WILLIAM & MARY

CHARTERED 1693

9-24-1973

A survey in the Elizabeth River for oysters, clams and shell in the vicinity of the proposed TRANSCO construction site

Dexter Haven
Virginia Institute of Marine Science

Paul Kendall
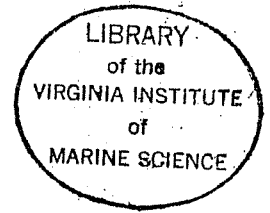*Virginia Institute of Marine Science*

Recommended Citation

A SURVEY IN THE ELIZABETH RIVER, VIRGINIA, FOR OYSTERS,
CLAMS AND SHELL IN THE VICINITY OF THE
PROPOSED TRANSCO CONSTRUCTION SITE.

by

Dexter Haven and Paul Kendall

Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

24 September, 1973

INTRODUCTION

Purpose

This study was conducted by the Virginia Institute of Marine Science at Gloucester Point, Virginia at the request of Woodward Envicon Inc. Its purpose was to evaluate the magnitude of populations of hard clams Mercenaria mercenaria, oysters Crassostrea virginica, and shell in the area of the proposed TRANSCO channel, in the Elizabeth River, Virginia.

The survey was under the direction of Mr. Dexter Haven, Head of the Department of Applied Biology at the Virginia Institute of Marine Science. Collection of the field data was by Mr. Paul Kendall. Statistical aspects of the program were outlined by Dr. Joseph Loesch, and the final report was prepared by Mr. Haven and Mr. Kendall.

The area studied extended from Craney Island to a point 3,800 feet south and from the western edge of Craney Island Reach toward the western shore. At this latter location, it ended where water depths became less than 1 foot MLW (Figure 1). This entire area included: 1) Anchorage areas; 2) Baylor Survey Grounds; 3) The proposed location of the TRANSCO channel; 4) Unassigned public bottoms; 5) Leased oyster grounds belonging to J. H. Miles and Company and Roger West (Figure 1 and Table 1).

Selection of Sampling Sites

The areas to be sampled and sampling techniques were decided on after a preliminary study. This indicated that the area termed

"Anchorage Area", was largely soft mud with no living oysters or clams, and the inshore areas to the west contained only scattered populations of living oysters.

METHODS

The basis for locating areas was an aerial photograph of the Elizabeth River south of Craney Island provided by Woodward-Envicon Inc. on which was shown land marks, Baylor Survey grounds, oyster leases, channels, etc. This photograph was over laid with a grid as an aid in locating sampling sites. In the anchorage area, the grid was one inch = 500'. For the shallower area to the west the area was divided into 250' square segments (Figure 1). Samples were taken in every square in the lease areas. In other locations half the squares were sampled, those sampled being selected with the aid of a table of random numbers.

The corners of private oyster leases shown in Figure 1 were marked prior to the study by wooden stakes stuck in the bottom and buoys by employees of Woodward-Envicon.

All samples collected in the survey were obtained with patent tongs operated by an experienced waterman using a boat chartered by the Virginia Institute of Marine Science. Patent tongs were used because they efficiently collect bottom material within a known area. Those used in this program raised material from an area of 1.004 square yards.

Bottom samples were collected as follows: the boat was first positioned at the approximate center of a desired square with the aid of a sextant using locations on shore or buoys as reference points.

Next, two separate grabs were made in each square with the boat being moved slightly between grabs. An exception to the preceeding sampling plan was in the anchorage area where eight grabs were made in each square. In most instances the tongs raised mud or sand along with the oysters and shell. This was removed by rapidly raising and lowering the tongs in and out of the water. This washed out mud and sand, but retained material larger than about one inch.

Bottom type was determined for each square by examining material raised by the patent tongs and by probing the bottom with a pole. The oysters and hard clams collected in each grab were totaled and measured. Later using the area sampled by the tongs (1.004 yd^2), the average density per square yard was calculated for each square and for representative areas.

Shells raised by the dredge were almost always whole or fragmented oyster shells. The quantity recovered from each square was measured in quarts in respect to being "buried" or "surface" shells and results expressed as number of quarts/yd^2. Buried shells were recognized by their black coloration. Surface shells were recognized by their light brown color and by the occurrence on the shell of fouling organisms such as barnacles, bryzoans or mussels. The significance of shell is that it is often used to "stiffen" muddy bottoms so that oysters may be planted on top. Also, shells which are not buried may serve as sites for the attachment of oyster larvae.

Observations were made on the occurrence of submerged aquatic vegetation.

The methods used to calculate density of oysters per acre, numbers
of oysters per bushel and various conversion factors are shown in
Table 2.

MSX and Pollution in the Elizabeth River

The Elizabeth River, a tributary to the lower James River, is
an industrialized region with much shipping and several sewerage
outfalls. As a result of the sewage and vessel activity, the area
is classed as restricted for the harvest of oysters by the Virginia
Bureau of Shellfish Sanitation. Oysters grown in the Elizabeth River
may not be marketed directly for human consumption. They may be
marketed, however, if they are first harvested and replanted during
the approved season on State approved bottoms for a period of 15 days
with water temperatures above 50°F. This cultural practice is expensive
since it means a double harvest; seldom is it possible to recover
more than about 70% of the replanted oysters. Therefore, relaying is
today regarded as economically impractical by most oyster growers.

The oyster disease MSX is present in lower Chesapeake Bay in
waters where salinities average above 15 parts per thousand, and the
disease is present in the Elizabeth River. MSX entered the bay in
1960 and made oyster culture economically unprofitable in the high
salinity regions. In years characterized by heavy rainfall, salinities
in down river regions, similar to the Elizabeth River, may drop to the
level when MSX becomes inactive. Therefore, oyster culture may become
temporarily practical in these locations. With the return of high

salinities, however, mortalities may again become excessive.

In summary, the study area in the Elizabeth River is located where it is not economically feasible because of MSX and pollution to culture oysters from seed to market size. The area has been subject to below average salinities in 1971, 1972 and 1973. As a result, mortalities due to MSX seem to have been low and this has allowed scattered populations of oysters to develop.

RESULTS - CLAMS

The entire 375.4 acres in the study area was unproductive of hard clams. Only 12 clams were obtained in 362 grabs (363 yd^2) or about .0003 clams per yd^2. This area included: the site of the proposed TRANSCO channel, Baylor survey grounds, unassigned public bottoms and leased bottoms.

RESULTS - OYSTERS

Anchorage Area

This area shown in Figure 1 as the Anchorage Area plus additional 400 foot wide zones to the north and south contained no living oysters (Table 3 and Figure 2). One very minor exception to this statement occurred in the northern part, but this was in shallow water.

The bottom was soft mud containing almost no shell.

No hard clams were obtained in this area.

This 218.1 acre area tract contained the site of the eastern end of the proposed 45 foot TRANSCO channel, the Baylor Grounds, and the deep and shallow anchorage areas.

Area Between the Western Edge of the Anchorage Area and the Oyster Leases

This 39 acre area of unassigned public bottom had the highest density of oysters and shell of any of the stations sampled. Average density of oysters was 5.7/yd^2 (Table 4; Figures 2 and 3). Average density of surface and buried shell respectively was 3.3 and 5.1 quarts/yd^2. The average length of live oysters was 58.1 mm (2.3 inches). Four hard clams were obtained in all grabs; no submerged aquatic vegetation was observed.

Calculations indicate that at the indicated density there are about 27,588 oysters per acre. Assuming 442 oysters per bushel (Table 2) this would amount to about 62 bushels per acre. This quantity is considered too low to be harvested with any expectation of economic profit since the cost of harvesting this scattered crop would exceed the value of the oysters.

Calculations show about 782 bushels of shell per acre.

An examination of the oysters collected in the tongs indicated that they had originated as a natural set which probably occurred in 1971 and 1972; none appeared to have been planted. The fact that oysters and shell occur on this unassigned (unleased) public bottom suggests that at one time the area was "worked" as leased

bottom or that the ground was used in conjunction with the existing inshore leases.

Areas to the North, West and South of the Leased Areas

These areas of unassigned public bottoms have a total size of 51.6 acres. The northern end contained the inshore section of the proposed TRANSCO channel.

This entire area, with one minor exception, was devoid of living oysters and contained insignificant quantity of shell; no hard clams were found (Table 5, Figures 2 and 3).

Leases of J. H. Miles Co.

Leases belonging to the J. H. Miles Co. will be discussed in two parts: 1) the northern section; and 2) the southern section (Table 6, Figures 2 and 3).

1. Northern Section - Twenty two locations were sampled in this 24.4 acre area and live oysters were recovered in only five squares. At these five stations, the density ranged from 0.5 to 3.0 oysters/yd^2; average density for all squares was 0.3 yd^2. Surface and buried shell were found at the average rate of 0.7 and 2.1 quarts/yd^2, respectively. Mean size of the oysters was 49.9 mm (2 inches). No hard clams were obtained.

Calculations based on average densities indicate about 1,452 oysters per acre or about 3 bushels. This quantity is

regarded as too low to be harvested at a profit by standard dredging methods.

Calculations indicate a total of about 261 bushels of shell per acre.

The bottom in the area renaged from sand to mud. No submerged aquatic plants were seen. The oysters appear to all have originated from a natural strike as did those in the area to the west of the anchorage zone.

2. <u>Southern Section</u> - On this 10.3 acre tract only two of the twelve squares sampled contained living oysters. The average density for the area was $1.6/yd^2$. The mean size of these were 2.1 inches. Average values for surface and buried shell were 1.1 and 2.0 quarts/yd^2, respectively. The bottom type ranged from sand to mud. Four hard clams were obtained (Table 6, Figures 2 and 3).

At the indicated density, calculations show 7,841 oysters per acre or about 18 bushels.

As in the northern sector, the oysters appear to have originated from a natural set; none appear to have been planted. The concentration of oysters in the plot are too low to be harvested at a profit.

Lease of Roger West

On this 32.0 acre tract, ten of twenty eight locations yielded live oysters. One square yielded seventy-five oysters in two grabs,

which was the highest quantity recovered at any location. Average for all squares was $2.4/yd^2$. Mean size of oysters was 60.4 mm (2.4 inches). For surface and buried shell, averages were 1.4 quarts and 2.4 quarts per square yard, respectively. Two hard clams were collected in the area and no vegetation was observed (Table 7 and Figures 2 and 3).

At the sample density calculations indicate an average density of 11,616 oysters per acre or about 26 bushels. Again, as for the other leased bottoms this quantity is too low to harvest at a profit. Oysters appeared to have set in the area during 1971 and 1972; none appear to have been planted. Calculations show a total of 363 bushels of shell per acre.

SUMMARY AND CONCLUSIONS

1. There were insignificant quantities of hard clams in the 375.4 acres sampled. Only 12 clams were recovered in the 362 samples which covered 363 square yards.

2. In the anchorage area and in the 400 feet areas to the north and south there were insignificant quantities of oysters and almost no shell. This large area contained: 1) the anchorage areas; 2) the Baylor ground; and 3) the off shore half of the proposed TRANSCO channel. The almost complete absence of shell strongly suggested that the area has not been productive in the past 10 to 20 years.

3. The areas of unleased public bottoms to north, west and south of the leased areas were devoid of living oysters and shell. It is doubtful, as evidenced by the absence of shell, that these areas had been productive in the past 10 to 20 years.

4. The unassigned bottom between the leased areas and the anchorages contains oysters at an estimated 62 bushels per acre, and shell at an estimated 782 bushels per acre. The oysters are seed sized, and probably originated from a natural set which occurred in 1971 and 1972.

5. The northern leased area of J. H. Miles Company and the lease of Roger West are located in the region of the inshore end of the TRANSCO channel. This area contained from 3 to 26 bushels of seed sized oysters per acre, and from 261 to 363 bushels of shell.

    The leased bottom to the south, belonging to J. H. Miles, contained oysters of similar size at the rate of 18 bushels per acre; shell occurred at 288 bushels per acre. The oysters in all three leased sections probably originated as a natural set.

6. It is evident that the oyster leases investigated in the Elizabeth River are now only marginally productive since sampling showed concentrations ranging from 0.5 to 26.0 bushels per acre. These are such low densities per unit area that it is extremely doubtful if they could be harvested at a profit. That is, the cost of dredging in all probability would exceed the value of the harvest.

7. The quantity of shell recovered on the leased bottoms ranging from 261 to 363 bushels per acre. It is the usual practice of oyster growers who wish to "improve" bottoms to plant up to 10,000 bushels

of shell per acre while 5,000 bushels is considered average. We conclude, therefore, that quantities of shell now existing on the leased bottom are minimal for cultural practices.

8. The area of unassigned public bottom between the oyster leases and the anchorage area contained 62 bushels per acre. While this was the highest density of oysters noted in the area it is debatable if they occur at a density high enough to be worth harvesting.

9. The leased oyster bottoms in the Elizabeth River have little value as sites for growing seed oysters to maturity because the area is classed by the Virginia Bureau of Shellfish Sanitation as restricted for shellfish culture and because of the presence of the oyster disease MSX.

10. Leased bottoms may have value as seed areas where small oysters are transferred to other areas before undergoing excessive mortality from MSX. The magnitude of the present standing crop, however, indicates only a low productivity for this purpose.

Table 1

Areas Sampled and Number of Samples Taken.

Sample Area	Size (acres)	Number of stations	Number of samples (grabs)
Lease of Roger West	32.0	28	56
Leases of J. H. Miles Co.			
northernmost	24.4**	22	44
southernmost	10.3**	12	24
Anchorage areas*	218.1	20	160
Area west of anchorage area and surrounding leased areas.			
a) Areas between the western edge of the anchorage area and the oyster leases	39.0	18	36
b) Area north, west and south of leased oyster ground	51.6**	22	44

* Includes Baylor Survey Ground.

** Measured from TRANSCO-furnished aerial photo and overlaid drawing by polar planimeter.

Table 2

Methods of Calculating Average Density of
Live Oysters and Shells

A. Constants Used:

    1. It was calculated that there are 52.0 quarts in a Virginia

       bushel (data were collected in quarts).

    2. By definition, there are 4,840 square yards in an acre.

    3. By measurement, it was determined that the live oysters

       recovered in this survey averaged 442 per Va. bushel.

    4. Each grab of the patent tongs used in this survey covered

       1.004 square yards of surface area.

B. Example of Calculation:

Oyster Density per Acre = $\underline{\text{Oyster density yd}^2 \times 4{,}840}$ (sq/yds acre)
    (in numbers)

Oyster Density per Acre = $\dfrac{\text{Oyster density yd}^2 \times 4{,}840}{442}$
    (in bushels)

Table 3

Density of live oysters and shell in anchorage area and in
areas to the north and south - August 1973.

Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters		Shell (quarts)			
					Surface		Buried	
			Total	Average/ sq yd	Total	Average/ sq yd	Total	Average/ sq yd
112	Mud	10	32	4	15	1.9	13	1.6
116	"	49	0	0	0	0	0	0
119	"	36	0	0	0	0	0	0
120	"	45	0	0	0	0	0	0
122	"	24	0	0	0	0	0	0
124	"	24	0	0	0	0	0	0
127	"	21	0	0	0	0	0	0
128	"	22	0	0	0	0	0	0
130	"	33	0	0	0	0	0	0
131	"	45	0	0	0	0	0	0
134	"	33	0	0	0	0	0	0
135	"	33	0	0	0	0	0	0
136	"	43	0	0	0	0	0	0
137	"	23	0	0	0	0	0	0
139	"	31	0	0	0	0	0	0
140	"	32	0	0	0	0	0	0
143	"	23	0	0	0	0	0	0
144	"	32	0	0	0	0	0	0
150	"	20	0	0	0	0	0.5	0.1
151	Mud	24	0	0	0	0	0	0

Average length of live oysters: 64.8 mm or 2.6 in.
Mercenaria mercenaria (hard clam): 0
Vegetation: None.

Table 4

Density of live oysters and shell in that area between
the oyster leases and the western edge of the anchorage
area, August 1973.

Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters		Shell (quarts)			
					Surface		Buried	
			Total	Average/ sq yd	Total	Average/ sq yd	Total	Average/ sq yd
15	M	9	0	0	6	3	20	10
16	M	8	4	2	12	6	12	6
31	M	9	10	5	9	4.5	9	4.5
32	M	26	0	0	0	0	3	1.5
38	S	8	0	0	0	0	1.5	0.8
45	M	9	5	2.5	5	2.5	10	5
59	M	10	19	9.5	16	8	5	2.5
60	M	9	14	7	6	3	24	12
67	M	9	9	4.5	4	2	14	7
72	M	10	2	1	0	0	6	3
73	M	10	18	9	9	4.5	9	4.5
79	MS	9	18	9	4	2	12	6
85	MS	8	34	17	13	6.5	13	6.5
90	MS	9	41	20.5	18	9	18	9
96	MS	9	14	7	12	6	12	6
101	MS	7	0	0	0	0	3	1.5
102	MS	10	17	8.5	5	2.5	12	6
111	SM	7	0	0	0	0	1	0.5
Average per yd^2				5.68		3.30		5.11

Average length of live oysters: 58.1 mm or 2.3 in.
M = mud; S = sand; MS = muddy sand; SM = sandy mud.
Mercenaria mercenaria (hard clams): 4
Vegetation: None.

Table 5

Density of live oysters and shell found in the area
north, west and south of the leased oyster ground -
August 1973.

Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters		Shell (quarts)			
					Surface		Buried	
			Total	Average/ sq yd	Total	Average/ sq yd	Total	Average/ sq yd
5	M	27	0	0	0	0	0	0
9	M	28	0	0	0	0	0	0
10	M	28	0	0	0	0	0	0
11	M	27	0	0	0	0	1	0.5
13	M	28	0	0	0	0	1	0.5
17	S	4	0	0	0	0	0	0
25	S	15	0	0	0	0	0	0
26	S	15	0	0	0	0	0	0
33	S	16	0	0	0	0	0	0
34	M	14	0	0	0	0	0.5	0.2
41	S	8	0	0	0	0	0	0
47	S	17	0	0	0	0	0	0
61	MS	12	0	0	0	0	0	0
63	MS	6	0	0	0	0	0	0
86	S	4	0	0	0	0	0	0
87	S	5	0	0	0	0	0.5	0.2
94	S	6	0	0	0	0	0	0
98	S	5	0	0	0	0	0	0
99	S	6	0	0	0	0	0	0
103	S	5	0	0	0	0	0	0
108	SM	4	1	0.5	0	0	0	0
109	SM	5	0	0	0	0	1	0.5
Average per yd^2				0.2		0		0.009

S = sand; M = mud; SM = sandy mud; MS = muddy sand.
Length of live oysters: 49 mm or 2 in.
Mercenaria mercenaria (Hard clam): 0
Vegetation: None

Table 6

Density of live oysters and shell found on two tracts located in the Elizabeth River and leased by J. H. Miles Company – August 1973.

NORTHERN SECTION

Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters Total	Live Oysters Average/ sq yd	Shell (quarts) Surface Total	Shell (quarts) Surface Average/ sq yd	Shell (quarts) Buried Total	Shell (quarts) Buried Average/ sq yd
12	M	30	0	0	0	0	0	0
13	M	28	0	0	0	0	1	0.5
14	M	22	0	0	0	0	4	2
15	SM	7.5	3	1.5	7	3.5	6	3
19	M	21	0	0	0	0	0	0
20	M	29	0	0	0	0	1	0.5
21	M	28	0	0	0	0	1	0.5
22	M	28	0	0	0	0	0	0
23	M	26	0	0	0	0	7	3.5
27	S	7	0	0	2	1	3	1.5
28	MS	9	6	3	4	2	20	10
29	M	9	1	0.5	4	2	3	1.5
30	M	9	2	1	4	2	20	10
31	M	7	0	0	1	0.5	2	1
34	S	14	0	0	0	0	0	0
35	S	6	0	0	2	1	3	1.5
36	M	9	0	0	0	0	*	---
37	M	9	0	0	3	1.5	6	3
41	MS	17	0	0	0	0	0	0
42	M	14	0	0	0	0	0	0
43	M	9	1	0.5	2	1	16	8
49	M	18	0	0	0	0	0	0
Average yd^2				0.30		0.66		2.10

Average length of live oysters: 49.9 mm or 2 in.
Mercenaria mercenaria (Hard Clam): 0
Vegetation: None.

Table 6

(Continued)

SOUTHERN SECTION

Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters		Shell (quarts)			
					Surface		Buried	
			Total	Average/ sq yd	Total	Average/ sq yd	Total	Average/ sq yd
83	MS	8	0	0	0	0	6	3
84	S	10	37	18.5	15	7.5	15	7.5
88	MS	6	0	0	0	0	0.5	0.2
89	MS	8	0	0	1	0.5	2.0	1
90	S	9	2	1	5	2.5	5	2.5
94	MS	6	0	0	0	0	1	0.5
95	S	8	0	0	1	0.5	3	1.5
96	SM	7.5	0	0	1	0.5	7	3.5
100	S	6	0	0	0	0	0.5	0.2
101	MS	7	0	0	2	1	3	1.5
105	S	6	0	0	0	0	1.0	0.5
106	MS	7	0	0	1	0.5	6	3
Average yd^2				1.62		1.08		2.00

* Less than half a quart.
  Average length of live oysters: 52.2 mm or 2.1 in.
  M = mud; S = sand; MS = muddy sand; SM = sandy mud.
  Mercenaria mercenaria (Hard clam): 4
  Vegetation: None.

Table 7

Density of live oysters and shell found on a tract
located in the Elizabeth River and leased by Roger
West - August 1973.

| Station Number (chosen at random)	Sediment Type	Depth (feet)	Live Oysters		Shell (quarts)			
					Surface		Buried	
			Total	Average/ sq yd	Total	Average/ sq yd	Total	Average/ sq yd
37	M	9	1	0.5	3	1.5	7	3.5
38	M	8.5	0	0	0	0	4	2
43	M	9	4	2	6	3	11	5.5
44	M	9	0	0	0	0	0.5	0.2
45	M	8	9	4.5	6	3	9	4.5
49	S, M, St	18	0	0	0	0	0	0
50	MS	9	0	0	0	0	0.5	0.2
51	M	9	0	0	0	0	0.5	0.2
52	M	8	0	0	0	0	*	---
56	SM	14	0	0	0	0	*	---
57	SM	10	9	4.5	15	7.5	15	7.5
58	M	9	17	8.5	6	3	12	6
59	M	8	0	0	0	0	4	2
63	MS	7	0	0	0	0	0	0
64	M	10	0	0	0	0	4	2
65	M	10	0	0	0	0	1	0.5
66	M	8.5	0	0	3	1.5	9	4.5
69	SM	6	0	0	0	0	0	0
70	M	9	0	0	0	0	5	2.5
71	M	10	0	0	0	0	6	3.0
72	M	8.5	0	0	0	0	5	2.5
75	S	6	0	0	0	0	*	---
76	MS	9	10	5	6	3	6	3.0
77	M	10	2	1	1	0.5	7	3.5
78	M	8.5	4	2	3	1.5	4	2.0
82	S	7	0	0	0	0	*	---
83	MS	9	1	0.5	2	1	3	1.5
84	S	8	75	37.5	30	15	25	12.5
Average yd^2				2.35		1.44		2.43

* Less than half a quart.
St = stones.; S = sand; M = mud; SM = sandy mud; MS = muddy sand.
Average length of the live oysters: 60.4 mm or 2.4 in.
Mercenaria mercenaria (Hard Clam): 2
Vegetation: None.
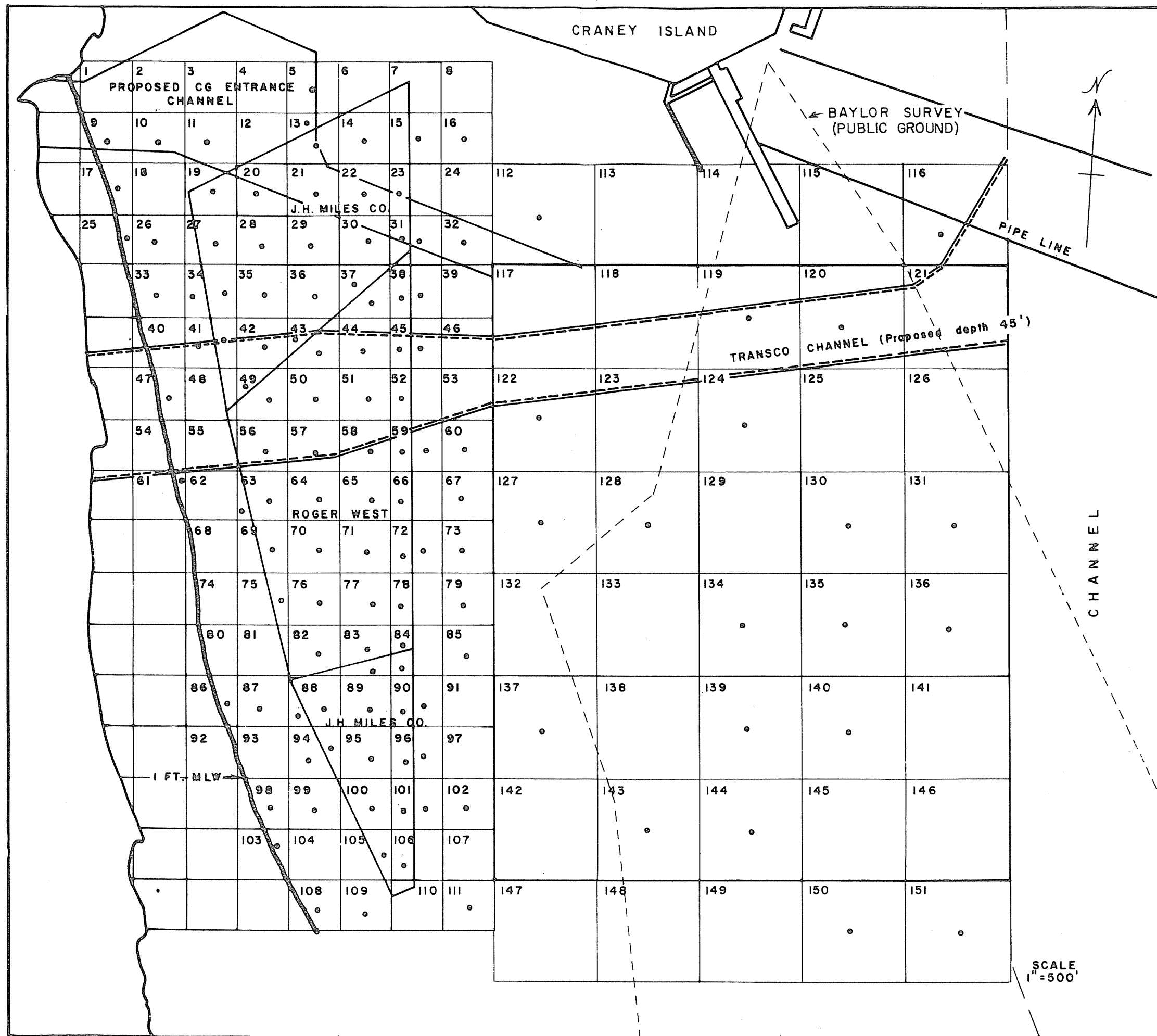
─ELIZABETH─
RIVER
SAMPLING
PATTERN

SHOWING OYSTER
LEASES,
CHANNELS,
AND PUBLIC
GROUNDS
(Dots indicate
stations
sampled)

FIGURE 1.

CRANEY ISLAND

PROPOSED CG ENTRANCE CHANNEL

BAYLOR SURVEY
(PUBLIC GROUND)

PIPE LINE

TRANSCO CHANNEL (Proposed depth 45')

1 FT. MLW

CHANNEL

—ELIZABETH—
RIVER

NUMBERS OF
OYSTERS PER
SQUARE YARD

SCALE
1" = 500'

FIGURE 2.

CRANEY ISLAND

BAYLOR SURVEY
(PUBLIC GROUND)

PROPOSED CG ENTRANCE
CHANNEL

PIPE LINE

TRANSCO CHANNEL (Proposed depth 45')

CHANNEL

N

—ELIZABETH—
RIVER

QUANTITY OF
SURFACE AND
BURIED SHELL
IN QUARTS
PER SQUARE
YARD
(SURFACE
⎯⎯⎯
BURIED)

1 FT. MLW

SCALE
1" = 500'

FIGURE 3.