A Final Report entitled:

Survey of shellfish resources in the proposed force main alignment route in the Lower James River, 2021

submitted to:
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by:
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and
Virginia Marine Resources Commission (VMRC)

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Executive Summary

A forced main pipeline is to be installed across the lower James River from (approximately) Newport News Point to the Suffolk shoreline east of Pig Point. This part of Hampton Roads has long supported a fishery for hard clam (*Mercenaria mercenaria)* and contains a portion of Baylor Grounds, which supports an oyster (*Crassostrea virginica)* fishery. The last comprehensive survey of hard clam resources in Hampton Roads was completed by a joint effort of the Virginia Institute of Marine Science (VIMS) and the Virginia Marine Resources Commission (VMRC) in 2001-2002 when hard clams were present both upstream and downstream of the proposed construction location. AECOM, through Waterways, approached VIMS to perform a survey of the current hard clam and oyster resource in the proposed installation area. A field survey was completed in May 2021 in a swath extending 100 m both downstream and upstream of the proposed cut. A sampling grid was developed by the Repletion Program at VMRC based on a sampling density of one sample station per every 5 acres (389.2 acres for a total of 78 samples). Each sample was a one-meter square collection with a hydraulic patent tong. Mean clam density was 0.08 m^{-2}, for a total of approximately 122,728 clams present on the 389.2 acres. Oysters were present within the boundary of the Baylor Grounds (102 acres) as well as on a small section of the area near the proposed bend in the line (3 acres), covering approximately 105 acres of the proposed cut area. Mean oyster density within this area was 2.0 oysters m^{-2}, for a total of approximately 849,828 live oysters present. There were no significant oyster populations in the majority of the proposed cut area, and clam densities were comparatively low as well as shown by the comparison of previous surveys.

Rationale and work statement

AECOM requested assistance in surveying shellfish resources in the proposed path of a forced main installation across the lower James River from (approximately) Newport News Point to the Suffolk shoreline east of Pig Point. The installation will be in part by directional drilling with no surface (that is sediment-water interface at the river bottom) signature and in part by open cut excavation with a surface signature. The open cut section is where AECOM is seeking assistance.

The goal of the AECOM request was (to quote correspondence between Mr. J Moore of AECOM and R. Mann of VIMS dated 4/16/2021):

> "Project construction will include horizontal drilling under the main channel and adjacent deeper areas (well below mudline, no impacts anticipated) and open cut excavation to install the remaining portion of the pipe from the channel to the Suffolk shore. The open cut portion is where we need to assess shellfish populations.
>
> The goal of this request is to assess "concentrated shellfish populations" to be avoided in accordance with Clean Water Act Section 404 - Nationwide Permit 58, I inserted the applicable permit condition language below*. Not clear on the appropriate methodology

to assess this, hoping VIMS could apply whatever standard methods you have used in the past for similar linear projects. Assume some kind of sampling interval following the proposed alignment to verify presence/absence/density of shellfish populations? Final deliverable could be a simple letter report documenting work performed with a map, findings, and a conclusion re shellfish populations in this alignment?

*"5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27. "

The proposed installation crosses Hampton Roads in a region that has historically supported both hard clam (*Mercenaria mercenaria*) and oyster (*Crassostrea virginica*) resources. The last comprehensive survey of hard clam resources in Hampton Roads was completed by a joint effort of the Virginia Institute of Marine Science (VIMS) and the Virginia Marine Resources Commission (VMRC) in 2001-2002 (report can be supplied if needed)[1]. Oyster resources are surveyed annually although not regularly in this particular region. Of note is that the Lower James also contains substantial oyster shell resources (much as buried fossil shell) that is used by VMRC in shellfish replenishment in support of the oyster fishery. The proposed area of impact contains unassigned grounds, Baylor Grounds (public oyster grounds) and private leased grounds.

Through Mr. J Moore, AECOM approached the VIMS PI (Mann) requesting a scope of work statement, timetable for possible survey, and cost estimate for a survey to specifically address the scope of work described above. In preparing the proposal Mann worked both internally at VIMS with staff scientist Southworth and with the VMRC Repletion Program Staff (Button and Rowe) to (a) review the maps provided by AECOM outlining the region of interest; (b) prepare a sampling grid at an appropriate density for a corridor extending 100m downstream of and 100m upstream of the proposed installation for the entire length of the open cut section; (c) determine a time window in late spring 2021 when all parties and resources (notably including the survey vessel) required to implement a field program would be available; (d) determine any modifications (materials, costs, installation time) to the survey vessel required to access to the deeper waters in the survey swath; (e) determine effort and vessel days required to complete the survey; (f) determine time and effort to prepare a final report for submission to AECOM after completion of the field survey; and (g) provide a concise summary of expected cost to complete the tasks outlined in (a) through (f) as listed.

The submitted list was approved and field work was completed in mid-May 2021. Data compilation was completed in late May 2021 and this report prepared in early June 2021. A brief review of the items (a) through (f) above is given below, followed by a concise summary of field data and project conclusion in respect to hard clam and oyster presence in the proposed cut area.

[1] Final report to Chesapeake Bay Stock Assessment Committee under project number NA07FU0535, from Virginia Institute of Marine Science and the Virginia Marine Resources Commission and entitled: "Fishery independent standing stock surveys of hard clam populations in the Chesapeake Bay and a comparison with continuing estimates from fishery dependent data."

(a) and (b). Coordinates for the proposed force main alignment were provided to the Repletion Program at VMRC by AECOM. From these a sampling polygon extending 100m both upstream and downstream of the boring line was prepared. The resulting polygon was 389.2 acres. A sampling grid was then overlaid on the polygon and the computer randomly selected 78 Lat/Long coordinates to target for sampling, representing coverage of one sample per every 5 acres. This density of sampling is similar to that used in the 2001-2002 survey and based on tests of sampling density performed at that time, considered adequate to generally represent hard clam population. The sampling tool used was a hydraulic patent tong with an open sampling area of one square meter operated from the VMRC owned vessel R/V J.B. Baylor. Tong depth penetration was approximately 15 cm, the length of the "teeth" on the tong extremities. Oysters live on the surface on hard bottom and hard clams have short siphons and bury only minimally when closed to avoid predation or disturbance. Thus, we consider them both to be representatively sampled by this tong. The tong was deployed at each computer-generated random station (Lat/Long coordinate) within the sampling grid. The tong is designed such that the closing and retrieval mechanisms act in sequence to insure minimal loss of sampled material. Once returned to the support survey vessel the sample was picked through, the material collected was washed and all hard clams and oysters were counted and measured. The summary hard clam density per unit area (one square meter) provides the basis for extrapolation to total standing stock estimates for the sampling grid as a whole. This is a standard procedure that has been approved by peer review for prior surveys by VIMS and VMRC of both hard clams and oysters in the Hampton Roads, James River and regions further afield in the Chesapeake Bay. The choice of a 100m survey zone on either side of the proposed force main alignment is based on prior precedent with other VDOT construction of crossings in the Hampton Roads region (e.g., the Lafayette River Bridge adjacent to the Norfolk Yacht Club and the expansion of the HRBT) and a reasoned estimate of navigation clearance required by the coring vessel. A more comprehensive description of sampling site is given in the field results section later in this report.

(c) The original request by AECOM to complete the survey in late Spring 2021 was accommodated within the prior commitments of the survey vessel and crew.

(d) There were no modifications required to complete this work. The maximum depth encountered during the sampling effort was approximately 45 ft and the hydraulic hoses available on the survey vessel were able to reach this depth (available hoses are 50 ft long and can reach to approximately 46 ft).

(e) Based on survey design a 2-day window was set aside to complete the survey and the survey was completed on May 12, 2021.

(f) The final report format was agreed upon to include a single hard copy (more can be provided if requested) with an additional digital copy. The digital copy (this document) a database with individual station data (Lat, Long, depth, total number of clams, clam size frequency distribution, total number of oysters, oysters size frequency, total culch material, along with other ancillary information collected) and calculation as employed to estimate total standing stock of clams and oysters within the survey area as a whole.

Field survey results

Figures 1 through 4 respectively describe sediment type (by visual observation; this protocol followed in the 2001-2002 clam survey as well as that regularly used by the investigators for other surveys they conduct) for the sampled stations, catches of live hard clams, catches of live oysters, and other live bivalves. Values in Figure 2 and 3 are per square meter (= patent tong sample area). Sediment types varied between sand and mud-sand mixes throughout the sampling polygon, indicating sufficient water movement to continually grade sediments and oxygenate the near bottom environment. For comparative purposes Figure 5 presents the sampling strata as occupied in the 2001-2002 joint VIMS-VMRC hard clam survey. Clam densities were 0.08 m^{-2} in the current study and 1.06 m^{-2} and 0 m^{-2} in James River areas 16 and 18, respectively, during the 2001-2002 VIMS/VMRC survey (Table 1). The 2001-2002 value in James River 16 was on the lower end of densities in areas targeted for commercial fishing (typically ~1.00 – 8.00 clams m^{-2}) as described in the 2002 final assessment report referenced earlier. The total number of estimated clams in the 2021 surveyed area are 122,728[2]. Oysters were found to be present within the boundary of the Baylor Grounds (covering 102 acres of total area surveyed) as well as on a small section of the area near the proposed bend in the line (approximately 3 acres of the total area surveyed), covering approximately 105 acres of the proposed cut area. Mean oyster density within this area was 2.0 oysters m^{-2}, for a total of approximately 849,828 live oysters present within the survey area. Approximately 11% (0.2 m^{-2}) of the oysters collected were market oysters (oysters >75 mm SL).

This sampling protocol leads to the discussion of commercially viable, "fishable" densities. Finding a small number of stations with higher densities among many with lower densities/absence of oysters does not portray a region with commercially viable populations. It simply portrays patchy distribution. The three stations in this where oysters were found contained a total of six market sized oysters (>76 mm). Certain fishing gear types, such as dredges, can partially overcome patchy distributions by fishing over large areas, but oyster tongs are limited in this respect. The term commercially viable is better applied to natural extensive reefs or oyster plantings. The area surveyed herein does not represent extensive distribution and it is not appropriate to characterize it as commercially viable. For comparison, consider Point of Shoals in the Burwell Bay region of the James River as a viable commercial reef – 154 acres with a mean density of market oysters in the 20+ m^{-2} for at least the past decade (see http://cmap2.vims.edu/VOSARA/viewer/VOSARA.html).

A record of all 2021 survey data is given as an EXCEL file in digital Appendix 1 wherein the following data are presented on a station by station basis: sample #, Longitude, Latitude, Depth (feet), brown shell (shell found above the sediment water interface; volume L), black shell (buried shell that was exhumed in the sampling process; volume L), # live clams, # clam "boxes" (dead shells still attached as a pair, years since death unknown), # live oysters, # live other bivalves, and ancillary comments including shell length (SL, mm) and shell height (SH, mm) of any hard clams collected, shell height (SL, mm) of any live oysters collected, and shell length of any other live bivalves collected. An explanation of standard bivalve measurements are included in the metadata for the table.

[2] Absolute numbers of clams and oysters per sampled region are estimated by: # of clams or oysters m^{-2} * 4046.8 * # acres in the sampled region). One acre = 4046.8 m^2.

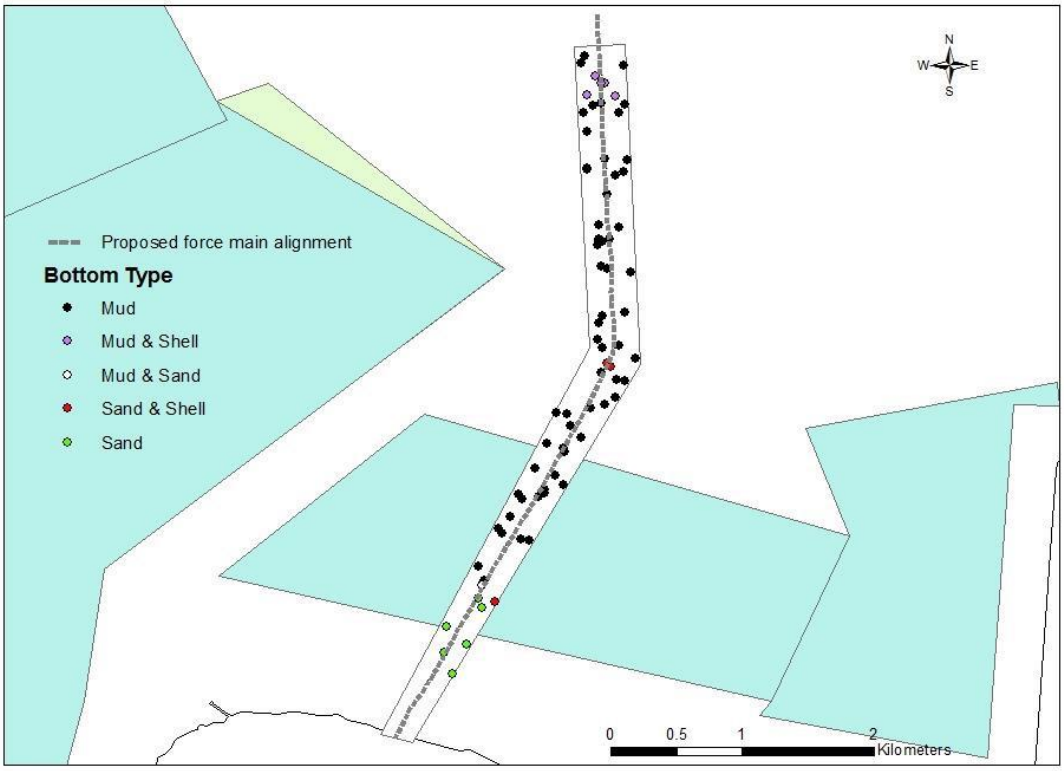


Figure 1. Sediment types throughout sampling polygon.

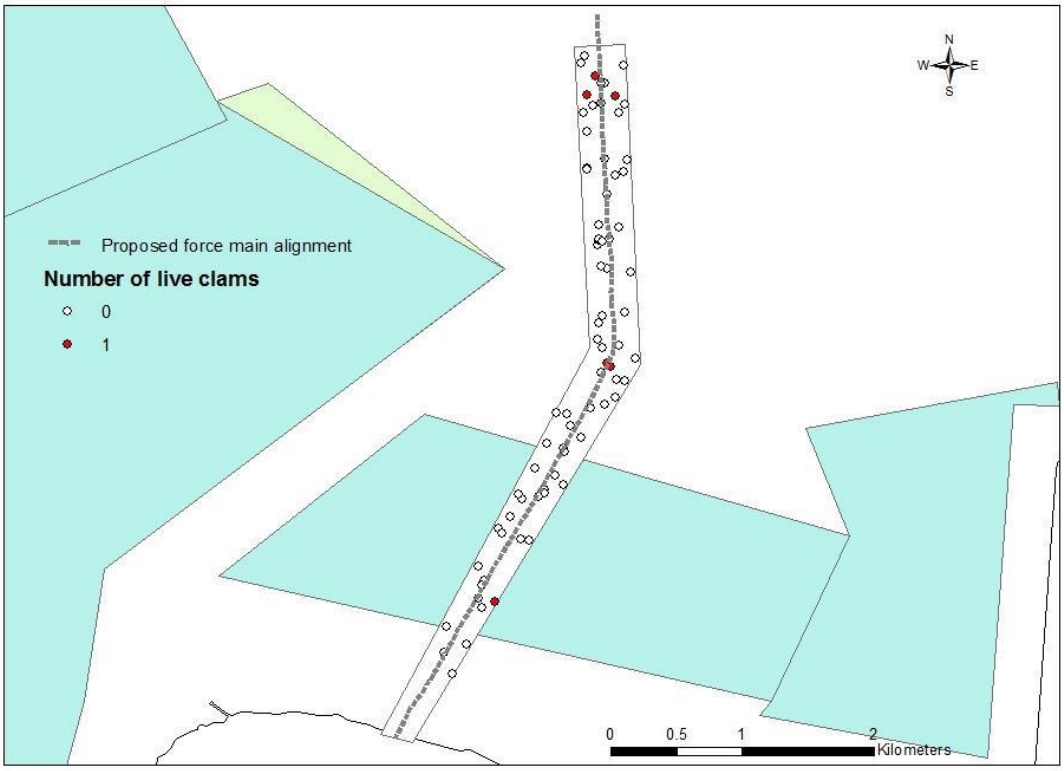


Figure 2. Density of live hard clams (#/m^2) throughout the sampling polygon.

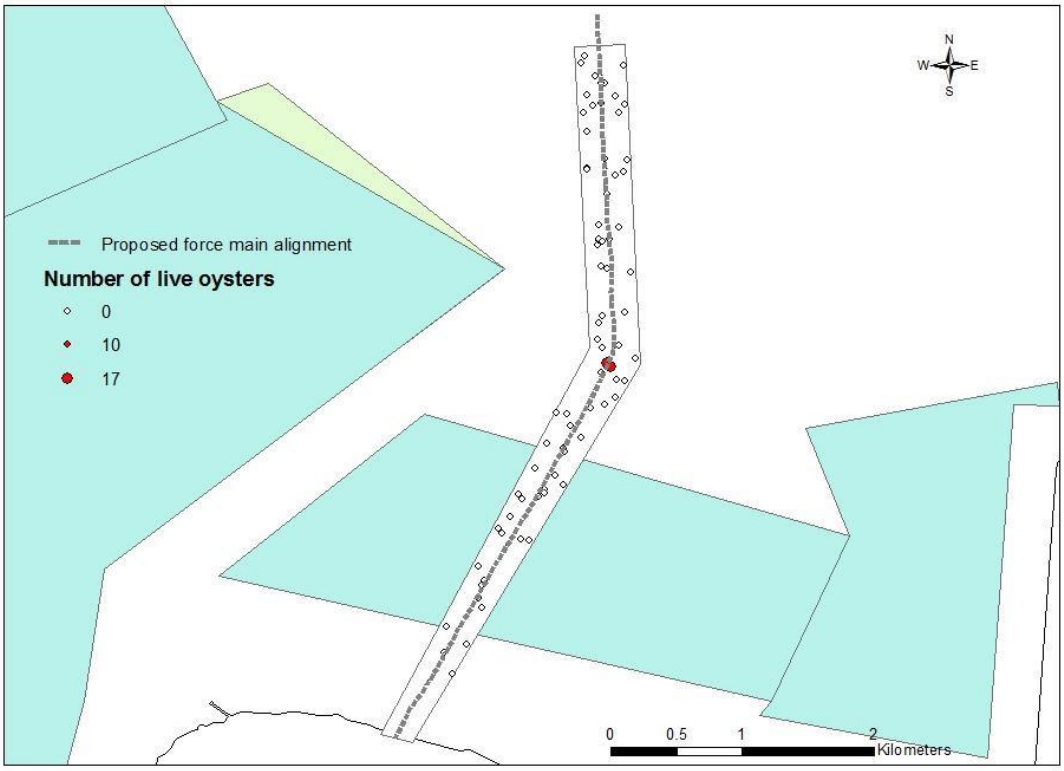


Figure 3. Density of live oysters (#/m^2) throughout the sampling polygon.

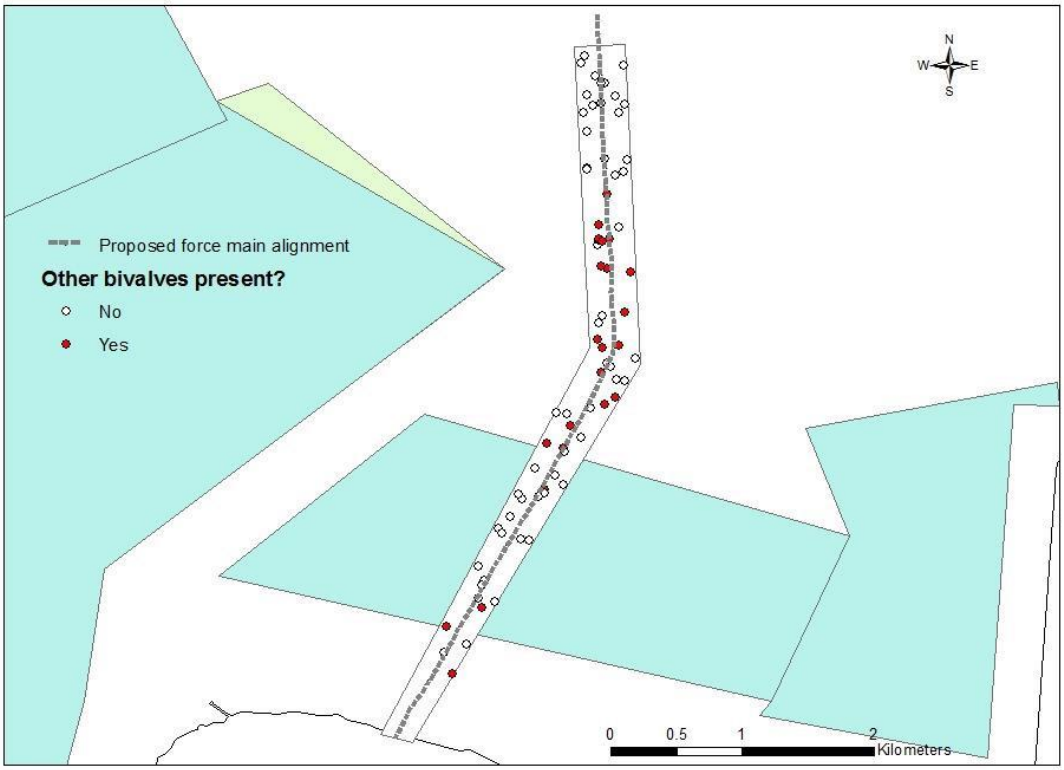


Figure 4. Presence/absence of other bivalves throughout the sampling polygon (see database for specific types of other bivalves observed).

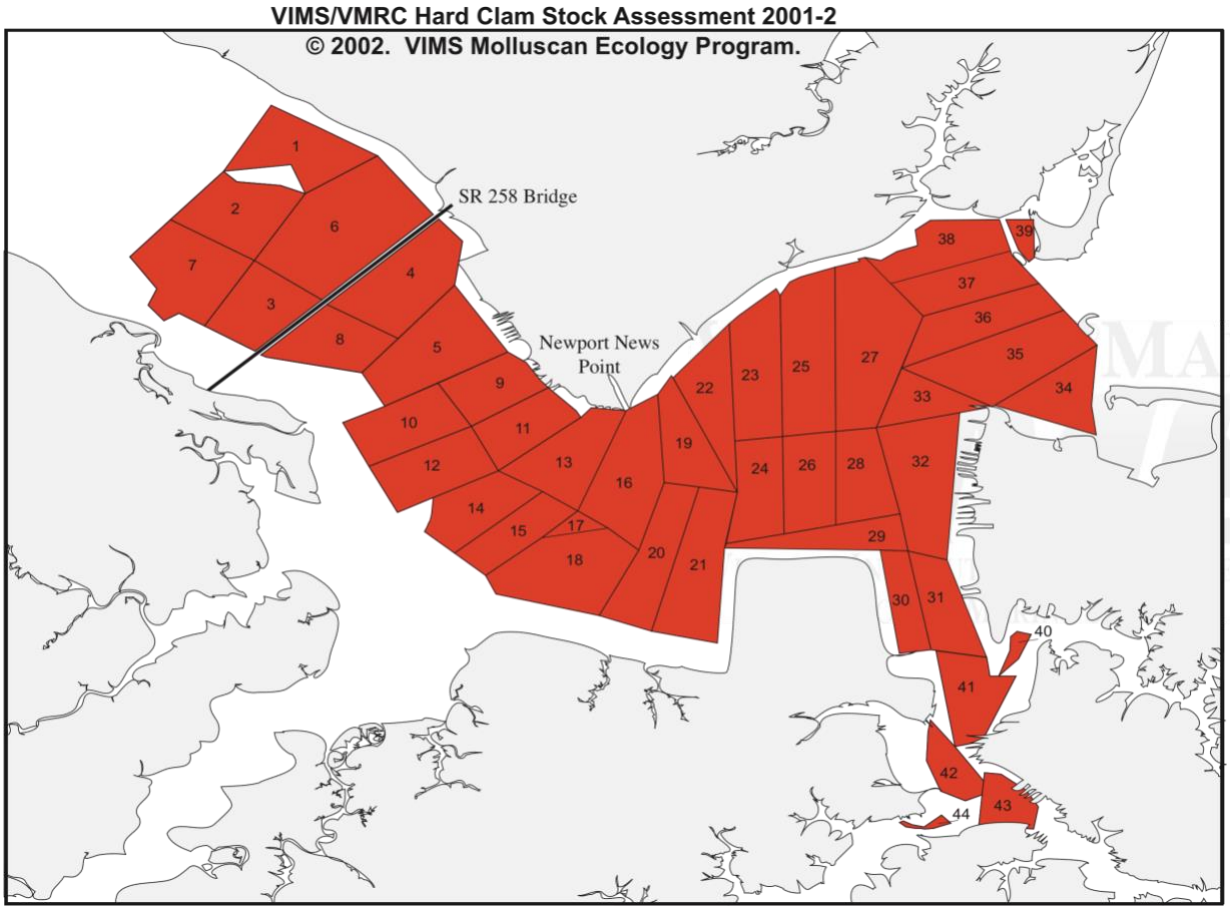


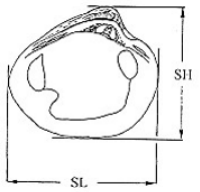
Figure 5. Hard clam stock assessment sampling regions in the Lower James River 2001-2002.

Area	Year	Acreage	# samples	# live hard clams	# live hard clams per sq. m	# of clams in area
Proposed cut (this study)	2021	389.2	77	6	0.08	122,728
James River 16	2001	1126.4	141	149	1.06	4,817,181
James River 18	2001	1248.7	78	0	0	0

Table 1: Summary of hard clam densities in the 2021 sample area and selected regions (James River 16 and 18; see Figure 5) from the 2001-2002 VIMS/VMRC hard clam stock assessment in the lower James River.

Appendix 1

Sample #: Number assigned to sample
Longitude W: west longitude where sample was collected
Latitude N: north latitude where sample was collected
Depth: depth in feet where sample was collected
Bottom: code for type of bottom (1 = 100% mud, 2 = mix of mud and shell, 3 = mix of sand and mud, 5 = mix of sand and shell, 6 = 100% sand)
Sampling device: hydraulic patent tong with opening of one square meter - all data is per square meter
Brown shell: Amount of brown shell (shell on surface of sediment) in liters collected in the sample
Black shell: Amount of black shell (shell buried in sediment) in liters collected in the sample
Live clams: the number of Mercenaria hard clams collected in the sample
Clam boxes: the number of Mercenaria hard clam boxes (dead clams) collected in the sample
live oysters: the number of live oysters collected in the sample
live other bivalves: the number of other live bivalves (not including clams and oysters) collected in the sample
Comments: Sizes of all bivalves included in this section as well as other pertinent information



 SL = shell length, SH = Shell height)

NOTES
Samples were collected on May 12, 2021.
Bottom temperature on day of sampling ranged from 17.1-17.4 C (62.8-63.3 F)
Bottom salinity ranged from 16.8-19.6 ppt (salinity was higher at the deeper sites)
Most of the mud samples had a good amount of tube worms in them.
Animals collected: Mercenaria mercenaria (hard clam), Crassostrea virginica (oyster), Tagelus plebeius (stout razor clam), Cyrtopleaura costata (angel wing clam), Upogebia affinis (burrowing mud shrimp)
Measurements are as follows: Mercenaria (SLxSH, mm), Crassostrea (SH, mm), Tagelus and Cyrtopleura (SL, mm)

Sample #	Longitude W	Latitude N	Depth (ft)	Bottom	Brown shell (L)	Black Shell (L)	# Live Clams	# Clam boxes	# live oysters	# live other bivalves	Comments
1	-76.41628333	36.92793333	15	1	0	0	0	0	0	1	Tagelus (25 mm)
2	-76.41696667	36.92738333	15	1	0	0	0	0	0	1	Tagelus (55 mm)
3	-76.41793333	36.92716667	16	1	0	0	0	0	0	0	
4	-76.4196	36.92673333	16	1	0	0	0	0	0	0	
5	-76.42028333	36.92683333	15	1	0	0	0	0	0	0	
6	-76.41931667	36.92595	16	1	0	0	0	0	0	1	Tagelus (67 mm)
7	-76.41863333	36.92518333	16	1	0	0	0	0	0	0	
8	-76.41986667	36.92441667	16	1	0	0	0	0	0	1	Tagelus (55 mm)
9	-76.41973333	36.9242	16	1	0	0	0	0	0	0	
10	-76.42096667	36.74086667	16	1	0	0	0	0	0	0	
11	-76.42096667	36.92475	16	1	0	0	0	0	0	1	Tagelus (64 mm)
12	-76.4218	36.923	15	1	0	0	0	0	0	0	
13	-76.42041667	36.92256667	15	1	0	0	0	0	0	0	
14	-76.41986667	36.9219	15	1	0	0	0	0	0	0	
15	-76.42111667	36.92156667	13	1	0	0	0	0	0	1	Tagelus (53 mm)
16	-76.42111667	36.92135	14	1	0	0	0	0	0	0	
17	-76.42151667	36.92113333	14	1	0	0	0	0	0	0	
18	-76.42263333	36.92091667	14	1	0	0	0	0	0	0	
19	-76.4229	36.92125	15	1	0	0	0	0	0	0	
20	-76.42345	36.9197	12	1	0	0.1	0	0	0	0	
21	-76.42428333	36.91893333	12	1	0	0	0	0	0	0	
22	-76.42401667	36.91861667	12	1	0	0	0	0	0	0	
23	-76.42276667	36.91816667	12	1	0	0	0	0	0	0	
24	-76.42221667	36.91806667	12	1	0	0	0	0	0	0	
25	-76.42566667	36.91631667	12	1	0	0	0	0	0	0	
26	-76.42525	36.91531667	11	1	0	0	0	0	0	0	
27	-76.42538333	36.915	11	3	0	0	0	0	0	0	
28	-76.42566667	36.91411667	9	6	0	0	0	0	0	0	
29	-76.42538333	36.91345	8	6	0	0	0	0	0	1	Tagelus (47 mm)
30	-76.42456667	36.9139	10	5	3	2	1	0	10	0	1 Mercenaria (57x51 mm), 10 Crassostrea (16, 1
31	-76.4265	36.91093333	5	6	0	0	0	0	0	0	
32	-76.42801667	36.91038333	5	6	0	0	0	0	0	0	
33	-76.42746667	36.90896667	5	6	0	0	0	0	0	1	Tagelus (38 mm)
34	-76.42786667	36.91215	5	6	0	0	0	0	0	1	Tagelus (42 mm)
35	-76.42995	36.90643333	< 3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Too shallow to safely sample
36	-76.41725	36.92958333	16	1	0	0	0	0	0	1	Tagelus (71 mm)
37	-76.41683333	36.93023333	13	5	3	1	1	0	17	0	1 Mercenaria (70x68 mm), 17 Crassostrea (17, 1
38	-76.41655	36.93001667	13	5	5	0	1	0	17	0	1 Mercenaria (82x71 mm), 17 Crassostrea (15, 1
39	-76.41615	36.92913333	16	1	0	0	0	0	0	0	
40	-76.41558333	36.92903333	16	1	0	0	0	0	0	0	
41	-76.4149	36.93056667	16	1	0	0.1	0	0	0	0	
42	-76.416	36.93143333	15	1	0	0	0	0	0	2	Tagelus (75, 67 mm)
43	-76.41711667	36.93133333	15	1	0	0	0	0	0	1	Tagelus (69 mm)
44	-76.41751667	36.93188333	15	1	0	2	0	0	0	1	Tagelus (62 mm)
45	-76.41738333	36.93298333	15	1	0	0	0	0	0	0	
46	-76.41711667	36.93351667	15	1	0	0	0	0	0	0	
47	-76.41558333	36.93375	16	1	0	0	0	0	0	2	Tagelus (75, 61 mm)
48	-76.41518333	36.93648333	20	1	0	0	0	0	0	1	Tagelus (42 mm)
49	-76.41683333	36.9367	19	1	0	0	0	0	0	1	Tagelus (76 mm)
50	-76.41725	36.93691667	19	1	0	0	0	0	0	1	Tagelus (59 mm)
51	-76.41751667	36.93835	21	1	0	0	0	0	0	0	
52	-76.41738333	36.93868333	21	1	0	0	0	0	0	0	
53	-76.41738333	36.93878333	21	1	0	0	0	0	0	2	Tagelus (52, 71 mm)
54	-76.41711667	36.93856667	21	1	0	0	0	0	0	6	Tagelus (66, 75, 74, 53, 64, 54 mm)
55	-76.4167	36.93878333	22	1	0	0	0	0	0	2	Tagelus (68, 64 mm)
56	-76.416	36.93955	23	1	0	0	0	0	0	0	
57	-76.41738333	36.93976667	22	1	0	0	0	0	0	2	Tagelus (68, 59 mm)
58	-76.41683333	36.94185	24	1	0	0	0	0	0	1	Cryptopleura (63 mm)
59	-76.41628333	36.94316667	25	1	0	0	0	0	0	0	
60	-76.41573333	36.94338333	25	1	0	0	0	0	0	0	
61	-76.41545	36.94416667	26	1	0	0	0	0	0	0	
62	-76.41696667	36.94426667	25	1	0	0	0	0	0	0	
63	-76.41821667	36.94361667	23	1	0	0	0	0	0	0	
64	-76.41821667	36.9435	23	1	0	0	0	0	0	0	
65	-76.41821667	36.94613333	26	1	0	0	0	0	0	0	1 Upogebia affinis
66	-76.41848333	36.94745	29	1	0	0	0	0	0	0	
67	-76.4178	36.94788333	30	1	0	0	0	0	0	0	
68	-76.41725	36.9481	30	1	0	0	0	0	0	0	
69	-76.41628333	36.94855	31	2	0.1	0	1	0	0	0	Mercenaria (59x51 mm), 1 Upogebia affinis
70	-76.41558333	36.948	29	1	0	0	0	0	0	0	1 Upogebia affinis
71	-76.416	36.94745	29	1	0	0	0	0	0	0	
72	-76.41696667	36.94941667	32	2	0.1	0	0	0	0	0	
73	-76.41725	36.94941667	32	2	0.1	0	0	0	0	0	
74	-76.41766667	36.94996667	34	2	0.1	0	1	0	0	0	Mercenaria (77x68 mm)
75	-76.41863333	36.95085	42	1	0	0	0	0	0	0	
76	-76.41835	36.95128333	45	1	0	0	0	0	0	0	
77	-76.41821667	36.94865	31	2	0.1	0	1	0	0	0	Mercenaria (71x64 mm)
78	-76.41573333	36.95063333	36	1	0	0	0	0	0	0	