

A Final Report:

Survey of clam resources in the vicinity of the Hampton Roads Bridge Tunnel (I-64): Fall 2018

submitted to:

Virginia Department of Transportation
Environmental Division
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by:

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Period of activity: October 1, 2018 – December 15, 2018

Executive Summary

The Hampton Roads I-64 Bridge Tunnel (HRBT) is to be expanded. Hampton Roads has long supported a fishery for the hard clam (*Mercenaria mercenaria*). 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 HRBT location. The Virginia Department of Transportation (VDOT), through Stantec, approached VIMS to perform a survey of current hard clam resources in the HRBT expansion project area. A field survey was completed on October 2018 in a swath extending 100m downstream and 200m upstream of the current HRBT for the entire length of the structure from Hampton at the western terminus to the eastern “over-water” limit at Willoughby Spit. A sampling grid was developed by the Repletion Program at VMRC based on a sampling density of one sample station per every 5 acres. Each sample was a one meter square collection with a hydraulic patent tong. A total of 110 samples were collected: 20 from Willoughby Bay, 34 from HRBT South (the southern approach to HRBT) and 56 from HRBT North. These three sampling regions have the following estimates of clam populations: clams are absent from 45 acres of Willoughby Spit, 67,854 clams are present on 186 acres of HRBT South, and 439,731 clams are present on 362 acres of HRBT North. Throughout the sampled regions clam densities were $<0.3\text{m}^{-2}$, comparable to or less than 2001-2002 clam densities for the same region and below that generally targeted by for commercial fishing (typically $\sim 1.00 - 8.00$ clams m^{-2}). The observed 2018 clam densities and size distributions are not indicative of regular clam recruitment of any notable magnitude.

Rationale and work statement

The Hampton Roads I-64 Bridge Tunnel (HRBT) provides access across the lower James River between Hampton and Norfolk for over 100,000 vehicles per day in peak summer periods. The original tunnel was opened in 1957 (current westbound lanes) and expanded in 1976 (eastbound lanes). Both tunnels are approximately 7,500 feet long. The decision for additional expansion has been made. A construction contract is expected to be awarded in 2019, with an estimated completion in 2024.

Hampton Roads has long supported a fishery for the hard clam (*Mercenaria mercenaria*) with product sold as both chowders (large clams) and little necks (small clams \sim one inch in longest dimension). The last comprehensive survey of hard clam resources in Virginia (which included the HRBT area of 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 and 2002. Hard clams were present both upstream and downstream of the HRBT location (report by Mann and collaborators previously supplied to Stantec¹).

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.”

In a VMRC letter to Virginia Department of Transportation (VDOT) dated July 20, 2018, a hard clam survey was requested to reflect current standing stock abundance in the benthic habitats proximate to the proposed HRBT expansion (HRBT Expansion Area). VDOT, through Stantec, approached the VIMS PI (Mann) requesting a scope of work, timetable for a possible survey, and cost estimate to specifically address VMRC's letter dated July 20, 2018 that a hard clam survey be performed to reflect current standing stock abundance in the benthic habitats proximate to the proposed HRBT expansion (HRBT Expansion Area) project area. This document is the final report to Stantec and VDOT.

PI Mann worked both internally at VIMS with staff scientist Southworth and with the VMRC Repletion Program Staff (Button and Rowe) to develop a task and deliverables list to complete the survey. The following list was developed and submitted for approval by Stantec:

- (a) review the shape file provided by Stantec outlining the HRBT Study Limits, within which the Sampling Corridor was developed;
- (b) prepare a sampling grid at the density of one station per every 5 acres within a Sampling Corridor extending 100 meters (m) downstream of the current HRBT and 200m upstream of the current HRBT for the entire length of the structure from Hampton at the western terminus to the eastern "over-water" limit at Willoughby Spit;
- (c) determine a time window in the 2018 fall months when all parties (VMRC and VIMS staff) and resources required to implement a field program would be available;
- (d) include consideration of any modifications (materials, costs, installation time) to the survey vessel to allow access to the deeper waters (sampling equipment limited to a maximum of 40 feet depth, depth in the Sampling Corridor ranges between 4 and 70 feet) in the Sampling Corridor;
- (e) determine effort and vessel days required to complete the survey;
- (f) determine time and effort to prepare a final report for submission to VDOT 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 October 2018. Data compilation was completed in late October 2018 and this report prepared in November 2018. A brief review of items (a) through (g) above is given below, followed by a concise summary of field data and project conclusion with respect to hard clam presence in the Sampling Corridor.

- (a) and (b). Shape files were provided by Stantec via VDOT. From these a sampling grid was prepared at the density of one station per every 5 acres within the Sampling Corridor extending 100m downstream of the current HRBT and 200m upstream of the current HRBT for the entire length of the structure from Hampton at the western terminus to the eastern "over-water" limit at Willoughby Spit. Shape files were compared to the 2001 survey to determine prior records of clam presence. Clams were present throughout the Sampling Corridor proposed for the 2018 survey in 2001. Three sampling grids (HRBT South, HRBT North and Willoughby Bay) were developed by the Repletion Program at VMRC based on a sampling density of one sample station per every 5 acres. So for example, HRBT South was approximately 186 acres and the computer randomly selected 38 lat/long coordinates to

target for sampling. This density is similar to that used in the 2001 survey and, based on tests of sampling density performed at that time, considered adequate to generally represent the hard clam population. The sampling tool used in both the 2001 and the current 2018 survey was a hydraulic patent tong with an open sampling area of one square meter operated from the VMRC owned vessel R/V JB Baylor. Tong depth penetration was approximately 15 cm, the length of the “teeth” on the tong extremities. Hard clams have short siphons and bury only minimally when closed to avoid predation or disturbance. Thus we consider them to be representatively sampled by this tong. The tong was deployed at each computer generated random station (lat/long coordinate) within the three sampling grids. 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 washed and all hard clams 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 each sampling grid (HRBT South, HRBT North and Willoughby Bay) and the Sampling Corridor 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 100 or 200 m survey zone either side of the current HRBT 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 a reasoned estimate of navigation clearance required by vessel and barge traffic associated with construction of the additional tunnel and/or refurbishment of the existing trestle structure. A more comprehensive description of sampling sites is given in the field results section later in this report.

- (c) The original request by Stantec to complete the survey in Fall 2018 was accommodated within the prior commitments of the survey vessel and crew.
- (d) A modest modification was required to the survey vessel to allow sampling in deeper waters than are typically encountered in scheduled surveys. Additional winch wire and longer hydraulic hoses were purchased locally and installed by VMRC staff.
- (e) Based on survey design a 2-3 day field effort was set aside for survey completion.
- (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) includes a database with individual station data (Lat, Long, depth, total number of hard clams, clam size frequency distribution) and calculations as employed to estimate total standing stock of clams by sampling grid within the survey and for Sample Corridor whole.

Field survey results

Figures 1 through 3 respectively describe sediment type (by visual observation; this derivation follows what was used in the 2001 and 2002 clam survey as well as what is regularly used by the investigators for other surveys they conduct) for the sampled stations, catches of live hard clams, and other live bivalves. Values in Figure 2 are per square meter (= patent tong sample area).

Sediment types varied between sand and mud-sand mixes throughout most of the Sampling Corridor, indicating sufficient water movement to continually grade sediments and oxygenate the near bottom environment. The only exception to these observations is in the eastern most samples immediately south of Willoughby Spit where mud-shell mixes graded to anoxic muds indicating sedimentary zones (Figure 1). Table 1 presents a summary of clam densities for current 2018 and historic 2001-2002 surveys. Evident is the low density or absence (Willoughby Bay 2018) of hard clams at all sampled 2018 stations (Figure 2 and Table 1). For comparative purposes Figures 4 and 5 present the sampling strata as occupied in the 2001-2002 joint VIMS-VMRC hard clam survey. Throughout the sampled regions in both 2018 and 2001-2002 clam densities were, with one exception, less than one clam per square meter. 2018 mean values for HRBT South (0.09 clams m⁻²) and HRBT North (0.30 clams m⁻²) were at the lower end of the 2001-2002 range for the Lower James (0.48 - 1.21 clams m⁻², mean 0.73 clams m⁻²) and Oceanview (0.34 – 0.61 clams m⁻², mean 0.44 clams m⁻²). These 2001-2002 values are 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 numbers of estimated clams in the respective 2018 surveyed areas are Willoughby Spit, 45 acres, 0 clams; HRBT South, 186.3 acres, 67,854 clams; HRBT North, 362 acres, 439,731 clams².

A record of all 2018 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), # other bivalves, and ancillary comments including shell length (SL, mm) and shell height (SH, mm) of any hard clams collected. A few comments are pertinent. Clam “boxes” (dead shells) at Willoughby are large (>70 mm SL) and do not show evidence of small clams dying shortly after recruitment. Live hard clams at HRBT South were >50 mm SL. Three of the hard clams at HRBT North were < 50 mm SL, all others were larger. The observed densities (low) and size distributions (lacking in small = young clams) are not indicative of regular clam recruitment of any notable magnitude. A single station (#14) in HRBT North included 43 oysters (*Crassostrea virginica* species); given their size (all<20mm SL) these are a single year class of recruits from 2018. There is no evidence of widespread occurrence of oysters in the survey Sample Corridor.

² Absolute numbers of clams per sampled region are estimated by (# clam. * m⁻² * 4046.8 * # acres in sampled region). One acre = 4046.8 m²

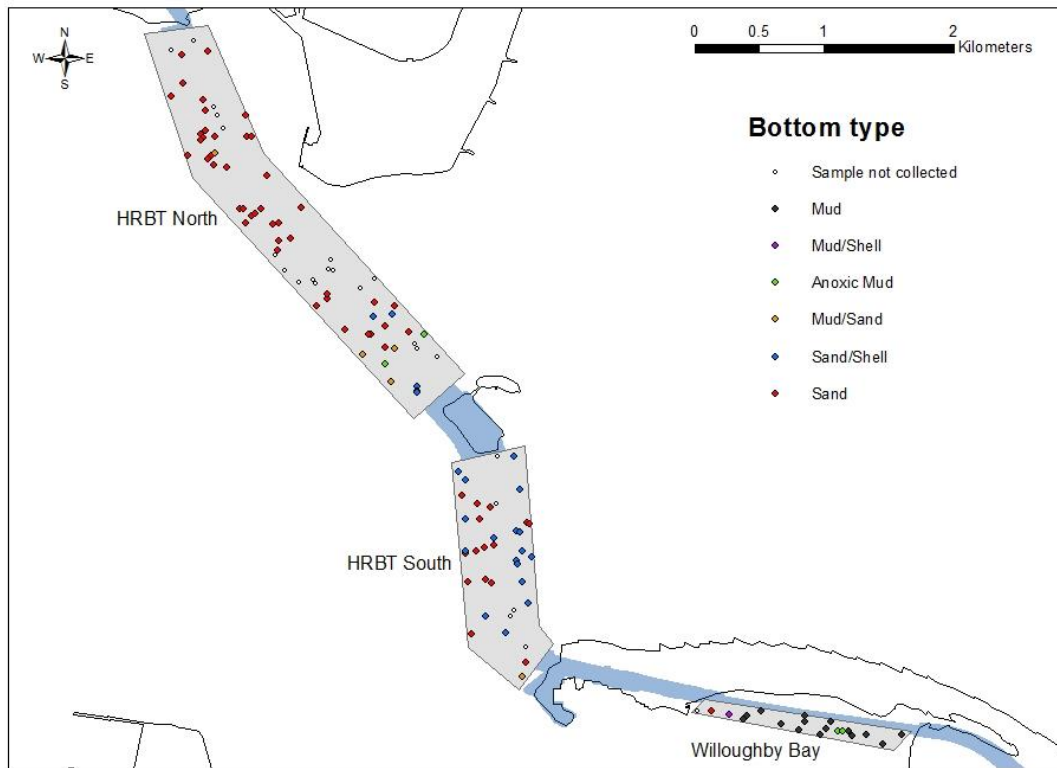


Figure 1. Sediment types throughout sampling corridor.

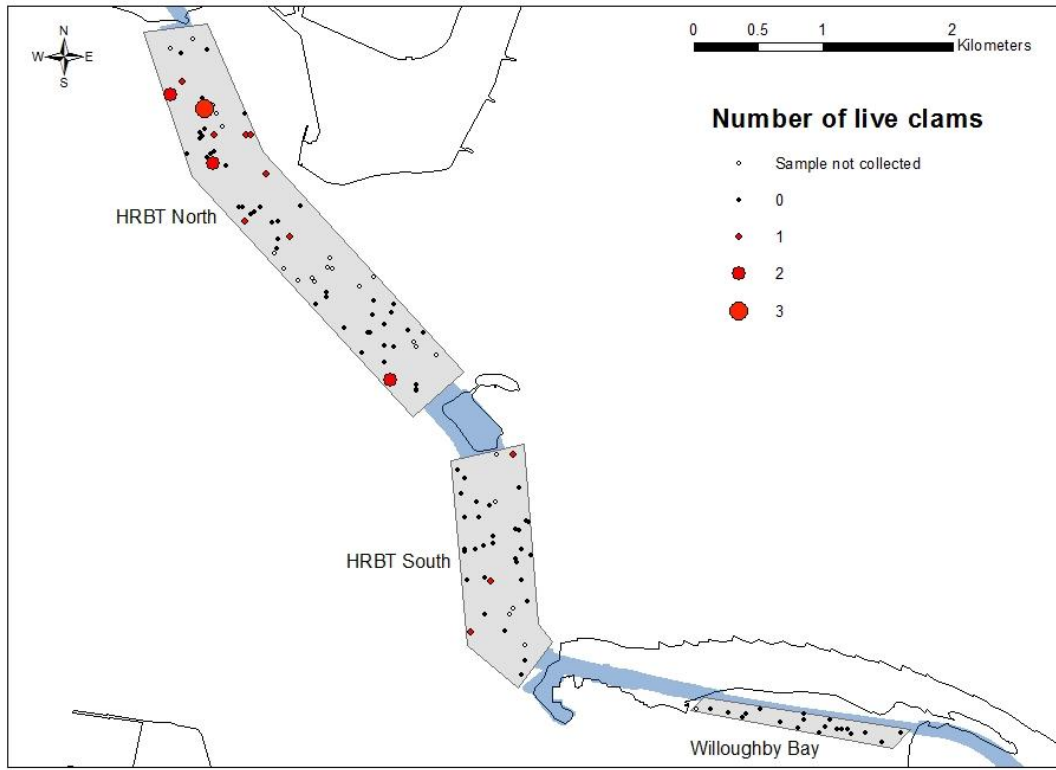


Figure 2. Density of live hard clams ($\#/m^2$) throughout the sampling corridor.

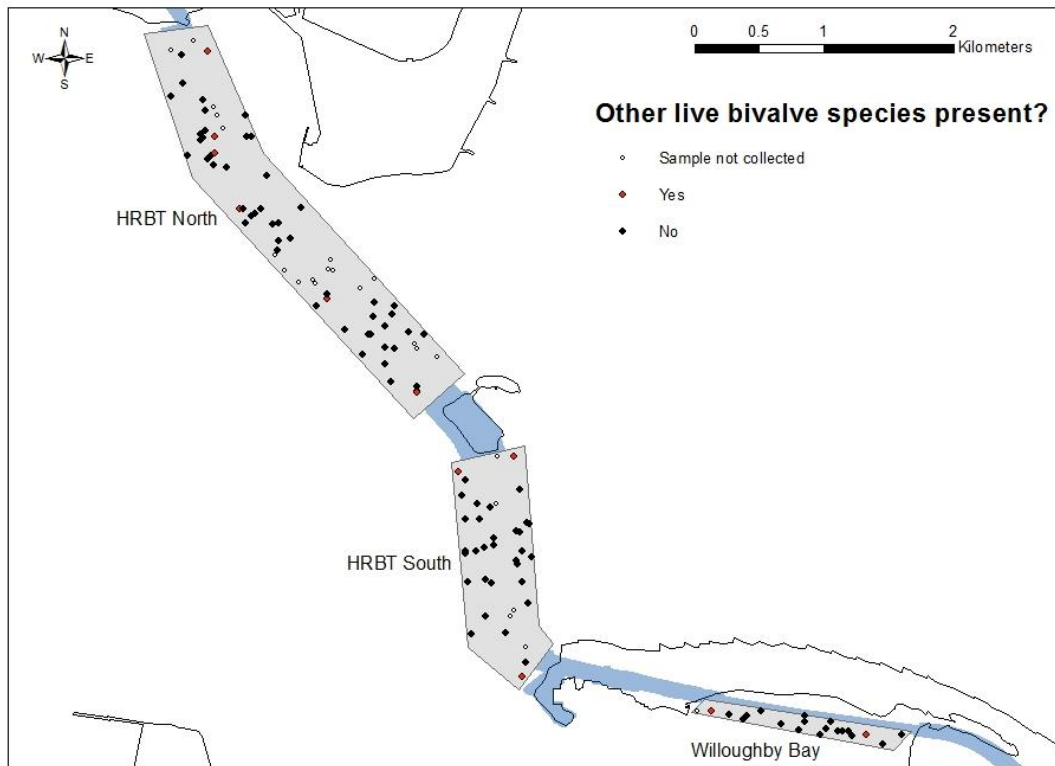


Figure 3. Density of other bivalves ($\#/m^2$) throughout the sampling corridor.

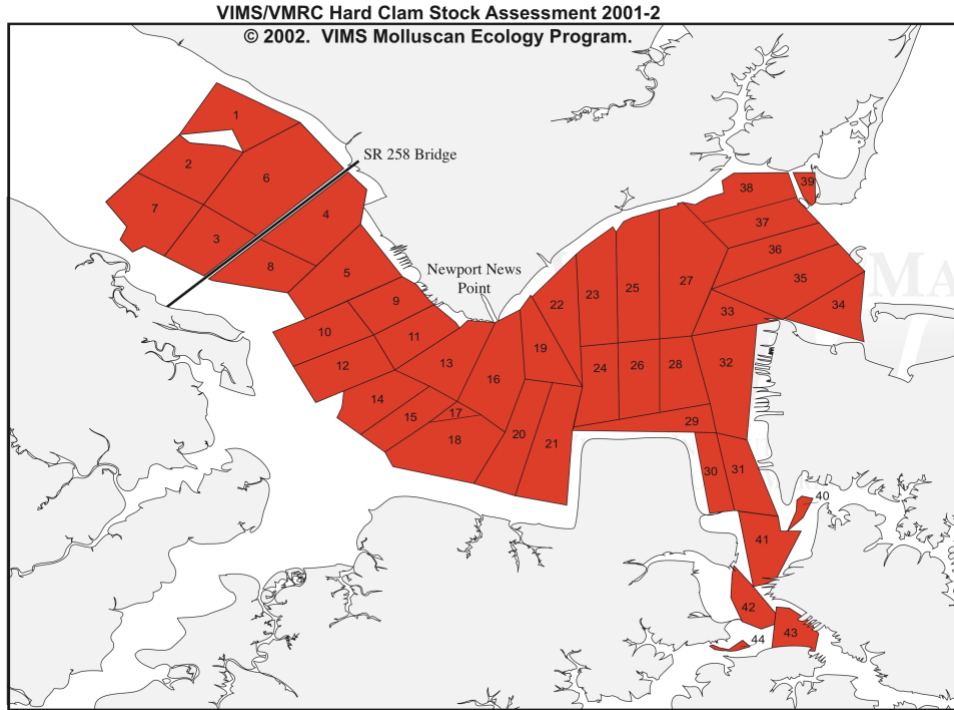


Figure 4. Hard clam stock assessment sampling regions in Lower James River 2002

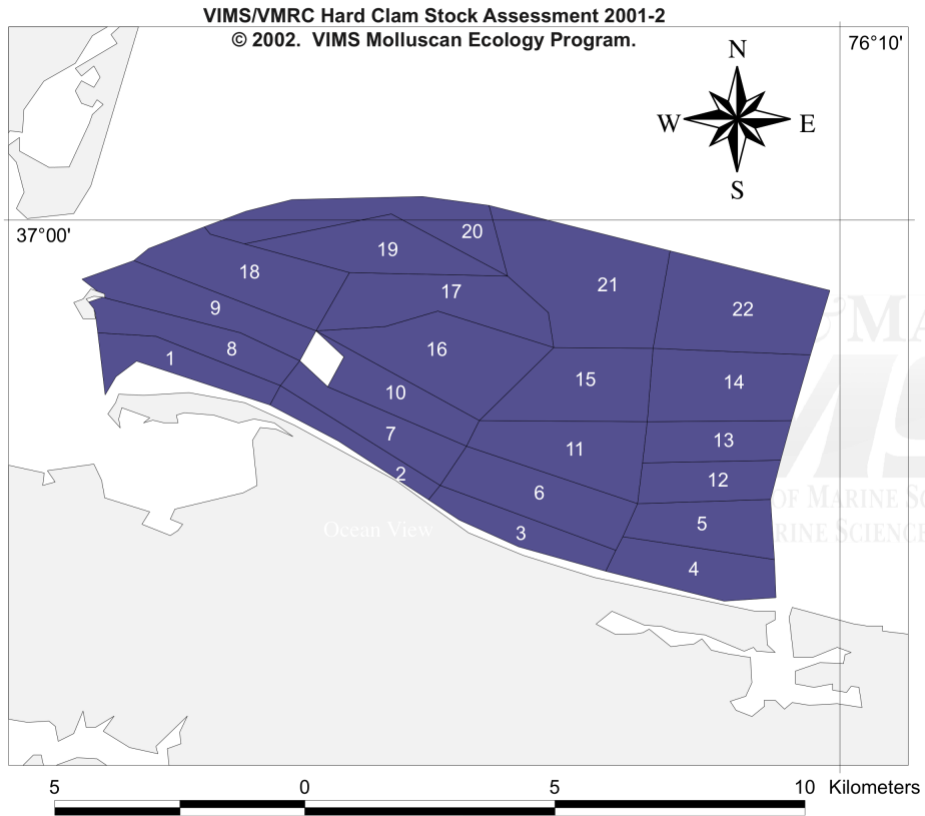


Figure 5. Clam stock assessment sampling regions in Oceanview 2001

Table 1: Summary of hard clam densities 2018 by region (see Figure 1) and selected regions from the 2001-2002 VIMS/VMRC hard clam stock assessment in the lower James River (Figure 5) and Oceanview (Figure 6)

Area	Year	Acreage	# samples	# live hard clams	# live hard clams per sq. m	# of clams in area
Willoughby Bay	2018	45	20	0	0	0
HRBT South	2018	186.3	34	3	0.09	67,854
HRBT North	2018	362.3	56	16	0.29	439,731
James River 34	2002	645.2	81	39	0.48	1,257,177
James River 35	2002	1280.2	123	99	0.80	4,170,055
James River 36	2002	813.2	70	45	0.64	2,115,664
James River 37	2002	717.3	70	98	0.53	4,064,118
James River 38	2002	727.7	67	81	1.21	3,560,459
James River 39	2002	112.2	16	12	0.75	340,555
Total		4295.8	427			15,508,028
Mean				62	0.73	
Oceanview 1	2002	418.9	42	16	0.38	645,890
Oceanview 8	2002	495.5	49	30	0.61	1,227,777
Oceanview 9	2002	605.9	61	21	0.34	844,212
Oceanview 18	2002	810.6	81	36	0.44	1,457,985
Total		2331.0	233			4,175,864
Mean				25.75	0.44	

Additional digital record.

Appendix 1: EXCEL file “ClamData_allsites_HRBTsurveyFall2018.xlsx”