

## PRELIMINARY STUDY OF THE FISH POPULATIONS

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## INTRODUCTION

Preliminary investigations of the fish populations in the Cedar River began in June 1973. To date, the following species have been captured: (1) Rainbow trout (*Salmo gairdneri*), (2) cutthroat trout (*Salmo clarki*), (3) Dolly Varden (*Salvelinus malma*), (4) sockeye salmon (*Oncorhynchus nerka*), (5) coho salmon (*Oncorhynchus kisutch*), (6) chinook salmon (*Oncorhynchus tshawytscha*), (7) mountain whitefish (*Prosopium williamsoni*), (8) largescale sucker (*Catostomus macrocheilus*), (9) longnose dace (*Rhinichthys cataractae*), (10) Torrent sculpin (*Cottus rhotheus*), (11) coastrange sculpin (*Cottus aleuticus*), and (12) brook lamprey (*Lampetra richardsoni*).

The primary objectives are to calculate total fish production and to study the composition of species in the river. Secondary objectives include investigation of the utilization of available food sources previously described in the macroinvertebrate studies. Data from this study will provide input for the modeling effort by Norm Bartoo and complement fish population studies in the Lookout Creek drainage area of Oregon (R. S. Aho and J. O. Hall 1972).

## DESCRIPTION OF STUDY AREA

The Cedar River, by virtue of its three distinct sections, provides an excellent opportunity for study. The upper natural section and the middle section which are closed to the public can be compared to the lower section, which is not only heavily utilized by man but has become increasingly important in sockeye salmon production. This provides three distinct fish populations within the same river, consisting of unfished resident populations in the upper and middle sections and populations under major influence by sockeye salmon, as well as other anadromous fishes, in the lower river.

## METHODS

Six sample sites (A-F) have been selected for study (Figure 1). Station A, upstream from Lake Chester Morse is at river mile 43.6. Stations B and C above the diversion at Landsburg, are located at river mile 32.6 and 23.6, respectively. Stations D, E, and F are located at river mile 17.2, 12.5, and 1.4, respectively, upstream from Lake Washington. These stations were chosen of equal length to correspond as

closely as possible with the macroinvertebrate studies previously described; however, the discharge at Station C has consistently been too high to allow adequate fish sampling. Station D was added in order to obtain more information on the anadromous species.

After much research in electrofishery (Patten and Gillaspie 1966, Vibert 1967, and Edwards and Higgin 1973) it was decided to use a Coeffelt model V.V.P.-15 electroshocker to collect the samples. The stations were sampled monthly during June, July, August, and September; however, estimates were only based on August and September samples. Several methods of estimating populations have been reviewed (Ricker 1958, Seber and Whale 1970, and Zippin 1958). At this time the removal method described by Zippin (1958) is being used which is very similar to the Seber and Whale 3-catch estimate used in Mack Creek, Oregon (Aho and Hall 1972).

Block nets were stretched across each section at the upper and lower ends to prevent escapement as well as movement through a station during sampling. Three passes with the electrofishing gear were made through each section with each pass considered a standard unit of effort.

All fish caught on each pass were removed from the section and held separately in a live car. Each fish was then anesthetized with MS-222 and measured to the nearest millimeter total length. Those fish above 10 cm in length were weighed on a triple-beam balance to the nearest 0.1 g. The weights of those fish shorter than 10 cm were calculated from a length-weight relationship derived using the methods in the IBP Handbook No. 3. Above the Landsburg diversion all adult fish greater than 15 cm were tagged with FLOY anchor tags and juveniles 10 cm to 15 cm were tagged with KORN tags. To date 147 tagged fish have been released consisting of 75 with KORN type and 72 with FLOY type tags. The data gained in this tagging effort will be used to check growth rate and also will help to understand fish movements.

Scale samples have been taken on most fish above 15 cm in length at each station. These will be mounted and read for age determination and the results will be used to validate the age distribution determined by length-frequency diagrams (Figure 2-4). Stomach samples will be taken on a subsample of about 10% of the catch at each station. These will be analyzed to determine the utilization of available food supplies.

Population estimates of the adult sockeye salmon (*Oncorhynchus nerka*) are being made in the river by the Washington State Department of Fisheries. The adult biomass entering the system will be calculated using these data. However, the production of juvenile sockeye in the river is not presently being studied.

Two species of cottids (*Cottus rotheus* and *Cottus aleuticus*) have so far been identified in the river. Due to the difficulty of obtaining these species from the substrate, a 1-m square sampler has been devised on the order of a Surber sampler. The sampler is placed at random throughout the study section. The gravel in the square meter is stirred while shocking is carried out. It is anticipated that an estimate of the cottids per square meter can be obtained with this procedure.

Monthly water samples are obtained and measurements of alkalinity, dissolved oxygen, hardness, and pH are made with a Hach kit. Constant temperature recordings as well as discharge data are also available and utilized. Measurements of conductivity are provided by the City of Seattle Water Quality Laboratories.

## RESULTS AND DISCUSSION

Preliminary results for August and September 1973 are shown in Tables 1 and 2, respectively. Rainbow trout (*Salmo gairdneri*) and sculpins (*Cottus rhotheus* and *Cottus aleuticus*) were found at all stations. Dolly Varden (*Salvelinus malma*) only occur above Lake Chester Morse. Resident rainbow (*S. gairdneri*) predominate below the Chester Morse dam (Station B), although some adult cutthroat (*Salmo clarki*) and some rainbow and cutthroat hybrids have been sampled here as well as at Station C. Rainbow-steelhead (*S. gairdneri*) are most numerous below Landsburg diversion along with significant numbers of juvenile chinook (*O. tshawytscha*) and coho salmon (*O. kisutch*). The adult sockeye salmon (*O. nerka*) use this portion of the river heavily, and their contribution will be handled as discussed earlier. Cutthroat trout (*S. clarki*) that are believed to be sea-run are found at Station E. During preliminary work in June, 21 largescale suckers (*Castostomus macrocheilus*) were sampled at Station E. These fish may migrate upstream from Lake Washington to spawn.

Among other goals, it is anticipated that production estimates for the Cedar River will be calculated. Goodnight and Bjornn (1971) were able to break production down by species in two Idaho streams. Production estimates will be computed as described by Chapman (1971) in the IBP Handbook No. 3.

The population estimates shown in Tables 1 and 2 were made using the removal method of Zippin. Ninety-five percent confidence levels were also calculated by the method described by Zippin (1958) to indicate fairly reliable estimates. When biomass is enumerated as gram per square meter for each section the results range from 0.59 g/m<sup>2</sup> to 7.48 g/m<sup>2</sup>. This compares reasonably well with estimates made in the Lookout Creek drainage of values ranging from 0.26 g/m<sup>2</sup> to 5.55 g/m<sup>2</sup> (omitting the one value of 218 g/m<sup>2</sup> made for cutthroat at site no. 2 in Mack Creek).

The length-frequency diagrams (Figures 2-4) were used in an attempt to show age groups of rainbow (*S. gairdneri*) sampled. It is believed that zero-age fish were not recruited by the gear. The peaks are not very apparent and ages will be later verified by scale readings.

The field work will continue through September of 1974. However, it is anticipated that the discharge will remain too high during the winter months for much field work to be accomplished.

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Table 1: Estimates of the number of fish and fish biomass in sections of the Cedar river (95% confidence intervals around the population estimates where data allowed computation).

Sample date: Aug. 14, 1973

Station	Species	Est. no.	Rel. abundance (Percent)	Biomass est. (g/m <sup>2</sup> )	Total biomass est. (g/m <sup>2</sup> )
A (Area 1034m <sup>2</sup> ) River Mile 43.6	Rainbow	84 (55-113)	79	0.88	1.48
	year 1	49 (43-55)			
	year 2	36 (30-42)			
	year 3	4			
	Dolly Varden	23 (19-27)	21	0.60	
B (Area 1476m <sup>2</sup> ) River Mile 32.6	Rainbow	154 (115-198)	100	4.05	4.05
	year 1	97 (71-123)			
	year 2	55 (37-73)			
	Cutthroat	0			
D (Area 1572m <sup>2</sup> ) River Mile 17.2	Rainbow	398 (125-671)	65	3.60	4.61
	Cutthroat	2			
	Chinook	64 (2-126)			
	Coho	138*			
	Dace	14*			
E (Area 1325m <sup>2</sup> ) River Mile 12.5	Rainbow	190 (178-202)	51	3.34	6.71
	Cutthroat	15			
	Chinook	54 (32-76)			
	Coho	109 (83-135)			
	Dace	1*			
F (Area 2788m <sup>2</sup> ) River Mile 1.4	Rainbow	141 (135-147)	95	0.58	0.59
	Whitefish	1*			
	Dace	6*			

\*No estimate made

Table 2: Estimates of the number of fish and fish biomass in sections of the Cedar river (95% confidence intervals around the population estimates where data allowed computation). Sample date: Sept. 13, 1973  
date: Sept. 13, 1973

Station	Species	Est. No.	Rel. abundance (Percent)	Biomass est. (g/m <sup>2</sup> )	Total biomass est. (g/m <sup>2</sup> )		
A (Area 1034m <sup>2</sup> ) River Mile 43.6	Rainbow year 1	160 (130-190)	76	1.27	2.02		
	year 2						
	year 3						
	Dolly Varden	50 (38-62)	24	0.75			
B (Area 1476m <sup>2</sup> ) River Mile 32.6	Rainbow year 1	451 (191-711)	100	7.29	7.48		
	year 2						
	Cutthroat					2*	0.19
D (Area 1572m <sup>2</sup> ) River Mile 17.2	Rainbow	227 (162-292)	80	1.41	1.17		
	Cutthroat					0	
	Chinook					0	
	Coho					48*	0.21
	Dace					8*	0.09
E (Area 1325m <sup>2</sup> ) River Mile 12.5	Rainbow	264 (222-306)	69	2.35	4.12		
	Cutthroat					7*	1.06
	Chinook					39 (28-50)	0.26
	Coho					73*	0.45
	Dace					0	
F (Area 2788m <sup>2</sup> ) River Mile 1.4	Rainbow	175 (151-199)	93	0.82	0.84		
	Whitefish					0	
	Dace					14*	0.02

\*No estimate made

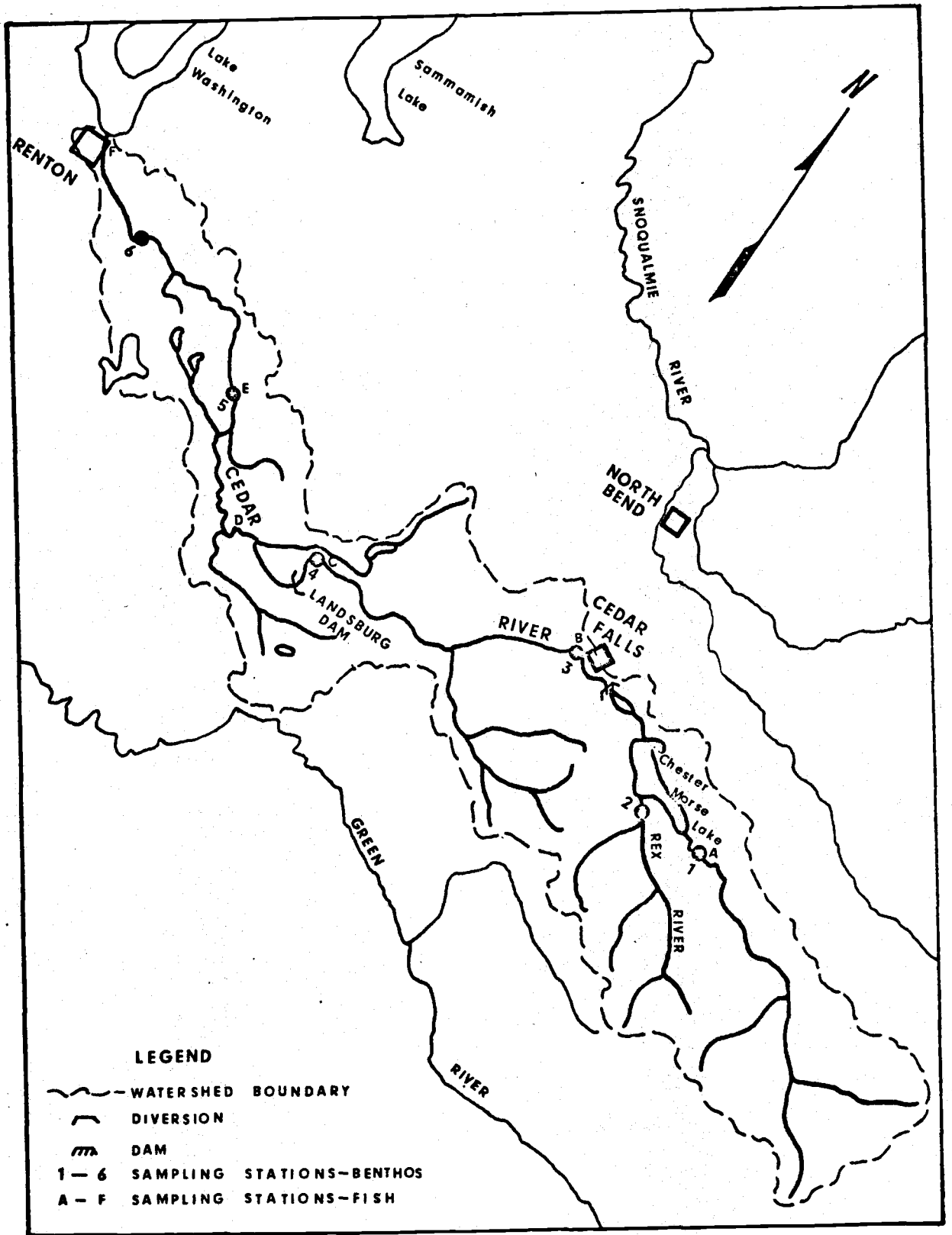


Figure 1. Map of the Cedar River basin showing sampling stations.

STATION - A  
 LENGTH - FREQUENCY  
 RAINBOW TROUT

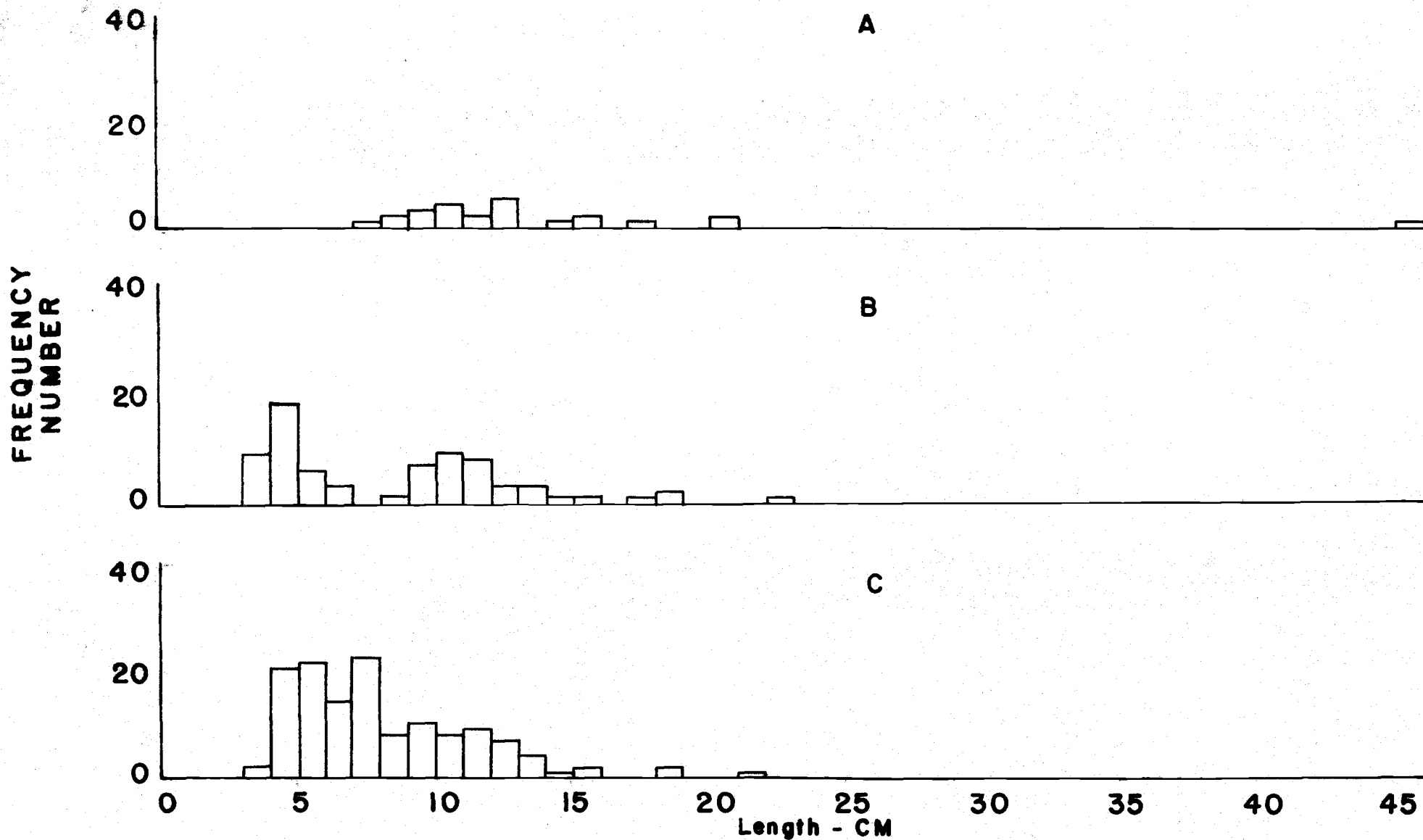


Figure 2. Length-frequency diagram of rainbow trout by month in 1973 - Station A.  
 A = 17 July (24 fish), B = 17 Aug. (73 fish), C = 13 Sept. (131 fish).



STATION - A  
 LENGTH - FREQUENCY  
 RAINBOW TROUT

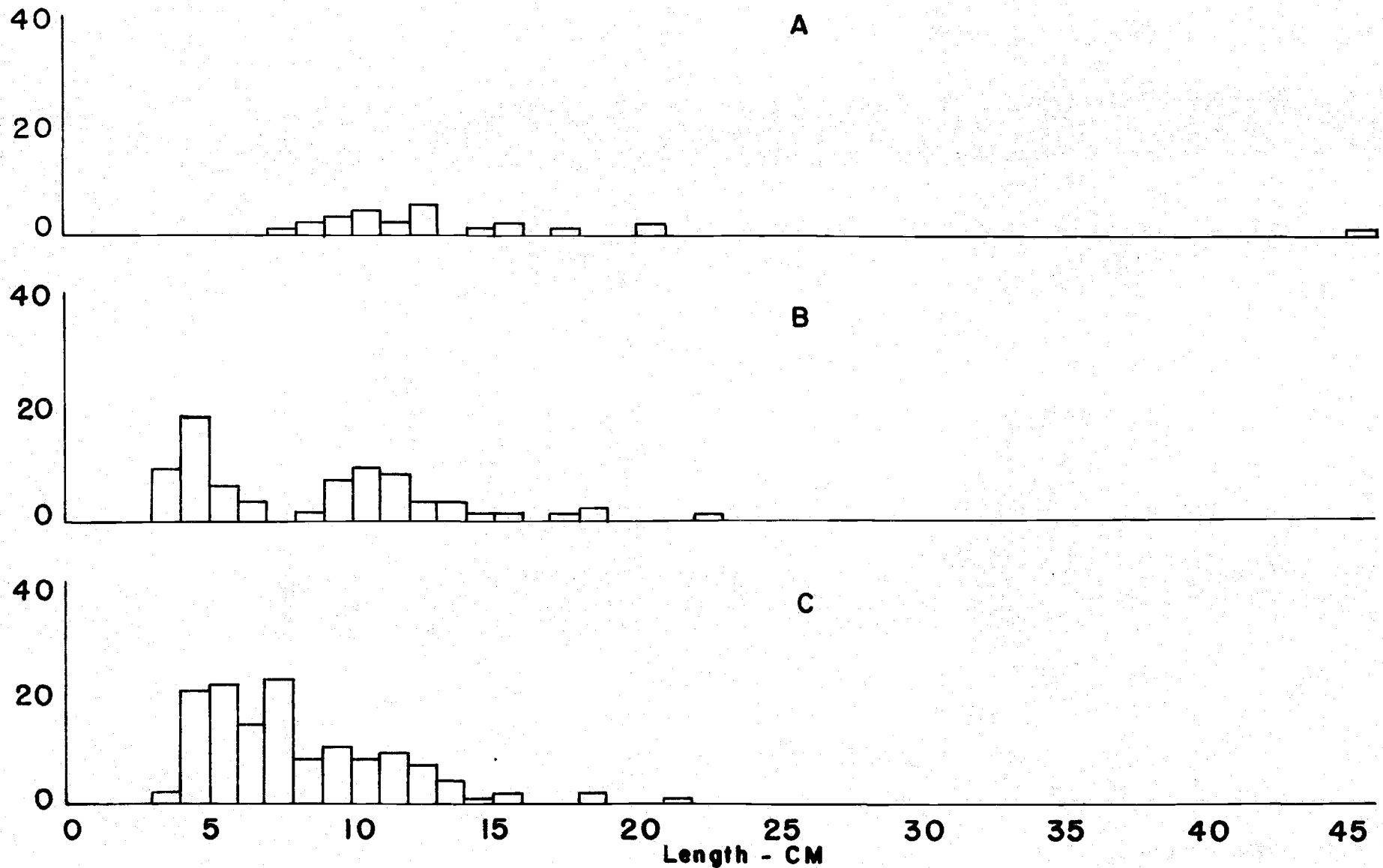


Figure 2. Length-frequency diagram of rainbow trout by month in 1973 - Station A. A = 17 July (24 fish), B = 17 Aug. (73 fish), C = 13 Sept. (131 fish).

STATION E  
 LENGTH - FREQUENCY  
 RAINBOW TROUT

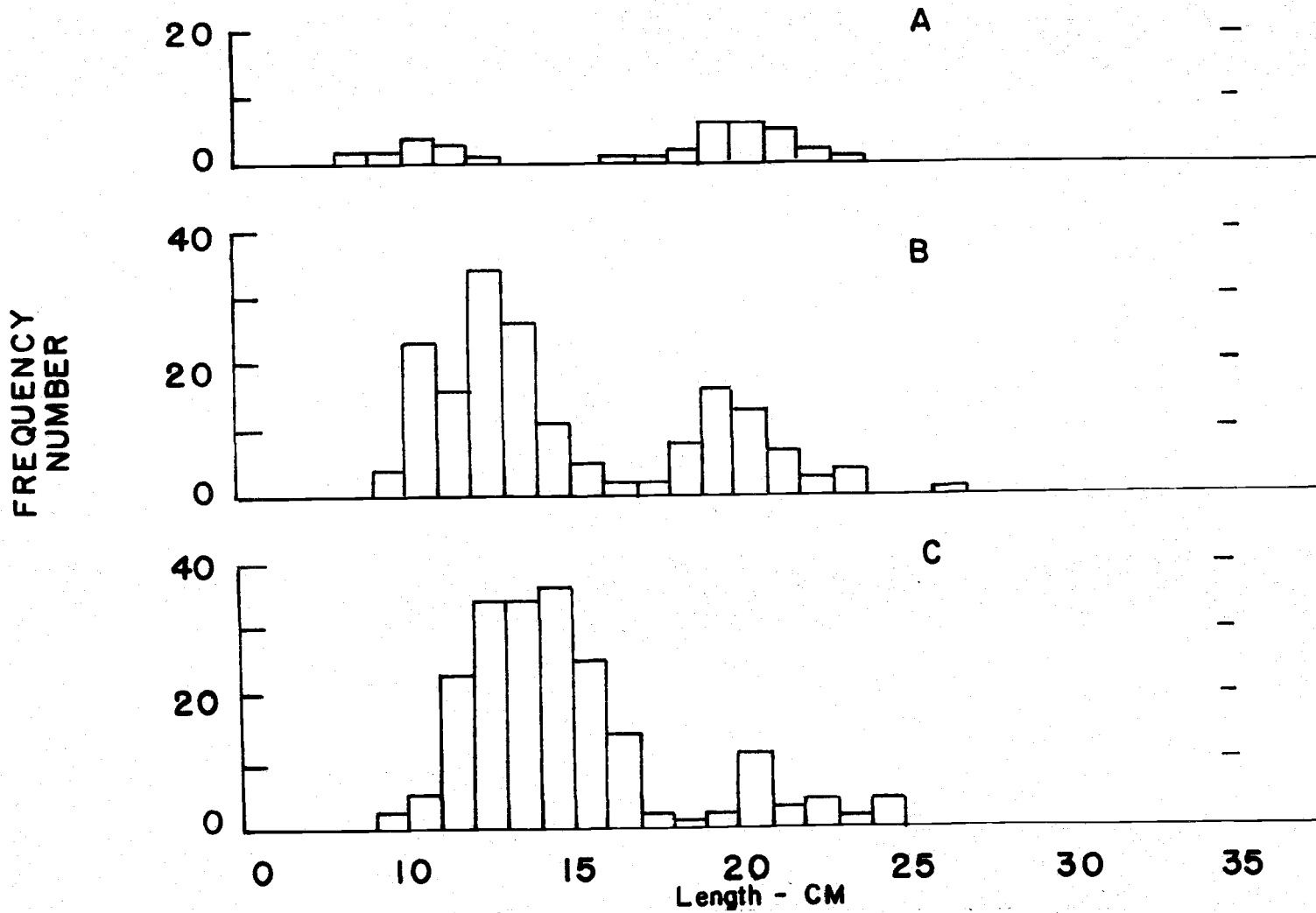


Figure 4. Length-frequency of rainbow trout by month in 1973 - Station E.  
 A = 18 July (36 fish), B = 14 Aug. (180 fish), C = 11 Sept. (203 fish).

STATION - A  
 LENGTH - FREQUENCY  
 RAINBOW TROUT

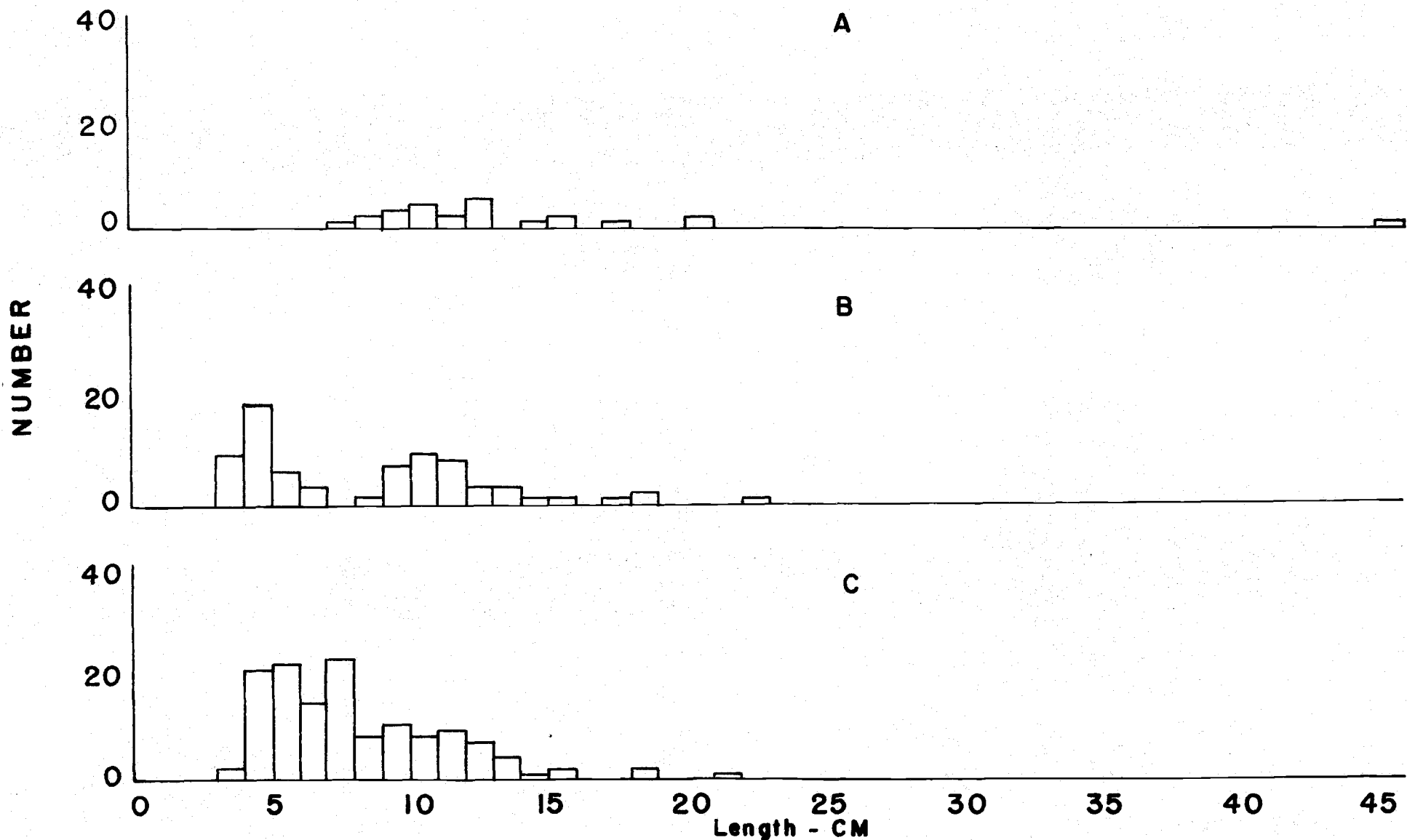


Figure 2. Length-frequency diagram of rainbow trout by month in 1973 - Station A. A = 17 July (24 fish), B = 17 Aug. (73 fish), C = 13 Sept. (131 fish).

STATION E  
 LENGTH - FREQUENCY  
 RAINBOW TROUT

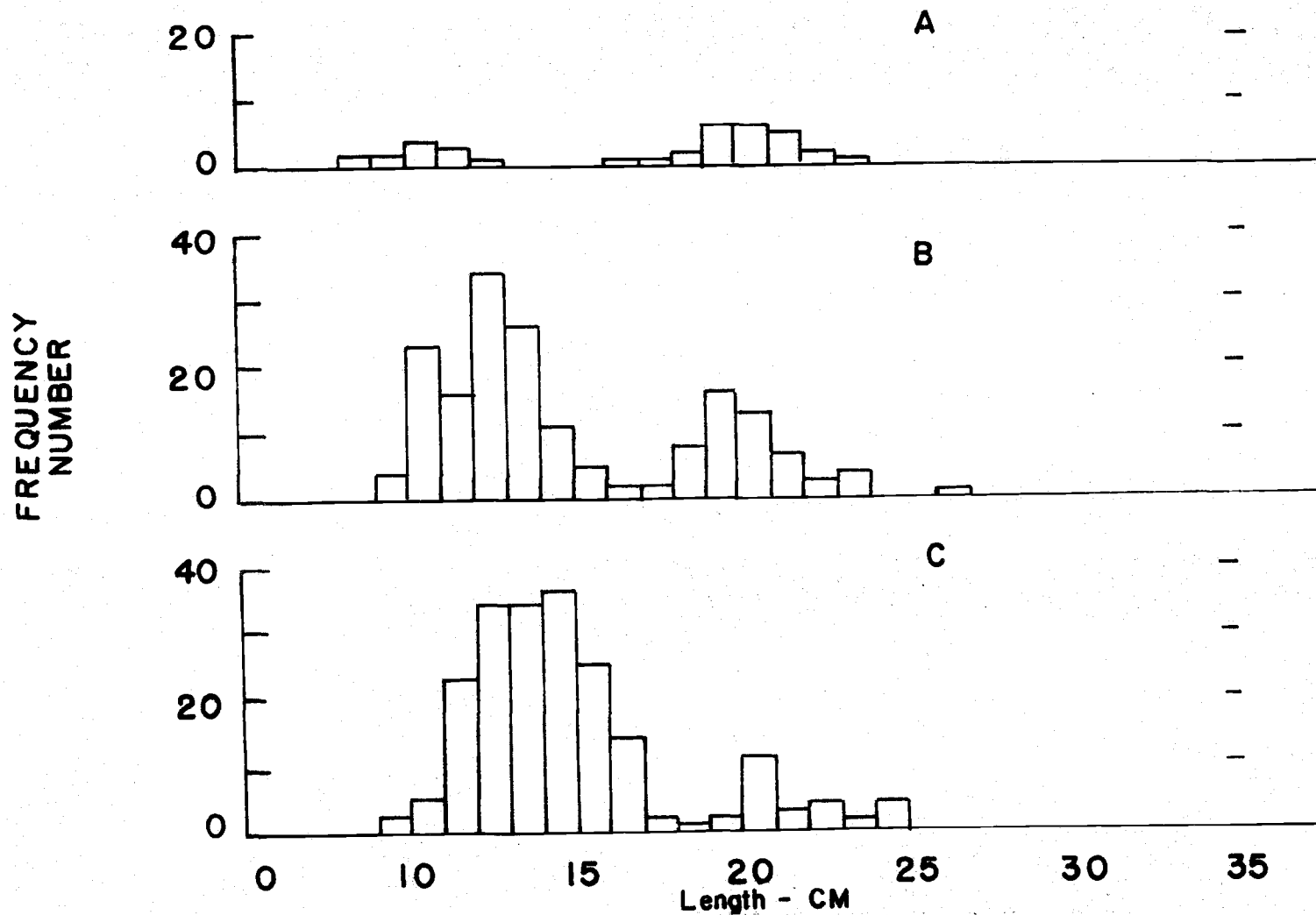


Figure 4. Length-frequency of rainbow trout by month in 1973 - Station E.  
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