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Recommended Citation

Haven, D. S., & Kendall, P. C. (1979) Report of sampling conducted in Chuckatuck Creek on leased grounds near the U.S. 17 bridge. Virginia Institute of Marine Science, William & Mary. <https://doi.org/10.25773/h78g-cd21>

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Report of Sampling Conducted in Chuckatuck Creek
On Leased Grounds Near the US 17 Bridge.

Conducted for the
Virginia Department of Highways and Transportation
Projects 6017-061-104, RW-201
& 6017-046-103, RW-201

By

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November, 1979

INTRODUCTION

This report conveys the results of a study of certain leased oyster grounds in the vicinity of the US 17 Bridge across Chuckatuck Creek. The study was made by the Virginia Institute of Marine Science and School of Marine Science of the College of William and Mary for the Department of Highways and Transportation, Suffolk, Virginia. Purposes of the study were to: 1) provide a description of the shellfish resource prior to construction of a new, wider bridge; 2) estimate the value of the oysters and shell on leased areas within the right-of-way; and, 3) provide a basis for a later study after construction to evaluate possible environmental changes. Sampling for the study was conducted at intervals from late June to mid-August 1979.

Description of the Area

Chuckatuck Creek is a tributary to the James River; it receives saline water from the James and fresh water from its own water shed. Salinities in the vicinity of the Chuckatuck Bridge average less than 15‰. Characteristics of the water (such as salinity, dissolved oxygen, presence of nutrients, and absence of oyster toxins) are such as to favor the natural growth of oysters (Crassostrea virginica), but not the hard clam (Mercenaria mercenaria).

The mouth of Chuckatuck Creek is at the normal upper salinity limit of the diseases MSX and Dermo and the predatory oyster drill. Therefore, during most years these factors are not a problem in oyster culture.

The area studied by VIMS is located approximately between two-thirds and three-quarters of a mile upstream from the point where Chuckatuck Creek empties into Batten Bay. The shore along the west side is a tidal marsh. On the higher ground of the eastern shore there are a few residential houses and a boatyard.

Waters of the entire creek were condemned by the Virginia Department of Public Health effective 28 June 1979 (see Health Department Condemnation Area 80) and the harvesting of shellfish after that date was restricted. Among the many restrictions placed on harvesting and marketing oysters from restricted areas are:

1. The oysters must be relaid in clean waters under the supervision of the Virginia Marine Resources Commission.
2. They must stay on this bottom for at least 15 days with the water temperature over 50°F.

METHODS AND MATERIALS

In preparation for determining the size of the molluscan resource in the study area a chart of the leased portion of Chuckatuck Creek in the vicinity of the bridge was overlaid with a 100 foot square grid which extended 600 feet from the bridge on each side (Figure 1). The centers of each of these squares became the stations where hand tong samples were taken. The diver's survey and the fathometer survey were also made along transects through the centers of these squares.

Location of Leased Grounds and Stations

The corners of leased grounds were marked by stakes which were placed by a surveyor from the Virginia Marine Resources Commission. Stations were located by referring to the corner stakes and to buoys placed on selected locations by VIMS personnel. Positioning of the buoys was done with the aid of a floating measuring line.

Collection of Samples and Observations

Samples of material from the bottom of the creek were collected by an experienced waterman using a conventional pair of oyster tongs; the shafts of the tongs were tied so that the tongs opened an equal distance on each lick or grab.

One lick (i.e. one sample) was taken at each station or center of each square. A second lick of the tongs was taken at a station only if a shell(s) and/or oyster(s) were found in the first lick. The areas covered by the tong heads varied from 1.22 ft² to 3.75 ft² depending on depths; these areas were used to calculate oyster density.

Samples were also taken by a diver who used his hands to retrieve everything solid within a square frame. (covering 4.0 ft² in area) which he laid on the bottom at certain stations. The leased plots sampled, the area studied, along with the number of stations and samples on each are shown in Table 1. The methods of calculation are shown in Table 2.

Material collected by sampling was observed, and the following was noted for each station:

- numbers and volumes of live large (3 inches and more in length) oysters;
- numbers and volumes of live small oysters;
- numbers of spat (oysters which had set in the summer of 1978);
- numbers of boxes (a box is an oyster shell which has both valves still hinged but is empty of meat);
- volume of shells which had been resting on the bottom (spat may attach to this shell);

- volume of shells which had been buried in the bottom; and
- type of bottom (M = soft mud; M, Sh = mud and shells).

Using the above data on oyster and shell densities per square foot were calculated. These data were later used to calculate bushels per acre, and the dollar value per acre.

Oyster mortality was calculated as:

$$\% \text{ Mortality} = \frac{\text{No. Boxes}}{\text{No. Live Oysters} + \text{No. Boxes}}$$

Data relating to the bottom were gathered by two other different but complementary methods. In one a diver using SCUBA swam over the bottom and observed it visually or by touch within the span of his arms (5 feet). The diver covered the creek from side to side along four transects (Figure 2): in the existing right-of-way upstream of the bridge (Transect B) and downstream (Transect C); and in the area proposed to be added to the right-of-way upstream (Transect A) and downstream (Transect D) of the bridge. In addition a shorter fifth transect (E-F) below the bridge was covered.

At intervals of a hundred feet or less along each transect the diver reported his observations to a recorder in the accompanying boat. The following categories of

observations were made and recorded:

- composition (smoothness and firmness of the bottom);
- depth of the water and visibility;
- quantity of shells and oysters encountered;
- depth of silt layer covering exposed shell and oysters; and,
- nature of the distribution of shells and/or oysters.

Another method of determining the character of the bottom was the use of a portable recording fathometer to profile the bottom along transects parallel to the bridge (Figure 3). Copies of the traces made by the fathometer are included in Appendix I.

RESULTS AND DISCUSSION

Observations and results will be presented and discussed according to the leased plot which they relate to.

Leased Area 1 (William R. Gay, Jr.)

This is part (6.58 acres) of an 11.52-acre tract leased by William R. Gay, Jr. None of this lease lay in the right-of-way. Results of the hand tong sampling are shown in Table 3.

This lease had few oysters or shells on the bottom. Live oysters were found at only two stations; the other 29 stations had a soft mud bottom and no oysters. In addition to the two stations with oysters, eight other stations contained shell; most of the shell found (9.4 quarts compared to 3.9) was taken from beneath the surface of the mud. No 1978 spat were seen; only one box was found, which suggested a 4% mortality. Small oysters (those under three inches long) outnumbered large oysters almost two to one. The average oyster density for the area was 0.1/ft² shell averaged 0.06 qts/ft².

The diver did not cover any portion of this area during his survey nor was the fathometer used here.

The finding of oysters at only two stations indicate that oysters are scarce on this area; the same is true for shell. Mortality (as indicated by the percentage of boxes) was low. The bottom of this area can be classed as mud with scattered oysters and shell.

Leased Area 2 (Nansemond-Adams Oyster Co.)

The portion of the 7.80 acre lease within 600 feet of the bridge was 2.60 acres. None of this lease lay within the right-of-way. Most of the bottom was soft mud devoid of oysters and shell.

Live oysters were found at two of the twelve stations sampled with hand tongs (Table 4). The five

oysters which were found gave an average density of $<0.1/\text{ft}^2$. A total of 2.8 quarts of shell, slightly over half of it buried, was found here; density of the shell averaged $0.03 \text{ qts}/\text{ft}^2$ for the area. No boxes and no spat were observed.

No diver or fathometer survey was made in this area.

This area was characterized by mud bottom and scarce oysters and shell. The absence of spat is consistent with the scanty cultch available for setting.

Leased Area 3 (Linwood C. Wright)

The area surveyed consisted of 1.99 acres of Linwood C. Wright's 5.02 acre lease, all of which was upstream from the right-of-way. No fathometer survey or diver's observations were made here.

Results of the hand tong survey, which are shown in detail in Table 5, may be summarized as follows. Live oysters were found at half of the stations sampled. Density of oysters at individual stations ranged from $3.3 \text{ oysters}/\text{ft}^2$ to $0.5/\text{ft}^2$; the average density was 1.2. Shell was found at all but one of the ten stations. At one place one and a third qt/ft^2 was found; average density for the area was $0.30 \text{ qts}/\text{ft}^2$. No spat were recovered. One box was seen.

Oysters were more plentiful here than on the two inshore areas previously discussed; this is probably due to

its location in the channel and a much greater quantity of shell. Oyster mortality at the time of our study was low (1%).

Leased Area 4 (James C. Hatten)

Two and six tenths acres of James C. Hatten's 4.63 acre lease were studied with hand tongs. There were few oysters on this lease (Table 6).

At three of the fourteen stations sampled a total of thirty-two large and small oysters were found; oyster density averaged $0.41/\text{ft}^2$. In addition, three spat were seen. Boxes (18) showed a 36% mortality. Forty and eight-tenths quarts of shell (roughly two-thirds of it buried) was found in an average density of $0.53 \text{ qt}/\text{ft}^2$.

Other than one area (stations A7 & 8 and B7) where all the oysters and most of the shell was found, the rest of this area appeared to be mud with some shell. Natural recruitment had occurred; i.e. three spat were found which set in 1978. The recent mortality had been high for this type of area.

Leased Area 5 (Edwin Crittenden)

The area surveyed encompassed the entire 1.59 acres of the lease. The area was upstream of the bridge right-of-way (Figure 1). No fathometer or diver observations were made here. The bottom at all stations was soft mud.

Hand tong sampling (Table 7) yielded no live oysters, no spat, one box and less than a quart of shell total; density of the shell averaged 0.02 qts/ft². The absence of oysters and near-absence of shell indicate that this area is barren.

Leased Area 6 (G. C. Martin)

This area (3.82 acres of G. C. Martin's 7.19 acre lease) was upstream of the bridge; part of the area lay in the right-of-way.

Right-of-Way

Over most of this area the bottom was soft mud. Eighteen live oysters were found at one out of four stations for an average density of 0.6/ft². Shell material was very scarce, and average density was 0.18 qts/ft². No spat were observed (Table 8).

One transect with the fathometer recording the profile of the bottom was made in this area. Along this transect (1-A) which was 80 feet from the bridge, the fathometer indicated a smooth and level bottom (Figure 3 and Appendix).

The diver, swimming along the same transect (Figure 2) observed that for approximately the middle 100 feet of this transect oysters and/or shell were continuously and fairly uniformly distributed; a sample taken here by the diver using a 1.08 ft² frame, indicated densities

in numbers per ft² as follow: market oyster - 1; small oysters - 6; spat - 4; and shell - 1 qt. On the inshore and offshore ends of the transect (50 feet each), clumps (of up to 5 oysters each) occurred approximately one each 2 feet of transect (10 square feet of area). The exposed portions of oysters and shells were covered with 1/4 to 1/8 inch of fine silt.

The oysters in the 100 foot patch occurred at about eighty feet from the bridge. Mortality, judging from the 10% of boxes seen in our sampling, had been low.

Outside the Right-of-Way

Oysters were very scarce in this area, as was shell; most of the bottom was soft mud (Table 8).

Sampling with hand tongs at 16 stations turned up one small oyster for an average density of $<0.1/\text{ft}^2$. At each of five stations two or three shells were found for an average density of $0.01 \text{ qt}/\text{ft}^2$. No spat were seen.

Leased Area 7 (Nansemond Fish and Oyster Co.)

Most of this 4.80 acre lease of Nansemond Fish and Oyster Company was in the right-of-way. The entire lease lay within the study area.

Right-of-Way

The bottom was largely soft mud in this area and supported only minimal quantities of oysters and shell.

At twenty-four hand tong stations one large live oyster was found for an average density of less than $0.1/\text{ft}^2$ (Table 9). One box was tonged up. No spat were seen. Less than a quart of shell was taken, making density negligible.

The fathometer was run along four transects here (Figure 3 and Appendix). All four transects (1B, 2, 3B and 4B) indicate that the surface of the bottom was soft mud with no irregularities.

Along all four transects which he swam over the diver observed essentially the same thing each time; a smooth, bottom of soft mud with infrequent oysters and shell. The bottom near the inshore boundary downstream of the bridge was very soft mud - much softer than that on the opposite side of the bridge; when he tried to stand, the diver sank about 18 inches into the bottom compared to about 2 inches upstream of the bridge.

In all of Transect A (80 feet upstream of the bridge) the diver saw approximately a dozen oysters in two locations; in both places the oysters were clustered together. Along Transect B (15-20 feet from the bridge on the upstream side) shells were observed occasionally (1 per 10 or 15 ft^2), but oysters were seen only in the offshore 50 feet. Forty-five feet downstream of the bridge at Transect C the distribution of oysters and shells was the same as along Transect B.

Along Transect D (135 feet from the bridge) the diver observed fewer oysters and shell than on any of the preceding transects.

Outside the Right-of-Way

Only two hand tong stations in this area lay outside the right-of-way. Mud and a very small amount of shell (0.6 qt total) were found here, which is consistent with the rest of the area.

Leased Area 8 (Nansemond Fish and Oyster Co.)

This area was part (14.88 acres) of a tract (16.47 acres) leased by Nansemond Fish & Oyster Company (Figure 1). Almost half of the area studied was within the bridge right-of-way.

Right-of-Way

The bottom in this area was largely soft mud devoid of oysters and with minimal quantities of shell.

Hand tong samples at two out of thirty stations yielded live oysters; from both locations six oysters were recovered, which calculates to an average density of less than $0.1/\text{ft}^2$. Two spat and three boxes were seen. Shell (21% of it surface shell) amounted to 10.8 quarts total for an average density of $0.05 \text{ qts}/\text{ft}^2$ (Table 10).

The fathometer was operated along four transects across this area (Figure 3 and Appendix, Transects 1B, 2,

3B and 4B). All profiles traced by the fathometer reveal a bottom the surface of which was fairly smooth. It sloped gradually at first, and then more rapidly toward the channel of the creek. All four transects show large dips in the bottom near the offshore edge of the area. This bottom here forms the shoulder of the channel, and the dips on the fathometer tracings probably indicate furrows cut by the strong water current noted here.

Observations made by the diver swimming over four transects revealed a bottom which was largely soft mud and smooth with only scattered shells (approximately $1/10 \text{ ft}^2$) and few if any oysters. Shell or oysters in greater concentrations were seen only on the offshore portions of the transects as follows:

Transect A (80 feet upstream of the bridge) -

Patches (i.e. small, dense clusters) of oysters were scattered over the offshore 200 feet of the transect.

Transect B (20 feet from the bridge) -

Oysters were observed for 50 feet near the offshore edge of the area; here the oysters and/or shell were continuously distributed over the bottom. A sample taken here shows densities in numbers per square foot as follow: market oyster - 0; small oyster - 0; spat - 2; and shell - 3 quarts.

Transect C (45 feet downstream of the bridge) -

In the offshore 100-150 feet a patchy distribution of oysters and/or shell was observed (i.e. groups of oysters and/or shells of up to 3 or 4 in the span of one hand were scattered over the bottom); numbers from a sample of one square foot were: market oyster - 0; small oyster - 0; spat - 0; and shell - 2 quarts.

Transect D (135 feet downstream of the bridge) -

Along approximately 350 feet in the middle of this transect there was a continuous and uniform distribution of oysters and/or shells; the bottom was hard like pavement. In this area the diver took a sample in which shells were buried in the bottom for a depth of 6 inches and were packed so closely together that he had difficulty digging them out. The density of oysters in the sample in numbers per square foot were as follow: market oyster - 1; small oysters - 9; spat - 3; and shell - 2½ quarts. Exposed oysters and shells were covered with approximately 1/8 inch of fine sediment.

The diver also reported small depressions of approximately 6 inches in diameter and of unknown depth occurring occasionally between 200 and 75 feet from the offshore end of Transect A. Also on this transect there were a couple of deeper depressions (1-2 feet deep and larger diameters); these were located from 75 to 10 feet inshore or in back of the upper end of the bridge fender. The latter depressions

were probably associated with eddy currents from the bridge fenders which were observed to be strong at times of maximum tidal current.

In summary, this area appears to be mostly mud with some oysters and shell. The oysters and shell which were found were, for the most part, scattered and patchy and low in number. The exception was downstream of the bridge in the middle of the area where, according to the diver, an almost continuous distribution of oysters and/or shell occurred. Densities of oysters and shell found here were as follow:

market oysters - 0.3 and 1.0/ft²;

small oysters - 0.4 and 9.0/ft²;

spat - 3/ft²; and,

shell - 0.20 to 2.5 qts/ft².

Outside the Right-of-Way

Hand tong samples were taken at 39 stations; live oysters were found at 10 of them. The total of live oysters was 138 for an average density over the plot of 0.5/ft².

In all, 23 spat were seen. Eighteen boxes, or 12% of live plus dead oysters, were found. Shell density averaged 0.33 qts/ft².

The oysters and most of the shell occurred in the middle of the area with the greatest densities being at a

group of adjacent stations J11, K12, L12, and M12 and at M9 a short distance away.

In summary, the central portion of this area contained a moderate quantity of oysters; associated with this and spread over a wider area was abundant shell. The number of spat seen here indicates the occurrence of natural recruitment. Recent mortality (12%) was about average for this type of an area.

Leased Area 9 (J. W. Ingersoll)

This area took in the entire 3.23 acre lease of J. W. Ingersoll.

Right-of-Way

Live oysters were found at five of the nine hand tong stations; average density was 1.5/ft². There were six spat from two locations and three boxes (7%). A total of 14.4 quarts of shell, mostly from the surface, was tonged up; average density was 0.52 qts/ft² (Table 11).

Fathometer-traced profiles of the bottom surface indicated an irregular bottom scoured by the channel of the creek (Figure 3 and Appendix, Transects 1A and 3A). At approximately 80 feet from the upper edge of the bridge the diver reported a continuous, hard pavement of oysters and/or shells on two-thirds or 200 feet of the transect; densities

in number per square foot calculated from a sample taken here follow: market oysters (over 3 inches in length) - 2; small oysters - 2; 1978 spat - 2; shell - 2 qts. The offshore end (100 feet) of the transect was in the channel; hard shell/mud bottom and occasional surface shell and/or oysters were observed there.

The diver reported finding the following from 15 to 20 feet upstream of the bridge. Along approximately the inshore half (150 feet) of this portion of the transect, a continuous distribution of oysters and/or shells that felt as hard as pavement was observed. A sample taken from this portion contained the following densities in numbers per square foot: market oysters - 6; small oysters - 2; spat - 5; and shell - 1 quart. On the offshore 125 feet of this transect across Plot 9, oyster/shell distribution was patchy (i.e. not continuous).

At a distance of about 45 feet from the downstream side of the bridge, the diver reported mostly a hard pavement of oysters and/or shells; the diver had difficulty digging shells from the bottom because they were so tightly packed down to 6 or 8 inches below the surface. Densities per square foot in a sample taken here were as follow: market oyster - 0; small oyster - 1; spat - 0; and shell - 3 quarts. No silt was observed on exposed shells and oysters. The pavement of oysters and shells was observed even though the

water depth ranged from 15-17 feet. However, near the offshore edge of plot 9 (in the channel, last 100 feet of the transect) where the water depth went to 19 feet, only soft mud bottom with no oysters and no shells was found.

Overall, this area contained some oysters and abundant shell. It had some natural set and showed a low mortality rate.

Leased Area 10 (Annie E. Newman)

Here 2.68 acres of Annie E. Newman's 10.16 acre lease were studied.

Right-of-Way

At two stations two market oysters were all the live oysters which were found. In addition two spat were seen. Six boxes were recovered; some of which had been buried. Ninety percent of the 11.5 quarts of shell had been buried (Table 12).

Fathometer study revealed an irregularly shaped bottom which had been scoured by the water currents (Figure 3 and Appendix, Transect 4A).

At 135 feet from the bridge (downstream) the diver observed that along the inshore 150 feet of this transect the bottom was continuously covered with a uniform distribution of shells, but few oysters; the bottom was as hard as pavement.

At the offshore end (approximately 65 feet) the bottom was soft mud and contained no shell or oysters. In other words, a substantial amount of shell and a few oysters were found here.

Outside the Right-of-Way

Live oysters were found at two of eight stations; at these stations they were fairly abundant (a total of nineteen - average density was 0.6). In all, 66.2 quarts of shell were tonged up for an average density of 2.07 qts/ft². Ten spat were seen. Boxes (30 of them) amounted to 61 percent which indicated a heavy mortality.

The fathometer tracing along Transect 5A shows the surface of the bottom was irregular, consistent with its location in the creek channel.

The diver reported widely scattered oysters and shell on three-fourths of the mud bottom of Transect E-F (Figure 3).

To summarize, this area had moderate quantities of shells but few oysters. Mortality here was heavy and much higher than for areas on the opposite side of the channel.

Leased Area 11 (Ralph E. Blythe, Sr.)

All 1.14 acres of the lease of Ralph E. Blythe, Sr. were included in this area.

Right-of-Way

No oysters and little shell were found here in six hand tong samples (Table 13).

A fathometer-traced profile (Figure 3 and Appendix, Transect 4A) show that the bottom was smooth and flat for most of the width of the area when it sloped toward the channel.

The diver reported only mud on Transects C&D with one exception - on the downstream transect (D) for the fifty feet nearest the channel a few small patches of oysters where up to 6 oysters per patch were observed.

All observations indicate a negligible oyster resource here.

Leased Area 12 (Nansemond-Adams Oyster Co.)

This area included a 0.69 acre portion of a 1.43 acre lease of Nansemond-Adams Oyster Company. This lease was not surveyed out to 600 feet from the bridge because part of it was occupied by boat piers and docking space at a boatyard.

No oysters and some shell (98% of it buried) were found here (Table 14); average density of the shell was 0.24 qts/ft². This area is classed as barren.

SUMMARY

Value of Oysters and Shells on the Various Leases

Densities in bushels per acre and quantities of oysters and shells estimated to be on leased grounds are summarized in Tables 15 and 16. The values of the above-mentioned oysters and shell in the right-of-way are shown in Table 17. The estimated values are based on our findings that oysters from Chuckatuck Creek are typically of good quality, and that market-sized oysters might sell for as high as \$12.00 per bushel and the small oysters may be valued at \$5.00 (if they come from non-condemned areas). These prices, however, have been reduced in our value calculations by 30% since the study area is classed as condemned and oysters must be relaid prior to sale. This practice, of course, is expensive and it adds to their sale price. If the condemnation were lifted the estimated values would increase.

Shells were valued at 32¢ a bushel which is the "planted" value.

Outside the Right-of-Way

Estimated densities of bushels per acre and quantities of oysters and shells estimated to be on leased areas outside the right-of-way (as proposed) are summarized in Table 15. One area (9) indicated a high density of oysters (251.6 bu/

acre). On six other areas (3, 4, 7, 8, 10 and 11) estimated densities were moderate. Densities on areas 1, 2, 5, 6 and 12 indicated that those areas could be considered barren of oysters.

In the Right-of-Way (As Proposed)

Area 6 - Martin:

Here oysters were found in a moderate density. On 0.470 acres there were an estimated 34.7 bushels of large and small oysters for an estimated value of \$199.36. Value of shell on the area was estimated as \$23.14.

Area 7 & 8 - Nansemond Fish & Oyster Co.:

Estimated average densities here indicate essentially barren ground. For that part of the area in the City of Suffolk (0.830 acre) an estimated \$46.20 worth of oysters and \$9.25 of shells was present. The comparable values in the Isle of Wight County (9.722 acres) were \$151.90 for oysters and \$74.43 for shell.

Area 9 - Ingersoll:

A high density of oysters (172.3 bu/acre) worth an estimated \$1,827.35 was found here on 1.588 acres. Shell estimated to be present was valued at \$228.99.

Area 10 - Newman:

On 0.428 acres a moderate density of oysters (54.4 bu/acre) and a high density of shells (1,252.4 bu/

acre) were indicated by our sampling. Combined value was estimated at \$367.22.

Area 11 - Blythe:

No oysters and some shell was found on this 1.140 acre area. The shell was valued at \$25.41.

Table 1

Leases in the Vicinity of the US 17 Bridge Across Chuckatuck
Creek - Sampled June thru August 1979.

<u>Lessee's Name</u>	<u>Acreage in Lease</u>	<u>Area Studied¹ (acres)</u>	<u>Number of Stations</u>	<u>Number of Samples</u>
1. William R. Gay, Jr.	11.52	6.58	31	62
2. Nansemond-Adams Oyster Co.	7.80	2.60	12	23
3. Linwood C. Wright	5.02	1.99	10	19
4. James C. Hatten	4.63	2.60	14	26
5. Edwin Crittenden	1.59	1.59	8	14
6. G. C. Martin, Jr.	7.19	3.82	20	40
7. Nansemond Fish & Oyster Co.	4.80	4.80	26	52
8. Nansemond Fish & Oyster Co.	16.47	14.88	69	134
9. J. W. Ingersoll	3.23	3.23	16	29
10. Annie E. Newman	10.16	2.68	10	10
11. Ralph E. Blythe, Sr.	1.14	1.14	7	14
12. Nansemond-Adams Oyster Co.	1.43	0.69	4	6
TOTALS		46.60	227	429

Note:

1. Measured by VIMS.

Table 2

Methods and Factors Used in Making Calculations in This Report.

1. The area of bottom which the hand tongs covered was controlled by tying the shafts of the tongs, thereby controlling the distance which the heads could be opened. Since the location of the rope varied with the depth of the water, the areas covered varied. In most of the areas the tongs covered 3.75 square feet with each lick or grab; in deeper water the tie-line was moved up the shafts, thereby decreasing the opening of the heads and the area covered to 1.30 or 1.22 square feet. (At the deepest stations samples were collected by a diver who picked up everything solid from a 4 square foot area.) The area at each station is shown in following tables.
2. The following numbers of live oysters per bushel were used for the various leased areas:

<u>Leased Area</u>	<u>Large Oysters</u>	<u>Small Oysters</u>
1	219*	550*
2	219*	550*
3	219*	550*
4	200!	400!
5	200!	450!
6	300!	400*
7&8	219!	550!
9	182!	750!
10	200*	650*
11	250!	350!

3. Estimated densities of oysters and shell were calculated as shown:

Data from Station B14 - on Linwood C. Wright's lease - are used as an example. At this station a total of 25 live oysters and 4.0 quarts of shell were recovered by tonging from an area covering 7.50 square feet.

$$25 \text{ total oysters} \div 7.50 \text{ square feet} = 3.3 \text{ oysters/sq. ft.}$$

$$4.0 \text{ quarts of shell} \div 7.50 \text{ sq. ft.} = 0.53 \text{ qts/sq. ft.}$$

4. Estimated quantities of oysters and shell were calculated as shown:

Using data from Leased Area 9 (J. W. Ingersoll) - an area of 3.23 acres - for example, shows that 33 large and 52 small oysters and 30.9 quarts of shell were collected from 52.18 square feet of bottom.

Table 2 (Contd.)

$(33 \text{ lg oysters} \div 52.18 \text{ sq. ft.}) \times 43,560 \text{ sq. ft./acre} \div 182 \text{ lg oysters per bu} \times 3.23 \text{ acres} = 489 \text{ bu of lg oysters}$

$(52 \text{ sm oysters} \div 52.18 \text{ sq. ft.}) \times 43,560 \text{ sq. ft./acre} \div 750 \text{ sm oysters per bu} \times 3.23 \text{ acres} = 187 \text{ bu of sm oysters}$

The total estimated quantity of oysters on this leased area is the sum of 489 bu large oysters and 187 bu small oysters, which is 676 bushels.

$(30.9 \text{ qts shell} \div 52.18 \text{ sq ft}) \times 43,560 \text{ sq ft/acre} \div 50 \text{ qts/bu} \times 3.23 \text{ acres} = 1,666 \text{ bu of shell}$

5. The average number of shells in one quart was observed to be 13.

Notes: ! based on measurements.

* assumed, based on observations nearby.

Table 3

Results of Sampling Leased Area 1 (William R. Gay, Jr.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bot-tom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)	
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total					Surface	Buried	Total		
A18	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
A19	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
A20	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
A21	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
A22	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
A23	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
B18	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
B19	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
B20	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
B21	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
B22	7.50	M	0	0	0	---	0	0	0	0	0.0	0.2	0.2	0.03
B23	7.50	M	0	0	0	---	0	0	0	0	0.0	0.2	0.2	0.03
C17	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
C18	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
C19	7.50	M	0	0	0	---	0	0	0	0	0.0	0.0	0.0	---
C20	7.50	M	0	0	0	---	0	0	0	0	0.0	0.2	0.2	0.03
C21	7.50	M, Sh	5	11	16	2.1	0	0	0	3.2	0.8	4.0	0.53	0.53
C22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
C23	7.50	M, Sh	4	5	9	1.2	0	1	10	0.7	1.3	2.0	0.27	0.27
D17	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
D18	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
D19	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
D20	7.50	M, Sh	0	0	0	---	0	0	0	0.0	2.0	2.0	0.27	0.27
D21	7.50	M, Sh	0	0	0	---	0	0	0	0.0	2.0	2.0	0.27	0.27
D22	7.50	M	0	0	0	---	0	0	0	0.0	0.5	0.5	0.07	0.07
E17	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
E18	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
E19	7.50	M, Sh	0	0	0	---	0	0	0	0.0	2.0	2.0	0.27	0.27
E20	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
E21	7.50	M	0	0	0	---	0	0	0	0.0	0.2	0.2	0.03	0.03
E22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	0.0	---
Totals	232.50		9	16	25	0.11 ²	0	1	4 ²	3.9	9.4	13.3	0.06 ²	

Notes:

1. Samples taken with hand tongs.
2. These are averages.

Table 4

Results of Sampling Leased Area 2 (Nansemond-Adams Oyster Co.) in Chuckatuck Creek - 1979.¹

Station Designation	Area Covered (sq ft)	Bot- tom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)	
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total					Surface	Buried	Total		
A15	3.75	M, Sh	1	2	3	0.8	0	0	0	0	0.2	0.2	0.4	0.11
A16	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
A17	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
B15	7.50	M	0	0	0	--	0	0	0	0	0.0	0.2	0.2	0.03
B16	7.50	M	0	0	0	--	0	0	0	0	0.0	0.1	0.1	0.01
B17	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
C14	7.50	M, Sh	2	0	2	0.3	0	0	0	0	1.0	1.0	2.0	0.27
C15	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
C16	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
D15	7.50	M	0	0	0	--	0	0	0	0	0.0	0.1	0.1	0.01
D16	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
E16	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
Totals	86.25		3	2	5	<0.1 ²	0	0	0 ²	1.2	1.6	2.8	0.03 ²	

Notes:

1. Samples were taken with hand tongs.
2. These data are averages.

Table 5

Results of Sampling Leased Area 3 (Linwood C. Wright) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters			Density of Total (No./ft ²)	Number of Spat	Boxes		Shell			Density of Total (Qts/ft ²)
			Large	Small	Total			Number	Percent of Total	Quantity (quarts)			
									Surface	Buried	Total		
A11	7.50	M, Sh	0	0	0	--	0	0	0.0	1.3	1.3	0.17	
A12	7.50	M	0	0	0	--	0	0	0.0	0.0	0.0	--	
A13	7.50	M, Sh	3	18	21	2.8	0	1	1.5	1.0	2.5	0.33	
A14	7.50	M, Sh	3	9	12	1.6	0	0	2.8	1.2	4.0	0.53	
A15	3.75	M, Sh	1	3	4	0.5	0	0	2.5	2.5	5.0	1.33	
B12	7.50	M, Sh	0	0	0	--	0	0	0.4	1.6	2.0	0.27	
B13	7.50	M, Sh	7	14	21	2.8	0	0	1.2	0.8	2.0	0.27	
B14	7.50	M, Sh	12	13	25	3.3	0	0	2.8	1.2	4.0	0.53	
C12	7.50	M	0	0	0	--	0	0	0.0	0.5	0.5	0.07	
C13	7.50	M	0	0	0	--	0	0	0.0	0.4	0.4	0.05	
Totals	71.25		26	57	83	1.2 ²	0	1	1 ²	11.2	10.5	21.7	0.30 ²

Notes:

1. Samples taken with hand tongs.
2. These are averages.

Table 6

Results of Sampling Leased Area 4 (James C. Hatten) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)
			Number		Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total			Number		Surface	Buried	Total	
A 5	3.75	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
A 6	7.50	M	0	0	0	--	0	0	0	0.0	2.0	2.0	0.27
A 7	7.50	M	9	9	18	2.4	0	10	36	2.8	9.2	12.0	1.60
A 8	7.50	M	6	4	10	1.3	3	5	33	2.3	4.7	7.0	0.93
A 9	2.44	M	0	0	0	--	0	1	100	3.0	1.5	4.5	0.60
A10	2.44	M	0	0	0	--	0	0	0	0.5	1.0	1.5	0.20
B 7	7.50	M	3	1	4	0.5	0	1	20	0.4	2.6	3.0	0.40
B 8	7.50	M	0	0	0	--	0	1	100	0.3	3.7	4.0	0.53
B 9	2.44	M	0	0	0	--	0	0	0	2.7	1.3	4.0	0.53
B10*	4.00	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
B11	7.50	M, Sh	0	0	0	--	0	0	0	0.0	0.3	0.3	0.04
C 9	2.44	M	0	0	0	--	0	0	0	1.3	1.2	2.5	0.33
C10	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
C11	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
Totals	77.51		18	14	32	0.4 ²	3	18	36 ²	13.3	27.5	40.8	0.53 ²

Notes:

1. Samples taken with hand tongs except at those stations marked by an asterisk(*) where a diver took the samples.
2. These are averages.

Table 7

Results of Sampling Leased Area 5 (Edwin Crittenden) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bot-tom Type	Live Oysters			Density of Total (No./ft ²)	Number of Spat	Boxes		Shell			Density of Total (Qts/ft ²)
			Number		Percent of Total			Quantity (quarts)					
			Large	Small				Surface	Buried	Total			
A5	3.75	M	0	0	0	--	0	0	0.0	0.0	0.0	--	
B5	7.50	M	0	0	0	--	0	0	0.0	0.0	0.0	--	
B6	7.50	M	0	0	0	--	0	0	0.0	0.0	0.0	--	
C5	7.50	M	0	0	0	--	0	0	0.0	0.2	0.2	0.03	
C6	7.50	M	0	0	0	--	0	0	0.0	0.1	0.1	0.01	
D4	7.50	M	0	0	0	--	0	0	0.0	0.0	0.0	--	
D5	7.50	M	0	0	0	--	0	100	0.1	0.1	0.2	0.03	
E5	3.75	M	0	0	0	--	0	0	0.0	0.3	0.3	0.08	
Totals	52.50		0	0	0	--	0	1	100 ²	0.1	0.7	0.8	0.02 ²

Notes:

1. Samples taken with hand tongs.
2. Data are averages.

Table 8

Results of Sampling Leased Area 6 (G. C. Martin, Jr.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)	
			Number		Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)					
			Large	Small					Total	Surface	Buried	Total		
A. Existing Right-of-Way														
G2	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
G3	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
Subtotals	15.00		0	0	0	-- ²	0	0	0 ²	0.0	0.0	0.0	0.0	-- ²
B. Proposed Addition to Right-of-Way														
F2	7.50	M, Sh	7	11	18	2.4	0	2	10	3.2	0.9	4.1	0.55	
F3	7.50	M	0	0	0	--	0	0	0	0.0	1.2	1.2	0.16	
Subtotals	15.00		7	11	18	1.2 ²	0	2	10 ²	3.2	2.1	5.3	0.35 ²	
C. Other														
A1	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
A2	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
A3	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
A4	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03	
B1	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
B2	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
B3	7.50	M	0	1	1	0.1	0	3	75	0.1	0.1	0.2	0.03	
B4	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
C1	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	
C2	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03	
C3	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01	
C4	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--	

Table 8 (Contd.)

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)	
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total					Surface	Buried	Total		
D2	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
D3	7.50	M	0	0	0	--	0	0	0	0	0.0	0.1	0.1	0.01
E2	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
E3	7.50	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
Subtotals	60.00		0	1	1	<0.1 ²	0	3	75 ²	0.1	0.7	0.8	0.01 ²	
Totals	90.00		7	12	19	0.2 ²	0	5	21 ²	3.3	2.8	6.1	0.07 ²	

Notes:

1. Samples taken with hand tongs.
2. Data are averages.

Table 9

Results of Sampling Leased Area 7 (Nansemond Fish & Oyster Co.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (Sq ft)	Bottom Type	Live Oysters				Boxes		Shell			Density of Total (Qts/ft ²)	
			Number Large	Number Small	Density of Total (No./ft ²)	Number of Total	Percent of Total	Quantity (quarts)		Density of Total (Qts/ft ²)			
								Surface	Buried	Total			
A. Existing Right-of-Way													
G17	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
G18	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
G19	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
G20	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
G21	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
G22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
H17	7.50	M	0	0	0	---	0	0	0	0.0	0.2	0.2	0.03
H18	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
H19	7.50	M	0	0	0	---	0	0	0	0.0	0.1	0.1	0.01
H20	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
H21	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
H22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
Subtotals	90.00		0	0	0	--- ²	0	0	0 ²	0.0	0.3	0.3	<0.01 ²
B. Proposed Addition to Right-of- Way													
F17	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
F18	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
F19	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
F20	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
F21	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
F22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
I17	7.50	M	0	0	0	---	0	1	100	0.0	0.0	0.0	---
I18	7.50	M	0	0	0	---	0	0	0	0.0	0.4	0.4	0.05
I19	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
I20	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
I21	7.50	M	1	0	1	0.1	0	0	0	0.0	0.0	0.0	---
I22	7.50	M	0	0	0	---	0	0	0	0.0	0.0	0.0	---
Subtotals	90.00		1	0	1	<0.1 ²	0	1	50 ²	0.0	0.4	0.4	<0.01 ²

Table 9 (Contd.)

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (qts/ft ²)
			Number		Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total					Surface	Buried	Total	
O. Other													
J18	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03
J19	7.50	M	0	0	0	--	0	0	0	0.0	0.4	0.4	0.05
Subtotals	15.00		0	0	0	-- ²	0	0	0 ²	0.0	0.6	0.6	0.04 ²
Totals	195.00		1	0	1	<0.1 ²	0	1	50 ²	0.0	1.3	1.3	<0.01 ²

Notes:

1. Samples taken with hand tongs.
2. Data are averages.

Table 10

Results of Sampling Leased Area 8 (Nansemond Fish & Oyster Co.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)			
			Large	Small	Total					Surface	Buried	Total	
A. Existing Right-of-Way													
G10	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
G11	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
G12	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
G13	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
G14	7.50	M	0	0	0	--	0	0	0	0.0	0.8	0.8	0.11
G15	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
G16	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
H 9	7.50	M, Sh	1	0	1	0.1	2	0	0	0.9	0.2	1.1	0.15
H10	7.50	M	0	0	0	--	0	0	0	0.0	0.3	0.3	0.04
H11	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03
H12	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
H13	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03
H14	7.50	M	0	0	0	--	0	0	0	0.5	0.6	1.1	0.15
H15	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
H16	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
Subtotals	112.50		1	0	1	<0.1 ²	2	0	0 ²	1.4	2.4	3.8	0.03 ²
B. Proposed Addition to Right-of-Way													
F10	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
F11	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
F12	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
F13	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
F14	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
F15	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
F16	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
I 9	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
I10	7.50	M	0	0	0	--	0	0	0	0.0	0.4	0.4	0.05
I11	7.50	M	0	0	0	--	0	0	0	0.2	0.2	0.4	0.05
I12	7.50	M, Sh	2	3	5	0.7	0	1	17	0.4	2.1	2.5	0.33

Table 10 (Contd.)

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)			
			Large	Small	Total					Surface	Buried	Total	
I13	7.50	M	0	0	0	--	0	2	100	0.0	2.0	2.0	0.27
I14	7.50	M	0	0	0	--	0	0	0	0.3	1.2	1.5	0.20
I15	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
I16	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
Subtotals	112.50		2	3	5	<0.1 ²	0	3	38 ²	0.9	6.1	7.0	0.06 ²
C. Other													
D11	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
D12	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
D13	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
D14	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.03
E11	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E12	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E13	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E14	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E15	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
J 8*	4.00	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
J 9	7.50	M	0	0	0	--	0	0	0	0.1	0.8	0.7	0.12
J10	7.50	M, Sh	0	0	0	--	0	0	0	0.0	0.7	0.7	0.09
J11	7.50	M	7	10	17	2.3	3	5	23	1.9	3.1	5.0	0.67
J12	7.50	M, Sh	1	0	1	0.1	0	0	0	0.0	7.0	7.0	0.93
J13	7.50	M	1	6	7	0.9	0	2	22	0.3	3.2	3.5	0.47
J14	7.50	M	0	0	0	--	0	0	0	0.1	1.4	1.5	0.20
J15	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
J16	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
J17	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
K 8*	4.00	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
K 9	7.50	M	0	0	0	--	0	1	100	0.0	1.0	1.0	0.13
K10	7.50	M, Sh	0	0	0	--	0	0	0	0.5	1.5	2.0	0.27
K11	7.50	M, Sh	0	0	0	--	0	0	0	0.1	2.4	2.5	0.33
K12	7.50	M, Sh	8	18	26	3.5	5	0	0	8.5	0.5	9.0	1.20
K13	7.50	M	3	13	16	2.1	6	1	6	4.7	4.3	9.0	1.20
K14	7.50		1	1	2	0.3	0	3	6	1.0	3.5	4.5	0.60
K15	7.50		0	0	0	--	0	0	0	0.0	0.2	0.2	0.03

Table 10 (Contd.)

Station Designations	Area Covered (sq ft)	Bot- tom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)	
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small	Total					Surface	Buried	Total		
K16	3.75	M	0	0	0	--	0	0	0	0	0.0	0.2	0.2	0.03
K17	3.75	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
L 8*	4.00	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
L 9	7.50	M	0	0	0	--	0	0	0	0	0.0	0.5	0.5	0.07
L10	7.50	M, Sh	1	3	4	0.5	0	0	0	0	0.1	3.4	3.5	0.47
L11	7.50	M, Sh	0	0	0	--	0	0	2	100	0.3	3.7	4.0	0.53
L12	7.50	Sh	9	17	26	3.5	1	0	0	0	8.6	2.4	11.0	1.47
M 8*	4.00	M	0	0	0	--	0	0	0	0	0.0	0.0	0.0	--
M 9	2.44	S, Sh	4	8	12	4.9	4	3	20		4.5	5.5	10.0	4.10
M10	7.50	M	0	0	0	--	0	0	0	0	0.0	0.2	0.2	0.03
M11	7.50	M	0	0	0	--	0	0	0	0	0.3	6.7	7.0	0.93
M12	7.50	M, Sh	6	21	27	3.6	4	1	4		6.8	1.2	8.0	1.07
Subtotals	273.44		41	97	138	0.5 ²	23	18	12 ²		37.8	53.8	91.6	0.33 ²
Totals	498.44		44	100	144	0.3 ²	25	21	13 ²		40.1	62.3	102.4	0.21 ²

Notes:

1. Samples taken with hand tongs except at those stations marked by an asterisk (*) where a diver took the samples.
2. Data are averages.

Table 11

Results of Sampling Leased Area 9 (J. W. Ingersoll) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters				Boxes		Shell			Density of Total (Qts/ft ²)	
			Large	Number Small	Total	Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total ¹	Quantity (quarts)			
									Surface	Buried	Total		
A. Existing Right-of-Way													
G 6	1.22	M	0	0	0	--	0	0	0	0.0	1.0	1.0	0.82
G 7	2.60	M, Sh	1	2	3	1.2	0	1	25	0.2	0.0	0.2	0.08
G 8	2.44	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
H 6	2.44	M, Sh	8	14	22	9.0	0	0	0	2.0	0.0	2.0	0.82
H 7	2.44	M, Sh	0	0	0	--	0	0	0	3.1	0.4	3.5	1.43
H 8*	4.00	M, Sh	0	5	5	1.2	4	2	29	2.5	2.5	5.0	1.25
Subtotals	15.14		9	21	30	2.0 ²	4	3	9 ²	7.8	3.9	11.7	0.77 ²
B. Proposed Addition to Right-of-Way													
F 7	2.60	M, Sh	2	2	4	1.5	0	0	0	0.5	0.0	0.5	0.19
F 8	2.60	M, Sh	2	6	8	3.1	2	0	0	0.5	1.5	2.0	0.77
F 9	7.50	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.08
Subtotals	12.70		4	8	12	0.9 ²	2	0	0 ²	1.0	1.7	2.7	0.21 ²
C. Other													
C 8	2.60	M, Sh	11	14	25	9.6	1	2	7	5.8	2.2	8.0	3.08
D 7	2.60	M, Sh	6	9	15	5.8	6	2	12	4.2	1.8	6.0	2.31
D 8	2.60	M, Sh	3	0	3	1.2	0	1	25	0.0	0.5	0.5	0.19
D 9*	4.00	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E 7	2.60	M	0	0	0	--	0	0	0	0.7	1.3	2.0	0.77
E 8	2.44	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
E 9	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
Subtotals	24.34		20	23	43	1.8 ²	7	5	10 ²	10.7	5.8	16.5	0.68 ²
Totals	52.18		33	52	85	1.6 ²	13	8	9 ²	19.5	11.4	30.9	0.59 ²

Notes:

1. Samples taken with hand tongs except at those stations marked by an asterisk (*) where a diver took the samples.
2. Data are averages for the area or subareas.

Table 12

Results of Sampling Leased Area 10 (Annie E. Newman) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)
			Number		Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small					Total	Surface	Buried	Total	
A. Proposed Addition to Right-of-Way													
I 6	4.00	M, Sh	2	0	2	0.5	2	6	75	1.1	9.9	11.0	2.75
I 7	4.00	M	0	0	0	--	0	0	0	0.0	0.5	0.5	0.12
Subtotals	8.00		2	0	2	0.2 ²	2	6	75 ²	1.1	10.4	11.5	0.72 ²
B. Other													
J 6	4.00	M, Sh	0	0	0	--	0	2	100	1.6	6.4	8.0	2.00
J 7	4.00	M	0	0	0	--	0	0	0	0.0	0.2	0.2	0.05
K 6	4.00	M, Sh	0	0	0	--	0	3	100	1.2	10.8	12.0	3.00
K 7	4.00	M, Sh	0	0	0	--	0	0	0	0.4	3.6	4.0	1.00
L 6	4.00	M, Sh	0	0	0	--	0	0	0	0.2	4.8	5.0	1.25
L 7	4.00	M, Sh	2	0	2	0.5	7	8	80	2.6	14.4	17.0	4.25
M 6	4.00	M, Sh	13	4	17	4.2	0	4	19	2.2	6.8	9.0	2.25
M 7	4.00	M, Sh	0	0	0	--	3	13	100	4.4	6.6	11.0	2.75
Subtotals	32.00		15	4	19	0.6 ²	10	30	61 ²	12.6	53.6	66.2	2.07 ²
Totals	40.00		17	4	21	0.5 ²	12	36	63 ²	13.7	64.0	77.7	1.94 ²

Notes:

1. Samples taken by a diver.
2. Data are averages for the area or subareas.

Table 13

Results of Sampling Leased Area 11 (Ralph E. Blythe, Sr.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters				Boxes		Shell			Density of Total (Qts/ft ²)	
			Number		Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)				
			Large	Small					Total	Surface	Buried		Total
A. Existing Right-of-Way													
H 3	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
H 4	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
H 5	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
Subtotals	22.50		0	0	0	-- ²	0	0 ²		0.0	0.0	0.0	-- ²
B. Proposed Addition to Right-of-Way													
I 3	7.50	M	0	0	0	--	0	0	0	0.0	0.0	0.0	--
I 4	7.50	M	0	0	0	--	0	0	0	0.0	0.1	0.1	0.01
I 5	7.50	M	0	0	0	--	0	0	0	0.7	2.8	3.5	0.47
Subtotals	22.50		0	0	0	-- ²	0	0 ²		0.7	2.9	3.6	0.16 ²
C. Other													
J 3	7.50	M, Sh	1	2	3	0.4	0	0	0	4.0	1.0	5.0	0.67
Totals	52.50		1	2	3	<0.1 ²	0	0 ²		4.7	3.9	8.6	0.16 ²

Notes:

1. Samples taken with hand tongs.
2. Data are averages for the area or subareas.

Table 14

Results of Sampling Leased Area 12 (Nansemond-Adams Oyster Co.) in Chuckatuck Creek - 1979.¹

Station Designations	Area Covered (sq ft)	Bottom Type	Live Oysters					Boxes		Shell			Density of Total (Qts/ft ²)
			Number			Density of Total (No./ft ²)	Number of Spat	Number	Percent of Total	Quantity (quarts)			
			Large	Small	Total					Surface	Buried	Total	
J 4	7.50	M	0	0	0	--	0	0	0	0.0	2.5	2.5	0.33
J 5	3.75	M	0	0	0	--	0	0	0	0.0	1.0	1.0	0.27
K 4	7.50	M	0	0	0	--	0	1	100	0.1	1.9	2.0	0.27
K 5	3.75		0	0	0	--	0	0	0	0.0	0.0	0.0	--
Totals	22.50		0	0	0	-- ²	0	1	100 ²	0.1	5.4	5.5	0.24 ²

Notes:

1. Samples taken with hand tongs.
2. These data are averages for the area or subareas.

Table 15

Estimates of Quantities of Live Oysters and Shell in Sampled Portions of Leased Oyster Planting Ground Outside the Right-of-Way.

Area Number & Name of Lessee	Portion of Lease in Area (acres) ¹	LIVE OYSTERS				SHELL	
		Estimated Average Density (Bu/Ac) ²		Estimated Quantity (Bu)		Estimated Average Density (Bu/Ac) ²	Estimated Quantity (Bu)
		Lg Oysters	Sm Oysters	Lg Oysters	Sm Oysters		
1-Gay	6.580	7.7	5.4	50.7	35.9	49.8	327.9
2-Nansemond-Adams	2.600	6.9	1.8	18.0	4.8	28.3	73.5
3-Wright	1.990	72.6	63.4	144.4	126.1	265.3	528.0
4-Hatten	2.600	50.6	19.7	131.5	51.1	458.6	1,192.3
5-Crittenden	1.590	--	--	0.0	0.0	13.3	21.1
6-Martin	3.350	--	1.8	0.0	6.1	11.6	38.9
7&8-Nansemond F&O	9.128	28.3	26.6	258.1	243.1	278.5	2,542.0
9-Ingersoll	1.642	196.7	54.9	322.9	90.1	590.5	969.7
10-Newman	2.252	102.1	8.4	229.9	18.9	1,802.3	4,058.8
11-Blythe	1.140	23.2	33.2	26.5	37.83	580.1	662.1
12-Nansemond-Adams	0.690	--	--	0.0	0.0	213.0	146.9

Notes:

1. Areas studied measured by Paul Kendall with right-of-way areas (furnished by VDH&T) subtracted.
2. Calculated as outlined in Tables 2 from data in Tables 3 through 14.

Table 16

Estimates of Quantities of Live Oysters and Shell in Portions of Leased Oyster Planting Ground in the Right-of-Way Area for the US 17 Bridge Across Chuckatuck Creek.

Area Number & Name of Lessee	Portion of Lease in Area (acres) ¹	LIVE OYSTERS				SHELL	
		Estimated Average Density (Bu/Ac) ²		Estimated Quantity (Bu)		Estimated Average Density (Bu/Ac) ²	Estimated Quantity (Bu)
		Lg Oysters	Sm Oysters	Lg Oysters	Sm Oysters		
6-Martin	0.470	33.9	39.9	15.9	18.8	153.9	72.3
7&8-Nansemond F & O							
in City of Suffolk	0.830	6.6	--	5.5	0	34.8	28.9
in Isle of Wight	9.722	1.6	0.6	15.5	6.2	23.9	232.6
9-Ingersoll	1.588	111.8	60.5	177.5	96.1	450.6	715.6
10-Newman	0.428	54.4	--	23.3	0	1,252.4	536.0
11-Blythe	1.140	--	--	0	0	69.7	79.4

Notes:

1. Areas from the Virginia Department of Highways and Transportation.
2. Calculated as outlined in Table 2 from data in Tables 3 through 14.

Table 17

Estimated Value¹ of Oysters and Shells on Leased Ground in the Chuckatuck Creek in the US 17 Bridge Right-of-Way.

Lease	Large Oysters		Small Oysters		Total		Shell	
	Quantity ² (Bu)	Value (\$)	Quantity ² (Bu)	Value (\$)	Quantity (Bu)	Value (\$)	Quantity ² (Bu)	Value (\$)
6-Martin	15.9	133.56	18.8	65.80	34.7	199.36	72.3	23.14
7&8-Nansemond F&O								
in City of Suffolk	5.5	46.20	0.0	0.00	5.5	46.20	28.9	9.25
in Isle of Wight	15.5	130.20	6.2	21.70	21.7	151.90	232.6	74.43
9-Ingersoll	177.5	1,491.00	96.1	336.35	273.6	1,827.35	715.6	228.99
10-Newman	23.3	195.70	0.0	0.00	23.3	195.70	536.0	171.52
11-Blythe	0.0	0.00	0.0	0.00	0.0	0.00	79.4	25.41

Notes:

1. Calculation of value based on the following prices: for large (3 inches or longer) oysters \$12/bu is a reasonable price for good quality oysters; for smaller oysters, \$5/bu; and for shells 32¢/bu. The prices for oysters have been reduced by 30% because the waters of Chuckatuck Creek have been condemned by the Public Health Department.
2. From Table 16.

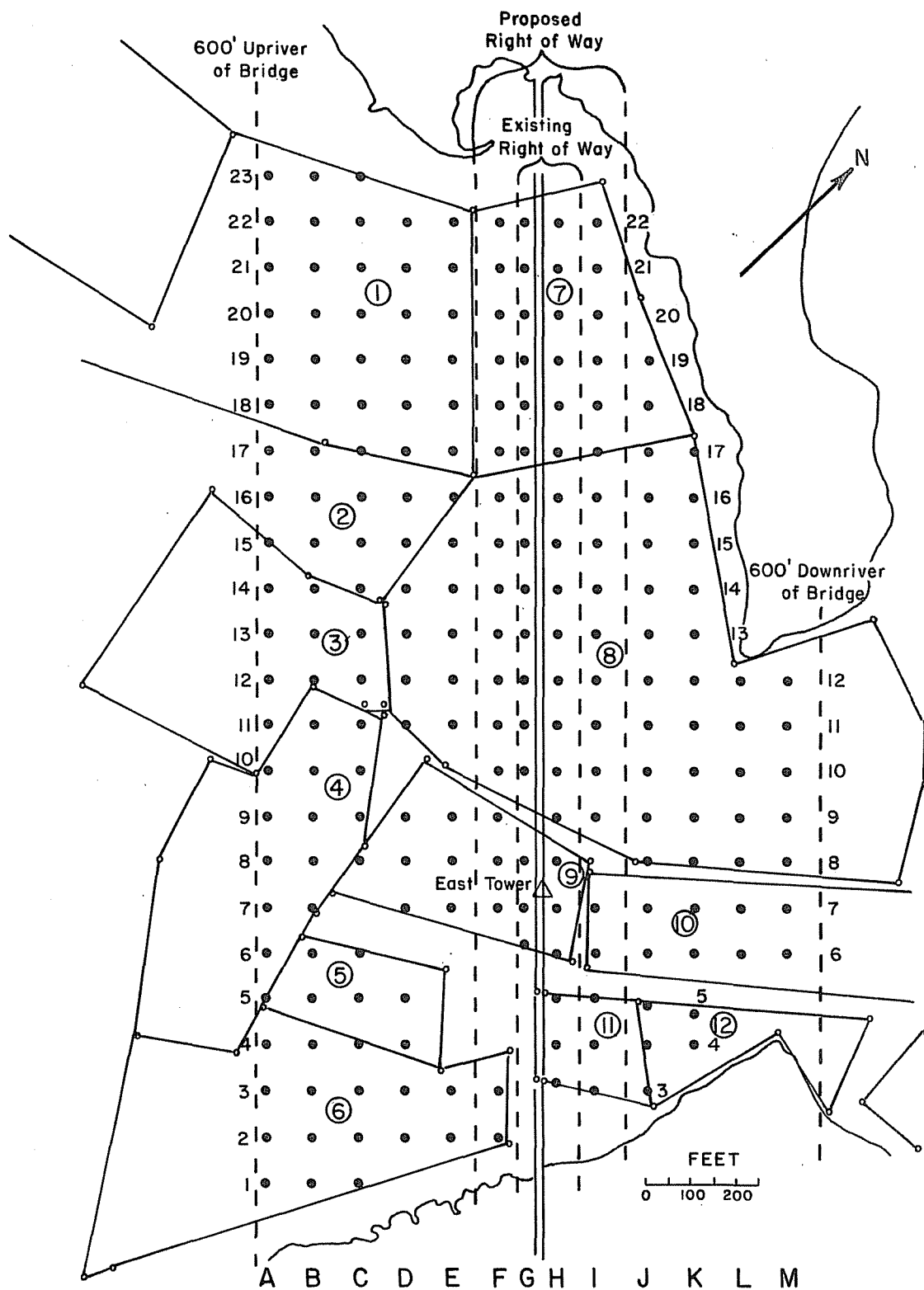


Figure 1. Chuckatuck Creek, in the vicinity of the US 17 Bridge; showing oyster ground leases, right-of-way, and location of stations sampled with hand tongs in 1979.

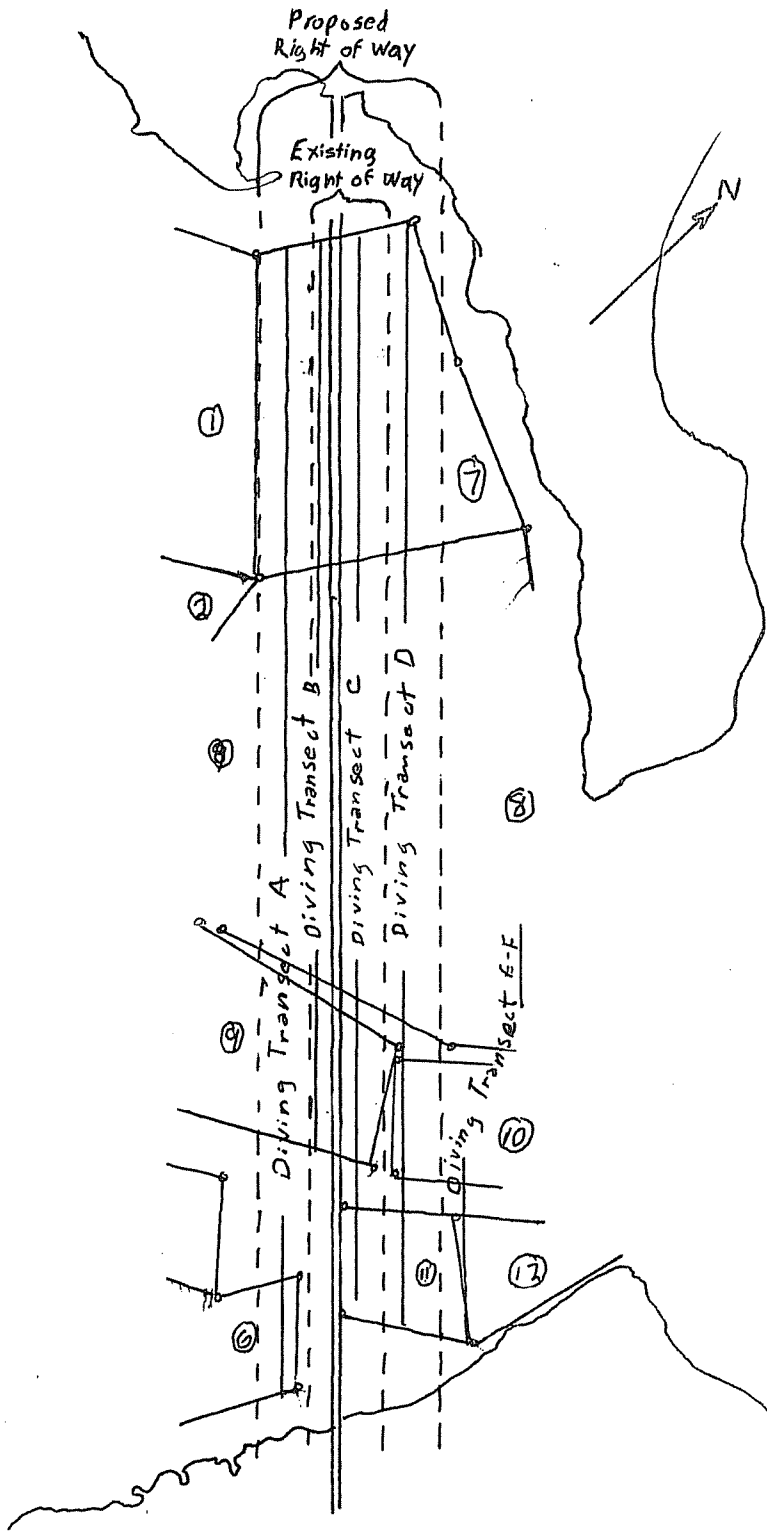


Figure 2. Location of Transects or Paths Followed by a Diver on 20 July 1979.

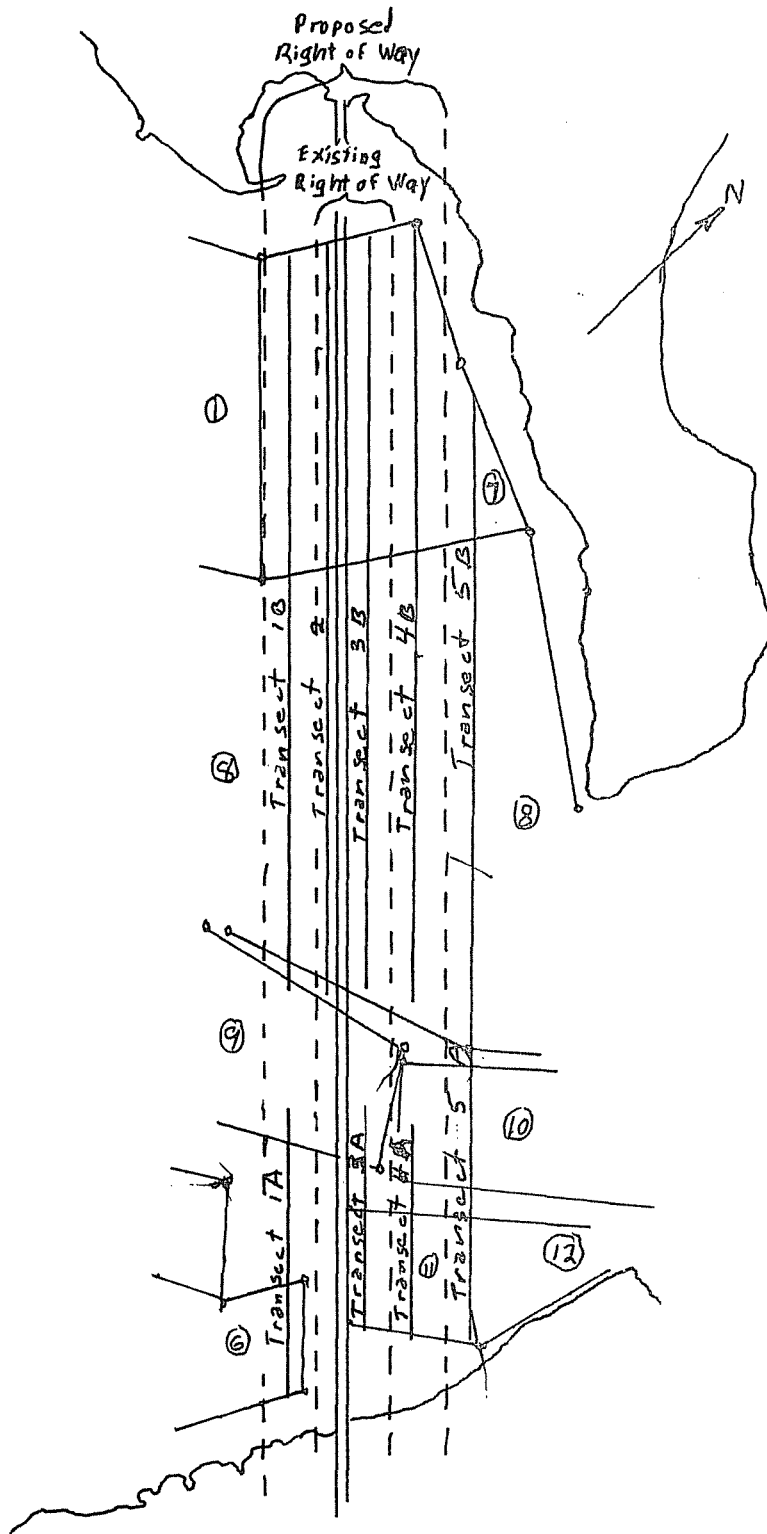
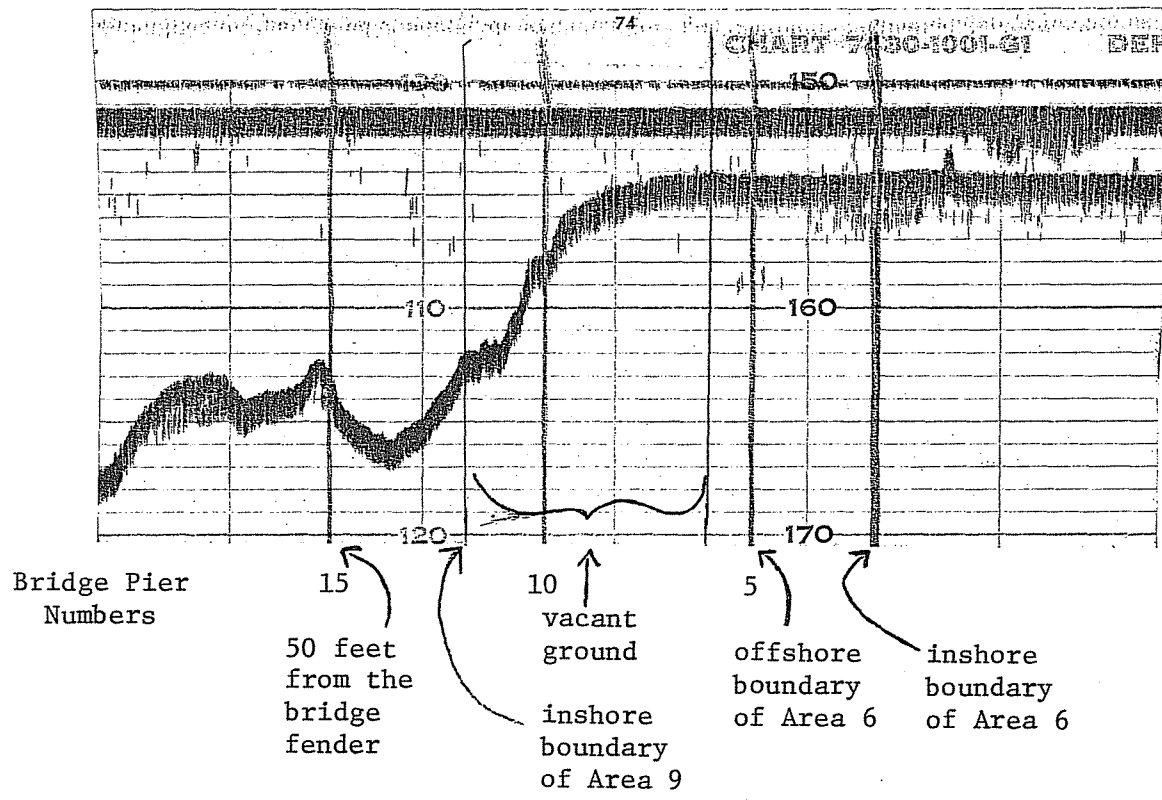
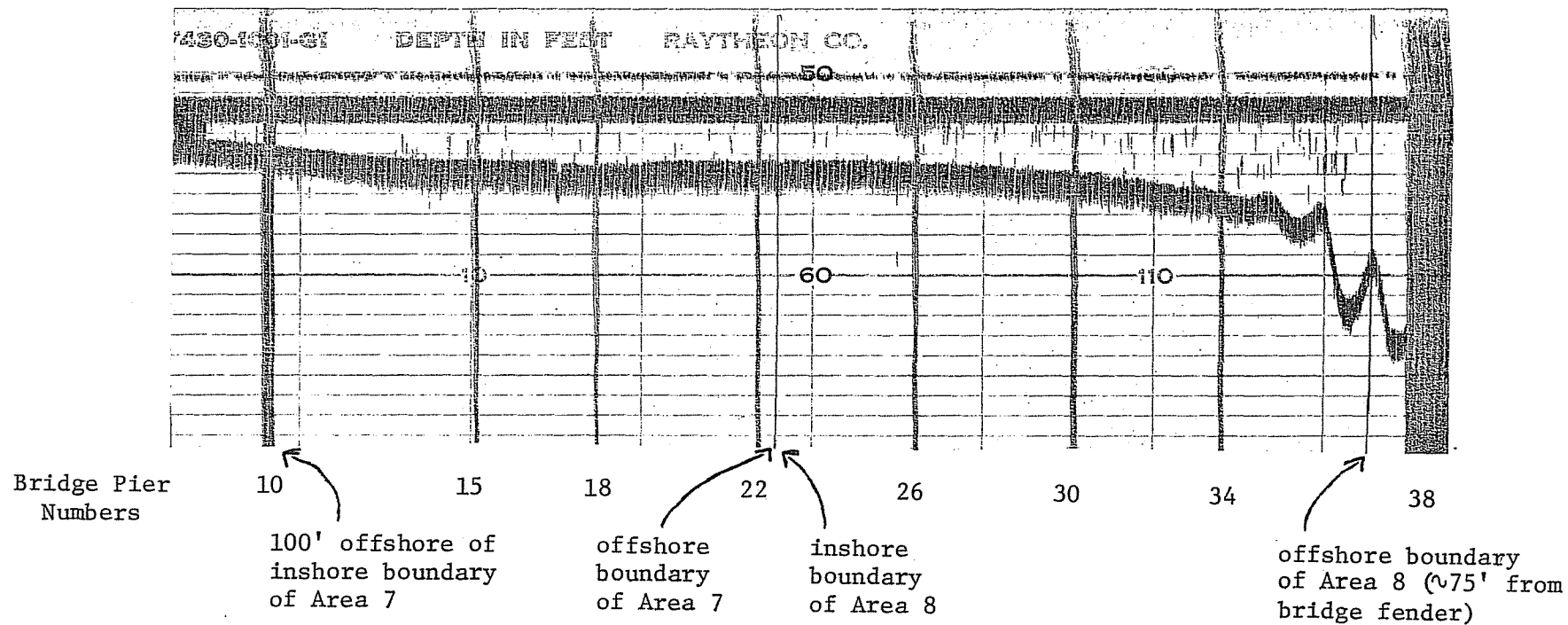


Figure 3. Location of Transects Along Which a Fathometer Was Operated on 1 August 1979.

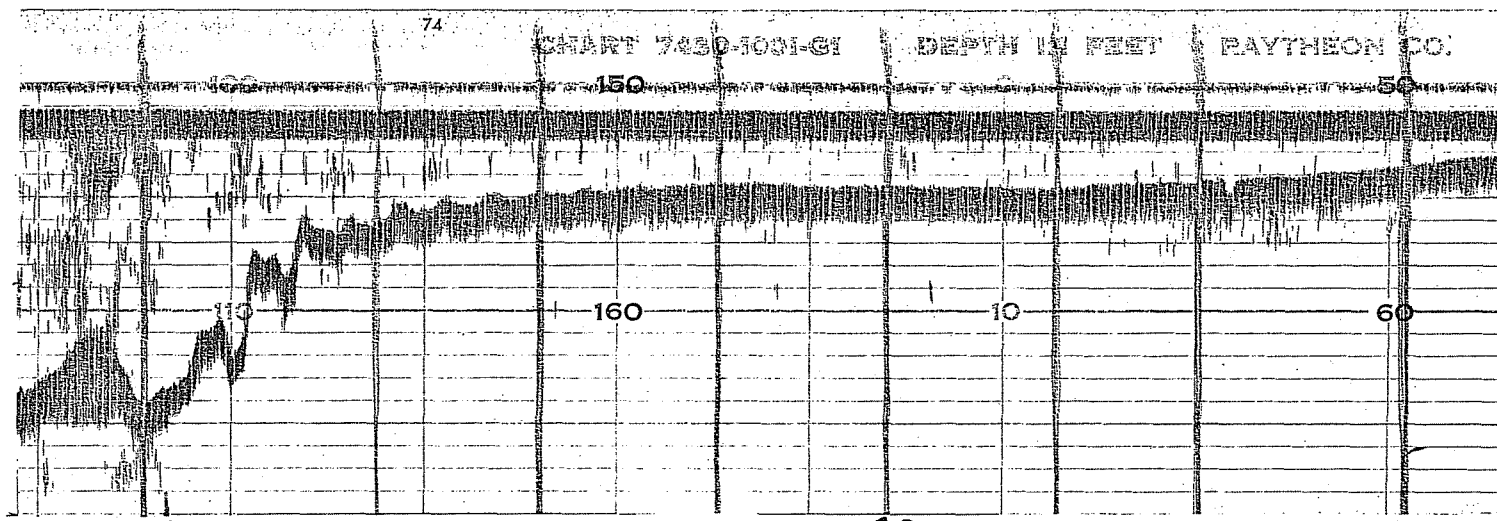
APPENDIX



Transect 1A. Leased Areas 6&9. Bottom Profile Recorded by Fathometer.
1 August 1979.



Transect 1B. Leased Areas 7&8. Bottom Profile Recorded by Fathometer.
1 August 1979.



Bridge Pier
Numbers

38

34

30

26

22

18

15

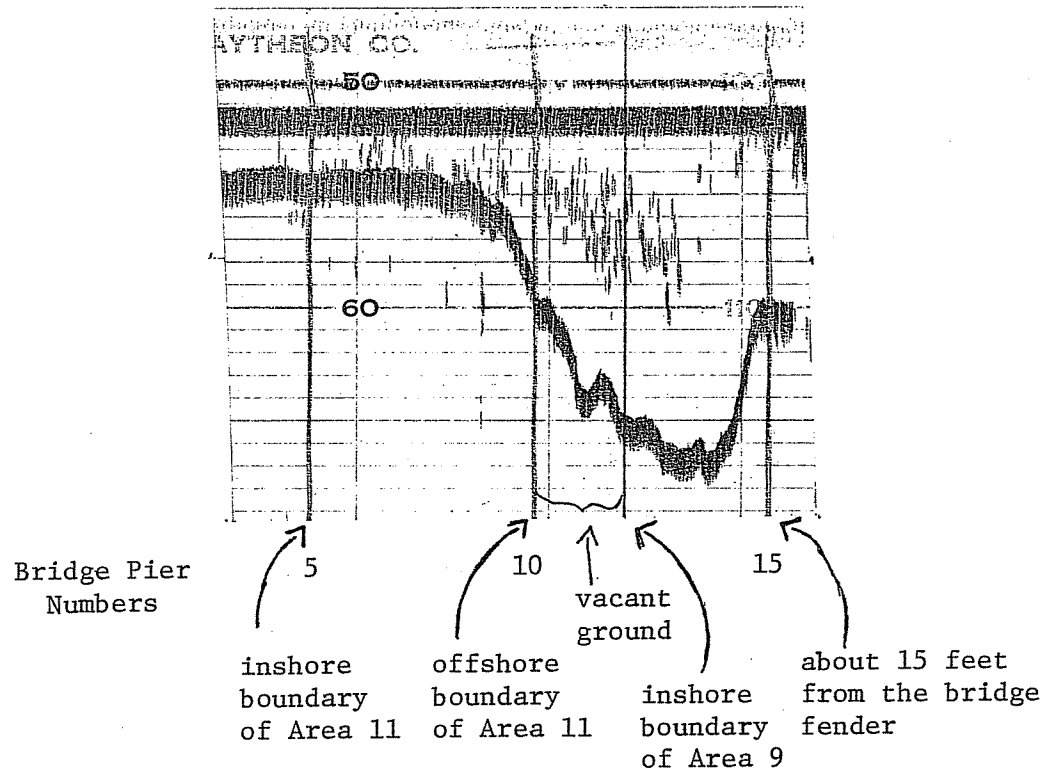
10

offshore
boundary
of Area 8

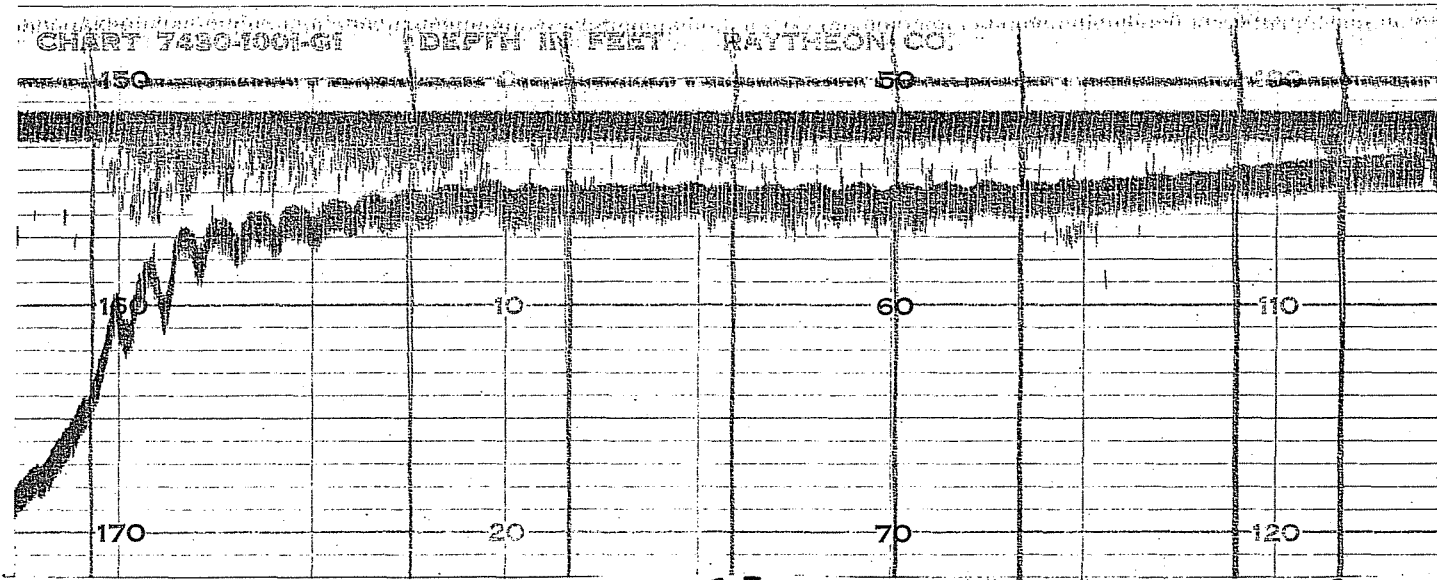
inshore
boundary
of Area 8 offshore
boundary
of Area 7

100 feet offshore
of inshore boundary
of Area 7

Transect 2. Leased Areas 7&8. Bottom Profile Recorded by Fathometer.
1 August 1979.



Transect 3A. Leased Areas 9 & 11. Bottom Profile Recorded by Fathometer.
1 August 1979.



Bridge Pier
Numbers

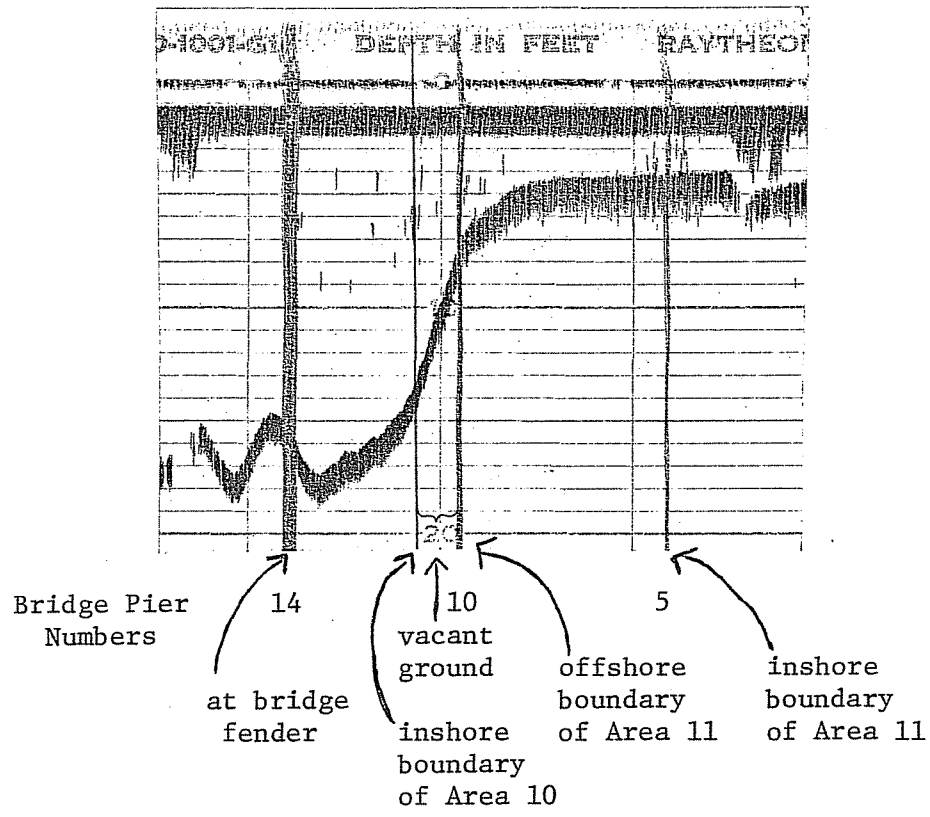
38 30 26 22 18 15 10 8

about 50 feet
inshore of
offshore boundary
of Area 8

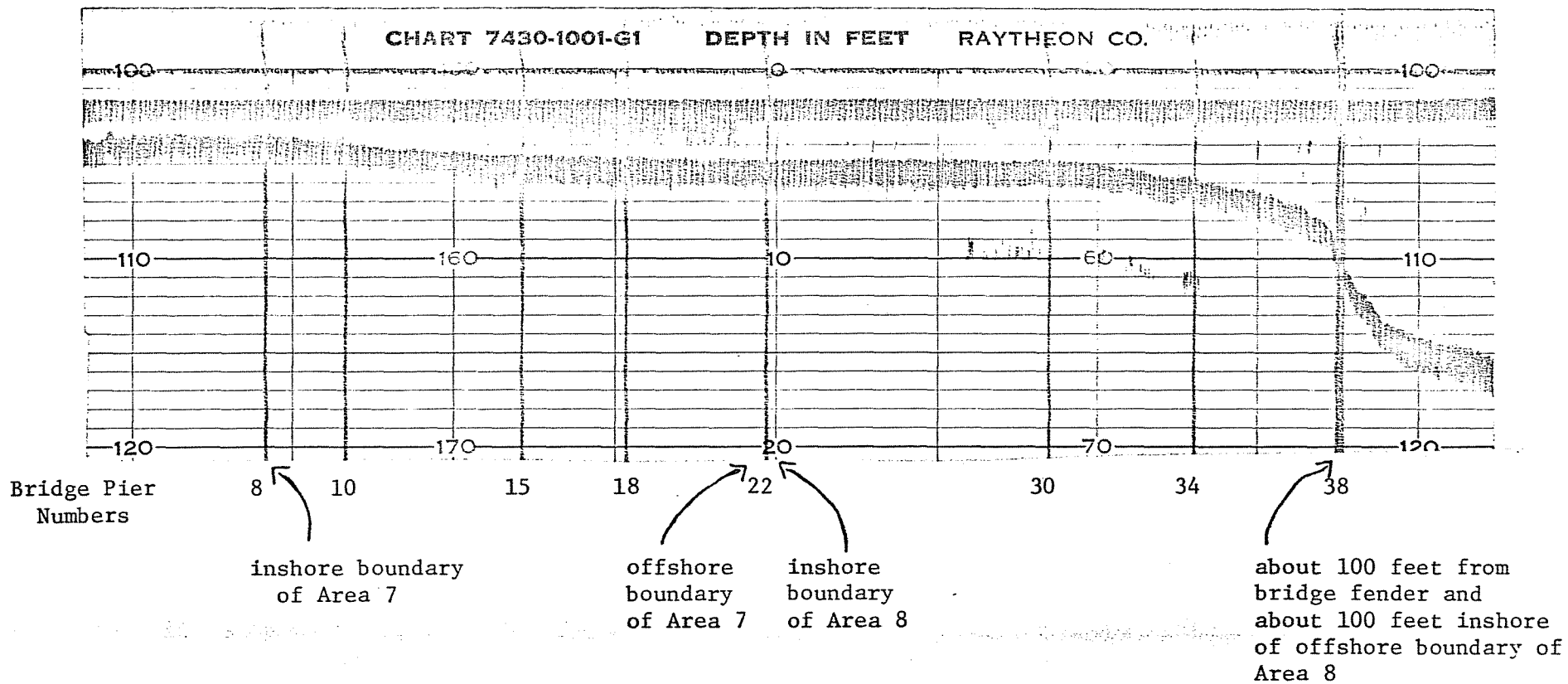
inshore
boundary
of Area 8 offshore
boundary
of Area 7

inshore
boundary
of Area 7

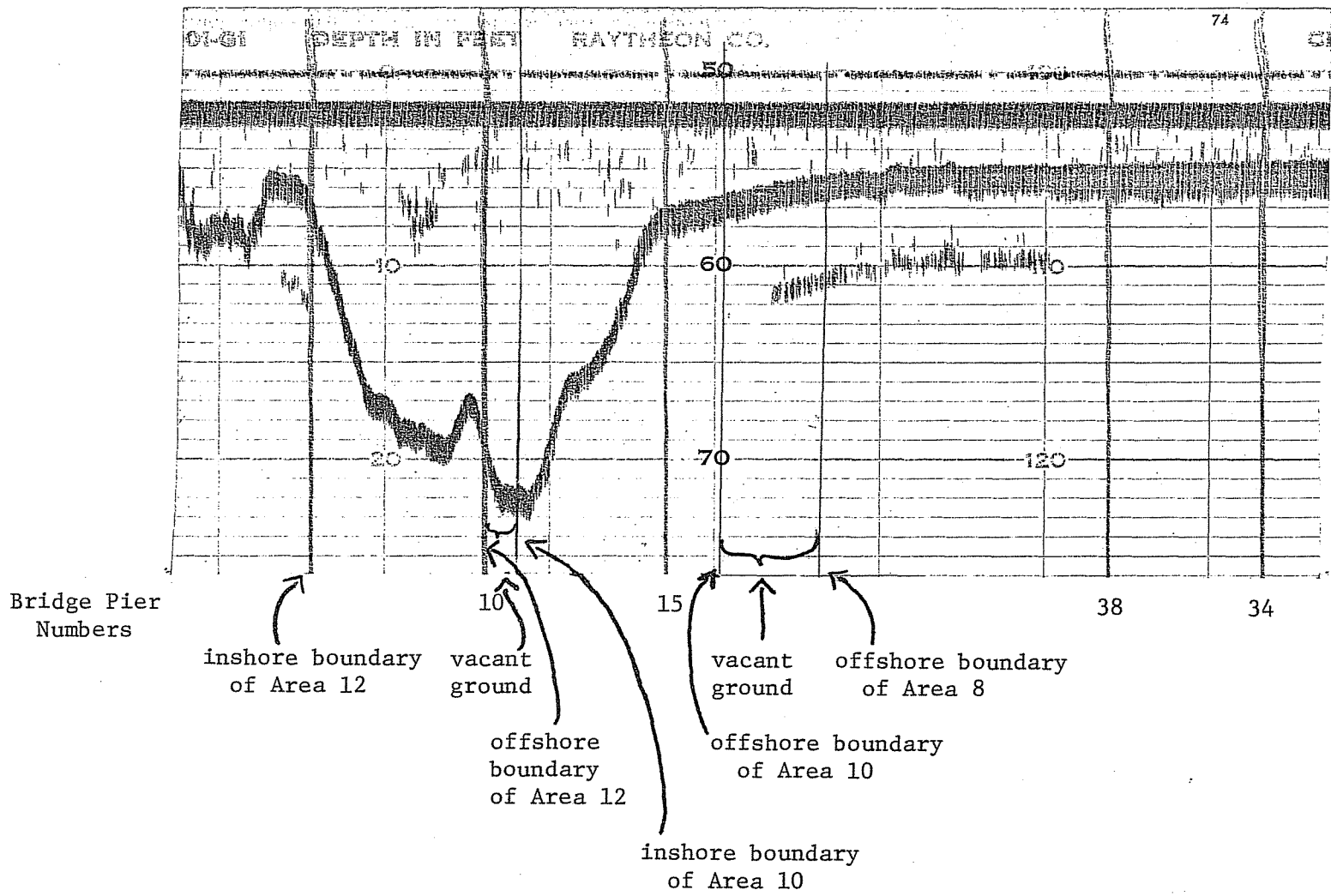
Transect 3B. Leased Areas 7&8. Bottom Profile Recorded by Fathometer.
1 August 1979.



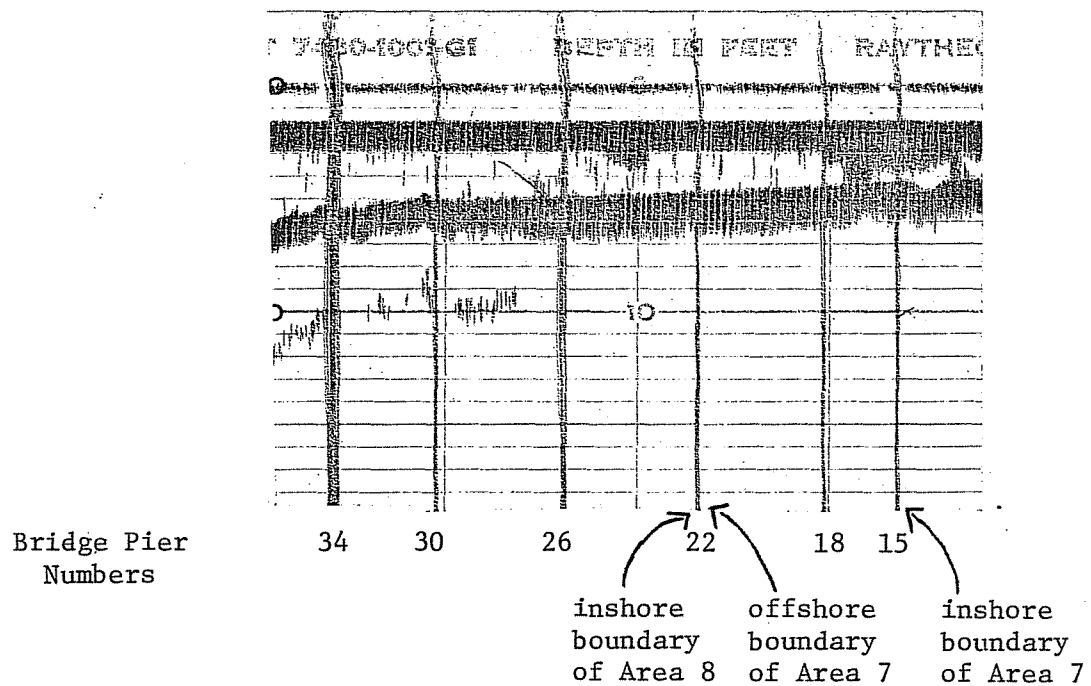
Transect 4A. Leased Areas 10 & 11. Bottom Profile Recorded by Fathometer.
1 August 1979.



Transect 4B. Leased Areas 7&8. Bottom Profile Recorded by Fathometer.
1 August 1979.



Transect 5A. Leased Areas 8, 10 & 12. Bottom Profile Recorded by Fathometer.
1 August 1979.



Transect 5B. Leased Areas 7&8. Bottom Profile Recorded by Fathometer.
1 August 1979.