

Diagnosing the Corsica River Fish Kill

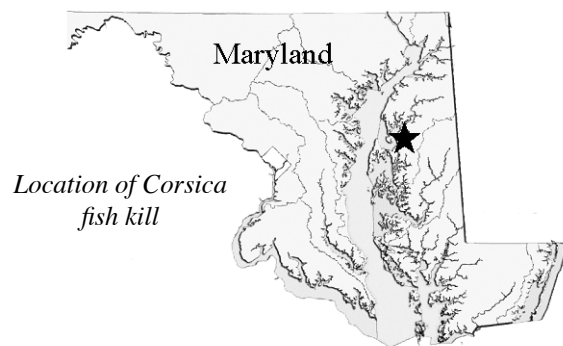
by Peter Tango

During the last week of September, an estimated 30-50,000 fish died in the Corsica River. Fish die for many reasons such as disease, parasites, bacteria, viruses, predation, harmful pollutants introduced to the water, poor water quality conditions, and more. This fish kill is considered the result of combined effects from low dissolved oxygen from the death and decomposition of a large algal bloom and the presence of sufficient algal karlotoxins in the water affecting the fish. The Corsica River is recognized as an impaired watershed and is slated for an unprecedented test of intensive restoration efforts – Governor Robert L. Ehrlich Jr. recently announced a focused pilot project over the next five years implementing land and water based best management practices to remove the Corsica River from U.S. Environmental Protection Agencies Impaired Waters list.

Timeline – coordinated efforts identify kill and causes.

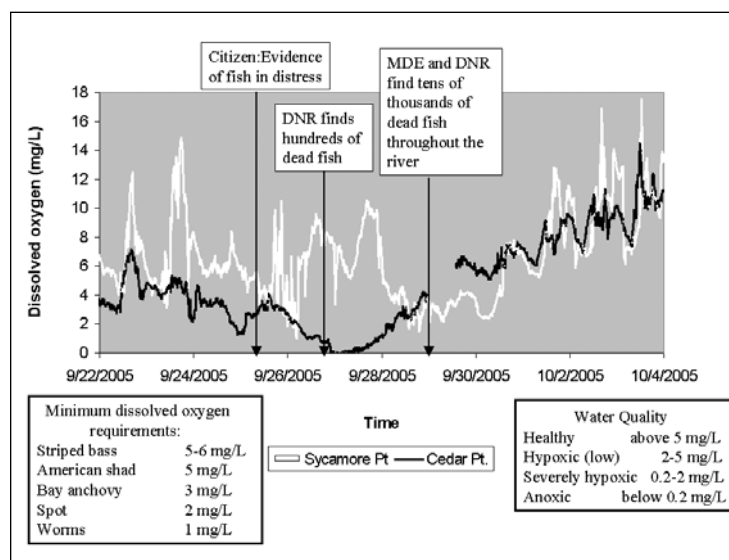
On Monday morning, September 26, Maryland Department of Natural Resources (DNR) field personnel estimated a few hundred fish dead along the upper and middle Corsica River while conducted monitoring efforts. By afternoon, estimates increased to 2000 dead fish. A Maryland Department of the Environment (MDE) field team visited the river on Tuesday and estimated nearly 10,000 fish dead and dying in the river. Maryland DNR and MDE visited the river on Wednesday and Thursday estimating 30,000-50,000 fish had died. Fish of 15 species were identified by MDE, the most abundant fish were menhaden but many gizzard shad, hickory shad, sunfish, catfish, white and yellow perch, carp and killifish were also observed.

Reviewing water quality data collected every 15 minutes from two continuous monitoring stations (Sycamore Point and Cedar Point) showed that on the weekend prior to the DNR monitoring visit, algal populations were large. Algae rely on sunlight to produce food to survive. At this time of year, summer algae species are decreasingly able to produce enough food to survive through the night with the shorter days. As a result, the algae will use up their stored food resources before the next morning then begin to starve in essence and senesce (die). Cloudy weather over this preceding weekend further reduced available sunlight and the large algal populations started a rapid decline by Monday. Dissolved oxygen levels were observed to reach stressful and lethal levels for fish survival. At the same time the primary algae dying was a potentially toxic dinoflagellate, *Karlodinium micrum* (soon being called *Karlodinium veneficum*).



Understanding toxic algae

Karlodinium was measured at concentrations up to 56,000 cells/ml. The species is commonly encountered during the summer in Chesapeake Bay at small fraction of this level. *Karlodinium* has for example been associated with fish kills in brackish water retention ponds in South Carolina,



in waters of England and repeatedly in the Perth River, Australia. In 1997 in Maryland, a significant fish kill at the HyRock Farm aquaculture facility along the Manokin River of the lower Eastern Shore was linked with a toxic bloom of *Karlodinium*. Since 2000, several smaller, localized fish kills in Maryland tidewaters have had actively toxic *Karlodinium* with measures of lethal toxin concentrations.

The toxin, called karlotoxin, has been shown in the laboratory to act on fish gill tissue with no known human health effects. The toxins affect delicate gill tissues degrading the condition of gill filaments and making breathing increasingly difficult to the fish. If sufficient gill damage occurs the fish will die. The added stress of low dissolved oxygen levels increases the likelihood that affected fish will die if affected by the algal toxin. The Sarbanes Cooperative Oxford Laboratory is conducting necropsy work to examine fish from the recent Corsica River fish kill.

Eliminating potential causes of such kills helps narrow the scope of the investigation. The community of algae was examined under a microscope from water samples collected over the river and indicated *Karlodinium* was the most abundant possibly toxic algae. With over 700 possible species of algae in the Bay, there are about 20 species among them that are potentially toxic. Holly Bowers at Dr. David Oldach's laboratory UMBI Baltimore used advanced genetic probe techniques looking for any of ten of the most likely possibly toxic algae species found in Maryland waters. Water tested positive only for *Karlodinium*; no *Pfiesteria* species were found.

Dr. Allen Place, Tsetso Bachvaroff and Jason Adolf, located at the University of Maryland Biotechnology Institute Center of Marine Biotechnology Laboratory, further assisted our understanding of the Corsica River events. Algal toxin testing was conducted on water samples from the fish kill site. Using a device known as a mass spectrophotometer allowed them to narrow the search for the identification and concentration of the algal toxin. Two of the three water samples contained sublethal but still harmful karlotoxin levels at 229 and 410 nanograms per milliliter. (Note: lethal level equals 1000 nanograms per milliliter (ng/ml), a level shown to kill fish in less than 1-hour in the laboratory. Gill tissue effects can occur at 100 ng/ml.) The third sample contained nearly twice the lethal concentration of toxin (1809 ng/ml).

Diagnosing the fish kill.

Stressful to lethal levels of dissolved oxygen were located in parts of the Corsica River throughout the week. However, fish were observed in some areas dying when dissolved oxygen conditions were measured well above critical levels

but algal toxins were present. The combined effects of low or no dissolved oxygen availability and algal toxins at lethal and sublethal levels are considered to have combined to produce the kill. A team of managers and scientists from multiple agencies and academic institutions combined to track events in the field and laboratory, evaluate data from water quality instruments and make rapid assessments of water quality, algal species and potential toxins.

Restoration efforts on the Corsica River, supported by Bay citizens, local, state and federal agencies in concert with Bay environmental organizations are expected to reduce nutrient inputs and improve the health of this

river system while also enhancing filter feeder and aquatic vegetation populations. Fewer algal blooms and improved dissolved oxygen levels supportive of a broader range of living resource needs are expected.

Visit Maryland DNR's *Eye's on the Bay* monitoring website at <http://mddnr.chesapeakebay.net/eyesonthebay/index> for water quality information regarding the Corsica River and other waterways of the Chesapeake and Coastal Bays. DNR's *Harmful Algae News* website <http://www.dnr.state.md.us/bay/hab/index.html> has additional information on algal blooms tracked in 2005 plus an historical archive of nearly 200 articles involving water quality investigations in the State since 1997.



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