Water quality & SAV improved in mesohaline Chesapeake Bay in 2004:

Was this due to abundant dark false mussels?

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Background

1. Dark false mussel (*Mytilopsis leucophaeata* or DFM) populations reached record levels in summer 2004 in several Chesapeake Bay tidal tributaries in the low mesohaline zone (~5-12 ppt); the populations were especially high in the upper **Magothy River.** Most were gone by 2005 (except in the upper Magothy), and DFM populations returned to their usual low levels by 2006.
2. Habitats used expanded from oyster bars to almost any hard surface (pilings, cages, etc.)
3. Possible causes of high DFM abundance include a wet year (more spawning) plus a storm surge (new habitats?) in 2003
4. We assumed that **if water quality or SAV improved only when mussels were abundant, and got worse again when they were rare, that they probably caused the change**
5. We collected other data to support mussels as the main cause of the changes seen:
   A. Surveys of mussels in Cattail Creek, to estimate filtration time
   B. Paired Secchi depth data, near and far from piers with and without DFM

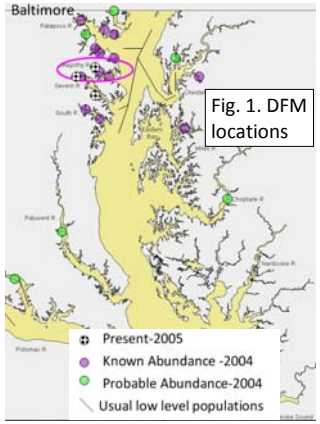

Fig. 1. DFM locations

Fig. 2. DFM on a piling and on a rope.

Fig. 3. DFM on a floating dock showing their siphons (white circles); it's actually a clam (same family as zebra mussel).

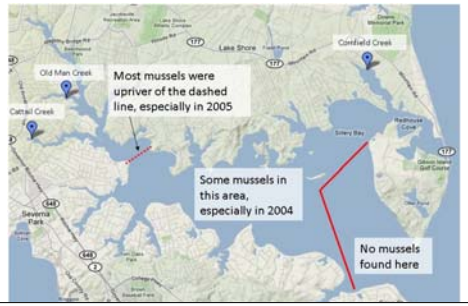

Fig. 4. Magothy DFM and water quality locations, 2004-2005

Parameter	Effects of irruption (2004)	Explanation
Water clarity (Secchi depth)	**Better**	*More filtration means less algae and suspended solids*
Submerged aquatic vegetation (SAV)	**Better (also in 2005)**	*More water clarity allows SAV beds to expand (more light)*
Dissolved oxygen (surface & bottom)	**Better**	*More filtration means less algae to die and decompose*

Table 1. Likely mussel effects, Magothy River

Year	Number of mussels (mean length)	Filtration time (ignoring tidal exchange)	Effects on Cattail Creek
2004	**380 million** (14 mm)	**2 days**	Improved water clarity and DO
2005	**69 million** (12.8 mm)	**15 days**	Water clarity and DO back to previous levels

Note: filtration rates estimated based on zebra mussel data for the same sizes.

Table 2. Dark false mussel filtration estimates, Cattail Creek.

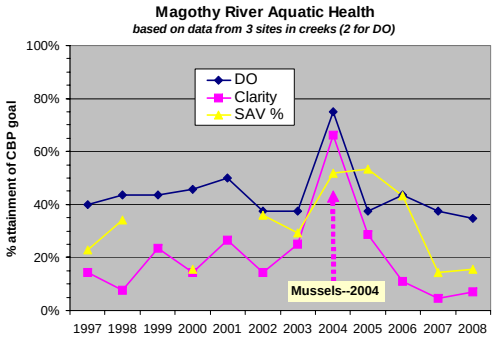

Fig. 5. Dissolved oxygen, water clarity and SAV status for three Magothy creeks with abundant mussels, 1997-2008.

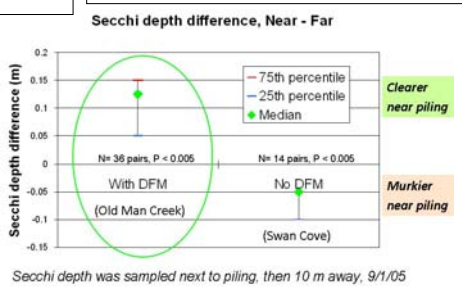

Fig. 6. Differences in water clarity, near and far from pilings with and without DFM.

Fig. 7. Hooked mussels (left) and brackish water clams (right).

Results & Discussion

1. Most of the Chesapeake Bay rivers with increased mussel abundance in 2004 were low mesohaline, with fewer in 2005 (Fig. 1).
2. DFM covered most submerged hard substrates in the Magothy in 2004-05 (Figs. 2-3).
3. Water quality data shown here are from three creeks with abundant DFM, and mussels were common over much of the Magothy in 2004-05 (Fig. 4).
4. The likely effects of mussel filtration on water quality in three creeks with mussels & SAV over the whole river are shown in Table 1 and Fig. 5 (better in 2004, and also in 2005 for SAV).
5. Surveys of DFM in Cattail Creek in 2004-05 by MRA Team Diver suggested that the DFM could filter its water volume in 2 days in 2004, compared to 15 days in 2005 (Table 2). This supports DFM as the cause of clearer water in Cattail Creek in 2004.
6. Secchi depths collected near and far from pilings with and without DFM support DFM as the cause of clearer water in 2004-05 (Fig. 6): Secchi depths were better near pilings only when they had DFM (left side of graph).
7. These results suggest that *restoration aquaculture might bring longer-lasting improvements in Magothy water quality and SAV area if a longer-lived native bivalve could be grown at similar densities.* Native bivalve candidates include:
   A. Dark false mussels (if we can find a way to make them sustainable)
   B. Hooked mussels *Ischadium recurvum* (Fig. 7), if they tolerate low salinity events (< 5 ppt)
   C. Brackish water clams *Rangia cuneata* (Fig. 7), if we can suspend them in the water column without putting them in sediments
8. Thanks to MRA Team Diver, Mitch Tarnowski, Sarah Maglov, and Bill Kobett for advice or data, local citizens for DFM reports, colleagues for comments, and the Chesapeake Bay Trust for financial support to the MRA for monitoring.
9. Questions or comments? Write to peter.bergstrom@noaa.gov

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