THE MAGOTHY RIVER INDEX–2004
February 16, 2005
"State of the Magothy River"

by Dr. Peter Bergstrom

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 along the Magothy River Watershed. We devote our efforts to projects that protect the welfare of the river and its inhabitants.

The Magothy River Association's Magothy River Index is an annual assessment of the health of the tidal river for communication to the residents of the watershed. Its format is based on similar reports by the Chesapeake Bay Foundation on the whole Bay, and by the Potomac River Association on Breton Bay in Saint Mary's County. We hope that this index is useful to residents of the watershed to learn more about the status of vital habitats and water quality in the previous year. 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 principal author Peter Bergstrom at sav2@magothyriver.org.

SUMMARY OF MAGOTHY RIVER CHANGES OVER 2002-2004

The last three years have varied in the amount of rainfall in the Chesapeake watershed. The drought of 1999-2002 was followed by two wet years in 2003 and 2004. Although wet years often have worse water quality, Magothy water quality saw some improvements in 2004.

- The biggest environmental story of 2004 in the Magothy was **the dramatic increase in dark false mussels** (*Mytilopsis leucophaeata*), a small bivalve that was first noticed in higher than normal numbers the Magothy late in 2003. The high rainfall in 2003 may have caused increases in a native mussel that is usually restricted to oyster bars. Dark false mussels reached record population levels in 2004, especially in small tidal creeks on the upper Magothy. They covered almost all hard surfaces in some parts of the river, including pilings, bulkheads, rocks, branches, and some boats.
- **2004 saw record high (good) levels of water clarity in Cattail and Old Man creeks**, where we have measured water clarity since 1992. Both creeks also had record low (good) levels of total suspended solids in 2004. These are two of the Magothy creeks that had the largest populations of dark false mussels, which probably contributed to these improvements, which were contrary to the usual pattern of worse water quality in wet years.
- **In 2004, nitrogen levels followed the usual pattern of worse conditions in wet years**, however. Median dissolved inorganic nitrogen levels in the two creeks in 2002 were among the best we had measured since 1993, probably due to the drought. In contrast, 2003 and 2004 median nitrogen levels were the highest (worst) levels we have measured in the creeks and the mainstem, probably due to high rainfall in both years, which causes more surface runoff of nitrogen, and flushes more nitrogen from ground water.
- **Submerged Aquatic Vegetation (SAV) area in the Magothy decreased slightly in 2003** (the latest year for which surveys are available), from 38% to 31% of the Chesapeake Bay Program restoration goal. Some of the photographs for the 2003 survey were taken after Tropical Storm Isabel, which may have contributed to the lower area mapped by reducing water clarity. **The 2004 SAV survey is not finished yet, but based on preliminary**

estimates, we expect a substantial increase in Magothy SAV area in 2004.

- Data we collected in 2004 showed that bottom dissolved oxygen conditions at oyster restoration sites remained adequate for oyster growth, as they were in 2002-2003. These conditions were much better at oyster restoration sites than at the deeper mid-river site where the state collects water quality data, which lacks oysters. Bottom dissolved oxygen conditions at the mid-river site improved in 2004 compared to 2003, which was encouraging, since wet years tend to have worse bottom dissolved oxygen conditions.

2004 MAGOTHY RIVER INDEX

The factors used in the Index are divided into two categories: Vital Habitats and Water Quality. The results are summarized in Table 1 and Figures 1 and 2. Habitats are good places for the fish and wildlife of the Magothy to live, such as fish, crabs, turtles, and birds. 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 how many fish and wildlife we had in the Magothy) we have no data, so we cannot use them in the Index. Several important factors for which we cannot calculate an index value are discussed after the Water Quality section. We only calculated an overall average index value for the 4 components of water quality for SAV growth, since they were all measured at the same stations on the same days.

VITAL HABITATS

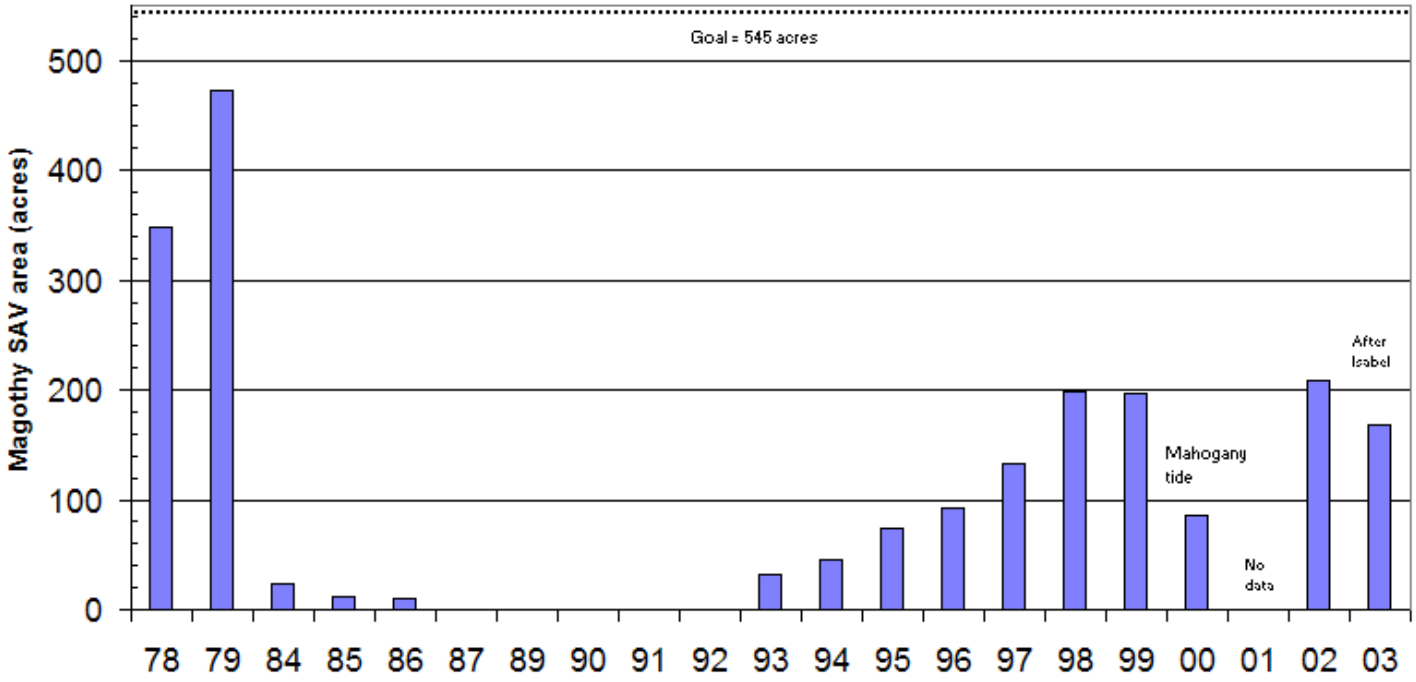
Tidal and non-tidal wetlands: These are important habitats for fish and wildlife, and they are greatly reduced in the Magothy watershed compared to what was here in the past, although they are not monitored regularly. Wetlands once made up 7.5% of the watershed, which we used as our interim goal. They now cover 2% of the watershed, so **currently wetlands are 27% of this goal.**

Forested 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. Ideally, this would be 100% (our goal), and we can increase this 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 544 acres. In 2003, the last year with for which data are available, there were 169 acres of SAV mapped by aerial surveys in the Magothy, or **31% of the CBP goal.** This was a decline from the 2002 acreage, probably at least partly due to visibility problems and/or SAV diebacks caused by Tropical Storm Isabel. Magothy SAV is usually photographed in late September or early October after the air and water become clearer but before the plants die back. In 2003 these photographs were taken after Tropical Storm Isabel, which reduced water clarity and made it harder to see any plants that remained.
SAV area data from past years are also available for most years since 1978. Figure 1 shows that Magothy SAV area increased through 1998-1999 to the highest area since 1979, before something (probably a “mahogany tide” algae bloom in Spring 2000) caused an SAV dieback in 2000. There are no data for 2001 due to airspace restrictions following the terrorist attacks. In 2002 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. **The 2004 SAV survey is not finished yet, but based on preliminary estimates, we expect a substantial increase in 2004 over the 2003 Magothy SAV area, which is good news.** Note that Magothy SAV area started increasing in 1993, when Mainstem water clarity was above (better than) the water clarity goal (Figure 3).

Figure 1. Submerged Aquatic Vegetation (SAV) area in the Magothy River, 1978-2003. (Data are from http://www.vims.edu/bio/sav/segtots.html converted to acres)



MRA volunteers continued mapping and identifying species in natural SAV beds to supplement the aerial surveys in 2004. We found that the sago pondweed that increased in the Magothy during the drought and high salinity in 2002 held on in many areas in 2003, but appeared to decline in 2004 as low salinity levels continued. However, the common waterweed that appeared to die back during the drought of 2002 appeared to increase in 2004, especially near Gibson Island. The Magothy is near the middle of the salinity range for redhead grass, which did not seem to change much in abundance as the salinity changed. Increased species diversity of SAV makes it more likely that some species will persist as conditions change.

The redhead grass planted by MRA volunteers at the Grachur Club (near the mouth of Cockey Creek) in 2002 and 2003 was doing fine in 2004. There was some evidence of grazing by waterfowl but the plants were dense and healthy and had started to spread. The redhead grass planted in 2004 outside the mouth of Grays Creek off the Sylvan View Beach were also doing well in fall 2004, and we will plant there again in 2005. Redhead grass and wild celery planting done by Broadneck High School teacher Denny Mekic and his students in the Little Magothy River in 2003 and 2004 had little survival in 2003 but had good survival in 2004. More information on Magothy SAV can be found on the MRA web site at http://www.magothyriver.org/Plants.html and about our SAV planting projects at

http://www.magothyriver.org/SAV_Restoration.html and
http://www.magothyriver.org/Grasses_for_the_Masses.html

WATER QUALITY

Attainment of the water clarity goal & SAV habitat requirements in Table 1 were 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 per visit in June-November (6 months), which is when most low DO occurs in the Magothy. DO sampling was done about 3 times a month. The 2002-2004 data for the factors highlighted in Table 1 are also graphed in Figure 2 below.

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 the restoration depth for SAV in that river (1 meter at Mean Low Water in the Magothy). MRA volunteers led by Peter Bergstrom collected the water clarity data used for this index in shallow water (where SAV can grow) at three stations in two groups, all sampled monthly on the same day:
Upper creeks: data from two creek stations (sampled from piers on Old Man and Cattail creeks) were averaged to represent conditions in the smaller, upriver creeks.
Mainstem: data from the end of the Ulmstead pier represents conditions near shore in the wider part of the river and the mouths of the larger creeks.
We found that the water clarity at the Upper creek sites in 2004 achieved 129% of the goal, while the Mainstem site achieved 95% of the water clarity goal. This was an improvement over 2002 and 2003 values for both areas in the river (Table 1 and Figure 2). This pattern (more improvement in the creeks) suggests that the filtration by dark false mussels may have been the cause, since the creeks had more mussels (because they have more piers per unit volume of water) and less volume of water than the mainstem of the river. MRA volunteer divers and kayakers led by Dick Carey estimated in fall 2004 that there were about 400 million mussels in Cattail Creek. Based on published filtration rates for zebra mussels of the same size, the dark false mussels in Cattail Creek filtered the water in that creek every 42 hours in 2004.

Dissolved oxygen: Dissolved oxygen (DO) is important to the survival of the aquatic life we cherish in the Magothy River. 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 this was used as our goal: bottom DO that never went below this value. MRA volunteers led by Dick Carey collected the dissolved oxygen data used for this index near the bottom (where oysters live) at four or five stations in two groups, all sampled by boat about three times a month on the same day:
1) Midriver is the same station (WT6.1) that is also sampled monthly by Maryland Department of Natural Resources, located between North & South Ferry Points, which has no oysters nearby. It is about 5.5 meters (18 feet) deep.
2) Three or four shallower Oyster restoration sites (3-4 meters deep) had similar water quality, so their results were averaged and reported as a single value.
We found that the dissolved oxygen at the Oyster restoration sites was higher (better for oyster growth and survival), meeting the 2 mg/l goal in 97% of samples, than dissolved oxygen at the Midriver site, meeting it in only 50% of samples (Table 1 and Figure 2). This is encouraging and

shows that we picked oyster restoration sites where there is usually enough dissolved oxygen for oyster survival. DO conditions at the Midriver site got worse in 2003 compared to 2002, but improved in 2004 (Table 1 and Figure 2). The worsening in 2003 was probably due to increased rainfall, which usually leads to worse DO conditions, but the causes of the improvement in 2004 are not clear, since total rainfall in 2004 was still above average.

Dissolved inorganic nitrogen, chlorophyll, and total suspended solids concentrations: These water quality parameters all have habitat requirements for SAV growth, but only chlorophyll has a Chesapeake Bay Program water quality goal (Table 1). Unlike water clarity and dissolved oxygen, for these three parameters, less is better.

The most notable change in these concentrations in 2002-2004 was that annual growing season medians of dissolved inorganic nitrogen (DIN) in 2003 and 2004 were much higher than in 2002 (Table 1). Based on data we collected since 1993 (not shown), DIN medians were worse (higher) than the SAV habitat requirement at the Upper Creek sites every year except in 2001-2002 during the drought. In contrast, DIN medians were better (lower) than the SAV habitat requirement at the Mainstem site in every year except 2003 and 2004. DIN is generally more affected by changes in rainfall than any of the other water quality parameters, partly because one of its components, nitrate, can be abundant in ground water, and high rainfall flushes more ground water into the river.

Too much dissolved inorganic nitrogen can fuel algae blooms, although not in this case: chlorophyll levels in the Magothy were much better then the CBP goal in all three years, setting records (Table 1). These years (2002-2004) were the first time since we started measuring chlorophyll in 1993 that chlorophyll levels met the goal for two or more years in a row, which is encouraging, especially since nitrogen levels went up. In previous years, one year with good (low) chlorophyll levels would be followed by one or more years with high levels. Since these chlorophyll improvements started in 2002 before the increase in dark false mussels in 2003-2004, their increased filtration is probably not a cause of it.

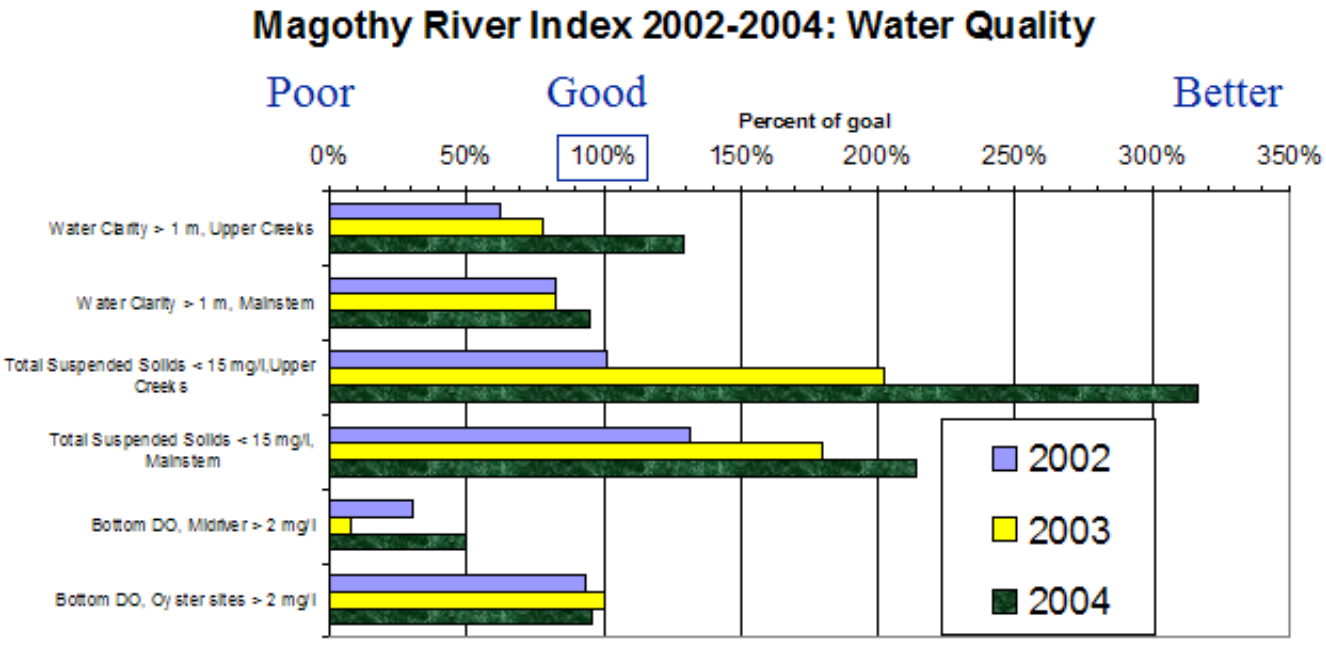
Mean status for water clarity, dissolved inorganic nitrogen, chlorophyll, and total suspended solids: The last two rows of Table 1 show the unweighted mean by year of these four components of habitat requirements for SAV growth. They show that while in the creeks this mean stayed the same in 2003 and increased (improved) in 2004, in the mainstem it decreased in 2003 and stayed the same in 2004. Looking at the four components of the mean, this decrease in the mainstem mean, with no increase in 2004 as occurred in the creeks, was mainly caused by worse dissolved inorganic nitrogen conditions in 2003 and 2004. The creek sites also had worse dissolved inorganic nitrogen conditions in 2003, but they improved in the creeks in 2004, and water clarity and TSS improved in the creeks in 2004 more than they did in the mainstem.

Table 1. MAGOTHY RIVER INDEX, 2002-2004

Indicator	What	Where	2002	2003	2004
VITAL HABITATS					
Submerged Aquatic Vegetation (SAV)	% of historical amount based on aerial survey	All tidal waters	38%	31%	*Not available*
Wetlands (tidal & non-tidal)	% of historical amount (estimated)	Whole watershed	27%	27%	27%
Forested stream buffers	% of stream miles with 100 foot or wider buffers	All nontidal streams	23%	23%	23%
WATER QUALITY					
Water Clarity > 1 m, Upper Creeks*	% of SAV water clarity goal achieved	Upper creeks (2)	62%	78%	129%
Water Clarity > 1 m, Mainstem	Same	Mainstem	83%	83%	95%
Total Suspended Solids < 15 mg/l, Upper Creeks	% of SAV habitat requirement achieved	Upper creeks (2)	101%	202%	316%
Total Suspended Solids < 15 mg/l, Mainstem	Same	Mainstem	131%	180%	214%
Bottom DO, Midriver > 2 mg/l	% of data that met level needed by oysters (> 2.0 mg/l)	Mid-river (WT6.1)	31%	8%	50%
Bottom DO, Oyster sites > 2 mg/l	Same	Oyster restoration sites (3-4)	94%	100%	96%
Bottom DO, Midriver > 5 mg/l	% of data that met level needed by fish, and state standard (> 5.0 mg/l)	Mid-river (WT6.1)	25%	0%	13%
Bottom DO, Oyster sites > 5 mg/l	Same	Oyster restoration sites (3-4)	59%	68%	65%
Chlorophyll a < 8 ug/l, Upper Creeks	% of CBP goal to ensure adequate SAV water clarity achieved	Upper creeks (2)	139%	192%	183%
Chlorophyll a < 8 ug/l, Mainstem	Same	Mainstem	75%	111%	90%
Dissolved Inorganic Nitrogen < 0.15 mg/l, Upper Creeks	% of SAV habitat requirement achieved	Upper creeks (2)	207%	35%	34%
Dissolved Inorganic Nitrogen < 0.15 mg/l, Mainstem	Same	Mainstem	222%	82%	52%
MEAN SAV WQ—Upper creeks	***Unweighted mean of 4 water quality values***	***Upper creeks (2)***	***127%***	***127%***	***166%***
MEAN SAV WQ--Mainstem	***Same***	***Mainstem***	***128%***	***114%***	***113%***

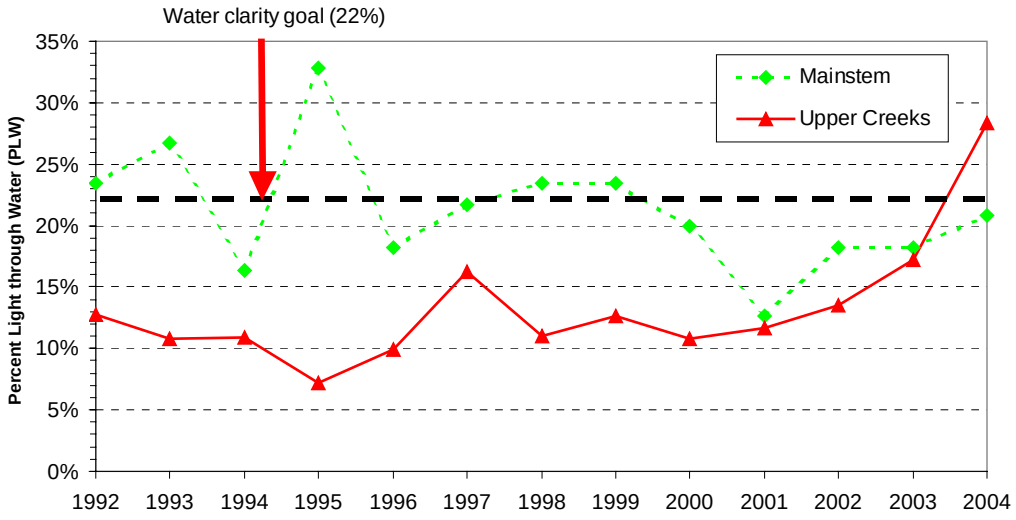
*Shaded rows are graphed in Figure 2 below.

Figure 2. Graph of selected Magothy River Index values for 2002-2004.



Water clarity changes, 1992-2004: MRA volunteers led by Peter Bergstrom have sampled water clarity at the same three stations since 1992, and Figure 3 shows that water clarity (as PLW, Percent light through the water) in 2004 was much higher (better) than in 2002-2003 at the upper creeks, and slightly better than 2002-2003 in the mainstem. 2004 was the first year that the creeks had better clarity than the mainstem site, and the first year the creeks met the goal, probably due to the increase in dark false mussels. Water clarity tends to be better in most rivers in drought years, and it went up in the mainstem during a dry year (1995), but it went down in the creeks the same year. However, the water clarity goal was also met at the Mainstem site in 1993 and 1998, which had higher than normal rainfall. Thus, Magothy water clarity over this period did not appear to have any clear trend over time, or to respond in a predictable way to rainfall amount.

Figure 3. Growing season medians of water clarity by year and site, 1992-2004, compared to 22% water clarity goal to allow SAV growth.



MAGOTHY ENVIRONMENTAL FACTORS NOT USED IN THE INDEX

These environmental factors were not included in the index because the available data have no goal and thus could not be expressed as a percentage, or because data are missing.

Data available, but no numerical goal:

Fish Consumption Advisories: The Maryland Department of the Environment (MDE) issues these based on toxic contaminant levels found in fish caught in each river, using models of your risks from eating various amounts of fish. In 2003, the Magothy was listed for two fish species, channel catfish and white perch. In 2004, channel catfish were dropped (http://www.mde.state.md.us/assets/document/advisory_summary(2).pdf) because none were caught in the latest surveys, but the Magothy still has a consumption advisory for white perch. Current recommended limits (in meals per year) for the general population are 23; for women of childbearing age, 17; and children 6 and under, 14 meals per year, due to risks from PCBs and pesticides. Several nearby rivers also had consumption advisories for white perch (Patapsco, Chester, Severn, and South rivers).

Non-tidal Tributary Health: In spring 2002 and 2003, Magothy River Association (MRA) volunteers sampled 20 points on Magothy non-tidal tributary streams for benthic invertebrate animals (insects and other animals living on the bottom of streams). Nineteen of the 20 sites had Poor quality based on these samples. The one site rated Fair was on Magothy Branch (the non-tidal Magothy) above Lake Waterford, near Brookwood & Obrecht roads, just upstream of Jumpers Hole Road. To see the data go to http://mddnr.chesapeakebay.net/mbss/streamwaders.cfm and type “Magothy” in the box for “8 digit watershed name.” Statewide, half of the small streams sampled by DNR were rated Poor,

about a third were rated Fair, and the rest (11%) were rated Good. Thus, with 95% of the streams sampled rated Poor, the Magothy is much worse than the state average. Most of the Fair and Good sites were in watersheds with less developed land than the Magothy watershed, which has about 25% developed land. Some MD coastal plain watersheds have only 5% developed land or less. For more information see: http://www.dnr.state.md.us/streams/mbss/mbss_volun.html

No data available:

Oysters: Although the MRA has conducted extensive native oyster restoration efforts for a number of years, there is no easy way to locate or count the total number of oysters in a river. Even if we knew our current oyster population size, we don't know the historical abundance of oysters in the Magothy. For more on MRA oyster projects see: http://www.magothyriver.org/Current_Projects.html

Fish, Crabs and Turtles: These are also hard to count, but for different reasons: they move around and are hard to catch. Maryland DNR did summer fish surveys in the Magothy in the past (1989-1991) using a seine net in the shallows and trawls at various depths, and documented a total of 37 finfish species. There are no known surveys of Magothy crabs or turtles. Turtles seen in our tidal waters include snapping turtles and diamondback terrapins. Terrapins need natural shorelines with beaches to nest, and these are becoming rare on the Magothy.

Birds: One of our more visible waterbirds is the Osprey, which spends the warmer months here, and spends the winter in South America. Local resident George Kerchner counted osprey nests on the Magothy in 1996 when he found 25 active nests. Ospreys have increased so much that their nest sites may be limited in the Magothy. If you are a waterfront property owner and are interested in erecting a nest platform, contact sav2@magothyriver.org for more information. The MRA web site has information about common birds seen around the Magothy at http://www.magothyriver.org/Critters.html

There are no confirmed bald eagle nests in the watershed, but eagles are sometimes seen flying over the river, sometimes in pairs. They prefer to nest in undisturbed wooded waterfront tracts, of which there are few on the Magothy. They nest on the Severn and South rivers most years.

Recent efforts to map mute swans and their nests by MD DNR and other agencies noted a few mute swan nests on the Magothy, but not as many as on the Severn and South rivers. The nests are being mapped as part of an effort to control this exotic and invasive species in Maryland, which competes with native waterfowl and damages SAV beds. For more details see: http://www.dnr.state.md.us/wildlife/muteswans.html

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. **Sign up to get trees through MRA in April 2005.**
- **Increase oyster beds** 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 "Grasses for Masses" to improve water quality and increase fish and shellfish habitat (Contact magothyriversavers@yahoo.com), and help with **surveys of current SAV locations** (Contact 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). 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 it 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, and much of this 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