ADVOCATES FOR HERRING BAY
OYSTER RESTORATION REEF IN HERRING BAY

2022 MONITORING REPORT
January 13 2023

Summary:

In 2019, the Advocates for Herring Bay (AHB) identified a site in the Herring Bay Oyster Sanctuary that was deemed suitable for restoration because of its hard bottom and suitable layer of cultch[1]. With permission from the Maryland Department of Natural Resources (DNR), AHB planted over 1 million spat-on-shell over the three-year period from September 9, 2019 through November 6, 2021.

A survey conducted by divers in the fall of 2022 found an average of 236 live oysters per square meter (m^2) on the Herring Bay site. This is well above the standard restoration metric[2] of a mean density of 50 oysters per square meter. This report documents the results of AHB's 2022 survey of the Herring Bay oyster restoration site. It describes the collection methodology, provides detailed data on each sample, and summarizes the statistical analysis.

1) Cultch: Hard substrate, such as oyster shells that could be used for spat attachment.

2) Restoration Goals, Quantitative Metrics and Assessment Protocols for Evaluating Success on Restored Oyster Reef Sanctuaries: Submitted to the Sustainable Fisheries Goal Implementation Team of the Chesapeake Bay Program. December 2011

Background on the oyster restoration site:

The quarter-acre site AHB has been restoring is located on an historic Yates bar in the Herring Bay Oyster Sanctuary. Spat-on-shell were planted in eight different batches, which were distributed throughout the quarter acre area. Table 1 shows the age distribution of the million spat-on-shell planted prior to the 2022 survey. (An estimated 92,000 spat were planted in November 2022, after the survey was completed.)

Table 1: Age Distribution of Oysters Planted

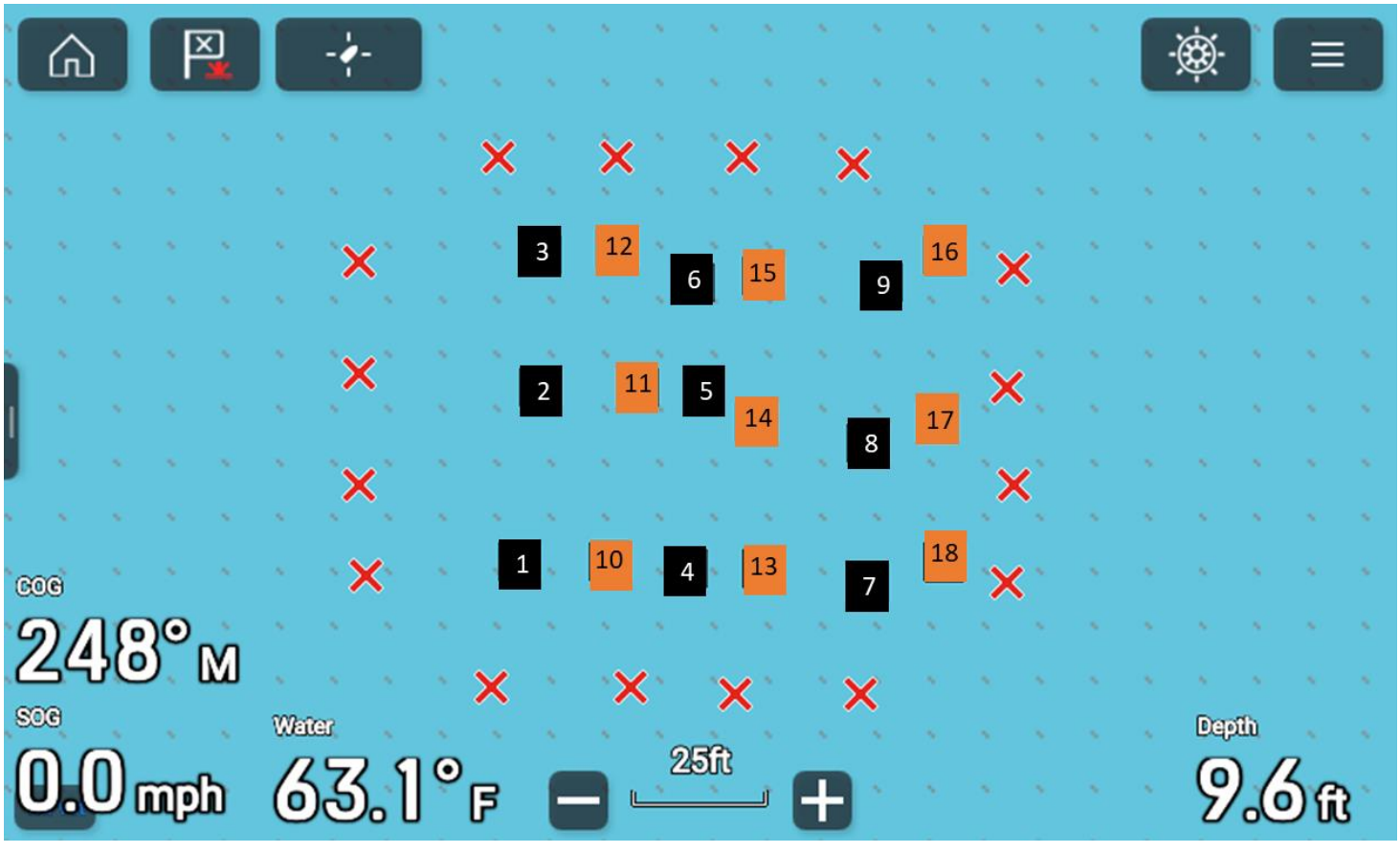
Date of Spat Planting	Approximate Age at Time of 2022 Monitoring (years)	Estimated Number of Spat on Shell Planted	Cumulative Number of Spat Planted
9/9/2019	3	60,000	60,000
9/11/2020	2	131,000	191,000
10/9/2020	2	25,500	216,500
11/8/2020	2	61,000	277,500
5/22/2021	2*	8,625	286,125
8/31/2021	1	43,750	329,875
9/30/2021	1	635,475	965,350
11/6/2021	1	47,625	1,012,975

*This cohort of spat is the same age as the oysters planted on 11/8/20. These spat overwintered at a Chesapeake Bay Foundation facility before being planted in 2021. Thus, they were about one year older than the other spat planted in 2021.

Collection Methodology:

AHB's oyster population survey was conducted by a team of divers on September 26 and October 6, 2022. A total of 18 samples were taken, spacing 9 sample points throughout the area on each day.* The various locations of these points are shown in Figure 1.

Figure 1: Sample points from 9/26/22 and 10/6/22



Sample Sites – ■ September 26th Dive ■ October 6th Dive

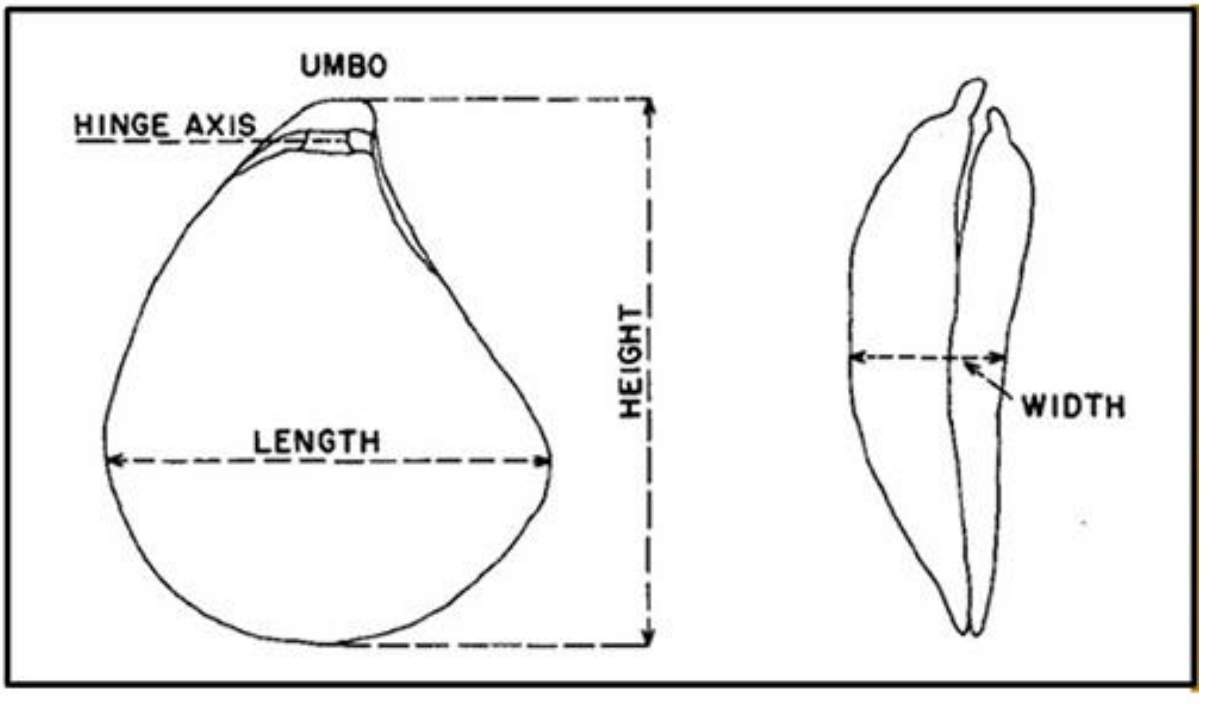
Numbered, weighted buckets, attached to floating buoys, were dropped at each sample location. Divers each carried a 0.25 m^2 frame. They dropped the frame next to the bucket, and filled the bucket with all of the live oysters and cultch within the frame. In the case of site number 10 a second bucket was required in order to collect all of the live oysters. The cultch would not fit in the buckets and was therefore not collected at this site.

*The original survey design called for taking a total 25 samples, but stormy weather caused by Hurricane Ian forced the team to reschedule the dives to dates when fewer divers were available.

Measurements Methodology:

For each sample:

1) **Picture:** Live oysters were placed on the left side of a table, and cultch on the right side. The oyster sample was photographed with its sample number in the top lefthand corner.
2) **Count**: Oysters were washed and counted. All live oysters, boxes and scars were recorded.
3) **Oyster Height Measurements**: The height of fifteen random live oysters were measured and recorded. (See picture below.) All of the dead oysters were measured, up to a total of 15 dead oysters.
4) **Volume:** All of the live oysters were placed in a 5 gallon bucket, with one liter gradations. Water was poured into the bucket covering the live oysters.
    - The volume of the water + oysters was recorded.
    - The water was then poured into another bucket and its volume was recorded.
    - The water was returned to the original bucket and the cultch was added. The volume of oysters + cultch + water was recorded (In sample 9 additional water was added and measured in order to cover the cultch).
    - Volume of live oysters, cultch and both were calculated.



https://shellfish.ifas.ufl.edu/news/harvesting-uf-field-trials-2/

RESULTS

Data Sheets:
Each of the following data sheets has 3 tables and a picture of the sampled oysters.

Count: The first table is the count. It presents the counts for each of the clusters of oysters found in the sample. It shows the number of live oysters on the cluster, and the number of dead oysters (boxes and scars).

Size: The second table gives the size of the oysters. It shows the sizes of up to 15 random live and dead shells. In three of the data sheets, volunteers forgot to count the live oysters. They are noted on each page.

Volume: The third table shows the oyster and cultch volumes.

Finally, the picture shows the actual sampled oysters, with live oysters on the left, and cultch on the right.

Sample 1 - September 26, 2022

Count – Sample 1

Total	**56**	**4**	**1**
	Live	**Box**	**Scar**
1	**2**		
2	**8**	**1**	
3	**2**		
4	**1**		
5	**1**		
6	**1**		
7	**1**		
8	**1**		
9	**3**		
10	**1**		
11	**2**		
12	**5**	**1**	
13	**6**		
14	**10**		
15	**4**	**1**	**1**
16	**3**		
17	**5**	**1**	

Sizes in millimeters - Sample 1

	Live		Dead
1	**70**		**45**
2	**85**		**60**
3	**90**		**65**
4	**85**		**45**
5	**80**		**55**
6	**60**		
7	**90**		
8	**95**		
9	**60**		
10	**85**		
11	**70**		
12	**100**		
13	**65**		
14	**95**		
15	**95**		
Min	**60**		**45**
Max	**100**		**65**
Average	**82**		**54**

Volume in Liters - Sample 1

Water		**10**
Water + Live Oysters		**12.5**
Live Oysters		**2.5**
Water		**10**
Water + All		**13**
All		**3**
Cultch		**0.5**

Sample 2 - September 26, 2022

Count – Sample 2			
Total	45	2	0
	Live	Box	Scar
1	6	1	
2	3		
3	1		
4	1		
5	1		
6	1		
7	2		
8	2		
9	1		
10	2		
11	2		
12	1		
13	2		
14	5		
15	7	1	
16	8		

Sizes in millimeters - Sample 2			
	Live		Dead
1	110		95
2	90		35
3	45		
4	60		
5	65		
6	50		
7	50		
8	40		
9	80		
10	55		
11	30		
12	60		
13	85		
14	45		
15	55		
Min	30		35
Max	110		95
Average	61		65

Volume in Liters - Sample 2		
Water		7
Water + Live Oysters		8.75
Live Oysters		1.75
Water		7
Water + All		9
All		2
Cultch		0.25

Sample 3 - September 26, 2022

Count – Sample 3			
Total	13	0	3
	Live	Box	Scar
1	1		
2	1		
3	1		
4	1		
5	1		
6	2		2
7	4		1
8	1		
9	1		

Sizes in millimeters - Sample 3			
	Live		Dead
1	40		40
2	85		50
3	75		35
4	60		
5	60		
6	75		
7	60		
8	75		
9	80		
10	90		
11	30		
12	70		
13	80		
14	80		
15	65		
Min	30		35
Max	90		50
Average	68		28

Volume in Liters - Sample 3		
Water		4
Water + Live Oysters		4.75
Live Oysters		0.75
Water		4
Water + All		5.25
All		1.25
Cultch		0.5

Sample 4 - September 26, 2022

Count – Sample 4			
Total	76	2	0
	Live	Box	Scar
1	15		
2	5		
3	3		
4	10	1	
5	3		
6	4		
7	1		
8	1		
9	2		
10	3		
11	1		
12	2		
13	2		
14	1		
15	6		
16	3		
17	7	1	
18	7		

Sizes in millimeters - Sample 4			
	Live		Dead
1	70		40
2	70		50
3	80		
4	65		
5	60		
6	50		
7	40		
8	65		
9	75		
10	105		
11	65		
12	75		
13	50		
14	70		
15	65		
Min	40		40
Max	105		50
Average	67		45

Volume in Liters - Sample 4		
Water		9
Water + Live Oysters		12
Live Oysters		3
Water		9
Water + All		12.5
All		3.5
Cultch		0.5

Sample 5 - September 26, 2022

Count – Sample 5			
Total	**115**	**13**	**5**
	Live	**Box**	**Scar**
1	2		
2	1		
3	1		
4	1		
5	1		
6	1		
7	2		
8	5		
9	1	1	
10	3		
11	1		
12	1		
13	2		
14	1	1	
15	1		
16	5		
17	2	4	
18	3		
19	1		
20	3		
21	1		
22	12	1	
23	7		
24	1		
25	1		
26	2		
27	1		
28	11	1	
29	1		
30	2		
31	9		
32	4		
33	5		3
34	3		
35	6		1
36	4	4	
37	7	1	1

Sizes in millimeters - Sample 5			
	Live		**Dead**
1	60		60
2	90		70
3	75		65
4	65		55
5	45		75
6	50		65
7	60		30
8	75		30
9	90		
10	50		
11	95		
12	55		
13	70		
14	40		
15	100		
Min	**40**		**30**
Max	**100**		**75**
Average	**68**		**56**

Volume in Liters - Sample 5		
Water		**11.25**
Water + Live Oysters		**15.5**
Live Oysters		**4.25**
Water		**11.25**
Water + All		**16**
All		**4.75**
Cultch		**0.5**

Sample 6 - September 26, 2022

Count – Sample 6			
Total	17	1	0
	Live	Box	Scar
1	2		
2	0	1	
3	5		
4	2		
5	8		

Sizes in millimeters - Sample 6			
	Live		Dead
1	45		55
2	50		
3	50		
4	60		
5	45		
6	40		
7	60		
8	50		
9	50		
10	52		
11	65		
12	60		
13	70		
14	80		
15	50		
Min	40		55
Max	80		55
Average	55		55

Volume in Liters - Sample 6		
Water		4.75
Water + Live Oysters		5.5
Live Oysters		0.75
Water		4.75
Water + All		5.75
All		1
Cultch		0.25

Sample 7 - September 26, 2022

Count – Sample 7			
Total	77	3	3
	Live	Box	Scar
1	5		
2	1		
3	6		
4	1		
5	4	1	
6	3		
7	1		
8	2		
9	2		
10	1		
11	3		
12	3		
13	1		
14	1		
15	1		
16	5		
17	6		1
18	8		
19	1		1
20	4	1	1
21	1		
22	2	1	
23	2		
24	4		
25	1		
26	2		
27	1		
28	1		
29	1		
30	3		

Sizes in millimeters - Sample 7			
	Live		Dead
1	120		40
2	80		35
3	60		50
4	40		35
5	30		35
6	40		40
7	35		40
8	70		
9	65		
10	50		
11	75		
12	25		
13	50		
14	40		
15	45		
Min	25		35
Max	120		50
Average	55		39

Volume in Liters - Sample 7		
Water		9.75
Water + Live Oysters		13.5
Live Oysters		3.75
Water		9.75
Water + All		15
All		5.25
Cultch		1.5

Sample 8 - September 26, 2022

Count – Sample 8			
Total	**69**	**5**	**4**
	Live	**Box**	**Scar**
1	1		
2	5		
3	1		
4	2		
5	1		
6	5	1	
7	1		
8	1		1
9	3		
10	4		
11	1		
12	1		
13	1		
14	1		
15	1		
16	1		
17	4	1	
18	1		
19	1		2
20	1		
21	1		
22	1		
23	3		
24	1		
25	1		
26	2		
27	1		
28	1		
29	3		
30	1		
31	3	2	
32	4		
33	1		
34	3	1	1
35	6		

Sizes in millimeters - Sample 8			
	Live		**Dead**
1	50		50
2	55		90
3	80		30
4	55		35
5	55		40
6	60		35
7	105		35
8	60		45
9	55		45
10	55		
11	90		
12	45		
13	55		
14	70		
15	45		
Min	**45**		**30**
Max	**105**		**90**
Average	**62**		**45**

Volume in Liters - Sample 8		
Water		**7.25**
Water + Live Oysters		**10**
Live Oysters		**2.75**
Water		**7.25**
Water + All		**11.5**
All		**4.25**
Cultch		**1.5**

Sample 9 - September 26, 2022

Count – Sample 9			
Total	43	4	1
	Live	Box	Scar
1	0	1	
2	1		
3	11		
4	2		
5	3		
6	6		
7	2		
8	1		
9	2	1	
10	1		
11	1		
12	1		
13	5		
14	1	2	
15	1		
16	1		
17	1		
18	2		
19	1		
20	0		1

Sizes in millimeters - Sample 9			
	Live		Dead
1	100		110
2	90		70
3	80		65
4	90		60
5	40		53
6	70		
7	105		
8	95		
9	95		
10	70		
11	110		
12	105		
13	100		
14	100		
15	100		
Min	40		53
Max	110		110
Average	90		72

Volume in Liters - Sample 9		
Water		12.75
Water + Live Oysters		16
Live Oysters		3.25
Water		13.75
Water + All		18
All		4.25
Cultch		1

Sample 10 – October 6, 2022

Count – Sample 10			
Total	**162**	**11**	**0**
	Live	**Box**	**Scar**
1	2	1	
2	3	1	
3	4		
4	2		
5	2		
6	4	1	
7	3		
8	4		
9	5		
10	4		
11	2		
12	4	1	
13	1		
14	4		
15	3		
16	4	1	
17	3		
18	7	1	
19	2		
20	11		
21	1		
22	2		
23	6		
24	8		
25	10		
26	3	2	
27	5		
28	5		
29	1		
30	8	1	
31	5		
32	3	1	
33	9		
34	7		
35	8		
36	4		
37	2	1	
38	1		

Sizes in millimeters - Sample 10			
	Live*		**Dead**
1			30
2			30
3			55
4			70
5			85
6			60
7			80
8			70
9			70
10			60
11			65
12			
13			
14			
15			
Min			**30**
Max			**85**
Average			**61**

Volume in Liters - Sample 10	
Water	**13**
Water + Live Oysters	**32.5**
Live Oysters	**19.5**
Water	
Water + All*	
All	
Cultch*	

***Note: There was no room in the buckets for the cultch**

*Volunteers forgot to measure live oysters

Sample 11 – October 6, 2022

Count – Sample 11			
Total	**87**	**3**	**0**
	Live	Box	Scar
1	5		
2	1		
3	1		
4	3	1	
5	1		
6	1		
7	1		
8	1	1	
9	2		
10	1		
11	3		
12	3		
13	5		
14	1		
15	1		
16	3		
17	1		
18	8		
19	1		
20	1		
21	4		
22	3		
23	2		
24	2		
25	3		
26	1		
27	1		
28	8		
29	1		
30	1		
31	1		
32	5		
33	5	1	
34	1		
35	1		
36	1		
37	1		
38	2		

Sizes in millimeters - Sample 11			
	Live*		Dead
1			40
2			60
3			65
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
Min			40
Max			65
Average			55

Volume in Liters - Sample 11		
Water		7.25
Water + Live Oysters		10
Live Oysters		2.75
Water		7.25
Water + All		10.25
All		3
Cultch		0.25

*Volunteers forgot to measure live oysters

Sample 12 – October 6, 2022

Count – Sample 12			
Total	52	3	0
	Live	Box	Scar
1	5		
2	1		
3	1		
4	1		
5	1		
6	1		
7	1		
8	1		
9	1		
10	1		
11	1		
12	1		
13	1		
14	1		
15	1		
16	2		
17	2		
18	2	1	
19	1		
20	5		
21	3		
22	7	1	
23	11	1	

Sizes in millimeters - Sample 12			
	Live		Dead
1	70		90
2	80		70
3	80		70
4	90		
5	80		
6	100		
7	60		
8	80		
9	95		
10	80		
11	80		
12	80		
13	70		
14	75		
15	70		
Min	60		70
Max	100		90
Average	79		77

Volume in Liters - Sample 12	
Water	15
Water + Live Oysters	19.5
Live Oysters	4.5
Water	15
Water + All	20
All	5
Cultch	0.5

Sample 13 – October 6, 2022

Count – Sample 13			
Total	63	2	10
	Live	Box	Scar
1	6		
2	2		
3	4		
4	5		
5	2		
6	0		1
7	2		1
8	1	1	
9	4		
10	2		
11	1		
12	0		1
13	0	1	2
14	3		
15	1		
16	2		
17	1		
18	1		
19	0		1
20	1		2
21	3		
22	6		2
23	1		
24	1		
25	2		
26	5		
27	3		
28	2		
29	2		

Sizes in millimeters - Sample 13			
	Live		Dead
1	50		40
2	65		35
3	40		50
4	50		50
5	70		50
6	90		50
7	75		55
8	45		40
9	55		60
10	40		45
11	70		55
12	80		45
13	45		
14	70		
15	70		
Min	40		35
Max	90		60
Average	61		48

Volume in Liters - Sample 13		
Water		7.25
Water + Live Oysters		9
Live Oysters		1.75
Water		7.25
Water + All		10
All		2.75
Cultch		1

Sample 14 – October 6, 2022

Count – Sample 14			
Total	87	3	1
	Live	Box	Scar
1	4		
2	1		
3	2		
4	1	1	
5	10		1
6	3		
7	2	1	
8	7		
9	1		
10	6		
11	3		
12	2		
13	9		
14	1		
15	1		
16	1		
17	9		
18	11	1	
19	6		
20	7		

Sizes in millimeters - Sample 14			
	Live*		Dead
1			70
2			50
3			40
4			70
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
Min			40
Max			70
Average			58

Volume in Liters - Sample 14		
Water		10
Water + Live Oysters		13
Live Oysters		3
Water		10
Water + All		13.5
All		3.5
Cultch		0.5

*Volunteers forgot to measure live oysters

Sample 15 – October 6, 2022

Count – Sample 15			
Total	10	0	0
	Live	Box	Scar
1	1		
2	1		
3	3		
4	2		
5	3		

Sizes in millimeters - Sample 15			
	Live		Dead
1	100		
2	80		
3	100		
4	90		
5	95		
6	100		
7	100		
8	95		
9	95		
10	90		
11			
12			
13			
14			
15			
Min	80		
Max	100		
Average	95		

Volume in Liters - Sample 15		
Water		3.5
Water + Live Oysters		4.5
Live Oysters		1
Water		3.5
Water + All		5
All		1.5
Cultch		0.5

Sample 16 – October 6, 2022

Count – Sample 16			
Total	43	3	0
	Live	Box	Scar
1	3		
2	2		
3	1		
4	1		
5	3	1	
6	1		
7	1		
8	2		
9	2		
10	4		
11	2	1	
12	1		
13	1		
14	3		
15	4	1	
16	5		
17	7		

Sizes in millimeters - Sample 16			
	Live		Dead
1	70		55
2	50		45
3	70		50
4	120		
5	80		
6	100		
7	90		
8	95		
9	60		
10	85		
11	60		
12	70		
13	55		
14	110		
15	110		
Min	50		45
Max	120		55
Average	82		50

Volume in Liters - Sample 16		
Water		8.75
Water + Live Oysters		9.5
Live Oysters		0.75
Water		8.75
Water + All		10
All		1.25
Cultch		0.5

Sample 17 – October 6, 2022

Count – Sample 17			
Total	12	0	0
	Live	Box	Scar
1	1		
2	2		
3	3		
4	4		
5	2		

Sizes in millimeters - Sample 17			
	Live		Dead
1	95		
2	90		
3	65		
4	70		
5	65		
6	75		
7	85		
8	65		
9	60		
10	45		
11	41		
12	50		
13			
14			
15			
Min	41		
Max	95		
Average	67		

Volume in Liters - Sample 17		
Water		4
Water + Live Oysters		5
Live Oysters		1
Water		4
Water + All		5.25
All		1.25
Cultch		0.25

Sample 18 – October 6, 2022

Count – Sample 18			
Total	39	3	0
	Live	Box	Scar
1	1		
2	1		
3	1		
4	1		
5	1		
6	1		
7	1		
8	1	1	
9	3	1	
10	2		
11	2		
12	2		
13	1		
14	3		
15	1		
16	4		
17	5	1	
18	8		

Sizes in millimeters - Sample 18			
	Live		Dead
1	100		57
2	75		60
3	140		70
4	70		
5	90		
6	100		
7	70		
8	60		
9	60		
10	120		
11	90		
12	110		
13	90		
14	110		
15	90		
Min	60		57
Max	140		70
Average	92		62

Volume in Liters - Sample 18		
Water		11
Water + Live Oysters		15.5
Live Oysters		4.5
Water		11
Water + All		16.5
All		5.5
Cultch		1

ANALYSIS

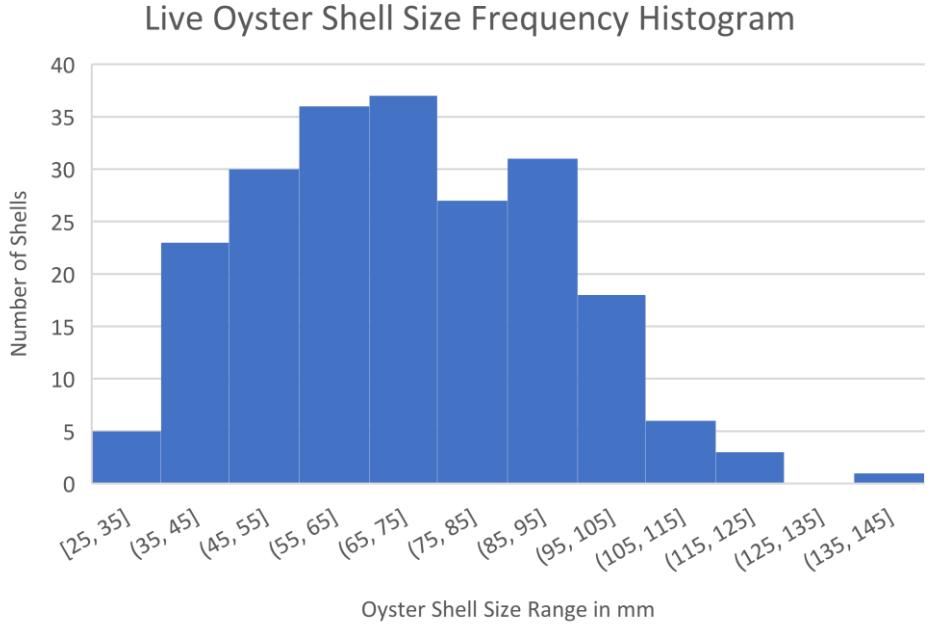
The Count:

From the 18 sites sampled we counted a total of 1,066 live oysters. The mean number of live oysters per 0.25 m^2 we sampled was 59. Using this we estimated the average number of live oysters per square meter to be 236.

Sizes:

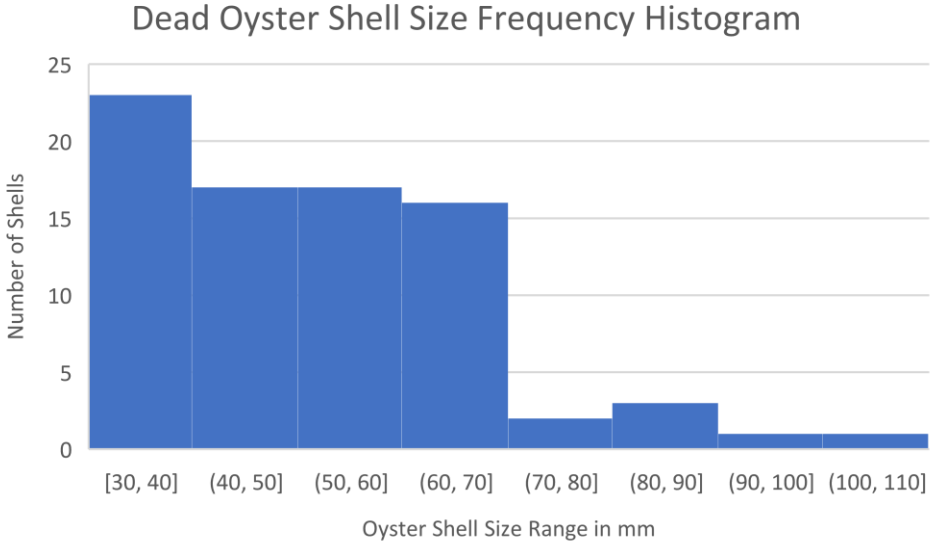
Live Oysters

We randomly chose up to 15 live oysters from each site to measure. Some sites had fewer than 15 oysters. We measured a total of 217 live oysters. Below is a histogram showing the live oyster size distributions.



Dead Oysters

We randomly chose up to 15 dead oysters from each site to measure. Several sites had fewer than 15 dead oysters. We measured a total of 80 dead oysters. Below is a histogram showing dead oyster size distributions.



Volume:

The total volume of live oysters from all 18 samples was 51.5 liters.
The average volume of live oysters per 0.25 m^2 was 2.86 liters.

The volume of cultch[1] from the 17 samples counted was 11 liters.
The average volume of cultch per 0.25 m^2 was .65 liters.
The estimated average volume of cultch per square meter was 2.6 liters. This exceeds Roger Mann's[2] estimate of at least 1.5 liters per square meter of cultch being necessary to maintain an oyster reef.

1) Cultch: Hard substrate, such as oyster shells that could be used for spat attachment.

2) From Virginia Institute of Marine Science

Submittal Letter to Maryland Department of Natural Resources

Advocates for Herring Bay

January 13, 2023

Christopher Judy, Director
Eric Campbell
Laurinda Serafin
Shellfish Division
Maryland Department of Natural Resources
580 Taylor Avenue, D-4
Annapolis, MD 20401

Dear Chris, Eric, and Laurinda,

The Advocates for Herring Bay (AHB) are pleased to share the enclosed report on the results of our 2022 survey of the oyster population on the Yates bar that AHB is restoring in the Herring Bay Oyster Sanctuary. Samples taken on our quarter-acre site suggested an average density of 236 live oysters per square meter, well above the standard restoration metric of 50 live oysters per square meter.

We owe the success of this restoration and monitoring effort to citizens from across Herring Bay, who donated funds and the time and physical labor needed to pick up spat from hatcheries, load it on boats, plant it in the bay, and dive down to the reef to retrieve samples for the survey. Added support came from the Oyster Recovery Partnership, which is collaborating with AHB on a Herring Bay Build-A-Reef Project, and from donations of spat-on-shell by the Chesapeake Bay Foundation and Maryland Grows Oysters program.

Thank you for giving us the opportunity to help restore the oyster population in Herring Bay. We look forward to working with you and our other partners in the future on new oyster restoration projects in the Sanctuary. If you have any questions about this or any other matter related to AHB's oyster restoration efforts, please contact us at herringbay@gmail.com.

Sincerely,

Kathy Gramp
President
Advocates for Herring Bay