SHELLFISH LABORATORY--PROGRESS REPORT NO. 20
Newport, Oregon
July, 1950

OBSERVATIONS ON HORSECLAMS OF THE 1949 SET

An excellent opportunity was afforded to observe growth of horseclams of the one-year-plus class when it was discovered April 7, 1950, that a newly formed mud flat in Yaquina Bay, formed September and October 1948 by fill from dredging operations, had thousands of young horseclams embedded in it. Because the horseclams spawn in February and March principally, these clams would of necessity have to be of the 1949 spawn, or one-year-old class.

One hundred seventy seven young clams taken April 7, 1950, were held over night in the aquaria and then divided into three groups according to increasing size. All dead or apparently weak clams were removed and set aside. Of the 177 specimens brought in 143 were acceptable for length weight relationship. Group I (20.0 to 29.9 mm in length - averaging 25.6 mm) with 49 clams averaged 2.39 grams per clam; Group II (30.0 to 39.9 mm in length - averaging 34.0) with 70 clams averaged 5.69 grams per clam; and Group III (40.0 to 49.9 mm in length - averaging 43.2 mm) with 24 clams averaged 12.33 grams per clam. The average length and average weight was 32.8 mm and 5.67 grams respectively.

Terminology used in the following paragraphs concerning age determination and methods of measuring may need some explanation. Whenever "ring" is used it shall be construed as meaning that ring which is formed during the slack season of growth, usually during winter months, by the slowing down of deposition of shell matter of the clam, this showing up as a "ring" on the outer shell and as a "ring" on the ligament bed (scar). The ligament bed is a mirror image of the ligament and is affected by good and poor growing periods as is the outside shell. On this ligament bed can be found the annual growth rings.

Depth of the shell (valve) is the staright line distance from the tip of the umbo to the outer edge of the shell, this line being approximately perpendicular to the length line.

The bodies were removed from the valves and the following measurements made on the shells:

1. Overall length of the shell
2. Overall depth of the shell
3. Length at "annual" ring
4. Depth at "annual" ring
5. Distance from the annual ring to the edge of the shell
6. Number of ligament rings showing in the ligament cocavity
7. Distance from rings to outer edge of the ligament bed

Graphical representation of overall length versus overall depth can be seen in graph #1, the average depth being 21.7 mm and the average length being 33.7 mm for the sample.

Location of growth rings were based on the following criteria which are listed in order of importance.

1. Definite changes in contour of the shell.
2. A close succession of lines causing growth rings.
3. Dark rings formed simultaneously with the growth rings by the periostracum.

Length of the shell at the ring was recorded as was depth of the shell at the ring. Length at the ring versus depth at the ring for the same sample is plotted in graph #2, the average depth being 17.4 mm and the average length being 27.3 mm. Graphs 1 and 2 when superimposed show identical slopes and similar spread further strengthening the length depth data.

Length frequency for both overall length and length at ring (graph #3) showed the average overall length (smoothed by 3's) to be 33.9 mm with one peak at 32 mm. The average length at ring was 27.3 with a peak at 21 mm. Superimposing these two and comparing peaks shows they compare in magnitude and is an indication that at least the rings were being read with a fair degree of accuracy.

It is important to note that the growth rings were deposited prior to April 7, 1950. Just how many days or weeks or months before is impossible to say but it appears from observation that they are formed around January or February.

As a follow up on the formation of ligament rings within the ligament bed each ligament bed was examined for rings. These rings have a bluish color and are easy to locate in the majority of cases. It is the contention of the writer that these rings are laid down the same time the annual ring is laid down on the outside of the shell. The fact that the rings were found in these one year old plus clams is strong evidence that they are formed every year. There will be, of course, a follow up through examination of this same stock of clams throughout this year and especially next winter to find out if and when a ring will be formed.

It was hoped that the distance from the ring to the edge of the shell would show a close correlation with the measurements made on the distance from the ligament ring to theedge of the ligament. However, when plotted against one another (graph #4) the correlation was poor (r = 0.42). This low correlation can be explained in most part, if not entirely, in the method of measuring the distance from the ligament ring to the edge of the ligament bed. An ocular micrometer was used in this case. The ring itself is anywhere from 0.05 to 0.20 ocular units wide (0.07 mm to 0.29 mm) when using 10X oculars and 0.7X objectives, and becomes ill defined with an increase in magnification power. The curvature of the edge of the ligament bed presents another problem in the definition of limits. A tilting of the shell a few degrees can mean a difference of 0.20 ocular units (0.29 mm). These variables account in the main for the poor correlation.

From superficial examination of older shells where the annual rings can be compared with the ligament rings there appears to be a close correlation between the two as far as growth and time of formation is concerned. It has been shown previously that the total numbers of ligament rings and growth rings are the same for any one clam.

Among almost any set of shells to be read for age determination there are a certain number which defy reading, i.e., there appears to be no annual rings formed. This is especially true in climates where the winters are mild and growth progresses relatively uninterrupted. However, after examination of ligament rings it was noted that a ligament ring occurred in 97.7% of the cases, whereas rings on the outer shell could be found in 93.2% of the cases for the same sample.

Summary:

1. A study area for horseclam growth has been set up in Yaquina Bay. This area was formed in the fall of 1948 by dredging activity and was subsequently seeded by natural spawning of adult horseclams the spring of 1949.

2. Of the first sample of clams taken from this area the average size for the first year of life -- at the time the ring was formed -- was 27.3 mm in length and 17.4 mm in depth.

3. The growth ring was formed prior to April 7, 1950.

4. April 7, 1950 these clams averaged 32.8 mm in length and 5.67 grams in weight.

5. Ligament rings appeared on ligament beds of shells even when growth rings on the outer shell were not distinguishable.

FURTHER HORSECLAM CONDITION STUDIES

This report is intended as a supplement to Progress Report #18, August 1949, which dealt with the physical condition of primarily the gonad of the horseclam throughout the various months of the year as related to the present regulation of a closed season from January 1st through June 30th. Spawning season of the horseclam has previously been designated for the Oregon Bays as chiefly February and March. This report will further discuss this matter with additional notes on the spawning season this year.

Yaquina Bay because of its central locality and accessibility has been the primary subject of concentrated research with Coos and Tillamook Bays being secondary.

The following points are taken from Progress Report #18:

1. Standard length-weight relationship for Yaquina Bay horseclams of the lengths 100 mm to 151 mm for the month of November has been established as a basis for comparison for other months of the year. These length-weight figures are used for computations in the following formula.

2. The derived standard formula for determining percent edible meat recovery from uncleaned whole weights is

$$\frac{\text{Wt. of Uncleaned necks} + \text{Wt. of Cleaned bodies}}{(\text{Yaq. Bay Stand. Wt}) \text{ for given length} \times (\text{No. of spec.}) \text{ in sample}} = \%\text{ Edible Meat Recovery from Uncleaned Whole Weights}$$

3. Horseclams reach their poorest condition in March and April and their best condition in November and December.

The "unusually" cold winter and spring had its effect on the spawning of horseclams in Yaquina Bay. Very few spawned-out gonads were noticed this season and it appeared that those clams that did spawn did not do so completely. (A spawned-out gonad is very watery and dark in color and is easily detected).

Furthermore, as could be expected, the spawning season was late, nearly a month so.

A horseclam when dug will squirt water from its mangle cavity, this water from a spawning clam being slightly milky at the peak of spawning. This was noticed during the months of March and April this year.

Looking at the graph (#5) on which the years 1949 and 1950 are compared one can see the trend is similar for both years, with the 1950 season showing the clams to be in better condition (fatter - more meat yield) for the same months than the 1949 season. Completeness of spawning is also evident for the two years with 1949 showing the more complete of the two with less edible meat recovery.

Gonad samples have been preserved and will be sectioned and examined in the future for confirmation of the spawning season by this indirect method of determining time of spawning.

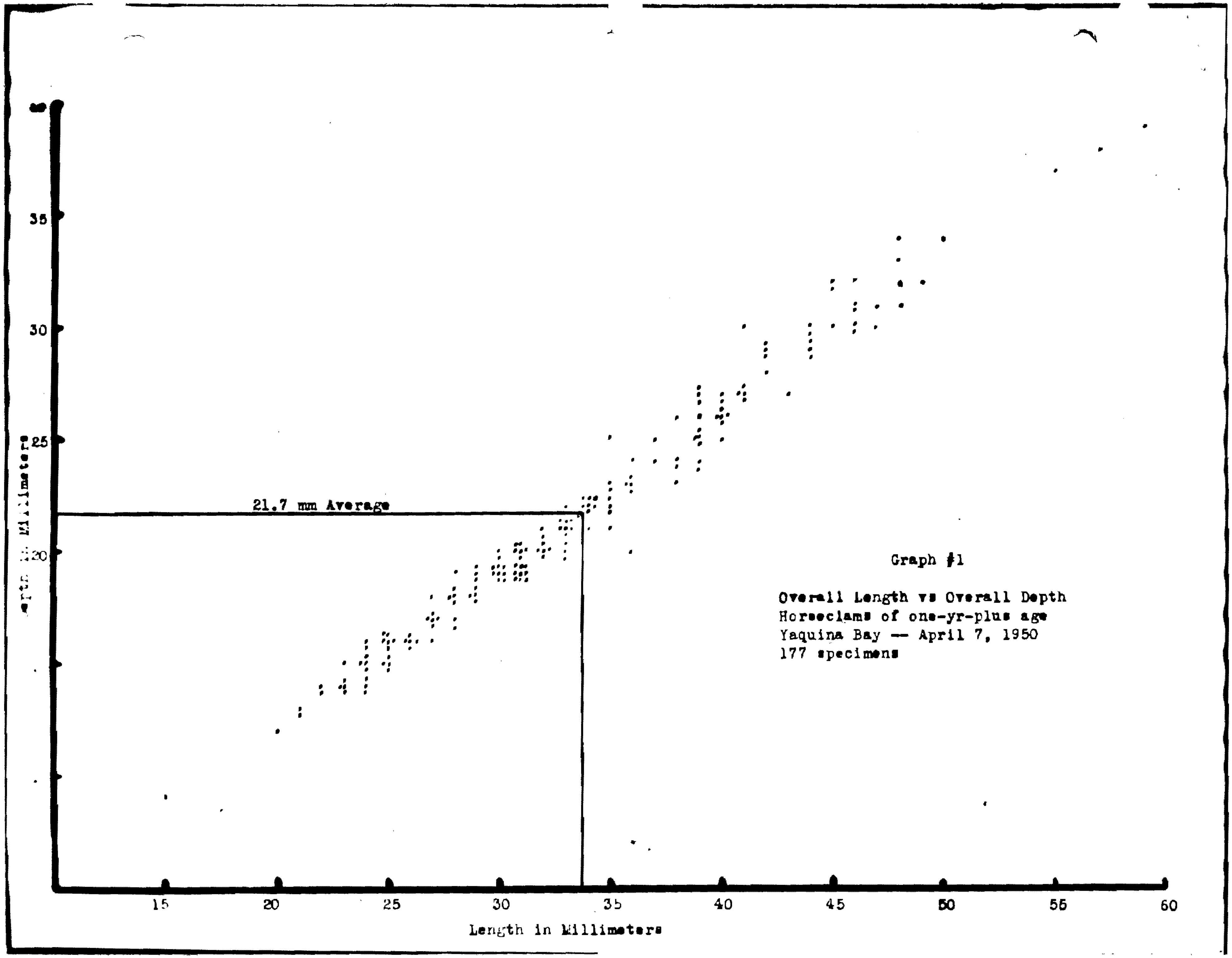
Horseclam samples of Yaquina, Coos and Tillamook Bays when tested for condition the opening month of the season (July) were as follows:

1. Yaquina Bay - 26.2% Edible Meat Recovery from Uncleaned Whole Weight
2. Coos Bay - 30.7% " " " " " " "
3. Tillamook Bay-26.2% " " " " " " "

(Maximum percent recovery for 1949 was 35% and minimum was 18%)

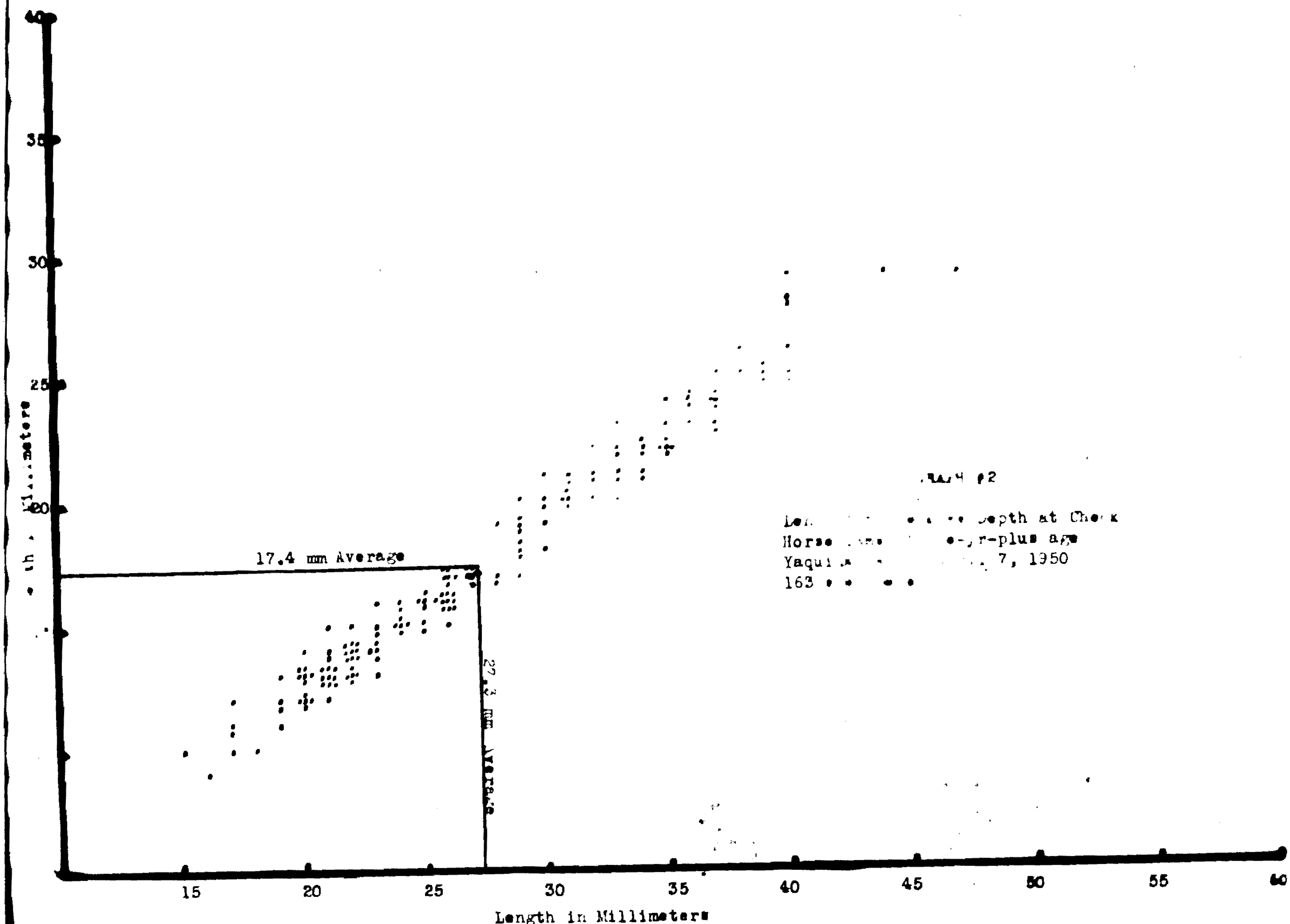
The Coos Bay horseclam has consistently been a fatter clam; the reason for this can only be theorized at present. Perhaps it is better food conditions or the beds have a larger flow of water over them. It has been demonstrated (Effects of Water Circulation on the Growth of Quahaugs and Oysters by C. J. Kerswill, J. Fish. Res. Bd. Can. 7 (9) 1949) that water circulation affects growth of shellfish.

Tillamook Bay on the opening month of the season was identical with Yaquina Bay comparing meat yield. Tillamook horseclams in the past have agreed closely in meat yield.

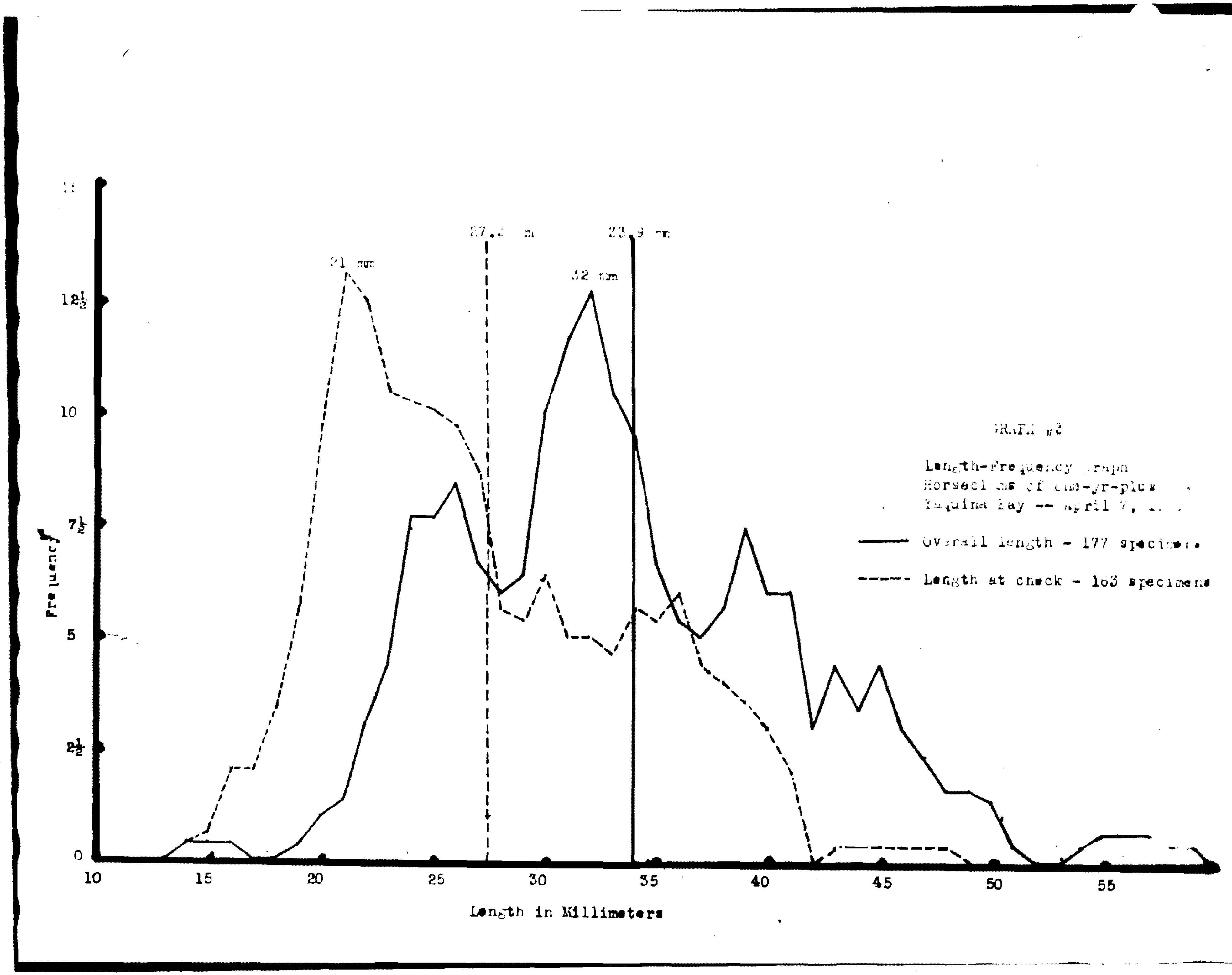


Graph #1

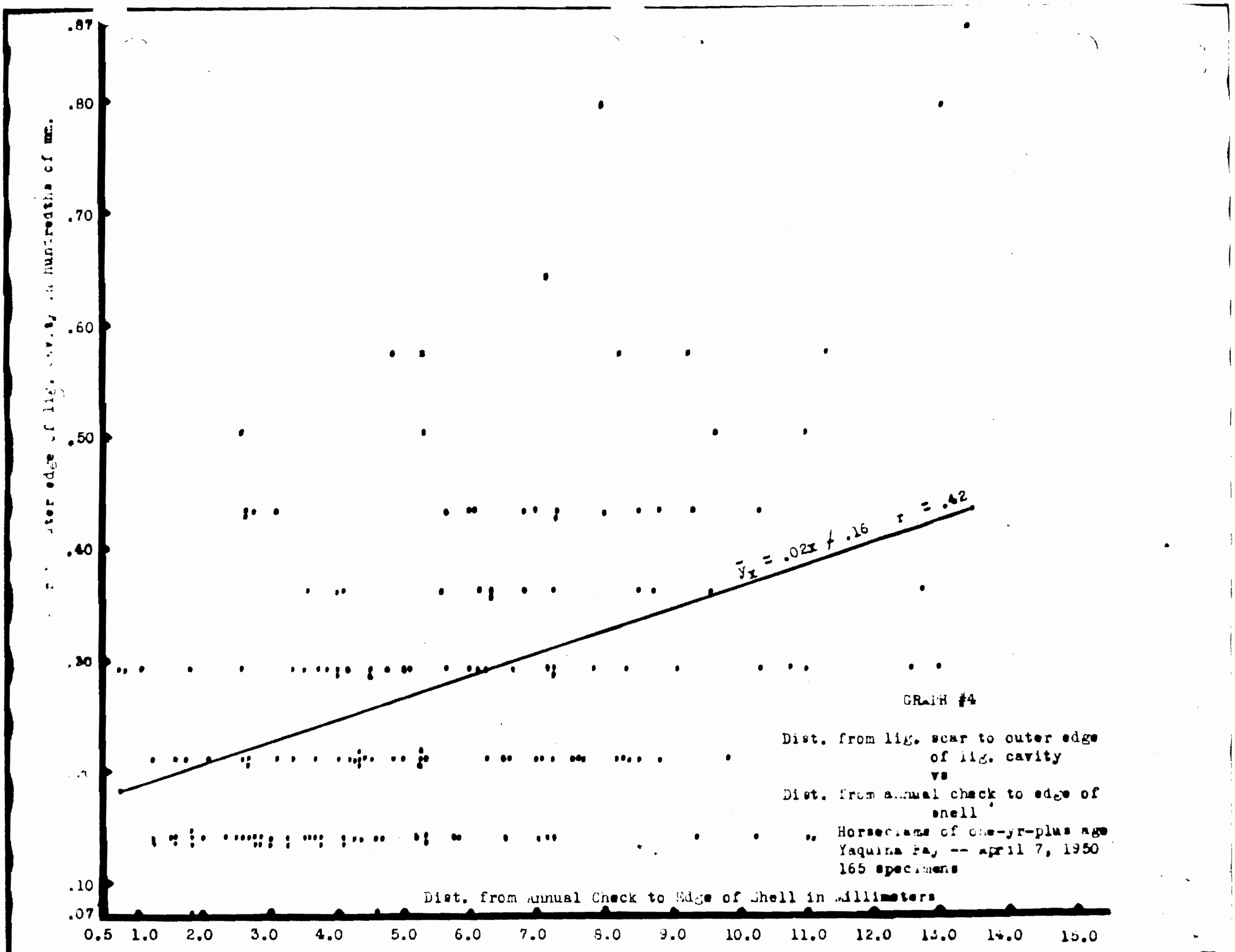
Overall Length vs Overall Depth
Horseclams of one-yr-plus age
Yaquina Bay -- April 7, 1950
177 specimens



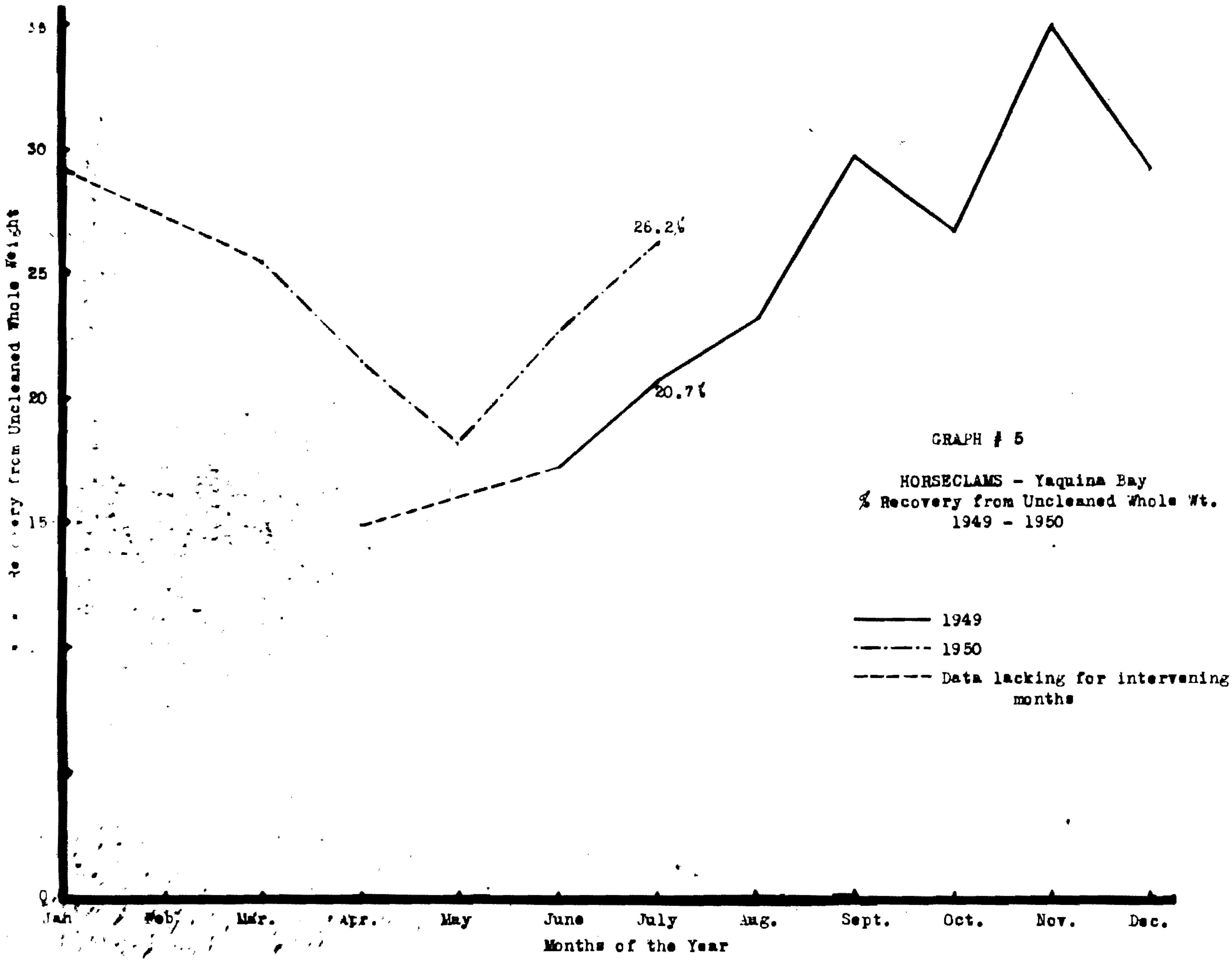
17.4 mm Average
27.3 mm Average
Depth at Check
Horse
-plus age
Yaqui
7, 1950
163
Length in Millimeters
15
20
25
30
35
40
45
50
55
60
40
35
30
25
20



Length-Frequency Graph
Yaquina Bay -- April 7,
Overall length - 177 specimens
Length at check - 163 specimens
21 mm
32 mm
Frequency
12½
10
7½
5
2½
0
10
15
20
25
30
35
40
45
50
55
Length in Millimeters



GRAPH #4
Dist. from lig. scar to outer edge of lig. cavity vs Dist. from annual check to edge of shell
Horseclams of one-yr-plus age
Yaquina Bay, -- April 7, 1950
165 specimens
$\bar{y}_x = .02x + .16$ r = .42
Dist. from Annual Check to Edge of Shell in Millimeters
.87
.80
.70
.60
.50
.40
.30
.10
.07
0.5
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0


GRAPH # 5
HORSECLAMS - Yaquina Bay
% Recovery from Uncleaned Whole Wt.
1949 - 1950
1949
1950
Data lacking for intervening months
26.2%
20.7%
30
25
20
15
0
from Uncleaned Whole Weight
Jan
Feb
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Months of the Year