THE MAGOTHY RIVER INDEX FOR 2006
***Long version*-- February 21, 2007**
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SUMMARY

The Magothy River Association's "Magothy River Index" is an assessment of the health of the tidal river for communication to the residents of the watershed, produced annually since 2002. It summarizes what we know about the status of vital habitats and water quality in the Magothy in the previous year, based mainly (for water quality) on monitoring done by MRA volunteers. We also summarize the ongoing and planned habitat restoration and protection actions in the watershed, and conclude with a section on what you can do to help the Magothy.

Monitoring done by others as well as Magothy River Association volunteers showed that :

- Submerged Aquatic Vegetation (SAV) area in the Magothy declined 20% in 2006
    - Not sure what caused the SAV decline; no decline in water quality in 2006 at mainstem site
    - The spread of redhead grass upriver continued in 2006, however
- Dark false mussels were gone in 2006
    - But clearer water continued on the mainstem, as it did in 2005
- Most water quality factors stayed about the same in 2006 compared to 2005
    - Those that got worse were water clarity, TSS and bottom Dissolved Oxygen (DO) in upper creeks (which have little or no SAV), and Dissolved Inorganic Nitrogen (DIN) at the Mainstem site
    - This worsening in upper creeks may have been the result of the dieback of the mussels in 2005-2006

INTRODUCTION AND METHODS

The Magothy River Association (MRA) is dedicated to the preservation and improvement of the water quality, plants, and wildlife of the Magothy River and its watershed. Founded in 1946, it is an all-volunteer group representing about 46 communities within the Magothy River Watershed. We devote our efforts to projects that protect the welfare of the river and its inhabitants. We plan to issue this report each year in late winter, and hope to add more data to it each year as they become available. This document will be available soon on our web site, www.magothyriver.org. Suggestions on how to improve the report are welcome, and can be sent to Peter Bergstrom at sav2@magothyriver.org.

Professionals collected all the data on Vital Habitats that we report below, but MRA volunteers, in two groups, collected all of the water quality data we report:

- MRA volunteers led by Peter Bergstrom collected most of the water quality data used for this index in shallow water (where SAV can grow) at three sites in two groups, all sampled monthly on the same day:
    - **Upper creeks**: Data collected from piers on Old Man and Cattail creeks were averaged to represent conditions in the smaller, upriver tidal creeks.

    - **Mainstem**: Data from the end of the Ulmstead pier in the mouth of Forked Creek represents conditions near shore in the wider part of the river and the mouths of the larger creeks.
- MRA volunteers led by Dick Carey collected the bottom dissolved oxygen data used for this index near the bottom (where oysters live) at six sites in two groups, all sampled by boat about two or three times a month, all on the same day:
    - **Midriver** (MRA site MR6) is the same site that is also sampled monthly by Maryland Department of Natural Resources (as WT6.1), located between North and South Ferry Points, which has no oysters nearby. It is about 5.5 meters (18 feet) deep. Our monitoring at this site has shown that it has some of the worst dissolved oxygen found in the river, so it is not representative of the river as a whole, even though it is near the middle of the river.
    - **Oyster restoration sites** (Five shallower sites, each 3-4 meters or 10-12 feet deep) had bottom dissolved oxygen values similar to each other, so their results were averaged and reported as a single value.

The factors used in the Index are divided into two categories: **Vital Habitats and Water Quality**. For both Vital Habitat and Water Quality, we compared the monitoring results to an established goal whenever possible. For those factors that have goals, the attainment of that goal was expressed as a percentage, with 100% meaning the goal was met, and higher values meaning it was exceeded. This also enabled us to scale the results so that **more attainment of a goal always means improvement**, including the water quality factors for which less is better based on their raw data (nitrogen, phosphorus, chlorophyll *a*, and total suspended solids).
Habitats are good places to live for fish, crabs, turtles, and birds, and other fish and wildlife of the Magothy to live. Water quality is another way to measure the quality of the Magothy as a habitat for aquatic life. Unfortunately, some factors for which we have data have no goal, and for some important measures (such as numbers of fish and wildlife in the Magothy) we have no data, so we cannot use them in the Index. We only calculated an overall average index value for the 3 components of water quality for SAV growth, since they were all measured at the same sites on the same days.

MAGOTHY RIVER INDEX FOR 2006: VITAL HABITATS

Tidal and non-tidal wetlands: These are important habitats for fish and wildlife, although they are not monitored regularly. Wetlands once made up about 7.5% of the area of the watershed, which we used as our interim goal. They now cover 2% of the watershed, based on National Wetlands Inventory (NWI) data from 1989, so **currently wetlands are 27% of this goal.** Wetlands area from additional years (1988, 1991, 1993, and 2001) may be available soon based on satellite images.

Forested nontidal stream buffers: These buffers improve water quality and provide wildlife habitats. In 1997 (the latest year with data), **23% of Magothy streams** had at least a 100 foot wide forested buffer, also called a riparian forested buffer. Our goal is for 100% of streams to have forested buffers, and you can help us reach this goal by planting trees along streams that lack them (see Conclusions section).

Submerged Aquatic Vegetation (SAV): These underwater bay grasses provide crucial habitat for fish, crabs and numerous other aquatic creatures. The Chesapeake Bay Program goal for SAV

restoration in the Magothy is 545 acres. In 2006 there were 248 acres of SAV mapped by aerial surveys in the Magothy, or **43% of the CBP goal,** down from 53% last year**.** Figure 1 shows that Magothy SAV area dropped sharply between 1979 and 1984 and increased through 1998-1999, before something (probably a "mahogany tide" algae bloom in spring 2000) caused murky water and thus an SAV dieback in 2000. There are no data for 2001 due to airspace restrictions following the terrorist attacks. In 2002, a drought year, the SAV area rose again, to slightly more than was mapped in 1999. SAV area declined again in 2003, probably because photos were taken after Tropical Storm Isabel passed, which made the water cloudier, and then rose dramatically in 2004 and slightly in 2005, probably as a result of clearer water in 2004 caused by filtration by dark false mussels. The causes of the 20% SAV area decline in 2006 are not clear, since water clarity at the mainstem site was still good (at 99% of the goal).

MRA volunteers continued mapping and identifying species in natural SAV beds to supplement the aerial surveys in 2006. We found that redhead grass coverage continued to expand upriver in 2006, with new, dense beds of mixed redhead grass and widgeongrass in the cove just upriver of Henderson Point. Some of these patches may have spread from the redhead grass we planted near the mouth of Cockey Creek in 2002-2003, some of which persisted until 2005.

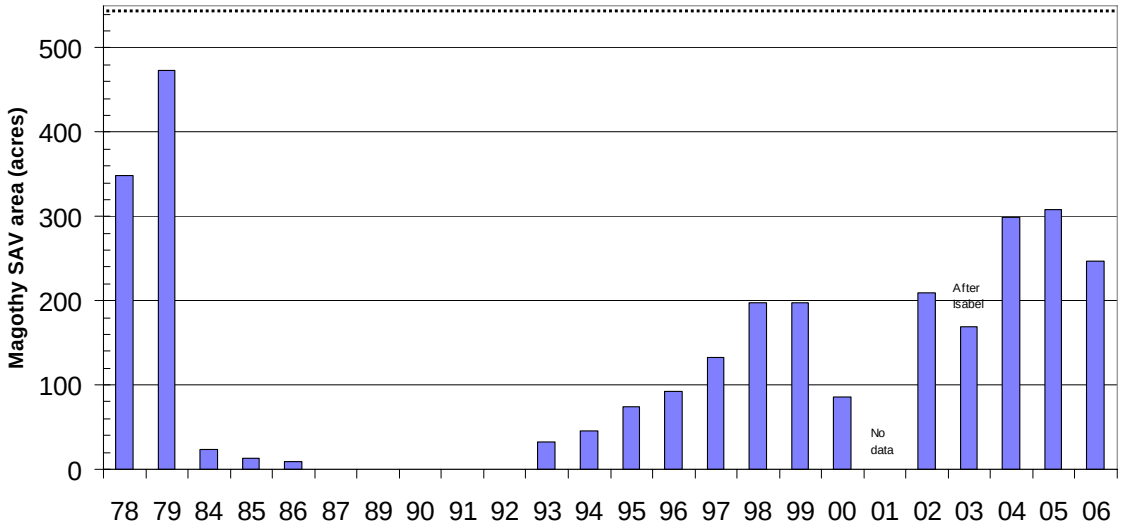

Figure 1. Submerged Aquatic Vegetation (SAV) area in the Magothy River, 1978-2006. (Data are from http://www.vims.edu/bio/sav/segtots.html converted to acres)

Forested tidal shoreline buffers: This came from the watershed survey done by MD DNR in 2004. Our goal is 100%. They estimated that **68%** or 52 miles of the tidal shoreline they surveyed had a forested buffer at least 50 feet wide.

Unaltered tidal shoreline (not bulkhead or riprap): This also came from the watershed survey done by MD DNR in 2004. Our goal is 100%. They estimated that **35%** of all tidal shorelines were unaltered.

The goal attainment for all of the Vital Habitats is summarized below in Table 1 and Figure 2. In Figure 2 the data used were the latest year with data available.

Table 1. MAGOTHY RIVER INDEX, VITAL HABITATS, 2002-2006

Indicator	What	Where	2002	2003	2004	2005	2006
Wetlands (tidal and non-tidal)	% of historical amount (estimated)	Whole watershed	**27%** *(1989)*	*SAME*	*SAME*	*SAME*	*SAME*
Forested nontidal stream buffers	% of stream miles with 100 foot or wider buffers	All nontidal streams	**23%** *(1997)*	*SAME*	*SAME*	*SAME*	*SAME*
Submerged Aquatic Vegetation (SAV)	% of historical amount based on aerial survey	All tidal waters	**36%**	**29%**	**52%**	**53%**	**43%**
Forested tidal shoreline buffers	% of shoreline with forested buffer at least 50 feet wide	All tidal shorelines	N/A	N/A	**68%**	*SAME*	*SAME*
Unaltered tidal shoreline	% of shoreline with no bulkhead or riprap	All tidal shorelines	N/A	N/A	**35%**	*SAME*	*SAME*

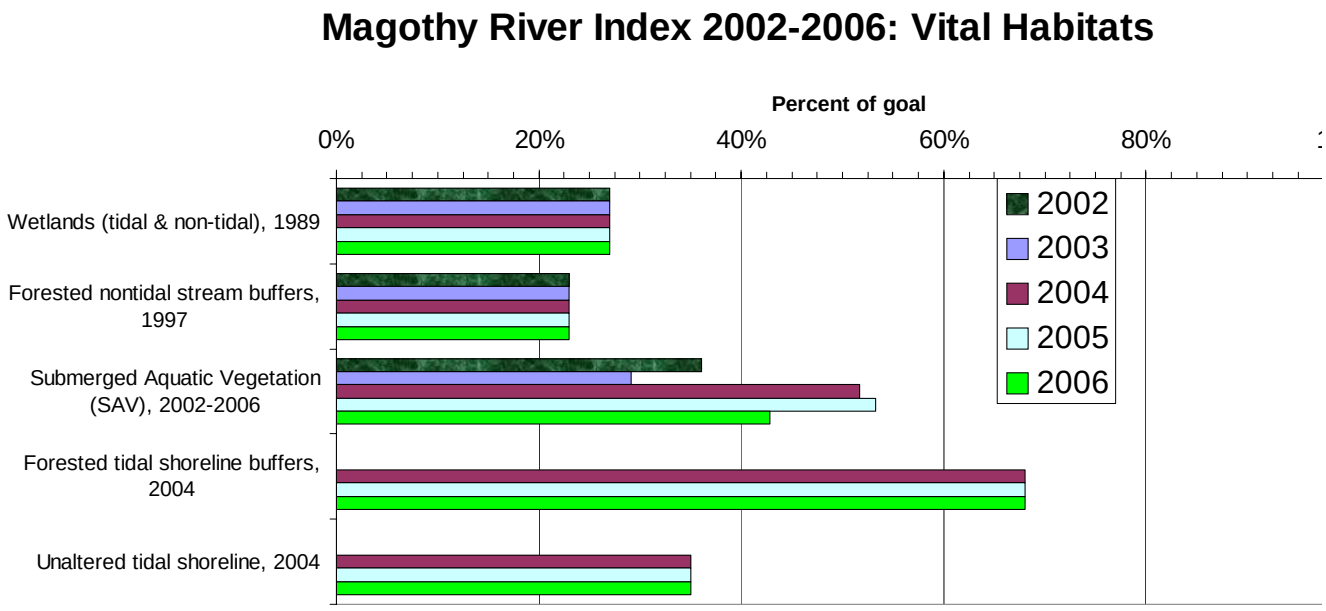

Figure 2. Graph of Magothy River Index vital habitat values for 2002-2006. The year for which data were reported is noted.

In conclusion, goal attainment for all of these habitats shows that we have a lot of room for improvement. We can improve any of these habitats by planting trees, restoring wetlands and SAV, and replacing hard shorelines with soft ones.

MAGOTHY RIVER INDEX FOR 2006: WATER QUALITY

Table 2 and Figure 3 summarize the attainment of water quality goals. Attainment of the goals other than dissolved oxygen based on medians of monthly data, April-October (7 months), which is the SAV growing season. Dissolved oxygen (DO) status was based on frequencies of low DO in June-November (6 months), which is when most low DO occurs in the Magothy. DO sampling was done about 2-3 times a month at the Midriver and Oyster sites, and 1-2 times a month at the Upper Creek sites.

Water Clarity: To allow the return of submerged aquatic vegetation (SAV) the Chesapeake Bay Program (CBP) has adopted the goal of improving water clarity (in rivers with higher salinity such as the Magothy) so that at least 22% of surface light reaches the bottom at 1 meter depth at low water. This corresponds to a Secchi depth of 1 meter or more.

We found that the water clarity at the Upper creek sites in 2006 achieved **64% of the goal**, while the Mainstem site achieved **99% of the water clarity goal**. This was a big decline for the Upper creek sites from their 2004 and 2005 values (Table 2 and Figure 3). Over all years shown (2002-2006), the mean clarity attainment was only slightly lower at the Upper Creeks compare to the Mainstem (85% vs. 90%, Table 2), mainly because the Upper Creeks had such good water clarity in 2004 (129% of the goal) when the mussels were most abundant.

Looking at all years for which we've collected data at these sites (1992-2006, data before 2002 not shown), the peak attainment in 2004 at the Upper Creek sites was the best clarity attainment found over any of the years sampled, 1992-2006. However, the good attainment found at the Mainstem site in 2004-2006 was **not** the best clarity we ever measured there. Water at the Mainstem site was slightly clearer in **1993, 1995, and 1999** than it was in 2004. 1995 & 1999 were drought years, which tend to have clearer water than years with more rain.

Bottom Dissolved oxygen: Aquatic animals require adequate dissolved oxygen to survive. State water quality standards require a minimum of 5.0 milligram per liter (mg/l) of dissolved oxygen, the level needed by many fish. Oysters can survive with less dissolved oxygen, as little as 2.0 mg/l, so we used this to set our goal. Attainment was expressed as the % of bottom samples that were above 2 mg/l, with a goal of 100%.

We found that bottom dissolved oxygen conditions in 2002-2006 were much better for oyster growth and survival at the Oyster restoration sites, meeting the 2 mg/l goal in 83-100% of samples (mean 93%), than at the Midriver site, where it met that goal in only 8-50% of samples (mean 28%; Table 2 and Figure 3). This difference shows that we picked oyster restoration sites where there is usually enough dissolved oxygen for oyster survival. We also found that bottom DO conditions at the two upper creek sites were poor, although not quite as bad as at the Midriver site, with 40-90% of the measurements over 2 mg/l (mean 55%; Table 2 and Figure 3).

Total suspended solids (TSS) and dissolved inorganic nitrogen (DIN):
These two water quality parameters also have habitat requirements for SAV growth (Table 2). TSS showed some likely effects of changes in mussel abundance, and DIN showed some likely effects of changes in rainfall amounts.

- **Total suspended solids** goal attainment may have improved in 2003-2004 due to filtration by

dark false mussels, even though both were high rainfall years, which tend to have more runoff and thus worse total suspended solids levels. Attainment of the goal got worse at the upper creek sites in 2005-2006 but stayed about the same at the Mainstem site in those years. In 2005-2006 there were both fewer mussels (and thus less filtration) but also less rainfall (and thus less runoff) compared to 2003-2004.

- **Dissolved inorganic nitrogen (DIN)** goal attainment in 2003 and 2004 was much worse than in 2002, which was a drought year (Table 2). Goal attainment improved greatly at the mainstem site in 2005 (it was better than in 2002), presumably because there was less rainfall that year, but it stayed low (poor) at both creek sites in 2005, for reasons that are not clear. At the mainstem site, DIN levels in 2005 were near normal in April, May, and October, but they were much lower than usual in June-September. In 2006 DIN goal attainment improved slightly at the upper creek sites but got much worse at the Mainstem site, also for reasons that are not clear (Table 2). DIN is generally more affected by changes in rainfall than most other water quality parameters, partly because one of its components, nitrate, can be abundant in both runoff (from air pollution, lawn fertilizer, etc.) and ground water (partly from nitrate from septic tanks). High rainfall flushes more ground water into the river, and also reduces the residence time of water in areas such as wetlands where dentrification (natural nitrogen removal) occurs. Worse DIN levels can fuel algae blooms.

Mean status for water clarity, dissolved inorganic nitrogen, and total suspended solids:

The last two rows of Table 2 show the unweighted mean by year of these three components of habitat requirements for SAV growth. They show that this mean got slightly worse in 2006 in both the upper creeks and the mainstem. Over all years (last column), the mean status of the mainstem was slightly better than in the upper creeks (137% vs. 114%), as expected since water quality tends to be better in the mainstem of a tidal river compared to its upper tidal creeks, for a variety of reasons.

MAGOTHY ENVIRONMENTAL FACTORS NOT USED IN THE INDEX

Several important environmental factors (fish consumption advisories, nontidal tributary health, and abundance of oysters, fish, crabs, turtles, and birds) were not included in the index because data are missing or because the available data have no goal and thus could not be expressed as a percentage. There were no new data available on these since last year's report, so you can find a summary of what we know about these in the 2005 Magothy River Index which is online here: http://www.magothyriver.org/MRAIndex.htm

Table 2. MAGOTHY RIVER INDEX, WATER QUALITY, 2002-2006*

Indicator	What	Where	2002	2003	2004	2005	2006	MEAN
Water Clarity > 1 m, Upper Creeks*	% of SAV water clarity goal achieved	Upper creeks (2)	62%	78%	129%	93%	**64%**	85%
Water Clarity > 1 m, Mainstem	Same	Mainstem	83%	83%	95%	91%	**99%**	90%
Total Suspended Solids < 15 mg/l, Upper Creeks	% of SAV habitat requirement achieved	Upper creeks	101%	202%	316%	154%	**146%**	184%
Total Suspended Solids < 15 mg/l, Mainstem	Same	Mainstem	131%	180%	214%	182%	**212%**	184%
Dissolved Inorganic Nitrogen < 0.15 mg/l, Upper Creeks	% of SAV habitat requirement achieved	Upper creeks	207%	35%	34%	42%	**52%**	74%
Dissolved Inorganic Nitrogen < 0.15 mg/l, Mainstem	Same	Mainstem	222%	82%	52%	238%	**87%**	136%
Bottom DO, Midriver > 2 mg/l	% that met level needed by oysters (> 2.0 mg/l)	Mid-river (MR6 or WT6.1)	31%	8%	50%	13%	**36%**	28%
Bottom DO, Oyster sites > 2 mg/l	Same	Oyster restoration sites (5)	94%	100%	96%	83%	**94%**	93%
Bottom DO, Upper creeks > 2 mg/l	Same	Upper creek sites	50%	50%	90%	43%	**40%**	55%
MEAN SAV WQ—Upper creeks	***Mean of first 3 values***	***Upper creeks***	*123%*	*105%*	*160%*	*96%*	***87%***	*114%*
MEAN SAV WQ--Mainstem	***Same***	***Mainstem***	*145%*	*115%*	*120%*	*170%*	***133%***	*137%*

*The annual data (without the means) are graphed in Figure 3 below.

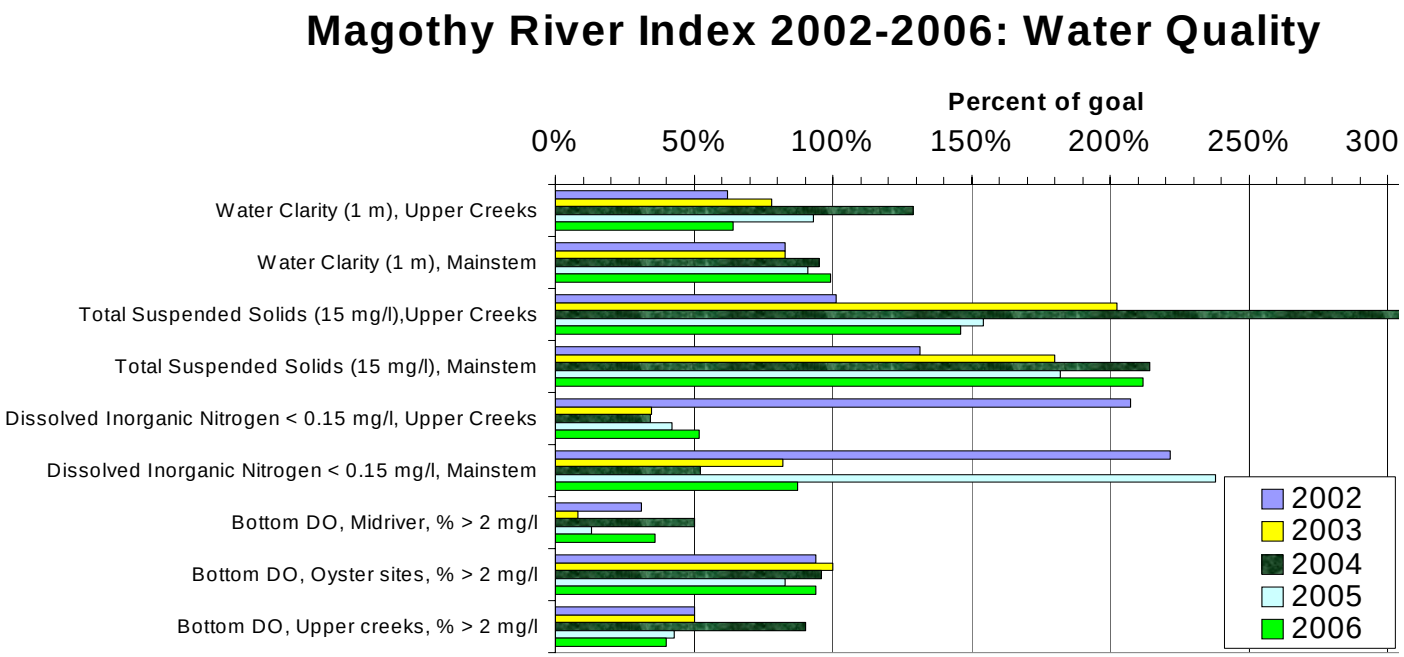

Figure 3. Graph of selected Magothy River Index water quality values for 2002-2006.

ONGOING and NEW ACTIONS TO HELP THE MAGOTHY

Oyster restoration (including reef balls): The MRA has done oyster restoration with our partners on five bars in the Magothy, with a sixth bar (Black Bar, BLKB in Figure 4 below) planned for future restoration. The statewide Oyster Recovery Partnership (http://www.oysterrecovery.org/projects/location/magothy.html) planted 1.3 million spat on shell on 0.5 acres adjacent to the Chest Neck Point (CNP) site in 2001, and later disease monitoring by University of MD staff found no diseased oysters. MRA has a 5-year oyster restoration plan with a goal of restoring 30 acres of oyster reef in the river. Since the Magothy is closed to oyster harvest, any oysters restored here will provide valuable water quality and habitat benefits. Reef balls have also been placed next to some of the oyster restoration sites, which provide fish habitat as well as oyster habitat. For more on MRA restoration projects see: http://www.magothyriver.org/Current_Projects.html

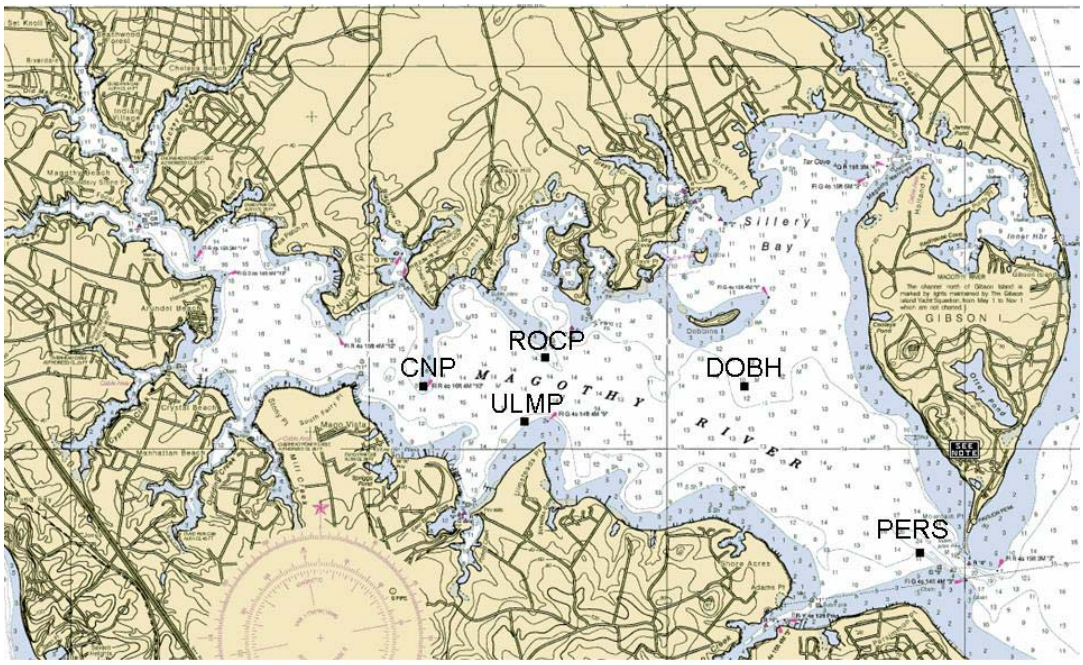

Figure 4. Active Magothy oyster bars, 2006

SAV restoration: The MRA started doing SAV restoration in the Magothy in 1998. We planted redhead grass every year from 2002-2005, first at the Grachur Club near Cockey Creek (2002-2003) and then off the Sylvan View beach near Grays Creek and Little Island (2004-2005). In 2006 we planted wild celery at the Grachur Club, because redhead grass was doing so well in the upper Magothy in 2005. All five of these projects had some survival for 1-3 years and had some plants spreading outside of the planted area.

Wetland and stream restoration, stormwater retrofits: Nontidal wetland restoration was done recently in North Grays Creek. New wetland projects are planned on Cattail Creek in Berrywood, and along North Cypress Branch. Stream restoration and stormwater retrofits are planned for

North Cypress Branch along McKinsey Road. See:
http://www.mdot.state.md.us/News/2005/October%202005/SHA_Cypress_branch.htm

Land protection: Our partner organization, the Magothy River Land Trust, has protected 413 acres in the Magothy watershed via permanent easements through 2005. Many of these include sensitive wetland habitats such as bogs. For a map of protected properties through 2004, see http://www.magothyriver.org/Land_Trust.html. The MRA is working to protect sensitive habitats on Dobbins Island from development, and reverse some of the damage done to habitats on Little Island through unpermitted development.

WHAT YOU CAN DO TO HELP THE MAGOTHY

- **Plant trees along streams and shorelines that lack them** or have a narrow forested buffer, to increase the number of stream and shoreline miles that have forested buffers.
- **Increase oyster reefs** to increase filtration capacity and fish habitat. You can do oyster gardening and help with oyster nurseries (oysterinfo@magothyriver.org), and do diving to support oyster restoration (diver@magothyriver.org).
- **Increase Submerged Aquatic Vegetation** (SAV) through planting to improve water quality and increase fish and shellfish habitat, contact Carl Treff at magothyriversavers@yahoo.com. If you can help with **surveys of current SAV locations**, please contact Peter Bergstrom at sav2@magothyriver.org.
- **Volunteer to help with water quality and dark false mussel monitoring**. To help with water quality monitoring, contact Peter Bergstrom (sav2@magothyriver.org) or Dick Carey (diver@magothyriver.org). Volunteers who live near Mill and Dividing creeks are especially needed this year. If you have a pier, get a ceramic tile from MRA to hang off your pier, and check it monthly to see if **new dark false mussels** have attached to it.
- Reduce your lawn area and your use of lawn fertilizer, and use native plants. **Fertilize your lawn (if necessary) only in the fall**, which is the best time for grass growth, and **avoid fertilizing in the spring**, when fertilizer runoff is more likely to cause algae blooms.
- **Reduce your use of vehicles and other internal combustion engines**. These add nitrogen to the air, much of which reaches the water. Car pool, combine trips, buy more fuel-efficient vehicles and four-cycle boat motors, and use electric yard tools instead of gas tools.
- **Encourage nutrient best management practices,** including nutrient management by lawn care companies, and at horse farms and other farms in the watershed.
- **If you have a septic system, keep it pumped out and in good repair.**
- **Minimize and when possible reduce the amount of pavement and other impervious surfaces in your yard,** since they increase runoff to the river. This can be done by using gravel or porous pavers for driveways and parking lots. Support stormwater retrofits in the watershed.
- **Install rain barrels, rain gardens, and other structures** to retain and improve the quality of runoff before it leaves your yard. See: http://www.arlingtonecho.org/rainbarrel.htm
- **Join the Magothy River Association: see** http://www.magothyriver.org/Who_We_Are.html or contact President Paul Spadaro at 410-647-8772 or president@magothyriver.org.
- Visit our web page (link above) and sign up for "News and Announcements" via email.

ACKNOWLEDGMENTS

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