

Appendix C

Evaluation of Maryland's Best Oyster Bars 2009-2018

**Oyster Management Review:
2016-2020**

**A Report Prepared by
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Section C.1: Background

In 2010, Maryland Department of Natural Resources amended its regulations for managing oysters in Maryland waters of the Chesapeake Bay in order to create additional sanctuaries, establish Public Shellfish Fishery Areas, and revise aquaculture rules. The preamble to the regulation states:

“The expanded sanctuary network will include half of the best remaining oyster bars. These ‘best bars’ were identified through a scientific analysis of 282 oyster bars from Maryland’s annual fall oyster survey. Best bars are oyster bars that over the last 10 years have consistently been among the top 10% of the oyster bars surveyed in Maryland. The other half of these best bars will remain in the public oyster fishery and be designated as public shellfish fishery areas.”

At the time of the 2010 regulation, the 2009 Jones and Rothschild’s¹ ‘best bars’ were used to divide the number of ‘best bars’ equally to sanctuaries and Public Shellfish Fishery Areas. In 2020, more than half of the Jones and Rothschild ‘best bars’ have some portion of their area within a sanctuary boundary. Also, more than half of the Jones and Rothschild ‘best bars’ have some portion of their area within a Public Shellfish Fishery Area. Some of the 2009 ‘best bars’ have acres in both sanctuary area and Public Shellfish Fishery Area so they are counted twice.

Given that oyster populations, as well as ‘best bars’, can change over time, the preamble to the 2010 regulation also states:

“The department has committed to reviewing the effectiveness of the locations of sanctuaries, public shellfish fishery areas, and aquaculture areas every 5 years and to propose changes where needed.”

Towards this commitment, the department drafted a report in 2016 evaluating the status of the oyster sanctuaries, Public Shellfish Fishery Areas, and aquaculture in Maryland waters from 2010-2015². In the 2016 report and the 2019 Oyster Fishery Management Plan³, the department stated its intent to review the best bars analysis from 2009⁴ by Jones and Rothschild and update the analysis using current data. Following is the updated assessment of the ‘best bars’ in Maryland for the 2016-2020 report.

¹ Jones, P. and B. Rothschild. 2009. Maryland’s Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

² Maryland Department of Natural Resources. 2016. Oyster Management Review: 2010-2015. 112 pp. <https://dnr.maryland.gov/fisheries/pages/oysters/5-year-oyster-review-report.aspx>

³ Maryland Department of Natural Resources. 2019. Oyster Fishery Management Plan. 93 pp. https://dnr.maryland.gov/fisheries/Documents/MD_Oyster_FMP-2019.pdf

⁴ Jones, P. and B. Rothschild. 2009. Maryland’s Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

Section C.2: Introduction and Methodology

The Jones and Rothschild (2009)⁵ ‘best bars’ study used data from 1996-2007 and only considered the number of market-sized oysters (legal size allowed to be harvested). Their ‘best bars’ were those with counts of live market oysters in the top 10% for four or more years in the time series. Additionally, the 2009 study included sites that had been planted with shells or oysters (either natural wild seed or hatchery spat-on-shell).

By contrast, this updated analysis on ‘best bars’ expands the understanding of what a best bar is by examining performance parameters beyond just market oysters and examines a more current time period (2008-2019). A ‘best bar’ should not only consistently contain high numbers of market-sized oysters but also have high counts of spat and small-sized oysters (oysters not able to be harvested) as well as relatively low mortality to ensure that spat and small oysters survive to become market-sized.

The ‘best bars’ of the Jones and Rothschild (2009)⁶ study included several bars with extensive seed plantings. These added oysters may not represent the natural potential of these areas, especially in areas with little to no natural recruitment. This updated analysis determined the current list of ‘natural best bars’, an oyster bar that has been naturally productive for the past ten years without having oysters (either wild seed (young oysters) or hatchery spat-on-shell) added in five years.

Additional analysis was conducted using all bars, including those with oyster plantings to compare to ‘natural best bars’. Some oyster bars may become ‘best bars’ or productive oyster bottom through human manipulation by planting wild natural seed or hatchery spat-on-shell. Some bars have received significant plantings either through restoration or public fishery plantings replenishment. Given that a ‘best bar’ should have high counts of all size classes of oysters, a bar with a one-time planting of oysters would not be expected to be a ‘best bar’ especially if it is located in an area with known low to no natural recruitment. However, a bar may become a ‘best bar’ through boosting an existing oyster population through multiple plantings, planting in areas where there is known recruitment, and/or tributary-scale plantings on multiple bars within the same time period.

Data Source for Analyses

The department and earlier agencies have conducted surveys of the oyster population in the Chesapeake Bay since 1939. The primary intent of the survey is to characterize the status of the oyster population by assessing aspects of the Eastern oyster (*Crassostrea virginica*) such as

⁵ Jones, P. and B. Rothschild. 2009. Maryland’s Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

⁶ IBID

recruitment (spatfall), biomass and mortality⁷. This survey is known as the Annual Fall Oyster Dredge Survey (Fall Survey).

The Fall Survey is conducted each autumn from mid-October through November and uses a 32-inch (0.81m) oyster dredge towed from the research vessel MISS KAY. Samples are collected throughout the Maryland portion of the Chesapeake Bay on natural oyster bars and seed and shell plantings on both public fishery and sanctuary oyster bars. There are over 1,000 named oyster bars in the Maryland portion of the Chesapeake Bay. The Fall Survey samples approximately 300 of them annually, and many bars have multiple sampling sites within them. Of the sampled bars, 53 are ‘key bars’ designed to provide an annual index of recruitment and another subset of 43 (31 of which are also spat key bars) are used to provide information on disease intensity and prevalence, as well as an estimate of oyster biomass. For most sites, a single 0.5-bushel sample of material is taken from a single tow. For key bar and disease sites, two 0.5-bushel samples are taken from separate dredge tows. Oysters are enumerated and sorted into size classes: spat (recently settled oysters), smalls (\geq one year old and $<$ 76mm) and markets (\geq 76 mm). Counts are expressed as the number of oysters per bushel. Small and market boxes (dead oysters with hinges articulated) are counted and provide an estimate of observed oyster mortality. Total observed mortality of a sample is calculated as a proportion of dead oysters to live oysters. The formula is:

Mt - total observed mortality

B – sum of market and small boxes

L – sum of live markets and smalls

$$Mt = B/(B+L) *100$$

Methods

In an effort to update the 2009 ‘best bars’ study, Fall Survey data from 2009 to 2018 was used to identify the bars with the ‘best’ performance naturally over time in several key categories: number of spat, number of live adult (small + market) oysters, and total observed mortality. ‘Best bars’, as defined in the preamble to the 2010 regulation, evaluated oyster bars over the last 10 years so this ten-year time period is consistent with using ten years in the 2009 ‘best bars’ study. The 2009-2018 time period also was chosen to reflect the most recent data collected.

These categories of oyster counts and mortality were used because they are the primary data collected during the Fall Survey and they are related to each other. A ‘best bar’ should not only consistently contain high numbers of live oysters and spat but also have relatively low mortality to ensure that spat and small oysters survive to become market-sized.

⁷ Maryland Department of Natural Resources: Maryland Oyster Population Status Report.
<https://dnr.maryland.gov/fisheries/pages/shellfish-monitoring/reports.aspx>

Because of the variability of oyster count data, and because total observed mortality is a calculated value, thus not directly comparable to counts, data were converted to ranks. Total observed mortality percentages are ranked in an ascending manner (best=0 and worst=100) while counts are ranked in a descending manner (the highest number gets a rank of 1, for example). For each year in the dataset, all samples were ranked separately for each category (adult oysters, spat, and observed mortality). When a bar had multiple sites sampled in one year, each was ranked separately. For each bar, these within-year ranks were averaged across years to give a single, mean rank for each category. In this analysis, ties were given the mean rank of all the tied values. When both the number of boxes and the number of live oysters is zero, total observed mortality is undefined and is not included in the calculations. Table C-1 is an example of how this was done for typical total observed mortality values, but the process was the same for ties in all three categories. The mean ranks across categories were added together to give a single overall score, which was then also ranked to give a final ranking for each bar. Bar ranks were aggregated by region and were averaged to give an idea of the strongest performing areas within the Maryland waters of the Chesapeake Bay. Low values for both overall score and rank represent the best bars. The 'best bars' for this study are those in the top ten percent by final rank (Table C-2). Table C-3 lists the scores for each bar and is arranged by the rank of each region.

Table C-1. An example of how tied values were ranked for total observed mortality values.		
Ordinal Position	Value	Rank
1	0	3.5
2	0	3.5
3	0	3.5
4	0	3.5
5	0	3.5
6	0	3.5
7	5	7
8	10	8
9	15	9
10	20	10

All data analysis and aggregation were done in R Studio, version 1.1.419⁸, an integrated development environment for the R language, version 3.4.3⁹. R is a highly flexible programming environment for statistical and graphical applications; its capabilities are expanded using packages developed by individual programmers or groups. The primary packages used in this analysis included ‘ggplot2’ for graphics¹⁰ and ‘tidyverse’¹¹, which includes several different packages for data manipulation. ‘flextable’¹² and ‘officer’¹³ are packages for creating the tables and inserting them into documents.

Section C.3: Results

Three types of analysis was conducted for this study: determination of ‘natural best bars’, comparison of ‘natural best bars’ to the 2009 Jones and Rothschild¹⁴ ‘best bars’, and additional analysis of ‘best bars’ when including those samples taken on oyster plantings.

'Natural Best Bars' Analysis

The 2009 Jones and Rothschild¹⁵ ‘best bars’ study included areas that were planted with oyster shells or seed. An analysis to determine ‘natural best bars’ excluded samples with wild natural seed (small oysters) or hatchery spat-on-shell plantings for the initial planting year and the following five years, but retained samples taken on shell plantings. Only bars with five or more years of data were included.

It is important to note that evaluating the natural oyster bars in Maryland was a critical component of this analysis, so it was appropriate in this case to exclude samples taken directly on wild natural seed and hatchery spat-on-shell plantings. In most cases, the density and area of oyster plantings in fished areas were small. In some cases, early in the time series, wild natural seed plantings were transplanted from elsewhere in Maryland where removals were not tracked; these do not represent new oysters from recruitment or growth and would complicate the interpretation of the rankings. The 'best bars' in the Jones and Rothschild (2009)¹⁶ study included several bars with extensive seed plantings. These added oysters do not represent the natural potential of these areas, which is why they were excluded from this analysis.

The initial data set included 286 bars and locations (the 282 bars from the 2009 'best bars' analysis and four other sampling locations (non-Yates bars). Following the removal of sites with

⁸ RStudio Team. 2016. RStudio: Integrated Development for R. RStudio, Inc., Boston, MA. <http://www.rstudio.com/>.

⁹ R Development Core Team. 2017. R: A language and environment for statistical computing, version 3.4.3. R Foundation for Statistical Computing, Vienna, Austria. <http://www.R-project.org>.

¹⁰ Wickham, H. 2016. ggplot2: Elegant Graphics for Data Analysis. 2nd ed. New York: Springer-Verlag.

¹¹ Wickham, H. 2017. Tidyverse: Easily Install and Load the 'Tidyverse'. R package version 1.2.1. <https://CRAN.R-project.org/package=tidyverse>

¹² Gohel, D. 2018. flextable: Functions for Tabular Reporting. R package version 0.4. <https://CRAN.R-project.org/package=flextable>

¹³ Gohel, D. 2018b. officer: Manipulation of Microsoft Word and PowerPoint Documents. R package version 0.3.2.

<https://CRAN.R-project.org/package=officer>

¹⁴ Jones, P. and B. Rothschild. 2009. Maryland's Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

¹⁵ IBID

¹⁶ IBID

less than five years of data and seed plantings, 232 bars remained. The final data set included 310 total sites (many bars have more than one sampling location within them), 83 of which occurred in sanctuaries (27%). The bars covered approximately 106,000 acres¹⁷, 20% of which is in sanctuaries. Sanctuaries were sampled at a slightly higher rate by acreage, with one site per 260 acres, while non-sanctuary areas were sampled at a rate of one site per 372 acres. Overall historic oyster bottom includes 78,961 acres in sanctuary and 248,476 acres in the public fishery.

Figure C-1 shows annual trends in spat, adult oysters (market-sized and small-sized oysters) and total observed mortality, baywide, from 2009 to 2018. Gray lines indicate long-term averages for each of those categories, which were calculated for the years 1985 to 2018. The long-term spat mean is taken from 53 spat key bars sampled during the Fall Survey¹⁸. For this study, the mean number of live spat was higher than the long-term mean for two out of ten years. Recruitment in 2010 and 2012 was nearly double the long-term mean. The long-term average for live adult oysters was also calculated from the key bars because these bars are not planted with spat. For seven out of ten years, the mean number of live adult oysters was at or above the long-term average. Mean total observed mortality was calculated from the 43 disease bars for 1985-2018. Total annual observed mortalities for the 10-year series ranged from approximately 9 to 15% and were below the long-term average of 21%. The highest mean total observed mortality for the time series evaluated occurred in 2018, but it was similar to the previous year and below the long-term average. Using a bay-wide mean can obscure high observed mortalities that might be found in discrete areas of the bay, but may not be widespread, due to disease or other factors. In 2018, for example, there were some locally heavy freshets from high rainfall that caused high observed mortalities in upper portions of some watersheds¹⁹.

Table C-2 contains a list of all bars, their final ranks, beginning and ending year of the dataset, and sanctuary status. The 'natural best bars' constitute the top ten percent of bars (23 bars) by final ranking and are indicated in bold type. Some bars had more than one site sampled each year, but not every site was sampled every year. Seventy-two of the 232 final bars (31%) were in sanctuaries. The number of sanctuary 'natural best bars' in the top 10% of bars was proportional to their presence overall (6 of 23 or 26%). Broad Creek and Harris Creek accounted for most of the bars in the top 10%. Figures C-2 through C-9 are maps of the various regions of the bay, the bars evaluated, and their final rankings.

Table C-3A contains a list of percentiles for each category in the "heatmap" in Table C-3B and the colors for each percentile. Lower numbers indicate a higher rank and those squares are colored green. The darkest green represents the top 10%. 50th percentile values are shaded in yellow. Higher numbers indicate lower ranks and are colored red. The darkest red indicates the lowest 10%. In Table C-3B, the regions are listed in order of their ranks (1 to 32). When examining 'natural best bars', Broad Creek was the best-ranked region, followed by Harris Creek and Manokin River. The upper bay, Chester River, and Severn River were the poorest-ranked regions in terms of 'natural best bars'.

¹⁷ Bar acres are based on historic oyster bottom as charted in the Yates Oyster Survey from 1906 to 1912 plus its amendments.

¹⁸ Tarnowski, M. 2019. Maryland Oyster Population Status Report: 2018 Fall Survey. Maryland Department of Natural Resources Publ. No. 17-070819-154. Annapolis, Md. 69 pp. <https://dnr.maryland.gov/fisheries/pages/shellfish-monitoring/reports.aspx>

¹⁹ IBID

Regions ranged from areas with just a single bar (Big Annemessex and Severn rivers) to twenty bars in the Choptank River.

Most regions with the highest number of 'natural best bars' occurred in the middle or lower portions of the bay and on the eastern shore. These areas have high recruitment and relatively high numbers of live oysters most years. Broad Creek had the most 'natural best bars' (Tables C-2 and C-3) and while there are bars that ranked higher in some individual scores (spat at Back Cove in Tangier Sound and live adults at Pagan in the St. Marys River). Deep Neck in Broad Creek had lower total observed mortality along with high numbers of spat and live adults making it the top ranked 'natural best bar'. Broad Creek was consistent across all categories (Table C-3) and had the most 'natural best bars' with the highest rankings. Harris Creek, just west of Broad Creek, had three bars evaluated (Table C-3), two of which were in the top ten. Harris Creek is an area where a lot of restoration work has been done, including plantings, which eliminated most of the bars from the data set. As with Broad Creek, consistency across all categories was a major factor, along with low mortality. The St. Marys River was the highest-ranking region on the western shore.

The Manokin River had higher observed mortalities than Broad Creek and Harris Creek regions, but still ranked third overall in 'natural best bars'. It has higher spat counts than Broad or Harris creeks. Most of the Manokin River is a sanctuary. The density and biomass of oysters has increased in the Manokin River, since becoming a sanctuary in 2010²⁰. Tangier Sound generally had high ranks for spat with most bars in the top 30%, but lower ranks for adult oysters. 'Natural best bars' in the upper part of Tangier Sound generally ranked slightly higher than those in the southern part.

Regions in the western and upper parts of the bay generally ranked the lowest, particularly the upper bay and the Chester and Severn rivers (Figure C-2 and C-3). These areas generally have little natural spat, which transition to few live oysters overall. The lowest overall ranked 'natural best bar', Man O' War Shoals, had very low numbers of spat and live adults, resulting in the lowest ranking. Total observed mortality was average to good in this area.

The Nanticoke region came after the Little Choptank region with most bars generally ranked in the top one-third of 'natural best bars'. The Lower Bay East region ranked above the St. Marys River region, with all bars being in the top 25% of 'natural best bars'. The Lower Bay West region had mixed rankings and was listed after the Tangier Sound region (Table C-3). Eastern Bay region was consistently ranked in the bottom half.

Some sanctuary regions ranked highly, like the Manokin and St. Marys rivers (partially a sanctuary) and others, like the Chester River, did not. Approximately 25% of samples were collected on sanctuary bars. Very few bars cross sanctuary boundaries. One exception is Susquehanna bar in the Little Choptank River. Although the sanctuary portion had a lower mean ranking for live adult oysters than the non-sanctuary portion of the bar, these areas are very

²⁰ Maryland Department of Natural Resources. 2016. Oyster Management Review: 2010-2015. 112 pp. <https://dnr.maryland.gov/fisheries/pages/oysters/5-year-oyster-review-report.aspx>

different and should be considered separate bars. The sanctuary site is an artificial reef consisting of dredge spoil covered by a shell cap.

Comparison of ‘Natural Best Bars’ to Jones and Rothschild 2009 ‘Best Bars’

The Jones and Rothschild 2009 study²¹ resulted in a list of 18 bars that were considered 'best bars' from 1996-2007 (Table C-4). These bars differ from this study due to different methodology used, time period, and inclusion of samples with plantings. Four of the bars from the 2009 study were ranked in the top 10% of this current 'natural best bars' 2009-2018 study (Deep Neck, Royston, Willeys Island Flats and Tilghman Wharf). Each of these bars were in the top ten percent by rank multiple times during the ten-year time series (Table C-2 and Table C-4). Of the remaining fourteen bars, three were excluded from this analysis because of plantings. None of the other ten bars were in the top ten percent by rank in the current study. One bar, Town Point, in the Little Choptank, was in the 'best bars' list twice in the 2009 study, but those sites were combined in the current study. Old Field in the Chester River was the lowest ranked bar from the 2009 study and was in the bottom 10% for all categories in this study except mortality.

Additional Analysis to Include Bars with Plantings

Some oyster bars could become ‘best bars’ or productive oyster bottom through human manipulation by planting wild seed (small oysters) or hatchery spat-on-shell. Revenue from a Maryland Department of Transportation grant, oyster surcharges, and the oyster bushel tax is used to annually plant hatchery spat-on-shell and, when available, wild seed on public fishery bottom. Also, there have been extensive plantings of hatchery spat-on-shell in the large-scale restoration tributaries (Harris Creek, Little Choptank River, and Tred Avon River). It should be noted that the Fall Survey cannot sample all the bars in these large-scale sanctuaries. Sites that have received stone as a reef base are unable to be sampled by a dredge, thus, these sites are not included in this analysis. Large-scale restoration monitoring reports²² often show oyster densities on stone substrate similar (and sometimes higher than) to oyster densities on a mixed shell reef base or on seed-only sites. Thus, these bars could possibly be ‘best bars’ due to the extensive multi-year seed plantings that populate the bars with spat, small, and market oysters.

Using the same methodology as determining ‘natural best bars’, an additional analysis was conducted using an expanded dataset of all bars sampled during the 2009-2018 Fall Surveys regardless of plantings. This expanded dataset included 262 bars and 388 total sites (many bars have more than one sampling location within them), 96 of which occurred in sanctuaries (21%). The bars covered approximately 114,252 acres, 21.7% of which is in sanctuaries. Sanctuaries

²¹ Jones, P. and B. Rothschild. 2009. Maryland’s Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

²² Maryland Oyster Restoration Interagency Workgroup under the Chesapeake Bay Program’s Sustainable Fisheries Goal Implementation Team. 2020. 2019 Oyster Reef Monitoring Report: Analysis of Data from Large-Scale Sanctuary Oyster Restoration Projects in Maryland Collected from Fall 2019 through Summer 2020. 76pg. https://dnr.maryland.gov/fisheries/Documents/Reg_Changes/2019_Maryland_Oyster_Restoration_Update_FINAL.pdf

were sampled at a slightly lower rate by acreage, with one site per 258 acres, while non-sanctuary areas were sampled at a rate of one site per 250 acres. Overall historic oyster bottom includes 78,961 acres in sanctuary and 248,476 acres in the public fishery.

The top ten percent of this dataset which uses all samples regardless of planting during the 2009-2018 time period has 26 ‘best bars’ (Table C-5). A total of thirteen bars (50% of ‘best bars’) are either completely within a sanctuary or have a portion of their historic oyster bottom within a sanctuary. This equated to 4,472 acres of the historic oyster bottom area within a sanctuary (39%). Within the large-scale restoration sanctuaries, six bars in Harris Creek Sanctuary and one bar in Little Choptank River Sanctuary are included in the ‘best bars’. This differs from the ‘natural best bars’ analysis whereas only two bars were in the top ten percent (Harris Creek). Manokin River and St. Marys River sanctuaries, large-scale restoration sanctuaries that have yet to receive restoration activities, had six ‘best bars’. Tred Avon River Sanctuary, also a large-scale restoration sanctuary that has ongoing restoration, did not have any ‘best bars’.

Within the public fishery bottom, Broad Creek had seven ‘best bars’, Fishing Bay one ‘best bar’, Harris Creek two ‘best bars’, Pocomoke Sound two ‘best bars’, and Tangier Sound one ‘best bar’.

There were differences between the list of ‘best bars’ when examining samples from 1996-2007 (the time period in Jones and Rothschild 2009 report) and this additional analysis for 2009-2018. Only nine bars were ‘best bars’ during both time periods (four in Broad Creek, two in Manokin River, two in St. Marys River, and one in Tangier Sound) (Table C-5). Two notable differences are the addition of the Harris Creek ‘best bars’ during 2009-2018 and loss of Lower Bay East ‘best bars’ from 1996-2007. Three bars in Little Choptank River Sanctuary also dropped from the ‘best bars’ list in 1996-2007 of which two have had a portion of the bar receive a stone base for restoration. Since stone-based reefs with plantings in sanctuaries can’t be sampled by the Fall Survey, however, there is a possibility they could be ‘best bars’.

Section C.4: Discussion

The ‘best bars’ and ‘natural best bars’ studies were qualitative assessments rather than statistical analyses. The lists of bars in this study differs from the 2009 study due to differing methodology and time series. The years 1996-2007 included some extreme events, compared to the 2009-2018 time period. During the 1996-2007 time period, 1997 was the highest recruitment year on record while 1999-2003 included both a drought and a disease epizootic, which resulted in a 58% observed total mortality rate in 2002²³. Due to this extreme observed mortality, only two of the bars in the 2009 study met the criterion for inclusion in the list of best bars for the year 2002 (Blunts, Thunder and Lightning). Both of those bars had recent seed plantings (2001 and 2000, respectively), which likely contributed to the higher number of market oysters in 2002. In

²³ Tarnowski, M. 2019. Maryland Oyster Population Status Report: 2018 Fall Survey. Maryland Department of Natural Resources Publ. No. 17-070819-154. Annapolis, Md. 69 pp. <https://dnr.maryland.gov/fisheries/pages/shellfish-monitoring/reports.aspx>

addition, fifty percent of the 'best bars' in the 2009 study had wild seed plantings that occurred during or leading up to (<5 years) the study period, while a third of the 'best bars' had two or more wild seed plantings during this period. The combination of these plantings and use of market abundance as a primary criterion for evaluating the 'best bars' in the 2009 study likely contributed to their ranking.

Eliminating wild or hatchery seed plantings allowed the evaluation of natural oyster bars and their performance through the time series. Wild seed plantings transplanted from within Maryland's portion of public fishery bottom do not represent "new" oysters and make interpretation of results more complicated. Using ranks instead of the raw counts eliminated the effect of outliers and resulted in a list of 'best bars' that were consistent across all categories.

A notable difference between the 2009 study and the current study (2009-2018 time period) was the expansion of the sanctuary program in 2010. When conducting the 'natural best bars' analysis, 38 Fall Survey sites on 31 bars within sanctuaries were excluded due to plantings. These 38 sites occurred within 14 sanctuaries in nine regions. Of the 14 sanctuaries that received plantings, only two had no sites within the sanctuary involved in the 'natural best bars' analysis (Neals Addition and Harris Creek sanctuaries). Neals Addition is a sanctuary that was established prior to 2010. It is a small sanctuary, encompassing 6.7 acres. Harris Creek is a sanctuary that has received a large amount of restoration, beginning in 2011. This restoration is toward the state's commitment of restoring oyster habitat in five tributaries by 2025 toward the 2014 Chesapeake Bay Watershed Agreement, with a total of 348 acres of reef restored. While the restoration efforts in Harris Creek are monitored and to date are performing well, they cannot be directly compared to natural reefs in areas that received no restoration, as was used to determine the 'natural best bars' in this analysis.

Bars can become 'best bars' or productive oyster bottom through human manipulation of adding oysters. Additional analysis which included samples with oyster plantings differed from the 'natural best bars' analysis. However, many of the regions with high numbers of 'best bars' were consistent between the two analyses. Some bars have received significant plantings either through restoration or public fishery plantings replenishment throughout 2009-2018. Because either the amount and/or location of plantings can change over time, the 'best bars' analysis should not remain static. Instead this analysis should be updated frequently to monitor both natural changes ('natural best bars') and impacts from human manipulation.

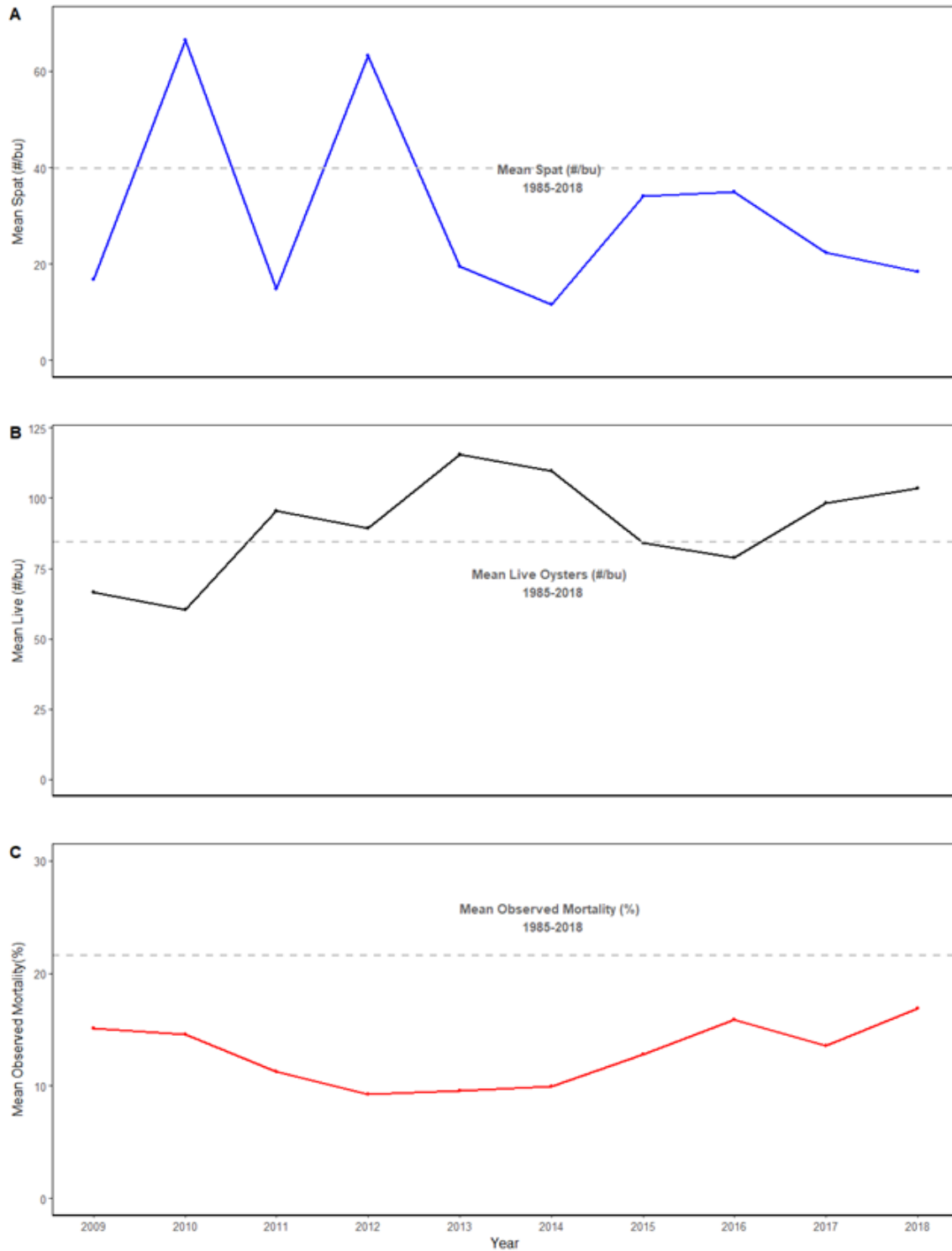


Figure C-1. Bay-wide trends in mean spat (A), mean live adult oysters (B) and mean total observed mortality (C), 2009-2018 samples without oyster plantings. Gray dashed lines indicate long-term bay-wide means from 1985-2018.

Table C-2. Oyster bars in the Maryland portion of Chesapeake Bay that have not been planted with wild seed or hatchery seed, 2009-2018 by overall rank. N is the total number of samples for the bar, Site Count is the number of individual sites (not all sites were sampled every year) and the Sanctuary column indicates if the bar is in a sanctuary and when the sanctuary was established. The final column is the number of times the bar was ranked in the top 10% for live oysters (markets and small). The top 10 percent are highlighted in bold; rank 1 to 23. These are the 'natural best bars' for this study.

*Sanctuary status is determined by the location of the Fall Survey site.

¹A portion of this bar is in a sanctuary.

² A portion of this bar is outside the sanctuary.

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
1	Deep Neck	Broad Creek	21	4	No	8
2	Great Bar	Broad Creek	23	3	No	6
3	Drum Point	Manokin River	10	1	Yes (2010) ²	6
4	Great Marsh	Harris Creek	10	1	No	6
5	Mulberry Point	Broad Creek	17	3	No	6
6	Willeys Island Flats	Broad Creek	20	2	No	5
7	Pagan	St. Marys River	10	1	Yes (2010)	7
8	Back Cove	Tangier Sound	16	7	No	6
9	Tilghman Wharf	Harris Creek	10	1	No ¹	5
10	Brown	Broad Creek	14	2	No	5
11	Horseshoe	St. Marys River	10	1	Yes (2010)	6
12	Georges	Manokin River	10	1	Yes (2010)	2
13	Ware Rock	Pocomoke Sound	10	1	No	2
14	Mine Creek	Manokin River	10	1	Yes (2010) ²	2
15	Gunby	Pocomoke Sound	20	2	No	1
16	Punch Island Creek	Lower Bay East	10	1	No	2
17	Evans	Fishing Bay	13	2	No	2
18	Irish Creek	Choptank River	10	1	No	2
19	Lakes Cove	Honga River	10	1	No	2

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
20	Piney Island Swash	Manokin River	10	1	Yes (2010)	1
21	Royston	Broad Creek	20	2	No	2
22	Old Rocks	Pocomoke Sound	10	1	No	2
23	Terrapin Sands Inner	Tangier Sound	15	2	No	2
24	Marshy Island	Manokin River	20	2	Yes (2010) ²	2
25	Great Shoal	Wicomico River East	10	1	No	2
26	Coppage	St. Marys River	10	1	No	2
27	Hill	Fishing Bay	10	1	No	3
28	Wild Cherry Tree	Harris Creek	21	3	No	3
29	Town	Little Choptank River	17	2	Yes (2010)	0
30	McKeils Point	Little Choptank River	8	1	Yes (2010)	2
31	Light House	Honga River	10	1	Yes (pre-2010)	2
32	Norman Add 1	Honga River	10	1	No	1
33	Butterpot	Little Choptank River	9	1	Yes (2010)	0
34	Smoke Point	Honga River	10	1	No	1
35	Mud Rock	Tangier Sound	10	1	No	2
36	Goose Creek	Fishing Bay	11	2	No	4
37	Bean Shoal	Nanticoke River	10	1	Yes (2010)	2
38	Haines	Tangier Sound	14	2	No	1
39	Harris	Tangier Sound	10	1	No	3
40	Crab Point	Honga River	10	1	No	2
41	Old House	Fishing Bay	10	1	No	2
42	Holland Straits East	Lower Bay East	10	1	No	1
43	Peanut Hill	Little Choptank River	10	1	No	0
44	Cherry Tree	Nanticoke River	10	1	Yes (2010)	1
45	Marumsco	Pocomoke Sound	10	1	No	1
46	Point Lookout	Lower Bay West	22	3	No	2

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
47	Grapevine	Little Choptank River	10	1	Yes (2010)	1
48	Clay Island	Fishing Bay	10	1	No	1
49	Sharkfin Shoal	Tangier Sound	14	2	No	1
50	Hawks Nest	Patuxent River	6	1	No	0
51	Halls Point	Wicomico River East	6	2	No	0
52	Hickory Nut	Nanticoke River	10	1	Yes (2010)	0
53	France	Choptank River	10	1	No	1
54	Northwest Middleground	Lower Bay East	20	2	Yes (2010)	1
55	Little Choptank	Little Choptank River	10	1	No	1
56	Cherry	St. Marys River	10	1	No	2
57	Susquehanna	Little Choptank River	9	1	No	2
58	Tedious Creek	Fishing Bay	10	1	No	2
59	Gravelly Run	St. Marys River	20	2	No	1
60	Ragged Point	Little Choptank River	20	2	No	0
61	Wilson Shoals	Nanticoke River	7	2	Yes (2010)	1
62	Old Womans Patch	Nanticoke River	10	1	Yes (2010)	0
63	Taylor Point	Honga River	7	1	No	1
64	Cason	Little Choptank River	10	1	Yes (2010)	0
65	Kent Point	Mid-Bay East	10	1	No	0
66	Cedar Shoal	Nanticoke River	10	1	Yes (2010)	1
67	Calvert Bay	Smith Creek	10	1	No	0
68	Chicken Cock	St. Marys River	6	1	No	1
69	Flat Rock	Pocomoke Sound	10	1	No	1
70	Butler	Lower Bay West	10	1	No	0
71	Stone	Mid-Bay East	10	1	No	0
72	Duck Island	Fishing Bay	10	1	No	3
73	Lighthouse	Choptank River	20	2	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
74	Roaring Point East	Nanticoke River	10	1	Yes (2010)	0
75	Broome Island	Patuxent River	13	2	No	0
76	Applegarth	Honga River	9	1	Yes (pre-2010)	1
77	Point Lookout Sanctuary	Lower Bay West	13	2	Yes (pre-2010)	2
78	Beacons	Choptank River	10	1	No	1
79	Hambrooks	Choptank River	10	1	No	0
80	Pecks Point	Tred Avon River	8	1	Yes (2010) ²	0
81	Wetipquin	Nanticoke River	10	1	Yes (2010)	0
82	Pattison	Little Choptank River	10	1	Yes (2010)	0
83	Stone Church	Tred Avon River	10	1	No	0
84	Bachelor Point	Tred Avon River	9	1	No	0
85	Hellen	Patuxent River	10	1	No	0
86	Chlora Point	Choptank River	10	1	Yes (2010) ²	0
87	Smith Creek	Smith Creek	10	1	No	0
88	Hungerford Hollow	Patuxent River	10	1	No	0
89	Cedar Point Hollow	Lower Bay West	10	1	No ¹	0
90	Dixon	Choptank River	10	1	Yes (2010)	0
91	Rocky Beach	Lower Bay West	9	1	No	0
92	St. George Island	Potomac River Northshore	10	1	No	0
93	Turtle Egg Island	Tangier Sound	20	2	No	0
94	Mares Point	Tred Avon River	10	1	Yes (2010)	0
95	Kitts	Potomac River Northshore	10	1	No	0
96	Windmill	Honga River	10	1	No	0
97	Piney Island East Add 1	Tangier Sound	30	3	Yes (pre-2010)	0
98	Cook Point	Choptank River	14	2	Yes (2010)	0
99	Howells Point Add 2	Choptank River	10	1	No	1
100	Jones	Potomac River Northshore	22	3	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
101	Chain Shoal	Tangier Sound	10	1	No	0
102	Broad Neck	Patuxent River	7	1	Yes (2010)	0
103	Big Annemessex	Big Annemessex River	9	1	No	0
104	Howells Point	Choptank River	10	2	No	0
105	Susquehanna- Sanctuary	Little Choptank River	7	1	Yes (2010)	0
106	Double Mills	Tred Avon River	10	1	Yes (2010)	0
107	Town Point	Tred Avon River	7	1	No	0
108	Piney Island West	Tangier Sound	20	2	No	0
109	Johnson Island	Eastern Bay	8	2	No	1
110	Cornfield Harbor	Potomac River Northshore	10	1	No	0
111	Mussel Hole	Tangier Sound	10	1	No	0
112	Tanners Patch	Choptank River	10	1	Yes (pre-2010)	0
113	Piney Island East	Tangier Sound	20	3	No	0
114	Louis Cove	Tred Avon River	7	1	Yes (2010)	0
115	Oyster Shell Point	Choptank River	9	2	Yes (2010)	0
116	Evans	Wicomico River East	15	2	No	0
117	Turtle Back	Miles River	10	1	No	0
118	Mill Dam	Choptank River	6	1	Yes (2010)	0
119	Mount Vernon Wharf	Wicomico River East	10	2	No	1
120	Sandy Hill	Choptank River	10	1	Yes (pre-2010)	0
121	Holland Point	Patuxent River	6	1	Yes (2010)	0
122	Brick House	Mid-Bay East	10	1	No	0
123	Dickinson	Choptank River	7	1	No	0
124	Broad Creek	Mid-Bay East	10	1	No ¹	0
125	Drum Point	Chester River	6	1	Yes (2010)	0
126	Hog Island	Lower Bay West	12	3	No	0
127	Poplar Island	Mid-Bay East	20	2	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
128	Coffee	Miles River	10	1	No	0
129	Great Rock	Tangier Sound	26	3	No	1
130	Bugby	Eastern Bay	39	5	No	0
131	Lows Point	Eastern Bay	10	1	No	0
132	Hurdle	Potomac River Northshore	9	1	No	0
133	Orem	Tred Avon River	10	1	Yes (2010)	0
134	Wild Ground	Eastern Bay	10	1	No	0
135	Thomas	Patuxent River	10	1	Yes (2010)	0
136	Milbourne Shore	Potomac River Northshore	10	1	No	0
137	Wild Ground	Miles River	10	1	No	0
138	Middleground	Nanticoke River	10	1	No	0
139	Herring Island	Miles River	10	1	No	0
140	Flag Pond	Lower Bay West	10	1	Yes (2010)	0
141	Swan Reef	South River	10	1	No	0
142	Mill Hill	Eastern Bay	10	1	No	0
143	Pascahanna	Potomac River Northshore	15	2	No	0
144	Drum Point	Choptank River	10	1	Yes (pre-2010)	0
145	Persimmon Tree	Miles River	10	1	No	0
146	Bramleigh Creek	Wicomico River West	6	1	No	0
147	Sycamore	Miles River	10	1	No	0
148	Bald Eagle Add 3	Eastern Bay	10	1	No	0
149	Blue Sow	Breton/St. Clements Bays	10	1	No ¹	0
150	Shell Hill	Mid-Bay East	10	1	No	0
151	The Black Buoy	Choptank River	7	1	Yes (2010)	0
152	Love Point	Upper Bay East	10	1	Yes (2010) ²	0
153	Hollicutts Noose	Eastern Bay	11	2	No	0
154	Kingcopsico	Potomac River Southshore	10	1	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
155	Bodkin Shoals	Eastern Bay	30	3	No	0
156	Turkey Point	Eastern Bay	10	1	No	0
157	Bald Eagle Add 2	Eastern Bay	10	1	No	0
158	Tall Timbers	Potomac River Northshore	10	1	No	0
159	Mills	Wye River	10	1	Yes (2010)	0
160	Nine Foot Knoll	Upper Bay West	10	1	No	0
161	Tolly Point	Mid-Bay West	8	2	No ¹	0
162	Ragged Point	Potomac River Southshore	10	1	No	0
163	Shoal Creek	Choptank River	20	2	Yes (2010)	0
164	Hackett Point	Mid-Bay West	10	1	No	0
165	Ringold Middleground	Eastern Bay	10	1	No ¹	0
166	Slaughter Creek	Little Choptank River	10	1	No	0
167	Cabin Creek	Choptank River	10	1	Yes (pre-2010)	0
168	Normans Fine Eyes	Eastern Bay	10	1	No	0
169	Maxmore Add 1	Tred Avon River	10	1	Yes (2010)	0
170	Mills West	Wicomico River West	10	1	No	0
171	Ash Craft	Miles River	10	1	No	0
172	Cohouck	Wicomico River West	9	1	No	0
173	Sandy Point South	Upper Bay West	13	2	No	0
174	Beacon	Potomac River Northshore	10	1	No	0
175	Gum	Potomac River Southshore	8	2	No	0
176	Parsons Island	Eastern Bay	11	2	No	0
177	Wickes Beach	Chester River	7	1	Yes (2010)	0
178	Seven Foot Knoll	Upper Bay West	10	1	No	0
179	Whetstone	Wye River	10	1	Yes (2010)	0
180	Cobb Island	Potomac River Northshore	7	1	No	0
181	Heron Island	Potomac River Northshore	10	1	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
182	Walter White	Eastern Bay	8	1	No	0
183	Coots	Mid-Bay West	12	2	No	0
184	Tolchester Lump	Upper Bay East	10	1	No	0
185	Southeast Middleground	Patuxent River	10	1	No	0
186	Purdy Flats	South River	10	1	No	0
187	Lancaster	Wicomico River West	7	1	No	0
188	Bruffs Island	Wye River	10	1	Yes (2010)	0
189	Lower Cedar Point	Potomac River Northshore	19	2	No	0
190	Lumps East of Craighill Channel	Upper Bay West	20	2	No	0
191	Green Marsh	Choptank River	10	1	Yes (2010)	0
192	Buzzard Island	Patuxent River	10	1	Yes (2010)	0
193	Deep Shoal	Upper Bay East	10	1	No	0
194	Second Point	Miles River	10	1	No	0
195	Popes Creek	Potomac River Northshore	10	1	No	0
196	Terrapin Sands Add 1	Tangier Sound	16	2	No	0
197	West End	Miles River	5	1	No	0
198	Ebb Point	Chester River	10	1	Yes (2010)	0
199	Buoy Rock	Chester River	10	1	No ¹	0
200	Horse Race	Chester River	11	2	No	0
201	Piney Point	Chester River	14	2	No	0
202	Manahowic Creek	Wicomico River West	9	1	No	0
203	Race Horse	Wye River	10	1	Yes (2010)	0
204	Well Cove	Eastern Bay	7	1	No	0
205	Hodges	Upper Bay East	10	1	No	0
206	Mountain Point	Upper Bay West	6	1	No	0
207	Chinks Point	Severn River	10	2	Yes (pre-2010)	0
208	Old Field	Chester River	7	1	Yes (2010) ²	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
209	Strong Bay	Chester River	18	2	Yes (pre-2010)	0
210	Spaniard Point	Chester River	7	1	Yes (2010)	0
211	Durdin	Chester River	10	2	No	0
212	Black Walnut	Breton/St. Clements Bays	10	1	Yes (2010)	0
213	Wye River Middleground	Wye River	10	1	Yes (2010)	0
214	Boathouse	Chester River	8	1	Yes (2010)	0
215	Sheepshead Bay	Potomac River Northshore	9	1	No	0
216	Sheep	Chester River	10	1	Yes (pre-2010)	0
217	Sixfoot Knoll	Upper Bay West	5	1	No	0
218	Rock Point	Wicomico River West	5	1	No	0
219	Long Point	Miles River	10	1	Yes (2010)	0
220	Old Womans Leg	Tangier Sound	10	1	No	0
221	Shippen Creek	Chester River	10	1	Yes (pre-2010)	0
222	Emory Hollow	Chester River	10	1	Yes (2010)	0
223	Swan Point	Upper Bay East	9	1	No ¹	0
224	Coal Lump	Upper Bay West	10	1	No	0
225	White Point	Wicomico River West	5	1	No	0
226	Swan Point	Potomac River Northshore	13	2	No	0
227	Bluff Point	Chester River	10	1	No ¹	0
228	Cliff	Chester River	10	1	Yes (2010)	0
229	Mouth Of River	Wicomico River West	8	1	No	0
230	Flat Rock	Upper Bay East	10	1	No	0
231	Holland Point	Mid-Bay West	10	1	Yes (2010)	0
232	Man O' War Shoals	Upper Bay West	10	1	No ¹	0

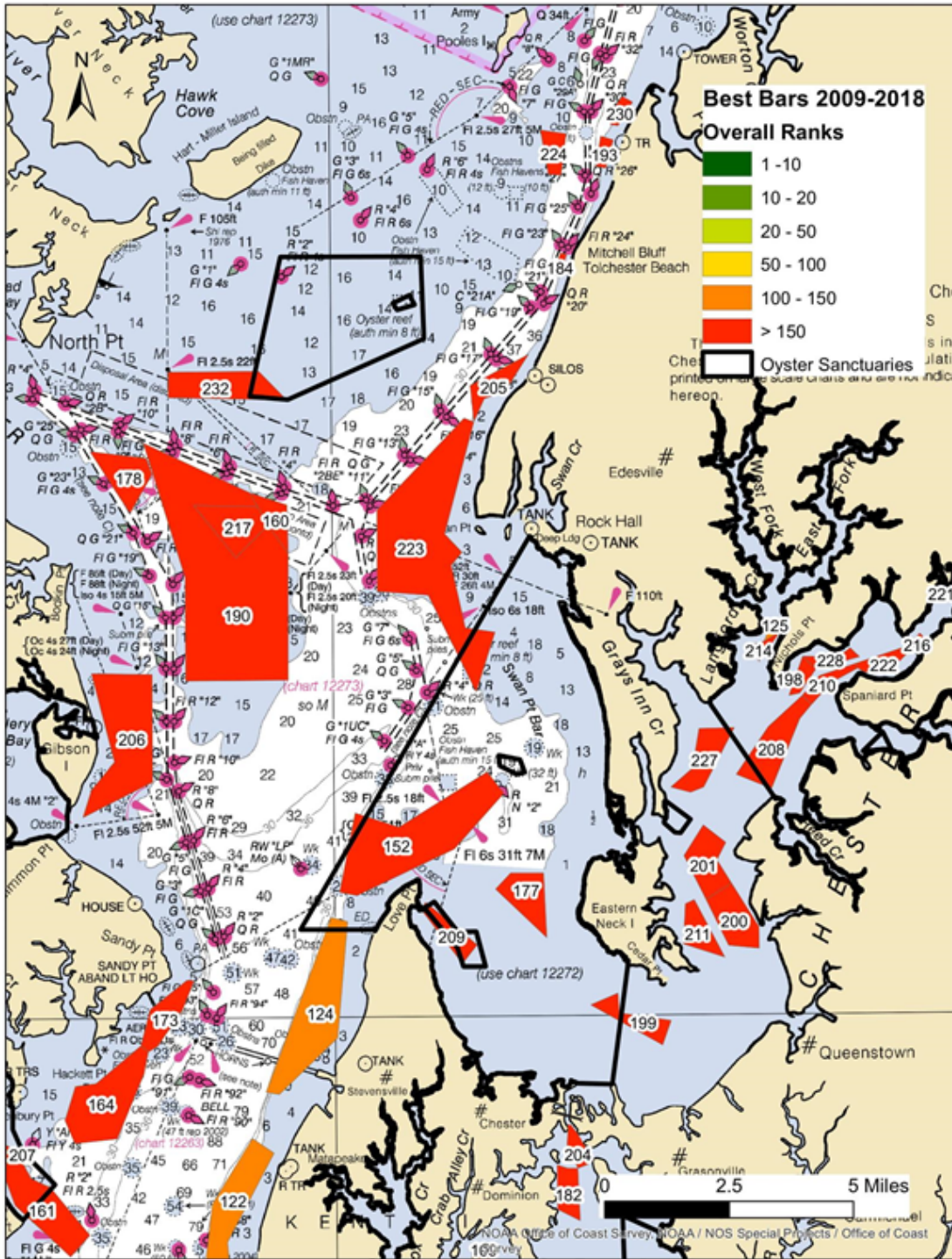


Figure C-2. Map of natural oyster bars (without plantings) used in the analysis in the upper bay, including the Chester River, and the final rank for each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

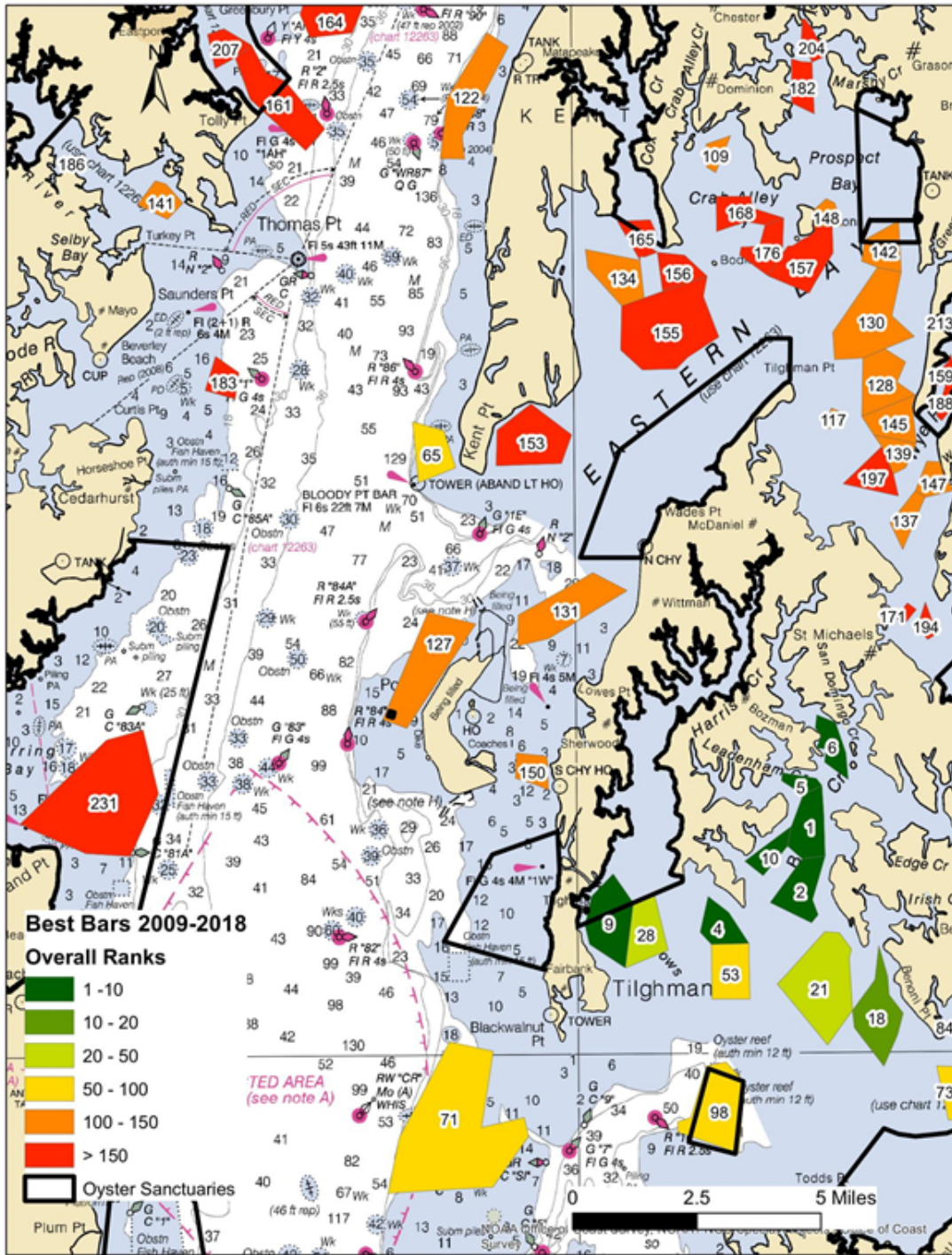


Figure C-3. Map of natural oyster bars (without plantings) used in the analysis in the mid-bay, including Eastern Bay, Harris Creek, Broad Creek and part of the Choptank River, and the final rank of each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

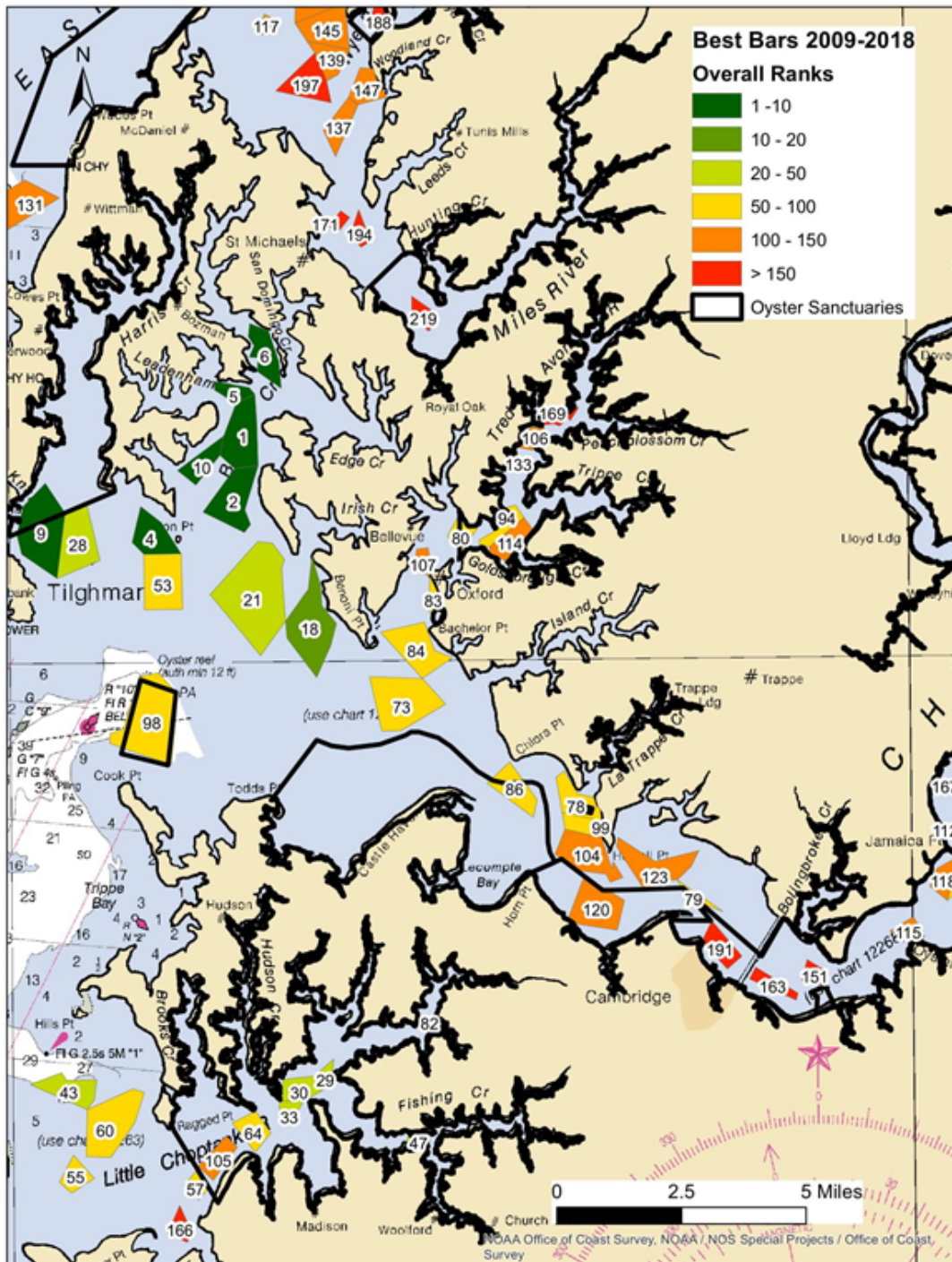


Figure C-4. Map of natural oyster bars (without plantings) used in the analysis in the Choptank River complex, the Little Choptank River (bottom) and the Miles River (at top), and the final rank of each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

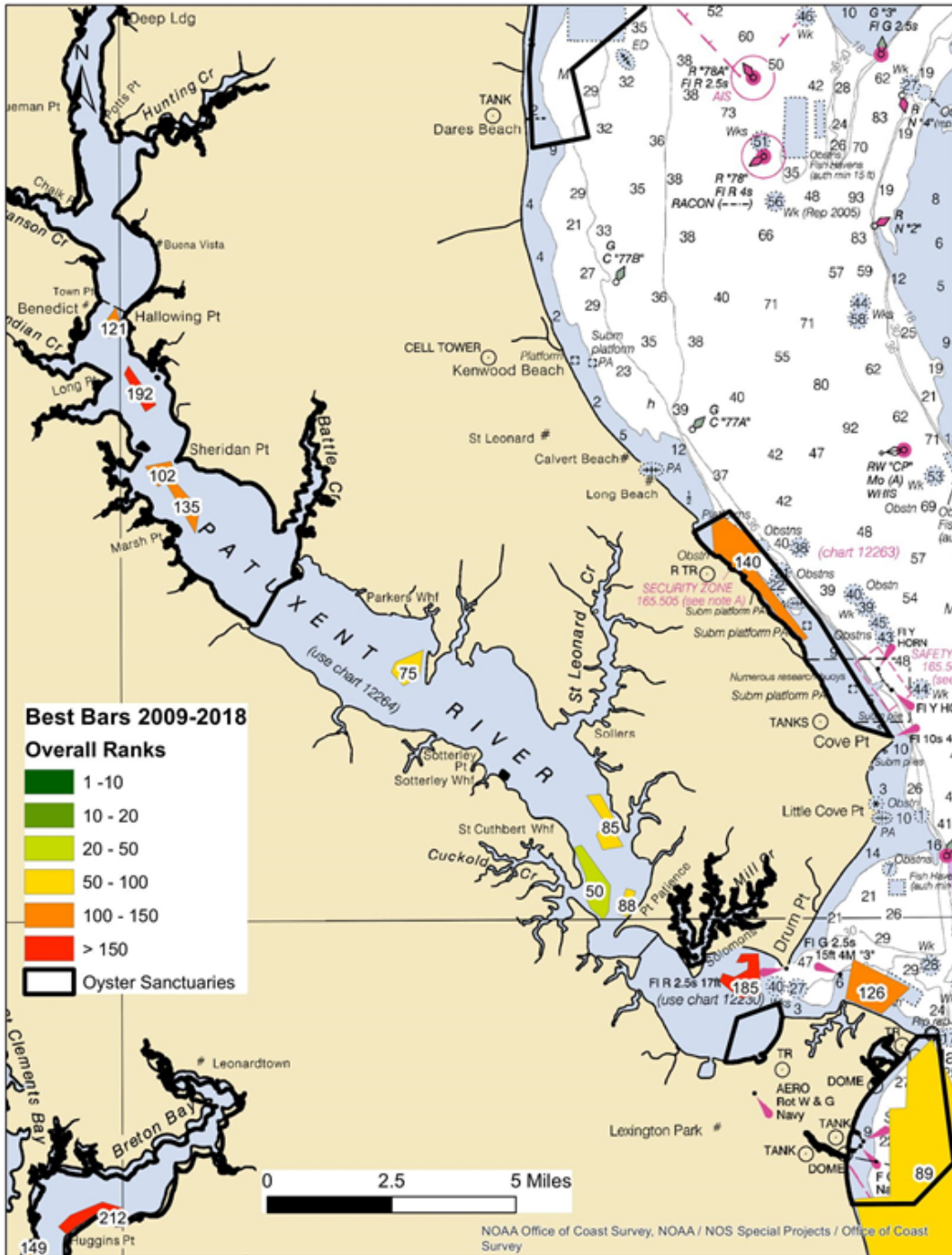


Figure C-5. Map of natural oyster bars (without plantings) used in the analysis in the Patuxent River and portions of the lower bay, and the final rank of each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

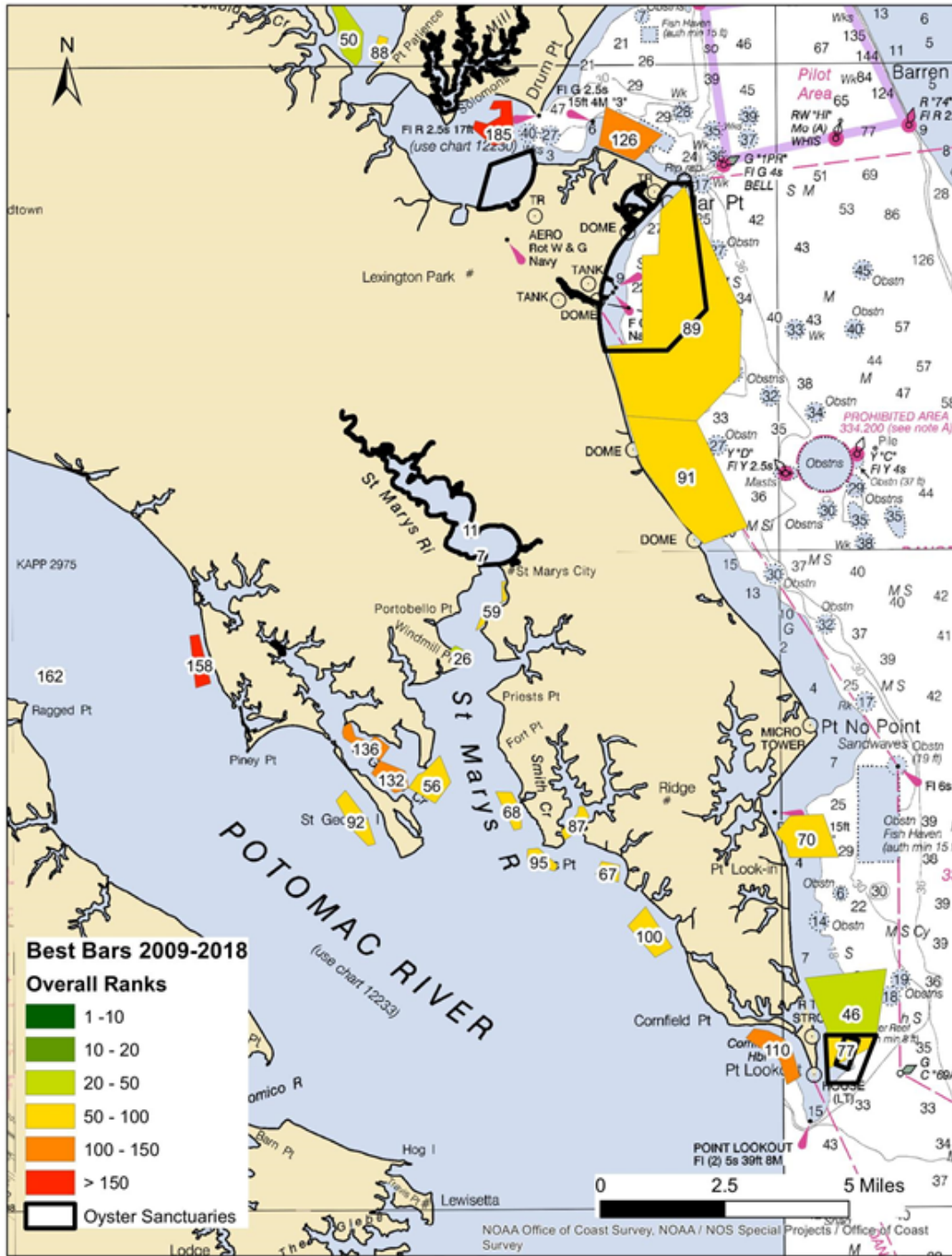


Figure C-6. Map of natural oyster bars (without plantings) used in the analysis in the St. Marys River, lower Potomac River and portions of the lower bay, including the final rank of each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

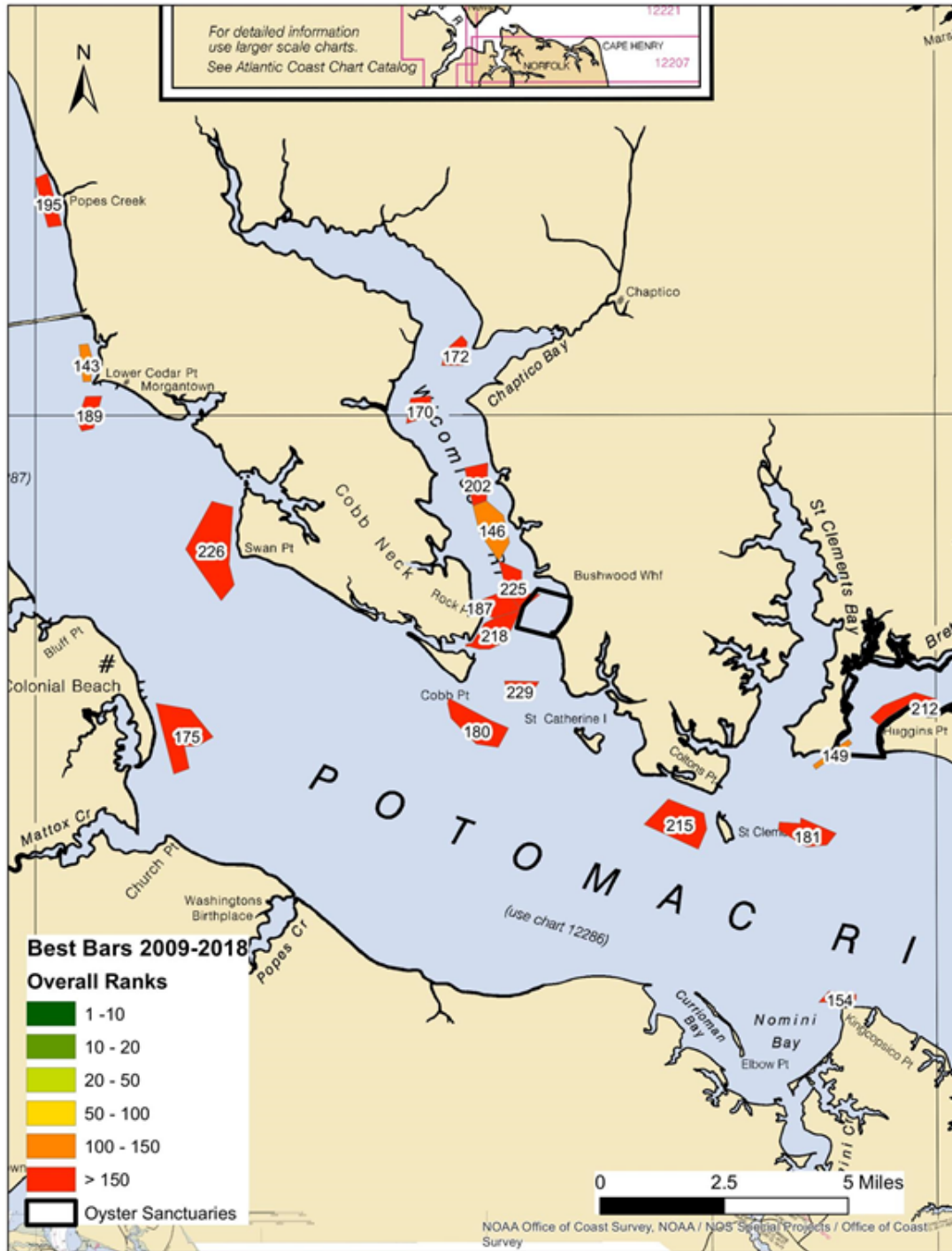


Figure C-7. Map of natural oyster bars (without plantings) used in the analysis in the upper Potomac River, including the Wicomico River and Breton Bay, and the final rank for each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See TableC- 2 for bar names for the corresponding rankings.

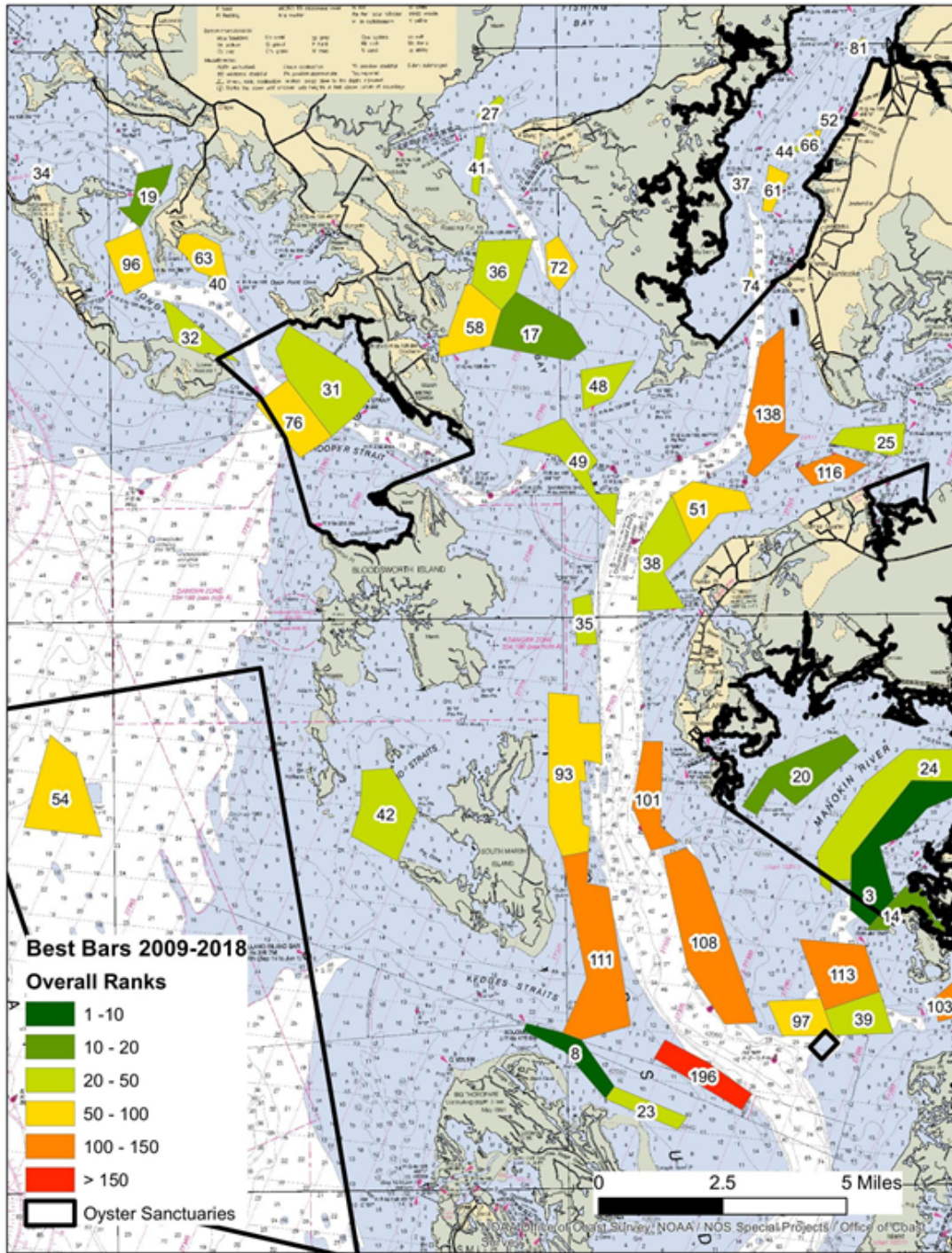


Figure C-8. Map of natural oyster bars (without plantings) used in the analysis in upper Tangier Sound, including the Honga River, Fishing Bay, Nanticoke and Wicomico (east) rivers, and the final rank for each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

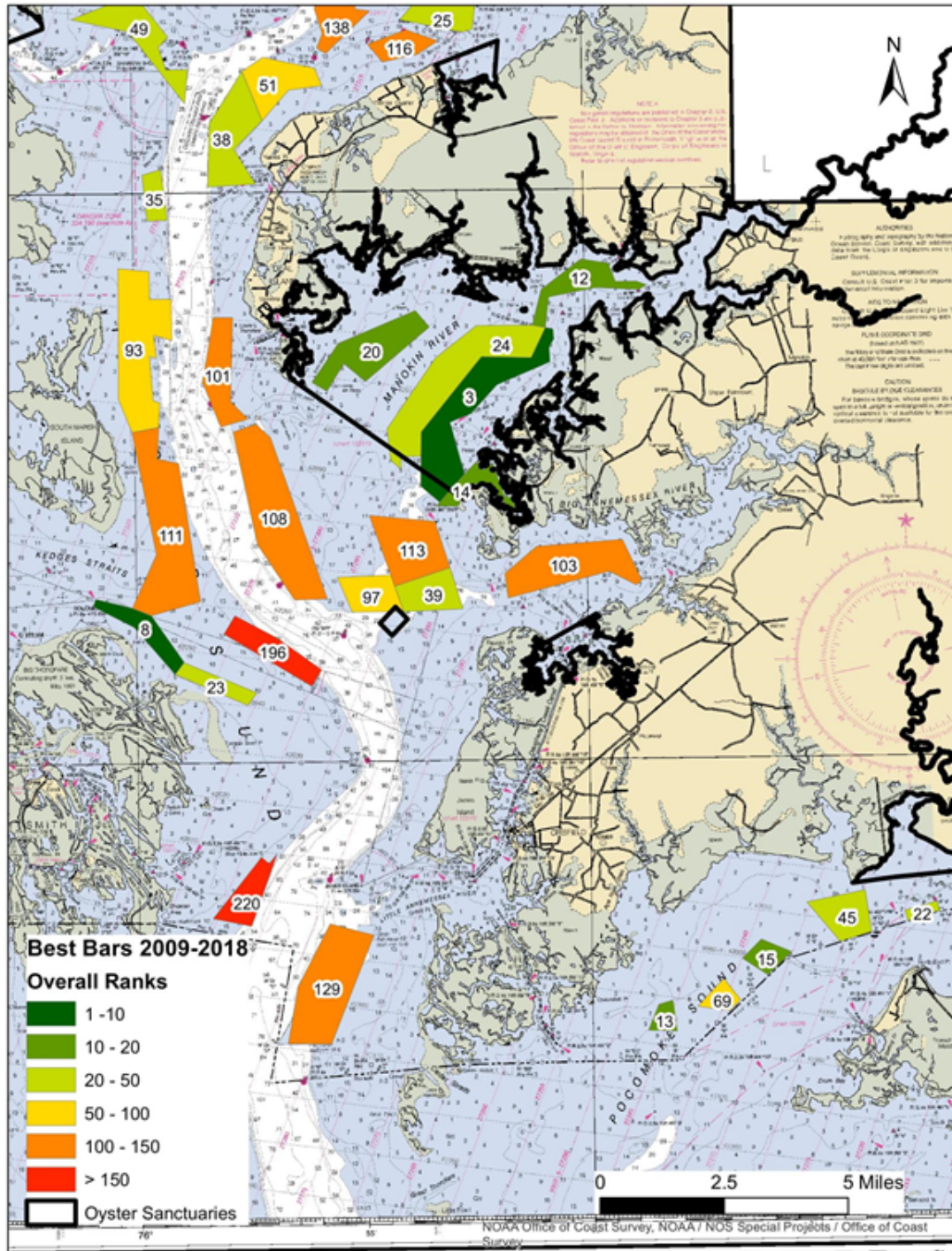


Figure C-9. Map of natural oyster bars (without plantings) used in the analysis in lower Tangier Sound, including the Manokin and Big Annemessex rivers and Pocomoke Sound and the final rank for each bar. Ranks range from 1 (best) to 232 (worst). ‘Natural Best Bars’ are those in the top 10% by rank (ranks 1 to 23). See Table C-2 for bar names for the corresponding rankings.

Table C-3A. Percentiles for mean ranks of all categories and the total score for the 'natural best bars' analysis. Colors indicate relative ranks within each category, with dark green being equivalent to the top 10% and dark red being the bottom 10%. Yellow represents the 50th percentile or the median value.

	Mean Live Rank	Mean Spat Rank	Mean Mortality Rank	Total Score
Top 10%	52	49	76	249
Top 20%	78	70	89	291
Top 30%	99	92	102	333
Top 40%	116	115	114	369
Top 50%	133	146	123	405
Bottom 50%	150	173	136	435
Bottom 40%	176	190	147	469
Bottom 30%	194	200	158	496
Bottom 20%	222	206	175	532
Bottom 10%	258	215	210	639

Table C-3B. Regions, bars, mean ranks for each category, total scores and the final, overall rank for the bars without plantings, with colors indicating percentiles for each category. Regions are listed in order by their rank. ‘Natural Best Bars’ (top 10% by rank or ranks 1-23) are in bold.

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Broad Creek	Deep Neck	17.48	46.05	95.86	159.38	1
	Great Bar	37.2	75.26	60.67	173.13	2
	Mulberry Point	28	55.38	96.74	180.12	5
	Willeys Island Flats	29.53	61.75	89.03	180.3	6
	Brown	25.07	70.32	104.29	199.68	10
	Royston	79.58	85.68	79.15	244.4	21
Harris Creek	Great Marsh	41.95	62.25	72.95	177.15	4
	Tilghman Wharf	64	63.2	68.75	195.95	9
	Wild Cherry Tree	75.57	93.38	84.88	253.83	28
Manokin River	Drum Point	21.4	18.75	134.35	174.5	3
	Georges	32.6	31.15	147.05	210.8	12
	Mine Creek	47.15	18.35	156.9	222.4	14
	Piney Island Swash	46.7	26.65	170.45	243.8	20
	Marshy Island	61.85	18.98	168.38	249.2	24
Pocomoke Sound	Ware Rock	78	21.4	118.75	218.15	13
	Gunby	69.48	37.95	128.03	235.45	15
	Old Rocks	52.55	61.6	131.6	245.75	22
	Marumsco	78.8	45.65	163	287.45	45
	Flat Rock	135.4	57.75	138.75	331.9	69
Lower Bay East	Punch Island Creek	38	50.95	147.05	236	16
	Holland Straits East	91.55	33.45	158.2	283.2	42
	Northwest Middleground	48	37.7	210.45	296.15	54
St. Marys River	Pagan	9.9	24.4	150.45	184.75	7
	Horseshoe	9.9	58.8	134.95	203.65	11

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
St. Marys River	Coppage	36.05	48.55	167.65	252.25	26
	Cherry	82	74.15	145.2	301.35	56
	Gravelly Run	42.78	67.1	201.18	311.05	59
	Chicken Cock	122.83	69.58	134	326.42	68
Fishing Bay	Evans	80.65	48.62	108.96	238.23	17
	Hill	98.1	71.1	84.4	253.6	27
	Goose Creek	78.68	62.91	129.23	270.82	36
	Old House	126.8	54.55	101.7	283.05	41
	Clay Island	95.45	44.3	152.4	292.15	48
	Tedious Creek	111.4	41.9	149.6	302.9	58
	Duck Island	120.2	65.6	152.85	338.65	72
Honga River	Lakes Cove	61.35	36.7	144.75	242.8	19
	Light House	61.85	14.95	183.25	260.05	31
	Norman Add 1	67	49.95	143.5	260.45	32
	Smoke Point	60.7	52.35	150.4	263.45	34
	Crab Point	66.6	46.95	166.05	279.6	40
	Taylor Point	87.36	60.14	169.43	316.93	63
	Applegarth	127.39	35.89	181.67	344.94	76
	Windmill	134.1	75.55	162.35	372	96
Little Choptank River	Town	26.59	76.18	151.38	254.15	29
	Mckeils Point	28.25	80.81	147.38	256.44	30
	Butterpot	26.89	65.78	170.28	262.94	33
	Peanut Hill	44.8	78.75	159.7	283.25	43
	Grapevine	52.1	93.05	145.45	290.6	47
	Little Choptank	40.25	99.2	159.75	299.2	55
	Susquehanna	42.22	90.67	169.67	302.56	57

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Little Choptank	Ragged Point	54.38	102.35	155.68	312.4	60
	Cason	52	86.35	179.4	317.75	64
	Pattison	74.55	135	144.95	354.5	82
	Susquehanna (sanctuary)	116.29	110.36	157.29	383.93	105
	Slaughter Creek	126.5	143.45	202.45	472.4	166
Nanticoke River	Bean Shoal	79.65	105.95	86.1	271.7	37
	Cherry Tree	101.5	106	76.5	284	44
	Hickory Nut	113.25	101.2	80.75	295.2	52
	Wilson Shoals	95.93	103.07	114.14	313.14	61
	Old Womans Patch	116	132.65	66.15	314.8	62
	Cedar Shoal	104.8	108.6	105.8	319.2	66
	Roaring Point East	90.6	102.7	147.9	341.2	74
	Wetipquin	152.1	124.55	75.5	352.15	81
	Middleground	192.1	64.8	177.55	434.45	138
Smith Creek	Calvert Bay	89.85	91.25	142.5	323.6	67
	Smith Creek	88.4	102.8	167.55	358.75	87
Wicomico River East	Great Shoal	119.9	75.5	53.9	249.3	25
	Halls Point	86.08	73.25	135.25	294.58	51
	Evans	157.6	111.67	134.97	404.23	116
	Mount Vernon Wharf	163.05	132.45	111	406.5	119
Tangier Sound	Back Cove	48.78	19.38	120.75	188.91	8
	Terrapin Sands Inner	82.5	14.67	151.8	248.97	23
	Mud Rock	75.4	38.05	151.9	265.35	35
	Haines	65.36	49.5	158.21	273.07	38
	Harris	53.8	55.45	164.1	273.35	39
	Sharkfin Shoal	74.5	53.32	164.5	292.32	49
	Turtle Egg Island	106.43	65.23	196.53	368.18	93

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Tangier Sound	Piney Island East Add 1	119.57	74.9	178.13	372.6	97
	Chain Shoal	114.65	73.35	187.6	375.6	101
	Piney Island West	115.98	91.73	185.68	393.38	108
	Mussel Hole	130.7	61.15	204.1	395.95	111
	Piney Island East	138.78	80.98	178.53	398.28	113
	Great Rock	149.17	85.85	186.06	421.08	129
	Terrapin Sands Add 1	200.53	148.06	157.17	505.76	196
	Old Womans Leg	221.45	139.55	188.4	549.4	220
Lower Bay West	Point Lookout	53.34	98.86	137.09	289.3	46
	Butler	108.5	113.1	111.05	332.65	70
	Point Lookout- Sanctuary	60.54	89.92	197	347.46	77
	Cedar Point Hollow	133.95	109.2	118.3	361.45	89
	Rocky Beach	123.94	120.94	118.17	363.06	91
	Hog Island	148.13	118.67	151.21	418	126
	Flag Pond	165.85	125.8	143.15	434.8	140
Big Annemessex River	Big Annemessex	238.61	34.67	107.94	381.22	103
Tred Avon River	Pecks Point	87	149.81	114.06	350.88	80
	Stone Church	91.95	148.25	116	356.2	83
	Bachelor Point	110.78	155.11	90.78	356.67	84
	Mares Point	101.15	151.55	117.1	369.8	94
	Double Mills	97.6	135.55	151.75	384.9	106
	Town Point	126.29	142.43	118.57	387.29	107
	Louis Cove	129.79	163.43	106.5	399.71	114
	Orem	124.3	179.35	125.15	428.8	133
	Maxmore Add 1	169.55	186.45	120.7	476.7	169
Choptank River	Irish Creek	98.9	103.85	39.4	242.15	18
	France	125.45	98.35	71.65	295.45	53

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Choptank River	Lighthouse	118.65	127.7	94.75	341.1	73
	Beacons	119.6	160.4	70.2	350.2	78
	Hambrooks	84.9	134.9	131.05	350.85	79
	Chlora Point	98.85	136.1	123.3	358.25	86
	Dixon	109.15	188.4	65.35	362.9	90
	Cook Point	105.46	101.25	166.25	372.96	98
	Howells Point Add 2	106.1	157.05	110.1	373.25	99
	Howells Point	138.75	171.05	73.65	383.45	104
	Tanners Patch	154.7	206.1	35.9	396.7	112
	Oyster Shell Point	124.61	188.33	89.22	402.17	115
	Mill Dam	113.42	203.08	89.33	405.83	118
	Sandy Hill	124.05	162.6	121.1	407.75	120
	Dickinson	116.64	143.5	151.86	412	123
	Drum Point	190.6	190.45	60.75	441.8	144
	The Black Buoy	163.93	197.36	93.14	454.43	151
	Shoal Creek	141.95	182.23	145.5	469.68	163
	Cabin Creek	175.5	205.05	92.5	473.05	167
	Green Marsh	138.2	188.15	174.75	501.1	191
Mid-Bay East	Kent Point	70.55	165.3	83.3	319.15	65
	Stone	70.85	128.15	135.05	334.05	71
	Brick House	147.65	179.7	83.3	410.65	122
	Broad Creek	150.7	199.35	62.6	412.65	124
	Poplar Island	146.45	177.05	96.2	419.7	127
	Shell Hill	202.4	172.8	78.55	453.75	150
Patuxent River	Hawks Nest	53.42	99.5	140.17	293.08	50
	Broome Island	102.96	119.39	122.04	344.39	75

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Patuxent River	Hellen	92.65	106.9	157.55	357.1	85
	Hungerford Hollow	93.15	94.7	172.85	360.7	88
	Broad Neck	110.43	173.29	95.86	379.57	102
	Holland Point	108.25	203.08	97.92	409.25	121
	Thomas	169.7	176.15	86	431.85	135
	Southeast Middleground	161.85	144	188.45	494.3	185
	Buzzard Island	177.15	186.8	137.75	501.7	192
Eastern Bay	Johnson Island	181.81	151.81	61.19	394.81	109
	Bugby	154.41	156.69	111	422.1	130
	Lows Point	144.45	171.75	108.9	425.1	131
	Wild Ground	176.45	172.7	80.45	429.6	134
	Mill Hill	168.15	168.15	100.7	437	142
	Bald Eagle Add 3	194.65	186.4	69	450.05	148
	Hollicutts Noose	142.82	192.59	121.05	456.46	153
	Bodkin Shoals	147.08	161.48	148.08	456.65	155
	Turkey Point	182	169.6	106.95	458.55	156
	Bald Eagle Add 2	158.45	141.4	161.95	461.8	157
	Ringold Middleground	148.65	199.5	123.85	472	165
	Normans Fine Eyes	218.2	178	77.11	473.31	168
	Parsons Island	180.32	166.68	135.46	482.46	176
	Walter White	204.69	192.69	92.44	489.81	182
	Well Cove	184.57	197.43	136.29	518.29	204
Potomac River Northshore	St. George Island	153.9	78.3	131.8	364	92
	Kitts	112.9	74.3	183.7	370.9	95
	Jones	110.07	85.64	179.75	375.46	100
	Cornfield Harbor	144.1	90.5	160.5	395.1	110
	Hurdle	98.39	123.94	203.83	426.17	132

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Potomac River Northshore	Milbourne Shore	131.75	119.6	180.95	432.3	136
	Pascahanna	132.83	207.3	101.5	441.63	143
	Tall Timbers	187.6	121.75	152.85	462.2	158
	Beacon	183.1	209.3	88.9	481.3	174
	Cobb Island	257.86	204.93	22.5	485.29	180
	Heron Island	255.55	203.75	27.5	486.8	181
	Lower Cedar Point	173.34	190.16	135.95	499.45	189
	Popes Creek	184	203.75	116.1	503.85	195
	Sheepshead Bay	242.78	197.67	95.75	536.19	215
	Swan Point	184.08	210.27	179.27	573.62	226
Miles River	Turtle Back	136.1	142.75	126.95	405.8	117
	Coffee	134.55	154.1	132.3	420.95	128
	Wild Ground	107.3	169.95	156.8	434.05	137
	Herring Island	131.8	194.55	108.1	434.45	139
	Persimmon Tree	140.95	181.15	120.35	442.45	145
	Sycamore	133.6	174.95	140.1	448.65	147
	Ash Craft	185.2	176.65	116.95	478.8	171
	Second Point	203.65	179.95	119.5	503.1	194
	West End	165.4	175	167.6	508	197
	Long Point	238.5	197.65	110.55	546.7	219
South River	Swan Reef	189.85	189.95	55.25	435.05	141
	Purdy Flats	148.2	196.6	151.95	496.75	186
Potomac R. Southshore	Kingcopsico	251.4	182.8	22.3	456.5	154
	Ragged Point	228.95	158.25	81.6	468.8	162
	Gum	181.88	208.88	90.88	481.63	175
Breton/St. Clements Bays	Blue Sow	155.9	189.75	104.61	450.26	149
	Black Walnut	210	192.8	132.45	535.25	212

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Mid-Bay West	Tolly Point	207.94	193.44	67.06	468.44	161
	Hackett Point	193.95	190.05	85.75	469.75	164
	Coots	210.5	204.13	75.46	490.08	183
	Holland Point	233.9	207.4	141.45	582.75	231
Wye River	Mills	153.55	199.05	110.25	462.85	159
	Whetstone	199.85	195.15	90.2	485.2	179
	Bruffs Island	171.35	193.5	134.1	498.95	188
	Race Horse	184.75	191.15	138.65	514.55	203
	Wye River Middleground	190.2	180.7	164.7	535.6	213
Wicomico River West	Bramleigh Creek	116.83	212.67	116.83	446.33	146
	Mills West	152.4	196.55	128.1	477.05	170
	Cohouck	157.89	208.67	113.39	479.94	172
	Lancaster	217.5	198.64	80.86	497	187
	Manahowic Creek	220.28	207.72	85.13	513.13	202
	Rock Point	225.3	195.7	125.3	546.3	218
	White Point	196.9	215.3	146.1	558.3	225
	Mouth of River	230	210.75	137.14	577.89	229
Upper Bay West	Nine Foot Knoll	192.6	195.5	76.2	464.3	160
	Sandy Point South	193.89	205	82.31	481.19	173
	Seven Foot Knoll	213.2	203.75	67.2	484.15	178
	Lumps East of Craighill	210.88	203.53	85.84	500.24	190
	Mountain Point	232.25	203.08	91.92	527.25	206
	Sixfoot Knoll	222.5	203.3	114.3	540.1	217
	Coal Lump	234.95	209.3	113.95	558.2	224
	Man O' War Shoals	239.65	209.3	189.75	638.7	232
Upper Bay East	Love Point	142.25	200.2	112.85	455.3	152
	Tolchester Lump	190.05	196.7	106.2	492.95	184

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Upper Bay East	Deep Shoal	196.7	202	104.3	503	193
	Hodges	221.8	206.1	97.9	525.8	205
	Swan Point	229.5	206	121.19	556.69	223
	Flat Rock	248.95	220	131.08	582.03	230
Chester River	Drum Point	134.08	203.08	80.08	417.25	125
	Wickes Beach	187.57	200.57	94.93	483.07	177
	Ebb Point	198.9	209.3	100.15	508.35	198
	Buoy Rock	191.55	201.55	116.55	509.65	199
	Horse Race	237.96	208.82	63.44	510.22	200
	Piney Point	219.46	206.71	85.42	511.6	201
	Old Field	218.07	206.64	104.71	529.43	208
	Strong Bay	157.94	201.78	172.75	532.47	209
	Spaniard Point	205.21	206.64	121.21	533.07	210
	Durdin	223	208.2	103.11	534.31	211
	Boathouse	232.88	203.75	99.5	536.13	214
	Sheep	226.25	206.1	104.3	536.65	216
	Shippen Creek	224.1	203.75	121.8	549.65	221
	Emory Hollow	208.75	199.5	141.9	550.15	222
	Bluff Point	229.55	209.3	135.45	574.3	227
Cliff	222.6	209.3	143.65	575.55	228	
Severn River	Chinks Point	176.65	203.3	148.45	528.4	207

Table C-4A. Maryland's 'best bars' (most productive oyster grounds) as defined by Jones and Rothschild (2009)*.

Region	Oyster Bar	Historic Oyster Bottom Area (acres)**	Area Outside Sanctuary (acres)	Percent Outside a Sanctuary Area
Broad Creek	Deep Neck	513	513	100%
Broad Creek	Royston	1,313	1,313	100%
Broad Creek	Willey's Island Flats	295	295	100%
Chester (Lower)	Blunts	378	378	100%
Chester (Upper)	Old Field	652	86	13%
Eastern Bay	Cedar Island	428	428	100%
Eastern Bay	Ringold Middleground	242	156	64%
Harris Creek	Tilghman Wharf	760	469	62%
Kent Shore	Kent Point	445	445	100%
Little Choptank	Cason	205	0	0%
Little Choptank	Susquehanna	191	0	0%
Little Choptank	Town	87	0	0%
Miles River	Coffee	583	583	100%
Severn	Chink's Point	251	0	0%
South River	Thunder & Lightning	48	46	98%
St. Marys Shore	Point Lookout	1,324	1,051	79%
Wye River	Bruffs Island	112	0	0%
Total Area		7,826	5,763	74%
Total Number of Bars		17	8	47%

* Jones, P.W. and Rothschild, B.J. 2009. Maryland's Oyster Redevelopment Program – Sanctuaries and Harvest Reserves. Final Report to the Maryland Department of Natural Resources. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

**Historic oyster bottom as charted in the Yates Oyster Survey of 1906 to 1912 and its amendments.

Table C-4B. Eighteen 'best bars' from Jones and Rothschild 2009 and their overall ranks out of the 232 evaluated 'natural best bars' without plantings. *Bars from the 2009 study with plantings. NR = Not ranked due to a bar being planted with oysters during 2009-2018.

Jones and Rothschild 2009			2009-2018 Study		
Region	Bar	# Years in Top 10%	Bar	Overall Rank (2009-2018)	# Years in Top 10%
Chester River	Old Field*	4	Old Field	208	0
	Blunt*	4	Blunt	NR	NR
Severn River	Chinks Point*	7	Chinks Point	207	0
South River	Thunder and Lightning*	5	Thunder and Lightning	NR	NR
Mid-Bay	Kent Point	4	Kent Point	65	0
Eastern Bay	Cedar Island*	4	Cedar Island	NR	NR
	Ringold Middleground*	4	Ringold Middleground	165	0
Miles River	Coffee	4	Coffee	128	0
Wye River	Bruffs Island	4	Bruffs Island	188	0
Broad Creek	Deep Neck*	5	Deep Neck	1	8
	Royston	4	Royston	21	2
	Willeys Island Flats	4	Willeys Island Flats	6	5
Harris Creek	Tilghman Wharf	6	Tilghman Wharf	9	5
Little Choptank	Cason	4	Cason	64	0
	Susquehanna	4	Susquehanna	57	0
	Town Point*	4	Town Point	29	0
	Town Point	4	Town Point	NR	NR
Lower Bay East	Point Lookout*	5	Point Lookout	46	2

Jones, P. and B. Rothschild. 2009. Maryland's Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf

Table C-5. Maryland’s most productive oyster grounds using methodology from the 2020 ‘best bars’ study and including all samples with oyster plantings. This analysis compared two time series (2009 to 2018 and 1996 to 2007*) to examine bars that continually ranked as productive.

Region	Bar Name	Historic Oyster Bottom Area (acres)**	Area Within Sanctuary (acres)	Percent in Sanctuary	2009-2018	1996-2007
Broad Creek	Broad Creek Middleground	193	0	0%	Yes	No
	Brown	216	0	0%	Yes	No
	Deep Neck	512	0	0%	Yes	Yes
	Great Bar	496	0	0%	Yes	Yes
	Joe Harris Flats	75	0	0%	No	Yes
	Mulberry Point	130	0	0%	Yes	Yes
	Royston	1312	0	0%	Yes	No
	Willeys Island Flats	295	0	0%	Yes	Yes
Choptank River	Irish Creek	735	0	0%	Yes	No
Fishing Bay	Evans	1,000	0	0%	Yes	No
Harris Creek	Change	262	262	100%	Yes	No
	Great Marsh	339	0	0%	Yes	No
	Little Neck	41	41	100%	Yes	No
	Mill Point	214	214	100%	Yes	No
	Rabbit Island	50	50	100%	Yes	No
	Tilghman Wharf	760	291	38%	Yes	No
	Walnut	216	216	100%	Yes	No
Little Choptank River	Butterpot	81	81	100%	No	Yes
	Mckeils Point	203	203	100%	Yes	No
	Pattison	8	8	100%	No	Yes
	Town	87	87	100%	No	Yes
Lower Bay East	Kedge Straits	632	0	0%	No	Yes
	Light House	1,424	1,424	100%	No	Yes

Region	Bar Name	Historic Oyster Bottom Area (acres)**	Area Within Sanctuary (acres)	Percent in Sanctuary	2009-2018	1996-2007
Lower Bay East	Northwest Middleground	1,172	1,172	100%	No	Yes
	Oyster Creek	545	0	0%	No	Yes
	Punch Island Creek	1,781	0	0%	No	Yes
	Western Island Addition	30	0	0%	No	Yes
	Western Islands	109	0	0%	No	Yes
Manokin River	Drum Point	1,521	1,405	92%	Yes	Yes
	Georges	577	577	100%	Yes	No
	Mine Creek	310	247	80%	Yes	Yes
	Piney Island Swash	945	945	100%	Yes	No
Pocomoke Sound	Gunby	236	0	0%	Yes	No
	Kitts Creek East	70	70	100%	No	Yes
	Ware Rock	155	0	0%	Yes	No
St. Marys River	Coppage	56	0	0%	No	Yes
	Horseshoe	9	9	100%	Yes	Yes
	Pagan	12	12	100%	Yes	Yes
Tangier Sound	Back Cove	709	0	0%	Yes	Yes
	Turtle Egg Island	421	0	0%	No	Yes
<p>*The 1996 to 2007 time periods correspond to the same time period used in the 2009 Jones and Rothschild 'best bars' study. Jones, P. and B. Rothschild. 2009. Maryland's Oyster Redevelopment Program- Sanctuaries and Harvest Reserves Final Report. 41 pp. http://dnr.maryland.gov/fisheries/Documents/Best_Bar_Report_summary.pdf</p> <p>** Historic oyster bottom as charted in the Yates Oyster Survey of 1906 to 1912 and its amendments.</p>						

Table C-6. Oyster bars in the Maryland portion of Chesapeake Bay, 2009-2018 by overall rank. N is the total number of samples for the bar, Site Count is the number of individual sites (not all sites were sampled every year) and the Sanctuary column indicates if the bar is in a sanctuary and when the sanctuary was established. The final column is the number of times the bar was ranked in the top 10% for live oysters (markets and small). The top 10 percent are highlighted in bold; rank 1 to 26. These are the 'best bars' for this study using all samples including those taken on bars with oyster plantings.

*Sanctuary status is determined by the location of the Fall Survey site.

¹A portion of this bar is in a sanctuary.

²A portion of this bar is outside the sanctuary.

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
1	Broad Creek Middleground	Broad Creek	10	1	No	6
2	Deep Neck	Broad Creek	27	4	No	8
3	Great Bar	Broad Creek	23	3	No	9
4	Rabbit Island	Harris Creek	6	1	Yes (2010)	5
5	Great Marsh	Harris Creek	10	1	No	3
6	Willeys Island Flats	Broad Creek	20	2	No	5
7	Drum Point	Manokin River	10	1	Yes (2010)²	7
8	Pagan	St. Marys River	10	1	Yes (2010)	8
9	Mulberry Point	Broad Creek	23	3	No	8
10	Back Cove	Tangier Sound	16	7	No	3
11	Tilghman Wharf	Harris Creek	10	1	No¹	0
12	Horseshoe	St. Marys River	10	1	Yes (2010)	8
13	Brown	Broad Creek	20	2	No	8
14	Georges	Manokin River	10	1	Yes (2010)	6
15	Walnut	Harris Creek	10	1	Yes (2010)	3
16	Change	Harris Creek	15	2	Yes (2010)	3
17	Ware Rock	Pocomoke Sound	10	1	No	2
18	Little Neck	Harris Creek	10	1	Yes (2010)	6
19	Mine Creek	Manokin River	10	1	Yes (2010)²	3

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
20	Mckeils Point	Little Choptank River	10	1	Yes (2010)	7
21	Mill Point	Harris Creek	10	1	Yes (2010)	2
22	Evans	Fishing Bay	13	2	No	0
23	Gunby	Pocomoke Sound	20	2	No	2
24	Irish Creek	Choptank River	10	1	No	0
25	Piney Island Swash	Manokin River	10	1	Yes (2010)	3
26	Royston	Broad Creek	20	2	No	0
27	Lakes Cove	Honga River	10	1	No	3
28	Town	Little Choptank River	20	2	Yes (2010)	7
29	Old Rocks	Pocomoke Sound	10	1	No	2
30	Punch Island Creek	Lower Bay East	12	2	No	3
31	Great Shoal	Wicomico River East	10	1	No	0
32	Terrapin Sands Inner	Tangier Sound	15	2	No	3
33	Coppage	St. Marys River	10	1	No	5
34	Marshy Island	Manokin River	20	2	Yes (2010) ²	3
35	Seths Point	Harris Creek	10	1	Yes (2010)	5
36	Hill	Fishing Bay	10	1	No	0
37	Wild Cherry Tree	Harris Creek	21	3	No	2
38	Butterpot	Little Choptank River	10	1	Yes (2010)	5
39	Light House	Honga River	10	1	Yes (pre-2010)	3
40	Norman Add 1	Honga River	10	1	No	1
41	Smoke Point	Honga River	10	1	No	3
42	Mud Rock	Tangier Sound	10	1	No	0
43	Bean Shoal	Nanticoke River	10	1	Yes (2010)	0
44	Harris	Tangier Sound	10	1	No	5
45	Langley Hollow	St. Marys River	11	2	No	3
46	Crab Point	Honga River	10	1	No	4

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
47	Old House	Fishing Bay	10	1	No	0
48	Peanut Hill	Little Choptank River	10	1	No	1
49	Holland Straits East	Lower Bay East	10	1	No	1
50	Cherry Tree	Nanticoke River	10	1	Yes (2010)	0
51	Susquehanna	Little Choptank River	10	1	No	3
52	Goose Creek	Fishing Bay	12	3	No	0
53	Marumsco	Pocomoke Sound	10	1	No	1
54	Clay Island	Fishing Bay	10	1	No	0
55	Grapevine	Little Choptank River	10	1	Yes (2010)	1
56	Point Lookout	Lower Bay West	22	3	No	5
57	Wilson Shoals	Nanticoke River	16	2	Yes (2010)	0
58	Sharkfin Shoal	Tangier Sound	14	2	No	1
59	Hickory Nut	Nanticoke River	10	1	Yes (2010)	0
60	Little Choptank	Little Choptank River	10	1	No	4
61	France	Choptank River	10	1	No	0
62	Northwest Middleground	Lower Bay East	20	2	Yes (2010)	5
63	Tedious Creek	Fishing Bay	10	1	No	0
64	Cherry	St. Marys River	10	1	No	0
65	Gravelly Run	St. Marys River	20	2	No	9
66	Haines	Tangier Sound	20	2	No	1
67	Thunder And Lightning	South River	10	1	No ¹	3
68	Hawks Nest	Patuxent River	13	2	No	1
69	Ragged Point	Little Choptank River	20	2	No	2
70	Taylor Point	Honga River	7	1	No	3
71	Old Womans Patch	Nanticoke River	10	1	Yes (2010)	0
72	Cason	Little Choptank River	10	1	Yes (2010)	0
73	Cedar Shoal	Nanticoke River	10	1	Yes (2010)	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
74	Kent Point	Mid-Bay East	10	1	No	0
75	Neal Add 1	Patuxent River	10	1	Yes (pre-2010)	2
76	Calvert Bay	Smith Creek	10	1	No	0
77	Back Of Island	Patuxent River	10	1	No	0
78	Halls Point	Wicomico River East	17	3	No	0
79	Flat Rock	Pocomoke Sound	10	1	No	1
80	Stone	Mid-Bay East	10	1	No	0
81	Butler	Lower Bay West	10	1	No	0
82	Duck Island	Fishing Bay	10	1	No	0
83	Bachelor Point	Tred Avon River	10	1	No	1
84	Sandy Point Lumps	Patuxent River	10	1	No	0
85	Lighthouse	Choptank River	20	2	No	0
86	Applegarth	Honga River	9	1	Yes (pre-2010)	0
87	Roaring Point East	Nanticoke River	10	1	Yes (2010)	0
88	Broome Island	Patuxent River	14	2	No	0
89	Bob Wise	Patuxent River	10	1	No	1
90	Pecks Point	Tred Avon River	10	1	Yes (2010) ²	0
91	Dickinson	Choptank River	20	2	No	3
92	Susquehanna Sanctuary	Little Choptank River	10	3	Yes (2010)	2
93	Chicken Cock	St. Marys River	13	2	No	1
94	Hambrooks	Choptank River	10	1	No	0
95	Beacons	Choptank River	10	1	No	0
96	Point Lookout Sanctuary	Lower Bay West	13	2	Yes (pre-2010)	2
97	Wetipquin	Nanticoke River	10	1	Yes (2010)	0
98	Stone Church	Tred Avon River	10	1	No	0
99	Wicomico Middleground	Wicomico River West	10	1	No	1
100	Pattison	Little Choptank River	10	1	Yes (2010)	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
101	Chlora Point	Choptank River	10	1	Yes (2010) ²	0
102	Louis Cove	Tred Avon River	10	1	Yes (2010)	1
103	Hellen	Patuxent River	10	1	No	0
104	Mill Dam	Choptank River	10	1	Yes (2010)	0
105	Dixon	Choptank River	10	1	Yes (2010)	0
106	Hungerford Hollow	Patuxent River	10	1	No	0
107	Smith Creek	Smith Creek	10	1	No	0
108	Cedar Point Hollow	Lower Bay West	10	1	No ¹	0
109	Spencers	Patuxent River	10	1	No	1
110	Turtle Egg Island	Tangier Sound	20	2	No	0
111	Rocky Beach	Lower Bay West	9	1	No	0
112	St. George Island	Potomac River Northshore	10	1	No	0
113	Howells Point Add 2	Choptank River	10	1	No	0
114	Mares Point	Tred Avon River	10	1	Yes (2010)	0
115	Cook Point	Choptank River	20	2	Yes (2010)	0
116	Johnson Island	Eastern Bay	10	3	No	2
117	Piney Island East Add 1	Tangier Sound	30	3	Yes (pre-2010)	5
1118	Kitts	Potomac River Northshore	10	1	No	0
119	Big Annemessex	Big Annemessex River	9	1	No	0
120	Windmill	Honga River	10	1	No	0
121	Chain Shoal	Tangier Sound	10	1	No	1
122	Mill Hill Sanctuary	Eastern Bay	10	1	Yes (pre-2010)	0
123	Jones	Potomac River Northshore	22	3	No	1
124	Howells Point	Choptank River	10	2	No	0
125	Outer Round Point	South River	10	1	No	1
126	Swash	Patuxent River	10	1	No	1
127	Double Mills	Tred Avon River	10	1	Yes (2010)	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
128	Town Point	Tred Avon River	10	1	No	0
129	Oyster Shell Point	Choptank River	13	2	Yes (2010)	0
130	Piney Island West	Tangier Sound	20	2	No	1
131	Mussel Hole	Tangier Sound	10	1	No	0
132	Tanners Patch	Choptank River	10	1	Yes (pre-2010)	0
133	Cornfield Harbor	Potomac River Northshore	10	1	No	0
134	Little Cove Point	Lower Bay West	9	1	No	0
135	Cedar Island	Eastern Bay	11	3	No	1
136	Mills East	Wicomico River West	9	1	No	0
137	Ragged Point	Potomac River Southshore	21	7	No	0
138	Hurdle	Potomac River Northshore	10	1	No	1
139	Piney Island East	Tangier Sound	20	3	No	1
140	Holland Point	Patuxent River	10	1	Yes (2010)	1
141	Mount Vernon Wharf	Wicomico River East	10	2	No	0
142	Sandy Hill	Choptank River	10	1	Yes (pre-2010)	0
143	Evans	Wicomico River East	19	3	No	0
144	Turtle Back	Miles River	10	1	Yes	0
145	Broad Neck	Patuxent River	10	1	Yes (2010)	0
146	Brick House	Mid-Bay East	10	1	No	0
147	Bramleigh Creek	Wicomico River West	10	1	No	2
148	Broad Creek	Mid-Bay East	10	1	No ¹	0
149	Bugby	Eastern Bay	42	6	No	0
150	Great Rock	Tangier Sound	26	3	No	0
151	Lancaster	Wicomico River West	16	3	No	1
152	Hog Island	Lower Bay West	12	3	No	0
153	Bolingbroke Sand	Choptank River	13	2	Yes (2010)	1
154	Wild Ground	Eastern Bay	13	2	No	1

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
155	Coffee	Miles River	10	1	No	0
156	Poplar Island	Mid-Bay East	20	2	No	0
157	Orem	Tred Avon River	10	1	Yes (2010)	1
158	Lows Point	Eastern Bay	10	1	No	0
159	Hill Point East	South River	10	1	No	1
160	Swan Point	Upper Bay East	38	7	No ¹	4
161	Middleground	Nanticoke River	10	1	No	0
162	Swan Reef	South River	10	1	No	0
163	Milbourne Shore	Potomac River Northshore	10	1	No	0
164	Drum Point	Chester River	10	1	Yes (2010)	0
165	Thomas	Patuxent River	10	1	Yes (2010)	0
166	Coots	Mid-Bay West	24	3	No	1
167	Flag Pond	Lower Bay West	10	1	Yes (2010)	1
168	Herring Island	Miles River	10	1	No	0
169	Wild Ground	Miles River	10	1	No	0
170	Drum Point	Choptank River	10	1	Yes (pre-2010)	0
171	Rock Point	Wicomico River West	10	1	No	0
172	Pascahanna	Potomac River Northshore	15	2	No	0
173	Mill Hill	Eastern Bay	10	1	No	0
174	Persimmon Tree	Miles River	10	1	No	0
175	Dukehart Channel	Breton/St. Clements Bays	10	1	No	0
176	Hail Point	Chester River	10	1	No	0
177	Blue Sow	Breton/St. Clements Bays	10	1	No ¹	1
178	Kingcopsico	Potomac River Southshore	10	1	No	0
179	Hackett Point	Mid-Bay West	17	3	No	1
180	Bald Eagle Add 3	Eastern Bay	10	1	No	0
181	Shell Hill	Mid-Bay East	10	1	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
182	Tolly Point	Mid-Bay West	14	2	No ¹	0
183	Sycamore	Miles River	10	1	No	0
184	Bodkin Shoals	Eastern Bay	30	3	No	0
185	Love Point	Upper Bay East	10	1	Yes (2010) ²	0
186	Turkey Point	Eastern Bay	10	1	No	0
187	Tall Timbers	Potomac River Northshore	10	1	No	0
188	Nine Foot Knoll	Upper Bay West	10	1	No	0
189	Bald Eagle Add 2	Eastern Bay	10	1	No	0
190	Wickes Beach	Chester River	10	1	Yes (2010)	0
191	Piney Point	Chester River	20	3	No	1
192	Hollicutts Noose	Eastern Bay	11	2	No	0
193	Mills	Wye River	10	1	Yes (2010)	0
194	Shoal Creek	Choptank River	20	2	Yes (2010)	0
195	Normans Fine Eyes	Eastern Bay	10	1	No	0
196	Slaughter Creek	Little Choptank River	10	1	Yes (2010)	0
197	The Black Buoy	Choptank River	10	1	Yes	0
198	Maxmore Add 1	Tred Avon River	10	1	Yes (2010)	0
199	Cabin Creek	Choptank River	10	1	Yes (pre-2010)	0
200	White Point	Wicomico River West	10	1	No	0
201	Sandy Point South	Upper Bay West	20	2	No	0
202	Seven Foot Knoll	Upper Bay West	10	1	No	0
203	Gum	Potomac River Southshore	10	3	No	1
204	Mills West	Wicomico River West	10	1	No	0
205	Bonums	Potomac River Southshore	7	2	No	0
206	Heron Island	Potomac River Northshore	10	1	No	0
207	Rock Point	South River	10	1	No	0
208	Ash Craft	Miles River	10	1	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
209	Beacon	Potomac River Northshore	10	1	No	0
210	Cohouck	Wicomico River West	9	1	No	0
211	Cobb Island	Potomac River Northshore	10	2	No	0
212	Whetstone	Wye River	10	1	Yes (2010)	0
213	Chinks Point	Severn River	20	2	Yes (pre-2010)	1
214	Walter White	Eastern Bay	8	1	No	0
215	Trent Hall	Patuxent River	10	1	Yes (pre-2010)	1
216	Tolchester Lump	Upper Bay East	10	1	No	0
217	Buoy Rock	Chester River	11	2	No ¹	0
218	Horse Race	Chester River	13	2	No	0
219	Parsons Island	Eastern Bay	11	2	No	0
220	Sixfoot Knoll	Upper Bay West	11	2	No	0
221	Durdin	Chester River	16	2	No	0
222	Terrapin Sands Add 1	Tangier Sound	22	4	No	0
223	Green Marsh	Choptank River	10	1	Yes (2010)	0
224	Lumps East Of Craighill Channel	Upper Bay West	20	2	No	0
225	Southeast Middleground	Patuxent River	10	1	No	0
226	Popes Creek	Potomac River Northshore	10	1	No	0
227	Deep Shoal	Upper Bay East	10	1	No	0
228	Lower Cedar Point	Potomac River Northshore	19	2	No	0
229	Ringold Middleground	Eastern Bay	14	2	No ¹	0
230	Buzzard Island	Patuxent River	10	1	Yes (2010)	0
231	Spaniard Point	Chester River	10	1	Yes (2010)	0
232	Bruffs Island	Wye River	10	1	Yes (2010)	0
233	Purdy Flats	South River	10	1	No	0
234	Strong Bay	Chester River	20	2	Yes (pre-2010)	0
235	Second Point	Miles River	10	1	No	0

Overall Rank	Bar Name	Region	N	Site Count	Sanctuary*	# of Years in top 10%
236	Ebb Point	Chester River	10	1	Yes (2010)	0
237	Man O War Shoals	Upper Bay West	23	3	No ¹	3
238	West End	Miles River	5	1	No	0
239	Mountain Point	Upper Bay West	11	2	No	0
240	Race Horse	Wye River	10	1	Yes (2010)	0
241	Well Cove	Eastern Bay	8	2	No	0
242	Boathouse	Chester River	10	1	Yes (2010)	0
243	Hodges	Upper Bay East	10	1	No	0
244	Manahowic Creek	Wicomico River West	10	1	No	0
245	Black Walnut	Breton/St. Clements Bays	10	1	Yes (2010)	1
246	Sheep	Chester River	10	1	Yes (pre-2010)	0
247	Sheepshead Bay	Potomac River Northshore	10	1	No	0
248	Wye River Middleground	Wye River	10	1	Yes (2010)	0
249	Old Womans Leg	Tangier Sound	10	1	No	0
250	Long Point	Miles River	10	1	Yes (2010)	0
251	Shippen Creek	Chester River	10	1	Yes (pre-2010)	0
252	Cox Neck	Eastern Bay	10	1	No	0
253	Old Field	Chester River	10	1	Yes (2010)	0
254	Emory Hollow	Chester River	10	1	Yes (2010)	0
255	Coal Lump	Upper Bay West	10	1	No	0
256	Mouth Of River	Wicomico River West	9	1	No	0
257	Cliff	Chester River	10	1	Yes (2010)	0
258	Bluff Point	Chester River	10	1	No ¹	0
259	Holland Point	Mid-Bay West	10	1	Yes (2010)	0
260	Swan Point	Potomac River Northshore	13	2	No	0
261	Flat Rock	Upper Bay East	10	1	No	0
262	Great Neck	Potomac River Southshore	7	2	No	0

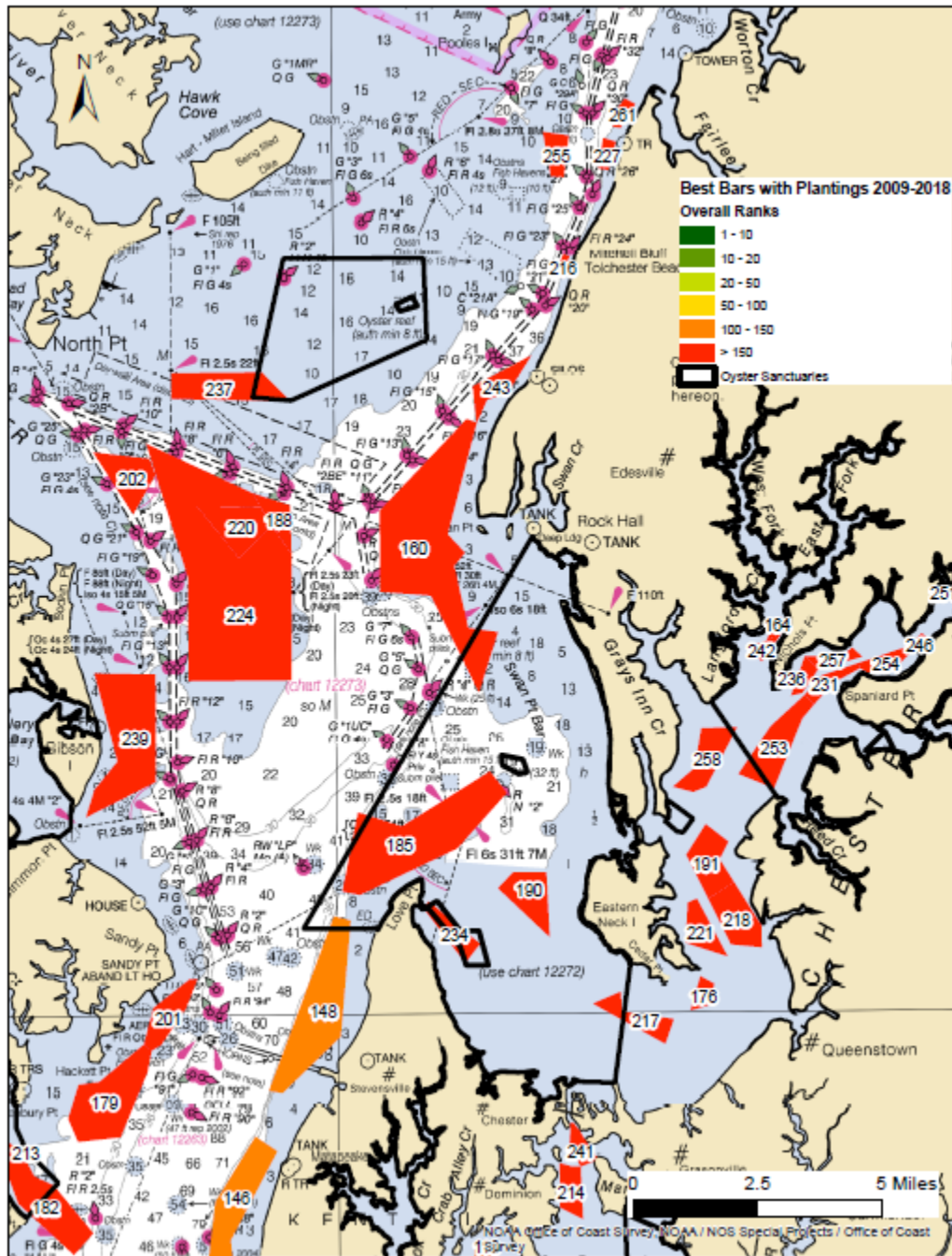


Figure C-10. Map of oyster bars (including those with oyster plantings) used in the analysis in the upper bay, including the Chester River, and the final rank for each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

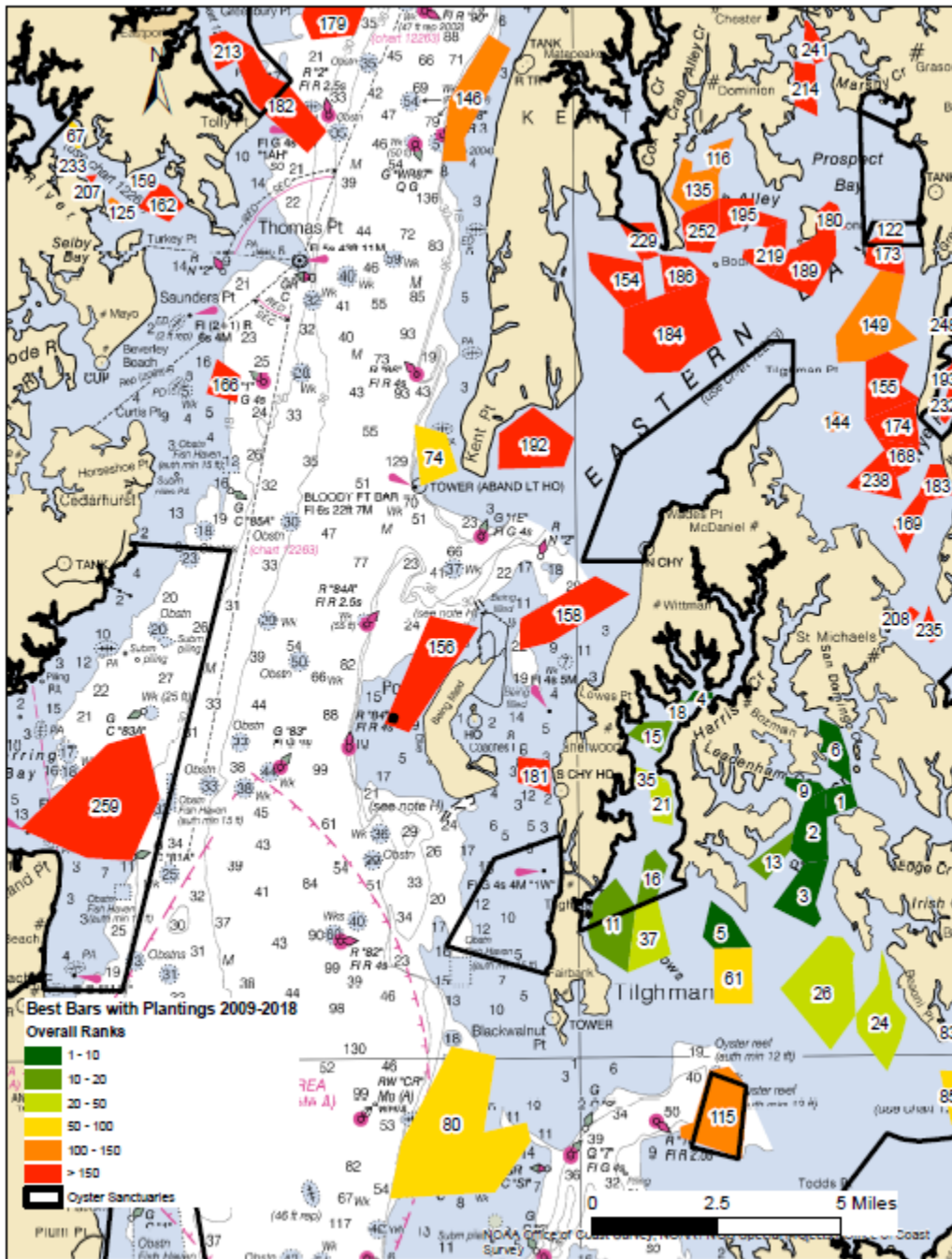


Figure C-11. Map of oyster bars (including those with oyster plantings) used in the analysis in the mid-bay, including Eastern Bay, Harris Creek, Broad Creek and part of the Choptank River, and the final rank of each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

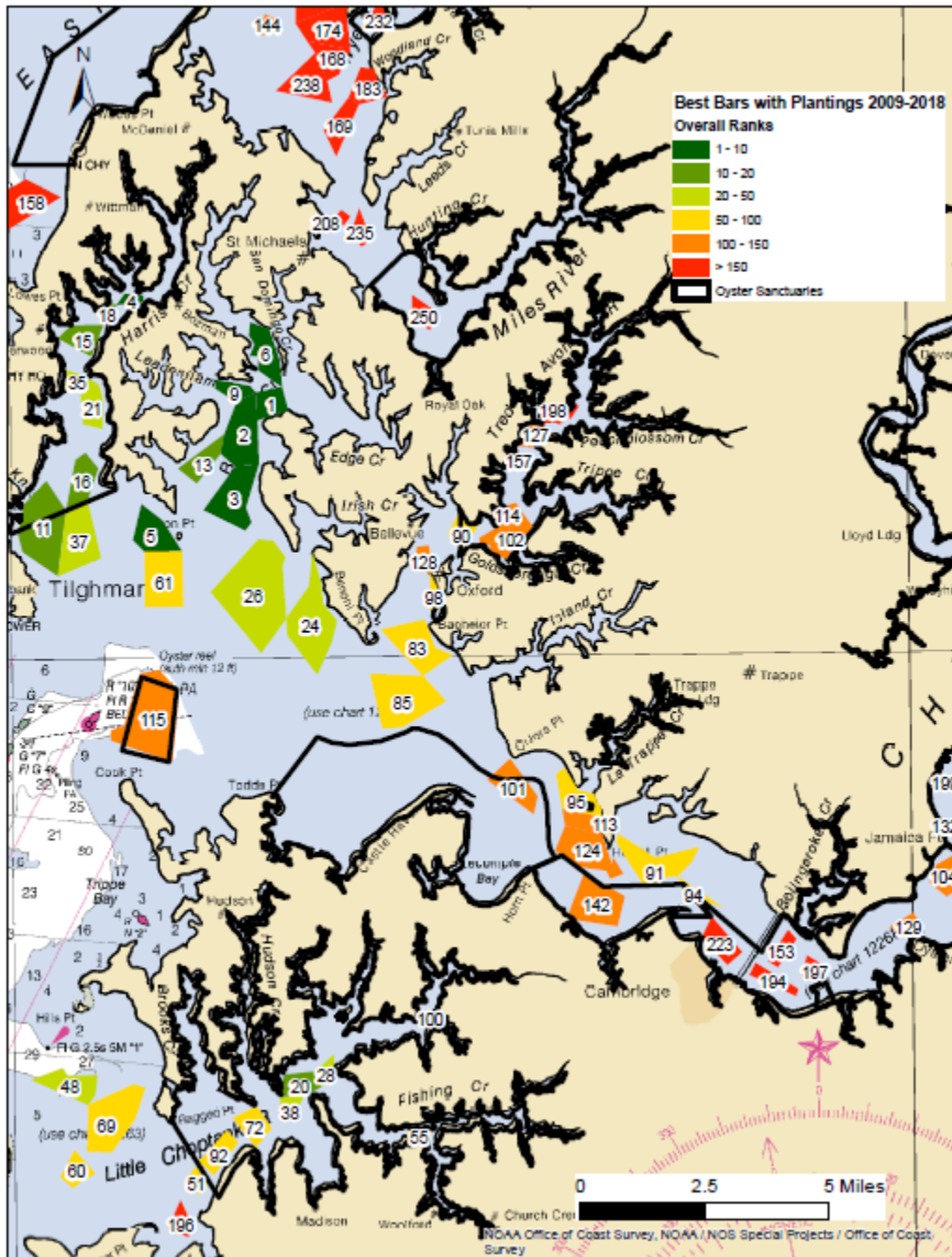


Figure C-12. Map of oyster bars (including those with oyster plantings) used in the analysis in the Choptank River complex, the Little Choptank River (bottom) and the Miles River (at top), and the final rank of each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

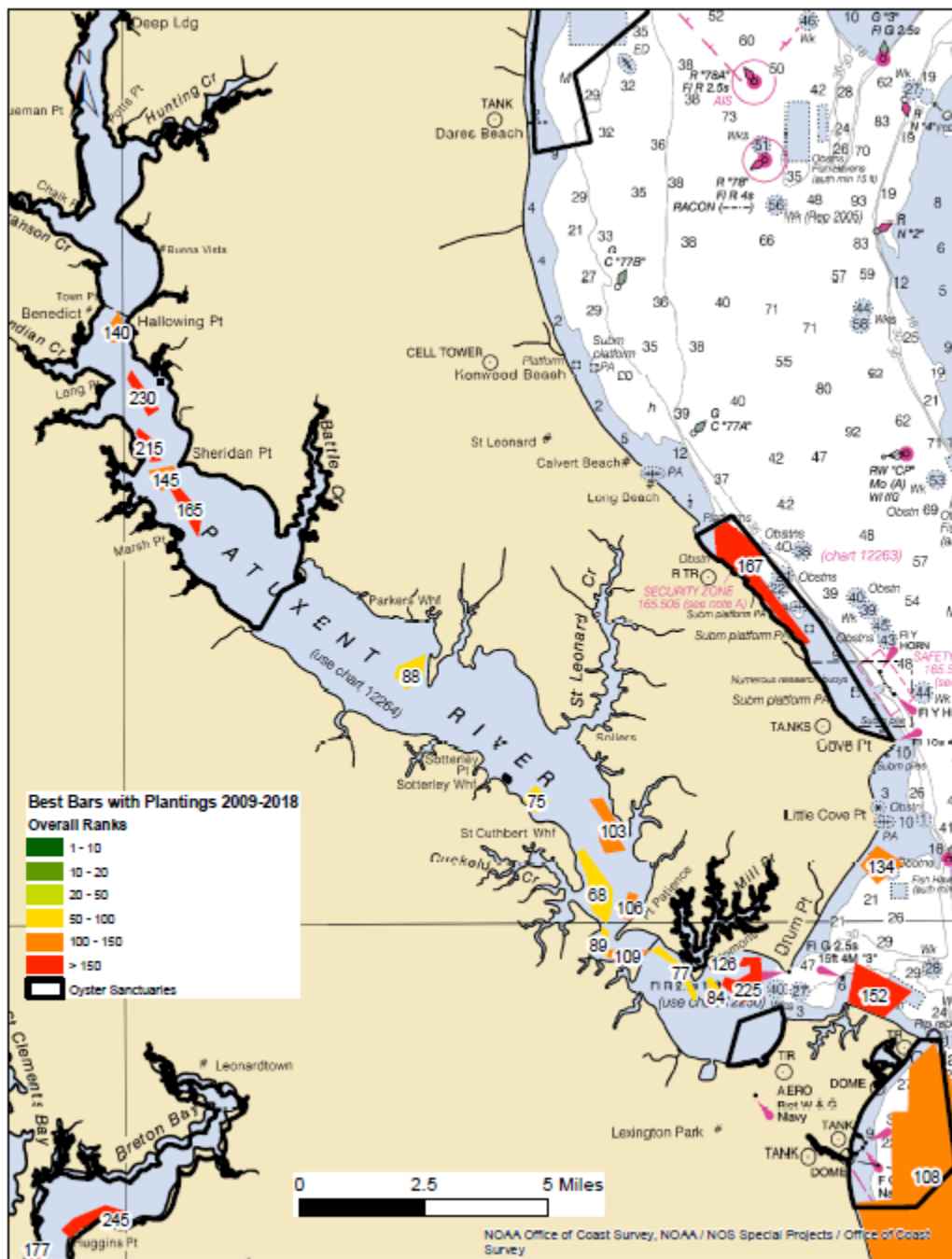


Figure C-13. Map of oyster bars (including those with oyster plantings) used in the analysis in the Patuxent River and portions of the lower bay, and the final rank of each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

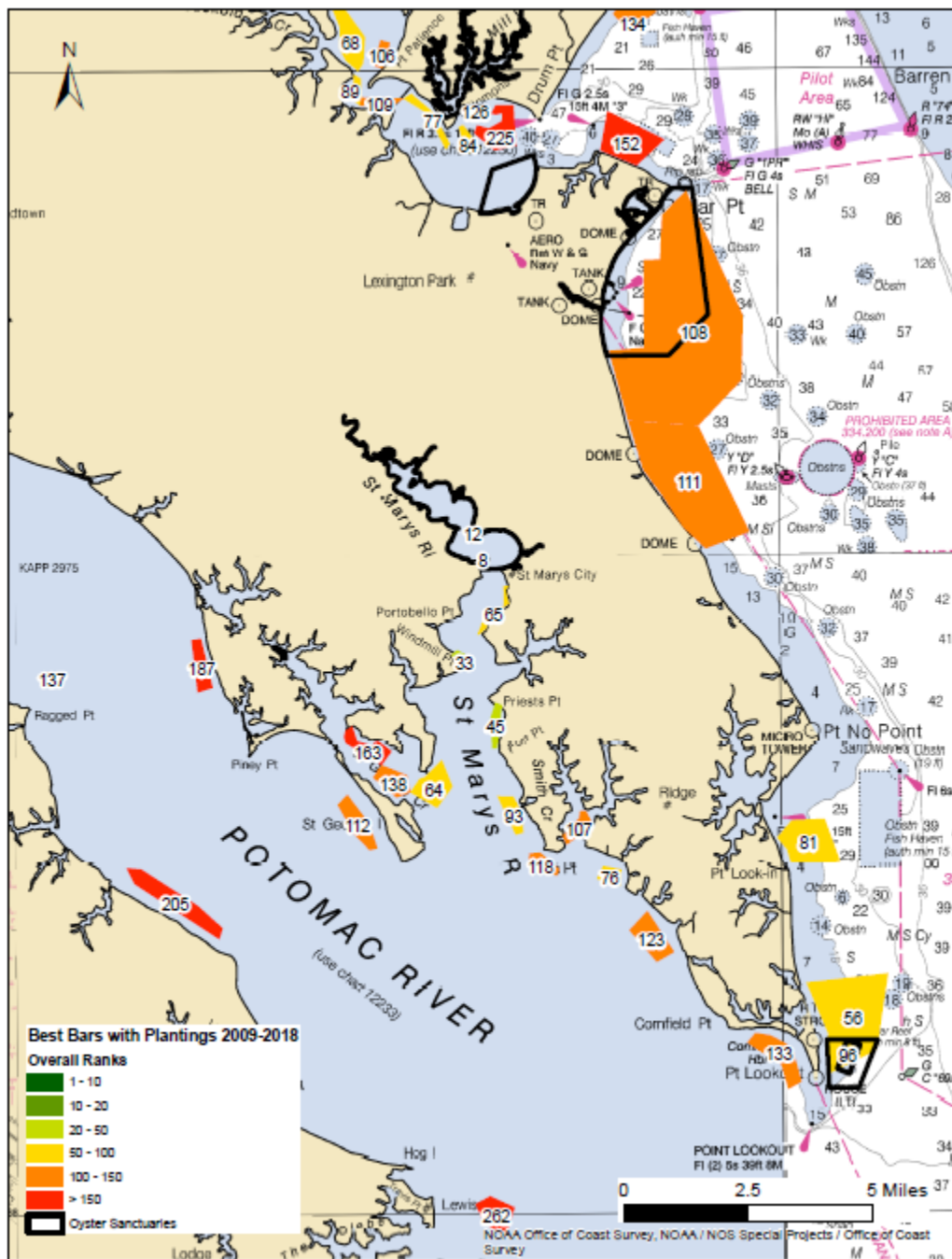


Figure C-14. Map of oyster bars (including those with oyster plantings) used in the analysis in the St. Marys River, lower Potomac River and portions of the lower bay, including the final rank of each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

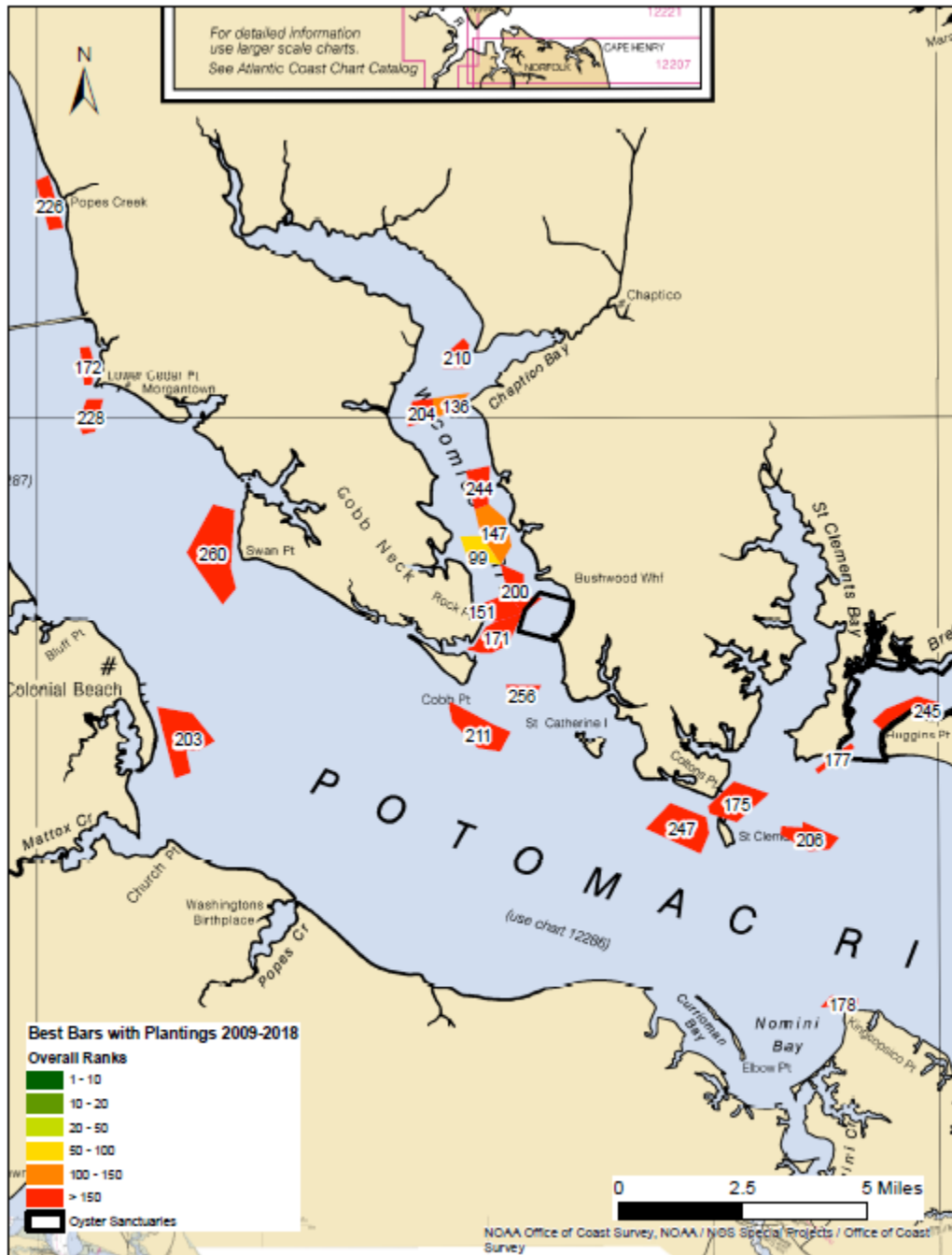


Figure C-15. Map of oyster bars (including those with oyster plantings) used in the analysis in the upper Potomac River, including the Wicomico River and Breton Bay, and the final rank for each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

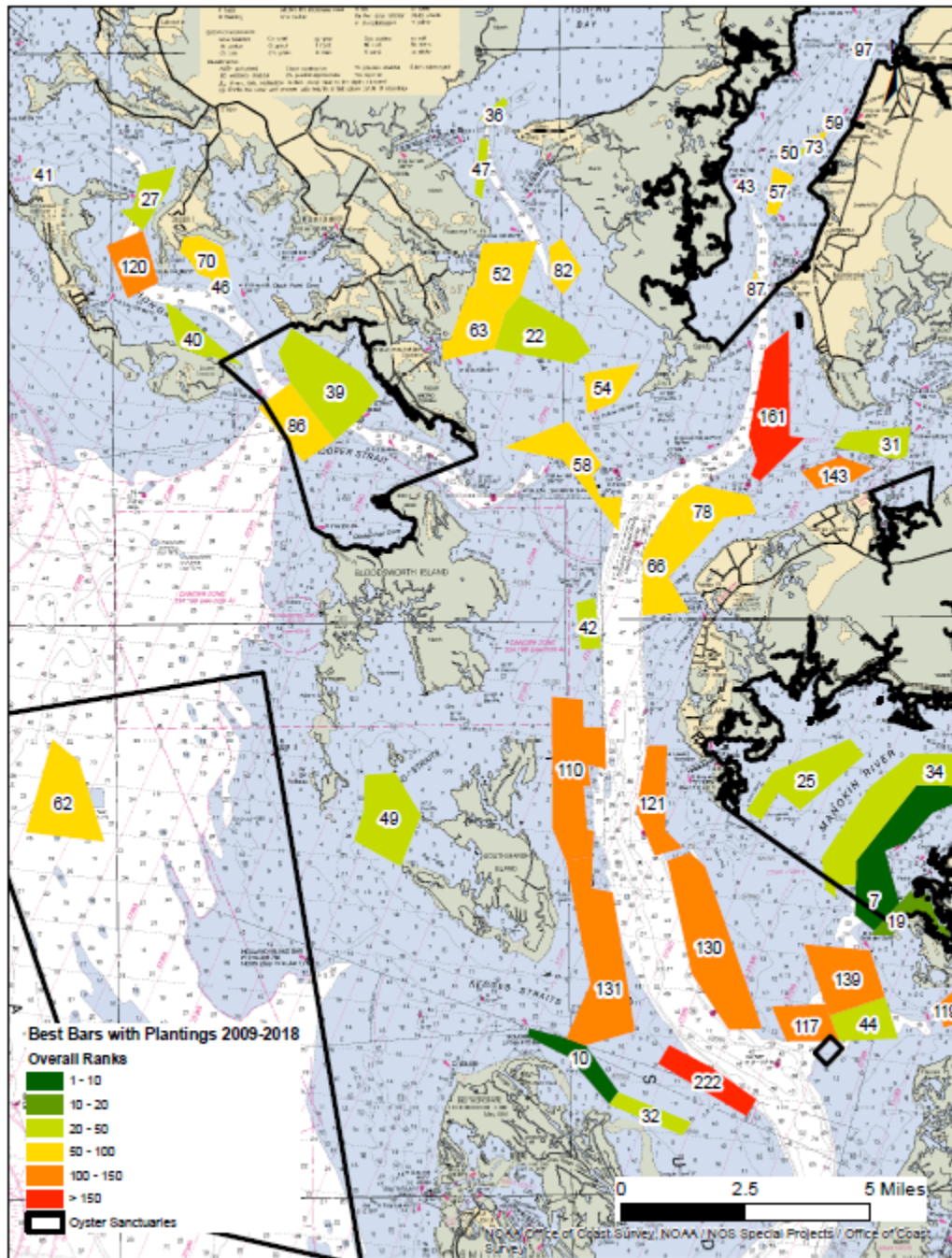


Figure C-16. Map of oyster bars (including those with oyster plantings) used in the analysis in upper Tangier Sound, including the Honga River, Fishing Bay, Nanticoke and Wicomico (east) rivers, and the final rank for each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

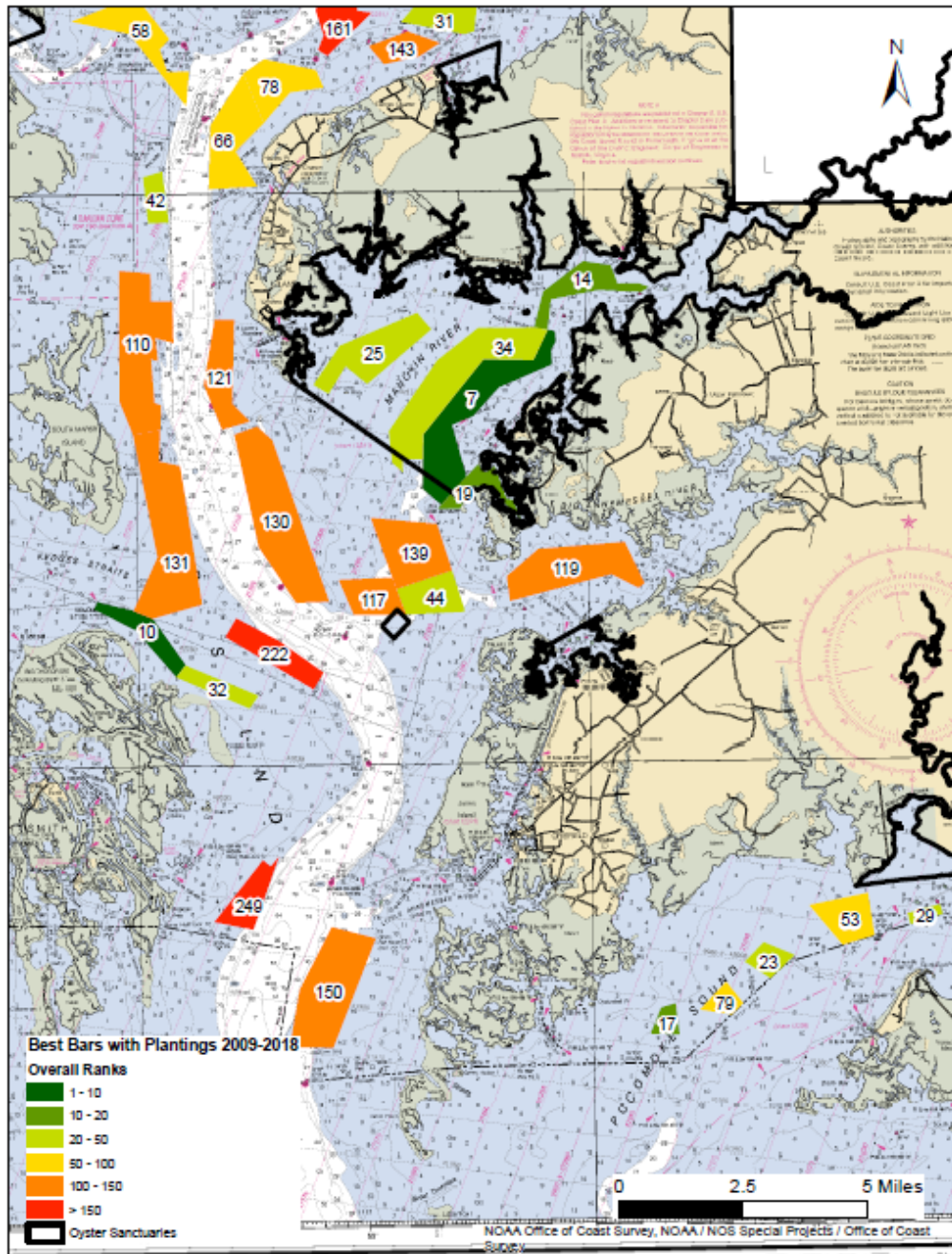


Figure C-17. Map of oyster bars (including those with oyster plantings) used in the analysis in lower Tangier Sound, including the Manokin and Big Annemessex rivers and Pocomoke Sound and the final rank for each bar. Ranks range from 1 (best) to 262 (worst). ‘Best Bars’ are those in the top 10% by rank (ranks 1 to 26). See Table C-6 for bar names for the corresponding rankings.

Table C-7A. Percentiles for mean ranks of all categories and the total score for the 'best bars' analysis. Colors indicate relative ranks within each category, with dark green being equivalent to the top 10% and dark red being the bottom 10%. Yellow represents the 50th percentile or the median value.

	Mean Live Rank	Mean Spat Rank	Mean Mortality Rank	Total Score
Top 10%	65	61	96	307
Top 20%	97	87	112	362
Top 30%	121	109	130	415
Top 40%	141	135	140	451
Top 50%	165	176	154	493
Bottom 50%	187	208	173	524
Bottom 40%	206	226	186	568
Bottom 30%	232	239	200	600
Bottom 20%	260	251	215	632
Bottom 10%	316	264	266	766

Table C-7B. Regions, bars, mean ranks for each category, total scores and the final, overall rank for the bars including samples on oyster plantings, with colors indicating percentiles for each category. Regions are listed in order by their rank. ‘Best Bars’ (top 10% by rank or ranks 1-26) are in bold.

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Broad Creek	Broad Creek Middleground	27.95	66.70	106.00	200.7	1
	Deep Neck	28.96	61.26	122.15	212.4	2
	Great Bar	51.52	90.41	75.37	217.3	3
	Willeys Island Flats	40.80	72.58	111.88	225.2	6
	Mulberry Point	37.04	72.17	124.33	233.5	9
	Brown	48.38	84.10	125.78	258.2	13
	Royston	106.08	101.62	99.33	307.0	26
Harris Creek	Rabbit Island	20.75	76.75	124.17	221.7	4
	Great Marsh	57.25	74.70	90.50	222.4	5
	Tilghman Wharf	85.00	75.75	86.25	247.0	11
	Walnut	52.95	88.25	132.80	274.0	15
	Change	84.43	96.10	94.00	274.5	16
	Little Neck	74.65	91.85	116.95	283.4	18
	Mill Point	84.80	103.70	109.00	297.5	21
	Seths Point	64.65	110.40	146.70	321.8	35
	Wild Cherry Tree	100.43	113.55	108.74	322.7	37
Manokin River	Drum Point	31.75	22.95	171.15	225.9	7
	Georges	47.10	37.30	185.35	269.8	14
	Mine Creek	64.75	21.85	200.15	286.8	19

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Manokin River	Piney Island Swash	61.15	31.40	213.75	306.3	25
	Marshy Island	83.08	22.93	212.80	318.8	34
Pocomoke Sound	Ware Rock	103.15	26.10	149.40	278.6	17
	Gunby	92.70	44.40	163.53	300.6	23
	Old Rocks	72.00	71.75	166.45	310.2	29
	Marumsc	105.30	52.80	204.50	362.6	53
	Flat Rock	173.40	67.35	174.65	415.4	79
St. Marys River	Pagan	13.60	29.10	190.15	232.9	8
	Horseshoe	14.40	69.60	171.90	255.9	12
	Coppage	49.40	56.60	212.60	318.6	33
	Langley Hollow	82.73	63.50	203.64	349.9	45
	Cherry	108.90	89.05	184.40	382.4	64
	Gravelly Run	55.08	78.90	251.43	385.4	65
	Chicken Cock	137.69	80.85	214.46	433.0	93
Lower Bay East	Punch Island Creek	55.75	60.79	194.75	311.3	30
	Holland Straits East	117.60	39.55	197.80	354.9	49
	Northwest Middleground	62.90	44.92	265.23	373.1	62
Fishing Bay	Evans	107.38	57.15	135.65	300.2	22
	Hill	129.70	86.65	106.30	322.6	36
	Old House	162.80	64.90	125.55	353.2	47
	Goose Creek	119.25	68.75	170.42	358.4	52
	Clay Island	123.65	51.70	188.60	364.0	54
	Tedious Creek	142.80	48.55	187.60	379.0	63
	Duck Island	151.25	77.60	189.55	418.4	82
Honga River	Lakes Cove	80.95	43.40	184.25	308.6	27
	Light House	79.70	17.95	227.65	325.3	39

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Honga River	Norman Add 1	88.40	59.00	182.05	329.5	40
	Smoke Point	81.45	60.90	189.25	331.6	41
	Crab Point	87.30	54.70	209.50	351.5	46
Honga River	Taylor Point	113.64	70.50	208.93	393.1	70
	Applegarth	160.83	42.94	222.83	426.6	86
	Windmill	172.35	89.00	205.45	466.8	120
Little Choptank River	Mckeils Point	38.20	93.25	164.90	296.4	20
	Town	36.23	93.08	179.75	309.1	28
	Butterpot	46.45	80.55	197.60	324.6	38
	Peanut Hill	60.50	92.50	201.50	354.5	48
	Susquehanna	50.00	108.65	199.50	358.1	51
	Grapevine	70.10	112.50	181.75	364.4	55
	Little Choptank	53.95	119.25	197.85	371.0	60
	Ragged Point1	73.00	122.35	195.45	390.8	69
	Cason	67.95	103.05	225.95	396.9	72
	Susquehanna- Sanctuary	128.30	109.15	195.35	432.8	92
	Pattison	98.95	163.90	184.30	447.2	100
	Slaughter Creek	161.90	172.40	253.20	587.5	196
Nanticoke River	Bean Shoal	105.55	126.00	109.80	341.4	43
	Cherry Tree	131.65	126.40	98.50	356.6	50
	Wilson Shoals	116.28	122.00	129.38	367.7	57
	Hickory Nut	147.35	119.80	102.20	369.3	59
	Old Womans Patch	149.20	160.75	85.05	395.0	71
	Cedar Shoal	135.70	129.65	133.15	398.5	73
	Roaring Point East	119.15	120.80	187.35	427.3	87

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Nanticoke River	Wetipquin	196.20	148.45	95.75	440.4	97
	Middleground	242.35	75.75	220.95	539.0	161
Smith Creek	Calvert Bay	117.95	108.25	180.10	406.3	76
	Smith Creek	118.25	123.20	210.15	451.6	107
Wicomico River East	Great Shoal	155.30	89.10	67.55	311.9	31
	Halls Point	132.38	88.00	194.12	414.5	78
	Mount Vernon Wharf	209.80	157.90	141.70	509.4	141
	Evans	196.39	132.61	183.74	512.7	143
Tangier Sound	Back Cove	63.28	23.97	157.69	244.9	10
	Terrapin Sands Inner	105.40	17.57	192.20	315.2	32
	Mud Rock	97.20	44.40	193.70	335.3	42
	Harris	72.10	65.85	209.60	347.5	44
	Sharkfin Shoal	97.32	61.82	209.96	369.1	58
	Haines	120.58	65.62	200.25	386.4	66
	Turtle Egg Island	135.28	77.30	245.35	457.9	110
	Piney Island East Add 1	152.08	88.52	224.47	465.1	117
	Chain Shoal	146.55	85.75	236.95	469.2	121
	Piney Island West	147.68	108.50	234.43	490.6	130
	Mussel Hole	165.05	72.70	255.30	493.1	131
	Piney Island East	174.55	97.62	229.78	502.0	139
	Great Rock	186.85	101.37	233.44	521.7	150
	Terrapin Sands Add 1	232.61	177.73	204.88	615.2	222
Old Womans Leg	274.00	165.15	235.20	674.3	249	
Lower Bay West	Point Lookout	68.45	119.09	178.11	365.7	56
	Butler	140.20	134.90	141.90	417.0	81
	Point Lookout- Sanctuary	79.38	108.65	251.77	439.8	96

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Lower Bay West	Cedar Point Hollow	172.55	131.20	149.55	453.3	108
	Rocky Beach	161.28	145.28	151.67	458.2	111
	Little Cove Point	171.39	157.83	167.33	496.6	134
	Hog Island	190.62	142.21	193.04	525.9	152
	Flag Pond	210.70	152.65	181.50	544.9	167
Big Annemessex River	Big Annemessex	295.50	41.28	129.81	466.6	119
Tred Avon River	Bachelor Point	133.65	179.25	105.70	418.6	83
	Pecks Point	102.75	179.45	145.70	427.9	90
	Stone Church	120.80	178.60	146.65	446.0	98
	Louis Cove	136.75	189.45	123.20	449.4	102
	Mares Point	131.65	182.60	148.40	462.6	114
	Double Mills	127.45	163.20	191.30	481.9	127
	Town Point	165.85	173.25	148.30	487.4	128
	Orem	158.60	216.95	157.30	532.8	157
	Maxmore Add 1	214.95	225.20	150.40	590.5	198
Choptank River	Irish Creek	129.35	124.30	49.15	302.8	24
	France	161.85	118.00	91.50	371.4	61
	Lighthouse	152.50	153.10	118.45	424.1	85
	Dickinson	136.00	152.82	140.30	429.1	91
	Hambrooks	110.75	161.35	163.35	435.5	94
	Beacons	155.75	193.10	88.45	437.3	95
	Chlora Point	129.45	163.40	155.60	448.5	101
	Mill Dam	139.40	223.90	87.45	450.8	104
	Dixon	142.40	226.95	81.80	451.2	105
	Howells Point Add 2	135.30	189.25	137.60	462.1	113

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Choptank River	Cook Point	126.75	128.80	209.00	464.6	115
	Howells Point	178.70	205.35	91.20	475.2	124
	Oyster Shell Point	151.04	230.65	106.50	488.2	129
	Tanners Patch	198.70	251.10	44.65	494.4	132
	Sandy Hill	161.35	195.55	153.05	509.9	142
	Bolingbroke Sand	172.54	223.31	130.62	526.5	153
	Drum Point	242.85	232.35	73.95	549.1	170
	Shoal Creek	182.15	220.28	183.50	585.9	194
	The Black Buoy	224.20	230.75	133.85	588.8	197
	Cabin Creek	223.45	250.30	117.05	590.8	199
	Green Marsh	176.30	226.35	216.20	618.8	223
Patuxent River	Hawks Nest	91.35	123.81	175.62	390.8	68
	Neal Add 1	65.40	131.00	205.70	402.1	75
	Back Of Island	104.75	104.05	202.10	410.9	77
	Sandy Point Lumps	106.05	116.10	201.15	423.3	84
	Broome Island	135.29	141.07	151.32	427.7	88
	Bob Wise	90.90	135.25	201.55	427.7	89
	Hellen	122.75	127.10	199.85	449.7	103
	Hungerford Hollow	119.65	112.05	219.55	451.2	106
	Spencers	117.80	106.75	229.15	453.7	109
	Swash	106.45	186.05	185.50	478.0	126
	Holland Point2	140.30	235.15	129.20	504.7	140
	Broad Neck	161.85	220.00	131.45	513.3	145
	Thomas	219.60	212.80	108.85	541.2	165
	Trent Hall	181.40	222.20	205.05	608.7	215

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Patuxent River	Southeast Middleground	208.20	174.65	237.50	620.4	225
	Buzzard Island	225.90	225.25	176.05	627.2	230
Mid-Bay East	Kent Point	92.50	198.60	108.10	399.2	74
	Stone	94.35	152.80	169.30	416.5	80
	Brick House	191.70	214.75	108.10	514.5	146
	Broad Creek	193.40	242.15	82.00	517.5	148
	Poplar Island	189.18	216.03	122.83	528.0	156
	Shell Hill	255.75	209.40	98.40	563.5	181
South River	Thunder And Lightning	84.70	202.30	101.35	388.4	67
	Outer Round Point	113.40	208.35	153.55	475.3	125
	Hill Point East	159.65	245.55	130.25	535.5	159
	Swan Reef	240.05	230.00	70.00	540.0	162
	Rock Point1	174.70	247.85	176.45	599.0	207
	Purdy Flats	194.35	239.65	194.80	628.8	233
Wicomico River West	Wicomico Middleground	179.60	203.85	63.65	447.1	99
	Mills East	178.61	216.44	102.61	497.7	136
	Bramleigh Creek	129.25	255.85	130.30	515.4	147
	Lancaster	178.34	238.59	106.97	523.9	151
	Rock Point	193.55	210.15	145.90	549.6	171
	White Point	203.50	255.85	133.15	592.5	200
	Mills West	194.95	239.95	162.35	597.2	204
	Cohouck	201.17	256.83	142.00	600.0	210
	Manahowic Creek	273.25	255.85	125.33	654.4	244
	Mouth Of River	264.28	258.67	176.44	699.4	256
Potomac River Northshore	St. George Island	195.65	92.90	170.30	458.9	112
	Kitts	145.35	88.05	231.70	465.1	118

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Potomac River Northshore	Jones	143.14	101.84	227.84	472.8	123
	Cornfield Harbor	185.00	108.40	202.45	495.8	133
	Hurdle	125.75	141.95	233.90	501.6	138
	Milbourne Shore	168.45	143.05	228.75	540.2	163
	Pascahanna	170.90	251.67	127.53	550.1	172
	Tall Timbers	235.60	146.40	192.75	574.8	187
	Heron Island	315.80	248.95	33.50	598.2	206
	Beacon	234.35	255.85	109.75	600.0	209
	Cobb Island	266.75	222.95	112.33	602.0	211
	Popes Creek	230.80	248.95	144.50	624.2	226
	Lower Cedar Point	219.13	232.37	173.34	624.8	228
	Sheepshead Bay	303.00	245.00	122.17	670.2	247
	Swan Point	233.69	259.54	227.42	720.7	260
Eastern Bay	Johnson Island	189.20	193.45	82.20	464.8	116
	Mill Hill Sanctuary	161.00	167.90	140.55	469.4	122
	Cedar Island	121.18	177.82	198.14	497.1	135
	Bugby	190.01	188.10	142.92	521.0	149
	Wild Ground	197.38	202.23	127.08	526.7	154
	Lows Point	187.00	208.50	139.45	535.0	158
	Mill Hill	216.30	204.90	131.55	552.8	173
	Bald Eagle Add 3	248.45	225.90	87.95	562.3	180
	Bodkin Shoals	188.73	194.98	186.88	570.6	184
	Turkey Point	231.55	204.60	137.00	573.1	186
	Bald Eagle Add 2	201.25	170.90	203.95	576.1	189

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Eastern Bay	Hollicutts Noose	185.95	235.68	157.09	578.7	192
	Normans Fine Eyes	273.90	216.00	96.89	586.8	195
	Walter White	257.50	233.69	114.69	605.9	214
	Parsons Island	233.41	202.73	175.73	611.9	219
	Ringold Middleground	208.00	244.86	172.29	625.1	229
	Well Cove	223.50	237.56	186.19	647.2	241
	Cox Neck	279.75	234.40	168.56	682.7	252
Miles River	Turtle Back	177.60	172.90	162.45	513.0	144
	Coffee	173.50	184.95	169.05	527.5	155
	Herring Island	170.45	237.20	137.45	545.1	168
	Wild Ground	141.20	205.05	199.15	545.4	169
	Persimmon Tree	182.40	220.40	151.35	554.1	174
	Sycamore	173.25	211.75	179.45	564.5	183
	Ash Craft	234.75	213.40	151.75	599.9	208
	Second Point	257.35	218.30	154.00	629.7	235
	West End	212.00	212.90	218.70	643.6	238
	Long Point	297.20	242.25	139.30	678.8	250
Mid-Bay West	Coots	209.48	229.10	105.56	544.1	166
	Hackett Point	206.50	236.41	118.88	561.8	179
	Tolly Point	227.36	250.18	86.64	564.2	182
	Holland Point	290.70	252.85	174.40	717.9	259
Potomac River Southshore	Ragged Point	228.88	182.43	89.63	500.9	137
	Kingcopsico	311.30	222.30	27.30	560.9	178
	Gum	215.75	254.60	126.45	596.8	203
	Bonums	207.93	242.43	147.00	597.4	205
	Great Neck	287.29	263.36	215.36	766.0	262

Region	Bar Name	Mean Live Oyster Rank	Mean Live Spat Rank	Mean Total Obs. Mortality Rank	Total Score	Rank
Breton/St. Clements Bays	Dukehart Channel	178.50	237.40	138.35	554.2	175
	Blue Sow	198.90	230.50	130.17	559.6	177
	Black Walnut	264.95	235.85	163.50	664.3	245
Severn River	Chinks Point	207.53	255.85	141.53	604.9	213
Upper Bay East	Swan Point	178.07	227.96	130.22	536.2	160
Upper Bay East	Love Point	184.30	243.25	144.95	572.5	185
	Tolchester Lump	238.85	238.70	132.90	610.4	216
	Deep Shoal	246.90	245.60	132.20	624.7	227
	Hodges	276.85	251.10	124.75	652.7	243
	Flat Rock	308.10	245.60	167.42	721.1	261
Upper Bay West	Nine Foot Knoll	239.85	238.35	97.70	575.9	188
	Sandy Point South	225.70	251.85	116.67	594.2	201
	Seven Foot Knoll	265.30	247.85	82.65	595.8	202
	Sixfoot Knoll	239.59	254.64	118.14	612.4	220
	Lumps East Of Craighill Channel	264.80	247.68	107.87	620.3	224
	Man O War Shoals	213.41	243.63	177.13	634.2	237
	Mountain Point	245.55	258.95	139.77	644.3	239
	Coal Lump	291.05	255.85	141.20	688.1	255
Wye River	Mills	198.55	243.15	139.80	581.5	193
	Whetstone	253.80	235.65	114.70	604.2	212
	Bruffs Island	220.45	235.30	172.05	627.8	232
	Race Horse	235.05	231.85	178.70	645.6	240
	Wye River Middleground	242.05	219.50	208.80	670.4	248
Chester River	Drum Point	203.55	235.65	101.10	540.3	164
	Hail Point	186.35	215.55	156.45	558.3	176
	Wickes Beach	234.20	230.70	111.95	576.9	190

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Chester River	Piney Point	239.60	253.47	84.47	577.5	191
	Buoy Rock	224.14	246.23	140.18	610.5	217
	Horse Race	293.31	249.69	67.95	611.0	218
	Durdin	235.28	254.06	124.97	614.3	221
	Spaniard Point	237.75	255.85	133.80	627.4	231
	Strong Bay	192.97	235.20	200.82	629.0	234
	Ebb Point	250.45	255.85	126.20	632.5	236
	Boathouse	289.95	255.85	103.17	649.0	242
	Sheep	282.90	251.10	133.30	667.3	246
	Shippen Creek	280.55	247.85	153.65	682.0	251
	Old Field	268.55	255.85	158.65	683.0	253
	Emory Hollow	260.65	242.30	180.45	683.4	254
	Cliff	277.75	255.85	180.50	714.1	257
	Bluff Point	286.35	255.85	172.80	715.0	258