Appendix L. Panel Meeting Minutes

This appendix contains the meeting minutes from the 30 Panel meetings held between December 2016 and October 2022. The meeting minutes describe discussions the Panel held to define and identify oyster practices and oyster-associated protocols for BMP consideration, and to develop the recommendations described in this report.

Oyster BMP Expert Panel Meeting, December 8, 2016, 1:00-3:00 PM

Location: Oyster Recovery Partnership, 1805A Virginia Street, Annapolis, MD and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Phone
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Phone
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	In Person
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	In Person
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Not Present
Bill Wolinski	Talbot County Department of Public Works	Not Present
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ed Ambrogio (EPA R3 Rep)	U.S. EPA Region III	In Person
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In person
Ward Slacum	Oyster Recovery Partnership	Not present
Emily French	Oyster Recovery Partnership	In person

Action Items:

1. **Action:** Suzanne will ask Liddel and Grizzle for their original data.
2. **Action:** Matt will send his data to Julie Reichert to compile for Julie Rose.
3. **Action:** Julie Reichert will incorporate Powell and Mann shell data sent by Lisa in Master spreadsheet.
4. **Action:** Once additional shell data is added to Master spreadsheet, Julie Rose will re-run quantile regression analyses.
5. **Action:** Julie Reichert will follow-up with Rich Batiuk on the status of the legal opinion concerning sequestration for in-water BMPs.

6. **Action:** Julie Reichert will follow-up with Ward to see if there is info on how much a bushel weighs and how much shell is returned to the Bay and where it came from (Chesapeake Bay or elsewhere).

Meeting Minutes:

1. **Coordination Updates**
   a. 1st report approval schedule: Watershed Technical Workgroup approved 1st report on 12/1/16; Jeff and Julie Reichert will be presenting the 1st report for approval during the 12/19/16 Water Quality Goal Implementation Team (both Habitat and Fisheries GITs have been invited to this meeting).
   b. Restore America Estuaries Conference: Panel's first report will be presented during the "The Shellfish – Water Quality Nexus" session.

2. **Begin conversation on N and P assimilation in shell protocols**
   a. **Preliminary conclusions from the policy group regarding the crediting of sequestered N and P in shell:**
      i. Julie Reichert: In discussing this with Region 3 council, CBP felt that sequestration could be allowed given that the nitrogen and phosphorus is considered a pollutant only when it's in the water column; CBP has sent request to general counsel at EPA headquarters to produce a memo capturing the agency's legal opinion concerning crediting N and P sequestration.
      ii. Chris asked, do we have any studies about shell degradation thus far, such as 1, 3 and 5 years from being placed in the water? Julie answered yes, a Waldbusser study that Ken Paynter originally mentioned; Suzanne also mentioned a thesis by Beth Darrow that is an analysis of N and P in a 2500 year old shell.
      iii. Matt asked, if oysters are actively growing, is there degradation happening to the shells? Chris said yes, that he has seen some natural oysters growing whose shells are being actively degraded in the Rappahannock; also mentioned that dissolution can be greater in VA due to the presence of boring sponges (Jim Wesson paper).
      iv. Julie Rose asked, I thought the concern with crediting shell for aquaculture was also about it not being returned back into the Bay? Julie Reichert answered, yes, that is also an issue that needs to be addressed; given that shell is an important and limited resource for these practices and the Bay, recommendations shouldn't encourage the unintended consequence of shipping shell away from the Bay; we will discuss this more later during this meeting.

   b. **Julie Reichert presented findings from compiling the shell data already acquired:**
      i. The Liddel data had some inconsistencies when compared to the other datasets (quite of few biomass values were much greater than the other datasets at shell heights less than 100 mm); unclear if this is "real" or if there was a data entry error of some sort (Lisa believes it is an error); for now, this dataset was removed from the preliminary quantile regression analysis conducted by Julie Rose.
         1. Matt asked if the Liddel data aquaculture or restored reef? Julie Reichert answered restored; mentioned that for his and Suzanne's project, the tech noted barnacles and spat on shells; since they add extra weight, could what is being observed in the Liddel data have something to do with this, if they didn't chip extra shell off?
         2. Julie said that the data above 100 mm shell height looked fine, so if it were a copy paste error it would seem that all the data would look odd; this may support Matt's theory.
      ii. In removing the Liddel data, we end up with 10 general locations instead of 22.
         1. Chris mentioned that the Eastern Shore is not as well represented now, which is where he expects more dissolution to be happening, which may affect shell sizes. Suzanne asked why? Chris said boring sponge is more prevalent in saltier water; Jim Wesson published a paper/ report two years ago that found within 5 years shell being researched was gone (in Virginia assuming).

2. Lisa said there is shell dry weight data in the Roger Mann data from VA that may help fill the gaps; Julie commented that we could look at that data especially if the Liddel data is flawed; Lisa said she'd be more interested in the Mann data since it has VA data in it.
3. Suzanne said she would be happy to meet up with Liddel to possibly obtain the original dataset to figure out if a data entry error occurred (Ken's database only included the compiled dataset).

c. **Julie Rose presented shell height to dry weight findings from analyzing the compiled shell data using the same quantile regression approach as tissue (without Liddel data):**
   i. Aquaculture shell data for with gear is lacking; the 50th quantile for the oysters in cages is lower than the rest of the data, potential to overcredit if combine with the no gear data.
      1. Matt asked about the sample size and mentioned that their study is collecting data now until May, so in a few months there will be a lot more data available for the in gear culture; data could shift upwards; when is the deadline for the 2nd report? Julie Reichert responded October to reach consensus, so there may be time to incorporate Matt and Suzanne's data, especially since it will help fill a gap.
   ii. Error around the 50th quantile for the oysters grown in cages is quite large due to small sample size; may need to go with a lower quantile (i.e., 30th) for the entire dataset; however the software produced identical results for the 30th and 50th quantiles (something odd is going on with the combined data; individual datasets looked fine; recommend separate estimates for off-bottom and on-bottom practices; quantiles looked better when data were separated by culture method).
      1. Lisa asked if we tried leaving out oysters larger than 125 mm given that is where the large spread occurs; Julie Rose said we could try that, but quantile regression is generally robust enough to account for the spread.
      2. Matt said he is curious to see how the regression would look with the 400 data points he sent earlier that day; Julie Reichert will incorporate this additional data in the Master spreadsheet for Julie Rose to analyze.
      3. Chris mentioned that he would expect the oyster data from the with gear dataset to be lower than the dataset without gear because contained aquaculture produces oysters with thinner shells; would justify separate estimates.
   iii. Julie Rose presented diploid and triploid data subsets; the triploid data is lacking; when looking at the triploid and diploid data from the same site, the diploid oysters had heavier shells than the triploid oysters.
      1. Matt said that the data is from the same farm and gear but the stocking date was not the same; diploid shell may weigh more but it could take diploids longer to get to that point; anecdotally, anything in a cage grows faster than on the bottom (may also influence dissolution rates); Matt suggests the categories, "diploid with gear," "diploid no gear," triploid with gear," and "triploid no gear" would work since there is a growth rate difference.
      2. Matt said it is difficult to substantiate the claim that triploids grow faster than diploids unless they're in the same areas.
   iv. Chris asked, how separated do farmers keep diploids and triploids?
      1. Panelist mentioned that not a lot of farmers use diploids in gear or triploids on bottom, but can occur.
      2. Another panelist mentioned that the use of diploids may become more popular because it can be difficult to get triploids.
   v. Julie Reichert asked, do we keep all 4 combinations that Matt suggested? Chris felt that culture method has a greater effect than ploidy; therefore separate out recommendations by culture method, but not necessarily ploidy; panelists agreed.

vi. Panelists felt getting more off-bottom data would be important along with data from VA; Julie Reichert will incorporate Matt and Suzanne's additional data and Powell and Mann data in Master spreadsheet to see if it helps fill in these gaps.

d. **Available literature for % N and % P content in shell**

i. Panelists agreed to include all Atlantic coast numbers (similar to tissue); Panelist asked why Grizzle et al. not included (New Hampshire data); Julie Reichert explained the Grizzle research was removed because it was an estimation from a graph; Suzanne volunteered to get in touch with Grizzle for actual numbers.

ii. Matt asked- if the data looks like there is not a lot of N variability, do we need to separate by culture method? Julie Reichert responded that the separation would be needed to calculate the biomass to apply the percentages to.

1. Julie Rose said that we need to separate the biomass calculation by culture method because the software can't accurately calculate the 30th quantile for the combined dataset with the available sample sizes.

iii. Panelist asked- the % content in shell is pretty low (less than 0.2%); does it make sense to have a shell crediting protocol?

1. Julie Reichert said that when looking at the entire oyster, the amount of N is around 60% in the tissue and 40% in the shell (the 0.2% is just based on the amount of N in the shell compared to the other elements in the shell, not how it's distributed in the entire oyster); given that shell weighs more than tissue, it could be a substantial amount; Panelists agreed.

iv. Julie Reichert asked- should we use the same averaging approach that was used for tissue for consistency? Panel agreed.

v. Julie Reichert said there is less data available for % P and there is no triploid data; Julie Rose mentioned that they have a chemist that will be evaluating the N and P content in oyster tissue and shell of diploid and triploid oysters and that around the May-July timeframe that the first batch of data should be done.

1. Julie Reichert remarked on the approval process by the water quality GIT and watershed technical workgroup; 4 week review and 8-12 weeks to get through approval process, so would need data by early July at the latest if looking to finalize approval by December 2017.

e. **Idea on addition/subtraction method to not have to deal with determining shell dissolution**

i. Julie Reichert asked about whether shell crediting can use a simple addition/subtraction method (record how much shell is put in and subtract that number from what is removed to determine the amount of shell that can be credited)

1. Matt- unit is in bushels (unclear how much a bushel weighs or how many shells in a bushel); does ORP have any info on this?
2. Lisa- unclear how long they sat on land (how much deterioration occurred); Julie Rose said some are broken and are not uniform - you'd want to know the weight of all shell going in.
3. Julie Reichert asked if there is more shell coming out then is put back in?
    a. Matt said that for on-bottom aquaculture shell is used to build up their lease bottom before putting spat on shell on top; they could be at a disadvantage if using this method.
4. Chris said counting shell would be very complicated; good resolution at farm level but still complicated; Matt and Chris suggested only giving credit to off-bottom aquaculture producing singles since only a tiny fragment of shell is used as cultch; Panelist mentioned that this is still an issue because the shell that they are getting credit for can and should end up back in the Bay.
5. Julie Rose suggested including a deduction to the shell assimilation credit based on the assumption that 100% of the shell is being returned to the Bay—deduction could be derived from a known dissolution rate over a period of time, e.g., 5 years); having a default

deduction applied to the assimilation credit would account for shell being returned to the Bay and therefore wouldn't discourage recycling because the deduction would be applied regardless where the shell ends up.
   a. Matt suggested using a smaller quantile to account for this.
   b. Julie Reichert mentioned that they are working on getting a legal opinion from EPA on whether sequestration can be incorporated in the estimate; will follow-up with Rich Batiuk on the status.
6. Lynn said that the crediting of shell worries her from an implementation standpoint; shell is a limited resource that is highly competitive; not sure if it's worth having a shell crediting protocol given the potential unintended consequence of not recycling shell.
   a. Chris asked if we have shell acquisition numbers- do we know how much shell is returned to the Bay; Matt asked do we know how much SRA shell is from different places; Julie Reichert will follow up with Ward to see if we have any info on this.
   b. Mark said that there are reports that document that shell is in short supply (2016 Oyster Summit, Blue Ribbon Panel, etc.) - we don't want to dis-incentivize shell being returned to the Bay; this alone could be rationale for not endorsing a shell crediting protocol.
   c. Julie Reichert mentioned that STAC concluded not to give credit for shell because of this concern.
7. Jeff said that there is data available to determine the amount of N and P assimilated in the shell, but data concerning the shell budget and dissolution rates may be less available and that the variability in those numbers will likely be daunting.
   a. Panelist mentioned a Jim Wesson (sp?) paper with shell dissolution rate data.
8. Julie Rose asked about restoration; do we have a sense of reefs increasing/decreasing?
   a. Lisa said biomass increasing; likely adding more shell.
   b. Chris said there isn't really sequestration until burial.
   c. Panelist mentioned that N and P is also sequestered in the reef, but once it reaches a steady-state (no longer increasing) then no more credit should be given.
   d. Panelist mentioned that Jay Lazar (sp?) is collecting reef spatial extent and height data for the 3 year check in (Harris Creek).
   e. Jeff mentioned that there isn't a huge amount of P in the shell.

Oyster BMP Expert Panel Meeting, January 19, 2017, 1:00-3:00 PM

Location: Oyster Recovery Partnership, 1805A Virginia Street, Annapolis, MD and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Not Present
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Phone
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	Not Present
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Not Present
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Not Present
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Phone
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ed Ambrogio (EPA R3 Rep)	U.S. EPA Region III	In Person
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In person
Ward Slacum	Oyster Recovery Partnership	In person
Emily French	Oyster Recovery Partnership	Not Present
Guest	**Affiliation**	**Present?**
Carl Cerco	US Army Corps of Engineers	Phone

Action Items:

1. **Action:** Carl will present additional information on the oyster model scenarios during Feb. 16 meeting
2. **Action:** Jeff will put together examples of calculations for a denitrification estimate; will send draft Marinetics paper when done.
3. **Action:** Suzanne will send link to presentations from the watermen's expo

Meeting Minutes:

1. **Coordination Updates**

a. 1st report updates: Press release with CBP, interview with Aquaculture N. America, ORP presenting Panel's recommendations at special session, "Aquaculture to Restore Coastal Ecosystems," at Aquaculture America 2017 (February 19-22).
b. The shell data are still in the process of being collected and cleaned up. We will resume the shell crediting protocol conversation once the data is ready.

2. Oyster Model Scoping Scenarios

a. Carl Cerco presented information on the oyster model scoping scenarios.
   i. Oyster model was developed in 2000 to evaluate potential water quality benefits from a 10-fold increase in oyster population, but was left dormant in TMDL (at that time the oyster population was not large enough to exhibit a noticeable impact to water quality)
   ii. Oyster model has not been calibrated or compared to data for biomass and distribution to consider growth in oyster population from oyster restoration and aquaculture activities.
   iii. Incorporating aquaculture is somewhat difficult given that the conditions may not be appropriate in a cell for oysters to grow; only have MD aquaculture harvest data by counties (actual location could not be given due to privacy regulations); will assign aquaculture locations by salinity and depth criteria.
   iv. When sanctuaries overlap with existing reefs then if will be assigned as sanctuary.
   v. For VA private landings data Mark provided info on decline and increase pattern: In the 1980s, the transplanting of wild stocks from low salinity to high salinity areas stopped due to disease (reason for decrease in landings); in 2009 private leasing started up causing an increase in oyster production.
   vi. Main takeaway from preliminary oyster model scoping scenarios: a significant impact in reducing chla and total nitrogen at tributary scale from increased aquaculture oyster biomass.
   vii. Jeff- important to consider location of reefs; 3% of Harris Creek planted resulting in 30-fold more biomass than surrounding areas; need to consider net biogeochemical processes.
b. Panelists discussed options in incorporating information as a BMP estimate versus incorporating directly into the model:
   i. Carl- ideally it would be beneficial to compute denitrification and burial in the model and compare with potential BMP estimates; also it would be better to be able to adjust the model to have the oysters placed where there are actually oysters; the model would do a better job incorporating the condition of the water.
   ii. Mark agreed with Jeff that we shouldn't do bay-wide analyses of oysters in model runs, but fundamentally agreed with Carl that it makes sense to incorporate denitrification in the model.
   iii. Panelists agreed that it would be useful to evaluate both approaches (model vs. empirical) to compare results to determine which would be the best approach to consider the water quality effect.

3. Thoughts on deriving a default denitrification estimate

a. Jeff presented his ideas on how to go about calculating a default denitrification estimate for Panel discussion:
   i. Jeff- In thinking about "enhanced" denitrification by oysters, we need to consider not only the footprint area (location of oysters), but also the surrounding area where biodeposits may be transported to; quantifying just at the site may not be appropriate.
   ii. Jeff- Also we need to consider N remineralization that occurs with and without the presence of the oysters; N remineralization does occur in the water column and sediments without oysters; oysters move the organic matter quicker to the sediment where N remineralization is greater; do we subtract what have occurred in the water column and sediment without the oysters (i.e., 50/50 assumption – only credit half the denitrification?).

iii. Jeff- Material that is processed directly underneath the oysters may not help water quality; however, if it is spread out away from the site there could be a benefit; need to consider biodeposit production and distribution; if using just the footprint area you could be overestimating a negative impact; need to figure out what the net enhanced denitrification value would be that considers both the footprint area and surrounding distribution area.
iv. Jeff- Overall we need to consider what makes sense for a BMP; can we develop a conservative default estimate for enhanced denitrification? Potential outcomes could include:
    1. Develop framework on how this could be done, but there may not be enough data to determine an estimate.
    2. Develop a default estimate that can be applied across all oyster practices/reefs.
    3. Recommend a site-specific estimate approach.

b. Panel discussion
    i. Mark agreed that physics matter and where biodeposits end up – would make sense to model and included recommendations for model inputs.
    ii. Bill- oyster reefs have been shown to clear the water and bring back SAVs (amount of material filtered out of water column is important).
    iii. Lew- likes the idea of a system approach; current oyster model is a larger systems approach; staging the model in shallower waters would be better for assessment of the water quality benefit.
    iv. Jeff- Marinetics have an 80 ft hole nearby, does denitrify.
    v. Jeff- For the stream restoration bmp, the estimate is not based on a regular process, instead a model is put in place to make the calculation; the model allows for site-specific estimates.

Oyster BMP Expert Panel Meeting, February 16, 2017, 1:00-3:00 PM

Location: Oyster Recovery Partnership, 1805A Virginia Street, Annapolis, MD and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Phone
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Phone
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	Phone
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	In Person
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Phone
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Phone
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ed Ambrogio (EPA R3 Rep)	U.S. EPA Region III	Not Present
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	Phone
Emily French	Oyster Recovery Partnership	In Person
Support Staff	**Affiliation**	**Present?**
Emilie Franke	Contractor, Fisheries GIT, NOAA Chesapeake Bay Office	Phone
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Guest	**Affiliation**	**Present?**
Carl Cerco	US Army Corps of Engineers	Phone

Action Items:

1. **Action:** Kyle and Julie will look into the VCU Rice Center and other locations as a possible public stakeholder location in Virginia.
2. **Action:** Chris will look into sharing VMRC aquaculture data with Carl.
3. **Action:** Matt and Carl will talk regarding max depth criteria of aquaculture in the model.
4. **Action:** Lynn will double-check the data accessibility on MD DNR's aquaculture siting tool.

5. **Action:** Jeff, Larry, and Lisa will work with Julie to capture denitrification BMP estimate information and thoughts to include in the report even if a BMP isn't established.
6. **Action:** Jeff will develop a table of terms to ensure consistent definitions throughout the report.

Meeting Minutes:

1. **Coordination Updates**
   a. Welcome to 3 new support staff from CBP: Emilie Franke, Paige Hobaugh, and Kyle Runion.
   b. ORP presenting Panel's recommendations at special session, "Aquaculture to Restore Coastal Ecosystems," at Aquaculture America 2017 (February 22).
   c. We are hoping to give a progress update at the WQGIT meeting in April in preparation for a public stakeholder meeting in May. Location is potentially Annapolis (CBPO). We can explore another session in Virginia but do not have funds to pay for a meeting location.
   d. Suzanne and Matt are water and oyster sampling at two locations that have potential for aquaculture research: Calvert Bay and Point Lookout. There are some nice experimental design sites with an adjacent natural reef. The farmer has the same strain of triploid oyster at each site and would be willing to put the same strain of spat on shell at each site. We are brainstorming potential research ideas for these sites such as denitrification in a reef next to an aquaculture sites or differences in meat quality.
   e. Andy and Lisa are beginning a new project in the Chesapeake Bay spring 2017 to work with aquaculture growers. This is a part of TNC's global marine strategy Aquaculture by Design program where we examine a range of conservation targets. This project has a partnership with four growers on the western shore of Virginia with both science and outreach aspects. Sites are in the Rappahannock, York, Lynnhaven, and Piankatank. We want to answer the question of is oyster aquaculture providing a service toward restoration of the Bay. Large and medium size operations use each floating gear and bottom cages. Nitrogen removed from shell and tissue, water quality data, sediment effects (organic content and grain size), benthic community structures, and mobile organism behavior will be investigated.

2. **Example of denitrification estimate calculation**
   a. Jeff presented an example of a calculation method for the denitrification estimate.
      i. Continuation from January. Summary of last meeting: We are trying to make estimates of enhanced denitrification associated with aquaculture or restoration. The issue with denitrification is that it occurs naturally to a significant proportion of the nitrogen in the Bay. We typically measure denitrification in the area of the reef, but biodeposit dispersion to the surrounding areas was measured as high as 90% at one site
      ii. Lew – Are you considering an enhanced settling rate of larger particles?
         1. Jeff – We are considering that this nitrogen was taken from the water column or sediments. The total system nitrogen regeneration does not change.
      iii. Components of denitrification: occurs in the water column and sediment in the reef area, and in the surrounding area.
         1. The efficiency of denitrification in each of these areas is an important parameter.
            a. There can be high spatial variability in the efficiency, based on transport to a high/low efficiency system.
      iv. There are conditions where an oyster reef is not particularly helpful in terms of denitrification even if rates seem high (high sediment efficiency, low halo) and vice versa.
         1. Halo: ratio of material transported off reef to that that was deposited within
         2. Because the efficiencies of the sediment and biodeposit processing are not changing, the only change is the net from the oyster reef.
            a. "Reef" is just referring to the area of the oysters – could be called aquaculture facility.
         3. Lisa – There are conflicting views on whether the algae pool is limited or unlimited.

v. Julie – Can you clarify reef efficiency?
    1. Jeff – The proportion of the ammonium that is regenerated on the reef into gaseous nitrogen.
vi. Lew – Would most biodeposits end up in shallow aerobic sediments?
    1. Jeff – The efficiency I used is from these shallow environments but there is a chance they would end up in deep channels where the denitrification efficiency is poor.
    2. Larry – A colleague ran a sediment transport model and found that larger, heavier biodeposits tended to settle in deeper water.
    3. Lew – Could the halo be modified to account for anaerobic activity? Could denitrification be quantified in these anaerobic areas?
vii. Matt – Curious to see how harvesting would effect biodeposit dispersal. Is there a nominal denitrification rate we assign? Unlikely at this stage.
    a. This calculation approach illustrates controls but is not a complete nitrogen model.

3. Oyster model – Denitrification Component

a. Carl presented calculations the oyster model uses for determining denitrification and gave an update on the status of the oyster model scenarios.
    i. Aquaculture refers to cages in this presentation.
    ii. Nitrogen cycle: Oysters filter particulate organic nitrogen from the water column. Feces and pseudofeces are deposited, some of which are resuspended and the rest into a particulate organic nitrogen (PON) pool. This PON pool is subject to burial or diagenesis to ammonium. A fraction of this ammonium is nitrified to nitrate, which is either denitrified or exchanged with nitrate in the water column.
        1. These processes come from various models: 2005 oyster model, sediment diagenesis model, water quality model.
    iii. We are having issues with locating areas in MD and VA where an increase in aquaculture to the desired level is feasible. The ten-fold increase needs to come from areas where oysters self-locate in the model rather than trying to push a ten-fold increase in each cell.
        1. Mark – On leased bottom in Virginia, almost all oysters were wild which declined in the 1980s and some seed was moved from elsewhere.
        2. Matt – The majority of Maryland aquaculture is spat on shell derived from a hatchery.
    iv. Bill - Side scan sonar data characterized into bottom habitat may be an important dataset here to show suitability.
    v. Lynn - There is, on MD DNR website, an aquaculture siting tool to show where all the active oyster leases, restricted harvest, sanctuary areas. Data accessibility can be an issue though.
    vi. Lew - At the small scale, oysters can have a significant impact on reaching local TMDLs.
    vii. Mark – Can Carl provide the rates of diagenesis in the model?

4. Denitrification Calculation Method Discussion

a. The Panel discussed their thoughts on which method they feel would best address denitrification (BMP estimate using an empirical approach, incorporating reduction via oyster model, combination, other?).
    i. Julie - Based on these models, it seems a conservative, default estimate would be difficult but a site specific estimate could be offered.
        1. Jeff – Agree. It is not clear if there are enough measurements and they do not converge particularly well.
        2. The panel agreed that they need a methodology for determining this.
            a. Larry - Would be difficult to confidently assign a number to the enhanced denitrification. An option is to state the science isn't available to recommend an efficiency.

b. Lew - Hopes there would be an estimate of additional transfer of organics to the sediment to show denitrification to the additional mass. Take conservative estimates and build an efficiency; this would be better than assuming no effect.
    i. Jeff - The fact that this can eventually affect nutrient trading makes this difficult.
3. Julie - Option is to use the retired oyster option in the estuarine model and treat it not as a BMP but allow it to be applied within the estuarine model.

ii. We hope to reach consensus decision regarding the denitrification protocol in next meeting.

Oyster BMP Expert Panel Meeting, March 16, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Phone
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Not Present
Andy Lacatell	The Nature Conservancy (TNC)	Phone
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	Phone
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Phone
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Not Present
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ed Ambrogio (EPA R3 Rep)	U.S. EPA Region III	In Person
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Phone
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	In Person
Emily French	Oyster Recovery Partnership	Not Present
Support Staff	**Affiliation**	**Present?**
Emilie Franke	Contractor, Fisheries GIT, NOAA Chesapeake Bay Office	In Person
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	In Person

Action Items:

1. **Action:** Jeff will standardize denitrification numbers from the literature and compile data examples from Harris Creek and the Lynnhaven River.
2. **Action:** Julie and staff will work with Jeff, Lisa, and Mark to re-structure the denitrification studies into categories discussed (Restoration = subtidal, below photic zone, subtidal in photic zone, and intertidal;

aquaculture = sediment grain size) and remove studies that used inhibition/slurry techniques to quantify denitrification.

3. **Action:** Bill and Ralph will investigate how the shoreline management and wetland panels derived efficiencies based on geography and environmental condition.
4. **Action:** Julie Reichert will revisit shell assimilation discussion and compile info on the %N and %P in shell.
5. **Action:** Julie Reichert (with help from staff) will conduct literature review for shell dissolution studies.
6. **Action:** Panelists will share any studies relevant to the shell dissolution discussion.

Meeting Minutes:

1. **Coordination Updates**
    a. Presenting Oyster BMP info at Seafood Seminar in Harrisburg, PA on April 4th at 3pm.
    b. MDE communications interested in including information on the approved oyster aquaculture BMPs (our first report) in their internal newsletter the Heron.
    c. WQGIT update scheduled for May 8th to introduce initial decisions by the Panel on how to proceed with shell and denitrification.
    d. An open stakeholder meeting is scheduled for 10am-12pm Monday, May 22nd at the Potomac River Fisheries Commission in Colonial Beach, Virginia, followed by a closed panel meeting until 2pm.
    e. Aquaculture North America recently posted an article regarding the Panel's work.

2. **Denitrification Literature Review,** Jeff Cornwell
    a. The group reviewed existing denitrification values from studies to evaluate whether a conservative estimate is possible for either aquaculture, restoration, or both grouped in the following categories:
        i. Restoration – Chesapeake Bay Studies & Other Location Studies
            1. Jeff- core studies (measured rates from sediment cores near and at the edge of reef sites) don't completely incorporate the complexity of reefs compared to chamber measurements.
                a. Core studies (e.g., Smyth) demonstrated 80-100% efficiency; chamber studies showed around 10-25% efficiency.
            2. Jeff suggested that the estimate should focus on studies that used the chamber method because the entire bottom community is included in evaluating denitrification rates (more reliable); a few studies in our review fit this criterion (e.g. Choptank and Lynnhaven data)
                a. This data did not see denitrification until high biomass was reached; Chris- can a relationship be formed to determine potential denitrification rates based on oyster biomass per square meter?
                b. The physical setting alters the relationship between biomass and denitrification.
                    i. To optimize denitrification – dark, high biomass, deep enough (minimizes wave related re-suspension of materials; keep material on site for higher chance to denitrify; pertains to reef restoration and on-bottom aquaculture).
            3. Jeff felt that the oyster model in the TMDL is not at the needed scale to evaluate local effects from enhanced denitrification from oyster reefs (not fine enough).
        ii. Aquaculture – Chesapeake Bay Studies & Other Location Studies

1. In some studies, up to 90% of the biodeposits were transferred off-site; there is no simple, straightforward calculation of the net benefit of denitrification in aquaculture.
    a. The main difference is the community factor, which you don't see in aquaculture. If you have offsite transport, you can have net benefits but challenging to calculate.
2. Other than oysters, mussels and clams – there are huge numbers of studies that show minimum denitrification and lots of ammonium production
3. Sediment grain size can be used as a crude proxy for the physical environment when categorizing studies.
    a. If we did this, facilities would need to verify their grain size.
4. Jeff – studies that used inhibition/slurry techniques to measure denitrification are not reliable and should be removed from the review.

iii. The wetland restoration BMP and shoreline management BMP derived efficiency estimates based on geography/landscape and environmental conditions. This strategy could be used here.
    1. Parsing these studies into different categories may be more effective: Restoration: subtidal, below photic zone, subtidal in photic zone, and intertidal; aquaculture: sediment grain size.

iv. With a limited number of studies, none were excluded by varying factors such as location or season of study.
    1. Bill – These factors should be taken into consideration though; such as season which can affect the rate of microbial activity and thus biodeposits and filtering through temperature.

b. Models have been found to be generally not accurately predictive of oyster denitrification. The hope is to find accurate denitrification efficiencies from the literature that we are comfortable assigning to these practices.
    i. The form these efficiencies take may differ but will be standardized to compare and evaluate studies.

c. Next step: Standardize the denitrification rates found in studies with appropriate methods and compare.

3. Shell Dissolution Method, Julie Rose and Julie Reichert

a. Share idea on how to address shell dissolution for aquaculture practices.
    i. Review following studies before meeting.
        1. Waldbusser et al. 2011 (particularly Figure 4)
        2. Powell et al. 2006
    ii. Amount of N and P assimilated in shell can be determined, but need separate estimates for on-bottom and off-bottom aquaculture; unknown whether there is enough information to incorporate dissolution effects when shell is returned to the water.
        1. Chris- Can we develop an accurate number?
        2. Julie Rose- we have a ton of data to develop the shell height to shell dry weight regressions.
        3. Regressions will be rerun with updated data from Mann, Matt & Suzanne, and possibly Liddel (Note: Liddel data were removed from the shell analysis since they were wet weights and not dry weights).
        4. The same approach as tissue assimilation will be used for shell assimilation estimates.

5. Julie Rose- Assume that 100% of shell is recycled; not sure if there is enough data to determine the effect of dissolution on the estimate.
6. Jeff- It is unknown whether the dissolution rate of N and P (no studies were found) is the same as the dissolution rate of calcium carbonate (few studies found).
7. Panelist mentioned that the dissolution rate of shells from off bottom aquaculture may be more rapid due to thinner shells.
8. Chris- also, boring organisms could cause shell to dissolve more rapidly.
9. Mark- stressed that a conservative dissolution rate should be used to avoid over-crediting.

iii. There is concern over discouraging shell recycling based on the potential credit for nutrient removal.
1. Shells currently have high value ($5/bushel in MD, $3.50/bushel in VA), so the resale of shells is going to be more lucrative than removal for credit.
2. Assuming all shell is returned to the Bay (the desired outcome), these concerns should be alleviated.
3. Suggestion was made to look more closely and other BMPs that aren't permanent fixtures, such as wetland and buffers; analogous with wetlands, oyster shell keeps accreting; panelist mentioned that most shell growth occurs in summer when dissolution is maximized.
    a. Bill- The wetland BMP is based on tidal and nontidal (not seasonal) and is a static number applied year-round.

iv. Apply a percent deduction from the shell biomass based on shell dissolution information and lifespan of harvested oyster of all harvested oysters receiving credit.
1. Apply % N and % P to the modified biomass after deduction has been applied.
2. Figure 4 of Waldbusser et al. 2011 provides dissolution time frames for multiple types of shell. A conservative rate is about 50% dissolution over two years when starting with weathered shell. BMP deductions could be based on this rate.

b. Is there enough information on shell dissolution? Julie and staff will review literature.

Oyster BMP Expert Panel Meeting, March 20, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Phone
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Not Present
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	In Person
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Phone
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Not Present
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Not Present
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	Not Present
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Not Present
Emilie Franke	Fisheries GIT, ERT/NOAA Chesapeake Bay Office	In Person
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	In Person

Action Items:

1. **Action:** Bill will provide which sections of Shoreline Management BMP report covered verification recommendations.
2. **Action:** Jeff will generate examples with Harris Creek and other data with proposed calculation for denitrification.
3. **Action:** Julie Rose will update shell regression
4. **Action:** Julie Reichert will update shell %N and %P content values (check with Grizzle on numbers).

5. **Action:** Emilie Franke will develop simple summary table of dissolution studies and Panel's conclusions.
6. **Action:** Jeff and Julie Reichert will draft May 8th presentation and send out for Panel review during week of May 1st.

Meeting Minutes:
This meeting focused on deciding which information to present during the May 8th WQGIT update related to the shell assimilation and enhanced denitrification protocols.

1. **Coordination Updates, Julie Reichert**
    a. Invited to speak at the Ecosystem services provided by shellfish resources session for CERF 2017 (drafting abstract this week; due on May 1).
        i. Julie Reichert will be presenting work on the first BMP report and initial findings of current panel report. All panelists will be listed as co-authors.
    b. MDE Heron article was canceled due to misunderstanding on what they wanted to cover in the article (more related to aquaculture in general and not the BMP); possibly a different article in the future.
    c. WQGIT update scheduled for May 8th; encourage folks to attend since the content presented here will be the focus of discussions during the May 22nd open stakeholder feedback meeting.
    d. Open stakeholder feedback meeting scheduled for Monday, May 22nd at Potomac River Fisheries Commission; Mike Foreman will be our facilitator. A survey of these presentations will be sent to registrants of the stakeholder meeting in VA on May 22nd. The registration link is open for the stakeholder meeting. Please indicate if you can attend. If you must attend remotely, you may lose some interaction with stakeholders during breakout sessions.

2. **Summary of Other BMPs for Perspective**
    a. Wetland BMP, Kyle Runion
        i. The Wetland Expert Panel's report of recommendations was approved through the CBP Partnership in December 2016. Recommendations were made for TN, TP, and TSS reduction efficiencies and upland acres treated values for nontidal wetland restoration. These efficiencies were determined through a literature review and acreage values through unpublished data and best professional judgement.
            1. The literature review had been specifically categorized by project type, wetland type, location, vegetation, etc., but eventually the panel decided to lump categories back together to a more wide-ranging group with a larger number of studies. The mean retention efficiency, in percentage, from these studies was used as the efficiency.
            2. Acreage values for existing projects were provided by panelists (unpublished data) and these were tweaked using the best professional judgement of panelists. The logic and thought behind these tweaks are well explained in the panel report.
        ii. This panel's recommendation was to use retention efficiencies of 42/40/31% (TN, TP, TSS) for wetland restoration. This was considered a conservative estimate from a large number of studies. Upland acres treated differed by physiographic region.
    b. Shoreline Management BMP, Julie Reichert
        i. Protocol 2: Denitrification
            1. Denitrification rates per area were compiled from a literature review and grouped so that one value was reported per study (18 studies) to define a grand median rate of 78 µmol/m^2/hr as a recommended denitrification rate.
                a. Calculation: Determine total post construction area of net increase of plantings and multiply by denitrification rate.

ii. Protocol 4: Marsh Redfield Ratio
    1. Determined C:N:P ratio, based on one study and adjusted based on median above and below ground vegetation mass of 25 studies. A one-time credit for initial uptake of nutrients from added vegetation was annualized based on the expected lifespan of a marsh (30 years based on this panel's best professional judgement).

iii. Discussion:
    1. Bill: Protocol 4 is a conservative approach as it is based on initial mass of planting and doesn't take into effect the growth of vegetation; Bill was on this panel and didn't agree with this decision.
    2. Jeff: The low number of studies is not ideal.
    3. Chris: Marsh plantings have varying vegetation (high/low marsh species). Are these credited similarly? If so, then this would be another weakness.
    4. Bill: crediting expires after 30 years; inspection and verification is done every number of years to ensure the BMP is functioning correctly; sea level rise was not specifically addressed.
    5. Jeff: Analogous to the stream restoration BMP by using rates per volume and turning them into areal rates; however denitrification in oysters is difficult to measure, but we are confident in our measurements; with oysters, have to consider the fate of nutrients without the oyster practice.

3. Enhanced Denitrification Protocol, Jeff Cornwell

a. Jeff went over standardized denitrification values from studies; he chose studies based on a general rule that they had to have used a modern technique (e.g., in-situ chambers, near/far cores) instead of outdated methods (e.g., acetylene inhibition technique). Table of studies summarize denitrification rates at face value during the warm season.

    i. Restoration:
        1. Difficult to encapsulate reef denitrification, but this table does a good job of including all relevant data; particularly Kellogg et al. 2013 and Humphries 2016 appears to be most relevant.
        2. Rates were assigned by the incubation type and averaged by footprint area (values at the reef/aquaculture site) and control or far (representative of halo area outside of footprint area).
        3. These numbers are probably very conservative. It is possible that darker, deeper reefs are much more effective compared to intertidal reefs which involve more movement of water.
        4. Near/far core method had terribly low values compared to the reef community method; capturing the whole community effect is important for reefs, which may rule out near/far core studies.
        5. Looking at tidal; will add Harris Creek 2015 data.

    ii. Aquaculture:
        1. Most relevant studies included Higgins 2013, Lunstrum 2015, and Testa.
        2. Core can be representative for aquaculture versus restoration; it gives an image of the footprint of an operation.
        3. Some studies suggest that aquaculture hurts rather than helps in terms of denitrification (Higgins et al. 2013); example of where not to set up an aquaculture operation (poor sediment).
        4. If dispersion and fate of material out of the footprint area is considered, then the net reduction benefit from denitrification could be higher for aquaculture and possibly lower for restoration.

5. Testa study demonstrated that the farm denitrification rate was indistinguishable from the surrounding sediments; important to consider the net value based on enhancing denitrification with oysters present.
6. Panelist asked about mussels and clams; mussels and clams not generating the same level of biodeposits as oysters, so likely doesn't enhance denitrification like oysters do.

iii. Plots of enhanced denitrification ("calculation") and simple subtraction control sediments from rates in the oyster "footprint". ("Denitrification Table April 20 2017 Info")

1. Plot A: With "calculation" approach, denitrification rates would be lower (negative net value) at shallower depths and increase to a positive net reduction at deeper depths compared to the simple subtraction approach, which would be a consistent net positive reduction.
2. Plot B: Denitrification rates slightly lower with calculation method than subtraction method with increasing oyster denitrification efficiency; calculation method considers what's happening in the water column.
3. Plot C: With calculation method, denitrification rate decreases with increasing sediment denitrification efficiency; denitrification that already occurs in the sediment is considered with calculation method (represents enhanced denitrification from oysters being present); simple subtraction method doesn't capture this (only slightly decreases)
4. Plot D: Would offer a net benefit if using the calculation method compared to the simple subtraction method; aquaculture associated- applicable to both floating and caged, but floating disperses more particles than caged; other factors include tides/storms; High flows are a net benefit for everybody; Example: At Marinetics, 90% of biodeposits are transported off site, so if just using the simple subtraction method it would show a very low net benefit, but using the calculation method, you would see a large positive net value for denitrification.
5. Comparing sites and seeing range may help focus in on studies to include and determine what the acceptable range would be.
6. Julie Rose: It would make sense to only apply as a BMP to situations where there is a net benefit. Can we apply this default rate based on these estimates? Are there any scenarios where a conservative default rate could be applied with us saying that these gaps should be addressed?
    a. Jeff: With Lisa and my new datasets, we could run these numbers and examine.
    b. Run 2-3 sites with calculation and look at net effect; extrapolate to whole year.
7. Chris: Rate will change with oyster density (density at Choptank was high). Do we have data to help determine a minimum density unit (e.g., densities less than 25 m^2, enhanced denitrification would not occur)
    a. Jeff: We have some data in VA but are not extremely confident in it. Are we comfortable with assigning general rate and working from that?

b. For the May 8th update, we will focus on background, studies, variabilities, concepts & ideas to create preliminary look of the panel's direction.
    i. Julie Reichert and Jeff will work on these slides over the next week and send out for review in early May.

4. **Shell Assimilation Protocol (Aquaculture Practices)**
    a. **Shell % N and % P content, Julie Reichert**
        i. From December 2016 meeting minutes: Panelists agreed to include Atlantic Coast studies and to use same averaging approach as tissue once Grizzle and Reitsma data were included in table.
        ii. Added Grizzle et al. 2016 and Reitsma 2016 data; Reitsma found that culture method affected the %N in whole oyster. Should we look at the averages by culture method?
            1. Nitrogen – 0.21 mean % N in shell (0.23 if we look at culture method)
            2. Phosphorus – only two studies in three locations – 0.04
        iii. Discussion
            1. Chris: We may want to only look at culture and remove reef due to lack of oyster shell counting during oyster restoration projects.
                a. Julie Rose: Any reason to expect percent of N or P to differ based on culture method?
                    i. We should think about justification for differing of methods compared to how we did tissue.
            2. A triploid site average was included in the Reitsma study, which was higher than the diploid averages. Should this be included?
            3. Mark: Overall data has low variance. We could simplify and use the same approach we used with tissue.
                a. Agreement from Julie Rose, Suzanne. No opposition.
                b. **Decision**: The group will follow the same averaging approach as tissue for determining the %N and %P for the shell assimilation protocol.
    b. **Shell Dissolution, Emilie Franke**
        i. Went over literature review of studies related to shell dissolution/degradation.
            1. Based on shell dissolution review, is there enough information to apply a deduction to the shell credit? Does it make sense for aquaculture to have a shell credit given that the entire shell will eventually dissolve? May be more feasible with oyster reef restoration practices using a similar one time credit approach found in the shoreline management BMP.
        ii. Most studies reported shell loss, which includes dissolution, burial, predation, etc. We are not able to differentiate between these loss mechanisms.
        iii. Grouped spreadsheet into four categories
            1. A: Annual shell loss rates in Delaware Bay, James River
            2. B: Instantaneous shell decay rates based on Smith 2005
            3. C: Instantaneous shell decay rates based on Christmas 1997
            4. D: Daily shell dissolution rates from Waldbusser 2011
        iv. Discussion:
            1. Jeff: No study examines renewed bioavailability of shell N. It is likely that there is a proportional rate between shell dissolution and bioavailability of N.
            2. Lisa: Because some loss due to shell burial, the N is not lost and is decaying at a slower rate. Some of these studies are not directly applicable to aquaculture. Dissolution and burial are opposite fates with regards to the N cycle. This makes Waldbusser study the most relevant.
                a. Chris: Waldbusser study seems the cleanest, but since it is a lab study, there are many ecosystem effects that aren't in play here. It is strong in measuring pH effects but lacking in other senses.
        v. **Decision**: We likely do not have enough information to account for the fate of the shell once returned to the water to allow crediting for shell in aquaculture operations.

1. Will still present findings, but do not have a good sense of the fate and cannot assign credit.

c. For May 8th: update regression, update N and P content, summarize dissolution studies and decisions today. Note that we will have future conversation on restoration regarding shell assimilation.

5. Recap

a. At the May 8th WQGIT meeting, we will present
   i. Progress on shell assimilation for aquaculture practices and enhanced denitrification for aquaculture and restoration.
   ii. There is adequate science for determining the shell height to weight regression and %N and %P content in the shell. There is not enough science to adequately determine the fate of the shell once returned to the Bay.
   iii. Background on the denitrification studies, including a preliminary look at examples when considering the footprint area versus also considering the halo area.

Oyster BMP Expert Panel Meeting, May 18, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Phone
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Phone
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Phone
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Not present
Chris Moore	Chesapeake Bay Foundation (CBF)	In person
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Phone
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Phone
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Phone
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Phone
Bill Wolinski	Talbot County Department of Public Works	In person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not present
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Not present
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In person
Ward Slacum	Oyster Recovery Partnership	Not present
Emily French	Oyster Recovery Partnership	In person
Support Staff	**Affiliation**	**Present?**
Emilie Franke	Contractor, Fisheries GIT, NOAA Chesapeake Bay Office	In person
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	Not present
Guest	**Affiliation**	**Present?**
Mike Foreman Todd Janeski	Facilitator for May 22nd meeting 2nd facilitator	Phone Phone

Action Items:

1. **Action:** Panel will rovide comments on Dr. Porter's proposal to Julie Reichert (jreichert@oysterrecovery.org).
2. **Action:** Julie Reichert will revise breakout group discussion questions to reflect suggestions.
3. **Action:** Julie Reichert will eend breakout group discussion questions to stakeholders and panelists in advance of Monday's meeting.

Meeting Minutes:

This meeting will focus on finalizing the logistics and content for the May 22nd Open Feedback meeting.

Coordination Updates, Julie Reichert

1. May 8th WQGIT update; went well, only 1 question related to incorporating reproduction potential as a consideration for the reduction effectiveness.
    i. Panel response: The panel is looking at practices individually and protocols are being developed individually, it is not our goal to estimate or model what the effect will be or considering reproduction in reductions. It'd be up to the counties as to what protocol combination they'd like to use.
2. Dr. Elka Porter's research proposal concerning resuspension of oyster biodeposits and fate of nitrogen within.
    i. Dr. Porter would like to know if her proposal will help address research gaps in understanding the nitrogen reduction effectiveness of oysters.
        1. Dr. Porter is looking for a support letter from the panel; the panel will be providing her with one within the next week.
        2. She wants to know its importance to the panel, if the panel had any other ideas, or if the paper isn't addressing something in particular.
3. Open stakeholder meeting scheduled for Monday, May 22nd at Potomac River Fisheries Commission (facilitated by Mike Foreman); if haven't done so already, register at https://oysterrecovery.org/bmpregistration/.

Logistics and content of May 22nd Open Feedback Meeting, Julie Reichert

1. Agenda
    i. Todd Janeski will be assisting Mike with the facilitation of Monday's meeting.
    ii. Survey responses will be presented with previous comments received during the 1st report.
    iii. Attendees will be placed into discussion topics groups based on their expertise.
        1. The webinar group will be covering all three discussion topics.
    iv. 18 stakeholders have RSVP'd thus far with guests continuing to register up until today; list of attendees has been sent to panelists.
    v. 15 panelists will be attending.
    vi. The panel could potentially combine both denitrification topics into one group; they are closely aligned if there isn't enough people to separate into two groups.
        1. If a group is too large, will be difficult for facilitator to control flow of info. Looking to have around 12-15 people per group; more than that would be difficult for the facilitators to manage.
    vii. Following the stakeholder interest process; we will summarize what we see and hear in our groups.
    viii. For panel leads: Offer facts or sound science to the group, otherwise sit back and let conversation play out. Stay with your group after the 30-minute switch; don't spend time rehashing what happened in the previous session.

ix. A closed Oyster BMP Panel meeting will take place immediately after the Stakeholder Meeting (12:30-2pm).

2. Breakout group assignments
    1. Nitrogen and Phosphorus Assimilation in Oyster Shell for Private Oyster Aquaculture
        1. Facilitator: Mike Foreman
        2. Panel Lead: Julie Rose
        3. Note-Taker: Emilie Franke
        4. Panel Participants: Suzanne Bricker, Matt Parker, Karen Hudson?
    2. Enhanced Denitrification for Private Oyster Aquaculture
        1. Facilitator: Todd Janeski
        2. Panel Lead: Jeff Cornwell?
        3. Note-Taker: Paige Hobaugh
        4. Panel Participants: Chris Moore, Mark Luckenbach?, Lynn Fegley?
    3. Enhanced Denitrification for Oyster Reef Restoration
        1. Facilitator: Ward Slacum
        2. Panel Lead: Andy Lacatell
        3. Note-Taker: Julie Reichert-Nguyen
        4. Panel Participants: Bill Wolinski, Ken Paynter?
    4. Webinar (will cover all 3 groups)
        1. Facilitator: Emily French?
        2. Panel Lead: Lisa Kellogg
        3. Note-Taker: Kyle Runion
        4. Panel Participants: Larry Sanford

3. Breakout group questions
    1. Discussion
        1. Question Revisions
            a. 1a and 2a should be more open ended; phrase “Related to the approach that could be used” to assign reduction estimates since we have not yet concluded a reduction estimation.
            b. 2g should also be included after 1f.
        2. Questions should be sent to stakeholders and panelists in advance.
        3. Each group should have a consideration list to reflect on after questions for ideas/approaches that we haven’t even thought of yet.
        4. The panel will put together a summary of what’s discussed, will send to participants so they can provide further comment in addition to the 30-day comment review of final report that will come later.

4. Survey Comment review/discussion
    1. Shell Assimilation Survey Results
        1. Response Summary
            a. Benefit
                1. Oyster company of Virginia (OCVA) and Norfolk Public Works (NPW) want the Panel to focus on the benefit of shell being returned to the bay as a positive consequence because it can result in more oyster production; don’t want the panel to disincentive shell recycling programs.
            b. Crediting protocols

1. OCVA would like the panel to consider the difference in annual and perpetual crediting as applied to some practices, particularly of practices that don't require harvest.
2. Southern Environmental Law Center (SELC) would like the panel to consider that shells from caged aquaculture can be thinner. The panel has addressed this.
3. SELC would like the panel to consider how growth can differ between months/seasons. The panel has denitrification data for only warm months, has shell data for months outside of summer.

c. Unintended consequences
   i. Citizens Advisory Committee (CAC), Chesapeake Bay Commission (CBC), Chesapeake Bay Foundation (CBF), SELC are concerned with the unintended consequences of using shellfish as in-water BMPs; shell not being returned to the bay, basing water quality on organisms that could die.

d. Individual response from Dr. Lynton Land
   i. Policy related
      1. Dr. Land would like to see oyster BMP's compared with on-land BMPs, such as those relating to fertilizer; this is outside the Panel's charge.

2. Discussion
   a. The panel may take shell out of the equation of nutrient sequestration entirely given the uncertainties.
      i. Conclusion: we can quantify amount going INTO the shell, but longevity of the shell in the environment is what is in question.
      ii. Crediting is unfeasible at this time due to a gap in research- just allow shell to remain; its value alone as substrate is enough.
      iii. The panel will present this information at the Stakeholders meeting, leaving the conversation open ended.
   b. Stakeholders will receive notecards to write in the top 2 areas of research they'd like to see the panel analyze.
      i. Allows stakeholders to identify research gaps.
      ii. Stakeholders in the webinar can type their responses into the Adobe Connect chat box for record of response.

2. Enhanced Denitrification Survey Results
   1. Response Summary
      a. Baseline
         i. SELC hopes the panel considers burial and denitrification that would occur in the absence of oysters. This is being considered by the panel.
      b. Crediting Protocol
         i. Lynnhaven River Now (LRN) would like the panel to continue to consider crediting protocol for sanctuary oyster reef nutrient and sediment removal.
      c. Data concerns
         i. CAC, SELC, et al. find temporal and spatial limitations of the data used in the 2013 STAC report. The Panel are considering these questions, but have a process to follow as a panel ourselves.
      d. Unintended consequences
         i. SELC et al. wants to know how the panel is addressing heavy biodeposit accumulations that could result from heavy aquaculture operations.
      e. Verification

i. CBF thinks crediting should be accompanied by verification guidelines given that much variability exists among sites.

f. Individual response from Dr. Lynton Land

i. Dr. Land finds the concept of estimating reduction premature given available data. Biodeposit accumulation during low tide that could be detrimental; fate of them must be considered.

2. Discussion
    a. Crediting denitrification will likely be site-specific.
    b. Verification guidelines could vary depending on the site.

Additional Shell Assimilation Protocol Analysis, Julie Rose

5. Gear differences in shell dry weight are as expected.
    1. Higher shell weight in oysters grown without gear than with gear.
6. Ploidy differences in shell dry weight at a single site with common gear- Orchard Point Oysters
    1. Triploids lighter than diploids
        1. Julie Rose- Triploids don't spawn, therefore have more tissue mass; why are their shells thinner than diploids?
            a. Lisa mentioned that triploids are selected for fast growth and therefore, likely grow faster than diploids.
        2. Differences in shell thickness exist in diploid oysters grown on bottom versus in gear.
    2. Julie Rose- from preliminary analysis, we should take into account gear vs. no gear and ploidy, they may need to be credited differently.
7. There is no large difference in dry weight between seasons.
    1. Julie Rose- We likely would not need to take season into consideration; should follow the same recommendation as tissue.

Oyster BMP Expert Panel Meeting, May 22, 2017, 12:30 PM – 2:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	In Person
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	In Person
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Not Present
Chris Moore	Chesapeake Bay Foundation (CBF)	In Person
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	In Person
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	In Person
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Phone
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Not Present
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	In Person
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	In Person
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	In Person
Emilie Franke	Fisheries GIT Staffer, ERT/NOAA Chesapeake Bay Office	In Person
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Guests	**Affiliation**	**Present?**
Mike Foreman	Facilitator from Open Meeting	In Person
Todd Janeski	Facilitator from Open Meeting	In Person

Action Items:

1. **Action:** Include list of science priorities for practice-protocol combinations where there are data gaps to assign an estimate (i.e., shell assimilation protocols).

2. **Action:** Rich will check with EPA headquarters to see the status of the legal opinion on whether sequestration can be credited for an in-water BMP.
3. **Action:** Sort out definition of public fishery and oyster reef restoration practices.
4. **Action:** Jeff and Lisa- categorize denitrification data according to intertidal, subtidal, photic, and non-photic and run examples with enhanced denitrification calculations.

Meeting Minutes:
This meeting focused on reviewing and discussing the feedback from the open stakeholder meeting.

1. **Group 1 Discussion (N and P Assimilation in Oyster Shell for Aquaculture Practices)**
    a. Julie Rose commented that the stakeholders are interested in a list of science priorities in the Panel's 2nd report concerning this protocol (what should they focus on first to fill in the knowledge gaps); industry representatives mentioned that could help fund projects.
    b. The differences concerning % N and P in shell for the different culture methods was of interest to the stakeholders; the Panel is currently including this in their analysis.
    c. Panelists commented that the stakeholders were also interested in possible geographic differences related to % N and P: Chesapeake Bay versus New England versus Pacific coast.
    d. Suzanne commented on Brad Rodgers suggestion about giving the shell credit to the person who puts the shell in; she thought it was an interesting concept, but wasn't sure how it would work in application from a nutrient reduction standpoint.
    e. Panelists agreed that shell tracking would be important if there is to be a shell crediting protocol and should include such a statement in the recommendation report.
        i. Chris- what does our on land shell budget look like?
        ii. Rich recommended looking at the manure model to see how tracking could function (manure is transported between states).
        iii. Julie Rose suggested that the report can include recommendations for both the dissolution piece and the tracking piece (present both options).
    f. Jeff commented that what we care about is actually preservation (amount of N and P stored in the shell and for how long; what gets buried); Emilie Franke mentioned that this appears to be a time-sensitive BMP.
    g. Bill asked about whether we will be considering nutrients that are stored in an oyster reef in sanctuaries.
        i. Julie Reichert- yes, but it is a different practice-protocol combination; currently it's on hold waiting for the legal opinion from EPA headquarters on whether sequestration can be credited for an in-water BMP.
            1. Rich will touch base with the lawyers to see where they are at with this evaluation.
        ii. Panelist mentioned that this could be done by determining the standing stock (oyster biomass) of the reef and give a one-time credit; also can figure out % buried per year to receive a continuing credit.
            1. Jeff mentioned it would be a longer period of time for burial (3-4 years).
        iii. Jeff- reef structure will increase (grows over time); would need to determine the lifespan of the practice; not certain about the time constant for dissolution.
    h. Panelists mentioned that it will be important to build public-private partnerships to implement BMP; CBP should loop in the Oyster Advisory Committee, county oyster committees, aquaculture coordinating councils, Shellfish Grower's Association, seafood councils, and watermen associations; some of these groups may be less informed about CBP's goals.
    i. Panelist asked when it comes to the public fishery, who would get the credit?
        i. Lynn- in Maryland, the county pays to have spat-on-shell planted on public grounds; planting and harvesting in these areas are akin to on-bottom aquaculture.

ii. Matt- Depends on who pays to put the oysters down.
iii. Julie Rose- in Mashpee, MA, the credit goes to the city (they are paying to plant the oysters).
iv. Matt- the County takes the harvest tag data.
v. Lynn- there are records for the landing tax, but there will likely be a need for a different set of record keeping for the BMP; currently, MD does not have bar specific data.
vi. Panelists agreed they need to sort out the definition of public fishery.

2. Group 2 and Group 3 (Enhanced Denitrification for Aquaculture and Restoration Practices)

a. Panelist mentioned that, for aquaculture, some stakeholders felt that there's not enough data to determine a default estimate (there is a need for more research); there wasn't a lot of agreement about using a minimum default number; more interested in making the determination on an individual basis.
    i. Panelist mentioned that one of the wild harvesters suggested that the denitrification assessment could be done at point of the permit (industry could foot the bill to collect the necessary information).
    ii. Panelist suggested that the restoration denitrification value could work for on-bottom aquaculture.
    iii. Chris mentioned that outside groups define/perceive aquaculture differently; clear definitions and terminology will be important for the report.
b. Panelist mentioned conflict of use- where there is good sediment quality to set up an aquaculture operation, the public fishery would also want.
c. Panelist mentioned that stakeholders were very interested in what they need to consider from a management, research, and legal perspective (applies to aquaculture and restoration practices).
    i. Panel is responsible for the research aspect, but can provide recommendations related to application and verification guidelines.
    ii. Panelists agreed that the type of sediment condition (sandy, muddy, etc.) is important to consider.
    iii. Lisa and Jeff will be looking at the data using intertidal, subtidal, photic, and non-photic characterizations.
        1. For restoration, the expectation is that water quality benefits are occurring; however, need to understand the performance of the project related to the improvement of water quality.
        2. Planning to use Harris Creek, Upper and Lower Choptank, and Lynnhaven data to run examples with the enhanced denitrification calculation.
            a. Lisa mentioned that for intertidal, the Harris Creek data was manipulated, so it would be better to use the Lynnhaven data.
d. Rich emphasized that it will be useful from a BMP standpoint for the Panel to provide recommendations regarding the general characteristics of the site that would qualify for enhanced denitrification.
e. Chris- acreage versus structure of the reef should be considered.
f. For restoration, need to reach agreement on how many sites will produce sufficient confidence for a default estimate.
g. Panelist asked about wave consideration and effect on fate of biodeposits.
    i. Jeff- the Bay model characterizes hydrodynamics, but not at the level we would need.
    ii. Larry- upper mesohaline- silt coming from river doesn't mean it doesn't flow.
h. Need to understand sediment-oxygen demand to understand denitrification; sediment-oxygen demand is highly variable.

i. Jeff- it would be good to provide suggestions in report how this may be done cheaply.

3. Adjourn

a. Panel will reconvene on June 15, 2017.

Oyster BMP Expert Panel Meeting, June 15, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Phone
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Phone
Karen Hudson	Virginia Institute of Marine Science (VIMS)	Not Present
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Phone
Andy Lacatell	The Nature Conservancy (TNC)	Not Present
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Phone
Chris Moore	Chesapeake Bay Foundation (CBF)	Phone
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	In Person
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Not Present
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Not Present
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Phone
Bill Wolinski	Talbot County Department of Public Works	Phone
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Not Present
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Not Present
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	Not Present
Emily French	Oyster Recovery Partnership	Not Present
Support Staff	**Affiliation**	**Present?**
Emilie Franke	Contractor, Fisheries GIT, NOAA Chesapeake Bay Office	Phone
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Kyle Runion	Habitat GIT Staffer, Chesapeake Bay Program	Not Present

Action Items:

1. **Action:** Lynn will look in to Maryland's public fishery planting rate.
2. **Action:** Julie will look in to if "addition" is necessary of an enhancement activity.

Meeting Minutes:

This meeting will focus on reviewing and determining which oyster practices should undergo BMP implementation concerning the public fishery and oyster reef restoration practices and drafting definitions for these practices.

1. **Coordination Updates**
    a. The meeting summary report was sent out to stakeholders for review. Their comments are due in two weeks, by June 30th.
    b. This is Emilie Franke's last meeting- she is headed to graduate school at the University of Washington. Thank you for your help Emilie!

2. **Go over oyster practice table to determine which practices should undergo BMP consideration**

    <u>Public Fishery (Oysters Removed from waterbody)</u>

    a. **F- On-bottom public fishery oyster production using hatchery-produced oysters: Panel decided that it should undergo BMP consideration.** This practice can result in a reduction due to enhancement. The Panel will discuss its effectiveness and qualifying conditions in future meeting.

        Discussion:
        i. Panelist asked who manages the public fishery; panelist answered that the State manages the public fishery.
        ii. Chris: Virginia and Maryland differ in their public fishery management; VA adds substrate to their public grounds (40-50%) while MD enhances the public fishery by planting hatchery-produced spat-on-shell.
        iii. Lynn: Sees no difference between what is happening on bottom aquaculture leases and public bars in terms of N and P reduction from assimilation- the only difference is who has access to the oyster; stressed that if any similar public fishery practices are not considered then the Panel would have to have a scientific reason to justify that decision.
            1. Panelists discussed how for aquaculture leases there are minimum to no oysters present (non-productive bar), while on the public grounds these practices are occurring in areas where there are oysters present and on productive bars; how would enhancement on public grounds be determined (oysters harvested due to addition versus oysters that were already there)?
            2. Lynn: In MD, they don't get natural spat set like in VA; no all public fishery areas already have oysters present; a designated public fishery area doesn't necessarily mean it is a productive bar.
            3. Lisa asked whether there are private leases in any areas that were historically productive. Lynn answered no.
        iv. Lynn: There is specific accounting of kinds of oysters being put in MD public fisheries- boats spreading spat-on-shell are equipped with GPS to define the areas. Not all public fishery areas are naturally productive, some are more than others. Fishermen pay surcharge (bushel tax) on each bushel harvested which goes back to the State for the county to purchase spat-on-shell to put back on the public grounds. There is a complete accounting of what's going out and they know which bars are being harvested on. The bushels are tagged on the water.
            1. Chris: For verification, you would need GPS tracking of plantings in well-defined areas.
            2. Panelist mentioned you would have to survey the bar to determine what's there already.

v. Panelist asked whether for the spat-on-shell practice if planting rate or volume planted could be used to determine how many oysters resulted from the enhancement activity.
    1. Matt: Build into the estimate considerations of how many oysters were planted.
    2. Chris asked if the planting rate per acre is known; Lynn answered yes.
vi. Chris: Enhancement will be difficult to measure; need to know what you put down, possibly will need to estimate a mortality rate, come up with a detrimental/maximum return. Accountability measures will likely need to be developed; no one can receive credit for more than they put down. Does on bottom aquaculture also need to consider mortality and held accountable as well? Panelists felt this would not be needed since aquaculture leases are in areas where there are minimum to no oysters (non-productive area).
    1. Panelist mentioned that plantings occur over plantings on an annual basis; recommendation needs to take this into account.
vii. Matt: Agrees that a state/county putting down spat on shell is no different than on bottom aquaculture receiving credit for oysters.
viii. Julie: Might be easier to not focus as much on what is already there; give credit on what was planted. No one may receive credit for more than what was planted.
ix. Panelist asked who would be receiving the credit; don't want productive public bars being exploited to receive more credit; Julie Reichert: It isn't up to the panel to decide who ends up with the TMDL credit, but we can preface this concern by using "the panel feels that…"; overall, EPA has oversight role on how jurisdictions implement.

b. **G- On-bottom public fishery oyster production using transplanted wild oysters:** Panel decided that it shouldn't undergo BMP consideration. Consensus is that moving wild oysters form one place to another is not an enhancement activity.
c. **H- On-bottom public fishery oyster production using substrate addition**: Undecided- the Panel will consider for now. The addition of substrate makes this an enhancement activity with the potential for new oyster growth. Qualifying conditions would likely differ from aquaculture; topic will be revisited with the option of not considering it in the future.

Discussion:

i. Matt: This occurs more often in VA than it does in MD. If substrate wasn't placed in an area, oysters wouldn't grow in that area- this is enhancement; Suzanne agreed; Lynn mentioned that some bars would disappear without adding shell back.
ii. Mark: This substrate goes onto reefs that have been productive but cannot sustain natural and harvest shell loss. This enhances the productivity of those reef; without substrate addition, the net shell budget of these areas would be zero; need to understand more what component of the harvest is attributed to the substrate addition.
iii. Bill mentioned that there are bottom conditions that limit oyster production; Chris mentioned that substrate addition can be used to convert a nonproducing area due to poor bottom conditions to a more productive area by adding substrate to improve the bottom condition; this is a bit different than adding substrate to already productive bars.
iv. Matt: This process should mirror the aquaculture example. This is an enhancement activity from a reduction standpoint; it should come with different application guidelines, qualifying conditions to employing the BMPs (no credit given for more than is put in, credit is given only for removal, no credit until oysters are harvested).
v. Chris: Doesn't see adding substrate to productive bars as an enhancement activity that rises to the occasion of significant reduction.

vi. Lynn: Comfortable having this mimic the aquaculture example, otherwise we must be extremely clear as to the difference between the two. Still unsure what the difference is.
vii. Lisa: Should the total harvest be discounted though, since shell is being added back? Panelist answered no since tissue is a separate estimate; also adding shell back has many benefits to the shell budget and habitat.
viii. Panelist felt that the focus of shell usage should be for spat-on-shell practices.
ix. Suzanne: For non-productive areas where there are little or no oysters, enhancement is occurring from substrate addition.

d. **I- Public fishery with no activity: Panel decided that it shouldn't undergo BMP consideration.** Consensus is that no enhancement is occurring to produce more oysters.

<u>Oyster Reef Restoration (Oysters remain in waterbody)</u>

a. **J- Active oyster reef restoration using hatchery-produced oysters: Panel decided that it should undergo BMP consideration.** Consider change to oyster practice title: "Oyster reef restoration using hatchery-produced oysters."
b. **K- Active oyster reef restoration using wild oysters: Panel decided that it should undergo BMP consideration.** Consider change to oyster practice title: "Oyster reef restoration using substrate addition."
c. **L- Passive oyster reef restoration: Undecided- the Panel will consider for now.** Consider change to oyster practice title: "Oyster reef conservation." Panel would like more information on whether there are other BMPs based on conservation.
d. **Discussion:**
    i. Bill: Eliminating harvest pressure from conservation implies that an activity is involved; would expect population to improve with time.
    ii. Lisa: Sanctuaries have the potential for enhancement; areas closed off to harvest have seen increases in population.
    iii. Julie Rose: Remove restoration from title, replace with conservation. Simplify other titles (remove active, passive).
    iv. Chris: Unsure that this practice leads to enhancement as there are no additions.
    v. Julie Reichert: Thinks that enhancement doesn't necessarily need to be associated with addition, sanctuary enhancement can be defined as a "no-take" area.
    vi. Mark: Look into terrestrial conservation easements as an example; another panelist recommended looking into buffer strips, since they are left alone to regrow.
    vii. Larry: Would credit be given for soft tissue since it's never taken out? Credit would have to be from either shell or denitrification, neither of which estimates have been determined for yet.

3. **Decide which practices will be covered in the 2nd report concerning the shell, tissue (public fishery) and denitrification protocols**
    a. The panel is in a good place with shell to begin writing it up for private aquaculture.
    b. Tackling public fishery practices in the second report could be easy if it aligns well with the aquaculture model. Nuances may slow down the approval process, putting denitrification progress on hold as well.
    c. The third report would cover everything dealing with sequestration and is slated to begin around this time next year. The EPA lawyers are still deciding the legality of sequestration; their decision may impact whether a third report occurs. This provides a good argument for including every other practice in the second report.

4. **Define oyster practices that will be covered in the 2nd report**
    a. This topic will be addressed via email.

Oyster BMP Expert Panel Meeting, August 17, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remotely
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Karen Hudson	Virginia Institute of Marine Science (VIMS)	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remotely
Andy Lacatell	The Nature Conservancy (TNC)	Remotely
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	No
Chris Moore	Chesapeake Bay Foundation (CBF)	Remotely
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Remotely
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remotely
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	No
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	In Person
Emily French	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person

Action Items:

1. **Action:** If any panel member's commitments no longer allow them to participate, please inform Julie Reichert.
2. **Action:** Final definition comment consensus will be done via email. Feel free to send Julie emails if you have any comments for revision.
3. **Action:** Jeff will work at determining realistic criteria for site-specific assessment in time for the September meeting.
4. **Action:** Julie will draft and distribute summary notes of this discussion and send to the panel; the conversation will continue through email.

Meeting Minutes:

This meeting will focus on reaching consensus on the definitions for oyster reef restoration and public fishery practices and to review the denitrification analysis to determine if a conservative default estimate is feasible. If time permits and information is ready, then we will also discuss the updated shell quantile regression analysis and public fishery BMP concepts.

1. **Coordination Updates**
    a. CERF abstract accepted: Presentation on Monday, November 6, 2017 at 1:15 PM during the Ecosystem services provided by shellfish resources session.
        i. The session will be co-led by Suzanne and Julie Rose. They hope to present something on denitrification if possible; Julie Reichert's preference is to present to the Water Quality GIT beforehand and incorporate any updates before CERF presentation. Harris Creek information will be presented in addition to an enhanced denitrification presentation (Thursday morning) at CERF as well.
    b. Draft report timeline.
        i. Before the panel decided to include public fishery practices, the draft report was expected to be complete by October. It may now take longer to complete.
2. **Review definitions –** See Definition file with Panel edits.
    a. **Comment:** Lisa sees the Marylanders Grow Oysters and CBF's Oyster Gardeners programs as falling under the "Oyster Reef Restoration using Hatchery-Produced Oysters" category as both programs distribute small oysters for grow-out by individuals at their docks and then collect those oysters and plant them in sanctuaries.
    b. **Discussion:**
        i. Julie Reichert agrees.
        ii. With respect to how many oysters are placed in the water, panelists should be cognizant that the numbers are estimates. Individual oysters are not being counted; sometimes they move 2-3 times before they are planted.
        iii. If it is possible to assign enough caveats to oyster garden oysters (since they move around so often), then we should count them.
        iv. Biomass estimates should be done every 2-3 years on restoration reefs to quantify how large the oysters get.
        v. The Marylanders Grow Oysters program counting protocol is heavily estimate based and very site specific; volunteers don't all care for their oysters the same way.
    c. The panel needs to create Qualifying Conditions that addresses the need to know how big the oysters are when they are removed from their initial grow-out location.
        i. If an oyster is less than two inches once it reaches location, then its benefits translate to where its transplanted to.

Action: Final definition comment consensus will be done via email. Feel free to send Julie emails if you have any comments for revision.

3. **Denitrification estimate analysis**
    a. Jeff will present his findings from his evaluation of whether the data supports a conservative default estimates for enhanced denitrification.
        i. Jeff created a flow chart to determine which data to use for this analysis (see figure on page 2 of Jeff's handout).

On-Bottom Aquaculture

i. Whole Community Consideration
    a. Sediments in reefs receive large amounts of organic matter and it turns into ammonia; it needs to be turned to nitrate and be kept around for

denitrification to occur. Sediments don't nitrify very well. The process isn't entirely understood, but denitrification is very localized and happens through the oyster shell. Huge amounts of activity by other animals (polychaete worms) even if the shell is empty.

b. Gene Caffrey has gulf coast data that says the same. If you do not consider the entire community (including the sediment), you will not get the correct estimate.
c. Most literature seems to be missing most of the denitrification occurring in the entire community.

ii. Acceptable Protocol
a. ^{15}N and N_2:Ar method studies might be appropriate – data from these studies is robust.
b. Must look at m^2 of the reef, that is where the denitrification is happening. Area rates or oyster biomass are the only data we can accept.
c. Jamaica Bay/NYC data – N to N_2O to NO method may or may not provide a realistic estimate as they flood their systems with nitrite.
d. Denitrification rates might be different in communities that are continually disrupted (e.g. dredging).

iii. Sufficient Data
a. Harris Creek, Lynnhaven, Hillcrest, Nanticoke provide a lot of data.
b. Probably cannot provide a generic, low number for what a reef does.
c. We need site specific data to determine estimates. This fall the panel can create a spreadsheet with specifications – For example, If Harris Creek does X, Y, and Z, it'll provide the net decrease associated with denitrification. Lynnhaven might be too diverse within its bounds for a protocol.
d. There are no plans for this kind of data gathering at this stage in restoration areas.

iv. Enhanced vs. Total Denitrification
a. Recent study (will be submitted to journal next week) looks at the alternative fates of particulates with or without oysters – are either breaking down to ammonia in the water column or falling out somewhere else. Harris Creek is currently the only place in the world where this calculation can currently be made.
b. In a restoration setting, it is highly likely that only half of the denitrification is from enhancement. This rate could be beneficial from an aquaculture standpoint.

Follow on-bottom aquaculture protocol for site specific denitrification rates. Data preference is surface area (as it can be related to oyster biomass). The geometry of the reef has impact on the rates.

Water Column Aquaculture

i. Consider Inside/Outside Footprint
a. Biogeochemically, the panel is most concerned about what is happening in the sediments. Should it consider what is happening inside or outside of the footprint? It could look terrible under the floats, but it could be adding benefit elsewhere. There is no value unless physics spreads the detritus around (e.g. no water circulation in Horn Point, but there is circulation at the Marinetics site).

ii. Light/Dark Incubations

a. Not amenable to doing light incubations. Denitrification generally decreases in light.
b. Jeff believes the panel can make reasonable estimates with the Marinetics site, but not the Virginia Commonwealth site.

iii. Sufficient Data
a. Literature spreadsheet needs to be included in the report

From a policy standpoint, CBP has restoration objectives, a strong argument could exist to promote this BMP alongside of it – can be used as incentive. A site-specific estimate approach is the way to go unless the panel gets more data that will allow it to determine a reduction baseline.

Restoration clumps are where the denitrification action is; reductions will likely be depicted with biomass units and eventually dollars per pound. Scott Knoche at Morgan State University is studying this.

Matt has funding for Jeff for Maryland aquaculture research.

Action: Jeff will work at determining realistic criteria for site-specific assessment in time for the September meeting.

4. Shell Analysis Revisited

a. New data (Mann et al. and Parker and Bricker unpublished) has been added to determine the quantile regression equations for shell N and P assimilation.
i. Julie did not present this information at the meeting; there were issues analyzing the new data. This discussion will be postponed until the next meeting. The panel already decided that due to research gaps, it will not be moving forward with creating a shell assimilation estimate. The science will be presented though, to explain future possibilities.

5. Public Fishery BMP Concepts

a. Ward and Julie will present a couple of ideas for the Panel to consider concerning the public fishery practices.

Of the 4 Public Fisheries practices, the panel agreed that "On-bottom public fishery oyster production using transplanted wild oysters" will not be considered for a reduction estimate as it does not result in the creation of new oysters. The practice "Public fishery with no activity" will also not be considered for an estimate.

The panel was undecided on the practice "On-bottom public fishery oyster production using substrate addition". Julie presented a study "Maryland Substrate Addition Practice on Public Grounds" who's authors see the practice as an enhancement activity. It wasn't made clear how the authors reached their enhancement determination. If the panel would like to consider this practice as a BMP, it will need to reach out to the authors and analyze their process.

Julie also presented analyses of shell planting/oyster biomass data from Mann and Southworth

i. **Analysis 1:** No activity the previous year, no SOS or seed, no shell planting or harvest in sampling year (unless sampled prior to harvest), no harvest 2 years prior to sampling

a. The addition of shell should provide enhancement two years down the road. More shelling on sanctuary than on harvest areas

ii. **Analysis 2:** No activity previous year, no SOS or seed, no harvest 2 years prior to sampling

iii. **Analysis 3:** No activity previous year, no SOS or seed

a. The results follow a similar pattern, only difference is added harvest bars (are likely open on a quicker rotation, tend to be better bars). There seems to be no effect on harvested bars.
b. States are making up for the harvest when they put shell out. Not "wasted" in practice, but from WQ BMP standpoint, states looking for harvest enhancement to be able to determine/apply a reduction.
c. The data does not convince the panel that consistently added shell yields more future market sized oysters.

Discussion:

i. Is it possible to suggest a delayed crediting process?
ii. Possibly in Maryland, but what Lisa presented about Virginia does not support this pattern. Panel would need more information on the subject.
iii. Matt: No credit should be given for throwing shell down, but that should not dissuade someone from putting shell down. Make aware the benefits of adding shell.
iv. Ward: The practice of adding shell is historic, it is unlikely that BMP news would change that.
v. Julie Rose: In Virginia, public grounds are historically productive sites that need surveying to understand what happens there. Is confident that activity is happening with recruitment at aquaculture sites.
vi. Lisa: There needs to be some accountability – if credit is given for shells added, are there penalties for taking shells out/removing recruitment substrate? How can it be determined if oysters are already present at sites that shell is being added?
vii. Jeff: It's not a matter of spat being there, it's the extra spat that's settled (enhancement) and beyond that even since oysters cannot be credited until they grow.
viii. Panel will put more thought into this if it is determined that it can be approached from a site-specific way. The way aquaculture leases are distributed may make it difficult to determine site-specific approaches into the future. The panel needs to decide if there is an approach to even determine a site-specific estimate that could count as crediting.

Action: Julie will draft and distribute summary notes of this discussion and send to the panel; the conversation will continue through email.

6. Next Meeting

a. Julie Reichert: Will likely have more shell data sorted by next meeting. Will be tying up loose ends with shell, denitrification, public fishery definitions and discussion. Panel will then be able to explore practices it does think could result in an estimate.

Oyster BMP Expert Panel Meeting, September 19, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	In Person
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Karen Hudson	Virginia Institute of Marine Science (VIMS)	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remotely
Andy Lacatell	The Nature Conservancy (TNC)	Remotely
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remotely
Chris Moore	Chesapeake Bay Foundation (CBF)	No
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	In Person
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remotely
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remotely
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	In Person
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Margot Cumming	Habitat GIT Staffer, Chesapeake Bay Program	In Person

Action Items:

a. **Action:** Paige and Margot will consider comparable BMPs, Bill will provide switchgrass BMP literature to aid in Column H decision.
b. **Action:** Julie Reichert will touch base with WQ GIT on baseline guidance for Oyster Reef Conservation.
c. **Action:** Julie Reichert will confer with Lucinda Power on Choice 2 approach

Meeting Minutes:

This meeting will focus on reaching consensus on the site-specific estimate methodology for the enhanced denitrification protocol for on bottom (includes restoration and aquaculture) and off bottom practices (includes aquaculture only), default shell estimates concerning how much N and P is stored in the shell (Step 1 and 2 of pending shell estimate; step 3 concerning dissolution is unknown due research gap), and finalize decisions concerning the public fishery practices for the tissue estimate.

Coordination Updates, Julie Reichert

a. Jeff- BMP presentation to agriculture group.
b. Aiming to have a draft of the report for review by 1st week of October.

Julie created a matrix to organize panel decisions on moving forward with determining estimates for certain practices – See "practice protocol combinations" PowerPoint document

- Dark gray – Practices covered in the first report
- Light gray – Practices that will potentially be covered in the third report
- Medium gray – Practices covered in the second report
    a. Nitrogen assimilation in oyster tissue
        i. Public fishery/Column F
            - Possible to use estimate from quantile regression, but with site specific qualifying conditions (e.g. exclude productive oyster bars).
            - Counties would receive the credit (they plant the oysters in MD). In VA, harvest records are kept by county, not by oyster bar. Oysters are counted by bushel (sizes between MD and VA differ). MD would like credit for this practice, VA unsure.
            - Credit will be based on harvest, not what is put out.
            - Panel should decide how to treat an area with an existing population; create an equation that will consider what is planted, harvested, and mortality.
        ii. Public fishery/Column H
            - VA practices fall under Column H (substrate addition) – state adds shell to productive bars where shell growth doesn't keep up with loss. No good way to determine how many oysters would have been there in the absence of the new shell.
            - MD doesn't apply much substrate without spat – resource too valuable not to ensure oyster growth.
            - There is alternative substrate being put down in the Nanticoke with an envisioned natural strike, benefit.
            - Even if shell is planted, you cannot consistently predict an increase in harvest. Would also require a reasonable mortality estimate – very difficult. If shell is planted and no oysters are attaching to it, no reduction activity is happening
            - Language in first report gives credit for substrate addition but specifies that it must be put in areas with no oysters present, requires a bottom assessment beforehand. No one gets to lease former or current oyster bars.
            - Site specific qualifying condition: survey with a reasonable estimate required before substrate is put down – must assess oyster presence and determine how that number factors into the reduction.
            - Similar CBP approved BMPs may provide insight on how to handle this practice. Decision needs to be made on Column H by end of next week.
        iii. Oyster Reef Conservation
            - Three possible qualifying conditions: Is it closed to activity? Is it being harvested? Have you had an increase in oyster production?
            - Panel will remove asterisk if it can decide on qualifying conditions – will be site specific.
            - Joyce Kilmer National Forest in North Carolina may serve as comparison.

Action: Paige and Margot will consider comparable BMPs, Bill will provide switchgrass BMP literature to aid in Column H decision.
Action: Julie Reichert will touch base with WQ GIT on baseline guidance for Oyster Reef Conservation.

Enhanced Denitrification Measurements, Jeff Cornwell

c. Jeff will present additional information on what measurements are needed for on bottom (aquaculture and restoration) and off bottom practices (aquaculture only).
    - Now that it is determined that denitrification measures are site specific, panel must decide on qualifying conditions. Panel must be careful how it provides guidance to people seeking out credit.
    - It will take a month or two to get together a paper on oyster denitrification literature numbers.
    - Denitrification takes place within reefs within oyster clumps, sediments themselves do virtually nothing. Material being brought to the bottom and remineralized under the reef had other potential fates – denitrification calculations must reflect that; net enhancement rate for a reef ecosystem.
    - Jeff will focus on key things that need to be measured, will diagram that approach to show how to make the calculation. The calculation method is going into peer review this week, should have feedback by the end of October.

Shell analysis (ploidy, culture method, season, and location considerations), Julie Rose

d. Julie Rose will present additional information on the shell analysis for determining the amount of N and P stored in the shell (could eventually be used for a default estimate once dissolution research gaps are filled).
    - Shell assimilation recommendations – quantile regression analysis
        - We are not recommending that credit be given at this time due to the unknown fate of shell after harvest
        - It is worth the time and investment now to generate equations with data available (initial leg work) if in the future there is more data on fate of shell
        - Diploid vs triploid
            - Triploids have lighter shells
        - With gear (off bottom) vs without gear (on bottom)
            - Shells grown in gear are lighter
        - Diploid all vs with gear
            - Limited amount of info on diploids in gear, but enough to do regression
            - Gear has strong effect on shell dry weight regardless of ploidy
            - There is no data for triploids grown without gear
        - Seasonal effects without gear
            - Not much of a difference
            - Biggest difference is seen during fall; equation is above mean of entire dataset (OK from management perspective)
        - Locations/salinity – diploid without gear/on bottom
            - Open water yields high weights
            - No location that skews significantly low
        - Recommendations
            - Use separate equations for diploids with gear and diploids without gear
            - Use one equation for triploids (no data for triploids without gear and if someone were to grow oysters without gear, they would be undercredited (based on diploid analysis) which is ok from a management perspective)

        - Because gear and ploidy have a strong effect on data, we just use the diploid without gear subset to look at seasonal and habitat differences (over 4,000 data points, robust set)
    - When there's enough science to understand fate of shell/return to bay, we can use these equations
    - Values of N and P stored in shell, not a reduction estimate as shell dissolution is not yet included in equation. Used similar approach as tissue.
        - Julie Reichert: Don't convert data to pounds/million oysters; could be deceiving. Leave amount stored in shell as g/oyster; explain the gap/missing research piece. Report will be clear that you cannot use numbers presented.

Public Fishery Tissue Assimilation Estimate, Julie Reichert

e. Julie will present options on how to handle the N and P tissue assimilation estimates for the public fishery practices.
    - It's possible that panel could be overestimating reduction due to oysters grown without gear data included in dataset analysis.
    - 1st report: with gear dataset is too small to run quantile regression. Additional tissue data could allow culture method to be re-evaluated.
    - Diploid with and without gear might need to be analyzed separately of all diploid subset – could overestimate reduction if lumped in with other categories.
    - Possibly undercrediting groups growing diploids in gear – it's possible the curve could be steeper due to anything being tumbled/rolled is going to develop a deeper, rounder cup, affecting the relationship between shell height and depth, showing a higher biomass.
    - Options
        - Choice 2 – Include addendum to numbers from first report in the second report
            - Section out estimates due to gear method and ploidy.

Action: Julie Reichert will confer with Lucinda Power on Choice 2 approach

2nd Draft Writing and Review Schedule

- Julie will be writing the 2nd draft within the next two weeks – core part of the report including recommendations and rationale, figures and tables will need to be cleaned up.
- It will be sent to the panel chapter by chapter.
- The shell section will be done by the end of next week.
- October will be review month
    - Jeff: more available than usual
    - Julie Rose: available this/next week to rerun plots
    - Lisa: available mid-late October
- Schedule will be adjusted
    - Panel will present update to Water Quality GIT before CERF in November
    - Report 2 draft will be made available in January
    - Schedule update will be made to website

Oyster BMP Expert Panel Meeting, October 19, 2017, 1:00 PM – 3:00 PM

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Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Karen Hudson	Virginia Institute of Marine Science (VIMS)	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remote
Andy Lacatell	The Nature Conservancy (TNC)	Remote
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Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Yes
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remote
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Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	No
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Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
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Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Action:** Cornwell will review Marinetics data to determine a site-specific estimate for example.
2. **Action:** Reichert will work with Kellogg on this calculation in November for Harris Creek
3. **Action:** Panel to read through Reichert's document. She will initiate a conversation via Email.

Meeting Minutes:

This meeting will focus on reaching consensus on the denitrification write-up and finalize decisions concerning which public fishery and restoration practices the Panel would recommend for BMP consideration.

Coordination Updates

1. **Presentation Requests:**
    a. MDNR Aquaculture and Shellfish Division for presentation on 1st report – scheduled **10/27/17**
    b. CBP Offset and Trading workgroup – scheduled **12/20/17**
    c. Water Quality GIT Update – looking to reschedule for **11/13/17** or **11/27/17**
    d. Fisheries GIT Meeting – looking for update on status of the 2nd report (recycle WQ GIT update). Scheduled for **12/18/17**.
2. **CERF Presentations:**
    a. Reichert-Nguyen et al. Quantifying Water Quality Benefits of Oyster Practices for Regulatory Use in Chesapeake Bay - Ecosystem services provided by shellfish resources, Monday, 11/6, 1:15 PM
    b. Kellogg is presenting Monday morning
    c. Bricker presentation on CBP Farm Model Calibration – 11:15am Monday
    d. Cornwell presentation focusing on denitrification concepts – Thursday, 11/9
    e. Rose is presenting on Monday
    f. Jeff's PhD student is presenting on Denitrification in Harris Creek – Monday morning

Enhanced Denitrification Write-up, Jeff Cornwell

3. Jeff will present denitrification write-up for the report, including additional information on what measurements are needed for on bottom (aquaculture and restoration) and off bottom practices (aquaculture only).

    Table of recommended approach for measurements of denitrification – Water Column Aquaculture

    Not enough data available to determine a number for denitrification – the data varies greatly. The fuel for the denitrification process is biodeposits – the fate of that material is key to the amount of denitrification that'll occur. Good techniques for measurements exist, no need for new technology to make these assessments. The difficulty in measuring denitrification is that biodeposits usually denitrify more efficiently in sediments than in reefs. Masses of biodeposits under reefs overwhelm the system, depletes the oxygen necessary for the deposits to nitrify. Measured denitrification does not necessarily equal enhanced denitrification.

    Page 2 of handout – diagram with blue arrows. We need to know that denitrification is happening in reefs and its efficiency. Kellogg 2013 study defines this.

    a. Figure JC3 - Enhanced denitrification doesn't occur under aquaculture facilities, but it's possible the biodeposits denitrify at an efficient rate offsite.
    b. Figure JC5 - If the sediments that biodeposits are moving to are efficient at denitrification, there is a huge net positive benefit. Aquaculture could be useful. Panel needs to determine the size and location of the halo/offsite landing area.

    Discussion
    a. Linker: If material is exported to sediments with overlying aerobic waters, that will also yield a positive net benefit.
    b. Reichert: Will the footprint/halo water quality cause issues with respect to crediting? Are there other BMPs that fit this model (water taking biodeposits elsewhere)?
    c. Linker: This would be a useful discussion for the CBP Trading and Offsets Workgroup. I believe this is fairy unique situation. If we can demonstrate that enhanced filtration and settling of organics that would largely not fall into trench, I think that'd be in positive favor.

d. Cornwell: We don't understand particles, how they're going to move, what they're going to do. At this stage, the scale of particulate modeling and resuspension modeling will not help at the scale of the farm (depending on size of farm). Could be developed, though.
e. Paynter: Deposits will fall into two pots on either side of a hypothetical farm of fecal matter. Oyster fecal material is large and not microscopic – it will be transported long ways.
f. Kellogg: Virginia perspective. The flow is not as clearly defined as you might expect. Not as simple as ingoing and outgoing tide. Lots of variance between 4 sites being studied. Growers spacing oysters out far, too – biodeposits aren't as concentrated/unit area as you might think, either. Measurements are site specific and very complex.
g. Cornwell: Putting cages on bottom can create depleted oxygen, too.
h. Reichert: Recommended conditions: e.g. the site needs to look like this.
    i. Location: Needs to look like halo in aerobic waters. Sites could be weighted/ranked for crediting. Portions of halos can be credited as well, if only certain portions fall within aerobic waters.
        1. Panel can rely on depth for the most part to determine areas of aerobic/anaerobic water. Nearshore respiration rate efficiency variations are low.
        2. Cornwell concerned this may be more of a research project than a BMP – we need tracers on the biodeposits to determine halo.
    ii. Cornwell: Include this as a model of what we need to do (regarding water column aquaculture). Would argue for restoration – we have enough here and can recommend something right now and find a number that's defensible. Treat on bottom aquaculture the same a restoration. There is not enough information for water column aquaculture.

For Report: We need a roadmap for the restoration section. The roadmap will need the Water Quality GIT's approval. Use similar language as first report – work with CBP to determine site specific estimate for inclusion in the model.

Action: Cornwell will review Marinetics data to determine a site-specific estimate for example.
Action: Reichert will work with Kellogg on this calculation in November for Harris creek.

Practices for BMP consideration, Paige Hobaugh and Julie Reichert

4. Paige will present information she found concerning other BMPs where the activity is to no touch an area (follow-up from discussion on whether oyster conservation under restoration practices should undergo BMP consideration).
    a. It'd be difficult to give credit to a practice for merely "existing" just because it could "not exist" and be something worse (e.g. a tract of land just standing still instead of having become developed).
    b. As for restoration on a forest sanctuary, as new trees are planted (much easier to account for than new oyster growth), they are credited toward Forestry BMPs.
    c. If there's a way to credit new oyster growth minus what already exists in a bed (as existing oyster beds are a built-in element of the estuary model), then that number can be included in the model.

Discussion
    a. Possibly consider agriculture buffers for comparison – land use change receives credit.
    b. Linker: Estuary model doesn't count wild oyster population as a reduction or BMP, it is part of the baseline. Aquaculture issues will also become baseline/background information upon CBP Principal Staff Committee decision. Isn't a current mechanism that will start to decrement

quantitatively a loss of resources like forests – will be a change in the way we count things. CBP thinking about establishing future baseline of degradation into the model.

c. Likely to be valuable in Virginia
d. Panel would like to change the name of the practice – possibly "Oyster reef conservation through reduced harvest"
e. Parker: Does CBP model assume a steady state of oyster population, account for growth?
f. Cornwell: Mike Willberg of Oyster Futures models the potential success of future reefs.

Action: Reichert, Parker, Wolinski, Kellogg, Hobaugh, and Linker will continue this conversation**.** A white paper detailing the discussion will be created for the end of October.

5. Julie Reichert will present merged Panel ideas for qualifying conditions concerning public fishery practices (spat-on-shell and substrate addition).

Discussion

a. Is there a way to consider the public fishery practice? If a jurisdiction is only adding substrate, yes.
b. Reichert: Designate an area where public fishing is occurring, assess the density and presence of shell for a "pre-substrate addition" baseline. First harvest credit would occur two years after planting

Action: Panel to read through Reichert's document. She will initiate a conversation via Email.

Procedure to update tissue estimates from approved report, Julie Reichert

6. From discussions with Lucinda, it is recommended that track changes are used to update the estimates and any pertinent info within the 1st report and re-submit for WQGIT approval (changes do not require 30 day review).

Discussion

a. Current tissue estimates are diploids grown in gear – this doesn't occur in nature, so panel must rethink its calculation/baseline.
b. Reichert: Possibly beneficial to wait for data to fill in the gap.
c. Crediting will be broken down by culture method and ploidy.
d. Can include in report the rationale: Current diploid estimates do not overestimate. Have identified that in the future, it'd be beneficial to gather more data for diploids grown in gear.
e. Panel can recommend the update in the report, but not necessarily perform it.

Oyster BMP Expert Panel Meeting, November 16, 2017, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
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Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
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Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	No
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Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Action:** Bill will explore the policy context and amount of N removal further, will send data to Lisa and the Panel.
2. **Action:** Julie and Lisa will work together to create slides for the WQ GIT presentation.
3. **Action:** Panel will use Ward's charts to determine how implementers will estimate a biomass number.
4. **Action:** "Designated Oyster Reef No-Harvest Area" consideration will be reviewed during a Panel phone call on 11/21/17.
5. **Action:** BMP considerations will be reviewed during a Panel phone call on 11/21/17.

Meeting Minutes:

This meeting will focus on reaching consensus on the denitrification site-specific method for restoration practices and finalize decisions concerning which restoration practices the Panel would recommend for BMP consideration.

Coordination Updates, Julie Reichert

1. **WQGIT update**
    a. Scheduled for Nov 27th
2. Discussion
    a. Julie wants the presentation to focus on the framework of how to determine a shell estimate (using the same strategy as tissue), less on showing the data.
    b. The Trading and Offset Workgroup presentation (11/15) went well. Based on feedback, the panel should make sure there are recommendations in report that will bar someone from having a lease and harvesting their own oysters for credit.
    c. The CERF presentation went well. Other groups presented on N removal and their rates were very high, they likely use less conservative approaches.

Enhanced denitrification site-specific method for oyster restoration practices

3. **Lisa Kellogg** – Presentation on method to determine site-specific estimate
    a. These recommendations only apply to oyster reefs
    b. Consider only methods that look at production of N_2 gas (net flux from the sediment to the water column). Must be scalable per unit area.
        i. N_2:Ar measurement in water column over time for reefs or reef sediments
        ii. Ion pairing is only appropriate for reef sediments (no samples with oysters or oyster shells)
    c. Oyster reefs exhibit high rates of restoration, batch incubation is appropriate. Flow through method incubation is potentially appropriate for sediments, but not for reefs.
    d. Light availability must be considered at each site – all measurements should include a dark incubation and a light incubation if reef is in an area of sufficient light.
    e. Data must be gathered from a reef and a nearby control site in order to measure enhancement
        i. Minimum three samples of each site
        ii. Each site must be measured during at least three seasons (Fall, Spring, Summer, 0 for Winter)
    f. O_2/N flux graph slope should be about 6.625 (Redfield ratio), plus or minus 25% of that number is acceptable to ensure validity of data.
    g. Statistics should show reef samples to have higher denitrification rates than the control samples.
        i. Measure N2/N flux for a reef sample and subtract the average of the control to get the enhancement rate (to retain variance in measurement and remain conservative)
    h. Credited enhancement rates
        i. Reefs: Credit at mean enhancement minus one standard deviation
        ii. Reef Sediments: Credit mean enhancement (already conservative measurement)
    i. Scaling measured rates
        i. Daily Rates: Multiple CER by 24 hours (reefs below eutrophic zone)
        ii. Scale night and day incubations depending on hours of day/night at each site
    j. Scaling measured rates by biomass/space

i. Those that don't measure denitrification with respect to biomass cannot be credited for any portion of the reef that doesn't meet a specific density of oysters at which measurements were taken

Discussion

a. It takes a significant biomass density beyond 50g/m^2 to see an effect on N_2 flux. Some sites experience densities higher than that.
b. Understanding what proportion of denitrification is attributable to oysters, other parts of reef community: Harris Creek data is available, but it hasn't been delved into yet. As of now, rates/considerations are likely to be site specific.
c. Some reef studies go autotrophic once light becomes available (O_2 inundation leads to bad denitrification estimates), data should be tossed out.
d. If an implementer is able to establish a density curve for each season, they should mimic the biomasses in the lab. The Kellogg lab intentionally stocks trays with a range of oyster biomasses (low, medium, high densities) and places them on the bay floor.
e. What is considered a season is not entirely clear currently. The Kellogg lab tends to measure 4x a year (April, June, August, October) and not in winter. There is evidence that seasons are defined by more than just water temperature.
f. Implementers should be sure to distribute their measurements evenly across months of the time window during which they measure.
g. Context of mass of N removal for policy purposes? Based on data, hundreds of pounds of N/acre/year (1-600 for tidal reefs).
    a. **Action:** Bill will explore the policy context and amount of N removal further, will send data to Lisa and the Panel.
h. Not many implementers have the equipment to make these measurements; a mass spectrometer is necessary to measure micromoles of N gas/liter.
i. The flow through approach could be useful on the finishing end of a large scale tributary project. It could be cost effective in places where an entire tributary is being considered at one time.
j. For estimate to be valid, implementers need to be sure that reef sustained at least its original biomass. If the function of biomass still works and implementers see an increase, they should project the new crediting outward. This is unlikely since densities in experiment examples are already very high.
k. Concerning die offs, poaching issues, how often should implementers check for biomass stability? MD samples restoration sites annually. Panel needs to examine available data, decide how much biomass changes from year to year and whether it changes with different parts of the bay.

The panel is comfortable with presenting this information to the Water Quality GIT.

Action: Julie and Lisa will work together to create slides for the WQ GIT presentation.

4. **Ward Slacum** – Presentation on method options to determine oyster density and shell heights
    a. Assumptions: Biomass is the estimated parameter used to scale reef size. It is a reflection of heights of oysters measured in the field.
    b. Recommendations:
        i. Implementers who want credit must consider rates at different densities.
        ii. No implementer may receive credit for measurements from reef densities higher than the highest density they measured for.
        iii. Performance metrics should be measured at the reef scale.
        iv. If a picture of the bottom exists, an implementer can do stratified random sampling. Without a picture, it is best to do random sampling.

v. Sampling size requirements are yet to be determined, it will depend on acreage

c. **Discussion**
   i. Every sample point is generated randomly in GIS, divers navigate to that area to sample. To remove bias, the vessel tries to anchor exactly on the site and the diver places the quadrat adjacently.
   ii. The area sampled by patent tons is twice the quadrat size that divers use. Divers are counting spat/natural recruitment, lends variability to sample.
   iii. Metrics are reef based, scales are applied to sample sizes to level sampling regimes. Reefs are monitored 3 and 6 years from restoration.
   iv. How many samples are necessary to determine biomass?

Action: Panel will use Ward's charts to determine how implementers will estimate a biomass number.

5. **Julie Reichert** – Presentation on available oyster data to determine regression equation to use with oyster restoration practices
   a. **Decision Needed: Does the Panel agree with this approach? What would we like to include in the WQGIT update?**
      i. The Panel is okay with using diploid estimates from the first report.

6. **Restoration Practices for BMP consideration, Paige Hobaugh and Julie Reichert, 2:00 – 2:45 PM**
   a. **Paige Hobaugh** – Present findings from Panel subgroup concerning the "Designated oyster reef no harvest area" category (formally known as "Oyster Reef Conservation" category)

      Action: "Designated Oyster Reef No-Harvest Area" consideration will be reviewed during a Panel phone call on 11/21/17.

   b. **Julie Reichert** – Lead consensus discussion on which oyster restoration practices will undergo BMP consideration.
      i. **Decision needed on which restoration practice categories will undergo BMP consideration**
      ii. **Decision so far**
         1. YES – Oyster reef restoration using hatchery-produced oysters
         2. ? – Oyster reef restoration using substrate addition
         3. ? – Designated oyster reef no harvest area (panel sub-group has recommended that yes, this category should undergo BMP consideration)

      Action: BMP considerations will be reviewed during a Panel phone call on 11/21/17.

Oyster BMP Expert Panel Meeting, January 4, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Yes
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	No
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	Yes
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Action:** Panel will move off-bottom aquaculture using hatchery produced oysters into the research gap section.
2. **Action:** Bricker and Fegley will work to determine any additional requirements for Categories F, G, and I (particularly from a public fisheries standpoint).

Meeting Minutes:

This meeting will focus on the site-specific measurement strategies to determine the reduction effectiveness associated with enhanced denitrification and decide whether to include N and P assimilation protocols for restoration in the 2nd report (tentative; pending on EPA lawyers' decision).

1. **Enhanced denitrification site-specific method (restoration and aquaculture)**
    a. Jeff Cornwell – Go over the strategies to measure enhanced denitrification for restoration and off and on bottom aquaculture.
        i. **Need to finalize recommendations on methods to measure denitrification and verify via biomass.**

Comments:

- Panel should point out in the report that some cases will result in the need of additional requirements. When oysters are left untouched, there is more confidence in the denitrification rate. Harvesting practice disturb sediments and the nitrogen flux of the system.
- Panel needs a denitrification number attached to the biomass at a site. Biomass changes over seasons in a substantial way, grows larger through a season, making finding denitrification rates more difficult.
- In a restoration setting, it is likely that the practitioner wouldn't begin measuring denitrification until the oyster population has established.
- Panel has little information about off-bottom aquaculture; it knows there is likely to be denitrification enhancement associated with aquaculture, but it doesn't know how to make that assessment (Assess in the 2nd year? Once oysters are harvest size? What happens after removal?)
- It is not likely that someone would find assessing denitrification rates financially worthwhile unless they research it under a limited duration.
- **On-bottom aquaculture** generally results in positive denitrification, though it is not a perfect, 100% assessment of all denitrification.
- **Off-bottom aquaculture** is a range of practices; sometimes in cages only 1-2ft off the bottom, no higher than reefs.
- Panel will move **off-bottom aquaculture** using hatchery produced oysters into the research gap section.

On-bottom public fishery:

- Panel can suggest: In order to qualify as BMP, choose an area, conduct a pre-denitrification survey, plant spat, leave it for three years to receive credit.

Determination of suitability of denitrification studies for consideration:

- It'd be okay for a practitioner to spend less money on denitrification study and get a lower rate- underestimating is okay for credit.
- Panel will not accept rates acquired by just any technique, though.
- Panel should explain which techniques are unacceptable; stating the pros and cons of using each method. Add background text about assumptions/issues with techniques (e.g. don't drive sample to anoxic conditions during incubation). Include images of the methods. Note that a practitioner would likely need to partner with a lab based on equipment requirements.
- The existing chart should be changed: practitioner can use sediment cores instead of the entire community resulting in an underestimation of denitrification rate.
- Table XX:
    - Rationale column items need additional information; change to "explanation"
    - What is a better control for this?
    - Start credit when practitioner measures enough creditable biomass

- How long to credit for? Need to reassess over time? Change crediting to "on the basis of your success"
- Site Specific Estimate Experiment Design:
  - Is the denitrification/biomass relationship determined by size and location?
  - Panel can say these are considerations that need to be made; must be reviewed with someone with survey design experience, knowledge of the site.
  - Variance threshold? If a practitioner's rates vary wildly among similar reefs, they cannot expect to use those numbers as a reasonable estimate. How do other BMPs deal with this?
  - Possibly add experiment/estimate review requirement? There is a precedent set up for that within the CBP partnership.

b. Get Panel's thoughts on baseline and timeframes for the BMPs
   i. Thoughts for January 18th meeting (see BMP Report Requirements document)
      - For new practices, panel should recommend that practitioners make measurements before they start the activity if they want credit. Establish the baseline, instead of finding a similar control site.
      - What time frame makes sense for the denitrification protocol? Is a certain size area optimal for enhanced denitrification?
      - Would time frames be different for on-bottom versus off-bottom?
      - The BMP is useful as long as oysters are filtering and enhancing denitrification. Assimilation useful life may be different.
      - What are the unintended consequences?
      - What timeline does the panel propose for the reevaluation of the panel recommendations based on new data/information?

2. Decide on whether to include N and P assimilation protocols for restoration practices in 2nd report (tentative)

a. The idea is to use the method from the biomass verification component of the enhanced denitrification protocol.

Comments:

- Panel is evaluating 6 BMP combinations. Upon reviewing the notes, Julie Reichert thinks the panel can potentially also accomplish more.
- Categories F, G, and I could be included – Bricker and Fegley will work to determine any additional requirements (particularly from a public fisheries standpoint). As long as there is data on what the oyster populations look like, this sounds doable.
- Challenge with Category F – what value to estimate about the baseline on a public bar? Most public bars in VA have shell addition when funding is available, not unlike with aquaculture. It'd be hard to determine what the estimate of increase above the baseline is.
- Leave Category H off for now.
- Panel to at least open the door for practitioners to use these practices; there are systems in place with counties and the locations they choose, data must be recorded.
- Now that the Panel has the legal opinion and will have to do no additional work, there is the potential to also include Categories J and K.

The target date for the second report draft is by January 31st. The panel will review in February and will set up a webinar for the beginning of March. Ideally, everything will be approved of and wrapped up by April.

Oyster BMP Expert Panel Meeting, January 18, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	No
Chris Moore	Chesapeake Bay Foundation (CBF)	No
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Yes
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Decision:** Recommend to assess each year for site specific denitrification rate, every 3 years for assimilation credit only, apply credit every 3-4 years for reef growth rate.
2. **Decision:** Default approach for whole oyster estimate – panelists are comfortable with this.
3. **Action:** Emily will distribute Oyster Sanctuary monitoring reports to panel; will work with Bill to review; will go over with panel at 2/15 meeting.
4. **Decision:** There will be no changes to the chart provided at today's meeting; this is how the report will be structured.
5. **Decision:** Panel recommends measuring biomass at least every 3 years. Can be done yearly to potentially gain higher crediting based on annual rates. Frequency at which to assess must be established and stated in the WIP.

Meeting Minutes:

This meeting will focus on finalizing which oyster practice-protocol combinations will be in the 2nd report. We will also go over some ideas for including N and P assimilation protocols for restoration (received ok from EPA lawyers that N and P sequestration from in water BMPs can count towards reduction effectiveness.

Practice-Protocol Decisions for 2nd Report

We will review decisions thus far and by end of meeting aim to reach consensus on what to include in the 2nd report (see progress table in Excel file)

Table –

- Darkest gray – Practices included in the first report
- Lighter gray – Practices being considered for the second report
- Lightest gray – Practices on hold for the third report
- Bolded – Practices panel may be able to include in second report

Second Report – see updated panel report schedule document

- If panel decides to add additional practice categories, it needs more time to complete report.
    - March – incorporate edits from panel; put together webinar
    - April/May – draft out for public comment
    - June – review comments
    - July – Second report approval
- For Approval –
    - A methodology to determine site-specific estimates for the "Enhanced denitrification associated with oysters" protocol to apply to endorsed oyster reef restoration practices.
    - Application of the approved default nitrogen and phosphorus tissue estimates from the first report for the endorsed oyster practice category, "On-bottom public fishery oyster production using hatchery-produced oysters."
    - Recommended default estimates for the amount of nitrogen and phosphorus sequestered in live oysters for the endorsed oyster reef restoration practices.
    - A framework to determine the reduction effectiveness estimates for the amount of nitrogen and phosphorus assimilated in oyster shell of harvested oysters (applies to endorsed private oyster aquaculture and public fishery practices).

    Discussion –
        - Regarding the information in parenthesis in the 4th bullet – it should be noted that harvest from public grounds with no activity is not endorsed by the panel.

- Informational –
    - Clarification on the intended qualifying condition of approved tissue estimates for the endorsed private oyster aquaculture practices concerning the presence of oysters before practice implementation.
    - Identification of research gaps associated with developing site-specific enhanced denitrification estimates for practices where oysters are harvested (i.e., endorsed private oyster aquaculture and public fishery practices).
    - Analysis on the effect of culture method on tissue biomass from new data that became available after December 2016.

    Discussion –
        - Explicitly state that at private aquaculture lease areas, panel expects there to be few, if any oysters present. If there are oysters present, lessee must perform an

assessment of the baseline population and deduct it from the total biomass at harvest.
    - Regarding 2nd bullet, there are many other factors that could influence denitrification rates
    - New data as of 12/2016 makes it worthwhile to reevaluation the relationship between ploidy and biomass

- Is the Panel still envisioning drafting a 3rd panel report and, if so, what would be included in this panel report?
    - Jeff Cornwell, Julie Reichert, and Ward Slacum think it'd be best for the panel to take a year or longer hiatus to allow the report proceedings to catch up before pursuing a 3rd report.
    - There isn't much available information on 3rd report categories.
    - Panel will inform CBP it is going on hiatus; when reconvening, just put request out to panelists for availability/interest.
    - Google Drive folder with access to literature will be established. Panelists should create folders for new categories with new data/studies.

- CAC Communication –
    - Ongoing policy issue with practice L "Designated Oyster Reef No Harvest Area". Panel is divided; majority feel it fits BMP model, some think otherwise. Science doesn't dismiss crediting for this practice, but policy seems to. Will be put forward as a policy issue.

Thoughts concerning N and P assimilation protocols for restoration practices in 2nd report – see powerpoint presentation

- Legal opinion –
    - Panel is assuming that sequestration falls under the legal opinion.
    - Nothing in Clean Water Act that would prevent in-water partnership approved BMPs – some already exist e.g. floating wetlands, Baltimore trash interceptors
- What to recommend for the N and P assimilated in oysters concerning oyster reef restoration practices –
    - Can the biomass determination from the enhanced denitrification verification guideline be used to estimate sequestered N and P in tissue?
        - Default, not site specific estimate.
    - Can we give credit to both tissue and shell if credit is only given to live oysters?
        - Shell dissolution shouldn't be a huge issue since the oysters are alive; panel can provide stipulations like timeframe.
        - Can count shell from oysters harvested as long as they're still alive, still growing. Reef will reach a stable state.
    - Timeframe –
        - Checking yearly would work nicely with denitrification (verification based on biomass; check oyster density, calculate biomass, apply denitrification rate based on that).
        - Biomass should be the rate of growth averaged over a period of time. Over crediting could occur if you were to credit each year.
        - Generally, we assume 100% return of shell. Would have to create a plan to determine where all of the shell goes; difficult to do, unsure of how to do so.
        - Protocol for Sanctuaries says to measure every 3-6 years.

Decision: Recommend to assess each year for site specific denitrification rate, every 3 years for assimilation credit only, apply credit every 3-4 years for reef growth rate.

- Method –
  - Quantile regression equation should be used to determine biomass; monitor for shell height, oyster size class.
  - Tissue: Panel could use diploid equation from first report for on-bottom restoration practices.
  - Shell: Whole oyster estimates for on-bottom reef restoration.
  - Credits for shell and tissue (growth rate) are different for denitrification (biomass as a proxy).

Decision: Default approach for whole oyster estimate – panelists are comfortable with this.

Action: Emily will distribute Oyster Sanctuary monitoring reports to panel; will work with Bill to review; will go over with panel at 2/15 meeting.

Decision: There will be no changes to the chart provided at today's meeting; this is how the report will be structured.

Enhanced denitrification site-specific method progress

Update Panel on edits to the enhanced denitrification chapter – see diagram.

- The panel learned enough to specify methods with which to make valid site specific rates.
  - 2 practices the panel can specify techniques that will yield a valid number.
- Aquaculture Practices
  - On-Bottom: Will harvest oysters as opposed to leaving them. Research gap that needs to be met.
  - Off-Bottom: Site specific based on where biodeposits land.
    - There isn't enough information currently to make any decisions with regard to the fates of materials.
- Oyster Reef Restoration Practices
  - Whole community testing is preferred; cores are acceptable with recognition that lessee is not getting as much possible credit.
  - If oyster reef, no harvest is eventually considered as a BMP, which category form the chart would it follow for crediting?
- The panel faces a challenge in being precise enough to specify an approach acceptable for oyster reef restoration and at the same time developing guidance and information for research gaps for Aquaculture.
- Denitrification process seems to be variable in ways not entirely understood by the panel.
  - Relationship between biomass and denitrification is not linear.
  - Relationship between biomass and denitrification reaches a maximum, may not be persistent across seasons – very site specific.
- If someone wants more crediting options, they can create denitrification rates at different biomass values. If not, they can measure one median biomass rate and receive credit based on that.

Decision: Panel recommends measuring biomass at least every 3 years. Can be done yearly to potentially gain higher crediting based on annual rates. Frequency at which to assess must be established and stated in the WIP.

Next Meeting –

Julie plans to begin work on the denitrification chapter next week. Emily and Bill will work on the assimilation chapter. The panel is looking for approval for the framework it developed (based on the literature review) for the shell chapter.

Oyster BMP Expert Panel Meeting, February 15, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Yes
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	No
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Action:** Jeff will work with Emily and Ken on a strawman crediting protocol and disperse it to the group for thoughts and comments in the next week.
2. **Action:** Emily will send the Oyster Metrics document that explains periodicity of monitoring and why year 3 was chosen for biomass, and the 10 Tributaries by 2025 2016 Monitoring Report to the panel.
3. **Decision:** The panel will not be prescriptive. It is up to the BMP Implementer to choose the useful life of the BMP for assimilation purposes (when to stop monitoring).
4. **Action:** Lew will send technical memo examples to the panel.
5. **Action:** Panel will to continue discussion on how prescriptive to be.
6. **Action:** Jeff will write up some sample text and send it to the panel for reaction.

Meeting Minutes:

1. Coordination Updates, Emily French

- **a.** ORP will provide update on panel progress to Citizen Advisory Committee (CAC) at their Feb 23rd meeting.
  - I. Ward will be presenting.
- **b.** Panel has been invited to present progress on Oyster BMPs at the Interstate Seafood Seminar on March 29th.
  - I. Julie Reichert will likely be presenting.

2. Restructured enhanced denitrification chapter and implications for report structure, Emily French and Jeff Cornwell (See table of contents document)

It was recommended by CBP representation that we structure each chapter in such a way that makes it clear what we are asking the WQGIT to make decisions on for BMP approval.

a. Some content of the denitrification chapter is therefore being shifted.
b. Implications for the report: Put recommendations panel is seeking approval on in its own subchapter under 'Complete recommendations', move informational items (ways to improve oyster reef restoration estimates; research gaps for aquaculture/public fishery practices) in a different subchapter under, 'Informational recommendations', and have content where framework is recommended but a complete recommendation will not be provided under 'Framework only recommendations'.

The Panel likes this structure.

3. Thoughts concerning verification for the N and P assimilation and enhanced denitrification for restoration practices subchapters, Emily French, Jeff Cornwell and Bill Wolinski (See Powerpoint presentation)

Looking for Panel input on the 'Recommendations for application and verification' sections within both the following chapters:

a. Nitrogen and phosphorus reduction effectiveness associated with assimilation in oysters for restoration practices
   I. Slide 4 – Concern about double counting
      - After original biomass measurements, only appreciation beyond amount originally credited can receive credit. No credit given for no appreciation.
        - Jeff: The challenge is with the increase/decrease associated with biomass. We don't have enough information to understand if the shell is coming and going. If biomass decreases, there is no crediting.
        - Jeff: There is no evidence yet that supports the idea of biomass increasing with time in sanctuaries with restoration activities.
        - Bill supports crediting only the appreciation in biomass.
        - Julie: Is okay with giving more than one credit based on difference from the original baseline.
        - Lynn- Be careful not to credit variability, which could look like appreciation.
      - Jeff: What is the timeline for this? Do we need to consider not using the first year's biomass when it's highest and think about using a year or two after restoration has occurred instead? What is the period over which observations will be averaged? Do we credit at the beginning of BMP implementation or should back crediting be possible?
        - Jeff: This may take an inspection of trends. After the first assessment, credit could be given to a proportion of the existing biomass and if the subsequent assessments are consistent with higher levels, then you credit that in full.

What is the average change between assessments? There won't really be any negative numbers if we average.
        - Emily: Not much data exists on biomass density over time of the same oyster population, therefore the question of 'when is a reef established enough to credit?' is difficult to answer. There are '10 Tributaries by 2025' sentinel site density and biomass data in annual reports; this may be the only data the panel has to refer to. Is there any other per meter squared oyster data available for the same sites sampled over time?
        - Ken: We can use the sentinel site data as an indicator of population health and density in Harris Creek. Should be able to detect large scale mortality event if monitoring correctly. We will be able to estimate the percent of mortality, make determination in other areas to confirm the mortalities. Provides a "snapshot" of what's going on. We cannot quantify impact of illegal harvest, though.
        - Mark: VA restoration sites not well established for annual monitoring yet, and not much data exists on biomass density over time of the same oyster population in VA.
        - A panelist mentioned that the sentinel site graph shown in the presentation/ accompanying report were in density and not biomass. Emily said she would find the equivalent biomass.
    - Mark: How do you take back credit if restoration site experiences drought/diseases and loses all oysters?
        - Julie: Sounds analogous to BMPs dependent on the establishment of new environments; wetlands, floating wetlands, buffer strips. Will always be potential for loss; how do they deal with it?
        - Lew: If a riparian buffer is torn up by a flood, it is entirely taken out of crediting. Oysters will be no different. Fate of resource (possible N and P back into environment) not considered.
        - Ken: When oysters die, tissue is consumed quickly by foraging animals.
        - Bill: Oyster credit is analogous to living shorelines credit. If things change, credit will be adjusted.

II. Slide 7 – Back-crediting Oyster Restoration
    - Chris: why consider going back and crediting a practice that was done before the BMP was approved?
        - Julie said she thought CBP suggested to include large restoration projects like Harris Creek due to such thorough ongoing monitoring. CBP didn't want to discount idea of crediting well-funded and monitored programs.
        - Bill: Concerted effort done in 2010 to establish sanctuaries and monitor them, but there was a commitment of resources to establish conditions for an extended period of time. Might have been positive changes in these areas that should be considered for crediting.
    - Emily: Is 2010 a reasonable date to consider? Why?
        - Lew: Unsure. What if panel were to say it's not a particular practice, but a process based determined by quality of baseline. Consider multiple density estimates over an area. Year doesn't matter if baseline data is good?
        - Julie: June 15th, 2016 meeting discussion on TMDL refers to 2009 as baseline.
        - Lew: Use any 2009 restoration projects plus additional quality baseline data taken after 2009.

        - Bill: 2009 monitoring not as good as now, judgement call on what constitutes good data. Panel doesn't make that judgement. Panel needs to create guidelines to assist with that judgement.
    - Emily: The text of the chapter currently reads that the BMP implementer should determine when biomass year 1 measurements should occur after restoration activities. Does this sound right to the panel?
        - Jeff: Could support that is crediting occurs the first year at a proportion, and full credit is given if subsequent years are consistent. In first assessment, don't give credit for all N sitting there. Take a second and third assessment to give total credit.
        - Lew: This sounds like the right track. Presumably the panel will come up with some protocol for baseline assessment. Some proportion of that baseline is the credit, then there are other protocols for how to assess going forward how that biomass changed and whether it's a multi assessment average. Must be checked every year to be sure.
        - Panelists say it's a reasonable compromise. However, it could be expensive to measure biomass for multiple years in a row.

Action: Jeff will work with Emily and Ken on a strawman crediting protocol and disperse it to the group for thoughts and comments in the next week.

Action: Emily will send the Oyster Metrics document that explains periodicity of monitoring and why year 3 was chosen for biomass, and the 10 Tributaries by 2025 2016 Monitoring Report to the panel.

III. Slide 8 – Lag time from implementation to fully-functional concerns
- Should there be more smaller size categories to account for fact that restoration has higher variability in size? Do we need to account for biomass dry weight variability? Could observations of shell height be fed directly into the regression instead of put through the size class table?
    - Jeff: Data dense quantile regressions are the best way to account for biomass.
    - Lisa: Were previous quantile regressions from restoration? All over the bay in different kinds of environments?
        - Julie: We can use the diploid equation from the first report and feed the shell height observations directly into it. There is no discernable difference between on-bottom diploid restoration oysters vs. the entire regression.

IV. Slide 6 – Declining biomass
- At what 3-year interval, if biomass has stagnated or declined, does measurement stop occurring?
    - Larry: This should be up to institution running restoration site.
    - Jeff: proportional crediting in beginning adds incentive for sustained monitoring.
    - Bill- Panel should follow '10 Tribs by 2025' monitoring protocols.

Decision: The panel will not be prescriptive. It is up to the BMP Implementer to choose the useful life of the BMP for assimilation purposes (when to stop monitoring).

V. Slide 9 –

- Mark: Is it common to see details of protocols for sampling inside a BMP document or more common to reference protocols for sampling? Might be worth getting background on sampling design.
- Lew: once a BMP is approved, there is a technical memo that goes out… "this is exactly what we expect to see with respect to how to develop this credit" based on info in panel report.
- Chris- we can include citation in the text of the report to specific approaches.

Action: Lew will send technical memo examples to the panel.
Action: Panel will to continue discussion on how prescriptive to be.

b. Nitrogen reduction effectiveness by the process of enhanced denitrification associated with oysters for restoration practices

I. Slide 10 –
- Highlights differences between denitrification and assimilation chapters.

II. Slide 11 –
- Does panel agree with 3 year intervals?
  - Jeff: Don't credit overages of biomass, defer to percentage of full crediting again. Lower biomass will still have significant effects on water quality.
  - Lisa: Agrees. Becomes non-linear at higher biomass (biomass vs. DNF) – what is threshold?
  - Bill: It will be valuable to expand on rationale for clarification.
  - Jeff- will include this information in a figure like the example in slide 11.
- Does panel agree with idea that 1st year biomass taken, same would go for denitrification measurements and would be good for 3 years afterward? Is panel comfortable with the assumption that biomass stays same for 3 years?
  - Jeff: Is comfortable with this.
- When reassessed at year 4, no rate analysis takes place, use year 1 rate again as long as biomass is similar or higher than year 1?
  - Jeff: we'll assume that it is good.
- Proportional scaling credits?
  - Intertidal reefs pose a bit of an issue, need to look back at data.
    - Biomass would be function of sampling design of that process.
  - Jeff: We need to create language as to caution people from making investments in these areas for now.

III. Slide 14 – On bottom restoration studies (refer to chart)
- Jeff: Reefs are more complicated than the reef in this chart. In the end, there was no export in biodeposits, this would be an overestimate. Is comfortable with this rate at this stage. Net denitrification rate between control and reef is 250.

IV. Slide 15:
- Emily: Not many people are set up to be able to make denitrification assessments at these rates.
- Jeff: Will describe here what techniques are appropriate. Need to put some thought into this.
- There is no need to overprescribe in the second paragraph. State "this is the way we believe these studies should be done".
- Put broad guidelines in this and leave it up to technical implementation the bay program would do.

Action: Jeff will write up some sample text and send it to the panel for reaction.

Oyster BMP Expert Panel Meeting, March 15, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Remotely
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	No
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Remotely
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remotely
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remotely
Chris Moore	Chesapeake Bay Foundation (CBF)	Remotely
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remotely
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remotely
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Remotely
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	No
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Emily French	Oyster Recovery Partnership	Yes
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:

1. **Action:** Bill and Emily will research BMP verification guidelines to develop a less prescriptive approach for report.
2. **Action:** Lisa created a spreadsheet that shows real sentinel site data used for assimilation partial crediting approach scenarios and will send it out to the group.
3. **Action:** Emily will connect with Lisa for sanctuary reef raw data.
4. **Action:** The panel will include a footnote of disturbance event guidelines in the assimilation chapter.

Meeting Minutes:

1. Coordination Updates, Emily French

a. ORP will provide a quick update on the Citizen Advisory Committee (CAC) Feb 23rd meeting.

b. Next oyster BMP Expert Panel meeting will take place April 19th; Julie will be in attendance
c. 2nd report draft should be done in April, public review period in May
    i. This draft/review schedule needs to be double checked with Julie
    ii. Bill asked if the first paragraph of the assimilation chapter, 'algae and organic matter' could be added to oyster filtering sentence.
d. CAC Meeting- Emily presented for Ward. CAC had two main concerns:
    i. With a decrease in potential budget, they are worried verification for restoration (monitoring) wouldn't be able to happen as outlined thus far in 2nd report.
    ii. Concerned about oyster aquaculturists not knowing how to adequately report the number of oysters in their farms, potential for overcrediting because reports on number of oysters could have incorrect figures.
e. There will be one or two more meetings before panel draft report review.

2. Thoughts concerning verification for the N and P assimilation and enhanced denitrification for restoration practices subchapters, Jeff Cornwell and Emily French

a. Denitrification Subchapter Crediting Approach Presentation – Jeff Cornwell
    i. Slide 3
        - Jeff: With any denitrification crediting scenario, it's a necessity to make measurements and have site specific data. There is no baseline data that says oyster reefs always behave in a certain manner, they're highly variable. Panels A, B, and C are biomass assessments over time. The red bars are the N credits associated with biomass. If biomass increases over time, we cannot exceed the initial measured amount and must give the same amount of credit. We do think there's a reasonable linear relationship with the decrease in biomass, therefore crediting will decrease. This is a broad proposition at this point, a draft figure. Assimilation crediting is even more complicated.
        - Jeff: Outstanding questions – What are these time periods? How long do we keep crediting denitrification?
        - Lynn: On Panel C, if you have biomass degrading, at what point do you stop crediting entirely as opposed to just decreasing credit?
            a. A panelist proposed at 50% biomass, credit is revoked entirely. Panelists agreed. Jeff mentioned, or they could do another DNF assessment.
            b. What behavior does this decision incentivize?
        - Lisa: Wants to review biomass decrease data once more.
        - Julie Rose: From an implementation standpoint, it seems unusual that you'd have decreases and increases steadily. It might jump around from year to year. If biomass decreases between T1 and T2 but increases at T3, it should be back to T1's credit.
        - Bill asked if benthic infauna and other small oyster reef residents enhance DNF, Jeff said yes.
        - Lew asked what this topic is relative to. Emily answered this discussion is only on sanctuaries, not aquaculture.
        - Lew: If biomass is stable for 10 years, does crediting continue or does it need a recheck?
            a. Jeff: Denitrification for that is on a constant basis. The intention in all of this is to achieve a balance in prescribing how things should be done but not overprescribing as not to exclude potential method advancements, innovation, etc.

b. Nitrogen and phosphorus reduction effectiveness associated with assimilation in oysters for restoration practices - Partial crediting approach

i. Slide 8
- Emily: This figure is what we have so far for biomass over time a restoration site. Other than this haven't found examples of density/ biomass data over time taken from the same oyster reef. Another idea for the sanctuaries with no restoration occurring is to look at fall MD survey data. It has no area measurement but there is a formula in a report for converting the second of dredge tow to an area. It tries not to sample areas where hatchery spat on shell has been planted.
- Lisa: There should be data from Virginia, sanctuary reefs are sampled yearly, collected by patent tong. Same restoration reef over time. Roger Mann and Missy Southworth can provide raw data – summary data can be found online.
- Emily: Will connect with you to find those data.

ii. Slide 9
- Emily: Here is the skeleton of recommended sampling that assimilation chapter would offer. Is it too prescriptive to apply to this or if this is enough of a skeleton to remain in the chapter?
- Lisa: Year 1 should be Time 1. Implementer gets to pick when they do their first assessment – reflects language used in report.
- Chris: There needs to be guidelines for what to do during disturbance events.
- Emily: We will include a footnote for disturbance events.

iii. Slide 10:
- Emily: Is 6 years too long for BMP implementer to receive credit? Alternative is 50% at time 1, 100% at time 2 if there's an appreciation?
- A panelist mentioned that any local government thinking about using oysters are assuming they are receiving continuous credits.
- Emily: This credit has to do with standing stock, potential concern for double counting.
- Lynn: Any discussion as to what to do at Time 2 if biomass has decreased? We need equations so that we're understanding the situation the same way.
    a. Default: no credit given, but no credit is revoked. Only credit oysters there at that moment in time. Not automatically giving credit for next year unless implementers can show that reef has grown.

c. Review '10 Tributaries by 2025' approach to collecting biomass measurements

i. Slide 4
- First bullet point: Stratified random sampling, does panel want to make assignment on sample design? Too prescriptive?
- Second bullet point: Assessment intervals.
    a. Emily: Is there any biological basis for 3-6 year assessment intervals?
    b. Ken: Substantial overplanting of bars would happen if natural recruitment wasn't assessed. Oysters are assessed at year 3 to figure out how many survived up to that point, and to assess oysters of a known age. If oysters are not surviving at a known threshold, more seeding occurs.
    c. Mark: this was mostly to add accountability that oysters are there; to monitor restoration sites and not just forget about them.

ii. Slide 6
- Review of 2016 Oyster Reef Monitoring Report.
    a. Survey design: Systematic grids created in ArcGIS.
    b. Sampling methods: Patent tongs for spat on shell, etc.

iii. Slide 7
- Emily: Current version of assimilation subchapter; does panel agree with this language?
- Chris: Diver language for monitoring is a little MD centric, lower parts of the bay can be restored/sampled without diving. Loosen up the language a little bit.
- Mark: Reefs aren't property of individuals, surprised we're saying how agencies should sample the reefs.
- Ken: Monitoring protocols have been developed through long efforts of trial and error; don't see that us describing how to do this is appropriate.
    a. A panelist mentioned, what about providing guidelines for small community restoration?
    b. Jeff: It is up to agencies how to implement this anyhow; simplify by saying use approaches approved by different agencies.
    c. Chris: Good for entities that have done restoration thus far. New implementers won't know the protocols that have been developed and may need the guidance. We need something in this chapter to address that.
    d. Lew: This track makes sense; up to panel to establish expectations for minimum level of monitoring for restoration sites.
    e. Mark- isn't there a technical appendix CBP writes that says this type of specific monitoring info? Chris responded yes, but allowing CBP to write the verification procedures for this report could result in a knowledge gap.
- Emily: language of paragraph is pretty general to begin with- should we be more prescriptive than this or leave this as it is, or less prescriptive? Do we need a technical appendix instead of this language?
    a. Jeff: Including a technical appendix sounds fine. We don't need to specify HOW to sample (e.g. with patent tongs). Make this paragraph more generic; include more approaches in technical appendix.
    b. Ken: take everything out after the first sentence.
- Emily: Do we keep that it is recommended that BMP implemented should collaborate with research institution? Keep?
    a. Lynn: If private groups want to embark on this, who is going to be the overseeing body?
    b. Chris: No matter the implementer, there needs to be a verification process in place. A process set up by the state.
    c. Lynn: Don't know enough about how this works in MD. Some private implementer might come up with a process really creative that we haven't thought of – system needs to be in place to review what they think of.
    d. Bill: Because of our mission to evaluate crediting for BMPs we have basic responsibility to reference some approach to sampling, verification. Oyster Metrics document seems to be the piece right now that bay is using, seems logical prescribe this.

e. Ken: Seems like we're getting into permitting process, would it not be appropriate to have language that the appropriate permitting agency should use specific guidance document to dole out recommendations?
f. Emily: Sounds like panel should play around with less prescriptive approach up front in chapters, include technical document, get information on approval practices/techniques.
g. Bill: Emily and I can research BMP verification guidelines. Shoreline Management BMP isn't too prescriptive. But since so many resources go into oyster restoration, maybe it would be better to have prescriptive approach, less room for error.
h. Lisa has created a spreadsheet that shows real sentinel site data used for assimilation partial crediting approach scenarios and will send it out to the group.

3. Will cover at next meeting: Nitrogen reduction effectiveness by the process of enhanced denitrification associated with oysters for restoration practices
    1. Discuss measurements related to biomass relationship with DNF
    2. Discuss guidance for when to take DNF measurements and with what method

Oyster BMP Expert Panel Meeting, May 17, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remotely
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Remotely
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remotely
Andy Lacatell	The Nature Conservancy (TNC)	Remotely
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remotely
Chris Moore	Chesapeake Bay Foundation (CBF)	Remotely
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remotely
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remotely
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remotely
Frank Marenghi (Guest)	Maryland Department of Natural Resources (MD DNR)	Remotely
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Guest	**Affiliation**	**Present?**
Frank Marenghi	Maryland Department of Natural Resources (MD DNR)	Remotely

Action Items:

1. **Action:** Julie will send doodle poll to schedule another call for the public fishery discussion.
2. **Action:** Julie will send out a draft of the second report for review; panel members should review the definitions and consider the BMP decisions/rationales.
3. **Action:** Lynn Fegley will continue conversation with MD DNR scientists, will report to the Panel about discussions on survivorship rates and timeframe.
4. **Action:** Julie, Lisa, and Jeff will discuss baseline scenarios, minimum timeframes for crediting and communicate with Panel via email.

5. **Action:** Jeff and Lisa will speak to the technical details of baseline denitrification rate within the next few weeks.
6. **Action:** Panel should read through all PowerPoint slides, reach out via email with comments and concerns.

Meeting Minutes:

Coordination Updates

a. Emily French was awarded a post-graduate fellowship at U.S. EPA in D.C. Her last day was May 4th.
b. **Action:** Julie will send doodle poll to schedule another call for the public fishery discussion.
c. Aiming for end of July to release draft of 2nd report for 30-day CBP Partnership/public review.
d. Should have beginning sections of report ready for Panel review next week (intro, report structure, panel effort, summary of determination framework, evaluation of oyster practices for BMP consideration and definitions).
e. **Action:** Julie will send out a draft of the second report for review; panel members should review the definitions and consider the BMP decisions/rationales.
f. New shell budget data from Roger Mann.

Application and verification for the N and P assimilation (restoration and public fishery) and enhanced denitrification subchapters, Julie Reichert and Jeff Cornwell

a. Resolve outstanding BMP report items for practice-protocol combinations for approval (public fishery-assimilation, oyster reef restoration-assimilation, oyster reef restoration-enhanced denitrification):

Practice-protocol combinations putting forward for BMP approval (need complete recommendations covering all the BMP Review Protocol items further below):

Nitrogen and phosphorus reduction by assimilation for endorsed public fishery practice:

- **On-bottom public fishery oyster production using hatchery-produced oysters**
  1. Baseline Recommendation
     a. Language from first report: Only include oysters removed moving forward from the time the BMP is implemented, practices are in areas with no oysters or <1 oyster/m^2. Reduction credit should only result from enhancement activity.

Discussion

i. Frank: Public fishery areas are not without oysters. Should have recommendations in place to address oysters that already exist in these areas.

b. Decision needed –

i. (1) Base crediting on monitoring data of oyster density pre-BMP and pre-harvesting (deduct existing population from overall harvest). Should baseline deduction be applied all at once or distributed evenly throughout the lifespan of the BMP?

ii. (2) Base crediting on an estimate of survivorship from plantings (put and take; e.g. 1,000,000 spat-on-shell planted, 5% survivorship, only 50,000 oysters can be counted for reduction effectiveness credit the following x years (would need to choose a timeframe; would not need to know oyster population pre-BMP)).

Discussion

i. Ken: Who would get credit in MD? Firm believer in option #1. A 5% survivorship rate would possibly under credit the credit receiving

jurisdiction. Would behoove both states to know that condition of these sites so they're not overplanting an already robust population.

ii. Lynn: Unsure who would get credit. Part of it depends on the administration in place at the time, unsure how funding would flow; possible that it may go back to the county through DNR.

iii. Julie: Can we do a combination of both options? 5% knowing we're likely to be under crediting, until implementer can prove through time they have better survivorship rate.

iv. Frank: Agrees with option #2 for now. If the survivorship rate needs to be tweaked based on data overtime, then that should be no issue. Implementers should only receive credit for one year for a planting. Would be best to do pre- and post-monitoring to be decisive, but I think moving forward with 5% for now is reasonable.

v. Mark: Leaning toward option #2. Regarding option #1, what would be the most accurate way to understand what an increase might be?

vi. Lynn: It'd be ideal if we could monitor productivity of every area pre- and post-planting, but it's difficult to do. The idea of pre-harvest is we know for a fact that we placed 1 million oysters in a certain area – no one will get credit for oysters coming from a section that wasn't planted, but people can receive credit for 50,000 oysters at 5%. We need to know from where on the bar the oysters are being harvested – this is not typically reported information.

vii. Frank: Not as worried about people getting credit from non-planted oysters. Most bars are planted each year and open for harvest during the entire regular season.

viii. Lisa: For Ken – Would you agree that if a county is willing to close a bar to harvest until large enough, you would be able to come up with the proportion of hatchery vs non-hatchery oysters?

   a. Ken: Yes, but the issues with that is you don't know how much they've been exposed to gear. It'd be beneficial to get bars into rotational practice.

ix. Frank: I'm more comforted by the harvest numbers because survival is so variable.

x. Lisa: A jurisdiction should only get credit for oysters that could potentially have been harvested off a bar. A pre-harvest survey will allocate the proportion of natural/planted oysters, determining what someone could get credit for regardless of what happens during harvest.

xi. Mark: The panel should be mindful of the credits people will receive under these scenarios, relative to the cost of the pre- and post-surveys.

Action: Lynn Fegley will continue this conversation with MD DNR scientists, will report to the Panel about discussions on survivorship rates and timeframe.

2. Qualifying Conditions/Temporal Performance
   a. Language from first report: Only include oysters removed moving forward from the time the BMP is approved for credit in the TMDL; Oysters had to have been grown from initial sizes < 2 inches shell height; Oysters have to be alive when removed for credit to count.
   b. Decision needed –

i. Should we include that the credit is only applicable after x years from planting?

Discussion

i. Julie: Is 3 years post planting okay? Does the panel prefer 4 years?

3. Useful life of BMP
    a. Language from first report: Oysters remain useful until they die or are removed from the water.
    b. Decision needed –
        i. Should this read "remains useful as long as planting activity occurs x years (need to pick a timeframe; 3 years?) before harvesting?"
4. Cumulative or annual practice
    a. Language from first report: Annual based on removed live oysters.
    b. Decision needed –
        i. Should this read "annual based on removed live oysters resulting from enhancement activity"?

Discussion

ii. Julie: This would likely be more of an annual basis, I will need discussion with Matt Johnston at CBP for this.

5. Reporting –
    a. Language from first report: Single Grow-out and Multiple Grow-out Location; Default and site-specific credit.
    b. Decision needed –
        i. Does it make sense to include a site-specific method to determine the biomass estimate for this practice given that it can occur in productive oyster areas? Samples may include natural and hatchery-produced oysters.
        ii. Does it make sense to keep the multiple grow-out recommendations? Spat-on-shell is typically planted with this practice, which means oysters are less than 2 inches; Lynn is pretty sure oysters are not moved.
6. Miscellaneous
    a. Queen Anne's County plants triploid oysters on public fishing grounds.
    b. Decision needed –
        i. Should only default diploid oysters apply to this practice is baseline shows existing oysters in areas?
        ii. Should triploids in this practice even be considered a BMP?

Nitrogen and phosphorus reduction by assimilation for endorsed oyster restoration practices

- **Oyster reef restoration using hatchery-produced oysters**
- **Oyster reef restoration using substrate addition**
    1. Partial reduction effectiveness crediting approach
        i. Biomass Scenarios (see Excel spreadsheet)

    Discussion

    i. Julie: Panel doesn't necessarily need to determine timing of biomass increase monitoring (2 years on spreadsheet).

    2. Baseline Recommendation
        i. Scenario 1 – Oyster restoration occurred between 2009 and when BMP is approved.
            i. Decision needed –
                1. Can Panel's regression equations be used to convert shell height to biomass if there are datasets on oyster density/shell height from BMP location?

2. If existing data can't be found from BMP location, can a reference location that mimics the BMP location be used?

ii. Scenario 2 – New restoration work after approval of BMP.

3. Qualifying Conditions/Temporal Performance
   i. Suggestions: Credit only applicable for live oysters >/= 2 inches; First crediting time-period to occur a minimum of 2 years after enhancement activity; Credit only given if estimated biomass from regression is more than the baseline biomass.
4. Useful life of BMP
   i. Decision needed –
      i. Suggest we set it at 6 years after each enhancement activity so the practice has a timeframe, but possible to expand its life past 6 years with additional plantings.
      ii. Useful as long as biomass is appreciating. Partial credit will be given based on a schedule that buffers against over-crediting.

   Discussion
      i. Lisa: I assumed only crediting after monitoring happens.
         a. Julie: This is true.
      ii. Julie: The panel must give CBP a qualifying condition, may not need 6-year timeframe.
      iii. Jeff: Implementers would need enhanced monitoring to keep crediting happening.
      iv. Julie: Additional plantings is adaptive management – if implementers are not getting biomass they want, they plant more oysters.
      v. Julie: Leave the time frame open, but determine the minimum of lag time. Should we only credit oysters greater than 2 inches? Monitor at a minimum of every 2 years? If implementers want to monitor every year, leave them that option?
      vi. Lisa: Unsure if I fully understand the data supporting only counting oysters greater than 2 inches.
      vii. Julie: 2 inches is past high chance of mortality. We want to make sure were crediting oysters that'll be there the next year.

   Action: Julie, Lisa, and Jeff will discuss baseline scenarios, minimum timeframes for crediting and communicate with Panel via email.
5. Cumulative or Annual Practice
   a. Decision needed –
      i. This is a cumulative practice with a recommended partial crediting scheme throughout the lifespan of the BMP.
6. Reporting
   a. There are miscellaneous oyster growing programs established in VA and MD.

   Discussion
      i. Ken: Oyster gardening yields small numbers. It'd make sense to capture those numbers if they add to a reef.
      ii. Julie: Any multiple grow out locations are removed from this protocol. Not possible to divide up credit for multiple docks, only consider if they decide to build a reef.
      iii. Julie: Regarding the site-specific method to determine biomass, are we using the table of size classes to pre-determine estimates of removal or having implementers plug them into our regression equation and take the average?

iv. Jeff: Either way is sufficient. Giving people option of how they want to approach this is fine, too.

7. Miscellaneous
    a. Stakeholder wants panel to consider role of substrate in oyster reef restoration practices for sequestration credit.

    Discussion

    i. Julie: How credit is divided amongst those involved is up to policy and implementation, not for the panel to decide. If an implementer wants to make an arrangement with a substrate provide, that is up to them to work out.
    ii. Julie: The Panel is putting forward a framework that dead shell/substrate could be considered in the future with more information based on dissolution.

Nitrogen reduction by enhanced denitrification for endorsed oyster restoration practices

- **Oyster reef restoration using hatchery-produced oysters**
- **Oyster reef restoration using substrate addition**

1. Reduction Effectiveness Crediting Approach –

    Discussion

    i. Jeff: If biomass increases, we don't feel we have sufficient information to give credit to that. Shape of increasing curve unclear. As biomass decreases, credit decreases. Once biomass is below 50% of original, no credit given.
    ii. Lisa: Not discounting anything on the front end.
    iii. Jeff: 100% of increase over background shouldn't be entirely credited because biodeposits can land elsewhere. We can simplify the fate of the particles. Any assessment we do misses a substantial amount of nutrient processing and denitrification.
    iv. Jeff: A whole ecosystem method is preferable. If people want to take a lower number and do cores or oysters, that's fine, but we're not doing any multiplier to bring them up to the entire system.
    v. Lisa: How can you measure denitrification from oysters without disturbing the entire system?
    vi. Jeff: Most denitrification moves with clumps, it's the entire community, not just the oysters.
    vii. Julie: The Panel can explain methods with which people can take their measurements, explain the pros and cons of each method in the report.

    Action: Jeff and Lisa will speak to the technical details of baseline denitrification rate within the next few weeks.

2. Baseline recommendation
    a. Two Scenarios –
        i. (1) Oyster restoration occurred between 2009 and when BMP is approved. Must use an existing dataset approved by CBP to establish baseline for denitrification rate which would be subtracted from first crediting time period.
        ii. (2) New restoration work after approval of BMP. Establish a pre-restoration baseline survey to include oyster densities, shell heights, and measured denitrification rate.

Discussion

i. Julie: As long as an implementer can prove their baseline, we are crediting restoration that occurred between 2009 and set up of BMP. Baseline must be based off of biomass density/rate, not denitrification rate.

3. Qualifying Conditions/Temporal Performance
4. Useful Life of BMP
    a. Decision needed –
        i. Suggest we set it at 6 years after each enhancement activity, can be expanded past 6 years if there are additional plantings.
        ii. Useful as long as credit is above baseline.
5. Cumulative or Annual Practice
    a. Decision needed –
        i. This practice can be credited continuously on an annual basis 2 years post first enhancement activity throughout the lifespan of BMP as long as denitrification rates are above the baseline.
6. Reporting
    a. Decision needed -

Discussion

i. Julie: Could people develop their own site-specific equation? How many options do we want to present in the report for these protocols?

Action: Panel should read through all PowerPoint slides, reach out via email with comments and concerns.

Outstanding CBP BMP Report Protocol Items (still need to finalize decisions)

1. Description of pre-BMP and post-BMP circumstances and individual practice baselines
2. Conditions under which the BMP works/not works (qualifying conditions)
3. Temporal performance of BMP including lag times between establishment and fully-functional
4. Useful life of the BMP
5. Cumulative or annual practice
6. Description of how BMP will be tracked and reported

Oyster BMP Expert Panel Meeting, June 8, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	Yes
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes
Guest	**Affiliation**	**Present?**
Frank Marenghi	Maryland Department of Natural Resources (MD DNR)	Yes
	EPA R3 ORISE Fellow	Yes

*Matt Parker provided written comments afterwards

Action Items:

1. **Action:** Lynn Fegley is going to meet with folks at DNR to get more data/information to help inform the percent to use (5% has been suggested so far) and the timeframe (minimum of 3 years have been suggested). Also, will discuss with folks potential verification measures. Will report back to the Panel during meeting in next couple of weeks.

2. **Action:** Julie Reichert will schedule a call with Lisa and Jeff to go through baseline suggestions (e.g., use of a reference location for post-TMDL/pre-BMP restoration projects) and whether there should be a

minimum time frame after the enhancement activity before the first crediting year (2 years have been suggested). Obtain Panel consensus decision through e-mail.

Meeting Minutes:

Practice-Protocol Combinations for BMP Consideration

1) Nitrogen and phosphorus reduction by tissue assimilation for endorsed public fishery practice:

- **On-bottom public fishery oyster production using hatchery-produced oysters**
- Discussion:
    - The Panel has not reached consensus yet. Discussions leaned towards the reduction credit being based on an estimate of survivorship from spat planted (e.g., 1,000,000 spat-on-shell planted, 5% survivorship, only 50,000 oysters can be counted for reduction effectiveness credit the following x years). Also, folks were considering a verification measure that evaluates the pre-harvest population survey after planting to ensure that the oysters are there for credit (oysters harvested from the bar may not be from the location where the oysters were planted; aiming for harvest to reflect what could have realistically survived from the planting even if not the actual oysters) and post-harvest surveys to help refine the % survivorship of spat planted. Jeff recommended a verification measure that x% of the bar should be assessed for ground-truthing (we could use similar language that an expert helps with the sampling design). Ken emphasized that verification measures should allow for assessing the success of the practice (oysters are surviving). Some panelists felt that verification would be easier if after planting the area is closed to harvest and opened only after the pre-harvest survey is done (could tell the hatchery-produced oysters from the natural oysters; similar to management reserve approach).

Action: Lynn Fegley is going to meet with folks at DNR to get more data/information to help inform the percent to use (5% has been suggested so far) and the timeframe (minimum of 3 years have been suggested). Also, will discuss with folks potential verification measures. Will report back to the Panel during meeting in next couple of weeks.

Discussion with Frank Marenghi, 6/7/18 and decisions during 6/8/18 Panel Meeting:

Frank and Lynn discussed this BMP more. Both agreed that an approach that requires the least amount of surveys, but still adequately addresses crediting the enhancement, would be better suited in implementing this BMP.

Frank and Julie Reichert discussed further and sorted out an approach that may work requiring only one initial survey. This approach was furthered discussed by the Panel during the 6/8/17 meeting and has been edited to accommodate the below decisions/feedback:

Decisions:

- The Panel agrees to a minimum timeframe of at least one year before opening bar to harvest.
- Credit must be paired with prior planting.
- Baseline is based on the density of oysters that are ≥ 2 inches.

Discussion:

- Lisa: Option 2 should be clearer in its language that credit goes to the number of harvested oysters minus 5% of the initial ≥ 2 inch oyster density.

- Julie: Spat must be sourced from hatcheries for credit to be given (transfer of wild spat does not qualify).
- Frank: 5% survival rate comes from a Ken Paynter technical report. Lisa: Mention that all data are from Maryland.
    - Matt Parker—Mike Congrove's Thesis from VIMS has Virginia spat on shell aquaculture estimate. For lack of other data, this could be substituted.

Edited Approach:

Recommendations are based on harvesting oysters that are ≥ 3 inches; Julie Nguyen—there are estimates for 2 inch oysters—shouldn't it be up to the implementing programs and regs to set what size oysters are harvested at?

- **BMP location:** Designate area on bar as a BMP area (report latitude and longitude).
- **BMP unit:** lbs of N and P from harvested oyster tissue from BMP location.
- **Baseline:**
  Two BMP location scenarios:
    1. BMP designated area is located where hatchery-produced oyster plantings have occurred.
    2. BMP designated area is located where there has been no hatchery-produced oyster plantings.

  Do an initial survey of the designated area to determine pre-BMP oyster density of oysters that are ≥ 50 mm (≥ 2 inches) (oyster size is based on shell height) per area unit (typically, surveys are in square meters; sampling design should reflect the BMP area). Julie Nguyen—Can past harvest data be used for initial survey?

  Two possible outcomes:

    1. The total of ≥ 50 mm (≥ 2 inches) oysters from the initial survey of the designated BMP area is zero or ≤ 1 oyster/m^2 (4057 oysters/acre). Indicates a non-productive/poor oyster recruitment area. The Panel recommends using the same requirements as the approved, "on bottom private oyster aquaculture using hatchery-produced oysters" BMP. All oysters harvested from this area would be eligible for reduction effectiveness crediting. It is expected that without the enhancement activity there wouldn't be harvest from this area.

    The total of ≥ 50 mm (≥ 2 inches) oysters from the initial survey of the designated BMP area is greater than 1 oyster/m^2 (4057 oysters/acre). Cap the number of harvested oysters ≥ 3 inches that would be eligible for reduction effectiveness credit at 5% of the number of spat planted (e.g., 10 million oyster spat planted per acre would equate to 500,000 harvested oysters ≥ 3 inches per acre eligible for credit). The spat survival of 5% is from [cite reference(s)—unclear where this number comes from; Matt Parker—there is actually quite a range in Paynter's reports]; the reports up to 2013 season are available for download on his lab website; personally I feel 5% is a touch too low]. To receive reduction effectiveness credit after the first planting, the number of harvested oysters equal to or greater than 3 inches from the BMP area must be more than the initial survey density of ≥ 50 mm (≥ 2 inches) per unit area. Reduction effectiveness credit after first planting would be on the increase in oyster density from the initial survey baseline. Any subsequent planting, credit would at the 5% spat survival rate. To adjust the 5% survival rate, optional pre-harvest and post-harvest surveys could be done to determine how many planted oysters are surviving to harvestable size.

- **Qualifying Conditions:**

1. Enhancement activity is the use of hatchery-produced spat-on-shell planted in the designated BMP area. Use of wild spat would not qualify. Reporting would include documenting how many spat are planted and dates planted.
2. Reduction effectiveness credit must be paired with a prior planting.
3. Reduction effectiveness credit becomes available after a minimum of 1 year of the area being closed to harvest and would be applicable during the year the area is open to harvest. [Matt Parker—Why is there a cap? There is no cap for aquaculture]
4. Only includes harvested oysters equal to or greater than ?-inch shell height moving forward from the time the BMP is approved/implemented for reduction effectiveness credit in the TMDL. In non-productive (zero oysters per square meter) or poor productive (≤ 1 oyster/m^2 or 4057 oysters/acre) areas, all harvested oysters equal to or greater than 3-inch shell height would be eligible for reduction effectiveness credit. In productive (> 1 oyster/m^2 or 4057 oysters/acre) areas, the baseline oyster density would be subtracted from the harvest of the first crediting period and capped at 5% of the total spat planted unless a site-specific spat survival rate is determined with pre-harvest and post-harvest surveys.
5. Oysters had to have been grown from initial sizes < 2.0 inches shell height.
6. Oysters have to be alive when removed to count toward the reduction effectiveness.

- **Temporal Performance of BMP:** In order to increase confidence that the harvest includes oysters from the enhancement activity, the designated BMP area should be closed to harvest at least a minimum of 1 year after planting the oyster spat [Matt Parker—for spat on shell oysters, you are looking at more like 36 months for oysters to reach "market" size. 18-24 months are for oysters grown in gear off the bottom]. The total closed timeframe beyond 1 year would be decided by the implementing programs based on type of oyster planted (diploid or triploid), environmental condition of location, or to meet any regulatory requirements. Past harvest information from the area or nearby similar area could be used to help determine the timeframe needed for oysters to reach the required harvestable size. The implementing program would decide on the minimum harvest size (must meet State's minimum size regulations). As long as the oyster shell height is equal to or greater than 3 inches, the harvested oysters could receive reduction effectiveness credit based on the corresponding on bottom estimates from the first report and qualifying conditions for this BMP.
- **Useful Life of BMP:** Planting equates to one available crediting period (credit paired with prior planting). [Matt Parker—why a cap?]
- **Reporting:** Include latitude and longitude of designated area, number of spat planted, BMP estimate (based on oyster size and ploidy type), planting year, initial survey density of oysters equal or greater than 2 inches, closure timeframe, year of harvest, number of oysters harvested.
- **Verification Guideline:** Include where spat came from to verify that hatchery-produced spat were used.
- **Example:** Credit would be applicable on the year the area is open for harvest.
    1. For outcome 1: All harvested oysters from the area would be eligible for reduction effectiveness credit.
    2. For outcome 2: Check whether harvest count is greater than the initial density of oysters equal to or greater than 2 inches. If greater, then credit harvest up to 5% of spat planted. Harvest from subsequent plantings within same designated timeframe, up to 5% of spat planted would be eligible for reduction effectiveness credit

2) Nitrogen and phosphorus reduction by assimilation for endorsed oyster restoration practices

- **Oyster reef restoration using hatchery-produced oysters**

- **Oyster reef restoration using substrate addition**

The Panel reached consensus on using a partial crediting approach for the standing stock of whole oyster biomass (tissue and shell) on the restored reef. Credit would only occur if monitoring demonstrates that there is appreciation of biomass over baseline biomass. For any given crediting year, the BMP implementer can receive 50% of the appreciated biomass and the other 50% in the following crediting year as long as the biomass remained the same or increased. If there is a depreciation in biomass, no credit is given.

In an e-mail after the Panel meeting, Lisa suggests that the Panel does not put a size restriction for the qualifying conditions (2 inches was suggested), but instead, in the application guidelines, include language that it may be more time/cost effective to limit survey data to larger oysters (i.e. leave it open to the surveyor to determine the size down to which they believe it to be worth measuring oysters). Lisa feels there is a safety net already built into the numbers because we are only crediting 50% for live oysters above baseline which is roughly equal to shell which will continue to sequester long after the oyster dies.

Panelists on the call were in agreement that programs like Oyster Gardening in VA and Marylander's Grow Oysters in MD should be credited as part of the reef restoration practice at the reef's location.

Action: Julie Reichert will schedule a call with Lisa and Jeff to go through baseline suggestions (e.g., use of a reference location for post-TMDL/pre-BMP restoration projects) and whether there should be a minimum timeframe after the enhancement activity before the first crediting year (2 years have been suggested). Obtain Panel consensus decision through e-mail.

Need to schedule follow-up discussion

3) Nitrogen reduction by enhanced denitrification for endorsed oyster restoration practices

- **Oyster reef restoration using hatchery-produced oysters**
- **Oyster reef restoration using substrate addition**

Panelists at the meeting were in agreement concerning the following reduction effectiveness recommendation:

The Panel is in agreement that this BMP will need site-specific measurements of denitrification rates at known biomass. To determine the reduction effectiveness credit, the implementer will have to establish a site-specific denitrification rate at a known biomass. To receive credit, verification of biomass is needed. The biomass can be determined from either oyster densities/shell heights using the first report's diploid shell height to tissue dry weight regression equation or actual biomass measurements. If the biomass is at the level that the denitrification rate was determined, then full credit is applicable based on the denitrification rate. If biomass increases, then the enhanced denitrification credit would be at the rate that was measured at the known biomass unless a new site-specific denitrification rate is established at the increased biomass level. If biomass decreases, then the credit would be reduced linearly as long as 50% of the known biomass is present. If less than 50% of known biomass is present, then no credit would be given unless a new denitrification rate is established at the lower biomass.

Action: Lisa and Jeff are going to go over some data to see what can be recommended in determining the baseline denitrification rate (e.g., use of reference sites for existing restoration projects post TMDL, but pre-BMP approval; denitrification assessment pre-BMP implementation for new restoration projects). Also, need to discuss timeframes for when the BMP is considered fully functional and the useful lifespan of the BMP.

Summary of phone conversation with Lisa and Jeff on 6/5/18:

Components needed to determine the site-specific enhanced denitrification estimate:

- Must have a measured denitrification rate at a known biomass for the site seeking BMP credit.
- Must have a measured control at a reference site that is representative of the environmental (temp, salinity, and dissolve oxygen) conditions and oyster biomass characteristics as the BMP restoration site before the enhancement activity (planting spat-on-shell or substrate).
- Consult with an expert to determine the sampling design and number of sampling points that will adequately capture the size of the BMP restoration site (this could influence the cost to implement).
- At a minimum, sample 3 times during the year that includes spring, summer, and fall time periods when active oyster filtration occurs. Can include winter if sampling is done. If not, then winter is set as zero for those months (Lisa and Jeff are planning to use a weighted average approach).
    - Discussion
        - Lisa: An average temperature across all months doesn't make sense, temperatures rise and fall rapidly.
        - Jeff: Implementers can collect winter month data if they want, but it will likely be cost inefficient for credits they'd receive.
- If light reaches the bottom then both dark and light incubations are needed to apply the denitrification rate for the full day. If there are only dark measurements then only dark hours in the year can receive credit.
    - Discussion
        - Jeff: If you have 14 hours of light measurements, calculate the light rate x 14 and the dark rate xv10. It'll be sufficient to get a 24-hour rate and extrapolate it.
        - Lisa: We generally see similar rates in dark/light on restored reefs. We haven't worked where there are loads of algae in most cases.
        - Jeff: It could be useful to know how much light a bar is receiving – possibly record using Secchi disks? Will pull literature together for guidance on this.
- QA/QC for the denitrification rate by measuring other fluxes (ammonium, nitrate, oxygen, and dissolved inorganic carbon; Jeff is writing details on this).
    - This topic will be discussed at the June 28th meeting.

Baseline for Denitrification Rate: Include in sampling design a reference site that is representative of the environmental (temp, salinity, and dissolve oxygen) conditions and oyster biomass characteristics as the BMP restoration site before the enhancement activity (planting spat-on-shell or substrate).

- **Qualifying Conditions:**
    1. Must have at least one planting of hatchery-produced oysters (amount of oysters to plant is dependent on area of BMP and sampling design to achieve desired oyster dry tissue biomass for the site-specific enhanced denitrification rate).
    2. Measured reference denitrification rate for baseline. Must be representative of the environmental (temp, salinity, and dissolve oxygen) conditions and oyster biomass characteristics as the BMP restoration site before the enhancement activity (planting spat-on-shell or substrate).
    3. Measured site-specific enhanced denitrification rate at known oyster dry tissue biomass.
    4. Credit only applicable if the site-specific denitrification rate is more than the reference site (baseline) denitrification rate.

5. Credit only applicable when biomass is determined during that crediting year. Biomass is a proxy to verify the enhanced denitrification rate.
6. If the biomass is at the level that the denitrification rate was determined, then full credit is applicable based on the denitrification rate. If biomass increases, then the enhanced denitrification credit would be at the rate that was measured at the known biomass unless a new site-specific denitrification rate is established at the increased biomass level. If biomass decreases, then the credit would be reduced linearly as long as 50% of the known biomass is present. If less than 50% of known biomass is present, then no credit would be given unless a new denitrification rate is established at the lower biomass.

- **Temporal Performance BMP:** The enhanced denitrification rate can be determined any time after planting, but it is recommended that an expert is consulted to determine the timeframe where oyster tissue biomass will be at a level that it would be beneficial to measure the denitrification rate. Higher biomass would likely result in higher denitrification rates. Typically, it would be advantageous to wait a year or more after planting before making denitrification measurements.
- **Useful life of the BMP:** The denitrification rate is good as long as the biomass is was measured at is present.
- **Type of Practice:** This practice can be credited annually as long as biomass is measured during the crediting year.
- **Reporting:** Lat and long of restoration site, lat and long of reference site, number of acres, oyster tissue biomass, mean reference site denitrification rate (minimum, dark incubation; optional light incubation), mean hourly enhanced denitrification rate (minimum, dark incubation; optional light incubation), number of dark and light hours (if applicable); mean annual enhanced denitrification rate in lbs/acre/year.

Rough Example using Data from Kellogg et al. 2013 from Little Choptank (will provide more complete example in report using hypothetical data to cover each scenario):

- **Location:** Little Choptank
- **Sampling Design:** Experimental plot was 4 m by 4 m (16 m2). Prior to the initial deployment of sampling trays (described below), each 4 m × 4 m experimental plot was subdivided into 4 equal subplots. Within each subplot, 5 potential deployment sites were identified and the sampling sequence was randomly assigned (Fig. 3 in paper). 4 samples were collected from each plot during each sampling period. This sampling design may not be adequate to extrapolate out to 1 acre, so caution should be exercised when discussing the N reduction from this example.
- **Season:** Included 4 samples at control and restoration sites during each seasonal sampling period. Average hourly fluxes for the year were estimated by applying the average of the 4 measured rates to the 8-month period from April through November, assigned zero values to the winter months and divided by 12 [this approach may be changed to a weighted average approach]. This method was intentionally chosen to generate conservative estimates.
- **Oyster Tissue Biomass:** Reference = 0 oysters m-2; restoration site not reported, but had an average of 131 oysters m-2 with average shell height of 4.5 inches. Using the Panel's estimate for 4.5 inches, tissue biomass would be around 353 g m-2 (2.7 g/oyster x 131 oysters).
- **Mean Reference Site Denitrification Rate:** 0.04 mmol N m-2 hr-1
- **Mean Restoration Site Denitrification Rate:** 0.5 mmol N m-2 hr-1
- **Hourly Enhanced Denitrification Rate:** 0.46 mmol N m-2 hr-1 (restoration site minus control site)
- **Number of Dark Hours in 2010:** 4,013 (study only did incubations in the dark and was in the euphotic zone, so can only credit dark hours)

Annual Enhanced Denitrification Rate for crediting: 231 lbs N per acre per year (as long as the oyster tissue biomass remains at or is above 353 g m-2). Multiplied the average hourly enhanced denitrification rate by the number of dark hours in the sampling year.

- This example will be examined further before the June 28th meeting.

Outstanding Questions:

- What if a denitrification experiment has been done recently (within 5 years?) that have all the BMP conditions met? Can this be used or would the experiment have to be repeated?
- What if the restoration site had existing oysters? Does oyster biomass have to be above this baseline value to qualify for credit?
- When determining the biomass to verify the enhanced denitrification rate, when in the year do you make the assessment (one time; which season; all 3 seasons)?

Oyster BMP Expert Panel Meeting, June 28, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	In Person
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remotely
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remotely
Andy Lacatell	The Nature Conservancy (TNC)	No; follow-up call on 7/17/18
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	No
Chris Moore	Chesapeake Bay Foundation (CBF)	No; follow-up call on 7/16/18
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Remotely
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remotely
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remotely
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remotely
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	In Person
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	No
Megan Munkacsy	Oyster Recovery Partnership	Remotely

Action Items:

1. **Action:** Julie Reichert—Follow-up with panelists who couldn't attend on decisions made during meeting; discuss new public fishery recommendations with Frank Marenghi for input.
2. **Action:** Jeff—Fill gaps in denitrification chapter (use reorganized version from Julie Reichert).
3. **Action:** Jeff and Lisa—Discuss seasonal time frame for denitrification rate recommendation.
4. **Action:** Jeff and Lisa—Sort out guidelines for when light denitrification rates are needed.
5. **Action:** Look into whether guidelines exist on how much spat to plant in an area to get the most out of the practice.

Meeting Minutes:

1. **Key Decisions:**
    a. **Public Fishery-Assimilation:**
        i. Panelists decided that a pre-BMP assessment wouldn't be needed if the first eligible crediting year in the designated area is a minimum of 3 years from the first planting. Rationale included that by 3 years, you'll be harvesting oysters influenced by the enhancement activity.
        ii. Panelists felt if the timeframe above is implemented then you would not have to have a cap on harvested oysters based on spat survivorship.
            1. Follow-up call with Chris Moore—concerned that regulators not familiar with oysters would interpret no cap equaling a scenario where 100% of the spat planted can survive. Even though oyster experts know that there is always mortality, which would be reflected through harvest, we should include text that makes it clear that there is mortality.
    b. **Restoration-Enhanced Denitrification**
        i. Panelists agreed to base recommendations on seasonal denitrification rates that could be used for that portion of the year instead of requiring 3 seasons to develop an annual rate and doing a weighted average.
            1. Need to sort out the definition of the seasonal timeframes (set months for spring, summer, fall, and winter, ± 1 month, etc.)
            2. Julie Rose expressed concern in phone call afterwards about the potential unintended consequence that someone could set up a sampling design that occurs in a week that has August and September dates and try to use one estimate to get credit for July, August, September, and October. She suggested we make it clear that a seasonal estimate can only be extrapolated out for a total of 3 months and no more.
            3. Chris Moore—asked whether the seasonal time frames would differ for different areas of the Bay (upper, mid, lower) because of differences in temperature.
        ii. Panelists agreed that light rates are needed for areas where the light reaches the bottom; need to sort out guidelines for when light denitrification rates are needed (not all areas have light hitting the bottom to cause concern over denitrification rate).
        iii. Existing data can be used to determine site-specific, seasonal denitrification rates as long as biomass was known/can be determined and rest of required components are met.

2. **Coordination Updates**
    a. CBF hosting Mussel Restoration Discussion and Luncheon on July 24, 2018 (exploring the possibility of a freshwater mussel BMP).
        i. Panelists planning to attend: Julie Reichert-Nguyen (presenting), Jeff Cornwell, Chris Moore, and Julie Rose

3. **Address remaining questions on endorsed public fishery practice**
    a. **Baseline:** For oyster aquaculture BMP, the baseline definition allows for planted oysters before approval of the BMP to be eligible for crediting. How should areas where plantings have occurred this year be handled with the endorsed public fishery BMP?

i. Aquaculture baseline definition: Only includes harvested oysters moving forward from the time the BMP is approved/implemented for reduction effectiveness credit in the TMDL.
ii. For public fishery practice, Panel recommended an initial survey to determine the pre-BMP baseline.
iii. Discussion:
    i. Panelists agreed that there must be a prior planting of hatchery-produced oysters in the BMP-designated area to allow harvest to be eligible for crediting.
    ii. Matt suggested instead of a pre-assessment survey, you just make a rule that the first eligible harvest for crediting would have to be 3 years after the first planting and any subsequent planting within 3 year timeframes would keep the BMP active (harvest each subsequent year could qualify for reduction credit).
        1. The Panel agreed to this approach stating that this time frame would represent harvest influenced by the enhancement activity.

b. **Qualifying Condition:** Based on my notes, folks were ok to only do an initial survey of oysters ≥ 2 inches because they would be at harvestable sizes a year from the first planting. Does that mean the reduction effectiveness is based on the harvested oysters that are ≥ 3-inch shell height.
    i. **Concern:** Since it's up to the implementing programs to establish harvestable sizes based on regulations, I recommend not setting a specific size for the baseline assessment. Instead the qualifying condition could be more generic, such as 1 inch smaller than harvestable size.
        i. Matt Parker: Ken Paynter has some size frequency distribution data in his annual sanctuary reports that might be helpful for this.
    ii. **Concern:** I thought it takes around 18-24 months for oysters to reach 3 inches. Is a year closure too short?
        i. Matt Parker: On bottom wild and on bottom spat on shell would be closer to 36 months. 18-24 months are for oysters grown off bottom in cages.
    iii. Discussion:
        i. Panel agreed that it would be up to the implementing programs and regs to determine harvestable sizes. For reduction effectiveness purposes, there are estimates for oysters ≥ 2 inches.

c. **5% spat survivorship value:** I could not find a reference where this is explicitly stated.
    i. NOAA 2016 Oyster Reef Monitoring Report suggests an average of 3.09% with a range of 1.75% to 5.13%. Is there another source that would support 5%.
        i. Matt Parker: Paynter estimates 90% of spat die in the first year and 15% every year thereafter. That works out to about 7% survival after 3 years. Mutt Merrit says 70% of spat on shell die in the first year and 10% every year thereafter. That works out to around 24% after 3 years. Mike Congrove's thesis says you could expect around 18% (I'd have to double check the number) survival of spat on shell oysters.
    ii. **Food for thought:** We may want to re-think having a cap based on a percentage of survivorship. Since a baseline assessment is needed to implement this BMP, it essentially defines how many oysters are there before the BMP is implemented. It would seem subtracting this baseline from the harvest would be adequate. Are we being too restrictive (see example)?

i. Discussion:

1. Matt Parker: I would base this on reported harvest, just like for aquaculture. There will be good years and bad years, sometimes you will have better survival.
2. Panelists discussed a qualifying condition where the first eligible harvest for credit would be 3 years after the first planting of hatchery-produced oysters; Matt stressed that the Panel should not require the area be closed to harvest since that's up to the implementing programs. However, the Panel can state a timeframe for when harvest would be eligible for reduction credit; Panel agreed on 3 years and felt that if this eligibility timeframe is required then you wouldn't need a pre-assessment survey.
3. Panelist emphasized that the qualifying condition needs to explicitly state that only harvest from the designated BMP area is eligible for credit.

d. **Credit Cap:** Regarding Panel recommendation that planting equates to one available crediting period.

i. Should this be the case with non/poor productive area that resembles the on bottom aquaculture BMP?

ii. What if the cap isn't met? Can it be open for another year to receive the rest of the credit without doing another planting?

iii. Discussion:

i. Matt Parker: Why is there a credit cap? There is no cap for aquaculture? Harvest gear is inefficient. There will be oysters from a planting period that are missed and harvested with the next "group"

ii. Lisa: The cap was proposed since some areas may be productive areas.

iii. Panelists agreed cap wouldn't be needed if first eligible crediting period of harvest is at least 3 years from the first planting.

iv. Panelists agreed that reporting should include the number of spat planted in the area.

1. Panelist asked if there are guidelines for how much spat to plant; will look into for next meeting.

4. Go over enhanced denitrification components for determining the site-specific estimate

a. Using existing data: What if a denitrification experiment has been done recently that have all the BMP conditions met? Can this be used or would the experiment have to be repeated?

i. Jeff recommends that existing data can be used if it includes site-specific components and appropriate scale to extrapolate.

1. Panel agrees; guidelines should include similar salinity, depth, oyster biomass, and reasonable area to extrapolate (within tributary/embayment).

b. When determining the biomass to verify the enhanced denitrification rate, when in the year do you make the assessment (one time; which season; all 3 seasons)?

i. Jeff recommends a verification guideline that at least one measurement is done; the Panel agreed it could be up to the implementing programs when to make this measurement.

c. **Food for thought:** There is concern that the minimum requirement of 3 seasons to establish a site-specific rate would be too cumbersome for implementing programs to do right away. Instead of an annual rate, could seasonal rates be used and only the hours in that season be

eligible for credit? This would allow flexibility to the implementing programs in establishing site specific estimates.

i. For instance, if an implementer can only budget one season to measure denitrification rates (light, dark or both), then they would establish a rate in that season and only the hours (light, dark, or both, depending on rates that were established) within that seasonal time frame would be eligible for credit during that year.
ii. If a seasonal rate approach is used then a weighted average would not be needed since they are only getting credit for the hours in the seasons they have rates for.
iii. **Discussion:**
    1. Panel agreed to change recommendations to allow seasonal rates to be used to receive reduction credit only during that portion of the year.
    2. Panelists suggested two approaches to define seasons:
        a. Fixed months based on temperature profiles
            i. Chris asked if this would be the same across the Bay (upper, middle, lower) seeing how temps may be different.
        b. ± 1 month from sampling month
            i. Julie Rose expressed a potential unintended consequence of implementers using one seasonal rate across multiple seasons if they sample in a week where two months fall into. Should be clear that one seasonal rate applies to only 3 months.
iv. Other:
    1. Need to provide guidelines on when light rate measurements are needed; Secchi? Depth of site? Light meter? Etc.?
    2. September has shown the highest denitrification rates in some studies.
    3. Harris Creek and Lynnhaven may have existing data that can be used to determine site-specific, seasonal denitrification rates.

Oyster BMP Expert Panel Meeting, August 16, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Remote
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remote
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remote
Chris Moore	Chesapeake Bay Foundation (CBF)	Remote
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remote
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	No
Bill Wolinski	Talbot County Department of Public Works	In Person
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Remote
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	In Person
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	In Person
Guest	**Affiliation**	**Present?**
Frank Marenghi	Maryland Department of Natural Resources	Remote

Action Items:

1. **Action:** Julie Rose and Julie Nguyen - Julie N. will send Julie Rose data spreadsheet for the tissue-restoration quantile regression equations. Need to run seasonal and habitat grouping analysis to determine if a lower quantile is needed.
2. **Action:** Jeff C. and Lisa - Refine denitrification rate QA/QC
3. **Action:** Jeff C., Lisa, and Julie Nguyen - Work on revising the appropriate methods to measure reef denitrification (e.g., core measurements)

4. **Action:** Cornwell will load enhanced denitrification with restoration practices references onto the Google Drive folder.

Meeting Minutes:

Coordination Updates, Julie Reichert-Nguyen

- Jeff Sweeney is replacing Matt Johnston as Panel's Watershed Technical Workgroup Rep.
    - Matt took another role, Jeff will help write technical appendices; explain how to apply our recommendations to the TMDL model.
- Julie Reichert did some overhaul on draft report; will be close to 300 pages. She created a separate informational recommendation section for recommendations we are not seeking approval for; will be in the appendix. Each of the core recommendations will have their own clear, separate chapters to make approval easier.

Public Fishery-Tissue Assimilation: Go over recommendations from smaller Panel group

- **Group: Frank, Matt, Chris, and Julie Reichert; Met on 7/27/18**
    - Agreed that a pre-BMP assessment wouldn't be needed if the first eligible crediting year in the designated area is a minimum of 3 years from the first planting. Rationale included that by 3 years, you'll be harvesting oysters influenced by the enhancement activity. These areas have been heavily harvested and planted already so establishing true baseline populations is not practicable.
        - **New baseline guideline:** Where records of date and amount of spat planted exist at locations pre-BMP approval, harvested oysters can be credited 3 years after that date. E.g., harvested oysters planted during May-June this year (2018) can be eligible for reduction credit in 2021.
        - **New qualifying condition:** Where implementing programs have oyster growth data that demonstrates faster growth than 3 years at the BMP location, then the minimum 3-year timeframe can be adjusted to reflect the mean of this data.

    Discussion:
        - No dissenting Panel members.

    - **Old:** Panelists felt if the timeframe above is implemented then you would not have to have a cap on harvested oysters based on spat survivorship.
        - **Follow-up call with Chris Moore**: Concerned that regulators not familiar with oysters would interpret no cap equaling a scenario where 100% of the spat planted can survive. Even though oyster experts know that there is always mortality, which would be reflected through harvest, we should include a qualifying condition that makes it clear that there is mortality.
        - **New qualifying condition:** Group agreed to a cap of 30% of spat planted for how much harvest is eligible for reduction credit given the uncertainty in the possibility that existing oysters could be harvested since this practice occurs in productive areas. If harvest indicates more than a 30% spat survivorship from what was planted, then optional population surveys can be done to see if the higher survivorship percentage is real. At a minimum a pre-planting survey and pre-harvest survey should be done to establish survivorship at that location for the

next crediting year. If no population surveys are done, then 30% spat survivorship would remain as the cap for how many harvested oysters can receive credit.

Discussion:

- Wolinski: Is this 30% cumulative? Not very clear as written.
  - Moore: If you plant something every year, you can get up to 30% for each planting.
  - Reichert: It is cumulative. It can carry over is not fully met. Will make this clearer in the draft document.

- **Suggestion concerning use of first report tissue estimates:** Only diploid tissue estimates from the first report are used regardless if triploids are grown given the possibility of existing diploid oysters being present. If population survey indicates the absence of existing oysters, then triploid estimates can be used.

Discussion:

- Panel accepts this suggestion.

Restoration-Enhanced Denitrification: Go over recommendations from smaller Panel group

- **Group: Jeff, Lisa, and Julie Reichert-Nguyen; met on 7/30/18 –**
  - **Enhanced Denitrification Rate Determination:** Agreed to base recommendations on site-specific daily denitrification rates with dark and light (if needed) considerations built into the rate. A daily denitrification rate can be extrapolated based on defined seasonal timeframes and the following qualifying conditions and guidelines:

    Seasonal Timeframes
    - Spring: Mar, Apr, May (92 days total)
    - Summer: Jun, Jul, Aug (92 days total)
    - Fall: Sep, Oct, Nov (91 days total)
    - Winter: Dec, Jan, Feb (90 days total)

    Qualifying Conditions
    - The site-specific rate is on the day the flux measurements were initiated and would correspond to that season.
    - If there are more than one flux measurements within a season, first apply the month-specific rates to their corresponding amount of days from that month and use the lowest rate to extrapolate to months without a rate in that season.

    Guidelines:
    - Aim to conduct flux measurements on a day close to the mid-point of the season

- **Discussion (refer to PowerPoint presentation):**
  - Cornwell: There's a need for more data on aquaculture denitrification rates, we're not quite there yet. Only considering restoration in this report.
  - Reichert: Will remove y axis from graph on slide 2. X axis is "more confidence on use of this practice" as opposed to "data availability". Both axes will be updated for report.
  - Cornwell: Slide 3 – Impact of oyster restoration may be widely spread beyond the footprint of the reef itself; any transport of biodeposits will always lead us to underestimate reduction amounts.

- Cornwell: We are doing site specific rates because we are not at a place where we can determine a bay wide rate.
- Cornwell: **Establishing reference rate –** If you did 3 measurements at 2 restoration sites, you can pick reference site with stronger information.
    - Kellogg: When people identify their restoration sites, they should also identify their reference sites. Go out and figure out what looks like a comparable site in advance of doing measurements three years later.
- Cornwell: **Number of sampling sites** – statistically the more the merrier.
    - Kellogg: 5 is a great number, realistically, though, 3 at minimum is recommended.
    - Bricker: I like this table, but I'm curious about the 3 sampling points, what is this referring to? Not made very clear by this table.
    - Cornwell: This is referring to both reference site and restoration site.
- Reichert: For BMP are we recommending they can use average or median rates?
    - Kellogg and Cornwell: We recommend using average.
- Cornwell: **Light and/or dark incubations** – Algae not a huge issue at reef sites, worse at control/incubation sites, reduces denitrification rates.
    - Reichert: Is it a BMP requirement that you have to establish light measurements?
    - Cornwell: If someone want 24hr credit for dark rates, they must ensure light is not getting to bottom. If they think light is getting to bottom and you use light and dark, that's fine.
- Wolinski: **QA/QC** – Oxygen criteria, enough info available to determine if O_2 levels are 4mg/L? Not clear if this is in reference to incubation or reef/field conditions.
    - Cornwell: When water slows down and its dark, respiration slows down. During daylight, O_2 tends to stay up high.
    - Kellogg: Thought this was a recommendation for incubation of reef itself, not relevant to reef conditions. Don't want to drive O_2 levels below 4mg/L.
    - Reichert: Will make this clearer in draft document.
- Cornwell: 6.625 slope recommendation is more confusing than it is useful. Not essential. Mention that it's a summation of nitration.
    - Kellogg: Explain relationship of nitrogen/O_2 concentration slope (positive, negative), where it should be.
- Wolinski: For total nitrogen concentrations, should nitrite be included in sum? Not clear in definition of nitrogen summation.
    - Cornwell: Total N ratio here would be summation of nitrite plus ammonium nitrate and N_2 gas. Total N related to water quality means something totally different than this, this terminology will be confusing. Cornwell will redefine this term.
- Reichert: We need to be clear in what is expectation of reporting, too. Which fluxes we want them to report.
    - Cornwell: Take O_2/N summation from 2013 paper and refer to a figure after this note that shows a table of that particular relationship in action. Just describing it here may be insufficient for readers. Suggest we tone this table down a bit and make sure the explanation after this has the detail we need to explain it.

- Kellogg: More concerned about people reporting slopes that are very different from 6.625 or a $4r^2$ between the two.
    - Cornwell: A $4r^2$ would raise big warning flags. A strong relationship between the two would be sufficient for me.
- Kellogg: Write correlation between N and O_2 flux should be strong. Would be concerned if you have data that is all over the place.
    - Kellogg: Hadn't thought about time course, this is significant. Will discuss this later.
- Cornwell: **Season** - Originally talked about 10 degrees C, oysters stop filtering there but other animals that comprise the community can filter at lower temperatures.
    - Cornwell: Suggests someone does 3 runs/measurements a season. Each season has a defined number of days. Went with the simplest way of thinking about it.
    - Reichert: More manageable from a BMP standpoint when we have defined seasonal timeframes.
- Cornwell: **Biomass assessments** – Idea that when you do these incubations, you get shell height and do dry biomass of oysters you incubated. We're less concerned with biomass in the reef (we don't want it to flux dramatically, though).
    - Kellogg: We want people to measure shell height and determine biomass.
    - Reichert: What about sediment cores? Are oysters in there?
    - Cornwell: No oysters.
    - Reichert: How will we do biomass for that situation?
    - Cornwell: We can't do it this way.
    - Reichert: Would someone use a subsample of biomass from the site area?
    - Kellogg: I vote that we say you can't use cores.
- Cornwell: The other need for biomass is to determine whether reef is building or degrading.
    - Kellogg: There's no study that demonstrates that sediment denitrification rate scales with surrounding biomass.
    - Cornwell: How do we move forward beyond first assessment? What is the rate an implementer comes up with related to? There is nothing developed to say denitrification and biomass are related linearly.
    - Reichert: That would mean when people are using sediment cores, they would have to measure denitrification rates every time.
    - Cornwell: As it's written, you can't say reef has changed or stayed the same. I think that's another layer of complication to this.
    - Kellogg: For some core data out there already, there is no biomass estimate, measurements of surrounding reefs.
    - Cornwell: When taking sediment cores, you measure the edge and extrapolate to entire reef. Could be underestimating rates of denitrification.
    - Kellogg: Make sure implementers can push a core into the sediment, mark location, get pieces of shell out of the way. Come back at least two weeks later and core in the areas where they know they can get core in the sediment; there are oysters around the reefs.
    - Reichert: How big are these trays for the other method? Could you use a quadrat for oysters in conjunction with taking core samples?

        - Cornwell: Lisa is working on reducing variability on biomass vs. denitrification rates. If you incubate oysters, denitrification doesn't move with biomass in a predictable way. From BMP viewpoint, cores might be problematic.
        - Reichert: Not opposed to mentioning core method, however to meet BMP review criteria, cores would not be manageable. How do you verify core estimates year after year moving forward?
        - Kellogg: How bout measuring it per season? We can extrapolate over time, but can't scale it to biomass.
    - Wolinski: Is there a set frequency for monitoring biomass on restoration sites?
        - Cornwell: Not biomass, but oyster density and shell heights.
        - Kellogg: Only monitored every 3 years with exception of a few that are monitored every year.
    - Cornwell: Three of us (Kellogg, Cornwell, Reichert) need to convene again and think about this core issue. Its relatability to biomass is difficult; even after clearing out shell and making an area easier for core taking, it might be more worth it to set trays. In literature, cores are taken on periphery of oysters, not within a reef. Question remains, is it safe assumption that values you get there same as sediments you'd find in a reef? We don't know. Equivalence between edge and rest of system is unclear.
        - Wolinski: Make this a recommendation for future research.
        - Reichert: Leave cores as a valid option to obtain denitrification rates, but not a recommended option for the BMP given verification is based on biomass. Put this in future work section. Explain we don't have a way to relate it to biomass, BMP is set up to use biomass as verification.
        - Cornwell: It is possible that literature uses industrial strength corers, otherwise not generally possible. Make that apparent up front in text.

Chapter needs:

1. QA/QC needs to be fleshed out more, should take perspective of person who has to verify rate qualifies for TMDL. Cornwell will work on this.
2. Cornwell will work on sediment core section.
3. Wording changes on seasonality, remove temperature criterion.
4. More explanation of biomass.
5. Additional writing on required documentation.
6. Some word-smithing, organizational issues.

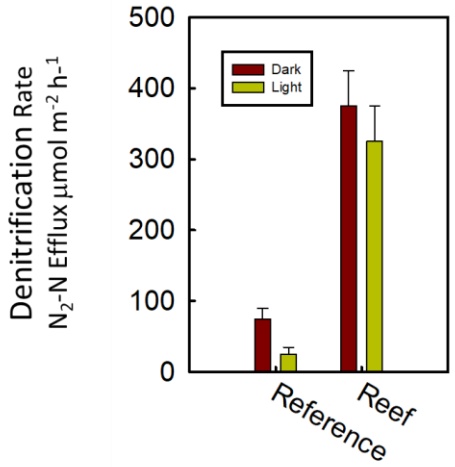
Additional Concerns:

- Luckenbach: My issues with the document were settled by this conversation. Did some word crafting and will send edits to Reichert. Thought it was good discussion, learned a lot by listening.
- Wolinski: Are these references accessible?
    - Reichert: No. We will work on making them accessible. I don't have all the papers Cornwell referenced in the chapter and will work on getting them.
    - **Action:** Cornwell will load enhanced denitrification with restoration practices references onto the Google Drive folder.
- **Action:** Reichert will reach out to Rose about tissue data and habitat (salinity, etc.) to look at differences that would change the quantile regression.
    - Rose: Has availability for this discussion in 2 weeks.

- Reichert**:** Will set up the data, find what is missing. Has nothing on location, habitat groupings, etc. Do we need to use a lower quantile for these regression equations?

Rate Calculation Example:

Figure xx. Example of calculation of denitrification using a reference sediment site. This example uses both dark and illuminated incubations. Rates are estimated on a 24 hour (daily) basis taking into account the day length estimated from the US Naval Observatory using the site location and date (http://aa.usno.navy.mil/data/docs/Dur_OneYear.php/).



Reference Rate: Dark = 60 ± 15 µmol N m^{-2} h^{-1}
Light = 20 ± 5 µmol N m^{-2} h^{-1}

Reef Rate: Dark = 375 ± 75 µmol N m^{-2} h^{-1}
Light = 325 ± 75 µmol N m^{-2} h^{-1}

Daily Rate if 14 hours light, 10 hours dark

Reference = (60*10 + 20*14) = 880 µmol m^{-2} d^{-1}
Reef = (375*10+ 325* 14) = 8,300 µmol m^{-2} d^{-1}

Reef – Reference = 7,420 µmol N m^{-2} d^{-1}
= 0.10388 g N m^{-2} d^{-1}
= 0.93 lbs N $acre^{-1}$ d^{-1}

Assumptions:
- Rates are typical warm season rates
- Reef biomass same as incubations or…
- If oyster biomass in the whole reef is lower rates get adjusted down in direct proportion. Data cannot be adjusted up for higher biomass.

- **Other:**
  - Chris Moore—previously asked whether the seasonal timeframes would differ for different areas of the Bay (upper, mid, lower) because of differences in temperature.
    - Jeff felt that these timeframes could be used throughout the Bay.
  - Panelists agreed that light rates are needed for areas where the light reaches the bottom
    - Guidelines on how to determine if light denitrification rates are needed (not all areas have light hitting the bottom to cause concern over denitrification rate):
      - Jeff and Lisa agreed that PAR measurements would be needed. Light incubations should be included where benthic light levels ≥2% of incident light levels.
  - Existing data can be used to determine site-specific denitrification rates as long as biomass was known or can be determined and rest of required components are met.

Oyster BMP Expert Panel Meeting, October 18, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remote
Chris Moore	Chesapeake Bay Foundation (CBF)	Remote
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Remote
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remote
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remote
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remote
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Remote
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Stephan Abel	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes
Guest	**Affiliation**	**Present?**
Frank Marenghi	Maryland Department of Natural Resources	Remote

Action Items:

1. **Action:** Please let Julie Reichert know if you are unable to attend the 11/15 Panel meeting.
2. **Decision:** Panel agrees to use Carry-Over with Expiration Approach to address Public Fishery harvest allowance and time lag. Time lag would apply to all plantings not just the first planting.
3. **Action:** Julie Reichert will write and distribute a one-page paper on the Panel's decision on the Public Fishery harvest allowance and time lag.
4. **Action:** The revised denitrification chapter will be distributed to the panel for review 1st week of November.

5. **Decision:** After reviewing the individual season and habitat 50th quantile equations, the Panel has no concerns using the 50th quantile of the entire dataset (representative of on bottom reefs) for converting shell height to tissue biomass for the restoration-assimilation and denitrification recommendations. Use equation on slide 1 with 50th quantile. Same conclusion for shell.

Meeting Minutes:

Coordination Updates, Julie Reichert-Nguyen

Report Schedule Proposal—Complete a full Panel review of the entire report before the holiday break in December and work through the EPA approval process afterwards.

- Potential Review Schedule (extra time in December would be used to address any issues discovered during review):
    - Restoration Denitrification Chapter: October 29-Nov 5
    - Restoration Assimilation Chapter: Nov 5-12
    - Appendices: Nov 26-Dec 3
- November 15 – Schedule Panel meeting to go over comments on restoration chapters (denitrification and assimilation recommendations)

Action: Please let Julie Reichert know if you are unable to attend the 11/15 Panel meeting.

Review first half of main body of 2nd report, Julie Reichert

- Chapter 6: Public Fishery-Assimilation Recommendations
    - Agree with qualifying conditions, application and verification guidelines, and example?
        - Conflicting opinions concerning the application of the harvest allowance based on the 15% cap. We would like to reach consensus on which approach to use. Potential Options (based on conversations with individuals):
            - **Carry-Over Approach**—Allows for the harvest allowance from a planting to be carried over in subsequent years until used up. This is the approach in the current draft document.
            - **Use it or Lose it Approach**—Each planting would be associated with a harvest crediting year. For instance, 15% of the first planting would only be available for credit during the first credited harvest. If a part of the harvest crediting allowance is not used, then it would be lost (no carry over to the next credited harvest year).
            - **Carry-Over with Expiration Approach**— Allows for the harvest allowance from a planting to be carried over in subsequent years, but would expire after 5 years.

    Discussion:
    - Julie Reichert: Stephan found issue with respect to the harvest time lag of 3 years and expiration date of BMP. This forces people to harvest right after the planting based on timing. We are looking to revise language on this.
    - Julie Reichert: Conflicting opinions based on review comments
        - Panel has differing thoughts on approach of how much to allow for harvest.
        - Julie will get draft with everyone's comments in one place and then apply it.

        - In our recommendations, we have criteria/qualifying conditions in place based on time lag.

    Original concept = Harvest 3 years after first planting to increase likelihood of harvest coming from site that is influenced by BMP activity.

        - BMP lifespan of 5 years encourages maintenance of BMP through repeated plantings.
        - 5 years seems like a more defensible timeframe for BMP influence on harvest.
    - Julie Reichert: Other criteria with conflicted Panel member opinions – Harvest Allowance: Implementers can claim up to 15% of what they plant.
        - See three potential options above
    - Julie Reichert: A bit of a compromise based on feedback: Allow carry over with an expiration date of 5 years.
    - Lisa: So little bottom exists, do we allow overplanting of the same place? Is there a reason for allowing overlapping of plantings?
        - Stephan: Is there enough bottom to square off specific acreages? Close the bar, plant it, wait 4 years, open it.
        - Lisa: Main concern is allowing harvesters to get credit for wild harvest. No crediting criteria in place to know whether harvest comes from your planting. More comfortable with confidence that what is being planted is what is being harvested.
        - Stephan: Make it a requirement to know what's on bottom before you plant.
    - Frank: Leases in Maryland are NOT only given unproductive oyster bottom. Bottoms are leased with oysters on them; we don't know the density of oysters there because surveys aren't done in most cases. Overlap is important. There's not enough bottom to enforce single year class plantings in most cases in areas we've been planting. The industry believes replanting is more productive due to the quality of bottom and differences in growth between years. I understand the accounting, but I don't see people trying to plant oysters in areas already productive or natural recruitment to have a significant effect, particularly with 3-year lag time and 5 years BMP lifespan.
        - Mark: how often are you planting spat on shell in these areas?
        - Frank: It varies, we are usually short on funding or spat so counties may plant every 2-3 years. Areas doing well are planted every year or every 2-4 years. Harvest is variable as well. In most cases, they're open every year. It depends on how oysters grow and how many viable year classes there are.
        - Lisa: Generally, harvest everything within a single year from a single planting?
        - Frank: To the extent possible. Everything that's market size in a certain area tends to be harvested, but not necessarily all from year class that was planted 3 years prior. Harvesters don't want to work on areas that have just been planted. It's possible to have areas without overlap in a BMP area, but not likely to be entirely discrete.
    - Julie Reichert: We don't want to set up a BMP that's so restrictive that were dictating when to plant, to harvest, size to harvest at. We do want to make sure that qualifying conditions capture the enhancement activity that's occurring. Depending on area, oysters growth rates are different. There are areas where they grow faster and areas they grow slower. Shouldn't be too prescriptive.
        - Chris: There are lots of BMPs that are very prescriptive, I don't think we should worry about being too prescriptive about creating a BMP that is scientifically defensible. Worrying about being prescriptive isn't a consideration for me. Needs to be scientifically defensible and verifiable.

        - Julie Reichert: Trying to find sweet spot where a BMP is defensible while not being too off putting/restrictive for implementers, like we did with the first report.
    - Bill: Would entail state of MD to implement harvest time of year amongst multiple harvesters in order to manage it. Is it realistic that state would undertake that?
        - Julie Reichert: They'd definitely have to do more reporting than they currently do.
    - Lisa: How is it determined if harvest came from BMP area?
        - Julie Reichert: It is up to implementing agencies. They'd have to figure out how to implement them and create a plan. Would definitely require additional recording.
        - Matt: MD Shellfish tag requires a bar ID.
        - Frank: MD requires bar reporting, we would maybe have to require bar and specific BMP area as well. Reports are not 100% accurate, but for the most part, people report accurately. That level of specificity is hard to get at. With small plantings, you find there is not much harvest being reported from these areas at all.
    - Julie Reichert: Implementation procedures come after panel decisions, we provide what the reduction effectiveness is. That is our goal. What I'm hearing is compromise; the expiration method is best.
    - Matt: We are talking about hatchery produced seed to put on bottom for waterman to catch and harvest, correct? How is this different than bottom spat on shell aquaculture and why would it be treated differently?
        - Jeff: Different person harvesting it.
        - Chris: Huge difference between public fishery and aquaculture.
        - Matt: jurisdiction/municipality receives the credit either way. No watermen get the credit.
        - Julie Reichert: It is not the charge of the panel to decide that.
        - Lisa: Potential in public fishery to place spat on area with large preexisting oyster population. Fundamental difference in assumption that lease has fewer oysters on it to begin with than public bottom.
        - Frank: Assumption that needs to be examined in more detail. No incentive to add to already productive oyster bottom.
    - Julie Reichert: In the first write up, we recommend a pre-survey to see what's there and had different scenarios based on number of oysters there. If it looks like on-bottom aquaculture, go with on-bottom aquaculture recommendations for that scenario. If there are lots of oysters there, we add additional qualifying conditions for that site. Would this be feasible?
        - Lisa: This requires initial survey and that's why we dropped it in the first place.
        - Stephan: if someone doesn't want to do the survey, they can follow the on-bottom aquaculture protocol.
    - Lisa: What are the procedures in each state for declaring something leasable bottom? Are there true written rules about whether something can be leased?
        - Mark: If it exists outside of the Baylor survey, it can be leased in VA.
        - Frank: MD has Yates bars in sanctuaries off limit to leasing and public shellfish areas that are reserved for fishery based on historic productions. There are cases where oysters are not on Yates bars in sanctuaries or not on public shellfish areas that are in the fishery that do have oysters on them.
            - Two Rules:
                1. If it's in a sanctuary, can't lease on Yates bar.
                2. If it's in a non-sanctuary area, can't lease in public fishery areas.

Areas can be conditioned to be leased if they're shown to be unproductive. There are areas reserved for public fishery that have less than commercial harvestable amount of oysters present.

- Julie Reichert: For the most part, it sounds like the goal is that leased areas have very few if any oysters.

- Julie Reichert: We need a decision. Is everyone ok with the carry-over expiration approach? Panel agreed yes; Chris: Do we include a time lag for each planting? Panel agreed yes, but can be adjusted upon individual surveys.
- Chris: Can you send out a one-pager with the new decisions before consensus?
  - Julie Reichert: Yes, I will write a one pager on what we decided today to make sure everyone's in agreement.
  - Jeff: To communicate this will not be easy. We're likely to have to double back on this one way or another once public comment and CBP comment comes into play.

Decision: Panel agrees to use Carry-Over with Expiration Approach to address Public Fishery harvest allowance and time lag.

Action: Julie Reichert will write and distribute a one-page paper on the Panel's decision on the Public Fishery harvest allowance and time lag.

Upcoming reviews and chapter status

- **Restoration-Assimilation Quantile Regression, Julie Rose**
  - Question Raised at Last Panel Meeting: Since we are using reef-specific quantile regression equations that includes new data, does the 50th quantile still work? Do we need a lower quantile? Julie Rose and Reichert evaluated this and will go over results with Panel.
  - Analyses for both tissue and shell (shell height to dry weight regressions and percent content completed); chapter intro done, working on writing up analyses and verification guidelines

Discussion:

- Julie Reichert: We're putting forward recommendation for reduction effectiveness of entire oyster. Shell and tissue. Sequestration standpoint, will count if oysters are not harvested.
- Julie Rose: See accompanying Powerpoint presentation.
  - Same analysis run last year for tissue recommendation that we put forward.
  - We left out aquaculture data. This brings us to 7k data points.
  - Tissue
    - Slide 1: Median of data
    - Slide 2: Season
      - Black line equals data subset, red line the entire dataset.
      - Black line above red line, under crediting using 50th quantile.
      - Black line under red line, over crediting using 50th quantile.
      - Winter virtually identical to entire dataset.
      - Spring falls above full dataset, tend to be a bit heavier on average than average of all full seasons together.
      - Summer falls slightly below entire dataset. For the most part, the red lines are near the entire dataset for sizes you'd typically encounter on a reef, so you wouldn't be consistently over crediting by very much based on season. Only potential for over crediting would be in summer and only by a tiny bit (~30 lbs per 1 million oysters).

        - The Panel agreed to use the 50th quantile equation of the entire dataset for all seasons.
    - Slide 4: Habitat type (Upper, middle, lower bay; tributary vs. open water; salinity)
        - Bay mesohaline mid-bay, tributary mesohaline mid-bay – both ok to use 50th quantile equation.
        - Lower bay mesohaline, lower bay tributary polyhaline – both ok to use 50th quantile equation.
        - Open water mid-bay mesohaline – ok to use 50th quantile equation.

Decision: Panel has no concerns using the 50th quantile of the entire dataset.

- Shell
    - Potential for over crediting for largest oysters in winter, Julie Rose is ok with using a single regression equation, though.

Decision: Panel has no concerns using 50th quantile of the entire dataset.

- **Denitrification Chapter Status**, **Jeff Cornwell**
    - Modifying text to capture different requirements if core method is used since there hasn't been any data directly relating it to oyster biomass.

Discussion:

- Jeff: Mostly in final editing and writing part of this. Still lots of work to be done, getting enough information for guidance without being restrictive with respect to techniques to use. Looking at practice of using entire community vs. cores (where most of the literature exists). In the end we believe you leave a lot of denitrification behind using cores, but cost goes down.

  Action: The revised denitrification chapter will be distributed to the panel for review 1st week of November.

Oyster BMP Expert Panel Meeting, November 15, 2018, 1:00 PM – 3:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	No
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	No
Bill Wolinski	Talbot County Department of Public Works	Yes
Frank Marenghi	Maryland Department of Natural Resources	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Yes
Matt Johnston (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Rich Batiuk (BMP Verification Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes

Action Items:
Action: Panel will include the other terms used for "public fishery" practice (e.g. "put-and-take fishery") and establish their equivalencies.

Meeting Minutes:
Coordination Updates

1. December 17th—Courtesy update to Fisheries GIT. Looking into inviting stakeholders and WQGIT to also participate to give a preview of recommendations focusing on reduction effectiveness determination strategies.

Review terminology and definition changes concerning "public fishery" practice

1. The Panel has expressed views that this practice of planting hatchery-produced oysters on commercial fishing grounds is an aquaculture-like practice. The current characterization of “public fishery” does not adequately represent this. Instead of characterizing this as “public fishery” we are proposing to change the title (see examples in decisions document) under “cultivation.” See proposed changes in revised oyster practice table.
2. Discussion
    a. Cornwell: This is a problematic description – “aquaculture like practice”. Occurs on public fishing grounds and includes multiple public fishers. Do we leave it as it is as approved in first report? Lisa suggested new variant on some of this, Matt backed it. She suggested “on bottom put-and-take harvest using hatchery produced oysters”.
    b. Kellogg: The new suggestion makes it clear you're actively putting oysters out to harvest later. Might resonate better with people since they’ve heard it before.
    c. Marenghi: "Put and Take" rubs me the wrong way. It does characterize what happens in our program, but it has a negative connotation in Maryland. Especially since we're trying to differentiate it from lease harvest. Including something with “public” in there is important because it's not only public fishery, also publicly funded as opposed to private aquaculture. With regard to "licensed oyster harvest", are we saying there are unlicensed harvests we’re not talking about? I don’t like "public aquaculture", either, but I see how it makes sense. I prefer "aquaculture practices on public fishing grounds” or “public oyster harvest using hatchery produced oysters”.
    d. Kellogg: What about "on bottom put-and-take using hatchery produced oysters"?
    e. Marenghi: I am opposed to put-and-take. Leasing is also put-and-take and has negative connotation with watermen. It puts negative bias on fishery way its been used in the past, makes it seem like it’s not a true public fishery.
    f. Moore: I don’t agree with stance that you’re lumping put-and-take designation with entire public fishery. We're better off removing word "public" - maybe its opposite concern, but people think "public" means "natural supported fishery". "Public" as a whole will lead us to confusion and more problems later.
    g. Reichert: I agree with Chris, it has to be differentiated from private oyster aquaculture. Just putting shell out there isn’t necessarily representative of put-and-take.
    h. Cornwell: It seems like were running in circles.
    i. Marenghi: Possibly, "harvest of hatchery produced oysters from public fishing grounds". I cant get away from use of public. Trying to distinguish between that, lease, and restoration.
    j. Moore: What about for managed bottom?
    k. Marenghi: State managed bottom? Leases would fall under that as well.
    l. Wolinski: In the revised oyster practices document, in the licensed oyster harvest section it lists 2 categories “wild” and “hatchery produced” followed by a practice. To me, this seem compatible with what's in revised practice table.
    m. Marenghi: I'm okay with that.
    n. Cornwell: I think that captures what we’ve been talking about. When I look at those columns, I have a clear idea of what this is, it's just the overarching label were struggling with. Is that the consensus with everybody? Follow the revised Chesapeake Bay oyster practice table.
    o. Kellogg: Put-and-take fishery is something people understand, let's mention that in the text somewhere so that people can equate the two, doesn’t have to be in the title.
    p. Cornwell: Put it in description line of excel table or in text somewhere. Sounds like we’re in agreement. In the write up, we will make sure we include the other terms used for this practice and establish their equivalencies.

Action: Panel will include the other terms used for “public fishery” practice (e.g. “put-and-take fishery”) and establish their equivalencies.

Review edits to licensed harvest recommendations (see Other Decision Public Fishery Example tab in Harvest Recommendations document)

1. Those who provided comments have been incorporated into the revised draft. We will review for consensus.
    a. Biggest change was to the reduction time lag recommendation. Instead of 3 years after a planting, changed to 2 years (allows for 3-year carry over instead of 2 years).
2. Discussion:
    a. Kellogg: This document is similar to the table Julie sent out before, with changes that I suggested and made more complicated. More detail in here now. If you follow the table, start at top of t0 (2019); I asked Julie to make it more specific about what t0 means and planting time. That value is the spat planted times 15%, then translated into bushels harvested. The table in yellow gives information about when oysters are harvested; in terms of bushels in row 12 and number of oysters in row 13. The table also denotes which planting the values refer to. Row 16 tells you the available harvest; you can look at blue table line 5 and get the same number in row 16 of yellow table. You can see how much of the harvest is claimed in row 13 if you're looking at year t2 (all are claimed). Reduction credits are at the bottom of the Harvest Running blue table. Incorporated in this is the two year time lag we've seen by email, 2nd page of the worksheet is justification for that (data collected in 2006 from plantings of known age that were not overplanted/zero recruitment). Rows highlighted in green and blue are actually of the specific ages were talking about in tables of previous tab (t0=40mm, t1=52, etc.). We didn't want to mandate that you couldn't harvest at t2 if your oysters are large enough.
    b. Cornwell: Anyone who wants to implement this, they may want to talk to Lisa or anyone else who has had practice with it.
    c. Kellogg: It's just a counting, pluses and minuses, just making sure you do that math right. I think being really clear and explicit in as small and as many steps as possible will make tracking from year to year all the easier.
    d. Cornwell: Is everyone alright with this? Every aspect of this is more complicated that many of the other BMPs out there and will be scrutinized at every turn.
    e. Panel is okay with this decision.
    f. Linker: No objection to name change or this going forward for review. Happy to discuss further my other concerns, but go forward with it and see how the CBP finds it.

Oyster BMP Expert Panel Meeting, April 18, 2019, 1:00 PM – 4:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lynn Fegley	Maryland Department of Natural Resources, Fisheries Service	No
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	No
Andy Lacatell	The Nature Conservancy (TNC)	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes
Guests	**Affiliation**	**Present?**
Frank Marenghi	Maryland Department of Natural Resources	Yes
Jason Bernagros	U.S. EPA (on detail at Chesapeake Bay Program Office)	Yes
Sara Coleman	Oyster Recovery Partnership	Yes
Kaycee Coleman	Oyster Recovery Partnership	Yes
Jeremy Hanson	Virginia Polytechnic Institute and State University	Yes

Action Items:

1. **Action:** Julie Reichert will send out a doodle poll to reschedule May 7th Chapter 7 and 8 review meeting
2. **Action:** Julie Reichert will make language regarding timeframe under which implementors can receive credit for harvest clearer in Chapter 6 Technical Appendix
3. **Action:** Julie Reichert will provide clarifying information with respect to harvest crediting, simplify calculation spreadsheet
4. **Action:** Julie Reichert will revise language regarding the partial crediting approach for oyster reef restoration practices.

5. **Action:** Julie Reichert will remove Chapter 5 reference of triploids oysters occurring in the wild.
6. **Action:** Julie Reichert will remove Chapter 5 language about developing site specific triploid estimates for this practice.
7. **Action:** Julie Reichert will remove reference to Lower Rappahannock Oyster Management Plan about harvesting hatchery-produced oysters.
8. **Action:** Julie Reichert will revise language to make it more of a suggestion to include who harvested oysters/who they were sold to.
9. **Action:** Julie Reichert include "underestimates" compared to 50th quantile of data subset in Chapter 6.
10. **Action:** Julie Reichert will rewrite averaging approach for percent nitrogen/phosphorus content in oysters.

Minutes:

Coordination Updates

1. April 22 – Send out revised Chapter 7 (restoration-assimilation)
    a. This may change based on today's conversation.
2. April 29 – Send out draft of restoration-denitrification chapter for Panel Review
3. May 7 – Schedule Panel meeting to go over comments on denitrification and assimilation recommendations (Chapters 7 and 8)

    Action: Julie Reichert will send out a doodle poll to reschedule May 7th Chapter 7 and 8 review meeting

4. May 21 – Tentative date to release draft report for public comment
    a. Panel will likely host webinar May 21st as well
5. Maryland WIP available for public comment: Includes use of approved oyster BMPs
    a. Hanson: Webinar is part of BMP Panel protocol now, helps to record webinar as well.

Discussion on Technical Appendices for Application with the TMDL model

1. Part 1. Chapter 6: Licensed Oyster Harvest-Assimilation Recommendations
    a. How to address the site-specific recommendation concerning the reduction time lag (time lags could vary); need to establish clear-cut crediting timeframe (when harvest is eligible for credit)
    b. How to address multiple plantings in a year producing eligible harvest for reduction credit over multiple years

    Discussion:
    c. Reichert: (Ref. Q2 Reduction Credit Time Lag bullet point) Could there be different sites with different time lags associated with each site? That would require a lot of tracking.
        i. Hanson: Depends on what balance is for states/whoever is tracking that information and reporting to CBP. For BMPs, panels make recommendations based on how permits work (e.g. permit timeline
        ii. Bernagros: Would be good to have sense of what available options are for how frequent assessments can be done. On CAST, we want to be able to report out 1-2 years. Depends on how it will be reported within the model.
        iii. Hanson: Reporting on an annual basis becomes difficult; e.g. tracking plantings and harvests each year.
    d. Reichert: Can we have a default timeframe? Do we need to offer that much availability?
        i. Slacum: 2 years is 2 years after planting, about 2.5 years of growth. 2.5 years gives low probability of need to harvest before that time frame. Potential is there, though.
        ii. Marenghi: Agree with that. 2 years will cover most scenarios, not likely that assessments will be done on some small percentage of BMP areas every 2 years.
    e. Reichert: I propose that we omit "unless an assessment is done demonstrating a timeframe less than two years is appropriate".

i. Marenghi: I'd rather leave it in. Wouldn't be a problem tracking it if we did have assessments. Good to have the flexibility.
ii. Reichert: As long as people can track and report appropriately, there shouldn't be an issue including it in TMDL/estuary model.
iii. Hanson: It never hurts to leave flexibility. States will give feedback on this language. MDE and VADEQ report the data to CBP and will have thoughts as well.
iv. Reichert: Will keep this language until we hear back during public review.

f. Reichert: We might want to make sure the timeframe that people can receive credit for harvest is clear e.g. Lifespan of Oyster Harvest allowance MINUS Time Lag (two years before ability to harvest/growth period). Time window for harvest is not 5 years from day of planting.
i. Hanson: "Lifespan" might be confusing, maybe use "harvest timeframe" or "harvest window" instead.
ii. Sanford: This is a little confusing. Suppose a site is planted every year, is harvesting immediately after planting precluded?
iii. Reichert: Implementors can harvest immediately, but that cannot be applied toward reduction credit.
iv. Sanford: Separate table for each planting would make it less confusing, easier to track, then sum all tables together.
v. Marenghi: Unsure I see a clear winner in this scenario right now. Showing the equations might be easier.
vi. Sanford: That was my initial thought as well. Can have identical table but write equations down below. Can annotate tables in Excel.
vii. Marenghi: Would help reader clarify any confusing from reading one table.
1. Sanford: Label rows, make it more like an annotated spreadsheet. Refer to column combinations to explain how calculations were done.

Action: Julie Reichert will make language regarding timeframe under which implementors can receive credit for harvest clearer in Chapter 6 Technical Appendix

Action: Julie Reichert will provide clarifying information with respect to harvest crediting, simplify calculation spreadsheet in Chapter 6 Technical Appendix

2. Part 2. Chapter 7: Restoration-Assimilation Recommendations
a. Reduction effectiveness approach needs to be revised to allow use with TMDL model (particularly the 50% partial crediting approach.

Discussion:

b. Reichert: This is site specific. Implementors monitor oyster counts and shell heights to determine appreciation in tissue/shell biomass in order to receive credit. There will be no lookup table. Implementors need to calculate tissue and shell reductions using regression equations on their own. One step of this process needs to be rethought – partial crediting approach.
c. Reichert: With respect to Step 1 – most folks will likely use option 1.
d. Reichert: With respect to Step 2 – partial crediting approach where you only receive credit during crediting year for biomass over baseline. Eligible biomass would equal 50% of that crediting value, the remaining 50% would be given the following year if you could prove you retained that biomass. This is not how it works with other BMPs within the TMDL.
i. Hanson: BMP receives credit right away, clearly forest buffer takes many years to be at full performance/maturity. Were crediting at full maturity right away, becomes complicated otherwise due to policy/planning decisions made based on this model. Entirely up to panel what is reasonable, though. Can choose to discount something based on lack of data variability, but don't need to base on lifespan/maturity of resource.

e. Reichert: Option 1 or Option 2 – discount all the time, always going to take off 10% to account for variability. Trying tot do 50% now and 50% later is so complicated to convey, lots of rules. Becomes a headache to track. Thoughts knowing TMDL is longer timescale? You still have to go out and monitor, but you get credit for what you have when you have it.
    i. Cornwell: Shell seems longer lived, do worry about variability in tissue a little more. If you monitor at a given year and things go up as opposed to down, it probably comes out a wash.
f. Wolinski: What is the monitoring protocol for sanctuaries?
    i. Marenghi: Generally, every 3 years for restoration projects.
g. Slacum: Those are for sites part of the Bay Agreement. No real known standard for all other reefs. For planting trees, idea is that there isn't a measured verification component. Most restorations I've seen recently have support and momentum behind them, idea not to plant and let them stay/be, there is a concerted effort to monitor and maintain. Monitoring occurs because it isn't like planting trees, reefs are more variable. I wonder if trying to discount it is discounting a small amount to begin with. Is there a potential for any conditions for these BMPs that have a plan that look into the future? Does it have to come with a monitoring plan to become BMP?
    i. Hanson: No. The implementing program decides what is worthwhile. It comes down to resources. If you are spending millions on projects, what's another 10k to monitor it. Using stream restoration as an example, there are many different permits involved at the federal level with specific requirements for monitoring/remediation, can vary by state, etc. If these oyster practices have permit requirements build into them, write them in and build on them if its something you find very important. Panels don't dictate what states do. Lack of monitoring/reporting sometimes means a BMP stops receiving credit.
    ii. Slacum: There is proper vetting that happens at implementation program level that ensures no overcrediting.
h. Moore: Were not talking about changing monitoring protocol but changing when people receive credit for this. We recommend that programs will present monitoring program to CBP, but they dictate the amount/times per years they monitor biomass. I am not as worried about time of crediting, especially if we write more in that chapter about monitoring to make sure it happens adequately. You get credits in increments of years you do sampling, nothing ahead of what you're monitoring.
i. Cornwell: Some projects will overcredit and some will undercredit, what we want is a system that will come out as a wash for entire bay system. Im confident that nitrogen and phosphorus will still be retained there, kind of a failsafe for decimation of population in shell.
j. Reichert: I propose we get rid of 50% now, 50% later language. Monitor now, what you have now that you didn't receive credit for over baseline, that is your nitrogen and phosphorus reduced. If it decreases, you get nothing.
    i. Panel OK with this decision

Action: Julie Reichert will revise language regarding the partial crediting approach for oyster reef restoration practices.

k. Bernagros: Would we still use regression equations as is?
    i. Reichert: Yes. Still convert everything to biomass and adjust based on appreciation.
l. Hanson: In how often assessments occur, suggest a minimum frequency of monitoring if you're leaving it up to states. We have cumulative BMPs that you get credit for every year until it dies/monitoring lapses – in agriculture sector it's 10 years. Annual BMPs like cover crops are done year to year on management basis. Other BMPs vary with respect to amount, e.g. street sweeping. We could make this a 3-year credit duration or can make it annual.

i. Reichert: This is annual then, otherwise we'd be double/overcounting.
ii. Marenghi: Language could be confusing. Section 7.2/Step 2: readers might think you can count it every time.

Go Over Substantial Panel Comments on Chapter 1-6

1. See below documents:
    a. For Discussion_Chapters 1-6
    b. Oyster Practice Definitions for 2nd Report_revised_4-16-19
    c. Oyster BMP 2nd Report_current_2019-04-19
2. For Discussion_Chapters 1-6 Discussion:
    a. Chapter 1 –
        i. Reichert: We don't want people to think public fishery BMP is crediting historical wild population. This is more of a MD practice, counting by counties. Category I is wild harvest with no activity – that is the wild fishery. Why we explained differences with wild oyster aquaculture; why we don't have 15% cap on what's planted, etc. Not worried about existing populations. I was trying to capture the policies in VA and MD that gave us the impression of less concern with/focus on wild fishery.
        ii. Cornwell: I like this 1st paragraph, really defines it in a way we didn't before.
        iii. Marenghi: I agree. I like where the language that was decided on using hatchery produced oysters, like how that reads, the Distinction between fishery and aquaculture.
        iv. Luckenbach: Who would BMP implementor? Who would get credit for this/apply to do thi
        v. Reichert: State would work at county level counterparts, county level plantings would go into local WIPs, eventually compiled into statewide WIP. State would have to report it to CBP based on what counties are doing.
            1. Reichert: Panel sounds like they're ok with this language. Will keep it as is unless I receive more feedback by Tuesday.
    b. Chapter 5 –
        i. Reichert: Reference for triploids occurring in wild. No reference/citation here, this is text carried over from first report.
        ii. Moore: Not big enough issue that it needs to be in report.
            1. Bricker: I agree.
        iii. Reichert: Do we want recommendations around triploid oysters? Not something we want to encourage to happen on public grounds. You still get credit for these oysters, but at diploid estimates (more conservative value).
            1. Panel okay with removing this language.
            2. Action: Julie Reichert will remove Chapter 5 language about developing site specific triploid estimates for this practice.
        iv. Reichert: Found one example in the Lower Rappahannock. Oyster management plan, they'd plant hatchery produced spat on shell oysters on public ground – is this information outdated? Wanted to emphasize thought it might not occur in VA it doesn't exclude them from using this BMP.
            1. Marenghi: Write it how you said it instead of Virginia Oyster Heritage Program, probably outdated.

Action: Julie Reichert will remove Chapter 5 reference of triploids oysters occurring in the wild.

Action: Julie Reichert will remove Chapter 5 language about developing site specific triploid estimates for this practice.

Action: Julie Reichert will remove reference to Lower Rappahannock Oyster Management Plan about harvesting hatchery-produced oysters.

v. Marenghi: Last bullet point in for discussion document. Reporting guideline in licensed oyster harvest practice. Concerned about people wanting to share proprietary information.
    1. Bricker: Proprietary if released to public. Having worked with growers, they are sensitive about that kind of information.
    2. Marenghi: They report who they sold to, what they cost. We don't release that info to public unless we have to. We wouldn't release individual harvest information to public.

vi. Moore: To explain my comment, getting out of fishery part by opting into trading, that is public removal of pollution from waterways. In addition, public information for those who have permit? Someone worried about proprietary impacts don't need to participate in this program, its not mandatory. If we require folks who put pollution in to be public, important to require those who say they're taking it out to be public as well.
    1. Marenghi: Can see that for leaseholders, if states want to do credit trading with individual leaseholders. Not form public harvest spat on shell BMP areas.
    2. Moore: Doesn't matter if it's public or private credit, public deserves to know who is being accredited. Not considered confidential or anything like that.
    3. Marenghi: Possibly an issue for lawyers to sort out.
    4. Reichert: This goes outside purview of panel because it doesn't have to do with reduction effectiveness. These are just suggestions, states may do things differently depending on laws in place.
    5. Matt Parker is concerned about who oysters are sold to, make it more clear that this is optional for verification purposes (how many are sold for harvest), but not required for crediting process.
    6. Moore: Will need to see new language before agreeing.

Action: Julie Reichert will revise language to make it more of a suggestion to include who harvested oysters/who they were sold to.

c. Chapter 6 –
    i. Reichert: First bullet point – description on quantile regression was complex to write. Not influenced by outliers, quantile regression approach. Did comparison analysis with 50% quantile of entire Chesapeake dataset and 50% quantile curves for subsets of the data.
    ii. Difference in pounds N and P reduced in summer subset negligible
        1. Bricker: Need to include that you did a sensitivity analysis
        2. Rose: Error around estimate is well constrained. For the purposes of appendix, this could be reasonable justification for not doing a separate crediting for those instances where subset quantile fell below entire dataset quantile (we're NOT overcrediting), were within error curves. Subset red lines below black lines fell between error curves, not that much of a difference in crediting values. This gives strong justification for providing a single default estimation value.
        3. Bricker: Confused by the averaging approach language.
    iii. Bricker: Confused by "more weight in value than sites in Chesapeake Bay" line.
    iv. Reichert: Usually BMPs don't to their own analyses, we're concerned as a group, but CBP isn't concerned at all. We've taken a robust approach.
    v. Reichert: For nitrogen for example, there were 6 total studies, out of 6 studies, there were 3 studies that had CB specific information. Form that, we took site averages reported. We averaged all study sites as one, then averaged them together for CB. We

could make it clearer that we averaged their overall overage, didn't have as much weight as it would with high or low values reported. Waterbody level vs. site level.

Action: Julie Reichert include "underestimates" compared to 50th quantile of data subset in Chapter 6.
Action: Julie Reichert will rewrite averaging approach for percent nitrogen/phosphorus content in oysters.

d. Chapter 7 –
    i. Reichert: Lisa mentioned this is for subtidal practices, but our calculations include intertidal data.
    ii. Cornwell: Denitrification in intertidal is lower, we don't have enough data to separate them. Keep them together is fine.

3. Oyster Practice Definitions Discussion:
    a. Definition J
        i. Reichert: Chris had a comment about sanctuary reefs vs. sanctuaries.
        ii. Moore: In MD when you talk about sanctuaries, you talk about whole systems. In VA, sanctuary reefs/areas that have harvest right next to them. General public thinks whole systems in MD, we don't have that in VA and don't see us doing that. In addition, sanctuary has legal definition behind it that's different than what they are in MD. Trying to be broad in order to capture nuances between each state.
        iii. Marenghi: how about no harvest areas? Something that doesn't have sanctuary in it.
        iv. Moore: Seems that sanctuary language is ingrained in some places, no harvest areas seems more like what we're talking about.
        v. Marenghi: Definitions J and K say "area where removal is not permitted", seems fine to me.

Oyster BMP Expert Panel Meeting, May 10, 2019, 1:00 PM – 4:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Remote
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remote
Andy Lacatell	The Nature Conservancy (TNC)	No
Frank Marenghi	Maryland Department of Natural Resources	No
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	No
Chris Moore	Chesapeake Bay Foundation (CBF)	Remote
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remote
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remote
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remote
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Remote
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Remote
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes
Guests	**Affiliation**	**Present?**
Sara Coleman	Oyster Recovery Partnership	Yes
Kaycee Coleman	Oyster Recovery Partnership	Yes
Jeremy Hanson	Virginia Polytechnic Institute and State University	No

Action Items:

1. Timeline:
    a. Chapter 7 draft to be sent by 5/14, panel has 1 week to provide comments.
    b. Chapter 8 draft will be sent to panel June 7th, 2nd week of June for meeting to discuss chapter.
    c. Draft report out for public comment end of June, webinar first week of August.
2. Chapter 6 Review:
    a. **Action:** Julie is writing a sentence regarding potential increased fishing pressure due to restoration sites – that the panel will put a limit on credit, not harvest, and that it's up to resource managers will manage an area to prevent overharvesting – and will send to panel for review.

3. Chapter 7 Review:
    a. **Action:** Julie will avoid including regression analysis information in report to avoid confusion.
    b. **Action:** Title will omit "production" but include "biomass".
    c. **Action:** "Literature Review" section will be renamed "Background".
    d. **Action:** Panel should send Julie important reports and information that should be included in "Background" section.
    e. Reduction effectiveness determination
        i. **Action:** "50m away" will be removed from this section as "basin" remains undefined.
        ii. **Action:** Julie will include same language from other chapters describing need for expert help/justification of reference site choice before baseline is established.
        iii. **Action:** Julie will add language with respect the complexity of ways to monitor restoration sites/how different factors influence methods/require technical review.
    f. Biomass determination options
        i. **Action:** Julie will include language from other chapters/report making sure the panel communicates that only live oysters/biomass will be credited.
    g. Step 2
        i. **Action:** Julie will include language that conveys that to continue receiving credit, monitoring should be complete in 3 years. To receive additional credits, implementors must monitor every 3 years minimum. Will reference CBP documents on this protocol.
    h. Step 4
        i. **Action:** Language will be included at the beginning to define sampling points within BMP site, Julie will make sure its consistent that report talks about BMP site area.

Minutes:

Coordination Updates

1. Chapter 7 draft to be sent by 5/14, panel will have 1 week to provide comments.
2. Chapter 8 draft; send to panel June 7th, 2nd week of June for meeting to discuss chapter.
3. Draft report hopefully to be out for public comment end of June, webinar first week of August.
4. Happy Birthday, Mark!!
5. Sara Coleman and Kaycee Coleman are new to ORP and might be helping with the Oyster BMP Expert Panel. Sara focuses on oyster restoration and monitoring while Kaycee helps with electronic reporting for fish.

Review of Chapter 7

1. **Literature Review (Subchapter 7.1)**
   Discussion
    a. Reichert: Could use help on what we want to include in this section. Most reduction effectiveness based on dataset we compiled, not literature. Any studies out there that demonstrate success of restoration efforts we want to include?
    b. Wolinski: Ongoing work with sanctuaries and reports that are issued. Controversy of efficacy of sanctuaries, should include stuff that highlights success of sanctuary efforts.
        i. Reichert: Will include NOAA reports.
    c. Slacum: ORP has several reports that document mortality in Harris Creek.
    d. Bricker: Include Kennedy et al. report.
    e. Luckenbach: Rename section, call it "background", not literature review. Stuff going back to publications from decades ago on successful restoration efforts. Pull out examples that make that point, geographic and message breadth that provides background makes a lot of sense.
    f. Reichert: Panel should send Julie key studies and highlight key information we want to include in this section.
2. **The steps to determine the reduction effectiveness (Subchapter 7.2)**
    a. **Baseline Determination Approaches Discussion**
       Discussion

i. Reichert: If practitioners have data and justify baseline using that data, that is their baseline. However, there are situations where they don't have that data, then can use reference site approach using existing or new data on sites representative of conditions at restoration site 50m away.
ii. Wolinski: Is basin defined in document?
iii. Julie: No, it isn't, how should we define basin?
iv. Moore: There are basins defined, e.g. riverbasin in state of VA. Too big because they'll always be more than 50 m away.
v. Cornwell: Rationale was we were concerned that biodeposits at bottom of reef could change things close to reef. Unsure this applies here as this is a different process. 50m is a guess, looking for halo effect near reefs, 50m isn't exact.
vi. Reichert: I'll delete that part, how we define basin is still up in the air.
vii. Cornwell: With application of our approved BMP, is dealing with crediting within same system meaning you can't plant oysters in Honga and help in Baltimore harbor. Definitions mean a lot with respect to implementation. Our context for basin here is little Choptank or Harris whereas TMDL boundaries could be different and not relevant to this question. Agencies implementing these will make their own decisions wrt definition of basin.
viii. Reichert: We will leave as is but take out 50m away.
ix. Reichert: No need for reference site approach if you already know you need to establish a baseline. If you don't collect baseline data, you cannot receive credit in this situation.
x. Cornwell: You're not allowed to bury reasonably successful oyster communities, any instances where there won't be assessments?
xi. Paynter: Restoration doesn't suffocate what's underneath, no chance unless you increase rest density by order of 2. See upwards of maybe 30-40 shells/m2 at highest, doesn't even cover bottom. We don't need to have worries about covering existing population as there isn't enough shell to do that.
xii. Slacum: Criteria to do assessment in areas that determines where and whether restoration can occur. With enough oysters in an area, there won't be resources allocated to plant more in those areas. What Julie is alluding to with respect to the baseline, pre-survey was done to assess Harris Creek information used to determine where restoration occurred.
xiii. Paynter: Worth mentioning that when my lab does ground truthing, we count live oysters we come across on 200m transects so we have rough estimate of what live oysters are at that site.
xiv. Reichert: What about VA projects? Established baseline before planting on those sites?
xv. Luckenbach: They're not planting on site they've taken samples from. The data sit in a notebook somewhere, they're not published. In making decisions with respect to where to add shell for restoration sites, data come from fall surveys and are posted on vims website. Pre-samplings used to determine what Julie is asking, I'm unaware.
xvi. Moore: I'm unaware of that as well. We'll sample an area generally to determine no large oyster biomass, pick up oysters that are there, and move them. Biomass that is there are never recorded to my knowledge.
xvii. Reichert: That's why we're thinking of allowing reference site approach to existing projects, practitioners could select site nearby that is representative, they assess reference site to establish a baseline. Oysters put in water post-2009 can be considered for BMP credit.
xviii. Kellogg: Same language warranted here from other chapter describing expert help/justification of reference site choosing before baseline is established.

xix. Reichert: Yes, I will include this language.
xx. Bricker: Does the reference site need to be approved by state? Years of sampling after restoration, what is time period and does that need to be approved? Any approval process that should take place?
xxi. Reichert: Any approval would be run by CBP so they'd allow it in their TMDL model.
xxii. Wolinski: Any language about comparing adequacy of baseline?
xxiii. Paynter: Imagined there'd be a scientific committee overviewing these baseline establishments.
xxiv. Reichert: CBP required a technical review in past, if panel recommends that such a review happens, CBP will lean more toward requiring that.
xxv. Wolinski: It seems appropriate to establish framework for analysis that is consistent.
xxvi. Reichert: That might be difficult, restoration projects differ majorly. Might want to write this more from case-to-case, more site specific.
xxvii. Luckenbach: They'd just need an approved monitoring plan, should be sufficient.
xxviii. Reichert: Will add language, due to complexity of ways to monitor restoration sites/how it's done differently per different factors, implementation plans require a technical review for verification.
xxix. Moore: Make sure language is consistent with oyster restoration activities in CBW.
xxx. Reichert: CBP does reach out to experts in field to put plans together, review plans. Possibly STAC or even ORP.

3. Biomass Determination Options Discussion

a. **Quantile Regression**

Discussion

i. Reichert: Pulled out data for on bottom aquaculture. Gave us 6,888 tissue data points. For shell it was less, 4,296 datapoints.
ii. Reichert: Also made a distribution map for shell and tissue datapoints… spread of the Chesapeake for shell regression. More representation from VA waters than MD. More data from MD for tissue map.
iii. Bricker: Have any measurements been done on reef oysters? Or all aquaculture oysters?
    1. Reichert: All reef oysters. For bottom aquaculture analysis, only data we have were from reefs for restoration BMP regression equations, except your dataset that we added later.
iv. Reichert: Julie Rose ran quantile analysis for these two datasets, made graphics for inclusion in report. Made some with subsets of the data with respect to influencing factors (e.g. season, salinity) compared to entire dataset for inclusion in report, too. If black line falls below red line, potential for overcounting, but falls within error for entire CBW. We're underestimating in more situations than not. Did this analysis for both shell and tissue. What we are over crediting is negligible, did analyses, will include in appendix to justify our decision.
v. Luckenbach: Correct wording is to say this difference is within error range of our estimates anyway. This difference lies within whatever the confidence range is.
vi. Paynter: Agree with Mark. Take it even step further, say the outcome isn't different from mean. Reality is that it's not significantly different.
vii. Rose: Agree with this. Point out that because its within error, we don't know if it's over or under crediting. It looks like it's over crediting, but due to the error all we can say is it's not significantly different from error. We can't say with confidence that its over crediting due to the error associated with that.
viii. Reichert: Will not include this analysis to avoid confusion. Anyone who wants to do that assessment can verify it for themselves.

b. **Measured Oyster Biomass**
Discussion
   i. Kellogg: Need to determine if we're using baywide or site-specific biomass. Need to shuck oyster to get biomass, no real shortcut to doing it in bulk that im aware of. Use default or site-specific number if implementor doesn't think site specific number is representative of their site. Would be rare to sample 3,000 oysters and do biomass on all of them.
   ii. Reichert: Ever a situation where you shuck and dry tissue and weigh as a group?
   iii. Kellogg: Could do it but it's a lot of shucking.
   iv. Bricker: Did that with 100 oysters to get average for tissue and shell, agree with Lisa that over one acre is a lot of work. M2 would be more reasonable. Doesn't sound like something people would do but can't say for sure.
   v. Kellogg: I'm sure it happens, but not a standard you want to set.
   vi. Paynter: Resource community wouldn't provide lots of information on that. I don't see that as being common.
   vii. Reichert: Want to make sure it's clear they're measuring shell and dry weights to do sampling.
   viii. Reichert: Will use language from other chapters. Want to make sure we're communicating that we're only crediting live oysters/biomass, will use biomass language.

4. **Step 2 -**
Discussion
   a. Kellogg: How long do we allow for monitoring after restoration activities?
   b. Wolinski: To retain credit, must maintain set frequency of monitoring – exists in some programs.
   c. Reichert: Thinking we could allow more flexibility for implementing programs, were thinking 3-5-year time frames for monitoring would make sense. Is there a time frame we want to say that you want to monitor before a certain time?
   d. Moore: CBP credit efficiencies kept if monitored every 5 years. Referring to past language used, 3 years might be best model to use for this.
   e. Reichert: What if someone wanted to monitor every 2 years?
   f. Moore: That's fine, say to continue to receive credit, monitoring should be completed in 3 years. Reference CBP documents on that. To maintain and receive additional credits, say must monitor every 3 years minimum.
   g. Reichert: Will revise language to reflect this.

5. **Step 4 -**
Discussion
   a. Reichert: Will define sampling points within BMP site at beginning, will make sure it's consistent that we talk about BMP site area.

Chapter 6 Review

1. **Addition of the following unintended consequence:**
   a. From Lisa Kellogg: What about locally enhancing harvest pressure? I assume an area planted with spat on shell is subject to more harvest activity per unit area. The background oyster population may be reduced beyond what it would have been if the spat-on-shell (SOS) had not been planted.

Discussion
   b. Kellogg: This practice normally happens in place good for oysters to begin with, might be significant population to begin with. Hence monitoring requisites. if you already have oysters in area and do practice on top, what is net impact on what was there before you started

practice. Prob enhancing local fishing pressure in that spot. Throwing that out there for thought

c. Panelisst: You wouldn't put SOS down and wait two years, I might be off base. Legitimate question to bring up. Generally open harvest areas not high enough to open harvest, necessitates planting SOS.
d. Kellogg: No major objections to not putting it in there. We put thought into what data necessary to collect if we wanted to credit this. Just throwing it out there.
e. Reichert: Maybe something to run by Frank to see if it's something he's familiar with.
f. Luckenbach: In MD, what gear are they allowed to use? Dredge?
    i. Reichert: Yes, during certain time periods.
    ii. Slacum: Regulations in place, SOS not designated to specific gear type. Up to discretion of county. Within county boundaries may be areas for certain harvest method. Dredging could be use in this scenario, also patent and hand tong, depends on county.
g. Reichert: Do we put statement in there that put in take fisheries it'd behoove managers that they choose management plan that area remains self-sustaining instead of overfishing.
    i. Panelist: Put in comments that this practice isn't for areas with self-sustaining populations.
h. Paynter: Older populations are likely from plantings in past. Areas that don't have natural spat set or oysters.
i. Reichert: Looking at this from POV of all of our qualifying conditions, there are quite a few.
j. Kellogg: Include note that says bear this in mind. Am I wrong about what is supposed to be in unintended consequences?
k. Reichert: I wonder if it will cause more fishing pressure. Just something to think about. Because we have harvest caps in place, do we even keep this as unintended consequence?
l. Kellogg: There will be more fisherman there for the fact that we will be putting oysters there. We're putting limit on credit, not harvest. Harvest isn't managed on site specific basis.
m. Slacum: I think what you said is important point. Credit isn't going to be so great they're going to overfish if return in investment, might not be unintended consequence.
n. Reichert: We can write statement to that. Resource managers will manage area to prevent overharvesting. Will write a new statement and send to the group for review.

Oyster BMP Expert Panel Meeting, June 21, 2019, 9:30 AM - 12:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Remote
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	No
Andy Lacatell	The Nature Conservancy (TNC)	Remote
Frank Marenghi	Maryland Department of Natural Resources	Remote
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	No
Chris Moore	Chesapeake Bay Foundation (CBF)	Remote
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	No
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Remote
Bill Wolinski	Talbot County Department of Public Works	No
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Remote
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	Remote
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Habitat GIT Staffer, Chesapeake Bay Program	Yes
Guests	**Affiliation**	**Present?**
Jeremy Hanson	Virginia Polytechnic Institute and State University	Yes

Action Items:

1. **Action:** Julie Reichert, Larry Sanford, Lew Linker, CBP modeling team will discuss the use of Oyster BMP in watershed vs. estuary model.
2. **Action:** Julie Reichert will work with Jeff Sweeney to put together a scenario with respect to crediting oyster restoration all at once, will present that to the panel.
3. **Action:** Julie Reichert will put together examples for the Panel on restoration sites with post-restoration, baseline data of varied ages.
4. **Action:** Julie Reichert will add statement regarding lack of knowledge of confounding factors that influence oyster reef densities (could be outside of substrate) to reporting requirements section.
5. **Action:** Will provide ranges seen in data for context to emphasize that reduction values are site specific, will show more conservative values in reporting requirements section.
6. **Action:** Julie Reichert will schedule hour long meeting, send doodlepoll. Will try our best but we may have to proceed with google doc in order to have draft ready by late July.

7. **Action:** Panel should send thoughts on Enhanced Denitrification Interim BMP documents to Julie Reichert ASAP. Jeff Cornwell will put together a presentation on planning estimates for next meeting.

Minutes:

Coordination Updates –

1. Licensed Oyster Harvest Using Hatchery Produced Oysters BMP—Meeting with EPA
    a. EPA requested to meet with Panel to better understand practice, discuss how it'd qualify as BMP. Meeting will take place 6/27.
2. July 8th—Tentative meeting with WQGIT to approve use of interim restoration BMPs (denitrification and assimilation) in Phase III WIPs for planning purposes only
    a. WQGIT is interested in pursuing Interim Oyster Restoration BMPs to allow for a placeholder in WIPs. CBP is working through the technical requirements for applying this to the model. Interim BMP numbers will likely be different than the one that'll be officially adopted.
        i. Cornwell: Will give update on this to Fisheries GIT next week at their spring meeting in Cambridge, MD.
    b. Interim BMP explanation: Interim BMPs exist as values/estimates available when CBP partners want to create "what if" scenarios for planning purposes, but these values cannot be used or reported for progress scenarios where any partner would get credit toward TMDL goals.
3. Bill Wolinski is retiring at the end of this month but is still hoping to attend panel meetings. Congratulations Bill!
4. Frank Marenghi taking over for Lynn Fegley as an official Panel member.
5. Paige Hobaugh is leaving the Bay Program early next month, will volunteer with ORP and continue helping the Panel.

Review Chapter 7 Technical Appendix and Panel's Comments (Restoration-Assimilation) –

a. Review technical appendix for application in the TMDL watershed model (**document that looks at recommendations and says how it can be applied in watershed model, have to be sure what we're recommending can be implemented in this process)**

1. **Discuss credit duration (See PowerPoint example):**
    a. Considerations for application: Converting the site-specific incremental credit to an annual estimate
        i. The way practices would be credited would be different than how panel originally envisioned.
    b. One-time credit to be distributed incrementally. Would be modeled after cumulative BMPs, but a little different.

Discussion

c. Hanson: With similar site specific practices like stream restoration, planners know the information to do calculations when the practice goes into the ground, are able to report numbers the years it's installed to receive credit immediately. This one requires you to do monitoring years later to get the number. Rather than try to make it confusing to apply credit retroactively, we can treat that monitoring/sample collection as the year you'd first start to get credit for the practices.

d. See application guideline for explanation of this concept for inclusion in watershed model.
    i. Hanson: For instance, practitioner does initial planting, goes back years later to take samples/calculate reduction, that's when they can report their reductions for credits,

that's when they get their crediting for the next x-many years (credit duration). Would be provided annually for x-amount of years.

ii. Reichert: t0 is establishing baseline/pre-restoration survey. Next comes the planting activity. Biomass isn't monitored until t3, then do post-restoration biomass/shell survey and calculate estimated reductions/credit at t3 by dividing by 3. In t4 you can qualify for 1/3 of calculation in t3, at t6, the estimate wouldn't be good the following year and you would need to go back and monitor for appreciated tissue/biomass from t3. This allows practitioners to use site specific reductions.

iii. Moore: Looking backwards, seems better to back credit t1-t3 instead of estimating into the future.

1. Hanson: That makes sense from accuracy perspective, but for how model is used, there's no BMP that we credit to previous years. You'd only ever get credit/see benefit when we update model every few years for progress runs. This is run so that states can get idea of reductions they've achieved in that year.
2. Moore: Potentially providing a false sense of hope this way. You're putting in reductions not there, haven't been verified yet for forward looking years. This is the first in-water BMP, seems like a bad road to go down. Credit t3 to t1-t3, we shouldn't assume that number will be the same from t3-t6.
3. Reichert: Saw this as more of a delay/lag. You won't be able to understand real-time what is happening in the system. We want to credit if we saw progress/verifying it also by requiring monitoring data to even establish the estimate. Think of it as a delay. Maybe biomass at t4-t5 doesn't look like it did in t1-t2, then just take it out of the model.
4. Moore: Should we actually credit something that's not there or do we tell permittee you did get x-lbs credit because biomass came back? Seems like a very bad precedent to set to credit stuff that isn't there yet.
5. Hanson: There is no ideal solution to this. Weighing extremely retroactive crediting that's hard to communicate vs. not accurately crediting biomass in proper years. Something to keep in mind – with other BMPs (e.g. forest buffers), practitioners are getting credit for full grown trees/buffers immediately the year it goes in. No BMP is 100% accurate when there are living structures/resources involved. Model is set up to get the sense of what BMPs are providing, more about understanding improvements on ground than it is having every pound correct.
6. Marenghi: I think I agree with Chris Moore. Why wouldn't you just get all credit in t3 for what was already done, you get that credit because its already in the past? Going forward to t4-t6 for projected, either say there's no credit because there's no monitoring or project forward the incremental amounts based on t3, but you wouldn't get any actual credit from t6 until its verified. Get bulk amounts in year of monitoring, it wouldn't be spread out annually.
    a. Hanson: This could be an option.
7. Cornwell: Point of model is to do inventory every year; credit is environmental benefit of whatever your management action was. Think of it that way. We want it to be credited annually if the oysters are there annually providing a benefit. Most BMPs have 10-year credit life – stays in model for 10 years

without verification/inspections, drops off after 10 years if it's not inspected again.

8. Cornwell: When I think about a large scale restoration with multiple rates, the integral of this makes a lot of sense. It's hard to wrap your head around crediting later for things accomplished earlier. Conceptually, it's evening out reef-to-reef annually which is more reflective of reality with variability between reefs on a large scale restoration site.

iv. Sanford: Agreed with Jeff Cornwell. Is this supposed to be applied in the watershed model?

1. Hanson: Yes, using the shoreline land source.
2. Sanford: From environmental impact POV, it's not clear the amount of nitrogen taken and put into oyster tissue has same affect if it never entered the bay in the first place. It's misplacing the environmental effect of nitrogen consumption entirely.
3. Sweeney: You're right. Effect on tidal waters, not on loads.
4. Sanford: Essentially nutrient trading in a sense. If a reef is restored, there are oysters in bay model as well. Do those oysters not get put into bay model because of their benefit?
5. Reichert: If state decides to implement it in BMP scenario, would need to remove it from estuary model as to not double count it. State would prefer for oyster restoration to be directly related to their program/load reduction as opposed to global application as it is in estuary model. States want this effort to be recognized toward their reductions.
6. Sanford: We were going to consider the effects of turbidity as well. Putting impact of tissue formation and filtration on nitrogen and putting it in watershed model removes its effect on turbidity.
7. Reichert: Will check with Lew on this. He said for certain processes, they'd still leave in filtration part with the sediment component but assimilation/sequestration would have to be turned off somehow in model.
    a. Sanford: interested in having offline discussion with Lew, you, and modeling team on this.
8. Sweeney: This is simply a way of doing bean counting for TMDL. Solely just for accounting now, science needs to stay correct.

v. Hanson: This is the preferred approach based on how other BMPs are credited. Most logical and acceptable to folks on Watershed Technical Workgroup and the Water Quality GIT. They have most stake/interest in how these practices are tracked and reported in watershed model. Not saying retroactive reporting can't happen, just don't know how it'd possibly work.

1. Marenghi: No problem with taking same amount of reduction and spreading it over 3 years, just seems different than other scenarios we've previously discussed. Issue with projected aspect vs. when credit is actually given. In other examples, we talked about giving credit in monitoring year.
2. Reichert: We've had conversations about that with the Watershed Technical Workgroup. There is concern that they can't actually review all data in timeframes necessary to report in CAST.
3. Moore: We've dealt primary in what a state would get on a timeline, different from model world. Agree that is confusing that there's a mismatch between

what model is saying and what input decks/states are saying. Different conversation between crediting for states and model, want both things to be congruent as possible.

a. Reichert: Jeremy and I can meet offline to throw together example of crediting in bulk.
b. Marenghi: Agree regarding having the two be more congruent, but okay with having them separate if modeling is that different. As long as this isn't in lieu of crediting model for states we discussed earlier. No reason for states to wait 6 years to receive 3 years of credit. If they exist as two separate streams, then I'm okay with this.

vi. Hanson: Added complexity to acknowledge – progress runs/years of BMP implementation aren't calendar year, it's June-July.

vii. Julie: To clarify – this isn't a rate, it's more of a one-time credit. It's based on appreciated biomass. You don't keep getting credit. Unless you keep monitoring and notice you have appreciation over the amount of what you already got credit for. Reef will reach stable state; won't receive credit for maintaining it if it's not appreciating for assimilation. Denitrification is another story, happening every year and credited by biomass, making it worth it to monitor every year. It would benefit state to do both because you have to monitor biomass for both anyway. Until we gather more research with respect to what the give/take and store/release rate looks like, we can only credit to a certain point. With this clarification, are we okay with this is distributed out with 3-year timeframe or do we still want to evaluate what it looks like with crediting full amount and leaving other years out of crediting until monitoring occurs again? Should we do extra evaluation?

1. Moore: Let's continue to look at this. I'm not quite on board yet.
2. Reichert: Will put scenario together with respect to crediting all at once, will present that to the panel. Jeff Sweeney will work with me on this, we'll list the pros and cons.

viii. Hanson: Then it would become strictly annual BMP, receiving credit in only year you monitor/report it.

2. **Discuss monitoring timeframes:**
   a. How old can baseline data be?
   b. How long can you wait to monitor after restoration activity to apply for credit?

Discussion

c. Reichert: Some restoration projects that have been ongoing since 2009, no BMP at the time so they didn't monitor baseline the way we hope for. Some options for those situations – 1) they can use existing data from the area (e.g. baseline for Harris Creek pre-restoration) or 2) could then choose reference/representative location nearby they can establish a baseline that way. Is there a timeframe we think is too old? I think if its post 2009 that should be fine.
d. Hanson: What are those constraints for being able to report this as a BMP as the Panel defines? How long to wait to monitor to receive credit?
   i. Reichert: Harris Creek ongoing for 6 years now, they don't necessarily have monitoring data.
   ii. Moore: In VA, nothing that's complete yet in terms of monitoring data.
e. Reichert: Any reefs in MD that don't have monitoring data 3 years post restoration?
   i. Slacum: Most effort has been on reefs in tributaries, still done at state level. Unlikely to work with reefs planted over 10 years ago.

ii. Reichert: Would it still be ok to receive a restoration credit for work done 10 years ago?
iii. Hanson: Once you're beyond 3-year window, then you'd likely have to use baseline/reference site approach. What do we say if there's a project and funding runs out in year 3 and can only go out to monitor in year 4 or year 5, what is our response to that?
iv. Reichert: Will put some examples together for this one, present to everybody and see how it plays out. One we have to think a little bit more about.

3. Review Reporting Requirements – see Interim BMP document:

a. See restoration-assimilation interim BMP example
   i. Should BMPs be based on the type of substrate used too?

Discussion

b. Reichert: Will try to send something to Fisheries GIT on Monday. This document breaks it down into 3-year timeframe. For planning BMP that should be fine because it's just numbers, even a little bit conservative. Could look very different from approved BMP. Dividing by 3 and distributing along longer timeframe might be better.
c. Reichert: Something to note – looking Harris Creek data, big difference in oyster density/biomass between different substrate sites. Grouped by stone/fossil shell (larger reductions) vs. shell based. We don't mention anything in our recommendations right now about having different substrate act as different BMPs – this might be a really important point. Instead of averaging all sites together? Leave it up to implementers to separate by substrate type?
   i. Cornwell: Most of our data falls within shell base, denitrification is just limited to shell base. Want the protocols to be able to work together. Might not be worth separating.
   ii. Moore: Is it oyster density or substrate that makes the difference, driving difference in biomass?
   iii. Reichert: What drives N and P reduction is oyster biomass at a site. Higher density generally means higher biomass, more reduction associated with that. A program that uses alternate substrate that's stone like, get credit for acres that they plant at higher reduction/year, shell based would get a lower one. If they're planting SOS only, if they're just planting substrate they automatically get lower value.
   iv. Marenghi: If it's just from oysters, not some chemical from base itself, leave this part out. Lots of variability in densities these are planted at, don't understand differential mortality between different bases and potentially issues with sampling, substrates are sampled using different techniques. Not clear to me that we'd expect large differences in density based solely on substrate base without having a full understanding of other variables.
   v. Reichert: If we don't care what treatment type you're using and you get credit for what's there, it may just look at individual reef in Harris Creek vs. all Harris Creek reefs averaged together.
   vi. Slacum: Question itself about presenting this as shell based vs. alternate substrate was more important when we had this broken up into market categories. If you in future biomass estimate done at reef level, wouldn't need to worry about this.
   vii. Reichert: This is just to provide a conservative average number. This is a site level estimate, regardless of stone/shell based, would be assessing at reef level what estimate looks like.

viii. Moore: Did sampling in one VA restoration tributary; biggest indicator of success was placement along river. Hardly any correlation with substrate type. Site specific piece is the right way to go.
ix. Reichert: Will add statement we don't know confounding factors that are influencing densities (could be outside of substrate). For planning purposes we could keep these separated.
x. Hanson: Purpose of planning BMP is doing "what if" scenarios, we can't predict future. Having just one number is the way to go – averaging or using a more conservative value unless people know exactly what kind of substrate they plan to use. Keep it simple because it's just a planning BMP.
xi. Moore: We're oversimplifying. We're using Harris Creek to be representative of entire Bay system and we know that is not the case for whole Bay. Have to go with most conservative number.
xii. Reichert: CBP needed a number ASAP for planning. We recognize it could look very different at a site level. Will modify this to show more conservative value. Will provide ranges we've seen in data for context, to send home that point values will be site variant/specific.

4. **Substantial Comments from Panel Review:**
   a. Reichert: I could send this section as google document that people could add comments under each question I had or schedule another shorter meeting to handle them.
      i. Bricker: I prefer meeting so we can discuss.
   b. Reichert: Will schedule hour long meeting, send doodlepoll. Will try our best but we may have to proceed with google doc in order to have draft ready by late July.
   c. Comments to Consider:
      i. How to determine which acres the average N and P reduction (lbs per acre) apply to? Do we need a minimum amount of spat or substrate that should be planted to qualify for BMP?
      ii. Refers to example: When determining how many oysters to measure from the samples, what is considered "small." Do we want a lower size limit, e.g., all oysters >25mm since smaller oysters have minimal biomass?
      iii. What constitutes a sample for the recommendation, "a minimum of three samples should be used to establish the average pre-restoration and post-restoration live oyster tissue and shell biomass."
      iv. Who do we mean by "reef expert;" include such as…

Review of Enhanced Denitrification Interim BMP –

   d. Discuss change to averaging approach to minimize estimates that would be needed for reporting in the watershed model (current approach could result in a total of 12 estimates per site if sampling is done during all the months)
      i. See enhanced DNF interim BMP example for a possible averaging approach.

Discussion

5. Cornwell: Made a planning document for planning/interim BMP for Fisheries GIT Chair Sean Corson. Using Harris Creek data, I parsed out low med high biomass to split up denitrification. Lisa split up between dark/light hours and seasons. Came up with average between seasons as 57 pound/acre for denitrification. We are not 100% on same page that light may not be driving factor. Bottom line provided season number on low end, confident that it'll hold up to level of scrutiny necessary for planning.
6. Bricker: What are the thresholds between biomass categories?

    a. Cornwell: Low: less than 75, medium: 75-225, high: <225 grams/m^2
7. Cornwell: Any thoughts you have on these documents, send to Julie Reichert ASAP so we can modify. These are supposed to be simple, conservative planning estimates. Will put together presentation for meeting.
8. Reichert: These exercises have been helpful in providing recommendations with respect to how to apply these credits/practices. Gave me confidence we could implement these moving forward.
9. Reichert: Currently, enhanced denitrification chapter is written in way of seasonal timeframes (3 months – spring starts in March, April, May). Eye opener to me with respect to Jeff's approach averaging over warm months gave same results as we did with smaller time frame. We can provide twelve estimates per site way its written right now. In working with interested Watershed Technical Workgroup members, I realized that it might be more difficult for them to work into model with twelve different estimates for each site. If I sample in spring summer fall, can I average one value that'd work for those seasons for easier implementation into model? Maybe more simplified approach is fine, modeling folks would be thankful.
10. Moore: They'd have to do at least 3 samples per year for a baseline right?
    a. Reichert: For denitrification, they'd use a reference site for baseline. Do that one time to establish baseline at restored rate. But it's based on biomass – for verification standpoint, have to go back out and monitor level of biomass. If values are retained they can keep rate of reduction for credit, any less and they lose credit.
11. Marenghi: I support using one number for denitrification vs. twelve. Maybe some percentage would be more appropriate vs. an average. Wouldn't be minimum, but likely wouldn't be average either.
12. Reichert: Something we can meet up with Lisa and talk about, present new approach to panel.

Oyster BMP Expert Panel Meeting, July 24, 2019, 9:30 AM - 12:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Remote
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Remote
Andy Lacatell	The Nature Conservancy (TNC)	Remote
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Remote
Frank Marenghi	Maryland Department of Natural Resources	Remote
Chris Moore	Chesapeake Bay Foundation (CBF)	No
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Remote
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Remote
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Remote
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	No
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeremy Hanson (WTWG Rep)	Virginia Tech (CBP)	Remote
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Remote
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Paige Hobaugh	Volunteer, Oyster Recovery Partnership	Yes

Action Items:

1. **Action:** Panel will stick with site specific denitrification estimate approach for each of the 4 seasons; add to Research Gap section what'd be helpful data wise to develop future default estimate.
2. **Action:** Julie Reichert will include a statement in reassessment section stating that if those who evaluated light and dark in summer and determine that light doesn't matter after 1 year can apply just the dark rate to summer. This is seasonally dependent.
3. **Action:** Panel will recommend reassessment of Enhanced Denitrification BMP every 6 years.
4. **Action:** Julie Reichert, Jeff Cornwell, and Lisa Kellogg will look into recommending the use of biomass ranges/thresholds when assigning denitrification credits.

5. **Action:** Panel agrees to add a note regarding the lack of information on alternate/artificial substrates and reef ball denitrification to research gap section.
6. **Action:** Lisa Kellogg will send Oyster Restoration Workgroup website link to Julie Reichert.

Minutes:

Coordination Updates

1. July 8th—WQGIT approved interim restoration BMPs (denitrification and assimilation) for planning purposes only
2. Panel review of denitrification chapter—August 5-August 19
    a. Julie Reichert is aiming send this chapter out August 5th, depending on the outcome of this meeting. Chapter will be about 60 pages long, will take time to review. First two sections are complete, application and verification samples will be done after decisions are made today.

Enhanced Denitrification BMP Discussion, Jeff Cornwell

1. Can we simplify seasonal calculations?
    a. Discuss seasonal timeframes—can there be an option for just evaluating a warm season?

    Discussion

    b. Cornwell: The balancing act of this chapter is applying what we know about influences (e.g. light, season) and recommending something that is useful from a management perspective for implementation. We need to make sure we capture elements that make quantitative differences with respect to calculating annual rate while at the same time not making it complicated. For the interim BMP calculation that we provided NOAA to bring that forward to Water Quality GIT (WQGIT), we used warm season data - Lisa split datasets into low/medium/high biomass, used biomass numbers for 6-month period. For this number, what is important for seasons? How should we parse out seasons? This needs to be a number less than 12, but more than 1. We can't expect people to be monitoring on a monthly basis. My preference is to push for seasonal part of this, but to allow for warm season series of measurements to extrapolate to a 6-month period – this would account for 60% of the denitrification if not more.
    c. Reichert: We can calculate that reduction using different rates. We could assign the BMP by season - e.g. “Summer Season X BMP”. This is one idea of Jeremy’s. It would provide more flexibility.
        i. Hanson: There could be other ways to approach it.
        ii. Reichert: The warm season option would be for a group that didn’t want to measure in winter. If they wanted to do winter, they’d have to sample for all 4 seasons.
        iii. Cornwell: This essentially becomes subset of annual. The months would have to be rearranged.
    d. Cornwell: We began by going out 4 times/year to measure denitrification rates per season. If you don’t do all 4 seasons, you stand to keep denitrification behind on site. How could we extrapolate this to one number to simplify process?
    e. Cornwell: Based on what Lisa and I did earlier, warm season would be May-October. A few of those months are in fall and one is in spring. That is how we would parse out a half year assessment for warm season. We don’t have a sense of what in the end someone implementing this will choose to do.
    f. Kellogg: Are we rejecting the seasons we originally established?
    g. Cornwell: The seasons we have now on annual basis make a lot of sense based on data we have, but if you were to pick 6-month warm season with # of measurements, what would that look like?

i. Reichert: To be conservative, can we use these seasons, cut out May? Possibly truncate the fall season, make measurements in June, July, or August, then one in October or September.

h. Cornwell: Leaving May out will leave denitrification behind, including October would result in an over-credit. The net of this probably doesn't matter at all. If we stick with original arrangement, in the end we'll come to exactly same place. The measurements are variable enough, it probably won't matter if we say use these same groupings of months.

i. Reichert: For application, we want to offer flexibility in options, but offering too many options may overload practitioners. Maybe provide guidance paragraph about optimal measurements (e.g. summer, fall for 6-month warm period).
   i. Cornwell: We don't have detailed measurements to base number this off for every month.

j. Paynter: Has there been consideration of contribution of gametes to water column? They lose body mass.
   i. Cornwell: That nitrogen loss from oysters will likely pale in comparison to denitrification. We should take a look at this.
   ii. Reichert: More likely related to assimilation. We only credit live tissue biomass.

k. Cornwell: Are people comfortable with spring, summer, fall, winter parsing? If need be, would a subset of summer and fall would be adequate?
   i. Wolinski: Is this only applicable for 6 months of the credit?
   ii. Cornwell: Correct, would zero out winter and spring.
   iii. Kellogg: If they take measure in season, they get credit for that season, if not, they don't get credit for that season.
   iv. Reichert: Small timeframes will force people to go out and take more measurements, will help seasonal data.
   v. Cornwell: Will benefit all future reiteration to have season sample data, but from an implementation/enforcement standpoint, it's not necessary.

l. Luckenbach: Is there a low-end from studies that have been done that you could say with no measurements, we could count the fall in? In the spirit of what you're talking about now - opt in for something that'll provide less credit, but is less costly.
   i. Cornwell: I think so, yes. Maybe we can add a note saying that at some point with more information a default can be implemented.
   ii. Reichert: Would that be similar to what we did for the interim BMP?
   iii. Rose: To build on that, perhaps in the future you have baseline level of biomass, you can assign very conservative default estimate to denitrification. Would provide a pathway moving forward that a future panel could assess.
      1. Cornwell: We need a statistical basis for picking that number.
      2. Kellogg: Doable, but the challenge will be that biomass threshold is different for intertidal vs. subtidal reefs. Rate assigned would be different for shallow light reefs vs. deep reefs. Would end up being 3 default estimates.
      3. Rose: Could have 1 default number, but we'd use the most conservative rate.
      4. Kellogg: Problem with that. Intertidal numbers require a high amount of biomass to estimate, most restoration sites would have a hard time reaching that.
      5. Rose: If we see pathway forward for future panels, path of least resistance to default estimates, we should include that in the report.

b. Luckenbach: Worth articulating at least that like other BMPs, we can put a number on this. For now, it's simply based on too few experiments. Should include this in moving forward section.

c. Cornwell: I envision in 5 years we could prescribe a default estimate with enough data from practitioners. Somewhere down the line it'll be helpful for implementing this more widely.

Action: Panel will stick with site specific denitrification estimate approach for each of the 4 seasons; add to Research Gap section what'd be helpful data wise to develop future default estimate.

2. Discuss light and dark requirements. Include caveats about light denitrification rates if light is shown to have little effect on reef incubations?

Discussion

a. Cornwell: The only dark and light information anywhere is created by our two labs. Light makes huge difference with respect to net denitrification. With respect to Harris Creek data, 53% of the time we get a higher rate on daily basis if we take only dark into account. Turning on lights in sediment creates autotrophic uptake of ammonia, decreasing bioavailability for N_2 production.

b. Kellogg: Are the numbers that make no sense we get doing light incubations included in calculation of percentage?
   i. Cornwell: No.

c. Kellogg: I think your values of about 50-50 are skewed. We have fewer values for light than we do dark.
   i. Cornwell: Light is dominant. If in a system if it's clear that light doesn't make a difference, do we continue to require it? They could eventually make the argument that light incubations are not necessary, until we have a compelling amount of data to exclude in our recommendation.

d. Kellogg: Does it make more sense to say in the future this can be considered or should we put it in now?
   i. Reichert: We could put this in application guidelines, say this is to be re-evaluated.
   ii. Cornwell: The reason to not take dark data from outset, we don't have large enough sample or good enough understanding to immediately exclude light as an influence.

e. Parker: Is there any situation where someone would only make light measurements and apply to light hours and never take dark estimates?
   i. Cornwell: We're still developing basic understanding of these processes, excluding light is a problem at this point.
   ii. Reichert: Will add recommendation saying not to do just light measurements.

f. Paynter: The presence of benthic algae can reduce denitrification rates. Is that number anywhere close to the assimilation rate of oyster tissue itself?
   i. Cornwell: Not sure the answer to that
   ii. Kellogg: I hesitate because we have data from intertidal sites with lots of microalgae present that shuts down denitrification - it sucks up ammonia that allows denitrification to happen. It'd be hard to describe it as anything long term with respect to nitrogen removal - microalgae lasts usually a year.
   iii. Cornwell: Algae moves around, decomposes to its original constituents. It's removing nitrogen, but where it decomposes you add it right back.
   iv. Luckenbach: It's very much the case in high density clams, that seasonally, there's as much nitrogen in standing stock of algae as there is in clams. Since standing stock overturns a lot, there's a high uptake rate, but the rate of turnover of algae just put the nitrogen right back in the system.
   v. Cornwell: Whether buried or denitrified, nitrogen goes back into the system.

g. Cornwell: Assessment of light should be part of recommendation. It's up to those making measurements to determine whether light is unimportant before it gets deleted. Cost of doing dark and light is a tiny fraction of total cost. Just a few more hours of incubating is a drop in the bucket compared to other costs of assessment.

Action: Julie Reichert will include a statement in reassessment section stating that if those who evaluated light and dark in summer and determine that light doesn't matter after 1 year can apply just the dark rate to summer. This is seasonally dependent.

3. Discuss timeframe when estimates should be re-evaluated. Five years has been proposed.

Discussion

a. Cornwell: Credit can't be run on forever even if biomass persists, what is that cutoff number?
b. Reichert: When do these values need to be reassessed? CBPO is looking for a credit duration. How long can they apply this during the model, is there anytime this expires/needs to be reassessed? For example, floating wetland BMP requires 6-year verification.
c. Cornwell: Harris Creek has a 3-year rotation for assessing biomass. Some multiple of that time frame - possibly 6 like other BMPs, make it some multiple of 3.
d. Luckenbach: The frequency with which things are being assessed is variable. Biggest amounts of money going into sanctuaries in VA are USACE dollars and like any of their restoration projects, they require to monitor out to 10 years post restoration, but not beyond that. Would be necessary to put in minimal reassessment by X number of years or it gets taken out of model.
e. Paynter: 3-year rotational survey would take care of most of data needs we have to determine denitrification rates and other things.
    i. Reichert: Denitrification rates are associated with tissue biomass. Denitrification rates are expensive to measure right now, why were linking it with biomass (much easier to assess). Maybe the 6 years makes sense, long enough window for money invested to receive credit. We don't have long term datasets for denitrification rates. Reassessment at 6-year mark would be helpful.
    ii. Hanson: Some BMPs have a lifespan of 30 years or longer, but credit duration is only used in the model. How long cumulative BMP stays in model until it's verified again or it's removed from model.
    iii. Paynter: Difference in life cycles - we have oysters that live 10-15 years, but we don't have recruitment to replace the animals. In south VA, oysters have 2-3 lifespan but natural recruitment that replaces that. How are those different types of environments encompassed by what we're doing here?
    iv. Rose: Ok with denitrification being longer, 6 years is fine. Good to tie it in with other activities, like both of those ideas.

Action: Panel will recommend reassessment of Enhanced Denitrification BMP every 6 years.

4. Discuss using biomass ranges to assign denitrification credit

Discussion

a. Reichert: Per the biomass recommendation, practitioner establishes the denitrification rate at a known biomass and verifies that biomass anytime they want to claim a denitrification rate. If biomass decreases, they can proportionally decrease the denitrification rate and still get credit. They can only receive credit if the measurement is above 50% of the original biomass. This is different than the interim BMP rates. I'm wondering if there is a range of biomass that as long as you maintain that range of biomass you can apply the same rate instead of proportionally decreasing it? Can be complicated to have to work with different rates/season.
b. Kellogg: the Interim BMP low, medium, and high categories are arbitrary. They represent natural breaks in dataset where we had a gap in biomass values between 75 and 150 and another between 225, an artifact of the study we had in hand when we chose the categories. Biomass categories will end up being site specific, the same reason we can't give a default minimum estimate. Curves are different for different sites, where to put breakpoints varies by what site you are working in.

c. Reichert: This might complicate things for technical appendix. May have different rates you're working with in one season depending on which season. Using average biomass for verification, but comparing it with biomass used to determine denitrification rate. If the biomasses aren't the same, we have prescribed rules that require practitioners to adjust/reduce rate.
    i. Hanson: My confusion was for assimilation BMP to get reduction credit you need appreciation of biomass sequestered in shell, is it the same for enhanced denitrification?
        1. Reichert: No. Totally separate from assimilation. We are measuring new denitrification annually. New reduction happens on an annual timeframe as long as you maintain oyster biomass vs. one-time credit of what's stored in tissue and shell in the assimilation BMP. Annual vs. one-time credit.
d. Reichert: We need to consider simplifying this, no other BMPs do this. Not sure how to do this; +/- 25% with change in biomass?
e. Cornwell: The issue here is that we need to establish a threshold number.
    i. Reichert: If I create my denitrification rate at 100g/m^2 and it's at 75g at reassessment, are we okay with 25% mass decrease and ok with applying the same rate? Is there a window you'd be comfortable allowing? A range that's acceptable for rate of denitrification to be used?
        1. Cornwell: I'm comfortable with 75% of the original biomass baseline.
        2. Kellogg: 75-100%, 50-75% seem like reasonable thresholds to consider.
    ii. Luckenbach: Pay attention to levels of 15g biomass/m^2 and 50g because those numbers are embedded in the metrics document and plenty of folks have accepted that as threshold.
        1. Kellogg: We had a hard time getting rates at less than 15g biomass in our study trays.
        2. Reichert: Maybe we should prescribe minimum biomass before even going out to measure for denitrification rates.

Action: Julie Reichert, Jeff Cornwell, and Lisa Kellogg will look into recommending the use of biomass ranges/thresholds when assigning denitrification credits.

5. Discuss which acres estimates apply to acres with alternative substrate?
    a. Large-scale oyster restoration projects include a mix of treatments (planting shell substrate, planting alternative substrate, planting spat-on-shell, no plantings if biomass is at target amount).

Discussion

b. Reichert: State representatives are looking at total goal of restore acres, e.g. there are 350 acres at Harris Creek, and are looking to apply estimates for the entire 350 acres even with different substrate types. Rates could vary quite differently - it may not be appropriate to extrapolate estimate derived from granite site to shell based area. If someone is developing a rate at shell based substrate can they extrapolate out to alternative substrate types or do they need a rate for each type?
c. Kellogg: Total lack of data with respect to denitrification and artificial/alternate substrate. Haven't figured out how to study it. Sny decision being made is being made in complete absence of data.
d. Paynter: To give credit to type of substrate down there will be hard to quantify.
e. Luckenbach: Possibly more of an issue with scaling up and distribution of substrates than with the type. For example, a project not on the ground yet, Virginia Beach/USACE joint application for restoration in Lynnhaven River, depending on how far dollars go, anticipate the project being 4-8 acre scale with cylindrical hollow concrete structures that will cover 14% of the area.

If nothing else, we have to consider how one scales up from something like that. Even with a measurement, someone needs to multiply that by 8 acres when in fact it's only 14% of 8 acres. Not sure what arrangements been done with granite, but reef balls/oyster castles make no attempt to create something that looks like full coverage. Commentary might need to be as much as scaling up your measurements as what the substrate type is.

f. Wolinski: In Harris Creek restoration project, they are big sites. Isn't there a metric established to determine biomass in different areas and they are averaged?
    i. Cornwell: Yes. We don't have those numbers, but I'd expect that we're not going to be terribly different than other kinds of substrate.
    ii. Reichert: Is there a metric that says we need to cover X-amount of area in your restoration activities? Ward would know this.
    iii. Kellogg: Success measurement is that restoration covers 30% of the bottom. Are we to say that if a successful reef that doesn't reach 30% it doesn't receive credit?
g. Paynter: We have to be careful about crediting substrate vs. oysters.
h. Kellogg: All credits come from reefs that don't come from artificial substrate, we should add caveat saying that these are the best findings we have. No data for SOS on granite or else, but because we don't have data and no reason to believe the values would be different in those instances, to the best of our knowledge, this is what's happening on granite reefs until we can say otherwise. Regarding the reef ball/castle question - fundamentally different from materials planted on bottom with no large space in the center like a reef ball.
    i. Paynter: Reef balls increase surface area upon which animals can recruit to including oysters. Construct is in another dimension compared to shells and granite.
    ii. Luckenbach: What lisa said needs to be in this document. Virginia Beach would be someone who wants to apply for this. 2 concerns: 1) these estimates do not apply or need to be applied with caution and 2) needs language about the care that must be taken when extrapolating to full areas because these structures are placed distances apart from one another.
    iii. Wolinski: On larger scale ball installations, would be easy metric to calculate surface areas and extrapolate out to surface area or projected area.
    iv. Cornwell: Mark is right. They can't put enough out there and extrapolate to make sense with respect to other substrates when considering denitrification. 450 at site covers hardly any area, but rates are high per ball, just not enough of them. Numbers need to be higher for denitrification to be quantitatively important.
    v. Kellogg: Justification for not crediting reef balls in the same way - those oysters are living above substratum and when we look at oyster aquaculture numbers, we don't see a lot of enhancement.
    vi. Cornwell: Larger structures are not part of this current BMP. This will be site specific, literature is just not there.
    vii. Paynter: Fundamentally, it's an improvement of bottom were talking about, enhancing the benthic community.
i. Recihert: As a compromise, we can add this to research gap section. Not saying this can never be credited, we just don't know how to credit it right now. More data needed to understand. Our definitions are more suited to on bottom plantings with oysters in contact with substratum.
j. Cornwell: On alternative substrate, best professional judgement, use numbers used for more standard approaches to those barring some assessment that shows its out of whack.
k. Kellogg: We need to make a clear definition of artificial substrate.
l. Paynter: Name a few specific examples and include "until further notice" statements.

m. Reichert: Panel agrees that if someone measures denitrification rate at site where they planted shell, they can apply that to a site they planted SOS to granite. They must tie substrate to oyster biomass.

Action: Panel agrees to add a note regarding the lack of information on alternate/artificial substrates and reef ball denitrification to research gap section.

Review Chapter 7 Technical Appendix and Panel's Comments (Restoration-Assimilation)

6. Technical appendix for application in the TMDL watershed model
    a. Revised example to reflect that crediting of monitored assimilated live oyster biomass can be credited within that year.

Discussion

b. Reichert: To apply to model, it's the monitored amount, not the planted amount that generates site specific estimate and when BMP becomes active. For example, at t0, I did my pre-restoration survey to establish my baseline. Have my sampling plan reviewed and approved by CBPO and going out there to do plantings, designated my area that this could apply to. Then I plant in designated BMP area (must be in place to make sure you can scale up your measurements to that area - we recommend that you consult with an expert to acquire enough sampling points to be able to scale up). t3 is the time for post-restoration survey for biomass. You only get credit for what is appreciated over the t0 baseline. It becomes active for crediting, apply that amount by multiplying by percent contents. That biomass is then complete. I get a one-time credit in t3. The reef could still be growing, so no activity at t4 or t5 - could plant more if you'd like, but you receive no credit in t4 or t5 because there's no evaluation. You evaluate in t6 and compare appreciated biomass over t3 numbers - would receive credit in t6. This situation better matches what panelists at last meeting were talking about.

c. There were no Panel objections.

7. Substantial Comments from Panel Review:
    a. How to determine which acres the average N and P reduction (lbs per acre) apply to? Do we need a minimum amount of spat or substrate that should be planted to qualify for BMP?

Discussion

b. Rose: My initial reaction, given that credit is proportional to biomass, is if biomass is limited, credit will be negligible. There's an administrative burden that'd keep those from even filing if credit would be little.

c. Reichert: A concern we need to add a definition for?

d. Reichert: If I want to achieve 50g of tissue/biomass, is there any guidance on how much SOS I need to be planting? It'd be nice if we could provide general guidance.

i. Kellogg: Concerned that this is more site specific than just Harris Creek numbers. Concerned that this is a deviation from our charge; the range is going to be so broad as to not be useful.

ii. Paynter: I have tried to help with aquaculture ventures. Someone with a fair amount of money asks how many SOS do I need to plant my 10 acres. The answer always depends on where, on what substrate.

iii. Reichert: We'll just say to defer to an expert.

iv. Rose: Are there restoration best practice guides that exist? We should point people to existing literature instead of creating something new.

v. Paynter: MDSG has publications for how much shell to use, something we used in previous reports.

vi. Kellogg: Information on Oyster Restoration Workgroup site as well - will send Julie link.

Action: Lisa Kellogg will send Oyster Restoration Workgroup website link to Julie Reichert.

e. Refers to example: When determining how many oysters to measure from the samples, what is considered "small." Do we want a lower size limit, e.g., all oysters >25mm since smaller oysters have minimal biomass?

Discussion

i. Reichert: Situations with samples that you'd have subset of measurements that can be extrapolated out to full sample.
ii. Kellogg: Don't want someone to measure 50 tiny spat and 3 large oysters and develop a regression from that.
iii. Paynter: I think that Rogers surveys are binned into 5ml science bins?
    1. Kellogg: Report to 1ml but bin them into 5ml bins on the website.
iv. Reichert: To simplify, add statement that larger oysters have larger biomass. If people end up measuring small oysters, they can add them in. It's up to their discretion.
v. Paynter: Is there any document that tells oyster growers/managers that would represent a simple graph of size vs. denitrification?
    1. Cornwell: Table from first report that does that. It would tell people whether it's worth looking at lower size classes.

f. What constitutes a sample for the recommendation, "a minimum of three samples should be used to establish the average pre-restoration and post-restoration live oyster tissue and shell biomass."

Discussion

i. Reichert: Whatever your random sample is, we don't want to put a requirement on it. Use random sampling design.
ii. Cornwell: For larger restoration projects, is that 3 per reef?
    1. Reichert: Yes. We can make that clearer in here.
    2. Paynter: 3 per cohort not per reef.
iii. Bricker: Oyster growers in Maryland started using 100 oysters/sample when small, 50/sample when larger. Just curious, is 2 oysters per sample enough? What is representative?
    1. Paynter: Not sure how much we discussed this yet. For example, MD DNR performs dredge pull, scrape, or patent tong sample and will push that sample into 5g bucket and level it off. The count becomes how many spat, small, and market size in that bucket. Volumetric way of doing the sample, not representative spatially. Important if possible to say there needs to be aerial/spatial estimate of abundance to some degree.
    2. Cornwell: Aerial is our metric. Established by experts to help you extrapolate that.
iv. jeff: When we say "reef expert", states will likely identify the expertise.
v. Reichert: Will address this definition if it comes up in public comments.

g. Outstanding Items
    i. Will be finished via email, there's not enough free time for everyone to meet again soon.

Discussion

ii. Rose: Folks want biomass and denitrification credit. We recommend temporal baseline for biomass, we might want to consider recommending a temporal baseline for denitrification.
iii. How old can baseline data be?
iv. How long can you wait to monitor after restoration activity to apply for credit?

Oyster BMP Expert Panel Meeting, September 5, 2019, 1:00 PM – 3:30 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Frank Marenghi	Maryland Department of Natural Resources	No
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	No
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeremy Hanson (WTWG Rep)	Virginia Tech (CBP)	Yes
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	Yes
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership	No
Support Staff	**Affiliation**	**Present?**
Guest	**Affiliation**	**Present?**
Jennifer Walters	Oyster Recovery Partnership	**Yes**

Action Items:

1. **Action:** Include statement in report outlining that you can incorporate higher rate if it applies
2. **Action:** Will clarify habitat characterizations in text (e.g., "Expert that can help assure that at least one sample is taken in areas with different habitat characteristics such as…..")

3. **Action:** Julie will add language to clarify that sampling design should reflect habitat characteristics. Also add comment that baseline can have fewer replicates than restored site
4. **Outcome**: Vote to remove time-based approach to remove confusion (unlikely that this process would be used)
5. **Outcome:** At a minimum going out at least every 3 years to reassess biomass – make changes in text; CBP could expect data at 3-year mark and if not, remove BMP, if data qualifies then they would allow it for additional 3 years
6. **Outcome:** Do light measures to prove that light is not hitting the bottom
7. **Outcome:** Add language to requirements that if you are previously stating that light is not reaching the bottom that you would need to confirm this at 3 year reassessment

Minutes:

Coordination Update

- **Goal**: Submit draft report as of September 30th; have another follow up meeting in November after submission

Review of Enhanced Denitrification BMP Chapter

Discussion:

- Oyster BMP for Denitrification is unique compared to other BMP's
- Using oyster tissue biomass as a way to verify denitrification rates
- Julie comments on misunderstanding of reassessment by clarifying that reassessment means re-opening panel
- When establishing site-specific rate, if you maintain that biomass you can then get credit for that rate (pg. 25, 42, 53)
    - Should be an option to apply new rate
    - Jeff and Mark agreed that wording was safe to say that when new data was available there can be a re-assessment
    - **Action:** Include statement in report outlining that you can incorporate higher rate if it applies
- Pg 28: (Comment brought up by Chris) – Comment about consulting reef expert to determine sampling plan (dependent upon how much area that reef covers)
    - Chris had asked if there were general guidance or size ranges of reefs vs. having too much variability in reef sizes
        - Lisa – Votes for consulting expert; gave example of variability in size of reef that are within 100m of one another
        - Chris – What are guidelines for consulting an expert?
        - Mark – How is an expert going to set a starting number/make an estimate
        - Lisa – There can be large variance in environmental conditions for reefs that are not that far apart – even if the biomass is the same there may be different rates for denitrification (ex. Difference in amount of macroalgae cover; would need to take samples in different sections of the reef); concern is that there is not that much data
        - Julie comments on updates to text that better defines expert as one who understands BMP compliance or denitrification process versus just expert in oysters
        - Ken suggests expert as statistician

- Lisa Kellogg – should have one person look at the reef and outline what habitat types exist and the sampling procedures that correspond – concern is trying to get the person to do that (statistician alone would limit expertise)
- Chris agrees for one sample collected for each habitat type in the area
- Julie – Can key elements for habitat type be included in report (i.e. sediment type, depth, substrate, light availability, biomass etc.)?
    - **Action:** Will clarify habitat characterizations in text (e.g., "Expert that can help assure that at least one sample is taken in areas with different habitat characteristics such as…..")

Review Comments from panelists

From Frank:

- Pg 37 – Using representative site as baseline to determine restored denitrification site rate
    - Want to clarify that you only have to go once to determine baseline
    - From resource standpoint, denitrification project done all at once versus the timeline approach (where this is not an issue)
    - Jeff thinks this is an issue where you have very low points in the reef that are not much above baseline – if using cores, he agrees that using 3 or 4 of those is plenty
    - Julie - Is it different depending on site characteristics on how many samples and reference points you need? – should this go back to consulting an expert? Is it confusing stating that you need a minimum of three replicates?
    - **Action:** Julie will add language to clarify that sampling design should reflect habitat characteristics
        - Also add comment that baseline can have fewer replicates than restored site
    - Possibly a non-issue when removing 6 year follow up text – once you establish baseline there is no need to reassess the baseline site/reference rate at 6 year mark but instead just measure restored site and compare to original reference rate to determine denitrification rate
    - **Action**: Julie decides that she is adding clarification sentence to only have one rate for reference from original baseline site that they can then compare to future restored sites; Text clarification about Size of MP area is up to influencing program

- Pg 43: "If the difference is more than 25 grams (at the low end) you can use that rate

From Lisa:

- Opinions on switching between approaches
    - Jeff says it would be a problem if they did the time based approach and saw large differences with reference sites
    - Jeff states that denitrification is greater in certain seasons
    - Lisa comments that there is a lot more variability annually than what is being considered
        - Better to have reference points at same point of year
    - **Outcome**: Vote to remove time-based approach to remove confusion (unlikely that this process would be used)
- Pg 42: If a denitrification rate is established at a known biomass can that same rate be used for 3 years – reassess after 3-year mark and can continue to use that rate unless it drops below a point where that rate would not apply anymore (5?)

    - Lisa does not think its viable to ask people to go out every year to reassess in order for them to get the credit
    - Julie brought up comment from Jeff Sweeney that the CBP looks on a decade scale rather than annual scale (not as concerned about over crediting from year to year)
    - **Outcome:** At a minimum going out at least every 3 years to reassess biomass – make changes in text; CBP could expect data at 3-year mark and if not, remove BMP, if data qualifies then they would allow it for additional 3 years
- Pg 42: Qualifying condition that if there is light hitting the bottom you need to measure the rate of light
    - If you have macroalgae present at site, light is hitting bottom – would not need to measure light – need to prove that you don't have to do light incubation
    - **Outcome:** Do light measures to prove that light is not hitting the bottom
    - If there is a change where previously only using dark rates but now light is reaching the bottom – prove at 3 year assessment that light is still not hitting the bottom?
        - If restoration is successful, turbidity should decrease allowing light to reach further
        - **Outcome:** Add language to requirements that if you are previously stating that light is not reaching the bottom that you would need to confirm this at 3 year reassessment
- Pg 45: Seasonal prioritization – summer is clearly the highest priority but other seasons cannot really be ranked due to variability among regions
    - Leave the text as open ended as possible to not restrict people from doing it in the season that they would like
    - Change: We can recommend that if funding is limited to do Summer only but any additional season is up to person
- Pg 45: Choosing the reference site could be qualitative instead of quantitative - might not need as many
    - Remove biomass requirement? – not necessarily capturing all of the information needed
    - How do you constitute what establishes a good reference site and what are the requirements besides biomass
    - What is the appropriate reference point for a site that has granite on it?
    - The problem for assessing sites with alternate substrate is that there is a lack of data
    - Ken brought up whether there is an idea of how many municipalities versus oyster farm participants
        - Municipalities might be more expected to use sites with alternate substrate than an oyster farmer so that they can maintain their credit
    - Lisa made point that reference site should be same bottom type as restoration site- don't want someone comparing a shell bottom with good restoration capabilities to a mucky bottom reference site
    - Move away from biomass alone as a qualifying characteristic for reference site and refer to Lisa and Jeff for more qualitative requirements based on bottom/habitat characteristics
    - Remove biomass measurements requirement table from report
    - Still a need to know biomass but not for selection of reference site

Check Text with Panel

- Pg 29 – Removing time based approach – no longer applicable
- Pg. 29 – Expanding on biomass requirements – no longer applicable
- Pg 30 – If there "**are**" existing denitrification …..

- Pg 35 – Measure the actual biomass concentrations in the chambers versus using regressions
    - Lisa made a comment that it is a lot of work to collect those biomass concentrations – reason why they take subsample of ~30 oysters and then run regression – collecting biomass concentrations for all of the oysters in each chamber is a lot more costly
    - Lisa suggests recommending a site specific biomass regression (NOT requiring it)
- Pg 45 – discussed summer as priority and no other ranking after that for other seasons
- Pg 28, 42, 53, 54 – "molded engineered substrate" – include this method in report?
    - Jeff comments that there is a lot of variability in these structures – suggests to keep wording loose in report but good to include it
    - Not likely for someone who is trying to generate a credit – not most cost efficient method
    - Strategy that is being used by CBF and TNC (reef balls)
    - Good suggestion and educational piece to include especially if this becomes a bigger trend

Next steps:

- Julie will make edits and send back out for review
- Look for insight on benefits – shoreline protection, etc. to add in text
- Look to panel for any final thoughts/comments – changes will be highlighted for review
- Goal to submit draft on September 30th
- Webinar for recommendations within 2 weeks of release of report (Julie will schedule with Jeff; Julie will send out doodle poll to try to get anyone available for webinar)

Oyster BMP Expert Panel Meeting, July 29, 2020, 1:00 – 3:30 PM

Location: Remote conference only

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
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Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership, NOAA Chesapeake Bay Office	Yes
Support Staff	**Affiliation**	**Present?**
Sara Coleman	Oyster Recovery Partnership	Yes
Jennifer Walters	Oyster Recovery Partnership	Yes
Guest	**Affiliation**	**Present?**
Sean Corson	NOAA Chesapeake Bay Office	Yes
Bruce Vogt	NOAA Chesapeake Bay Office	Yes
James Davis-Martin	Virginia Department of Environmental Quality	Yes
Michael Vogel		Yes

Minutes

- Jeff opened the meeting with a summary of where the panel stands
    - It has been almost 4 years since the first part of the BMP approved (oyster harvest)
    - Denitrification has been the biggest hang-up
        - Feeling data-limited
    - History: started out with idea that we do not have sufficient info for default number
        - Full workup on every scrap of data- pretty similar denitrification rates (Harris Creek not hugely different than sites in VA)
        - Original idea of site-specific approach
    - We are in good shape – want 2nd report out by September for public comment
        - Some delays, difficult logistics
    - Main goal after Lisa's presentation, does everyone agree that this a valid approach?
        - Jeff and Lisa would like buy-in from the panel before moving forward modifying the report
- Helpful to take a step back and brief everyone on status of report
    - Fairly straightforward- waiting on resolution of denitrification chapter
    - After text of report is completed, panel approves, next step is review by EPA
- Julie: excited for Lisa's presentation
    - Report will come together well once denitrification protocol is settled
        - Panel will need to do thorough review again
        - Working with Jeremy and Jeff on technical appendix
- Lisa gave a presentation on the denitrification protocol
    - Context: we have agreed to only consider denitrification estimates based on site-specific measurement (technically and logistically challenging)
    - Initial review of data: not enough data to feel comfortable with recommending a value
    - Jeff and Lisa have been collecting data for years
    - Caveats
        - Vast majority of data are from Harris Creek
        - All data come from single research team
        - Most data have not been peer-reviewed or published
        - Amount of data per season varies widely
    - Seasonal regressions: tissue biomass on x-axis, N_2-N flux on y-axis, each graph only contains data from a single season
        - each graph highlights points NOT from Harris
    - Spring regression: large gap in mid-range biomass for spring data
        - Fit two regressions
            - 80g or les: fit is better for dark incubations
            - High biomass: 3 outliers were removed
                - Significant fits for both dark and light incubations
                - Reduced denitrification as biomass gets very high
        - Julie Rose had several comments about the regression methods:
            - did Lisa use ordinary least squares? Not sure (default in most stat programs but very sensitive)
                - Comfortable with limited amount of data and marginal p-value
                - Other more robust regression methods we could use
            - There are other statistical outlier detection methods to flag values if we want

        - Holding value constant in spring is a great idea
    - For some regressions, outliers fall above other data points
        - Throw them out? most conservative to ditch high values
        - Lisa planned on reaching out to Julie for other methods (easier way to justify analysis)
    - Mark L: could negative slope at higher density be a lab artifact of those densities driving oxygen down?
    - Jeff: looking at broader sediment lit
        - In many situations, denitrification goes up with oxygen uptake bc more nitrogen is coming into system
        - Up and down pattern is expected from sediments
        - Exaggerated scale compared to sediments
        - Have to move quickly
        - In other systems, you see denitrification go up until 2 mg/L oxygen levels
    - Larry referenced Roger Newell's paper from 2004: curve looks very similar
        - Straight line where there are no data- should avoid from a regulatory view
            - Could create ambiguity in crediting based on inputs
            - Fit a single non-linear curve to whole thing?
                - Lisa: fit is not great because the data are not symmetrical
    - Chris Moore expressed concern if we have enough data
        - Want to get this right as it's the first time
        - This will apply lots of other places (might be different about Harris Creek)
        - Lisa would like to see that debated today
- Summer regression (has more data but not as widely distributed geographically)
    - 3 outliers from Choptank River not included (highest anywhere in literature)
    - Both light and dark regressions are highly significant
    - Low slope, lots of variance
    - Questions: is it reasonable to give default credit with limited geographic range?
    - Frank M: What would be the process for changing only the regression equation after the report comes out, after more data becomes available, say in a few years?
        - Julie: might differ depending on the review board at CBP
        - Jeremy: if we see updates coming down the road, good include simple recommendations
    - Sean asked if the outliers in spring and summer came from same location
        - Lisa: it's possible but need to go back and look
- Fall regression: less data than summer
    - Dark regression is significant, light is not
    - Prosing a default credit in the dark
    - Jeff: should we look at light and dark hours and do a daily rate?
        - Could be an issue if reefs are opaque at greater depths
        - Surprising that in a system where we don't see big shift in respiration, we see breakdown of the relationship
    - Julie Rose: interesting idea – but apply daily rate for all seasons
    - Larry: difference between what has been done here and what we're after with default values
        - Trying to fit a model

        - But what about reef that might never see light?
        - Lookup table might address concerns
    - Winter data: limited dataset (some potential in the dark for crediting)
        - All from Harris Creek
        - No default credit recommended for winter
    - Combined regressions
        - Annual DNF rate in lbs per acre per year based on midpoint of bin to create lookup table
        - Mark L: what was rationale for using dark rates only in fall?
        - Sean: clarification on control sites… in some cases, when we do pre-restoration surveys there can be lots of variety in existing condition
            - Lisa: if you have not reached threshold biomass, you will not get credit for restoration (from oyster metrics criteria)
                - Binning values was used to simplify crediting process
        - Jeremy asked why the lookup table cuts off at 454.9g DW biomass
            - Very high biomass levels lead to negative values – will not get credit
            - Lisa explained that denitrification is measured at sub-meter scale then extrapolated to mean value for reef
            - Jeff: controls is a vexing question in oyster restoration
                - Conservative component built in
        - Mark L: Is control DNF rate from beginning of restoration?
            - If we had not restored these sites, would there be significant changes in biomass?
            - How frequently would control site be measured?
            - Chris M: some sites may change significantly (maybe weather impacts, poaching related)
                - These lookup values might only apply to subtidal reefs
            - Ward added that controls are monitored with more frequency than cohort reefs in the Maryland tributaries
            - Julie: would be nice if implementers could use easily both protocols (denitrification and restoration assimilation)
            - Jeff: default number will not preclude site-specific approach
- Ward was pleased to see great discussion from the panel – we have landed at a spot where we need to think about next step
- Jeff posed the big question – what do people think about adding this approach to 2nd report? Do you feel comfortable with the science?
    - Lots of work to get this section into report
    - This will not be final consensus on report – as a panel we need to review all 3 sections
    - Does everyone understand the changes? Do you approve of them?
    - Substantial DNF effect in all seasons over controls
        - Site-specific approach is attractive
    - Chris: did you discuss biomass differences for three areas surveyed?
        - Harris Creek: 8 sites (3 controls)
        - Lisa: in second and third years, trying to reduce variance
    - Mark L: Chris said we were not ready for default number based on geographic range of data, what about now?

        - More comfortable now, still a bit worried about lack of info on western shore of Bay
        - Lisa: spring dataset includes data from 1 place on eastern shore (bayside)
            - Ways that we can use existing data and make it more conservative
    - Julie asked if there was a way to change the lookup table
        - Percent reduction seems arbitrary
    - Mark L: bin of 95-105 g DW biomass – 264 lbs of N per acre
        - Lisa: obtained years' worth of monitoring data for Rappahannock, lumped number of acres into each biomass category
            - Convinced her that bins needed to be smaller
            - Most acres fall into 0-14.9g per m^2 (abundance of small and market oysters)
        - Chris is concerned with how lookup table will be perceived
    - Do we need additional discussion/data?
        - Jeff- can advocate for more refinement going forward
            - Fairly convinced that this a reasonable start
            - Systems do not fully retain biodeposits
    - Julie Rose: agree with Julie's assessment on conservative nature of data interpretation
        - Fine with re-evaluating in a few years
    - Mark L: Julie and Lisa work together on statistical approach
        - Compare annualized regressions with single, smooth curve
    - Suzanne had a question about the graph Lisa produced based on Virginia monitoring data: abundance vs. biomass?
        - Not comparable, Lisa just wanted a quick breakdown
    - Bill W: impressed with the amount of work that went into it
    - Jeff: silence means agreement? More formal roll call process needed for full report
    - Julie: can we get a task list?
        - Do we know how long it would take to complete additional analyses?
        - Are other approaches more robust?
        - Really like lookup table but if we have mix of default and site-specific values, would we need lookup table for each season
            - How many lookup tables will be needed?
        - How would this look in CAST?
    - Jeff: can get started on writing as data analysis is underway
        - A lot of this work will become an appendix
    - Chris Moore: how clean is the difference between light and dark?
        - Jeff: with sediments, typically when you illuminate them, DNF decreases
        - Are there reefs that might be light in spring and summer then dark in fall?
            - Jeff: yes all the variability exists
    - Matt Parker: if you were able to go out and count number of oysters on reef and determine sizes, would that make it easier?
        - All oysters in trays were processed
        - Underwater robots to count and measure oysters on reefs are currently being researched

Oyster BMP Expert Panel Meeting, December 15, 2021, 10:00 AM – 1:00 PM

Location: 1805 A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Lisa Kellogg	Virginia Institute of Marine Science (VIMS)	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Frank Marenghi	Maryland Department of Natural Resources	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Yes
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	No
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	Yes
Jeremy Hanson (WTWG Rep)	Virginia Tech (CBP)	Yes
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Ralph Spagnolo (EPA R3 Rep)	U.S. EPA Region III	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Julie Reichert-Nguyen	Oyster Recovery Partnership	Yes
Ward Slacum	Oyster Recovery Partnership, NOAA Chesapeake Bay Office	Yes
Olivia Caretti	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Sara Coleman	Oyster Recovery Partnership	Yes
Elizabeth Franks	Oyster Recovery Partnership	Yes
Guest	**Affiliation**	**Present?**

Action Items:

<u>Chapter 7</u>

- Engineered Structures – Olivia include examples of how to sample and scale up biomass on engineered structures.
- Engineered Structures – Leave options 2 and 3 as only options currently appropriate to estimate biomass of oysters growing on engineered structures.
- Baseline – Revisit wording on Baseline measurements
    - Revisit old meeting minutes to determine whether/what decision made about when pre-restoration biomass should be collected (can data be used from prior to report publication?)
- Crediting – ORP discuss whether credit can be applied on a rolling basis with EPA

Chapter 8

- Engineered Structures – Incorporate new data from Jeff into appendix, include comment on how we need more research on denitrification rates for ES
- Baseline – clarify and revisit wording on baseline measurements

Other Chapters/ Full Report

- Edit for consistency and conciseness (e.g., tables)
- Chapter 6 – confirm whether 50th quantile regression differs from Chapters 7/8
- Update other chapters (2 and 10) once Chapters 6-8 are complete and recommendations are agreed upon by Panel

Timeline

- Panel members to complete reviews by Friday, Jan 14th
- Possible Panel meeting for late January/early February 2022 to seek agreement on scientific content

Minutes:

Introduction and Coordination Updates

- Olivia Caretti is new to ORP and will be coordinating BMP report moving forward. Sara Coleman (ORP) and Beth Franks (ORP) will be supporting Olivia
- Jeff reminded panelists of the history of the work and reiterated the importance of the work going on, reiterated that we need to stay focused on science
- Meeting Goals:
    1. Review major revisions to Chapters 7 and 8
        - Five major themes:
            - Engineered structures: require their own separate section?
            - Baseline/pre-restoration measurements
            - Crediting: old text regarding timelines
            - Sampling plan/Sampling design
            - Reporting
    2. Discuss report timeline

Chapter 7 Revisions

- **Engineered structures (ES)**: Refer to table summarizing panel comments and actions taken by ORP

- Challenges:
  - Some people wanted to create new section with info on how to sample oysters on structures
  - How to scale up biomass estimates to avoid over/under-crediting?
- Solution: New Section 7.5 addresses all these questions

Discussion:

- Lisa: main thing missing in this section is examples on engineered structures
  - Would be helpful to have examples with reef balls and oyster castles
    - Jeff: I will show slides of unpublished data- structures without oysters also do a lot of denitrification (barnacles and bryozoan)
      - ES may have set of benefits that have nothing to do with oysters (philosophical question)
    - Outside scope? Jeff says biomass is biomass
- Chris: generally structures we have seen are reef balls/oyster castles, but several new designs coming out
  - Olivia: Can we make text non-descriptive of type of structure (maybe discuss structures that are widely dispersed or densely placed/stacked)
- Julie: could give examples of ES for implementers in Chapter 5
  - Regarding sampling plan: would implementers need to sample every structure to measure oysters or just select representative?
    - Lisa concerned about scaling measurements up based on sq m
- Larry: surface area of structure times number of structures? Has Jeff looked at this?
  - Jeff: seeing big range of coverage of oysters, sometimes they fall off
    - Let's say we have 100 reef balls, what is sampling plan to determine average? Might require underwater drone or other means
    - Beauty of working in largescale projects is we sample trivial portion of oysters – big investment in coming up with appropriate numbers for these structures
  - Lisa: is all surface area available to sample? – if you can't actually sample the inside of it, you can't assume that the numbers of oysters inside is the same as those outside
    - Larry: Suggest create estimate of efficiency of coverage for each type of structure
  - Mark: obvious answer is normalizing across one location (oysters per structure)
    - Need to get valid estimate of average oysters per structure, whether that's subsampling or measuring every oyster on structure
    - Not sure we can go into lots of detail here, may change in future as new structures available
    - Larry: Mark's point is a good initial approach, studying scaling between structure type and size and configuration is a step beyond simple oysters per structure
    - Olivia agrees this is most reasonable approach
- Other outstanding item: what is best method to calculate biomass? No data to suggest oysters grow differently on ES, can incorporate into Section 7.7

        - Oysters tend to be elongated, Jeff thinks using length might be tough on reef balls
        - Currently report says people can use biomass estimate option 2 or 3
    - **Action/Decision Item** – Olivia include examples of how to sample and scale up biomass on engineered structures.
        - Include example for (a) densely stacked and (b) widely dispersed structures
        - Explain that oysters should be sampled from surface, consult experts for whether subsampling or measuring every oyster – acknowledge that high variability in # oysters per structure and need to take enough samples at multiple areas to get reasonable estimate
        - Scale up by multiplying average oysters per structure by # structures, NOT area
    - **Action/ Decision Item** – Leave options 2 and 3 as only options currently appropriate to estimate biomass of oysters growing on engineered structures. Leave need for research on how oysters grow differently (or not) on engineered structures in Future Research (section 7.7).

- **Baseline**: how to measure pre-restoration biomass?
    - Challenge: Lots of confusion on number of options, section in text was wordy
    - Panel suggested emphasizing one consistent approach with exception for areas that lack pre-restoration data

    Discussion

    - Julie Rose: non-time-based can only be applied for projects prior to 2009?
        - Olivia: Non-representative site can be used for any project that does not have pre-restoration data, regardless of when the reef was restored
        - Julie: Opposite of how she interpreted text, will need to revisit chapter
        - **Action item –** Olivia re-examine wording to make sure this is clear
    - Chris: continue to think 2009 date is something we should look at again
        - Say reference site has no restoration, but some biomass of oysters may have built up since 2009 – can people get credit for any biomass that accreted since 2009? Are we crediting from that first sample, or any biomass that accreted between 2009 and when you took your first sample?
            - Jeff: does this mean in reference site? Can also be moving target
                - Do we need to define as initial sampling?
            - Don't have ability to generate credit until first measurement
        - Julie Reichert-Nguyen clarified 2009 is when TMDL became active
            - Does not mean you have to go back and assess biomass from that point (nothing applies before that time – would not allow pre-2009 data to establish baseline conditions)
        - Chris: to get credit, implementers must do the work in this report
            - Ex: for Harris Creek, you'd have to take your baseline sample once this report is published (e.g., June 2022) and move forward from there
            - Julie says that's not how the report is currently written
            - Chris: Would we be double-counting?
            - In first report, we did not say you can go back and count oysters from 2009
            - Julie: that eliminates existing data requirement

- Ward: rely upon Julie, this is an area where the panel had previously agreed, he assumes this would have come up already
    - Julie: when we developed interim BMP report, it was agreed upon that we could use existing data (3-4 yrs ago)
    - If no existing data, then you would go to reference site to understand baseline condition (reference site might be influenced by restored site – possible to underestimate overall credit)
- Chris thought interim report was more for planning – go back to minutes?

- Lisa: recalls that we agreed on reference site, but 2009 seems like too long ago
    - Go back x number of years from when BMP is approved? Chris's issue is that this is somewhat arbitrary in nature
        - How do we put all projects on same footing?
        - Best way is to start when report is published
- Julie: what is actual reduction effectiveness of this practice? More accurate to use data from same location
    - Initially we allowed for existing data since that would be more representative of reduction effectiveness
- Mark: arbitrary date but if change, we are giving up situations where we had good pre-restoration samples
    - Pre-restoration data is more important than an off-site reference site
    - Chris: not saying any of those data are better or worse, more of a fairness issue (vast majority of projects do not have Harris Creek-level of data)
        - Different goal now – to credit in Chesapeake Bay, not just for ecological restoration
        - Other BMPs don't allow for back-crediting and are credited at the date the BMP was approved
    - Julie reiterates that 2009 is just regulatory timestamp
- Lew: we use estimated biomass from aquaculture
    - Restoration is not integrated into current model
    - In phase 7 we'll include best estimates
        - Water quality benefits would count to water quality standard
    - Mark agrees!

- **<u>Outstanding item</u>** – Olivia summarizes: we need to consider having more discussions regarding baseline data, will follow up via email
- **<u>Action item</u>** – Olivia revisit old meeting minutes to find whether/what decision was made about baseline

- **Crediting** (ties into previous discussion): monitoring within 3 year or 1 year timeframe?
    - Report states: Must have data within 12 months to apply for credit of accreted biomass
    - Olivia: Does credit expire? Can be applied on rolling basis?
        - Lew has no idea
        - Julie: technical appendices are best place to discuss this. Thought is you only get credit for appreciated biomass
    - Olivia: Is there a concern about over-crediting if you have reef that appreciates biomass then loses biomass? – unintended negative consequences

  - **Action Item** – Need to investigate if credit can be applied on rolling basis or other timeframe? ORP will discuss with EPA when working through technical appendices

- **Sampling plan vs. Design**
  - Report terminology: Reporting and review of plan
  - Likely will have conversations about this with Jeremy, EPA requirements might change things
  - How many samples are sufficient for sampling to estimate biomass? Increased minimum from 3 to 5, but sufficient spatial coverage is needed for larger sites
  - Outstanding question: what is realistic for minimum sample number? Must be statistically significant but also feasible
  - Lisa: confusion on what has to be reported in advance vs. at the end (e.g., planned sampling points vs. actual sampling points)
    - Section 7.4.2- Mark likes terms "proposed sampling design plan"
      - 5 reps should be minimum
      - Recommend emphasizing need to consult with an expert (we do – this is sufficient)
      - Other recommendations for reporting need to come from reporting agencies
  - Jeremy: multiple layers to reporting, with some needs for partners, Bay Program. Some details not reported to EPA. These recommendations need to go to agencies that are doing monitoring

- **Reporting**: additional questions on what is reported to who, need for overall consistency

- **Other items**
  - We need to fill in actual data in examples in section 7.4.3
  - Intertidal data for calculating baywide regression missing from Appendix
    - Julie Rose remembers adding intertidal oysters to quantile regressions (should be in appendix D)
    - **Action** – Olivia needs to track down missing data
      - Small dataset from Lynnhaven River
      - Mark: shape of oysters not typical for most intertidal oysters in VA, more similar to subtidal
      - Olivia needed confirmation that oysters grew similarly – don't need to have extensive discussion
  - Need overall updated literature citations throughout report and appendices
- Any other outstanding questions/concerns? Does Panel approve of these changes?
  - No concerns, Panel approves

Chapter 8 Revisions

- Many of the same revisions discussed in Ch 7 also apply here
- **Baseline**: sounds like we need to revisit this given earlier discussion
  - Same standard followed to resolve confusion on options
- **Reporting**: added info on what needs to be reported to who and when
  - Need further discussions with Jeremy

Jeff's presentation on Engineered Structures

- Point is not to add lots to the report
- Looked at reef balls and oyster castles
    - Reef balls are single structures (over 1000 in Choptank complex)
    - Methods:
        - Structures were removed from water submersed in a large tank of ambient river water
        - Short incubations to examine denitrification (1 hr)
        - High biomass: ~1000 oysters per reef ball (lots inside as well)
        - Not measuring surrounding impact in sediments
    - Denitrification fluxes dwarf that of sediments
        - We've talked a bit about surface area, but in the end we'll count per structure
    - Very high rates of denitrification
        - Crediting could alleviate costs of deployment (20-fold higher DNF on sq m basis)
        - Many questions about assessing biomass
    - Likely not this panel that would need to push this down the line
    - Plastic discs in Baltimore Harbor: many fouling organisms

    Discussion:

    - Bill: were these structures covered with spat first? Yes
        - Variable set rate
        - People are investigating direct setting with boom in situ
    - Lisa has point that as we stack these structures, surface area declines
    - What do we want to include in ch 8? Jeff does not see how we can incorporate
        - Could stop momentum
        - Important thing to consider in the future
        - If we can put out concrete and get high DNF levels without oysters, this complicates things
    - Bill: due to nature of ES, you get a more 3D aspect – expect higher accretion of biomass in the long run
        - Jeff: in Ch 7 opportunity is there to assess
        - What is baseline? Bare oyster castle?
    - Goal is to submit to journal – this could be placeholder in report for now
        - Some write-up and figure included to show potential
        - Keep in mind these are co-benefits (reef balls and castles are mainly deployed for fish habitat and shoreline stabilization)
    - Julie feels that this info should go in appendix, not main body of report – Jeff agrees
    - **Action/Decision item** – Include a figure and brief write up (1-2 paragraphs) in Appendix associated with literature review for DNF rates. And again, emphasize that need more research on understanding processes on engineered structures

- Sounds like we have a plan to incorporate data into appendix, include comment on how we need more research on denitrification rates for ES
- Some work to do on clarifying baseline

- Jeff: we'll need to reconvene once, approval can come in January once folks have time to review
- We evolved from a site-specific approach to one that allows crediting based on biomass of oysters, turning point is Lisa taking datasets and recognizing that VA and MD data were pretty consistent (gratitude to Lisa and Julie)

Chapters 1-6 Review

Discussion:

- Mark: Need to simplify title and clean up tables with standard format. Provided a more readable title, included a more readable alternative
    - No more styles of tables than absolutely necessary- strive for consistency
    - Table details below some tables?
        - Julie thinks implementers would want details near table, we can simplify explanations but keep them near tables so folks do not need to jump around (keep in mind these are complex BMPs!)
        - Matt Parker put in chat: Would it be possible to make an excel or google sheet page people could download as a template for all the calculations since this is quite complex?
    - Olivia: if you want to send me styles, or can edit based on this conversation
    - **Action item** – Olivia update table format to make consistent throughout report
    - Matt Parker wrote in chat: Perhaps those table details could be an appendix or section at the end of the chapter
        - I would also suggest following the format of the first report we did several years ago for consistency
- Very broad needs for each remaining chapter (lots of this will depend on final decisions for Ch 7 and 8)
    - Ch 2 is summary of recommendations: cannot complete yet
    - Ch 5 is oyster practices for BMP consideration – any updates that were previously pending approval? Ward thinks they're all good
    - Ch 6 licensed oyster harvest
        - Lots of detail on calculating oyster biomass using 50th quantile regression equation – is this already in appendix D?
            - Julie: different equations? For restoration we removed all aquaculture data
            - Chris: we include oysters smaller than 3 inches? Knock out a few lines
        - Unintended negative consequence: deploying SOS on fished reef could increase harvest pressure – should this be included?
            - Lisa: based this on some areas in MD where county oyster committees pay for SOS, there is natural background oyster population – are we then harvesting background population? (Chris agrees)
            - Harvester would not get credit – state or county would
            - Ward: Time is not on our side with this chapter. There is caveat built into this practice that limits credit
            - Mark: reason SOS is placed there in the first place is for harvest – not nutrient credit
            - Ward: in general, counties are placing SOS in locations where there are existing populations, already that incentive

- **Action/ Decision item** – remove extra information about oysters less than 3 inches to shorten text
- **Action/Decision item** – review whether 50th quantile regression for Ch 6 differs from Ch 7/8
- **Action/Decision item** – do not include additional harvest pressure as an unintended negative consequence, since additional harvest is the goal of SOS planting on public reefs

        - Chris: licensed oyster harvest wording – as written now, applies to both states
            - Pg 8 definitions – need to add qualification
            - Only practice we have approved is licensed harvest with spat on shell addition
    - Ch 9: Ancillary benefits
        - Only 2-3 paragraphs currently, is more info needed?
    - Ch 10 will be done once all other chapters are complete

Timeline and Next Steps

- Deadline for final review of Ch 7 and 8 – January 14th
- We want to first make sure all scientific content is addressed
- Another meeting in late January/early February?
- We need to resolve outstanding item of baseline biomass – Olivia will follow up via email

Oyster BMP Expert Panel Meeting, October 6, 2022, 10:00 AM – 12:00 PM

Location: 1805A Virginia Street, Annapolis, MD 21401 and remote conference

Participation:

Attendance		
Panelists	**Affiliation**	**Present?**
Jeff Cornwell (Panel Chair)	U. of Maryland Center for Environmental Science (UMCES)	Yes
Suzanne Bricker	NOAA, National Centers for Coastal Ocean Science	Yes
Andy Lacatell	The Nature Conservancy (TNC)	Yes
Mark Luckenbach	Virginia Institute of Marine Science (VIMS)	Yes
Frank Marenghi	Maryland Department of Natural Resources	Yes
Chris Moore	Chesapeake Bay Foundation (CBF)	Yes
Matt Parker	Sea Grant at U. of Maryland, Prince George's County Office	Yes
Ken Paynter	U. of Maryland Marine, Estuarine, Environmental Sciences	Yes
Julie Rose	NOAA Northeast Fisheries Science Center, Milford Lab	Yes
Larry Sanford	U. of Maryland Center for Environmental Science (UMCES)	Yes
Bill Wolinski	Talbot County Department of Public Works	Yes
Advisors	**Affiliation**	**Present?**
Lew Linker (CB Modeling Team Rep)	U.S. EPA Chesapeake Bay Program Office	No
Jeremy Hanson	Chesapeake Bay Program	No
Jeff Sweeney (WTWG Rep)	U.S. EPA Chesapeake Bay Program Office	No
Lucinda Power (WQGIT Rep)	U.S. EPA Chesapeake Bay Program Office	No
Coordinators	**Affiliation**	**Present?**
Ward Slacum	Oyster Recovery Partnership, NOAA Chesapeake Bay Office	Yes
Olivia Caretti	Oyster Recovery Partnership	Yes
Support Staff	**Affiliation**	**Present?**
Elizabeth Franks	Oyster Recovery Partnership	Yes
Jennica Moffat	Oyster Recovery Partnership	Yes
Guest	**Affiliation**	**Present?**

Action Items & Highlights:

- Use *BMP Site Area* in text as it's own term.
- Specify BMP site is a location, but it is also an area not a point location
- Make a few minor adjustments to definitions:
    - Potential negative effects
    - LOH as an activity – remove anything about substrate addition, specify these are state managed areas

- Olivia will draft a write up that walks through calcs for the default 3% survival rate and will circulate to group. The Panel can then decide whether to include it in main report or in appendix
- In Chapter 7 – adjust the qualifying condition to state *less than 1 inch when planted*,
- In Chapter 8 – remove size qualification since oysters are denitrifying regardless of size.
- Add text in Conclusion to discuss which protocols were not addressed by the Panel (given designation of "Later") and when/how this could be done
- **The Sept. 2022 BMP report has been officially approved by the Panel, with minor "tweaks" discussed in today's meeting – Congrats!**

Minutes:

1. BMP status update

- Report Appendices are a work in progress as we check references, tables, formatting, etc. No content within Appendices has changed and we hope to send those off shortly for panel review.

2. General housekeeping

- Panel Chair, Jeff, expressed his gratitude to everyone who has contributed their time over the years. Jeff acknowledged Bill Wolinski who has retired but is continuing involvement with the Panel. Bill was present at the ORP office for today's meeting.
- Olivia provided an overview of what's happened since the panel last met.
- Authorship – agreed that Jeff will be listed as lead author as Panel Chair, with all panel members listed alphabetically after that
- Jeff noted that many of the key elements of the report and much of the data came from Lisa Kellogg, and that she will be acknowledged as well.
    - Jeff will draft the text for the acknowledgement and send out for review.
    - Julie and Matt agreed that this was a good approach.

3. Review current BMP draft (v. Sept. 2022)

- Olivia noted that in the most updated draft, no concepts or recommendations have changed, except for the change in default survival rate from 15 percent to 3 percent in Chapter 6. The panel approved these changes via email in August 2022. No other concepts have changed.
- Over time, we have had many discussions of protocol definitions. We have reverted back to the original practice and protocol names in the current draft - those are the major changes herein.

4. Discussion of revisions and outstanding needs

- Outstanding needs to discuss during today's meeting include:
    - Firming up some terms or definitions
    - A few small questions on qualifying conditions
    - Revisiting the change in default survival rate from 15% to 3%. How do we want to convey the methods used to get to that 3%? Should this be an additional appendix or other?
- Main goals of today's meeting:
    - Does Panel agree with new draft?
    - Does the Panel wish to add a new appendix to describe calculations for the 3% default survival rate in Chapter 6?

4a. Definitions/Terms

- Olivia went over several updates to definitions and terms, including three that were revised, two that need approval/discussion, two that were added, and two that were removed since they weren't used in the text:
    - Revised three terms: Licensed Oyster Harvest, Ancillary benefits, Unintended Consequences
    - Two terms need approval/discussion: Licensed Oyster Harvest, BMP Site vs. BMP Site Area
    - Added definitions for Batch incubation (Ch 8 and Appendices) and no-harvest area to represent all of the terms used
    - Removed terms not used in text: Cultchless oysters, oyster sanctuary

BMP Site vs. *BMP Site Area*

- Mark Luckenbach doesn't think that "BMP Site vs BMP Site Area" needs to be a one or the other. The area is the actual area in which the restoration or enhancement took place. Mark suggests this change: Define *BMP Site Area* as the area of the actual enhancement activity. It may be smaller than the *BMP Site*. Mark has drafted this text and has added it as a comment in a draft he will be sending.
- Olivia questioned whether we need to define *Site Area* in the definitions?
    - Mark countered with whether we needed to have a definition for *BMP Site*? - if there was a desire to only have one or the other?
- Ken Paynter commented that Mark raises a good set of points.
- The question was raised whether the panel should stick with using *BMP Site Area* instead of *Footprint*?
    - Chris Moore commented that he thinks *Site Area* might be a little more descriptive because when we think of *Footprint* we might be thinking of a larger area. We need to be prescriptive to ensure we don't count a smaller area as a much larger one.
    - Jeff agrees – He has been using *Footprint* when referring to a larger area, and thinks using *Site Area* is a lot more precise.
    - Frank Marenghi also agrees with the previous comments and agrees with using *Site Area*. He doesn't think we need to use both *Footprint* and *Site Area*. He has one other comment on *BMP Site*, but it might be taken care of in the definition. He emphasized that it is important to clarify that these are AREAS – measured in meters^2 etc., not points. It is important to measure what's going on throughout the area where the enhancement occurs which would theoretically require multiple samples within the area.
- Ken asked whether it would be helpful to use *BMP Location* instead of *BMP Site*?
- ➔ **Olivia concluded that the document will use *BMP Site Area* instead of *Footprint*. ORP will add a phrase to the definition to clarify that it is not a site, but an area.** She asked whether there were any concerns with this approach from the panel and none were voiced

Additional terms

- Additional terms that were revised included *Unintended consequences* and *Ancillary benefits*, where definitions were adjusted to make sure the text was clear.
- Matt Parker asked about "*Unexpected Negative Consequences*" wondering wouldn't it be inferred that it was unexpected and suggests suggest changing to "*Potential Negative Effects*". Suzanne Bricker agreed.
- ➔ ***Unexpected negative consequences*** will be changed to ***potential negative effects***

Licensed Oyster Harvest (LOH)

- Jeff and Olivia reached the conclusion that *LOH* is the activity of removing oysters and is not necessarily referring to the LOH practices discussed in the report. Olivia proposed a change for the definition of *LOH* and provided some context with how it is used in the report.
    - *Licensed oyster harvest* specifically refers to oyster harvest from a managed fishery by individuals holding the proper harvest licenses; BMP crediting occurs only in areas that are supplemented with hatchery produced oysters (e.g., spat on shell or single oysters) or substrate addition.
- Mark – agrees with the term LOH. However, he finds the "or" in the sentence about crediting to be confusing. In this part of the report, we haven't yet established crediting. The phrase "*or substrate addition"* would include almost all of the traditional planting on leases throughout VA and most public harvest. He realizes it's clear later in the chapter, but in this early part, crediting occurs only or crediting is endorsed – He thinks this portion of text should be deleted or changed to "and substrate addition".
- Ken finds *LOH* ambiguous and open to interpretation. He questioned whether *Licensed Oyster Production* could be better?
    - Olivia described concern for maintaining consistency with terms already agreed on and with those used in the previous report. The part that's getting credited is the removal of those oysters.
    - Julie cautioned that *LO Production* could be confused for aquaculture.
- Frank likes the proposed definition for LOH. He suggests defining how it is applied to crediting later.
- Chris Moore echoed concern with how LOH could be interpreted down the road. He suggested including a note (e.g., *See section xx for a more detailed description*). Is Managed Oyster Harvest a Better term?
    - Mark asked if "managed" might be questioned as "managed by whom?" which could be aquaculture. Mark thought "Licensed' might better capture that.
    - Matt said he doesn't necessarily agree with Chris, suggesting that maybe the wording could be re-worked to include individuals holding the appropriate license from the appropriate entity. We want to specify that it is oyster harvest by individuals holding proper licenses from fishing areas managed by the state versus private aquaculture.
    - Mark – is it necessary at the definition stage to go into WHO manages it? Thinks we could leave it shortened here in the definition.
    - Matt suggested adding a comma or semi colon after area.
- ➔ Olivia summarized that **ORP will remove from the text any references to substrate addition and will think a little more about small changes to make this definition clearer, including adding a state managed fishery area to it.**
- Jeff reminded the panel to remember who the audience is. People translating this to policy will have a good understanding.

4b. Practice and protocol names and definitions

- Practice and protocol names have not changed from earlier drafts that were approved by the Panel
- Practice definitions have also not changed

- We wanted to make sure all were consistent with what panel had already reached consensus on.

4c. Recommendations

- Olivia briefly ran through the main panel recommendations for each of the recommendation chapters (Chapters 6, 7, and 8).

Chapter 6

- Most substantial change was the default survival rate from 15% to 3%. The Panel will need to review and approve new text on 3%. The Panel needs to discuss how best to present that – should this be an Appendix?
- Mark thinks an appendix is appropriate because people might initially think the rate is very low.
    - Jeff agrees.
    - Ken and Andy agree via Chat.
    - Larry Sanford agrees.
    - Frank thinks reasonable.

- Suzanne was anecdotally talking to bottom growers and learned the same thing about high mortality. She thinks 3% is realistic and agrees that an appendix would be useful but brevity would be good.
- ➔ Olivia has the spreadsheet and can **build a brief appendix to share with everyone to review**. She asked whether there were any concerns about doing this or if anyone disagreed.
    - Matt suggested reviewing how short it ends up, and then deciding if it should be an appendix or incorporated within the text.

Chapter 7

- Major change – There are new qualifying conditions for each baseline approach which were approved by the Panel in January 2022.
- There is a qualifying condition listed for Chapters 7 an 8 that says that shell height of oysters at the time of restoration must be less than 2 inches. Olivia asked whether this was an original condition that the Panel agreed on or was this added later with or without discussion?
    - Mark says it was discussed but he is unsure whether it was voted on.
    - Julie Rose says it was included as a qualifying condition for the aquaculture report. Suzanne agreed.
- Olivia asked whether this condition was necessary for the restoration practices?
    - Mark said it was a question for Chris, and wondered how much CBF is still doing regarding planting oysters that are larger than spat?
    - Chris explained that oysters can be bigger than 2 inches, and that a lot are right around 2 inches.
    - Jeff explained that this came in to play during the middle of COVID pandemic and shut-downs, TNC purchased oysters – SOAR program.
    - Matt added that this is coming up in Gulf of Mexico as well. It is a new potential market that we didn't envision when we first did this. He suggested the Panel may need to put additional text in the document that we didn't anticipate happening.
    - Frank asked whether the initial biomass would have to be measured after the planting of the SOAR oysters? If not, he felt we need to clarify.

- Ward – It seemed highly unlikely that there would be any project with SOAR oysters comprising the majority of oysters at a site.
- Andy agreed that the numbers of large oysters are low. He suggests we include an asterisk and state this and not provide a recommendation.
- Frank asked who is determining things like site, site area, how many would there be, how many new ones are there, etc.? If they're being added to a sanctuary but the sanctuary is 20,000 acres and we're adding ½ an acre.
- Larry suggested we could say "increases due to additions of adult oysters can't be credited."
- Ward – since the aquaculture BMP has now been approved, these projects wouldn't be eligible for more credit if they are moved to a restoration reef
- Matt cautioned that considering the many hours we discussed overcrediting for aquaculture, we need to include more than just an asterisk in this case.
- Ken thinks we should avoid terms like "adults" because of the ambiguous definition. He cautioned that the real concern is that we unintentionally endorse the movement of large oysters. There is a history of a lot of other negative consequences with moving oysters around. Diseases, epifauna, etc. We need to ensure we don't say anything in this document that says moving big oysters around is a good idea.
- Mark agrees with Larry's suggestion and adds that we should state in this chapter that if using individual oysters larger than spat-on-shell, only incremental growth beyond the planting size can be credited.
- Olivia stated that we will move forward to keep this qualifying condition. We will state that if using individual oysters larger than 2 inches, only incremental growth beyond the planting size can be credited. She asked for agreement from the Panel.
- Mark stated it should be larger than SOS, not larger than 2 inches.
- Frank says we need to pick a size and suggests using greater than 1 inch.
- Chris asked whether it is the site we're worried about not the individual oyster?
- Ward said when you measure the oysters that went down (whatever size) do you then remove that biomass from the resulting biomass you want credit for at the site level?
- Mark – Yes and added that's why he wants to include a statement of only getting credit for incremental growth beyond the planting size.

➔ **Olivia will adjust to: "Shell height of oysters at time of restoration be < 1.0 inches. For oysters larger than 1.0 inch, only incremental growth beyond the planting size can be credited"**

Chapter 8

- There is the same question about Qualifying condition for this chapter. Olivia asked if we want to apply same approach we just agreed on for Chapter 7 for this Chapter as well?
- Mark said he doesn't think we have to say anything about the size of the oyster here. Matt and Ken agree. The way that crediting works, you measure biomass at particular time and then use seasonal rates.
- Jeff agreed stating that we are worried about the process here.
- Larry added that a certain biomass of oysters produces a certain amount of biodeposits - why make a requirement that they have to be any certain size when planted? It doesn't make sense for this particular BMP.
- Larry – Why not credit reefs before 2009?
    - Olivia explained that we had that conversation at our last meeting. The 2009 date is a legislative boundary set by EPA that we likely can't work around.

- Chris added that the 2009 date is the date the Chesapeake Bay Program wanted to use.
- Larry added that he would withdraw the comment as he knows the Panel wants to get this report finished.

➔ Olivia summarized the discussion, stating that we will **remove the size qualification for Chapter 8 because oysters are denitrifying regardless of their size.** She asked for any comments, and there were none, the Panel was in agreement.

4d. Other needs/concerns/comments

- Larry – Suspended sediment was included as part of the charge – but is not mentioned it again. He says we need to address those things in Table 1.1 that were just labeled "later". In particular, we need to address suspended sediment, as well as burial and nitrogen and burial and phosphorus.
  - Jeff suggested that these could be addressed in a section where we make recommendations for future assessments
  - Larry added that this is a big enough hole that the Bay Program could even initiate another Panel for this. He said we could ask STAC to convene a workshop to see if there is enough data to pursue that. Larry thinks it needs to be addressed somewhere because it is an unclosed loop in the existing report.
  - Olivia suggests we could put this in the conclusion section. This would be a logical place to say What's Next and put our recommendations for What's Next.
  - Jeff can help craft text working with Olivia to discuss these points and will send to group for review.

➔ **Add text in Ch 10 (Conclusions) briefly discussing which practices and protocols were not addressed in this report, and recommendations for how they could be addressed later**

- Larry added an overall statement that he thinks the BMP Document is incredible! He stated that he hadn't read through it completely for a while and did before this meeting. He praised the logical layout, the tables, the structure, and the logical sequence of information, and the completeness. He asked whether there were going to be any papers coming out of this?
  - Jeff stated that would be a goal and that we were probably remiss in not doing that from first report.

5. Discuss next steps

- Jeff asked whether there were any questions moving forward. Do any panel members have any objections? Or Anything they've like to speak about?
- Larry asked whether there will be a Public review AND Expert Review committee?
  - Jeff explained that we will be making presentations to Water Quality Goal Implementation Team (GIT) and Fisheries GIT. There will also be at least one public session open to anybody to comment on the document. He noted that the process the last time was NOT particularly onerous.
  - Olivia added that we are grandfathered in under the old BMP Protocol rules so we are not required to go through more substantial additional steps for review and approval.
- Ken suggested we invoke Robert's Rules and motioned that the Board move forward with the draft with modifications discussed during today's meeting. Andy Lacatell seconded the motion. No objections were received.

- ➔ **The Sept. 2022 BMP report has been officially approved by the Panel, with minor "tweaks" discussed in today's meeting – Congrats!**
- Jeff thanked everyone and suggested that we should have a celebration, including Julie, since she worked so hard on this effort even while juggling many health issues.

The meeting ended at 11:40 am

- Following the meeting, Chris followed up with Olivia regarding the bulleted list of panel recommendations on Page 34 of the document, under Practice F. Chris emphasized that the most important part of this is the site area, and suggested that it should be included as a bullet too.
- ➔ **Revise to read: Designating a site area before enhancement begins in order to prevent overcrediting.**