

–June 19,2006

Region’s Scientists Investigate Lower Potomac Fish Kill

Experts from state agencies in Maryland and Virginia, as well as the Interstate Commission on the Potomac River Basin (ICPRB) are collecting and analyzing data to determine the cause of a fish kill that occurred in the lower tidal Potomac River on June 2-4.

The carcasses of 7,000 to 8,000 fish washed onto the Potomac’s Virginia shore in Westmoreland County between Colonial Beach and Coles Point. Affected species included striped bass, croaker, perch, spot, shad, and cow-nosed rays. The diverse array of species killed points to an environmental factor rather than disease, noted ICPRB Associate Director for Aquatic Habitats Claire Buchanan. Diseases, such as the mycobacterial infection afflicting striped bass stocks, tend to be more species-specific.

Researchers currently are examining dissolved oxygen levels and algae populations in the area in the weeks leading up to the kill. Initially, the 17-million gallon spill of untreated sewage at Blue Plains wastewater treatment plant on May 19 was linked to the kills, but there is no strong connection between the two events. The sewage volume was less than one percent of the water flowing over the fall-line that day, and less than one percent of the volume of the adjacent one-mile-long river segment. However, raw sewage has nutrient concentrations that are orders of magnitude higher than Potomac River water. Ongoing analysis will help determine if the spill contributed to the conditions that caused the kill.

Continuous monitoring buoys show that dissolved oxygen concentrations did drop below five milligrams per liter (mg/l) in mid-May at the mouth of the Potomac estuary. For the two weeks between the spill and the fish kill, concentrations in the upper and middle estuary were mostly above five mg/l, the concentration needed for healthy fish populations (Fig. 1). Maryland near-shore buoy data for dissolved oxygen on the dates of the fish kill are not yet available from the Maryland Department of Natural Resources (DNR) “Eyes on the Bay” web site, <http://www.dnr.state.md.us/bay/index.html>. However, researchers from Morgan State University Estuarine Research Lab, sampling in the area of the fish kills on June 5, observed anoxia in bottom waters off the Virginia side of the Potomac. Strong westerly winds occurred over the weekend, and the researchers suspect that the winds pushed surface waters toward the Maryland side, and pulled anoxic bottom waters to the Virginia side of the river. These conditions are known to create “crab jubilees” and fish kills.

Chlorophyll data from DNR continuous monitoring buoys indicate that a very large algal bloom occurred in the lower river in April, two to five weeks prior to the sewage spill (Fig. 1). The type of algal bloom has not been reported, but was likely diatoms, an important group of phytoplankton. The April bloom subsided and a smaller bloom developed in mid-May. Satellite images from mid-May to the present, where there is visibility in the region, show elevated chlorophyll levels in and around the mouth of the Potomac. Cloud cover has reduced the ability to consistently record conditions via satellite in that region.

Water samples collected in the lower Potomac estuary by Maryland and Virginia monitoring programs between May 31 and June 5 indicate the May/June phytoplankton community composition is dominated by several potentially harmful dinoflagellate species, particularly *Karlodinium micrum*. Other dinoflagellate taxa include *Prorocentrum minimum*, *Heterocapsa rotundatum*, and *Heterocapsa triquetra*. Euglenoids, diatoms, cryptomonads, and zooflagellates are also common in the samples.

High densities of *Karlodinium micrum* (54-million per liter) were first documented in the St. Clements, Md., area of the lower Potomac mainstem, between Swan Point and Piney Point two days before the sewage spill at Blue Plains, more than 80 miles upstream. The sewage spill was not the proximal cause of the dinoflagellate bloom. *Karlodinium* concentrations in the fish kill area on June 5 were 65-million per liter, and tests indicate Karlotoxin was present.

The dense populations of dinoflagellates and the positive toxicity tests indicate that algal toxins were a potential cause of the fish kills. The rise and fall of very high chlorophyll concentrations in the lower Potomac during April and the onset of the dinoflagellate bloom in mid-May suggest the dinoflagellate populations were initially fueled by the decomposition of the preceding bloom in the lower estuary, rather than sewage nutrients from upstream.

The partially processed dissolved oxygen data for the lower Potomac River for the first half of June indicates that bottom anoxia also was a potential factor in the fish kills, but may prove to be less important than algal toxins. The possible link between bottom anoxia and upstream nutrient loads, both from the upper nontidal watershed above the fall-line and the Blue Plains spill, will be examined when continuous buoy monitoring data and nutrient data become available. River water nutrient concentrations are relatively high at the fall-line, which reduces the dilution efficiency of the river, and excess nutrients reaching the lower estuary could exacerbate the existing dinoflagellate bloom. Further analysis will help clarify the relative importance of the ongoing dinoflagellate bloom and the upstream sewage spill to the fish kill.

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Information Sources:

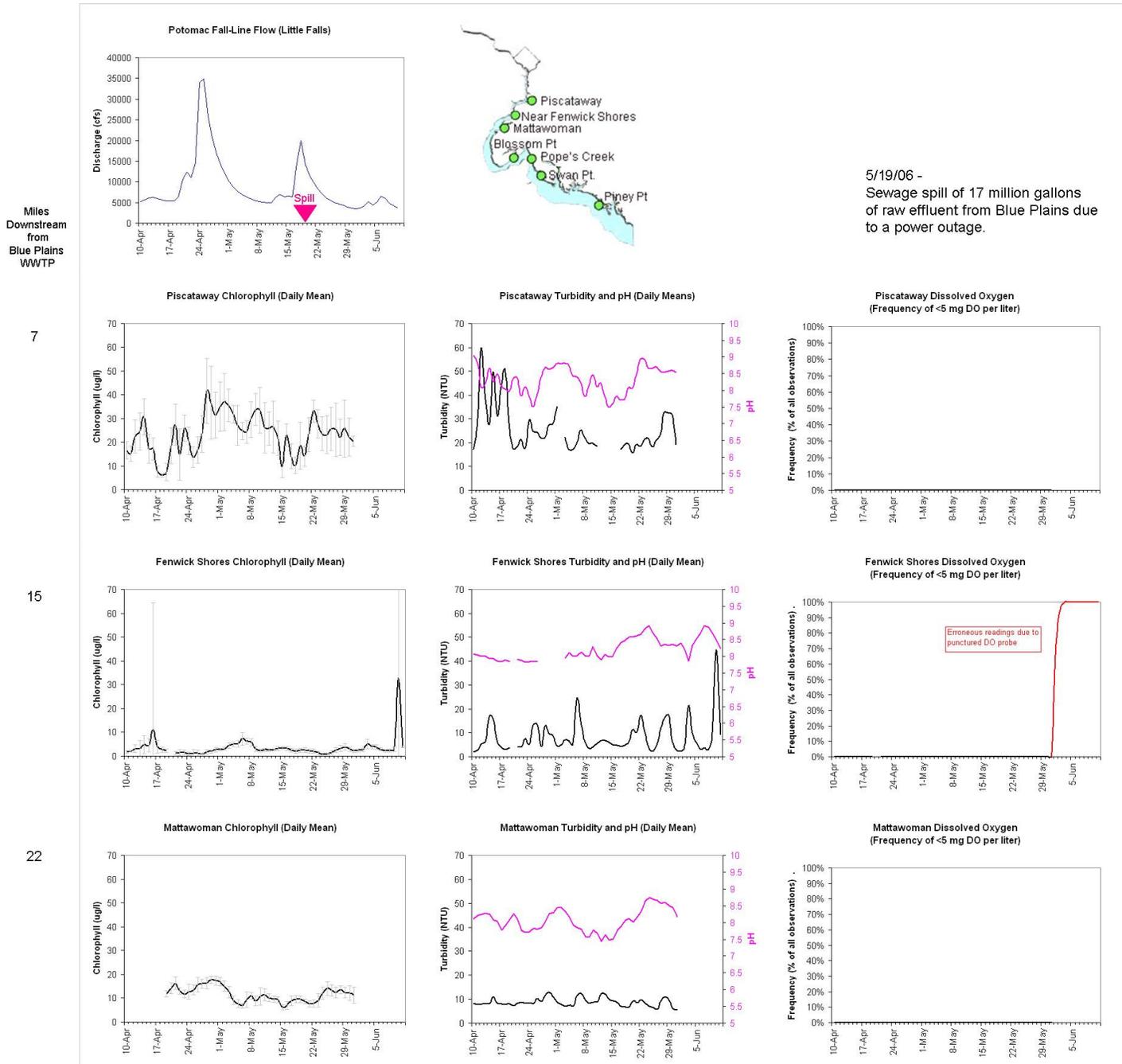
Continuous water quality monitoring data were obtained from the MDDNR "Eyes on the Bay" web site <http://mddnr.chesapeakebay.net/eyesonthebay/index.cfm#map>. Data were downloaded June 11, 2006. Stations: Piscataway, Near Fenwick Shores, Mattawoman Cr, Blossom Pt, Pope's Cr, Swan Pt. and Piney Pt.

The June 5th dissolved oxygen profiles were provided by Richard Lacouture (MSUERC, rlacouture@moac.morgan.edu, 410-586-9700)

Daily average fall-line flows were obtained from the USGS web site <http://waterdata.usgs.gov/md/nwis/current/?type=flow> on June 11, 2006.

Phytoplankton species information was obtained from the following individuals June 5-12, 2006:
 Peter Tango (MDDNR, PTANGO@dnr.state.md.us)
 Richard Lacouture (MSUERC, rlacouture@moac.morgan.edu)
 Walter Butler (MDDNR, WBUTLER@dnr.state.md.us)
 Harold Marshall (ODU, hmarshal@odu.edu)

Figure 1. Daily averages for US Geologic Survey (USGS) Potomac River fall-line flow and Maryland Department of Natural Resources (MDDNR) continuous monitoring data for chlorophyll *a*, pH, turbidity and dissolved oxygen for the period preceding the fish kill. Gray error bars in chlorophyll graphs are ± 1 standard deviation. Data were obtained from the MDDNR “Eyes on the Bay” website <http://mddnr.chesapeakebay.net/eyesonthebay/index.cfm> and the USGS stream gage flow web site <http://waterdata.usgs.gov/md/nwis/current/?type=flow>. Gaps indicate where no data were available as of June 11, 2006.



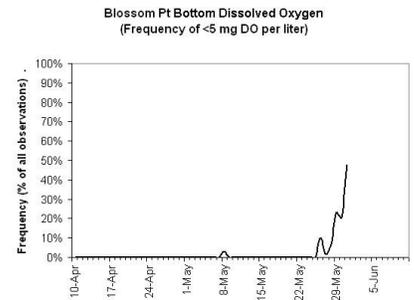
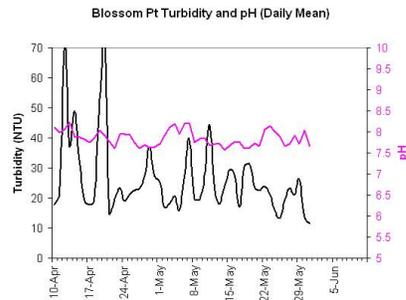
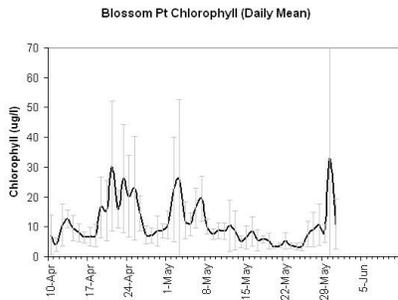
5/19/06 -
 Sewage spill of 17 million gallons
 of raw effluent from Blue Plains due to
 a power outage.

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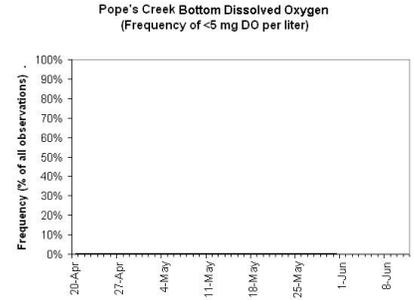
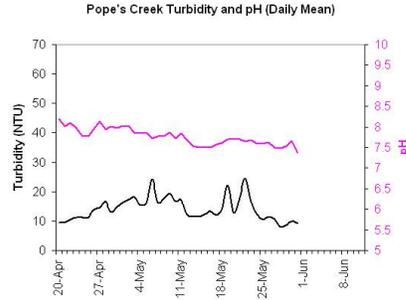
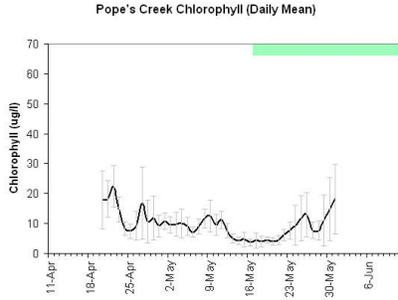
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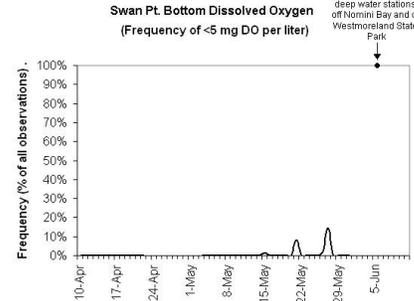
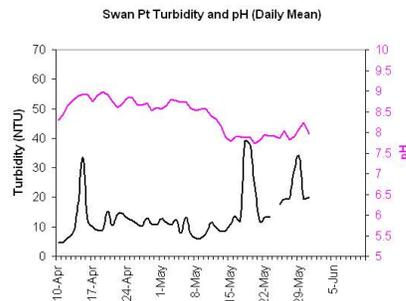
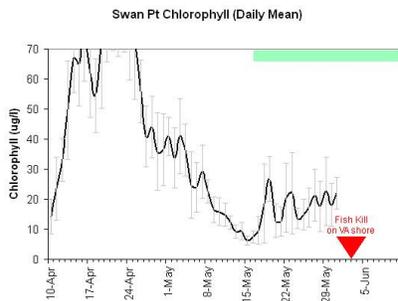
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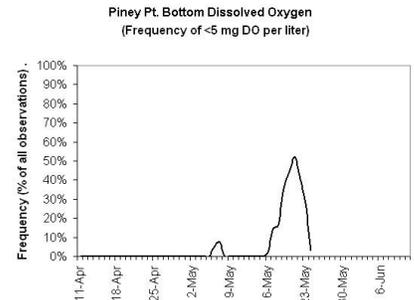
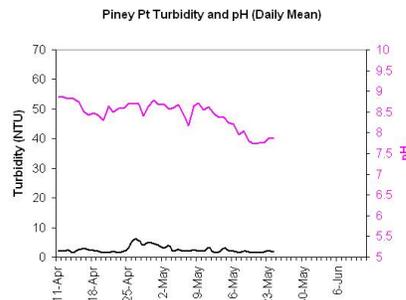
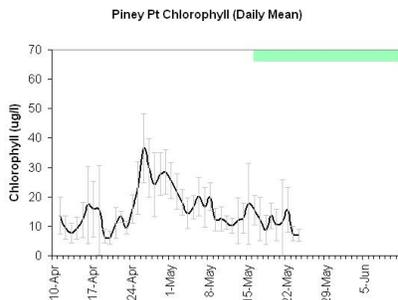
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Documented occurrence of known harmful algal taxa in lower Potomac

5/17/06 - *Karlodinium micrum* (dinoflagellate) bloom of 54 million cells per liter noted in St. Clements area between Swan Pt and Piney Pt. (Walt Butler)

Evidence of blooms in the lower Potomac and around the mouth of the Potomac in satellite chl a images since at least mid-May. (Peter Tango)

6/5/06 - Dominant species (abundance) in the fish kill area and adjacent Potomac River are the non-toxic *Heterocapsa rotundum* and the toxin-forming *Karlodinium micrum*. Abundances of *Karlodinium* are as high as 65 million cells per liter. (Richard Lacouture)

5/31/06 - 6/6/06 - Dominant species (abundance) in the Virginia embayments is *Karlodinium micrum*; sub-dominants are *Heterocapsa rotundum*, *H. triquetra*, *Prorocentrum minimum*, and several euglenoids, diatom and cryptomonad species. (Harold Marshall)