The Oyster Recovery Partnership's Recommendations for an Oyster BMP Expert Panel

Briefing Paper, April 13, 2015

To: Chesapeake Bay Program's Water Quality Goal Implementation Team
From: The Oyster Recovery Partnership

Purpose of Briefing Paper

This briefing paper highlights the Oyster Recovery Partnership's (ORP) recommendation to convene an oyster best management practice (BMP) expert panel to evaluate the nutrient reduction effectiveness of oyster practices as BMPs. In addition, recommendations have been provided for the expert panel, should it be formed, to address the policy and science gaps associated with implementing and crediting oyster practices as BMPs to help facilitate a positive outcome.

Introduction

The Federal and State governments are investing millions of dollars annually in rebuilding the Chesapeake Bay's oyster population for ecological benefits while concurrently building a robust aquaculture industry. There is an opportunity to potentially leverage/offset these investments by developing a process to recognize oyster practices as BMPs that reduce nutrient pollution.

Research has demonstrated that oysters can effectively remove nutrients from the water column via bio-assimilation of nitrogen and phosphorus in their tissues and shells and by enhancing denitrification (Kellogg et al. 2013 and 2014a). Since then, there has been an ever increasing level of interest to credit oyster practices, including oyster aquaculture and reef restoration activities (practices further described in Appendix A), as BMPs to help achieve the Clean Water Act (CWA) Total Maximum Daily Load (TMDL) nutrient reduction water quality goals for the Chesapeake Bay (Dan Watson, pers. comm., March 4, 2015 [see Appendix B for copy of e-mail correspondence], DiPasquale, response letter, September 8, 2014 [see Appendix C for copy of letter], McLaughlin 2013 [see Appendix D for copy of request], STAC 2013).

While this nutrient reduction potential exists, there are some unresolved policy and scientific questions regarding how best to quantify and approve oyster practices as BMPs, including the policy regarding nutrient removal *in situ* (i.e., removal of nutrients after they have entered the water) versus the typical BMP practice of removing nutrients before they enter the water (Lucinda Power and Rich Batiuk, pers. comm.) and how to deal with the uncertainty and variability in denitrification rates (Kellogg et al. 2013 and 2014a, STAC 2013).[1]

Task

ORP conducted an in-depth analysis to assist the U.S. EPA Chesapeake Bay Program in determining whether there is enough information to warrant an oyster BMP expert panel and provide recommendations on the structure and goals of the panel, if convened. This analysis included the review of the following information (see Appendix E for review summaries):

- Previous efforts on this topic, including the Scientific and Technical Advisory Committee (STAC) review report, "Evaluation of the Use of Shellfish as a Method of Nutrient Reduction in Chesapeake Bay (STAC 2013) and the workshop report, "Quantifying Nitrogen Removal by Oysters" (Kellogg et al. 2013).

[1] Denitrification is dependent on the presence of both aerobic and anaerobic microbial communities.

- The oyster BMP request from Steve McLaughlin from the City of Virginia Beach (McLaughlin 2013; see Appendix D for copy of request).
- Other related BMP efforts, including the Long Island Sound Study workshop report, "International Workshop on Bioextractive Technologies for Nutrient Remediation Summary Report" (Rose et al. 2010) and the Urban Stream Restoration BMP expert panel's report, "Recommendation of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (Schueler and Stack 2014).
- Oyster literature not previously considered in the STAC review (see Table 1 in Appendix E).

ORP also reached out to several policy and oyster research experts (see Appendix F for list of contacted experts) and used the information obtained during these discussions, along with the knowledge obtained from the review above, to develop the recommendations found below.

Recommendation to Convene an Oyster BMP Expert Panel

Based on ORP's review, we found that an oyster BMP expert panel is warranted and timely. A wealth of information already exists and a substantial effort has been expended on this topic (STAC 2013). Also, the level of interest for an oyster BMP expert panel is high (Bruce Vogt, pers. comm., March 4, 2015 [see Appendix A for copy of e-mail correspondence], DiPasquale, response letter, September 8, 2014 [see Appendix B for copy of letter]). Additionally, an oyster BMP expert panel would complement two related ongoing efforts. First, the oyster component in the Water Quality/Sediment Transport Model of the Chesapeake Bay TMDL watershed model is currently being updated to incorporate aquaculture operations and added oyster biomass from oyster restoration activities. Activities of the expert panel could help inform the use of the oyster model component in the development of the Watershed Implementation Plans for Phase III of the TMDL planned for 2017 (Lewis Linker and Carl Cerco, pers. comm.). Second, an oyster aquaculture nutrient trading pilot was approved by Virginia's Department of Environmental Quality (see Appendix G for copy of letter notifying U.S. EPA Region 3). Evaluating the use of oyster practices as BMPs could help inform this and other various nutrient trading efforts.

To that end, we feel that the ultimate goals of the expert panel would be to:

1. Reach a consensus on acceptable nutrient reduction effectiveness estimates for the various oyster practices in Chesapeake Bay based on existing science (see Appendix A for description of oyster practices occurring in Chesapeake Bay),
2. Establish a methodology and process to update these estimates when new science becomes available, and
3. Establish crediting and verification guidelines for their use in the Chesapeake Bay TMDL watershed model.

To achieve these goals, we believe the panel should first address the outstanding policy questions that currently exist and explore approaches to address the scientific gaps surrounding the use of oyster practices as BMPs. While we recognize this may be a departure from the typical design of these panels, we feel incorporating these activities is needed to support a positive outcome. To that end, we have identified four objectives that we feel the panel should carry out. They include:

1. Establish a crediting framework that evaluates oyster practices and associated nutrient cycling processes on an individual basis,
2. Resolve outstanding policy questions,
3. Evaluate the suitability of modeling approaches to fill in current knowledge gaps, and
4. Evaluate existing scientific information using the established crediting framework to determine nutrient reduction effectiveness of individual oyster practices.

These objectives are further described below along with recommended approaches to help meet them.

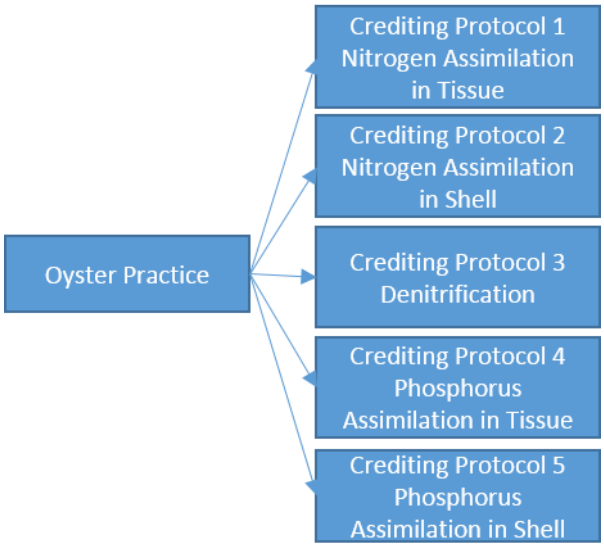
Recommended Objectives for the Oyster BMP Expert Panel

Objective 1: Establish a Crediting Framework that Evaluates Oyster Practices and Associated Nutrient Cycling Processes on an Individual Basis

Past efforts to assess the approval of oyster BMPs appear to have focused on considering all the practices together as a suite of BMPs instead of evaluating the practices individually, and having a complete scientific understanding of all the nitrogen cycling processes involved with these practices (e.g., assimilation, denitrification) (Lucinda Power, pers. comm.). Looking at all the practices as a single, all-encompassing BMP (versus individual BMPS) can create roadblocks and could limit progress in moving forward in approving practices and processes where the science and data is sufficient. Due to the differences between oyster practices and their intended outcomes (harvest versus no harvest) and the current state of knowledge of associated nutrient cycling processes, the framework should explore the individual practices in the context of what is scientifically known about individual nutrient cycling processes for those practices. For instance, intensive off bottom aquaculture has sufficient science to quantify nitrogen and phosphorus removal efficiencies of harvested oysters related to assimilation in tissues and shells (STAC 2013).

Recommended Panel Approach to Meet Objective: ORP proposes that the panel develop a crediting framework that will allow approval for individual oyster practices and nutrient cycling processes. Figure 1 depicts an example for such a proposed framework and was derived from a framework that was developed to define removal rates for individual stream restoration projects that was established by the Urban Stream Restoration BMP expert panel and approved by the Watershed Technical Work Group and Water Quality Goal Implementation Team in 2013 (Schueler and Stack 2014; summary of this effort can be found in Appendix E).

Figure 1: An example of a crediting framework that would allow oyster practices and nutrient cycling processes to be considered on an individual basis. Protocols would be implemented if they are applicable for a specific practice based on approved crediting guidelines. For example, if protocols 1-5 were determined to be applicable for intensive off bottom suspended aquaculture, there appears to be sufficient scientific information to establish nutrient removal efficiencies for nitrogen and phosphorus assimilation in the tissue and shell, but not denitrification (STAC 2013). Therefore, only protocol 1, 2, 4, and 5 would be applied for crediting purposes. Once there is sufficient scientific information for denitrification, then protocol 3 could be applied.



Objective 2: Resolve Outstanding Policy Questions

There are two unresolved policy points that need to be clarified regarding implementing oyster BMPs. The first being that if oyster BMPs are approved, how will they fit in the current BMP construct for use in the Chesapeake Bay watershed model given that oysters would in effect be removing them *in situ* (i.e., removal of nutrients after they have entered the water). The second is how the crediting of individual oyster practices should occur, given that these practices would differ in the potential amount of permanent nutrient removal (i.e., practices where harvest is allowed, such as in oyster aquaculture, versus practices where harvest doesn't occur, such as oyster restoration in sanctuaries) and are influenced by location due to varying environmental conditions. The Long Island Sound Study's workshop report, "International Workshop on Bioextractive Technologies for Nutrient Remediation Summary Report" (Rose et al. 2010) could be used as a resource to help structure this conversation. This workshop included policy, industry, and science experts and was structured with goals designed to explore the feasibility of using bioextractive aquaculture,[2] including oyster practices, for nutrient management purposes and applying these technologies within the state and federal regulatory framework (i.e., incorporation into the Long Island Sound TMDL and nutrient trading programs).

Recommended Panel Approach to Meet Objective: ORP proposes that policy and industry subject matter experts also be added to the discussions and/or expert panel in order to provide differing perspectives on how best to fit oyster practices as BMPs. This would enable panel members to provide recommendations on whether oyster practices should be given their own BMP classification (e.g., bioextraction BMP, *in situ* BMP) or if they fit in an existing BMP classification. The panel should also develop crediting and verification guidelines for the individual oyster practices and nutrient cycling processes (e.g., nutrient assimilation in the tissue and shell, denitrification) following the framework developed in recommendation 1. We also foresee the need for pilot studies to test the proposed crediting and verification guidelines and propose that the panel provide recommendations on how these studies should be designed.

Objective 3: Evaluate the Suitability of Modeling Approaches to Fill in Knowledge Gaps

ORP conducted a literature search and found several studies that had not been considered and/or completed in time for the 2013 STAC Review Report (summary of studies can be found in Table 1 of Appendix E). The majority of these studies developed and tested modeling methodologies to understand the nutrient removal potential of different oyster practices and in some cases compared them to existing nutrient load reduction/Chesapeake Bay TMDL activities (Kellogg et al. 2014b) or to nutrient-reducing BMPs (waste water treatment technologies [Pollack et al. 2013], stormwater and agricultural BMPs [Rose et al. 2014]). It would be useful for an expert panel to review different modeling approaches and determine if they would be acceptable to fill in the current knowledge gaps (see Table 1 in Appendix E for some identified modeling studies). In addition, we found that the 2010 Chesapeake Bay TMDL watershed model has a benthic filter-feeding component in the Water Quality/Sediment Transport Model that is currently being updated to incorporate oyster aquaculture operations and added oyster biomass from oyster restoration activities (U.S. EPA 2010; Lewis Linker, pers. comm.). It would also be beneficial for the panel to evaluate how this oyster model component within the Chesapeake Bay TMDL watershed model could be used to inform the development of nutrient reduction effectiveness estimates across the individual oyster practices.

Recommended Panel Approach to Meet Objective: ORP proposes that the panel review the modeling approaches highlighted above and determine if they would be applicable and acceptable in supporting

[2] Defined as the practice of farming and harvesting shellfish and seaweed for the purpose of removing nitrogen and other nutrients from the natural water bodies (http://longislandsoundstudy.net/issues-actions/water-quality/nutrient-bioextraction-overview/)

the establishment of nutrient reduction effectiveness estimates. The panel should consider including modeling experts to assist in reviewing the modeling methodologies.

Objective 4: Evaluate existing scientific information using the established crediting framework to determine the nutrient reduction effectiveness of individual oyster practices.

The 2013 oyster workshop (Kellogg et al. 2013) and the STAC Review (STAC 2013) laid the necessary groundwork for an oyster BMP by having 30 experts do a comprehensive literature review and additional experts from STAC providing recommendations on how the reviewed data could be applied in the Chesapeake Bay TMDL watershed model. With the results from these efforts and the addition of new published research from studies now becoming available (see Table 1 in Appendix E), coupled with an established crediting framework that could be applied to oyster practices (see recommendation 1) and the resolution of policy and modeling questions highlighted in recommendations 2 and 3, we feel there would be adequate information for the expert panel to evaluate and make recommendations on regarding the nutrient reduction effectiveness of individual oyster practices.

Recommended Panel Approach to Meet Objective: ORP proposes that the panel apply the crediting framework developed in recommendation 1, policy guidelines from recommendation 2, and decisions from recommendation 3 to determine whether existing scientific information supports acceptable nutrient reduction effectiveness estimates for any of the oyster practices.

Conclusions

After our review, it is our opinion that an oyster BMP expert panel is warranted and should be formed. The panel should be comprised of not only scientists, but also policy and industry experts, to address the objectives outlined above. The benefits of establishing an oyster BMP would not only quantify the benefits of oysters to our ecosystems but it would also have a regional impact given that more and more states are looking towards oyster recovery-related activities as potentially less-costly options to address water quality concerns.

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List of Appendices