RAZOR CLAM INVESTIGATION

Progress Report for 1949 and 1950

Rather than present a detailed report on all phases of the investigation and current data not compiled in any summary form, this report deals with two phases far enough under way to demonstrate tendencies in the fishery and elucidate phases of the biology. Such phases of the investigation as the marking program, current census data on diggers, etc., are so incomplete at the present time that little value could be obtained from their presentation and a great deal of summarization would be necessary before they could be presented at all.

The late spring data and some of the length frequency data of the commercial samples for May was obtained with the help of Ronald Gordon.

Abundance, mortality, and growth of the 1949 year class of razor clams

The exact time of spawning during the 1949 season is unknown (if we are to presume that there was any exact time of spawning). The investigation was not started until the last of June at which time the clams on the whole were fairly thin although on general observation the amount of gonadal material seemed to vary between individual clams. One dealer reported the largest drop in weight, one sign of spawning, as taking place in May of that year.

A close observation was kept on the beach for possible signs of a set. Sample screenings were made, all of which gave negative results. Plankton tows were made whenever possible, but with the exception of one sample in which a few unidentified pelecypod larva were discovered no sign of larvae were found. The first young clams of the 1949 year class were found August 29 on the surface of the dry sand. September 28 the first screening was started. Table 1 lists the date, location, and number of screenings made to date.

Table I

1949 and 1950 Screenings for Young Razor Clams

Date	Mesh Size of Screen Used	Area Screened I	II	III	IV	V	VI	VII	VIII
Sept. 28, 1949	16 to in.	3							
Sept. 29, 1949	16 to in.		3	3					
Oct. 3, 1949	16 to in.				3				
Oct. 6, 1949	16 to in.					3			
Oct. 10, 1949	16 to in.						3*		
Oct. 21, 1949	16 to in.	14	5						
Oct. 22, 1949	16 to in.			10	7	3			
Oct. 23, 1949	16 to in.						11	21	7
Oct. 25, 1949	16 to in.					5			
Dec. 18, 1949	16 to in.	3							
Jan. 3, 1950	16 to in.	3							
Feb. 16, 1950	16 to in.	1							
Feb. 16, 1950	6 to in.	5							
Feb. 17, 1950	16 to in.			1					
Feb. 17, 1950	6 to in.			5					
Apr. 29, 1950	16 to in.						6		
June 15, 1950	6 to in.						7	5	
June 15, 1950	16 to in.						1	1	
June 16, 1950	6 to in.								8
June 19, 1950	6 to in.				6				
Totals		17	20	19	16	11	25	30	15

Total screenings 153

Area I - .6 mile south of the Peter Iredale
Area II- .2 mile south of the South Jetty
Area III- .4 mile south of the Peter Iredale
Area IV- 3.7 miles south of the Sunset Beach entrance.
Area V- 1 mile south of Gearhart
Area VI- Off 12 Ave., Seaside
Area VII-Off "D" Ave., Seaside
Area VIII - Cove Area

* Taken off 3rd Ave. in Seaside

Methods of Screening

Sample areas were arbitrarily selected (about 4 miles apart on the northern area of beach; a shorter distance apart at Seaside) without reference to the character of the beach or any factor which would influence the abundance of set present. Square meter samples of sand were dug to a depth of about 6 to 8 inches and run through a specially constructed screen. These square meter samples were taken either 10 or 20 meters apart as time permitted, and run in a straight line between the waters edge and the high tide line perpendicular to the length of the beach. This was done for each of the eight areas selected. The distance of each square meter from the high tide line was recorded and also from any suitable landmark when available. The clams found in each square meter were placed in a separate bottle and recorded as to exact location of the sample.

The Purposes of Screening

The object of the screenings may be listed as follows:

1. To determine the intensity of the set upon the beach (the average number of young clams per square meter). This may be used as a comparison of abundance of set from year to year, to show the progressive mortality throughout the year, and to compare the abundance on different areas of beach.

2. As a means of obtaining a random sample of the size of the clams in the set and to determine the rate of growth throughout the year from changes in position of the modes.

Results of the Screening--Abundance of Set

Table II is a list of the young clams obtained through screening during 1949 and through February of 1950. It will be noticed that there are great variations in abundance from area to area with the extreme southern Cove Area having by far the heaviest set of clams. Table III is a comparison of

Table II

RESULTS OF SCREENINGS BY AREA AND HEIGHT ON BEACH

Corrected Distance from High Water Line	Area I				Area II		Area III			Area IV		Area V		Area VI		Area VII	Area VIII
	9-28-49	10-28-49	12-18-49 to 1-30-50	2-16-50	9-29-49	10-21-49	9-29-49	10-22-49	2-7-50	10-3-49	10-22-49	10-6-49	10-22 to 25 49	10-10-49	10-23-49	10-23-49	10-23-49
80 m/															0		
85																	
90														0	1		
95																	
100												0					
105																	
110					0					0					1		
115															2		
120														1			
125															1		
130															6		
135	0	0			0		1					3					
140								0	0						1		
145		4													3		
150			0	0						1							
155		2													1		
160			0				2	1							2		
165					0							0					
170		1	1	0											2		
175															1		
180		3					4	5	0								
185	3														3		
190				1											2		
195		2									0				3		
200								4	0	0			0				
205		3									0				4		
210				(0									0		0		
215		3		(2									0		6		
220								2			4						14
225				1											7	4	
230																	
235	8	4											0		4		
240			0					7			0					7	7
245						1									5		
250													1				
255		1														4	
260						1		4									22
265		1									2		0				
270																7	13
275		4				1											
280			1					9	0						11		47
285											8		1			7	
290		4				1									10		14
295								16									
300		4	2			3		1	1		3		0		8	9	39
Totals	11	35	4	4	0	7	7	49	1	1	17	3	2	1	61	62	156

Table III

Mean Abundance of Set of Young Razor Clams-September 28 to October 25, 1949

Distance in meters from High Water	Average number of clams per square meter by area								
	I	II	III	IV	V	VI	VII	VIII	Average
300 to 261	3.25	1.67	8.67	4.33	.33	13.00	7.67	28.25	8.40
260 to 221	4.33	1.00	5.50	0	.50	5.33	5.00	14.50	4.52
220 to 181	2.50	X	3.00	1.00	0	4.00	1.00	14.00	3.64
180 to 141	2.50	0	3.00	1.00	0	X	1.60	X	1.38
140 to 101	0	0	.50	0	3.00	1.00	2.20	X	.96
100 to 60	X	X	X	X	0	0	.50	X	.17

Table IV

Mean Abundance of Set of Young Razor Clams for Areas I and III

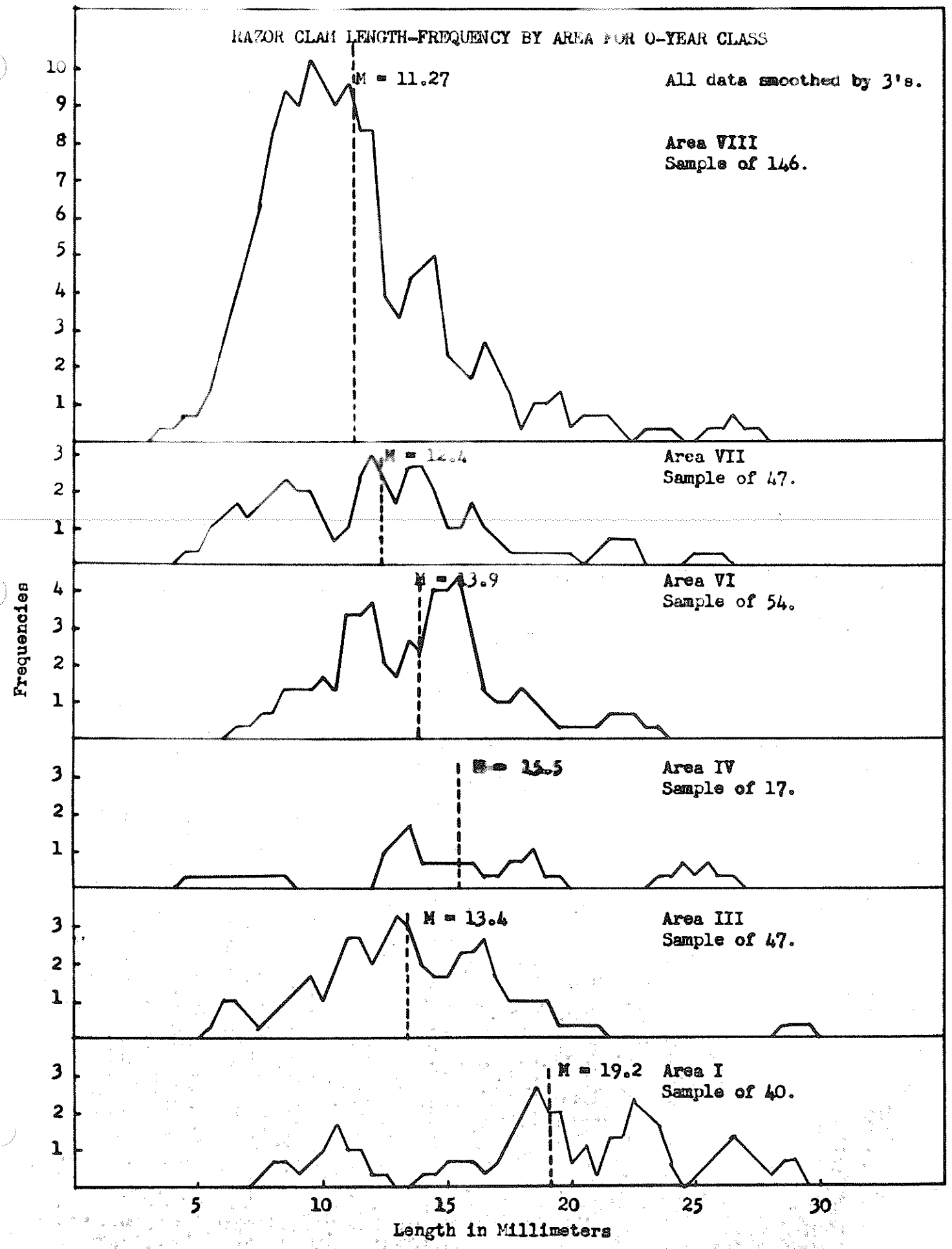
Distance in meters from High Water	Average number of clams per square meter by area				
	Area I			Area III	
	Sept.-Oct. 1949	Dec.-Jan. 1949-50	Feb. 1950	Sept.-Oct. 1949	Feb. 1950
300 to 261	3.25	1.00	X	8.67	.50
260 to 221	4.33	0	1.00	5.50	X
220 to 181	2.50	X	.75	3.00	0
180 to 141	2.50	.33	0	3.00	0
141 to 101	0	X	X	.50	0
100 to 61	X	X	X	X	X

the principle tide zones. In area I and area III the December, January and February screenings may be somewhat inaccurate as to meters from high water line. The winter storms may have changed the location of the high water mark (much of the character of the beach changes during the course of winter weather). The stakes that had been driven as fixed markers were either washed, buried or knocked down by rolling logs so they could not be found. All distances from high water mark are corrected for a standard total distance of 300 meters. It is assumed that during the tides October 21 to 23 for practical purposes the measurements (high to low water) were to the same low tide level. All measurements were corrected to have equivalent tide zones for comparison as to number and size of the set. The location of the numerically designated areas are given at the bottom of Table I.

Length Frequency Data on the 1949-50 Set of Young Clams

With the help of Messrs. Donald McKernen, Roger Tollefson, Dean Marriage, Jack Van Hyning, and Sigurd Westrheimm an excellent sample of screenings were obtained over the October 21 to 23 tides. These gave sufficient numbers of clams for comparison of sizes at different tide levels and on different areas of beach. Figure 1 contains the length frequency of clams found by area. There are not many marked differences in size distributions over the different areas. Area II and V were omitted because sufficient clams were not obtained for graphing purposes. In the southern areas and especially in the Cove a greater percentage of small clams were found, which is probably the reason for a smaller mean in the more southern areas. The range of size distribution does not differ markedly in the different areas.

FIGURE 1


RAZOR CLAM LENGTH-FREQUENCY BY AREA FOR 0-YEAR CLASS
All data smoothed by 3's.
M = 11.27
Area VIII
Sample of 146.
M = 12.4
Area VII
Sample of 47.
M = 13.9
Area VI
Sample of 54.
M = 15.5
Area IV
Sample of 17.
M = 13.4
Area III
Sample of 47.
M = 19.2
Area I
Sample of 40.
Frequencies
Length in Millimeters
5
10
15
20
25
30

To analyse the variations of size in relation to the distance on the beach from high to low water each area was divided up into five zones of about 40 meters each. The lengths of clams found in each zone were plotted separately (See figure 2). From the means of the size distribution a progression seems to occur, with the smaller clams being found in the lower tide zones. This is the opposite effect from what would be expected from assuming first, an equal distribution of the young clams upon first setting, and secondly, a greater rate or mortality on the higher more exposed areas of the beach. In this supposition the younger clams with less time exposed to beach mortality should have the more equal distribution from high to low water, a greater percentage of large clams should be found in the lower tide zones and a greater percent of smaller clams in the upper tide reaches. The result would be a shifting of the mean to the left with the progression from low to high water, less clams on the upper reaches of beach but composed mostly of the smaller clams.

Growth in the 1949 Year Class

The only feasible method of checking for growth in a 0 year class is through progressive increase in the lengths as exemplified by the mode or the mean. (The mean is subject to fluctuation with any differential mortality on size and more subject to variation with degrees of selectivity in the sampling). In the case of a higher mortality amongst the smaller clams the mean would tend to increase while the mode showed the better progression of actual growth, unless of course the mortality was high enough to destroy the previous mode. Two main sources of error thus enter the study of growth: (1) errors caused by differential mortality changing the mean or mode and (2) errors caused when the method of obtaining the sample has a degree of selectivity for particular sizes.

FIGURE 2

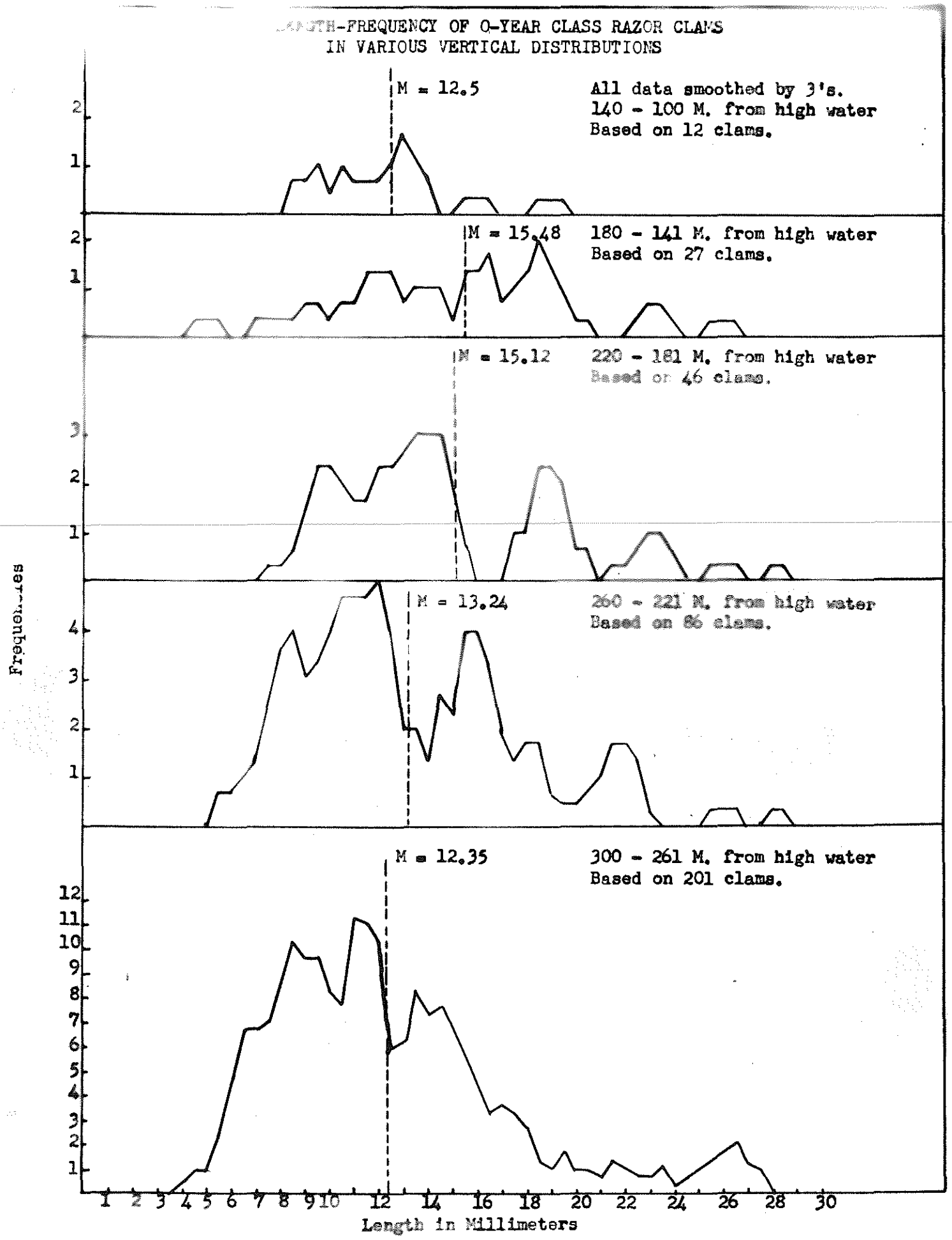
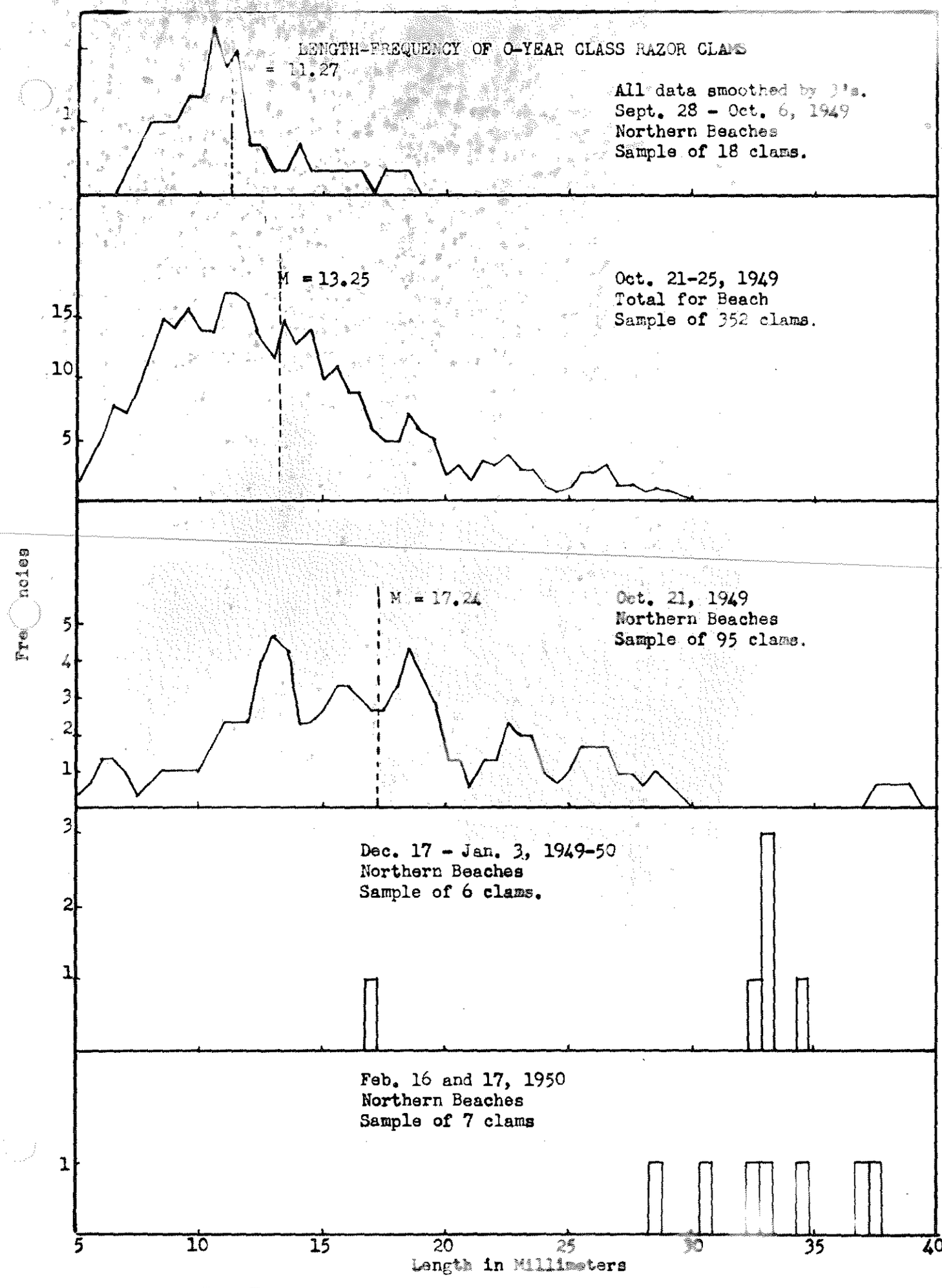

LENGTH-FREQUENCY OF 0-YEAR CLASS RAZOR CLAMS
IN VARIOUS VERTICAL DISTRIBUTIONS
M = 12.5
All data smoothed by 3's.
140 - 100 M. from high water
Based on 12 clams.
M = 15.48
180 - 141 M. from high water
Based on 27 clams.
M = 15.12
220 - 181 M. from high water
Based on 46 clams.
M = 13.24
260 - 221 M. from high water
Based on 86 clams.
M = 12.35
300 - 261 M. from high water
Based on 201 clams.
Frequencies
Length in Millimeters

Figure 3a and 3b (a graph of the two early samples) demonstrate differences of mode and mean which might be caused by growth but also which might be subject to several other errors such as additional setting taking place between the time of the two samples, and a marked difference in the height of the tide at which the sample was taken, the earlier sample coming from higher reaches of the beach than the latter sample. Also the two areas sampled aren't entirely comprable, in that the latter sample is heavily weighted by the Seaside beach and the Cove area (Areas VI, VII and VIII) while the earlier sample is entirely from the northern beach (Areas I, II, III, IV and V). As better sequence can be seen from figures 3a, 3c, 3d and 3e, where the northern beach area alone is compared. Except for the fact that similar areas are being compared all the other errors remain however. The latter two samples taken during the winter months are of insufficient magnitude with too vast a spread of lengths to show anything definite on growth. Also the suitability of screening as a means of obtaining a random sample of the catch becomes questionable as the clams reach the size occurring in the two samples. From February on, all samples of the 1949 year class were taken by digging. The results of screening gave so few clams that length frequencies could not be made; and although digging may be slightly selective for the larger clams, screening would be selective for the smaller sizes since the larger clams sometimes approached a depth below which it is feasible to dig for screening purposes. Finding several necks in the screen, obviously from the 1949 year class, and finding necks and clams in the hole afterward further substantuated doubts on the value of screening. Although good samples were despeately needed during this period they were almost impossible to obtain. Rough winter weather limited most of the screenings to upper limits of the beach. Breakers swept well up the beach with a rough surf even during the lower tide periods.

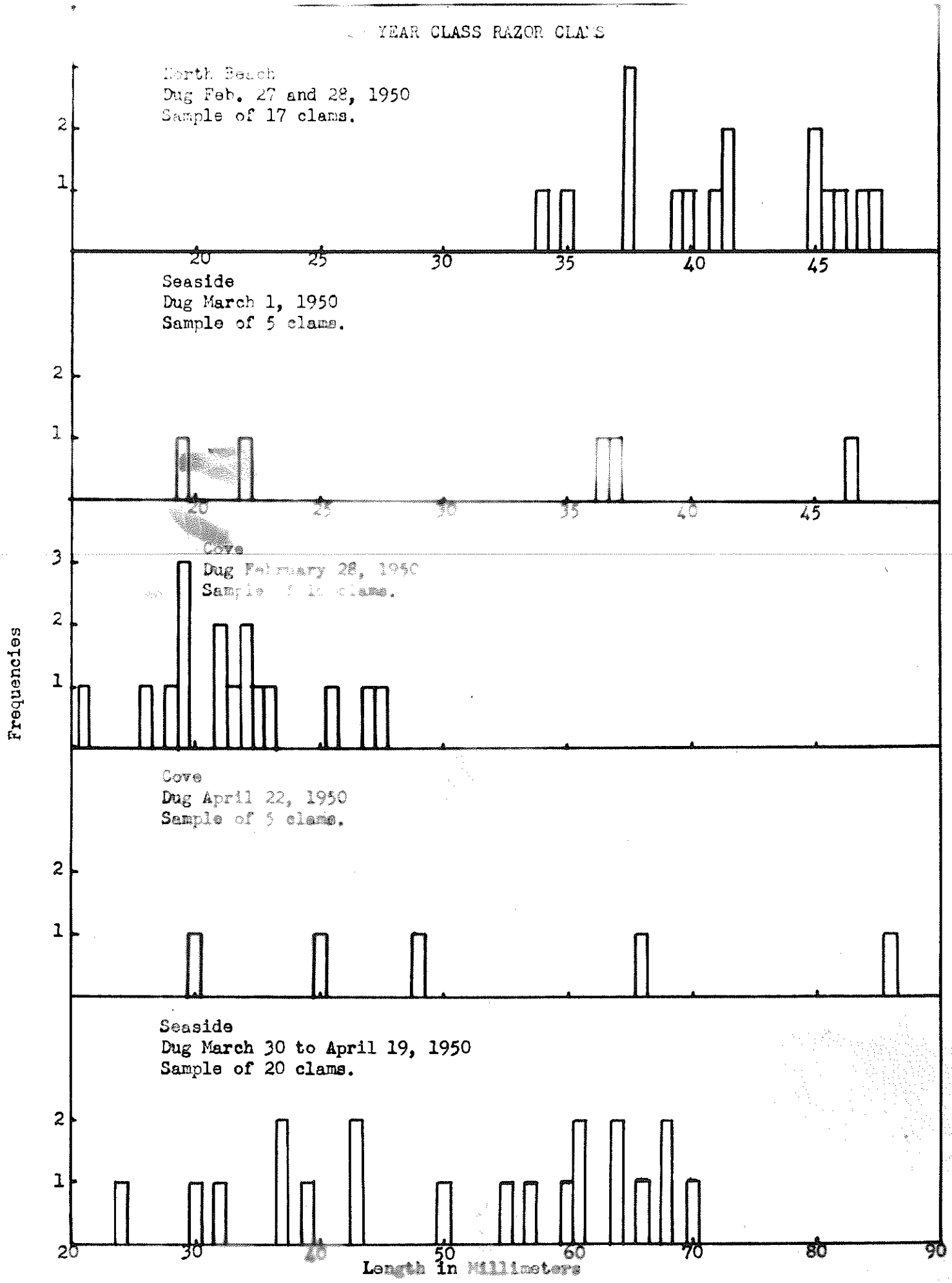
FIGURE 3


LENGTH-FREQUENCY OF 0-YEAR CLASS RAZOR CLAMS
M = 11.27
All data smoothed by 3's.
Sept. 28 - Oct. 6, 1949
Northern Beaches
Sample of 18 clams.
M = 13.25
Oct. 21-25, 1949
Total for Beach
Sample of 352 clams.
M = 17.24
Oct. 21, 1949
Northern Beaches
Sample of 95 clams.
Dec. 17 - Jan. 3, 1949-50
Northern Beaches
Sample of 6 clams.
Feb. 16 and 17, 1950
Northern Beaches
Sample of 7 clams
Frequencies
Length in Millimeters

Digging was slightly better than screening; this method failed to yield a sufficiently large sample. For every trip to the beach when some screening was done, at least three trips found the surf too rough to get on even the median ranges of the beach. To obtain accurate and sufficient screenings through the winter months more help would be needed and a year with a heavier set would have to be utilized. Screenings at Seaside and especially at the Cove, with their greater numbers of clams, might have been more successful but the concentration at Seaside was little better originally than some of the areas on the north beach. The Cove seemed to present an area peculiar in itself which would be difficult to utilize as an average condition for the beach as a whole.

The samples that were obtained show a progressive growth throughout the winter months if the December-January and the February samples can be considered as representative.

The samples in the spring were obtained from digging with great care being exercised to obtain a random sample of all sizes. Again none of the samples were large enough but they were as large as the time permitted since during February and March only a few tides were such that clams could be obtained. During April the tides were better but other work took first precedent on tides available. Of especial interest is the size frequency obtained from digging in the Cove area. (Figure 4c and d) It appears as though the Cove had the greatest survival of the smaller clams, a mode of greater magnitude was found originally in that area than any other area of beach (See Area VIII, figure 1). The survival at Seaside seems to be divided between the two modes, the very small clams and the larger clams. The north beaches seem to have virtually none of the smaller mode, although in most areas it was present during the October screenings. To what extent the discrepancy of sizes in the various areas is due to different environmental


YEAR CLASS RAZOR CLAMS
North Beach
Dug Feb. 27 and 28, 1950
Sample of 17 clams.
Seaside
Dug March 1, 1950
Sample of 5 clams.
Cove
Dug February 28, 1950
Sample of 14 clams.
Cove
Dug April 22, 1950
Sample of 5 clams.
Seaside
Dug March 30 to April 19, 1950
Sample of 20 clams.
Frequencies
Length in Millimeters

conditions, to differential size mortality, or to discrepancies in the method of sampling is not at present known. To properly determine the causes of the discrepancy more work will be required.

Adequate samples to determine growth were not obtained until May of this year. During the month excellent weather prevailed in conjunction with very favorable tides. In all, probably 1000 clams of all sizes were dug from different areas of the beach. Figures 6, 7 and 8 give the length frequencies of the clams dug by area.

In the process of distinguishing between the clams of one and two annual checks respectively, the overlapping of modes makes any segregation on the basis of size impossible. The determination of annual checks on many individual clams is also difficult and subject to many possible errors. All randomly dug samples were analyzed and by shell readings the ones and two's separated. The 1949 year class was then plotted (Figure 5) dividing them first into three general areas and then plotting them as a group. The graphs show a strong tendency toward a bimodal effect amongst the 1949 year class. This is especially true of the area from Gearhart to Sunset Beach and present in a lesser extent in the Seaside area. The area between Peter Iredale and the South Jetty however shows little if any tendency toward a second mode. One explanation might be that through inaccuracy or the shell reading on these samples some clams of two checks were included in the 1949 year class, but a glance at the random samples of total length frequency leads to the conclusion that if any two's are included, the entire group of two's must be present to give such a prominent mode. The close association of the modes in contrast to the growth rates makes the theory of two age classes seem unlikely. Possibly it represents a bimodal pattern in the size of the original set (an interval between two successive sets). More work must be done with the data before an adequate explanation can be reached.

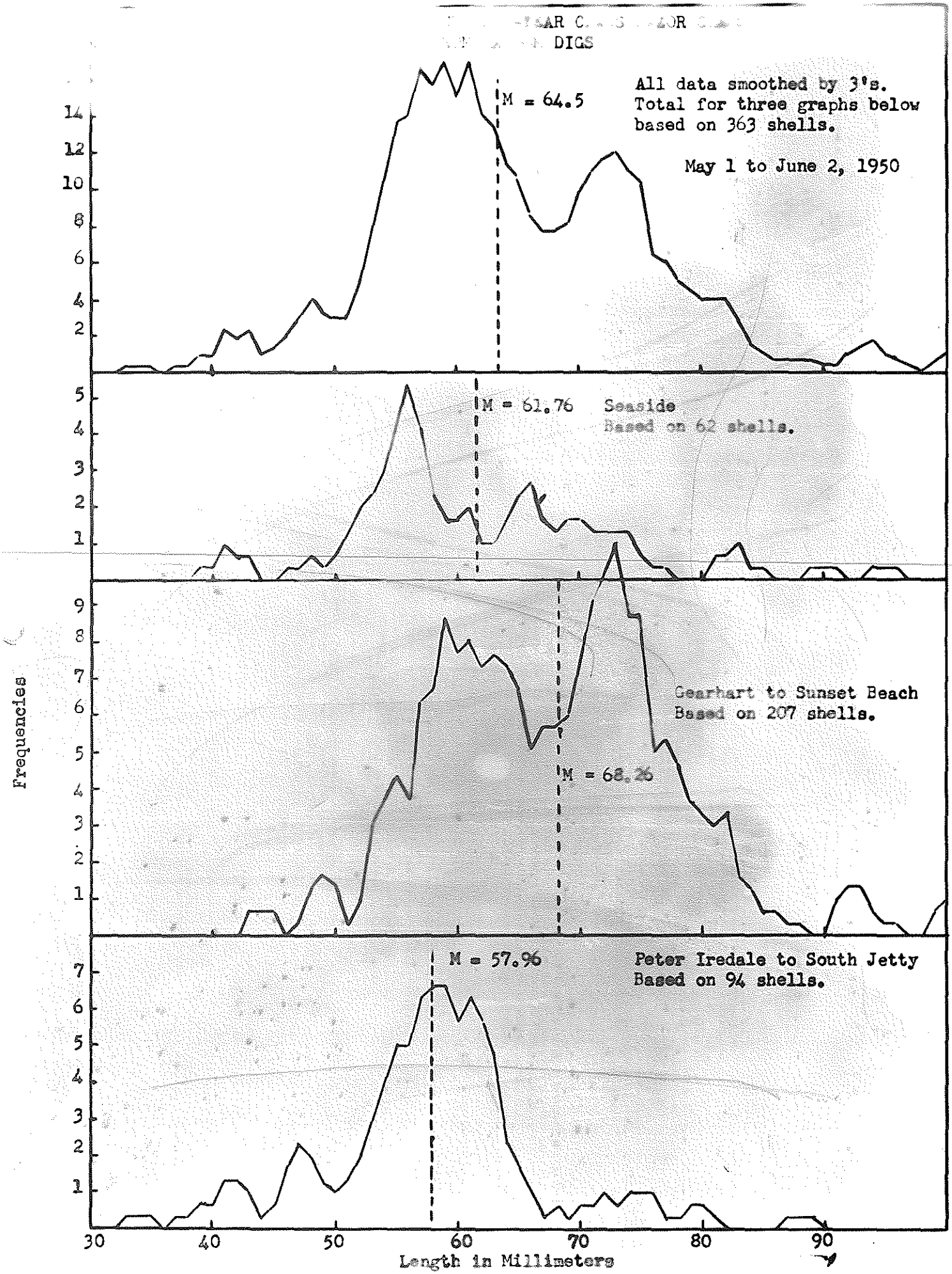

DIGS
All data smoothed by 3's.
Total for three graphs below
based on 363 shells.
May 1 to June 2, 1950
M = 64.5
M = 61.76
Seaside
Based on 62 shells.
Gearhart to Sunset Beach
Based on 207 shells.
M = 68.26
M = 57.96
Peter Iredale to South Jetty
Based on 94 shells.
Frequencies
Length in Millimeters
30
40
50
60
70
80
90

FIGURE 6

LENGTH FREQUENCY OF RAZOR CLAMS

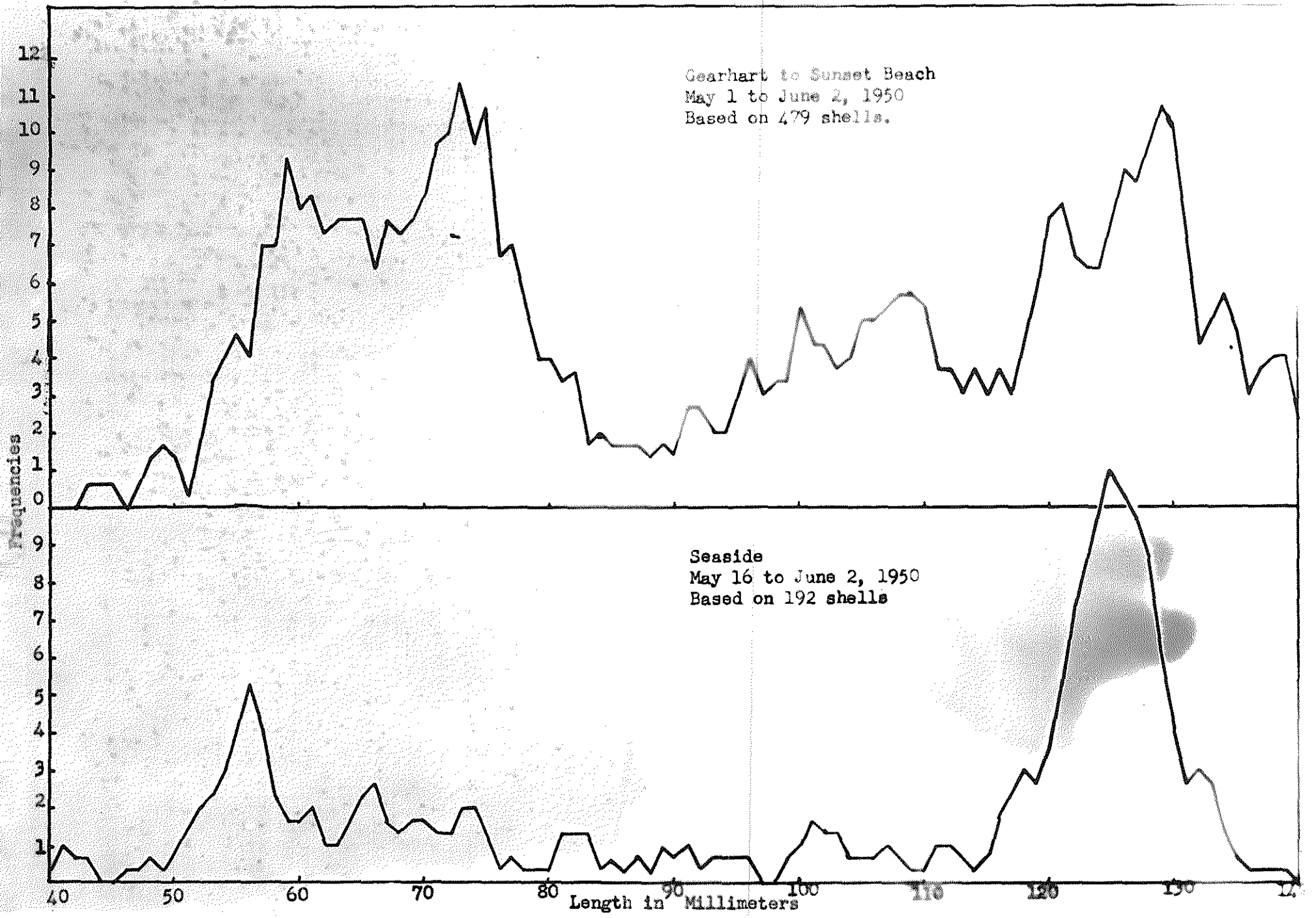
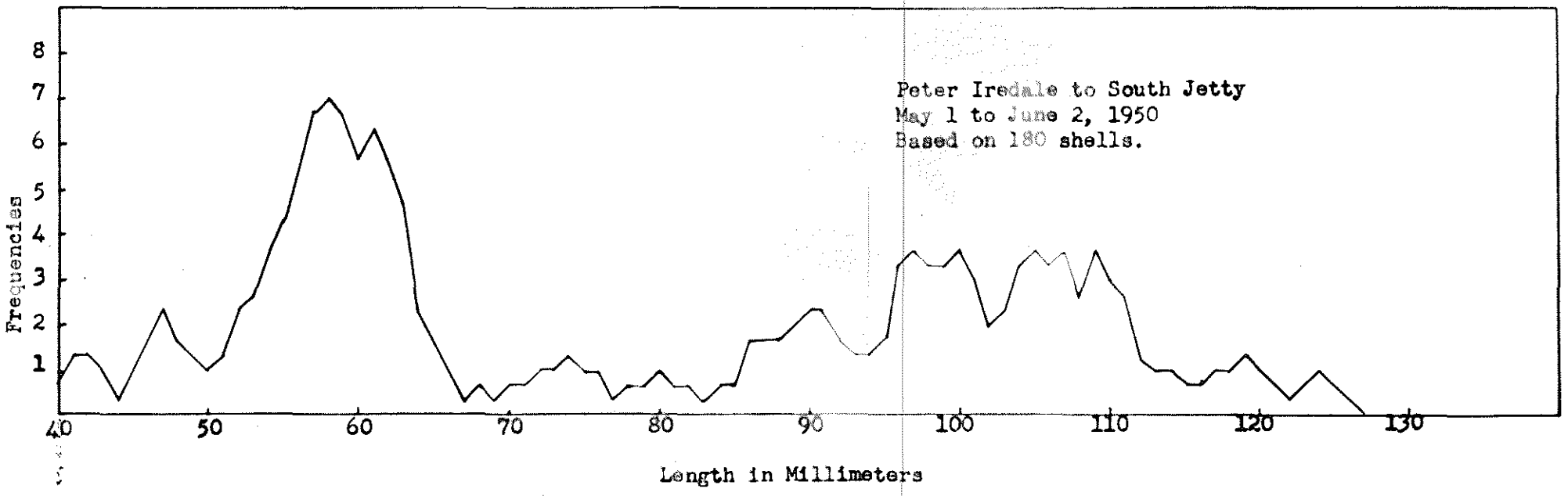


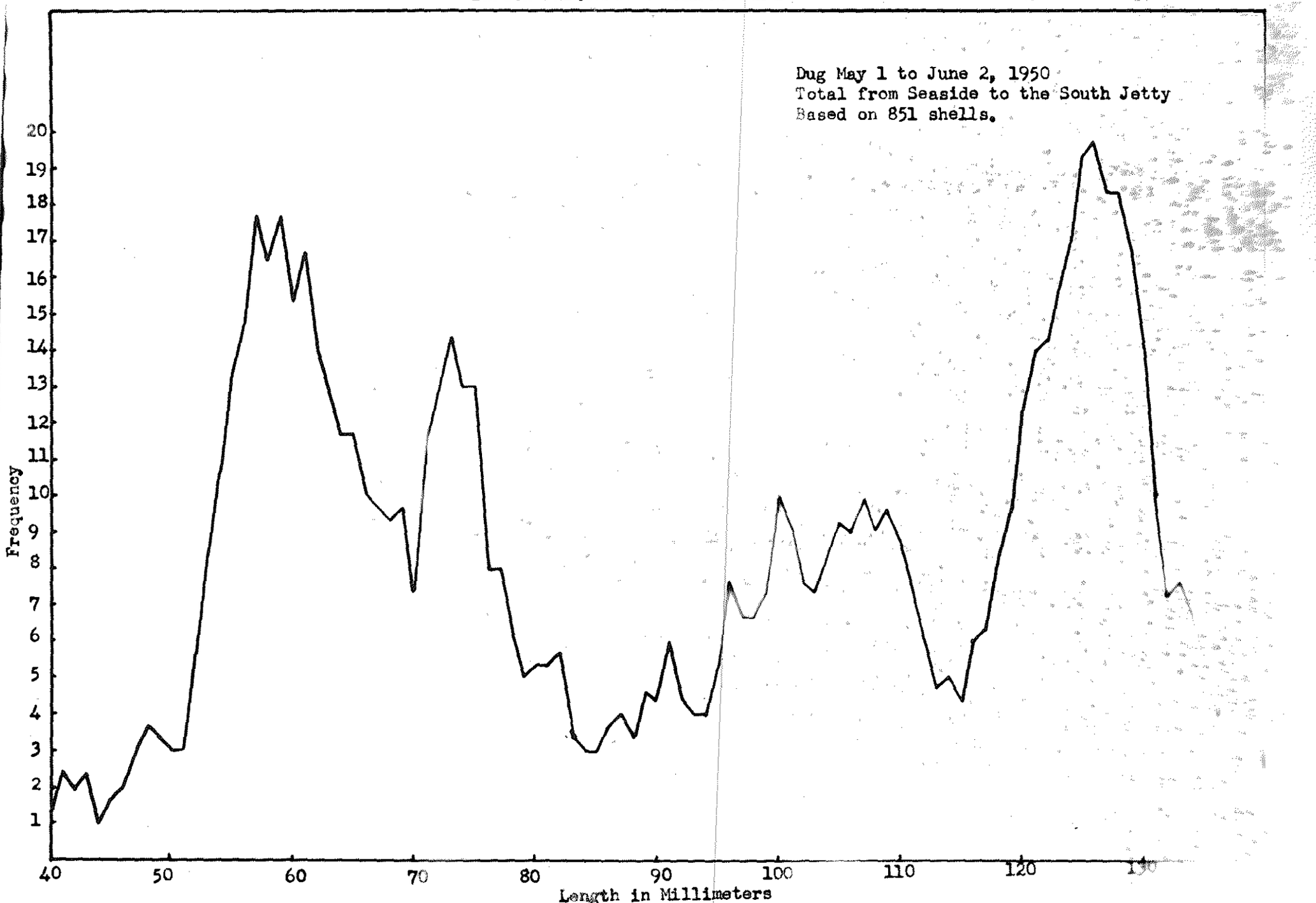
FIGURE 7

LENGTH FREQUENCY OF RAZOR CLAMS



FIGURE

LENGTH FREQUENCY OF RAZOR CLAMS



Samples of the Commercial Catch

Whenever available, shell samples were taken of the commercial catch. These are grouped by months but actually taken at intervals during the course of the month to be representative of varying conditions in the fishery. The length frequencies are plotted in figures 9 to 13. The 1948 data and April 1949 samples were obtained by Dawn Marriage and Roger Tollefson (the 1948 samples were presented in a previous progress report). They have been repeated here for comparison purposes. There is a great variation in sizes obtained during different months, largely dependent upon the type of digging taking place. Some progression of modes due to growth can be seen but an accurate analysis cannot be had until age readings are made of these samples. It seems as a general rule for the 1949 and 1950 data that the month when small sizes were taken are months of the smaller total poundages. All the commercial poundages have not been summarized but Table V is a listing of the poundages for 1949.

Donald Twohy
Charles Weeks

Aquatic Biologist

FIGURE 9

LENGTH FREQUENCY OF COMMERCIAL SAMPLE

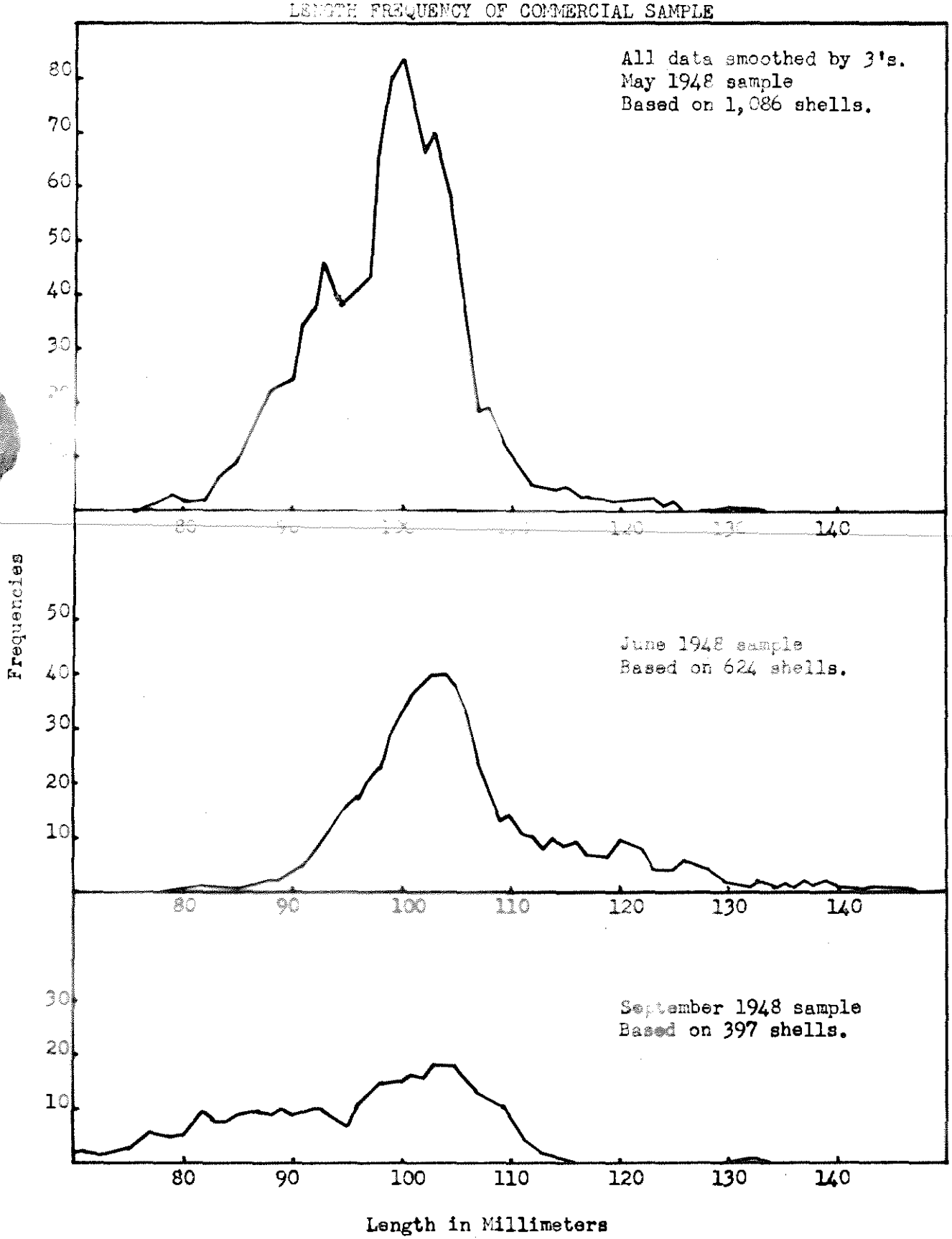


FIGURE 10

LENGTH FREQUENCY OF COMMERCIAL SAMPLE

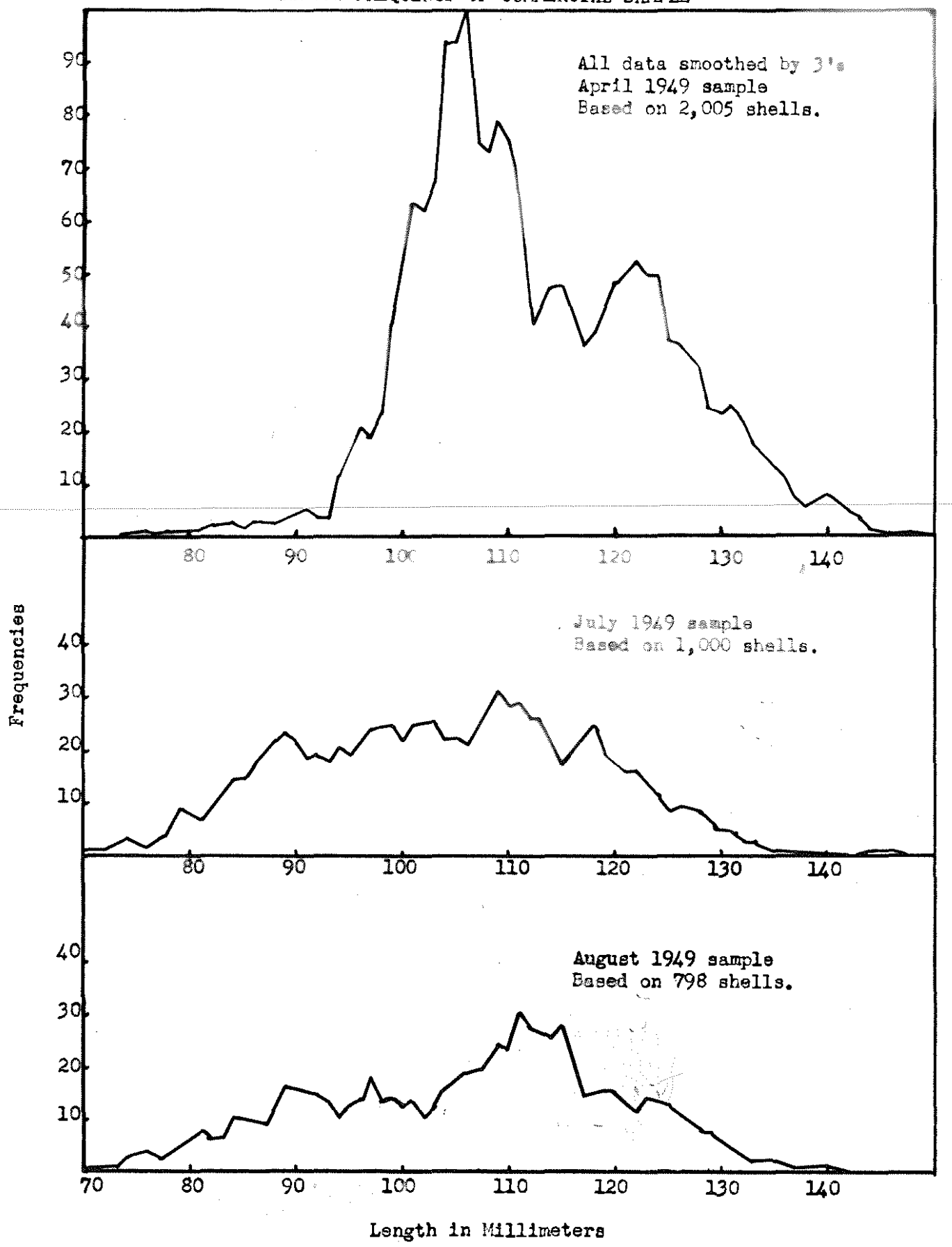


FIGURE 1

[illegible] MERCIAL SAMPLE

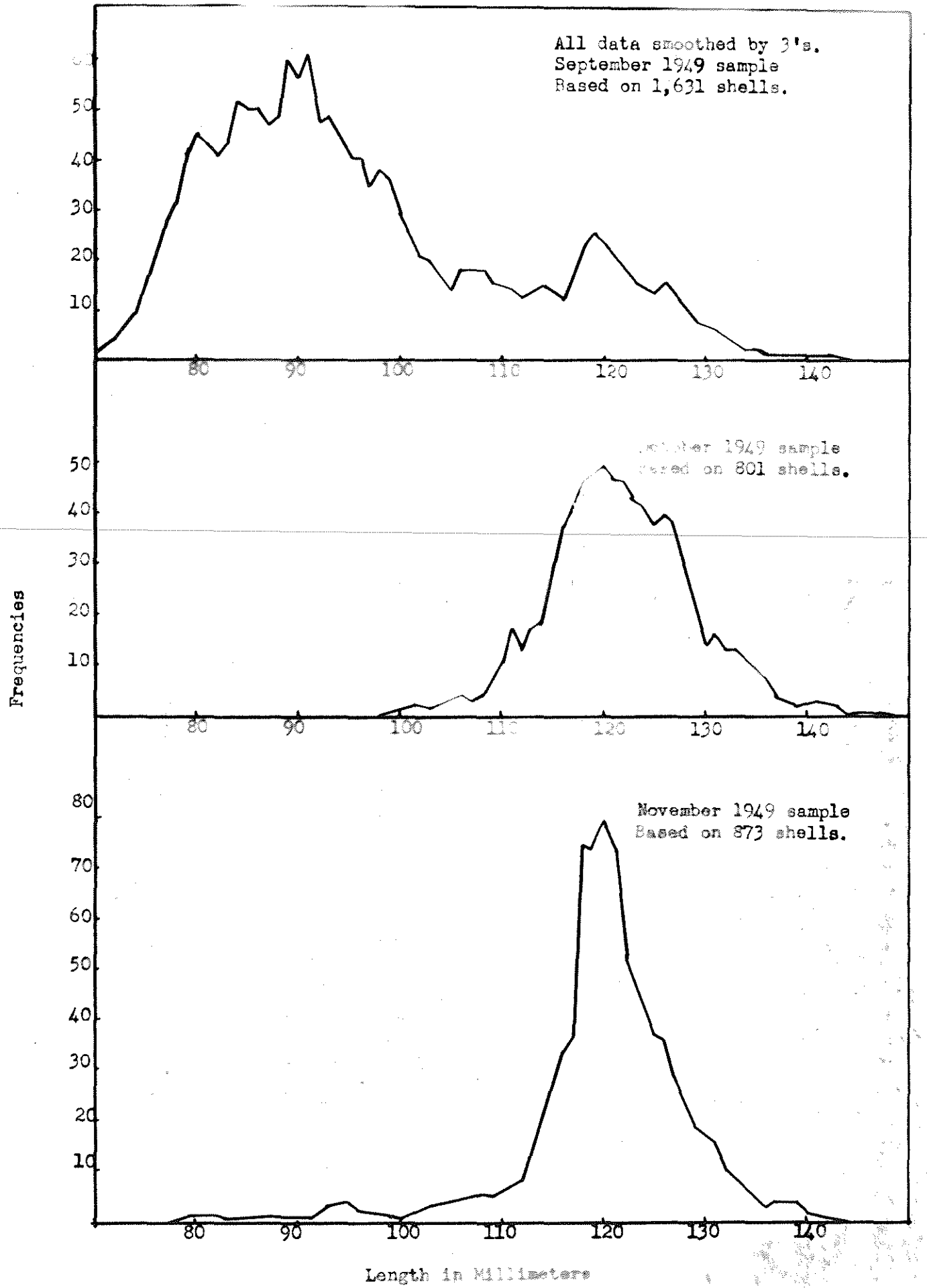


FIGURE 12

LENGTH FREQUENCY OF COMMERCIAL SAMPLE

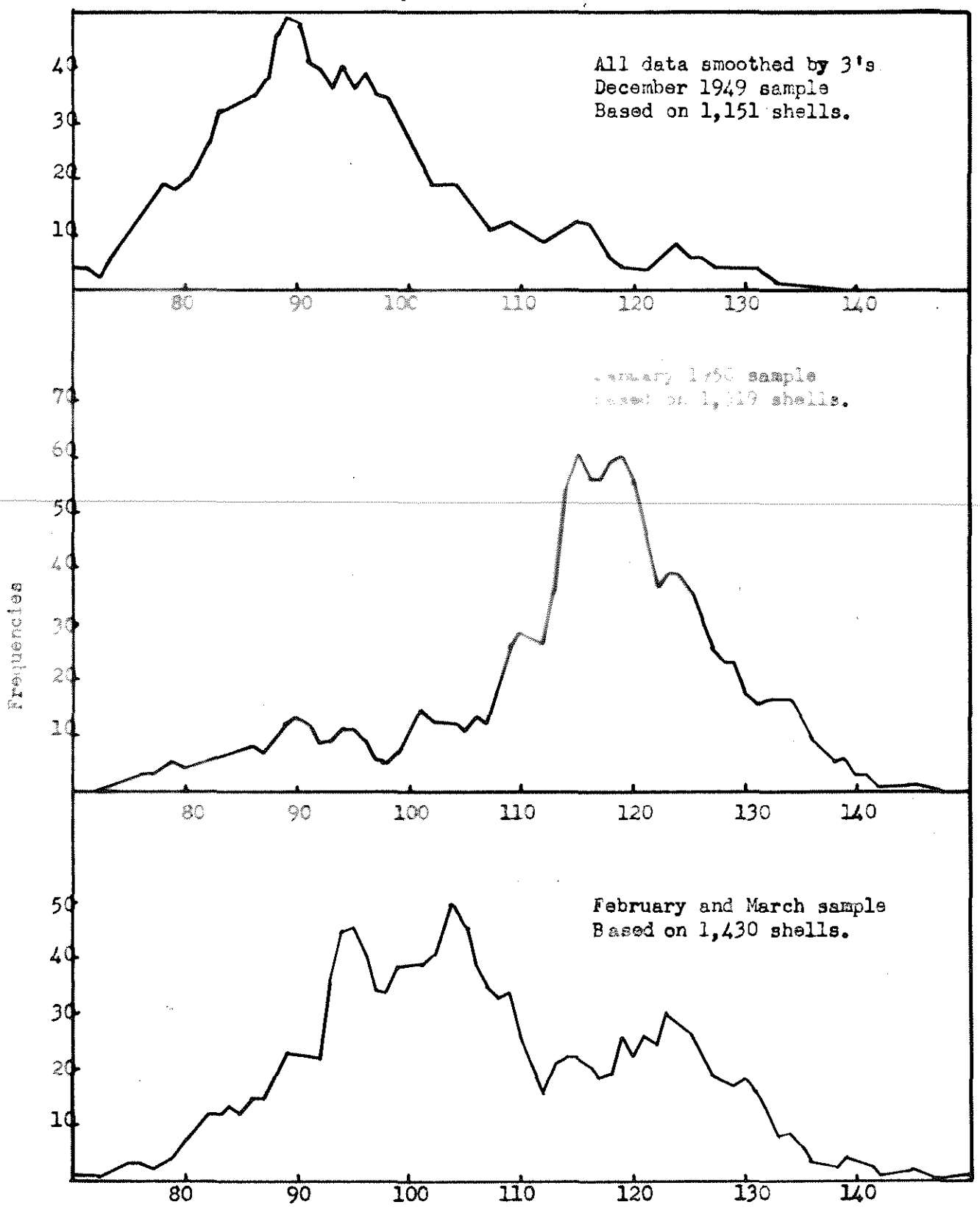


FIGURE 13

LENGTH FREQUENCY OF COMMERCIAL SAMPLE