

**Talbot Watermen Association's
Summary and Analysis
of the
Maryland Department of Natural Resources
Oyster Sanctuaries Report
2016-2020**

**I.
MARYLAND OYSTER SANCTUARIES REPORT
October 2021**

The Department of Natural Resources (Department or DNR) Oyster Sanctuaries Report submitted to the Oyster Advisory Commission (OAC) in October 2021, has been thoroughly reviewed by the Talbot Watermen Association (TWA). This Summary provides an overview of the latest DNR Report of Maryland's 51 oyster sanctuaries.

This Summary will also analyze whether the DNR's stated objectives for the sanctuaries are being met and where they are falling short.

- ⇒ Since 2010 with the adoption of the current far-reaching oyster sanctuary program there are 51 designated oyster sanctuaries comprising 253,007 acres of the Chesapeake Bay bottom.
- ⇒ In October 2021, the DNR published its second Oyster Management Review, Appendix A (Report) presenting "detailed data" on each of the oyster sanctuaries under its management for the period of 2016-2020.
- ⇒ In the Executive Summary of its Report the Department identified six objectives for the sanctuary program, which included:

***Objective #1:** Protect half of the Bay's most productive oyster grounds that remain and allow investigation of the reasons why these remain most productive.*

The Department states that this objective is met.

***Objective #2:** Facilitate development of natural disease resistance.*

The Department states that this objective is underway and remains under evaluation.

***Objective #3:** Provide essential natural ecological functions that cannot be obtained on a harvest bar.*

The Department states that this objective is being met and will continue to be evaluated.

***Objective #4:** Serve as a reservoir of reproductive capacity.*

The Department states that this objective remains under evaluation.

Objective #5: *Provide a broad geographic distribution across all salinity zones.*
The Department states that this objective is being met.

Objective #6: *Increase our [the department's] ability to protect these important areas from poaching.*

The Department states that this objective is being met.

- ⇒ In its Report, the Department essentially has declared that it has met three of its six objectives with “continued evaluation” of two of the Objectives and a mixed message of goal attainment and continued evaluation of Objective #3.
- ⇒ In its Objective #3 the Department notes its commitment to “restore five large scale restoration sanctuaries”. This Summary will particularly address the DNR’s two established large-scale projects: Harris Creek (Talbot County) and The Little Choptank River (Dorchester County), which the Report itself discloses are far from sustaining the Department’s goals and expectations despite the expenditure of tens of millions of dollars of federal and state funds.
- ⇒ Also, the Department states that it is still evaluating its Objective #4 as to whether the sanctuaries have and/or can function over time as a productive reservoir of oyster spat to repopulate the oysters of the Bay. This Summary will disclose that the Report’s 2016-2020 tests and monitoring of the 51 sanctuaries provide no substantive evidence to support the Department’s Objective #4. Without any specific data the Report only states that the spat regeneration and broadcasting from the major sanctuaries is the subject of a computer model, based on “theoretical larvae supply” projections. Curiously, after 10 years this goal of the sanctuary program is still “under evaluation”.

II. AREAS OF MAJOR CONCERN

1. **The Report on its face discloses the overall failure of the majority of sanctuaries and raises serious questions as to the effectiveness of the Two Large Scale Restoration Projects, Harris Creek and Little Choptank.**

The Report’s analysis of the successes and failures of each of the 51 oyster sanctuaries in the Department’s program from 2016-2020, based on its own testing methods, reflects the following:

A. Of the 51 Reported Sanctuaries:

1. Thirty-eight (38) are failures with no appreciable densities of spat, small and or marketable oysters with some of the sanctuaries having not been monitored since 2006.
2. Eight (8) have mixed results with varying increases/decreases of spat, small and market size oysters.

3. Two (2) large-scale restoration projects are touted as successes, however, a close review of the results of their monitoring are mixed. Therefore, the overall performance of the sanctuaries balanced against their aspirations must be considered as inconclusive.
4. Three (3) are successes.

This Summary's assessment that a large majority of the 51 sanctuaries have failed is significant. The public is not aware of this stunning and ongoing problem under the common assumption that after ten years (2010-2020) the sanctuary program was repopulating the Bay with oysters. The Department's 2016-2020 suggests otherwise.

- B. Regarding the two major identified Large Scale Oyster Restoration Projects, the reported results of sampling in the Harris Creek and Little Choptank sanctuaries raise even more concerns and inconsistencies:

Harris Creek

1. A proclaimed Large Scale Restoration Success bolstered by massive reef bottom restoration efforts and the expenditure of tens of millions of dollars, reflects surprisingly mixed results.
2. DNR has conducted limited Fall Survey sampling on sites without granite reef bases and no Patent Tong Surveys since 2006. The Department's Fall Survey samples reflects a sharp decline in live small oysters per square meter since 2011-2015, and a lesser decline in live market sized oysters for the same period.
3. "Other Organizations" have conducted monitoring of the restoration areas (limestone reefs) with patent tong and diver surveys reporting 97% of reefs met the minimum threshold of success criteria for restoration of 15 oysters per square meter.
4. The diver and bathymetric sampling of the reef bottoms by NOAA and its Workgroup (Other Organizations) lack the random sampling of a patent tong survey and are easily manipulated and therefore suspect.
5. The NOAA/Workgroup Surveys are not set forth in the Department's Report and only mentioned in a footnote (Note 32, page 57, Report Appendix A). The surveys can be accessed from the other DNR websites and for 2019 and 2020 boast of meeting minimum threshold oyster densities (15 oysters per m²) in the 97% range and target oyster densities (50 oysters per m²) in the 81% range for 30% of the reef areas. Given the suspect and subjective methods of monitoring (divers and bathymetric sampling) and the fact that the threshold data is are not reported other than as percentage conclusions, there are grave concerns about the integrity of the NOAA/Workgroup's methods and findings.
6. Interestingly the Department's Report Appendix B, page 256-262, for Broad Creek, a public fishery area disclosed vastly greater small oyster and biomass density as well as comparable market size oyster density compared to its heavily subsidized neighbor, Harris Creek. Broad Creek

as part of the public fishery is harvested on a yearly basis and has received plantings of shell, wild seed and spat on shell, but not to the extent of its sanctuary neighbor. Notwithstanding, these disparities, Broad Creek exceeds the minimum and target thresholds of the NOAA/Workgroup Report.

7. Harris Creek has been judged by the Department as a resounding success, however, a close look at the details of the DNR's 2016-2020 Report raise unanswered questions as to its efficacy.

Little Choptank

1. A proclaimed Large Scale Restoration Success bolstered by massive reef bottom restoration efforts and the expenditure of tens of millions of dollars.
2. DNR has conducted limited Fall Survey sampling on site without granite and fossil reef bases and no Patent Tong Surveys since 2014. The Department's Fall Survey samples reflect a steady number of small oysters per m² since 2011-2015, but a 42% decline in market size oysters for the same period.
3. "Other Organizations" have conducted monitoring of the restoration areas (limestone reefs) with patent tong and diver surveys reporting 97% of reefs met the minimum threshold of success criteria for restoration of 15 oysters per square meter.
4. The diver and bathymetric sampling at the reef bottom by NOAA and its Workgroup (Other Organizations) lack the random sampling of a Patent Tong Survey and are easily manipulated and therefore suspect.
5. The NOAA/Workgroup Surveys are not markedly different for the Little Choptank, a three-year-old reef than those in Harris Creek, a six-year-old reef and are subject to the same questions and concerns.
6. The NOAA/Workgroup Report, page 14, reveals an expensive failure to properly ascertain the nature of the river bottom (mud) before depositing quantities of spat-on-shell in 2013 and 2017. The entire plantings of these two years were lost. Oysters and their spat are suffocated in muddy bottoms and areas with high instances of silt accretion. The Workgroup's mistake was not discovered until a 2019 patent tong survey by the ORP. The NOAA/Workgroup in its best "professional judgement" has now resolved to confirm that future sites must meet "established pre-restoration criteria for river bottom type to maximize the chance of post-restoration success." Had the group infused common sense and rudimentary bottom scanning as part of its restoration regimen, then this expense blunder could have been averted. The input of watermen, many of whose vessels have bottom scanning devices, would have been able to detect areas of muddy and inhospitable bottom and averted the waste of two years of spat on shell plantings.
7. The Report's 2016-2020 sizable increase in spat density was admittedly due to the large 2020 Bay-wide spat set, which was naturally occurring.

Also, in its Fall Survey the Department reports another record spat set in the Bay amid three years of increasing public harvests. There is no empirical evidence that the record count is anything other than a natural occurrence and not the direct result of any “management” practice or policy.

2. The Report reflects a decline in volume of cultch in many of the sanctuaries.

Cultch is a blanket term for stone, shell or other materials deposited or naturally occurring on oyster bars or bottoms, which furnish points of attachment and growth of spat /immature oysters. The existence of cultch on oyster grounds is a necessary component of oyster propagation.

One of the most disturbing trends recorded in the DNR’s Report relates to the declining volume of cultch in the sanctuaries. This is evidenced by the fact that the Department noted a decline in cultch volume in nineteen (19) of the monitored sanctuaries with seven (7) remaining stable and only four (4) reflecting modest increases.

Of major concern in the cultch counts are the reported decreases in Harris Creek and the Little Choptank, the two sanctuaries in the Mid-Shore earmarked for Large-Scale Oyster Restoration. Each has received plantings of billions of spat-on-shell. However, over the past five (5) years of the current Report, both reflect declining cultch levels. This begs the obvious question as to what happened to the enormous volume of planted shell in these large-scale restoration sanctuary projects? The Report offers no explanation about this stunning incongruity, nor does it raise any concerns about the mystery of the missing cultch, other than to note in each instance that the amount of culch declined slightly from the previous five-year measurement.

The enormous shell plantings alone should result in increased culch volume particularly in Harris Creek and the Little Choptank, restoration sanctuary projects where no harvesting is permitted. Instead, the Report admittedly reflects that their cultch counts are down. No causes such as siltation, mud/porous bottoms or increased turbidity are identified or even explored. This is particularly concerning since cultch volume is a necessary element in reaching the goal of long-term oyster sustainability.

3. The Department’s failure to provide any competent evidence of the effectiveness of the sanctuary program in repopulating the Bay’s oyster stock.

In Objective #4 of the Report’s Executive Summary (page 6) the Department conceded that it was still evaluating whether the sanctuaries were fulfilling the goal of materially repopulating the Bay with oyster larvae. This goal lies at the heart of the expanded sanctuary program, which was established in 2010 during the O’Malley Administration. It continues to remain elusive and for the most part unrealized.

The Report's Appendix A, "Ecosystem Services" contains a glaring admission about the migration of oyster larvae from the sanctuaries by stating that its Objective #4 after 10 years is still being evaluated. In its 310-page Appendix A (Sanctuaries) the Report does not contain or cite any empirical evidence that sanctuary generated oyster larvae are being dispersed in the Bay. Instead, it merely notes that: "Researchers from the University of Maryland are using computer models to estimate the theoretical larvae supply from sanctuaries to public fishing areas." See Report, Appendix A, page 13.

4. The Report's failure to provide substantive information of the results of restoration effects on the Large-Scale Oyster Restoration Projects.

Replenishment and Restoration (R&R) are important terms/concepts in the Department's efforts to improve and increase oyster bar productivity in the Bay, and are specifically defined in the Report, Appendix A, page 6 as:

"Replenishment efforts are conducted on public fishery bottom prior to an area becoming a sanctuary and were primarily intended to enhance the public fishery for economic benefits. Restoration efforts are conducted on sanctuary areas with the primary objective to restore oyster populations for ecosystem and ecological benefits. those activities occurring after the establishment of the sanctuary with the objective to restore oyster populations for ecosystem and ecological benefits. The types of enhancements employed in both replenishment and restoration include planting fresh and dredged shell, transplanting natural, wild seed, and planting hatchery-reared spat in hopes of increasing oyster populations."

Oyster restoration lies at the very core of the sanctuary concept, yet the Report for some cryptic reason does not adequately address it. The Department notes the wide disparity in the plantings of shell and seed among the 51 sanctuaries with some receiving as many as two million oysters planted annually in a few acres of the bottoms of major restoration sanctuaries while other sanctuaries receive few or no plantings at all.

The Department, while conducting regular Fall Surveys on the Large-Scale-Restoration Projects, has relied heavily on the monitoring efforts of "Other Organizations", comprised of various interagency members including the National Oceanic and Atmospheric Administration (NOAA), the U.S. Army Corp of Engineers, Baltimore District, the DNR, the Oyster Recovery Partnership (ORP) as assisted by other organizations including the Chesapeake Bay Foundation, The Nature Conservancy, U. S. Fish and Wildlife Services and others.

The lack of random sampling and the criticism of the monitoring methods of the NOAA/Workgroup report have been previously discussed herein. Also, their conclusion-based standards of minimum and targeted based oyster densities have not been reflected in any specific sampling data.

5. The Department's Report admittedly fails to assess the success of the Sanctuary Program in the restoration of the Bay's oyster population.

On page 6, Appendix A of the Report the Department conceded:

“The annual planting information provides a general sense of how each sanctuary was manipulated over time. An analysis to determine if replenishment or restoration activities contributed to an increase in oyster population is beyond the scope of this report.”

If the Department’s comprehensive Report of 2016-2020 contains no conclusions regarding the efficacy of its sanctuary projects, then it is apparent that the Department simply does not know or have any reliable information whether the repopulation goals of the sanctuary program have ever or even can be met.

III.

THE SANCTUARIES TESTING METHODS AND SAMPLING ANALYSES

In order to assess the Department’s 2016-2020, Report an understanding of the monitoring methods employed by the Department to gauge the health and viability of each sanctuary is required.

To explain the sampling methods the following excerpts from the Report, Appendix A, pages 7-10 are cited verbatim to enhance this understanding:

Annual Fall Oyster Dredge Survey

The purpose of the department’s Annual Fall Oyster Dredge Survey (Fall Survey), conducted since 1939, is to assess the overall health of the Maryland’s oyster population. The Fall Survey represents the longest continuous and most geographically comprehensive oyster survey in Maryland.

The Fall Survey design included the sampling of spatfall and relative oyster abundance at a subset of Maryland’s oyster bars. This report utilizes Fall Survey data since 2006; a 15-year time period with standardized survey methodologies. In the fall each year, approximately 300 to 400 samples are collected. Some sanctuaries may have samples taken on multiple bars annually, some sanctuaries have only one oyster bar sampled annually, and some sanctuaries have not been sampled at all by the Fall Survey. For each sample, one or (in the case of the 43 fixed disease and biomass bars) two half bushel subsamples of material are collected by an oyster dredge. Detailed methods for the fall survey may be found in Tarnowski (2020).

For each sample collected by the Fall Survey, the number of live oysters per one bushel of material collected is counted. Oysters are classified as spat, small-sized oysters, or market sized oysters. Spat are less than one year old. Small-sized (sublegal) oysters are between one and three years old, and generally greater than 40 millimeters and always less than 76 millimeters. Market-sized (legal) oysters are always greater than 76 millimeters and generally three years and older. Changes in the number of oysters over time can provide a general sense of change in oyster abundance and age/size structure. Relative density of live

oysters can be estimated by standardizing the count of live oysters by the total volume of the sample, tow distance, width of the dredge, and a gear efficiency coefficient.

Samples taken on a fixed 43 bar subset of all the oyster bars sampled provide more detailed information on oyster sizes annually. Oyster shell height in millimeters is recorded for all oysters collected. Oyster size structure can be assessed by calculating the frequency distribution of oysters in each five mm size class.

A healthy oyster population would have a size distribution with oysters in all, or at least most, size classes from five millimeters to greater than 120 millimeters. This would indicate multiple age classes in the population.

Biomass is relative measure of how the oyster population is doing over time. It accounts for recruitment, individual growth, natural mortality, and harvesting in a single metric. In assessing the size of the population, biomass integrates both, the abundance of oyster shell height using laboratory-derived height-weight relationship. Weight is calculated in grams of dry tissue weight. Increased in biomass may reflect increases in the number of oyster and/or oyster growth.

Total Observed Mortality is an indicator of annual mortality rates of small and market sized oysters. Mortality can occur from disease or other natural factors such as freshets. Mortality is estimated based on the total count of small and market-sized live oysters and the total count of small and market-sized boxes (dead oysters with the valves still articulated).

Cultch (oyster habitat) is crucial for providing hard substrate for oyster setting as well as habitat for the myriad other organisms associated with the oyster community. For the purpose of the Fall Survey, cultch is defined as primarily both oysters (live and dead) and shell. The collection of quantitative cultch data was initiated during the 2005 Fall Survey. During a sampling tow, the distance covered by the dredge while sampling on the bottom is measured using a handheld geographic positioning system (GPS) unit with an odometer function. After the dredge is retrieved, the total volume of oysters and shell is measured in bushel units. Since tow distances vary, the volume is standardized to a 100 ft. tow by dividing 100 by the actual tow distance and multiplying the results by the total cultch volume. If the dredge is full that sample is dropped from the analysis.

Information on oyster diseases is collected from the same fixed subset of 43 bars on which shell heights are collected. Dermo (*Perkinsus marinus*) and MSX (*Haplosporidium nelsoni*) infection prevalence (the percentage of oysters infected) and intensity (the severity of infection) are measured from 30 oysters collected at each site. Disease prevalence and intensity both relate to mortality. For example, all of the oysters in a sample may be infected with a disease, but at such low intensity levels that few oysters are in danger of dying in the near future. Intensity is based on a 0 to 7 scale with values of 5 or greater representing lethal levels.

The Fall Survey data will be used to explore general characteristics of the oyster populations within those sanctuaries that were sampled in the Survey. Data presented will examine changes over time, based on the average number of oysters per a bushel of material, oyster

shell height, live oyster biomass, recruitment, mortality, cultch, and disease on oyster bottom within each sanctuary.

Patent Tong Surveys

Patent tong population surveys have been conducted by the department since the establishment of the 2010 sanctuaries, however, only surveys occurring after 2015 will be presented for each sanctuary in the appendix. These surveys use hydraulic patent tongs to obtain spatially explicit estimates of oyster density, as well as information on oyster size and the amount of cultch present. Patent tong surveys conducted by the department used a stratified random sampling design, with strata based on substrate type. The number of sampling points for each survey on each sanctuary ranged from 50 to 300, depending on the area of potential oyster habitat present in each sanctuary. Most sanctuaries have been surveyed at least once, and two sanctuaries have had two surveys conducted prior to sanctuary establishment.

The fixed area of the patent tongs (one square meter) allows for the calculation of oyster density. An average density of oysters based on all samples collected within a sanctuary can be used to derive the overall density of oyster habitat in the entire sanctuary. The patent tong surveys also measure the oyster larvae; therefore, the greater the volume of exposed shell, the greater the potential for spat set.

Comparison of Fall Survey and patent tong survey results is difficult given the difference in sampling efficiency and area between the two gear types; therefore, in this appendix the results from the two surveys are presented separately.

In this appendix oyster density and oyster shell height distribution from the patent tong surveys will be presented, where available, along with the Fall Survey information. In addition to the patent tong surveys conducted by the department, additional patent tong surveys were conducted by the Versar, Inc and the Oyster Recovery Partnership using a systematic sampling design. Results of these surveys may be referenced in this appendix.

IV.
LIST OF SANCTUARIES
DNR OYSTER MANAGEMENT REVIEW
2016-2020

The DNR's current Report (2016-2020) characterizes the Bay's oyster bottom as:

- Aquaculture – 7,593 Acres
- Sanctuaries – 253,007 Acres
- Public Shellfish Fishery Area (PSFA) – 175,836 Acres
- Remaining Historic Oyster Bottom (unproductive) – 121,761 Acres

The following list of the 51 sanctuaries described in pages 15 through 310 of the Report's Appendix are herein set forth along with comments of the Talbot Watermen's Association based on the sampling efforts of the DNR (2016-2020) and other information provided in the Report.

Section A.01 – Big Annemessex – Somerset County – Appendix A, pg. 15

- Sanctuary since 2010; 749 acres, 361 acres of historic oyster bottom
- Fall Surveys – 1 sample between 2006 – 2020 – No live oysters found in two surveys 20 years – No Fall Survey Table, patent tong survey in 2017 found no live oysters and no surface shell.
- **Survey Assessment: Failure**

Section A.02 – Breton Bay – N. Shore Potomac River – Appendix A, pg. 19

- Sanctuary since 2010; 3212 acres, 888 acres of historic oyster bottom
- Fall Survey 2016 – 2020; average density – market oyster decline 2016 – 2020; mortality above Bay-Wide average, no spat found and 0.1 small oysters with 0.4 market size oyster/ m².
- Patent Tong Survey by Dept. 2018 – No live oysters found.
- Maps. Mud Bottom predominantly
- Survey on Black Walnut Bar
- Decline – Table sampled 5/5 – 2006-10 also two out of 15, 2016-20 – live small oysters/sq. meters .1 plus or minus 0 spat/ market oysters declined .4 (2920) oyster biomass – declined – 16% mortality, culch declined.
- **Survey Assessment: Failure**

Section A.03 – Calvert Shore Sanctuary – Calvert County – Appendix A, pg. 27.

- Sanctuary since 2010, 2214 Acres, 673 acres of historic oyster bottoms
- Last Patent Tong Survey – 2015, Incomplete Data
- Fall Survey – 1 Bar – Flag Pond
- 2017 – 11.4 million spat on shell planted for restoration purposes – 2016-20
- Live Spat / Sq Meter .2 +/- .2-?
- Live small oysters/Sq Meter 1.9 +/- 1.1

- Market Oysters/Sq Meter 7.8 +/- 6.2
- Observed mortality per m² 13 +/- 9
- Values per tables based on annual mean +/- standard even.
- Expansion of Oyster – small and marketable – by 2020.
(3 years after 11.4 million spat on shell – 2017 restoration)
- **Survey Assessment: Mixed Results**

Sec A. 04 – Cedar Point Sanctuary – Upper St. Mary’s County Appendix A, pg. 35

- 2010 – 3,473 acres, 82% is historic oyster bottom
- Patent Tong Survey – 2013 – No new surveys since
- No replenishment/restoration efforts since 2006
- **Survey Assessment: Failure/Not Mentioned**

Sec A. 05 – Chester River ORA Zone A Sanctuary Appendix A, pg. 38

- Created 1996, no recent replenishment.
- 6,189 acres, 184 or 3% historic oyster bottom.
- Table Graphs
 - Steady declines of small and market sized oysters per m² since 2016
- Observed mortality % 15 +/- 3.
 - 5 years 2016 – 2020 – 10 samples
- Cultch declined since 2017, slight increase 2020.
- Overview ignores data.
- **Survey Assessment: Failure**

Sec A. 06 – Choptank River Sanctuary Appendix A, pg. 43

- Created 1996 – 8,962 Acres – 236 Acres or 3% historic oyster bottom.
- Table/Graphs
 - Small and market size oysters sharp declines since 2017
 - Observed mortality – sharp decline – 3x mortality since 2016.
 - Market oyster per square meter increase by 2016-17 and declining 60% since
 - Possibly relating to spat on shell plantings 15 million since 2006.
 - Effects of major restoration – no longer evident
- **Survey Assessment: Failure**

Sec A. 07 – Cook Point Sanctuary Appendix A, pg. 48

- Lower Choptank Established 2001 – 17A – expanded 2010 to 81% Acres and 781 acres of 96% historic oyster bottom.
- Two bars – Cook Point – 78% - Todd Point – 3% in sanctuary.
- Fall Surveys only – No patent tong surveys 3.
- Observed mortality 2 x Bay avg 2016 and 2017.
- “Likely due to disease” -? No Data or study of mortality in adjacent bars
- Once Productive Oyster Bottom
- Extensive plantings and restoration efforts:

- From 2006-2013 – 161 million spat on shell planted, together with 309 reef balls + 196,000 Bu shell.
- Sharp declines in small (80%) and market sized (60%) oysters per m² from 2010/2011 to 2020.
- **Survey Assessment: Failure**

Sec A. 08 – Cox Creek Sanctuary Appendix A, pg. 57

- Tributary of Eastern Bay – low salinity Zone I region
- Created 2010 – 2112 Acres, 939 acres (45%) historic oyster's bottom.
- Fall Surveys 2006 & 2019
 - No Spat
 - No Table or graphs provided.
- Patent Tong Surveys – 2014, .6 oyster per m² | 2020, 1 oyster per m².
- No replenishment or restoration plantings since 2006 except “Marylanders Grow Oysters (MGO)” between 2011 and 2015
- Bottom Type – Survey – mostly mud in main channel.
- **Survey Assessment: Failure**

Sec A. 09 – Eastern Bay Sanctuary Appendix A, pg. 61

- Medium salinity – created 2010 – 4521 acres, 939 acres (21%) historic oyster bottoms.
- No Fall Surveys from 2014 to 2020
- Patent Tong Surveys
 - 2014, .5 oysters per m² | 2020, .7 oysters per m²
- Restoration planting 20 million spat on shell (hatchery) – Map survey discloses mud bottom 65% to 1 km from shore despite such large restoration effort: no natural oysters and large areas of mud bottom.
- **Survey Assessment: Failure**

Sec A. 10 – Fort Carroll Sanctuary Appendix A, pg. 65

- Patapsco River, Low salinity region
- Created 1995 – 30 Acres
- Established – education purposes, living classroom programs, no samples since 2006; restorative plantings since 2006 by Living Classroom Foundation (LCF) + MGO since 2012
- No measure or study of any success by LPC and MGO plantings
- Not even limited patent tong surveys to determine whether “plantings” have been a waste of shell and spat area probably too polluted to justify plantings.
- **Survey Assessment: Failure/Not Monitored**

Sec. A. 11 – Harris Creek Sanctuary Appendix A, pg. 67

- Medium Salinity, Sanctuary established 2010 – 4647 acres, 1998 acres or 43% historic oyster bottom.
- 15 oyster bars; Sanctuary – “large-scale oyster restoration” under Chesapeake Bay Watershed Agreement – Initial restoration completed 2015 a list of

hatcheries spat on shell 2020 – no info about how much by volume restoration and reseeded.

- DNR:
 - No Patent Tong surveys since 2006.
 - Other organizations monitoring sanctuary patent tong and diver surveys.
 - NOAA/Workgroup multibeam bathymetric sonar-based depth reef height and diver surveys. The later methods lack the completely random sampling of a Patent Tong Survey and rely on the unmonitored judgement of the divers who are allowed to pick and choose the contents of the samples collected and then to estimate that the sampling is consistent over 30% of the reef sampled area.
 - Fall Surveys by DNR reflect 2016-2020 40% decline in small oysters and 8% decline in market size oysters since 2011-2015, despite massive plantings,
 - Fall Survey completed only 6 areas with no sampling of sites with reef base of granite.
 - Over 2.47 billion hatchery spat on shell planted from 2011-2020
 - Decreased Cultch
- Participants in Restoration
 - MDNR
 - Corps of Engineers
 - NOAA
 - Oyster Recovery Partnership
 - National Fish and Wildlife Foundation
 - Chesapeake Bay Foundation
 - Nature Conservancy
 - CSX Railroad
 - MGO “public outreach” planted oyster since 2012 at one site in sanctuary.
 - The Phillips Wharf Environmental Center est. planting
 - 750,800 oysters from 2012 to 2022, where? What results?
- With limited Fall Survey sampling. Incomplete suspect data as to monitoring by other organizations.
- **Survey Assessment: Inconclusive notwithstanding the Department’s claims of success. Concerns exist about limited Fall Survey sampling, incomplete/suspect data from the monitoring efforts of other organizations and a decline in the levels of cultch within the sanctuary. Finally, the massive expenditures of time, effort, and funds in the establishment and maintenance of the sanctuary defy any cost benefit analysis given the results of the Department’s 2016-2020 Report.**

Sec. A. 12 - Herring Bay Sanctuary Appendix A, pg.76

- Sanctuary created in 2010, 16,792 acres; 7891 (43%) historic oyster bottom – 8 bars.
- Fall Surveys – 1 bar; no oysters found 2019 – 2020 except one spat – 9 total in three previous years.
- Last PT survey 2014

- After 2010 – 19 million hatchery spat on shell planted.
- MGO plantings since 2012 – 8 years.
- Sanctuary – Complete Failure – despite extensive spat on shell plantings by State and MGO except – 9 oysters found – 2016 – 2018 – in Fall Survey
- Also, despite continuous water quality monitoring – Dermo spike – 2015 – 2019 charts – ½ sanctuary is mud.
- **Survey Assessment: Failure**

Sec A. 13 – Hooper Strait Sanctuary Appendix A, pg. 84

- Medium salinity: sanctuary established 2009 – 7,307 acres; 5,317 acres (73%) historic oyster bottoms.
- 15 bars in sanctuary – high mortality 2016-2020 % - 14+/- 6%
- Fall Surveys on two bars – spat density constant 2016 – 2020.
- DNR – patent tong surveys 2013 through 2020 – spat, increasing.
- Small oyster per square meter - .3, market oysters .2 pers square meter
- Of 121 samples – 85 had no live oysters.
- Between 2006 – 2008 – no plantings to enhance public fishery.
- Since sanctuary – 34 million hatchery spat on shell planted.
- Fall Surveys 2016-2020 increases small and market size oysters.
- Patent Tong Surveys 2013 and 2020 inconsistent with Fall Surveys.
- **Survey Assessment: Mixed Results**

Sec. A. 14 – Howell Point Sanctuary Appendix A, pg. 90

- Low salinity, Mid, Choptank Sanctuary established 2001 – 6 acres historic oyster bottoms, Fall Survey sampled since 2015 spat and small oysters higher – 2016-20 – density and market oysters lower.
- No PT surveys since 2016
- Since 2006 – 79 million spat on shell planted also MGO plantings since 2009.
- Ques. Tables – Fall Surveys – 58.4 +/- 12.8 market sized oysters per square meter for 2016-2020 due to massive plantings on small (6 acres) sanctuary.
- **Survey Assessment: Success**

Sec. A. 15 – Kitts Creek Sanctuary Appendix A, pg. 95

- SE Chesapeake Bay – High salinity – off Pocomoke Sound
- Manmsco Creek – Sanctuary established in 2001 – 1,181 acres, 95 or 8% historic oyster bottoms.
- Fall Surveys 2006 – 2007
- Patent Tong 2017 – Avg oyster density two per m²
- 61 samples – 40 no oysters
- No plantings since 2006
- No tables – little monitoring; no trends
- **Survey Assessment: Failure**

Sec A. 16 – La Trappe Creek Sanctuary Appendix A, pg. 99

- Choptank Tributary, Sanctuary established 2010 – 377 acres; 13 or 3.5% historic oyster bottoms.
- Fall Surveys – 1 time – 2015 – no live or dead oysters found – no Patent Tong surveys since 2006.
- MGO present on the creek – planting all spat on Howell Point Sanctuary.
- **Survey Assessment: Failure**

Sec. A. 17 – Little Choptank Sanctuary Appendix A, pg. 102

- Created 2010 – 9,415 acres, 1713 acres or 18% is historic oyster bottom – 18 bars.
- Sanctuary selected for large-scale oyster restoration under 2014 Chesapeake Bay Watershed Agreement – initial restoration completed 2020.
- Fall Surveys 9 bars – no samples on sites of restored stone reef base.
- DNR – patent tong survey 2014 – only – none since
- “Other organizations” – monitoring restoration See N41 – NOAA Oyster monitoring reports.
- Since 2010 sanctuary received substrate and hatchery spat on shell plantings; reefs restored, stone, fossil oyster shell, clam shell.
- 2010 – 2020 – over 1.78 billion spat on shell planted on 358 acres of restored oyster bottom
- DNR Fall Survey Table reflects consistent small oyster density however 42% decline market size oysters since 2010-2015 survey. Also decline of cultch from 2.1 BU to 1.6 BU per 100 feet towed.
- Large increase in spat during 2020, naturally occurring Bay-wide.
- **Survey Assessment: Inconclusive, notwithstanding Department’s claims of success. Concerns exist about declines in market size oyster density and cultch.**

Sec A. 18 – Lower Chester River Sanctuary Appendix A, pg. 111

- Mouth of Chester River – low salinity area
- Created 2010 – 24,147 acres; 6930 acres or 29% historic oyster bottoms.
- Also incorporated two previous sanctuaries (Strong Bay – (2003)) – 320 acres and East Neck Sanctuary – 2007 – 78 acres – Grand Total – 24,545 acres, 7,189 acres – historical oyster bottoms
- Fall Surveys 2016 – 2020 – 3 bars on Sanctuary – small and market oyster densities declined – observed mortality increased slightly above Baywide average.
- Culch decreased, last patent tong survey by DNR in 2014
- 2006 – 21 million hatchery spat on shell planted, 218,000 Bu dredged shell
- Since sanctuary – 244 mil hatchery spat or shell planted.
- Plantings reflect no result – small oysters decline 87% to .2 per m² – market oysters decline 40% to 6.8 per square meter.
- **Survey Assessment: Failure despite massive restoration attempt.**

Sec A. 19 – Lower Choptank River Sanctuary Appendix A, pg. 117

- South Shore of Choptank River Near Mouth – Castlehaven – East and West

- Medium salinity – Sanctuary established 2010 – 7172 acres, 4217 acres or 59% are historic oyster bottoms.
- Fall Surveys – 1 bar sampled – density – small oysters declined but density market oysters increased.
- Table
 - Small oyster decreased from 9.5 to 1.9/per sq meter – 80% decline.
 - Market oysters increased from 18.5 to 23.7 per sq meter.
- Small oysters have merely grown to market size.
- Mortality is 17% - increased three times in 2016-20 period.
- DNR posits – “due to disease” – no data.
- In 2011 – 35 million hatchery spat on shell, planted.
- Small oysters have grown out to market size and mortality increased; culch remain about s/avg 2006 – 2010.
- No Patent Tong Surveys.
- No Biomass data
- **Survey Assessment: Mixed Results**

Sec A. 20 – Lower Mainstem Sanctuary Appendix A, pg. 122

- West of Bloodsworth Island and South Marsh Island – Medium salinity
- Sanctuary established – 2010 – 38,290 Acres; 8,234 acres or 22% historic oyster bottom – 6 historic oyster bars.
- Fall Surveys – 2 bars sampled – density of spat and small oysters increased.
- Table – small oysters increased from 45.4 in 2011-15 to 71.6 in 2016-20, spat increased from 34.5 (11-15) to 59.7 (16-20) increase, and market oysters decreased from 13.4 (11-15) to 11 (16-20), cultch decreased by 1/3.
- Before sanctuary established – 88,000 Bu dredged shell planted.
- After Sanctuary established, no planting activities.
- Last Patent tong survey 2015.
- Increases without replenishment – but without patent tong surveys, not well monitored.
- **Mixed results/No Patent Tung Surveys, 2016-2020**

Sec A. 21 – Lower Patuxent River Sanctuary Appendix A, pg. 130

- Created 2010, 335 Acres, 315 Acres (94%) historic oyster bottom.
- No Fall Surveys since 2006; PT Survey 2015.
- No restoration or replenishment efforts since 2006
- **Survey Assessment: Mixed Results, increases of small oyster and spat with some decline in market oysters and cultch.**

Sec A. 22 - Magothy River Sanctuary Appendix A, pg. 133

- Sanctuary established 2010, 5607 acres; 230 acres or 4% historic oyster bottoms.
- No Fall Surveys since 2006.
- PT survey in 2018 – found 2.9 oysters per square meter – average density - .5/per square meter of 101 samples – 93 no oysters – 66 no shells.

- From 2006 – 2009, 20 million spent on shell planted – Jan 2021 – 100 reef balls placed by Magothy River Association. Also, Marylanders Grow Oysters and Magothy River Association planted since 2009.
- **Survey Assessment: Failure**

Sec. A. 23 – Manokin River Sanctuary Appendix A, pg.138

- Sanctuary since 2010 – 16320 acres; 11040 acres or 68% historic oyster bottoms
- Large active harvest area taken as sanctuary.
- 19 oyster bars – declared as “large-scale restoration” sanctuary.
- Fall Surveys, spat increasing last 10 years; density small oysters increased 2016-20, biomass higher.
- Patent Tong Surveys 2012, 2015, with 2017-2018 – oyster density 5.6 per square meter in 2017 and average oyster density-14.4/per square meter in 2018.
- PT Surveys 2017 and 2018 also reflect large sample with no oyster or surface shell volume.
- Since 2010 no restoration plantings
- Large scale restoration plantings set for 2021.
- Active harvest area converted to sanctuary has blossomed despite no large restoration projects.
- Oyster have increased on their own.
- **Survey Assessment: Mixed results/no Patent Tong Surveys since 2018.**

Sec A. 24 – Man O War Gales Lump Sanctuary Appendix A, pg. 148

- Upper Chesapeake – Sanctuary 2010 – 4,704 acres; 2310 (49%) historic oyster bottom
- Total 4747 acres, 2353 acres historic oyster bottom
- No Fall Surveys since 2006
- Patent Tong Survey – 2015-2016
 - 2015 – 2 oysters – 154 samples, 0.01 density/per square meter
- No replenishment, etc. since 2006
- Dead Zone
- **Survey Assessment: Failure**

Sec. A. 25 - Miles River Sanctuary Appendix A, pg. 152

- Medium salinity – sanctuary established 2010 – 3449 acres; 373 acres or 11% historic oyster bays.
- Fall Surveys – 1 bar sampled since 2015 with no spat (2016-2020) also practically no live oysters from 2016-2020 with no increases in 2020.
- 2020 – mortality rate slightly higher
- Patent Tong survey 2014 – 2020 - .09 oysters per square meter
- After Sanctuary established – 12 million spat on shell planted for restoration – MGO planted every year since 2010.
- Extremely limited oysters present despite restoration efforts.
- Bottom is mostly mud – why plantings?

- **Survey Assessment: Failure**

Sec A. 26 – Mill Hill Sanctuary Appendix A, pg. 161

- Eastern Bay Sanctuary established 2000 as an EPA Project.
- Remounted habitat and alternative materials.
- 295 acres; 188 acres or 64% historic oyster bays.
- Fall Surveys – 1 Bar – noting spat, small and market sized oysters in sharp declines.
- Patent Tong Surveys 2013 and 2020 the later reflecting 4.0 oysters/m2.
- 3.2 market size oyster .8 small oyster
- From 2006 to 2020 – 82 million hatchery spent on shell planted and Nature Conservancy planted 237,113 aquaculture oysters planted 2021 to help aquaculture farmers.
- Spat small oysters and market sized oysters declining despite large scale planting.

- **Survey Assessment: Failure**

Sec A. 27 – Nanticoke River Sanctuary Appendix A, pg. 167

- Low Salinity – sanctuary established 2010 – 16,699 Acres; 376 or 3.4% historic oyster bottoms.
- Fall Surveys “oyster abundance and biomass increased steadily since sanctuary established in 2010 due to establishment of sanctuary and no harvest and strong spat sets, observed mortality rates low.
- Replace and Restoration
 - 2006 to 2018 – 6,000 Bu, wild seed planted.
 - 2021 – Nature Conservancy planted – 571,596 aquaculture oysters
 - MGO active since 2009 – planting on one location
 - Patent tong survey 2018 – density 10.5 oys/per square meter more market oysters than small oysters
 - Planting scheduled for 2021.

- **Survey Assessment: Mixed Results/Decline in cultch**

Sec. A. 28 – Neal Addition Sanctuary Appendix A, pg. 177

- Middle Patuxent River – medium salinity – sanctuary established 2001 – Army Corps of Engineers Project – 7 acres.
- Fall Surveys – 1 location – spat and small oysters increased from 2016 to 2020.
- Observed mortality rate of 17% above Bay average.
- Patent Tong survey 2018 – 22.1 oyster per square meter, mostly small oysters
- From 2006 to 2020 – 10 million hatchery spat on shell planted.
- 2016-2020 – Increase in small oysters with decline I market sized oysters, no biomass data.
- Very small (7 Acres) Sanctuary with massive plantings.

- **Survey Assessment: Failure**

Sec A. 29 – Oxford Lab Sanctuary - Tred Avon River Appendix A, pg. 183

- Patent Tong survey – since 1961 – 36 acres Fall Survey not since 2006.
- Also, no PT surveys since 2006
- No replenishment efforts except MGO plantings annually since 2008
- No data – no measure of success or failure.
- **Survey Assessment: Failure**

Sec. A. 30 – Piney Point Sanctuary Appendix A, pg. 186

- St. George Creek – Lower Potomac – Sanctuary established 1986.
- 13 acres – no Fall Survey since 2006 – no PT surveys – no replenishment
- No data or measure of success or failure
- **Survey Assessment: Failure**

Sec A. 31 – Plum Point Sanctuary Appendix A, pg. 189

- Calvert County Shoreline Sanctuary established 1999 – 6,209 acres, 4405 Acres or 71% historic oyster bottom – No Fall Surveys or Patent Tong Surveys since 2006.
- No replenishment or restoration efforts since 2006
- No data or measure of success or failure
- **Survey Assessment: Failure**

Sec. A 32. – Point Lookout Sanctuary Appendix A, pg. 193

- Medium Salinity – Sanctuary expanded to 503 acres in 2010, 500 acres of historic oyster bottom.
- Fall Surveys – 2 sites/annually density-spat, small and market oysters increased 2016-20 – Table?
- Pt Surveys 2014-2020 – oyster density 5.3 per square meter, small oysters 3.1 market oysters
- Not much activity or substantial increases
- No restoration or planting since 2006
- Ques Table measures – oysters/per square meter, inconsistent with Fall Survey Table.
- **Survey Assessment: Mixed Results**

Sec A. 33 – Poplar Island Sanctuary Appendix A, pg. 202

- Medium Salinity – sanctuary established 2003, 7 acres – all historic oyster bottoms.
- No Fall Surveys since 2006 also no Patent Tong since 2006
- No replenishment since 2006
- No Data – Moribund
- **Survey Assessment: Failure**

Sec A. 34 – Prospect Bay Sanctuary Appendix A, pg. 205

- Eastern bay Sanctuary established 2010 – 1,478 acres; 1061 acres or 71% historic oyster bottoms.
- No Fall Surveys since 2006

- PT surveys 2013 and 2020 - .5 oysters per square meters – small oysters .42, market .6
- No replenishment from 2006 to 2010; one planting in 2011 with eight million hatchery spat on shell on 21 acres.
- No real progress despite planting
- **Survey Assessment: Failure**

Sec A. 35 – Prospect Bay Cabin Creek Sanctuary Appendix A, pg. 209

- Eastern Bay Sanctuary created 2005 by Chesapeake Bay Environment Control as pilot program. 298 acres, 128 acres or 45% historic oyster bays
- No Fall Surveys since 2006.
- Between 2006 and 2010, 6.5 million spat on shell planted and 160 reef balls deployed.
- **Survey Assessment: Failure**

Sec A. 36 – Ringold Survey Appendix A, pg. 212

- Upper Chester River: Sanctuary established 2001 – 120 acres; 63 acres or 52% historic oyster bottoms.
- No Fall Surveys since 2006; Patent Tong Survey – 2020 – found four market sized oysters – 100 samples – density 0.4 per square meter.
- No restoration since 2006
- **Survey Assessment: Failure**

Sec A. 37 – Roaring Point Sanctuary Appendix A, pg. 216

- Nanticoke River: Sanctuary established 2004 – 10 acres; zero acres of historic oyster bottoms.
- Sanctuary from old oyster lease – Chesapeake Bay Foundation
- No Fall Surveys since 2006; Patent tong survey in 2018 found 4 Samples – 0 Oysters
- MGO planted oysters annually since 2009 (11 years)
- No Data
- **Survey Assessment: Failure**

Sec. A 38 – Sandy Hill Sanctuary Appendix A, pg. 219

- Middle Choptank Sanctuary established 2009, 1947 acres, 1308 acres or 67% historic oyster bottoms + 10 acres old Horn Point Bottom.
- Fall Surveys – 1 location – biomass stable.
- Average size oyster – 100 mm – 61% over market oysters
- After 2009 – 93 million hatchery spat on shell planted.
- Major restoration effort
- Last Patent Tong Survey 2015
- With major planting, good bottom, why was Fall Survey sampling in one location and no PT survey since 2015 with no results listed.
- Data woefully inadequate.
- **Survey Assessment: Failure**

Sec. A. 39 - Severn River Sanctuary Appendix A, pg. 227

- Low salinity, Sanctuary established 2010 – 7,804 acres; 1376 acres or 18% historic oyster bottoms – 27 bars.
- Fall Surveys – 1 bar sampled - no natural spat found – 2016-20 – density of market size Oysters declined 2016-20 from previous 5 years. High mortality
- Despite good water quality
- Last patent tong survey 2012
- From 2006-2020 – 268 million spat on shell planted.
- MGO has plantings since 2009.
- Steep decreases in small oysters (80%) and market size oysters (51%) from 2016-2020.
- Sanctuary looks like a complete failure not withstanding massive plantings.
- **Survey Assessment: Failure**

Sec A. 40 – Solomons Creeks Sanctuary Appendix A, pg.234

- Lower Patuxent River, Medium salinity; Sanctuary established 2010 – 617 acres, five acres or .8% historical oyster bottoms.
- No Fall Surveys or Patent Tong surveys since 2006.
- Chesapeake Bay Foundation, Coastal Conservatory and Southern Maryland Oyster Cultivation Society planted 7.2 million oysters from 2008 to 2012 – discontinued – MGO has planted oysters since 2009.
- No data despite extensive plantings 2008-12 and continued annual MGO plantings thereafter.
- **Survey Assessment: Failure**

Sec. A. 41 – Somerset Sanctuary Appendix A, pg. 236

- Tangier Sound – High salinity, Sanctuary established 1999 – 101 acres; six acres or 6% historic oyster bottom.
- Fall surveys – 3 locations – 2015 to 2020 – Patent tong surveys.
- Higher mortality 2016-20
- Fall Surveys 2016-2020 reflects sharp decline with small and market size/ m² uptick in 2020.
- PT Surveys increase in density 50.3 Oysters per square meter.
- Spat – 25 per square meter, small oyster 21.8 per square meter, market size 3.5 per square meter.
- MGO planted between 2013 and 2017.
- **Survey Assessment: Failure**

Sec A. 42 – South River Sanctuary Appendix A, pg. 245

- Low Salinity Sanctuary established 2000, 2327 acres, 141 acres or 6% historic oyster bottoms.
- No Fall Surveys since 2006; Patent Tong Surveys 2014 only
- No restoration plantings since 2006 – four million hatchery spat on shell.
- MGO plantings since 2009

- No Data; approx. 70% mud.
- **Survey Assessment: Failure**

Sec. A. 43 – St. Mary's River Sanctuary Appendix A, pg. 249

- Medium Salinity Sanctuary established 2010 – 1304 acres, 89 acres or 9% historical oyster bottom.
- 2018 sanctuary selected as fourth large-scale restoration area under 2014 Chesapeake Bay Watershed Agreement
- Fall Surveys – 2 bars are market size and small densities stable 2016 – 2020.
- Avg market and small stable but increased mortality
- Patent Tong surveys 2018 – 64 acres are oyster density 18.15 oyster per square meter.
 - St Mary's Watershed Association constructed oyster reef 603 reef balls.
 - 185 tons concrete rubble, 27000 shell in piles and 27 million spat on shell; MGO plantings since 2009, St. Mary's College
- Large scale restoration plantings set for 2021. Steep decline in small and market sized oysters in 2020.
- **Survey Assessment: Failure Steep decline in oyster density, in 2020 despite massive restoration efforts, with massive die off.**

Sec A. 44 – Tilghman Island Sanctuary Appendix A, pg. 259

- Medium Salinity Sanctuary established 2010, 2534 acres, 1345 acres or 53% historic oyster bottom.
- No Fall Surveys since 2006; Patent Tong survey – 2015 – No results listed.
- No replenishment
- No Data
- **Survey Assessment: Failure**

Sec A. 45 – Tred Avon River Sanctuary Appendix A, pg. 262

- Low Salinity Sanctuary established 2010 – 4149 acres, 1152 or 28% historic oyster bottom.
- 27 bars
- Fall Surveys – 5 bars – Density spat – small and market oysters increased.
- 2016 – 20 – Large scale restoration project. Fall Surveys do not reflect such density of oysters commensurate with massive plantings, also cultch declining.
- Department – Patent Tong survey 2012 and 2013 – Other Organizations have monitored.
- Patent tong Surveys and Diver surveys – their results = 3 years after initial restoration – 80% reefs met minimum threshold restoration criteria – 15 oyster per square meter
- From 2006-10 – 14million hatchery spat on shell planted.
- After sanctuary hatchery spat on shell – 460.4 million hatchery spat on shell from 2015-20 on 92.48 acres.
- Participated in restoration.
- **Survey Assessment: Success/Massive Restoration Effect.**

Sec A. 46 - Upper Chester River Sanctuary Appendix A, pg. 271

- Low Salinity Sanctuary established 2010, 9033 acres; 2365 acres or 26% historic oyster bottom.
- Total in two add 1, 9,109 acres; 2389 acres, 31 oyster bars.
- Fall Surveys – 6 bars – no natural spat or small oysters found.
- 2016-20; market oysters 10.4 +/- 2.5 – declining.
- Last Patent Tong Survey 2012
- After Sanctuary established 150 million hatchery spat on shell planted
- MGO plantings since 2010
- **Survey Assessment: Failure**

Sec. A. 47 – Upper Choptank River Sanctuary Appendix A, pg. 279

- Low Salinity Sanctuary established 2010 with additions – 5980 acres, 1687 acres historic oyster bottom.
- Fall Surveys – 7 bars – avg density spat and oysters both small and market sized declined 2016-20
- Also, mortality increased – 16%
- Patent Tong survey 2015, no results reported.
- 2010 – 88 million hatchery spat on shell planted.
- **Survey Assessment: Failure**

Sec. A. 48 – Upper Patuxent River Sanctuary Appendix A, pg. 287

- Low Salinity Sanctuary established 2010 – adds 14,470 acres, 2229 acres historic oyster bottom.
- Fall Surveys – 5 bars – oyster densities – stable 2016-20 – biomass slight decline.
- Last patent tong survey – 2012 – after 2010 – 27 million hatchery spat on shell planted.
- **Survey Assessment: Success/Stable.**

Sec. A. 49 – Webster Sanctuary Appendix A, pg. 296

- Medium Salinity – Som Co. – Mouth Wicomico River – Sanctuary established 1997, 554 acres; zero acres historic oyster bottoms.
- Fall Surveys not since 2006 – also no Patent Tong surveys.
- **Survey Assessment: Failure**

Sec. A 50 – Wicomico River Sanctuary Appendix A, pg. 299

- W. Shore – Sanctuary established 2010 – 450 acres; 272 acres or 61% historic oyster bottom.
- Fall Surveys – 1 sample – 2015 – no live or dead oysters.
- No patent tong surveys – no replenishment or restorative efforts except MGO plantings annually since 20019
- No Data: moribund – failure not even deemed fit for Fall Surveys last 6 years.
- **Survey Assessment: Failure**

Sec. A. 51 – Wye River Sanctuary Appendix A, pg. 303

- Medium Salinity, Sanctuary established 2010 – 3,510 acres; 1100 acres or 31% historic oyster bottoms – 23 bars.
- Fall Surveys – 5 bars – oysters increased in first five years but recent declines due to lack of spat fall and increased mortality 23%; PT Survey 2020 does not square with 2020 Fall Survey.
- PT survey 2014 and 2020 are density live oysters .5 / per square meters lower than 2014 2.3 oysters per square meter: MGO plantings since 2010. Live market size oysters dropping off in 2020.
- Cultch declining 2016-2020.
- **Survey Assessment: Failure**

V. CONCLUSION

HARRIS AND BROAD CREEKS THE OYSTER'S TALE OF TWO CITIES

As if by pure happenstance the story of the Bay's oyster restoration is played out in the Choptank River's twin sisters, Harris, and Broad Creeks. They both flow northward in a roughly parallel track from the northwestern banks of the Choptank and are separated by no more than one mile from each other by Bozman Neck, which forms the easterly bank of Harris Creek and westerly bank of Broad Creek. In addition, they share the same waters and roughly the same tides and each are each abutted on all sides by lightly populated areas of predominantly agriculture land.

Both Harris Creek and Broad Creek are homes to many historically productive oyster bars and since 2010 with the aggressive expansion of the sanctuary program, they represent widely different paths in the efforts to increase and sustain the Bay's long term oyster replenishment and restoration of its oyster stock. Their close proximity to each other and the similarity of their shared environment highlight in sharp contrast the real effectiveness of the sanctuary programs of Harris Creek compared to its sister, Broad Creek, which thrives while remaining in the public fishery. The Department's 2016-2020 Report, Appendix A, pages 67-75, for Harris Creek and Appendix B, pages 256-262, relating to Broad Creek, bring this contrast to light.

Harris Creek, the Department's flag-ship large-scale oyster restoration sanctuary has since 2010 been off-limits to public harvest. Its bottom has been heavily engineered by state and federal agencies to provide an artificial substrate bottom with the goal of creating an extensive oyster reef system. Some of the methods in the bottom enhancements of Harris Creek include: massive deposits of granite, fossil shell, mixed shell, and spat-on-shell. By various estimates, the state and federal efforts at oyster restoration in Harris Creek (not including monitoring), have cost in excess of \$31 million dollars since it was designated as a sanctuary.

The 2016-2020 Fall Surveys of the DNR measuring oyster densities and biomass levels at Harris Creek and Broad Creek reveal results which are surprisingly similar.

The 2016-2020 Fall Survey Tables for Harris Creek disclose:

Live small oyster/ m ²	148.7 +/- 37.4
Live market-sized oysters/ m ²	115.9 +/- 2.2
Live oyster Biomass (weight/bushel)	357 +/- 24

The 2016-2020 Fall Survey Tables for Broad Creek disclose:

Live small oyster/ m ²	239.1 +/- 35.3
Live market-sized oysters/ m ²	77.5 +/- 12.5
Live oyster Biomass (weight/bushel)	381 +/- 19

See DNR's Report, Appendix A, page 71 and Appendix B, page 258.

The accompanying graphs for 2020 show the market-sized oysters/ m² declining in Harris Creek and increasing to approximately 120/ m² in Broad Creek.

The Department's randomly conducted Fall Surveys clearly demonstrate that the oyster densities and biomass are roughly comparable between the heavily subsidized and engineered sanctuary, Harris Creek, and its proximate neighbor Broad Creek, which remains in the public fishery and is harvested on a yearly basis. If anything, the rough comparison gives the edge to Broad Creek based on its maintenance and increases in oyster density and live oyster biomass.

Ironically, Broad Creek is not heavily subsidized and remains in the public fishery. It has benefited by deposits of shell and limited spat-on-shell by the DNR and the ORP in cooperation with the Talbot County Oyster Shell Committee. The replenishment efforts of the oyster stock at Broad Creek have cost over time an estimated 1 million dollars with the majority of the funds being generated by TFL oyster licensing fees, excise and per harvest bushel taxes and other state changes and taxes, much of which are self-sustaining.

Replenishment and restoration do not have to be considered as mutually exclusive concepts. Broad Creek has demonstrated that a thoughtful and well executed approach to oyster replenishment programs can also lead to restoration of the oyster stock. Not all of the replenished oysters are harvested and enough of the balance of the spat-on-shell grown to maturity whether as a small or market size oysters will serve to restore the resource as a matter of course. There just need to be more "replenished Broad Creeks" in the public fishery, which will ensure that the fishery while maintaining itself will at the same time further the goals of the restoration and regeneration of the Bay's oysters.