Appendix U.
Accounting for the Benefits of Filter Feeder Restoration Technical Documentation

Strategies for Allocating Filter Feeder Nutrient Assimilation into the Chesapeake Bay TMDL

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Introduction

Filter feeders play an important role in the uptake of nutrients from the Chesapeake Bay and have the potential to significantly improve water quality if present in large numbers. The current goal for the Chesapeake Bay is to increase the native Eastern oyster, *Crassostrea virginica*, population tenfold. A population increase of that magnitude could remove 10 million pounds of nitrogen annually (Cerco and Noel 2005). Menhaden fish, *Brevoortia tyrannus,* are another filter feeding organism in the Chesapeake Bay. This paper explores the options for incorporating the effects of filter feeders into the Chesapeake Bay TMDL and implementation plans. As a way of fostering management and restoration of filter feeders, the U.S. Environmental Protection Agency (EPA) intends to investigate future monitored levels of filter feeder populations and incorporate that into EPA's model-based tracking of State progress in achieving the 2-year milestones.

Current Harvest Situation

The Atlantic States Marine Fisheries Commission (ASMFC) reports that the reduction[1] fishery harvested 85,000 metric tons of menhaden from the Chesapeake Bay in 2008 and 21,150 metric tons from bait landings (ASMFC 2009b). The vast majority of the catch is in the Virginia portion of the Chesapeake Bay using the purse seining method. Purse seining has been banned in the Maryland portion of the Chesapeake Bay for decades, where menhaden are primarily harvested via pound nets.

Addendum IV to Amendment 1 to the Atlantic Menhaden Fishery Management Plan (Chesapeake Bay Reduction Harvest Cap Extension) extends the annual harvest cap established under Addendum III at 109,020 metric tons on reduction fishery harvests from the Chesapeake Bay (ASMFC 2009a). That will extend the cap through 2013. The cap was extended to allow further investigation into the abundance of menhaden in the Chesapeake Bay. There is concern that localized depletion of menhaden in the Bay is occurring. Stock assessments are conducted on a coast-wide basis and not on the Bay individually, so the Bay population is unknown.

According to the National Marine Fisheries Service (NMFS) Annual Commercial Landings Statistics (NMFS 2010), 249,485 pounds of eastern oyster were harvested in Maryland in 2008, and in Virginia, 352,678 pounds of eastern oysters were harvested. Current oyster populations are about 1 percent of the historic population. This is because of a number of factors including,

[1] A reduction fishery takes the harvested fish and processes or "reduces" the fish into non-food products, typically to fish meal and oil.

historical overharvesting, disease, loss of habitat, excess sedimentation from deforestation, agricultural practices, urban development, and natural predation (CBP 2009).

Strategies to Increase Filter Feeder Populations in the Chesapeake Bay

Menhaden Nutrient Assimilation

According to Brush et al. (2009), the Chesapeake Bay larval menhaden appear to feed on zooplankton, then transition to phytoplankton as juveniles and return to higher zooplankton consumption rates as adults (age 1+). Given calculated consumption rates for menhaden, based on age, "adults are unlikely to significantly impact phytoplankton biomass and production on a baywide basis" (Brush et al. 2009). Juvenile consumption of algae is estimated to be a few percent of the daily phytoplankton biomass in the summer and fall, and up to 5 percent and 20 percent of daily productivity in the summer and fall, respectively" (Brush et al. 2009). Menhaden might influence water quality on a smaller scale, such as an individual tributary, Bay segment, or menhaden school (Brush et al. 2009). A menhaden simulation is fully operational in the Water Quality and Sediment Transport Model of the Chesapeake Bay, and the model corroborates the findings of Brush et al. (2009). Although the influence of menhaden on water quality is estimated to be less than that of oyster filter feeders, even a small percentage of nutrient assimilation or chlorophyll reduction in the Chesapeake Bay would ease the pressure in meeting 2-year milestones.

Oyster Nutrient Assimilation

Research shows that 700 to 5,500 pounds of total nitrogen are removed annually per 1,000,000 market-sized oysters harvested from the system. That is a wide range of biomass needed for offsets. Assuming the 2:1 reduction requirement under Virginia's trading program, 3.6–28.5 million oysters would be needed to offset 10,000 pounds of total nitrogen (Stephenson 2008).

Stephenson (2009) estimates the cost of total nitrogen reduction from oyster assimilation at $0–$100 per pound. In comparison, agricultural best management practices (BMPs) costs in Virginia range from $4 to $200 per pound and urban stormwater BMPs can be $25 to more than $1,000 per pound or more (Stephenson 2009).

Oyster Restoration and Preservation

Sanctuaries are already part of the planning process in the Virginia Oyster Restoration Plan and Maryland Priority Restoration Areas. Sanctuary areas could provide spawning areas to increase the population of wild oysters.

The *2009 Maryland Oyster Restoration and Aquaculture Development Plan* would increase sanctuary areas from 9 percent to 24 percent of the remaining quality habitat (36,000 acres) in certain locations: Magothy River, Chester River, the area between Patapsco and Back Rivers, Upper St. Mary's River, Point Lookout, Little Choptank River, Upper Patuxent River, and the area between Hooper Strait and Smith Island.

The *Maryland Oyster Restoration and Aquaculture Development Plan* also outlines 600,000 acres newly available for bottom leasing, including 95,524 acres of formerly off-limits natural oyster bars, and develops Aquaculture Enterprise Zones, which are areas preapproved for leasing (MDNR 2009).

Challenges to Increasing Oyster Populations

A limited amount of bottom is suitable and available as oyster habitat. The *Oyster Management Plan* (CBP 2004) suggests that there are 10,000 to 20,000 acres of restorable habitat in Maryland and about 28,500 acres in Virginia. Even within suitable habitat areas, disease mortality and reduced fecundity are major inhibitors to population expansion.

There is a need to provide greater incentives for aquaculture of native oysters. Oyster aquaculture is limited by the supply of disease-resistant seed oysters. Expansion of aquaculture investment is not likely until more seed is available, which is limited by cost-effective market production from seed (CBP 2004).

Accounting for Filter Feeders in the TMDL

EPA has based the filter feeder component of the TMDL on the current population of filter feeders. Potential future population changes are not accounted for in the TMDL itself. Restoration efforts have been underway for years to increase filter feeder populations with minimal observed population change. The combined factors of disease, lack of suitable substrate and excess nutrients fuel the growth of algae blooms that deplete oxygen in deeper waters and can hinder the development of oysters. Until some of the stressors on the oyster population are alleviated it is not practical to heavily rely on filter feeders to address the water quality issues in the Chesapeake Bay. If future monitoring data indicate changes in the filter feeder population, the 2-year milestone delivered load reductions can be adjusted accordingly. The adjusted loads will be compared to the 2-year milestone commitments to ensure each state is meeting its obligations.

Crediting Filter Feeder Benefits

During the 2-year milestone evaluation of filter feed populations, credits or debits for changes in populations and associated nutrient assimilation can be assigned in one of two ways that EPA is considering.

Under Option A, only the state responsible for the filter feeder changes would obtain a credit/debit towards reaching its 2-year milestones. It would be possible for any state or the District of Columbia to receive credit toward increasing filter feeder populations. Maryland and Virginia can implement their programs directly. Nontidal states and the District of Columbia could provide support to Maryland and Virginia programs to increase filter feeder populations. Maryland and Virginia would have to ensure that any projects funded by other jurisdictions are in addition to activities planned by Maryland or Virginia or both. To eliminate double counting, each project credit must be properly assigned to the jurisdiction paying for the project.

Under Option B, any nutrient credit/debit associated with a change in filter feeder populations would be distributed proportionally across all the states and the District of Columbia, regardless of the jurisdiction responsible for funding or implementing the project.

Under both options, the changes in filter feeder populations would be based on monitoring data. To accurately assign credits to the appropriate jurisdiction and ensure milestones are reached, restoration activities and population increases must be tracked and verified. Regardless of the crediting option chosen, Maryland and Virginia should address filter feeder management in their watershed implementation plans. EPA and the jurisdictions will work together to establish a future strategy for crediting filter feeder benefits.

Other Issues of Concern

While increasing filter feeder populations can provide nutrient assimilation to mitigate the effects of excess nutrients, it is not a method of pollutant source reduction. Because nutrient assimilation can be considered an in-stream treatment technology by some regulators, there is some concern that it might be used in lieu of advanced wastewater treatment technologies (Stephenson 2009). Additionally, filter feeders reduce the pollutant downstream and pollutants are not reduced at or near the source. Reliance on filter feeders to reduce nitrogen downstream could create a problem with meeting local water quality standards in the upstream jurisdictions. Further consideration should be given to address these issues.

References

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