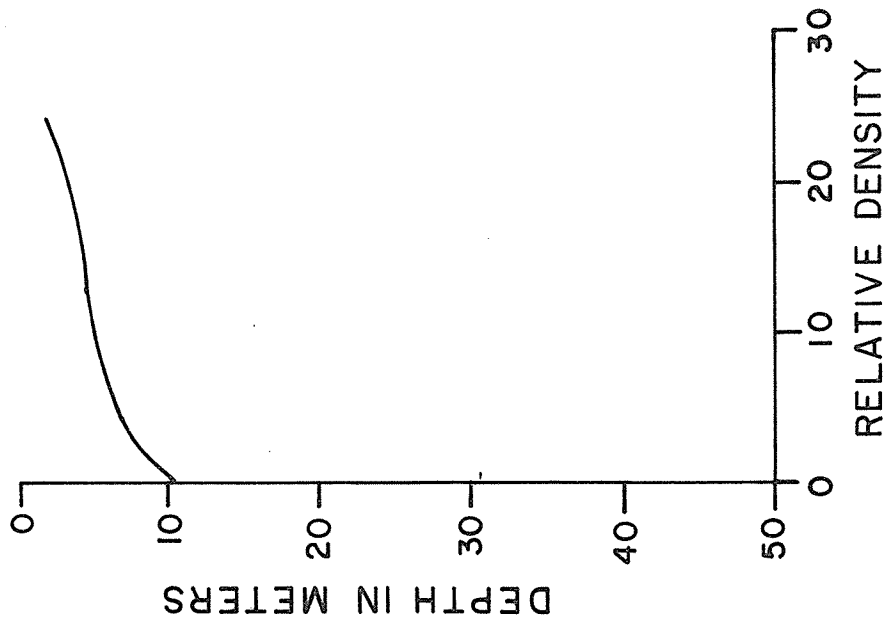


Fig. 8. Vertical fish density profile for Chignik Lake areas A, B, and C, August 28, 1973.

AREA D



AREA E

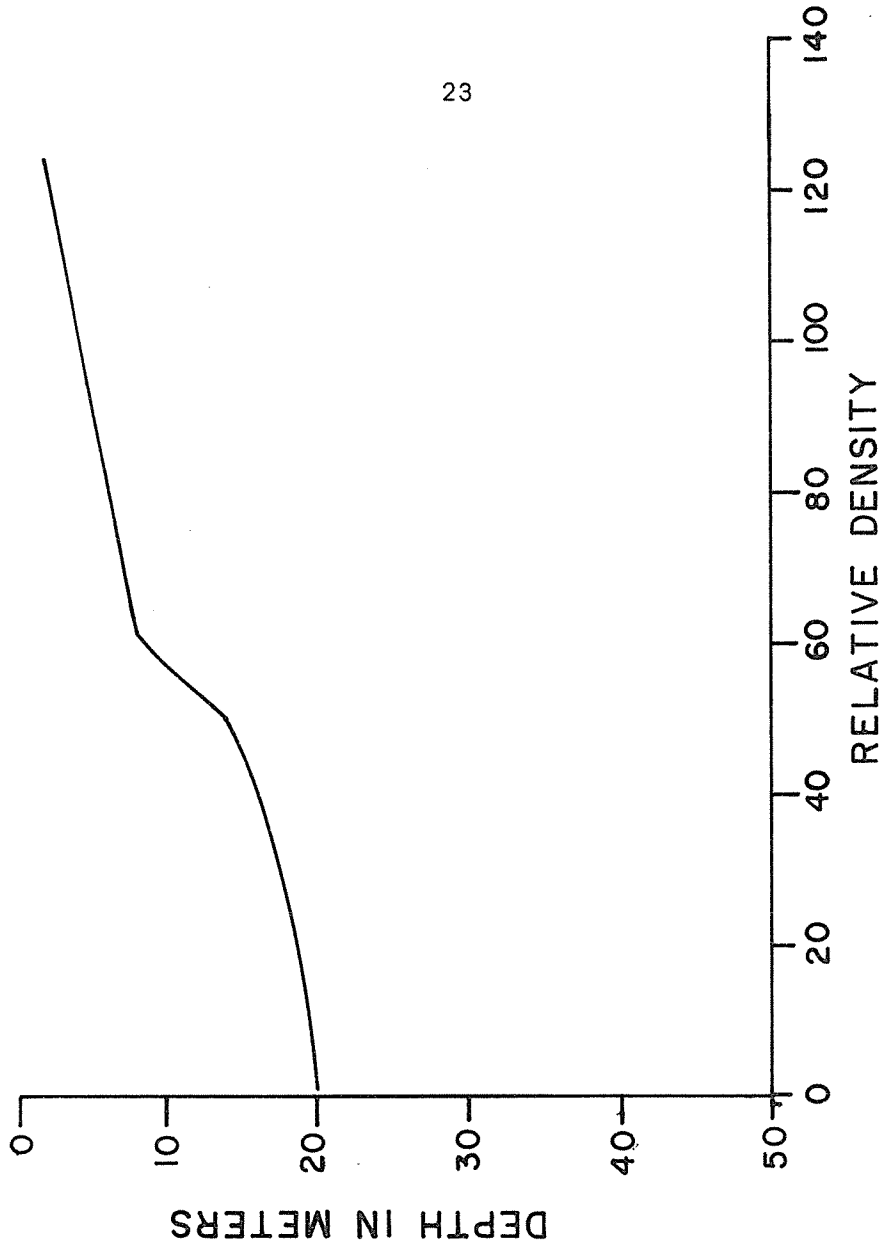


Fig. 9. Vertical fish density profiles for Chignik Lake, areas D and E, August 28, 1973.

Table 8. Fish abundance indices for Chignik Lake in 1973
expressed as average catch per minute

Date	Sockeye		Threespine stickleback			Ninespine stickleback		Pond smelt		
	0	I	0	I	I+	0	I+	0	I	I+
7/26	7.8	7.6	0	T ¹	T	T	0.5	0	T	0
8/6	17.1	10.8	0	T	T	0	1.5	0	0	0
8/28	14.4	21.6	T	0	T	T	0.5	0	T	0
11/9	5.0	T	T	T	0	T	0	0	0	0

¹T < 0.5.

The substantial decrease of the index between August 28 and November 9 for both age 0 and I sockeye may represent changing availability to the tow-net due to distributional phenomena or mortality. These data emphasize the need to initiate a comprehensive echosounding program in order to understand the temporal and spacial distribution and abundance of young sockeye in Chignik Lake.

Freshwater Scale Patterns

The problems of interpreting scale patterns of Chignik sockeye were discussed in detail in Burgner and Marshall (1974). Length frequency data (Fig. 10) illustrate the prolonged emergence of fry in Chignik Lake which is a factor in producing highly variable scale patterns. Of particular interest is the occurrence of fry less than 42 mm long, the length at which the first circulus is usually formed (Koo 1955).

The collection of scales from juvenile sockeye will be emphasized during the 1974 field season to provide a method for objectively interpreting the freshwater age of returning adults.

SUMMARY AND RECOMMENDATIONS

The temporal and spacial variability of tow-net catches on Black Lake indicates the need to establish the amount of effort required to obtain a reliable estimate of carrying capacity for this lake and the time at which this should be done. It is recommended, therefore, that the reliability of the historical data be established and that alternative methods of assessing the abundance of Black Lake fish population be investigated.

Tow-net and acoustical sampling in Chignik Lake illustrate the need to develop an upward-looking transducer and incorporate it into an extensive acoustical sampling scheme in order to obtain the best possible data on the distribution and abundance of juvenile sockeye in this lake.

The complex freshwater life history of Chignik sockeye which produce highly variable scale patterns was illustrated. The value of a definitive study of these scale patterns in helping to properly interpret the age from scales of returning adults seems apparent.

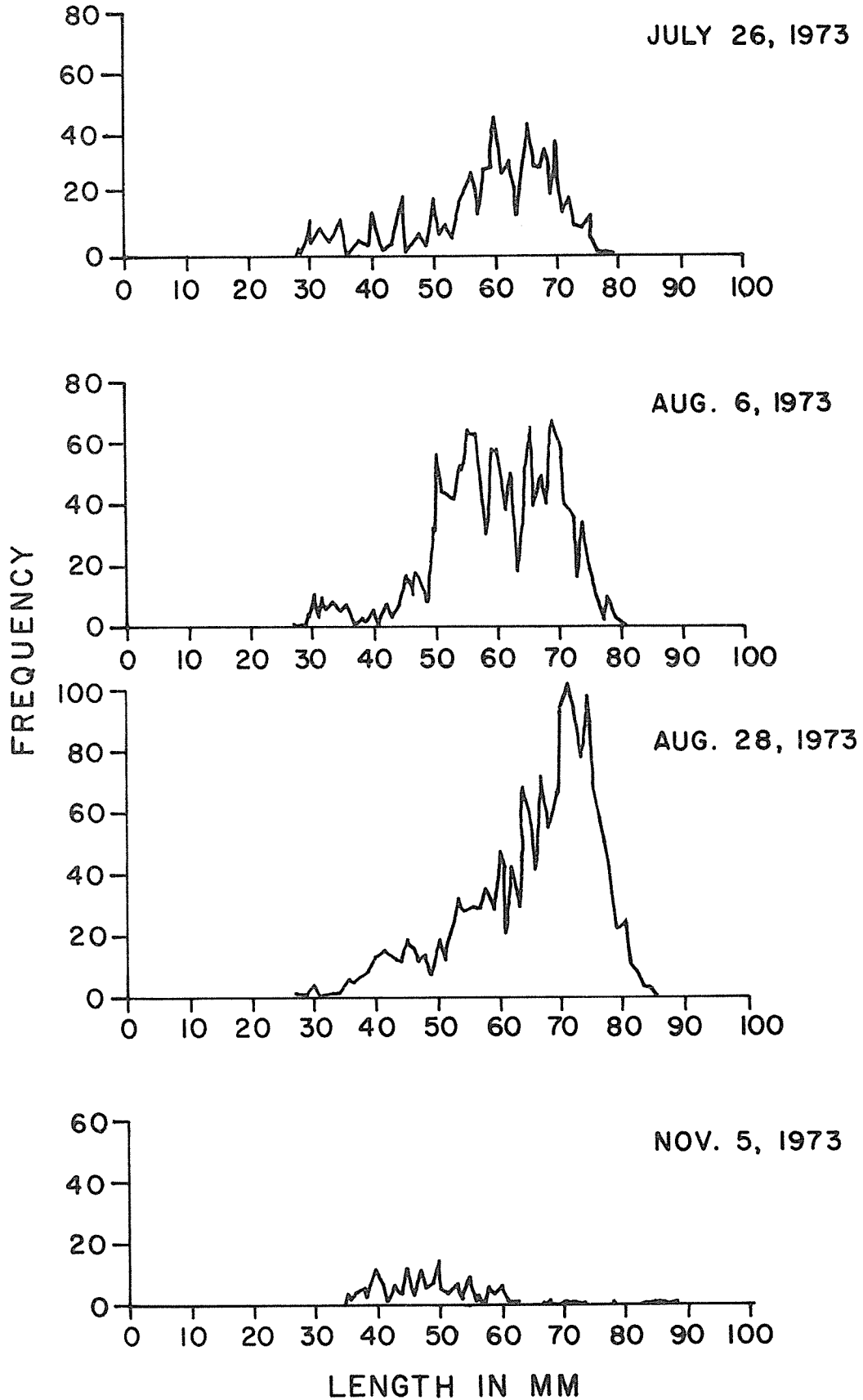


Fig. 10. Length frequency of juvenile sockeye in Chignik Lake, 1973.

CHIGNIK DATA FILE

The previously mentioned problems with properly interpreting the historical data, especially with regard to run separation and age determination, have stalled our efforts to create a data file for adult Chignik sockeye.

The data file for the young fish studies has been proceeding, however. During the fall of 1974 we plan to begin transferring data which is punched on cards to magnetic tape.

PERSONNEL ON PROJECT

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Co-Principal Investigator - Dr. Donald E. Rogers

Project Leader - Scott L. Marshall, Research Assistant

Acoustical Consultant - James J. Dawson, Fisheries Biologist II

Fisheries Technician - John A. Knutzen, Student Helper IV

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