Susquehanna River Basin Commission (SRBC)
Water Quality Advisory Committee (WQAC) Meeting Minutes

U.S. Geological Survey (USGS) Office
215 Limekiln Rd
New Cumberland, PA

May 25, 2010
10:00 a.m.

A. Introduction and Opening Remarks (Dave Heicher, SRBC)

Dave Heicher, SRBC, opened the meeting with introductions (see Participant List in Attachment A). The WQAC usually meets twice each year, in spring and fall.

B. Invasive Species Area of Special Interest in SRBC Comprehensive Plan (Dave Heicher, SRBC)

Dave Heicher, SRBC, provided background regarding the Invasive Species Area of Special Interest in SRBC's Comprehensive Plan. The Comprehensive Plan is SRBC's framework for managing and developing the water resources of the Susquehanna River Basin, and guides SRBC's programs and activities. It has 15-year duration, and was updated in 2008. Within the Comprehensive Plan are 12 Areas of Special Interest (ASIs), including invasive species. Invasive species are not one of the specific Priority Management Areas (PMAs) within the Comprehensive Plan, but they relate to some of the other PMAs, such as Water Quality (PMA B) and Ecosystems (PMA E). SRBC also participates in the Mid-Atlantic Panel on Aquatic Invasive Species (MAPAIS), monitors for zebra mussels, and provides educational materials to help prevent the inadvertent spread of invasive species.

C. Zebra Mussel Expansion in the Susquehanna River Basin (Sarah Whitney, PA Sea Grant)

Sarah Whitney, PA Sea Grant, gave an update on zebra and quagga mussel expansion in the Susquehanna River Basin. Invasive species are the greatest threat to freshwater biodiversity worldwide. Over 180 invasive species have been introduced into the Great Lakes since the 1800s.

Zebra and quagga mussel infestations have had many impacts. From 1989 to 2004, over $1 billion was spent on zebra mussel prevention and control by electric generation and water treatment facilities alone. These mussels can filter up to one liter of water per day. In Lake Erie, they have reduced phytoplankton by 60 percent. Removal of plankton, bacteria, and suspended sediments from water can lead to excessive plant growth and harmful algal blooms. Zebra and quagga mussels impact native mussels by colonizing on them and potentially causing suffocation.

Zebra mussels were first found in the Great Lakes in 1988. In less than 10 years, they spread through the Mississippi River and the rest of the Great Lakes. A few sightings also have been made in the western United States.

Sarah described the Pennsylvania Zebra and Quagga Mussel Monitoring Program, which the Pa. Department of Environmental Protection (PADEP) initiated in 1991. PA Sea Grant began helping PADEP to coordinate network activities in 2007.

The primary objectives of the monitoring program include detecting and tracking the spread of zebra and quagga mussels throughout Pennsylvania, alerting local water users, and developing educational outreach programs. PA Sea Grant has asked local scientific groups to look for these mussels as part of their normal sampling routines, and to report any findings to PA Sea Grant via a survey form. Good places to look include dark spaces, riprap, and places with boats (docks, etc.). Information on the mussel surveys can be found on Google Earth and on the PA Sea Grant website (http://seagrant.psu.edu/zm). PA Sea Grant also has a monitoring training program and videos online or in hard copy.

The most recent zebra mussel discoveries in the Susquehanna River Basin were in 2008 along the Pennsylvania/Maryland border. The first observation was at Conowingo Dam, followed by discoveries at Glen Cove Marina and Muddy Run Reservoir. Small numbers of young mussels (no adults) were found in all three locations.

Chemicals can be used to kill zebra mussels, but some of these can be harmful to the environment. Dr. Dan Molloy from the New York State Museum is performing research on a soil bacterium which, in its dead form, can kill zebra mussels, but not have an effect on other species. He is working with others to determine production costs, and to market and test this product.

Sarah indicated that the potential impacts associated with zebra mussels in the Susquehanna River Basin may be comparable to those observed in the Hudson River, where zebra mussels first appeared in 1991. After a year and a half, they were the dominant species in the freshwater tidal portion of the river. Phytoplankton biomass fell by 80 percent, and zooplankton numbers fell by 70 percent.

D. Golden Algae Problems and Concerns (Patrick Campbell, WV Department of Environmental Protection)

Pat Campbell from the West Virginia Department of Environmental Protection (WVDEP) gave an update on golden algae problems and concerns in the Dunkard Creek area. Dunkard Creek straddles the Pennsylvania/West Virginia state lines. High conductivity was found in the creek on August 26, 2009, followed by reports of dead fish and other aquatic life a few days later. This die-off of organisms was attributed to a species of algae called *Pyrmnesium parvum* (*P. parvum*), which turns the water in streams a characteristic brown-gold color.

P. parvum is a flagellated algal species that is normally found suspended in the water column. It was first identified in North America in 1985. The toxin it produces mainly kills fish and appears to have little effect on cattle, humans, or macroinvertebrates. This distinguishes it from red tides, which are algal blooms whose toxins can produce harmful effects in people. Pat said that no one knows exactly *where P. parvum* came from, but it is found in a number of other states (e.g., Texas, Arizona, New Mexico, Colorado, Okalahoma, North Carolina) and countries (e.g., China, Europe, Australia). The WVDEP web site (www.dep.wv.gov) has more information on this subject (search on Dunkard).

E. Update on Status of Flathead Catfish and Asian Swamp Eel (David Keller, Patrick Center for Environmental Research, Academy of Natural Sciences)

David Keller, Patrick Center for Environmental Research at the Academy of Natural Sciences, gave an update on the status of flathead catfish and Asian swamp eel in the Susquehanna and Delaware River drainages. David mentioned the article "Implications of *Pylodictis olivaris* (Flathead Catfish) Introduction into the Delaware and Susquehanna Drainages," (Brown et al., 2005) which appeared in *Northeastern Naturalist 12(4)*. This article gives background on flathead catfish introductions in both drainages.

Flathead catfish were first found to be reproducing in the lower and central Susquehanna River in 2005. They now inhabit approximately 65 river miles from Harrisburg to the Pennsylvania/Maryland border. There is a high density of fish in the stretch from York Haven Dam to Holtwood Dam, and low density above York Haven Dam. Various fishing reports have noted increased targeting of these fish by anglers.

The first documented sighting of flathead catfish in the Delaware River drainage was in 1997 at Blue Marsh Reservoir. Currently, their range has expanded to the entire mainstem Delaware River (approximately 220 miles). However, there is no documentation of them being found in tributaries in the state of Delaware.

David mentioned that there is no direct monitoring of flathead catfish. Habitat use, movements, population characteristics, and impacts on other species such as shad, trout, and American eel are largely unknown.

Asian swamp eel (*Monopterus albus*) is a new invasive species of concern in the Delaware River Basin. None has been found in the Susquehanna River Basin. Asian swamp eels are native to Southeast Asia, and have been found in Florida, Georgia, and Hawaii. These eels are hermaphroditic and can tolerate low dissolved oxygen (DO). They tolerate brackish water, can burrow in the mud, and are difficult to capture during electrofishing. Rotenone is not an effective means of control because the eels can surface and breathe air.

Asian swamp eels were first documented in 2008 in Silver Lake in the Cooper River drainage system. There were no occurrences in downstream impoundments when sampled in 2008. During summer 2008, 47 eels were collected by backpack electrofishing in Silver Lake, but only 18 were collected in summer 2009. The New Jersey Department of Fish & Wildlife is

developing a removal plan. Over 500 eels have been removed throughout New Jersey in two years. These eels have been known to feed on fish, crayfish, frogs, turtles, and invertebrates, but their ecological impact is still relatively unknown.

F. Lunch

Sherm Garrison, MDNR, gave a brief update on invasive species issues in Maryland. There have been no zebra mussel sightings since the 2008 samples were found. Rusty crayfish have been found in the Conowingo Pool. Signs have been posted in several areas asking anglers not to use these crayfish as bait, and not to dump their leftover bait into the water. The northern clearwater crayfish and the mimic shiner are two invasive species that are making their way down the Susquehanna River towards Maryland. Maryland has found a few instances of didymo algae (*Didymosphenia geminata*, also known as "rock snot") in the Gunpowder River and Savage River areas. The state is continuing to survey areas for didymo and golden algae as well. Maryland is discouraging the use of felt soled waders and encouraging anglers to use rubber soled waders instead. Wader wash stations have been set up in some areas to help clean boots. Northern snakeheads have been found in the state, mostly in the Potomac River. Maryland passed a law stating that no one may possess a live snakehead (i.e., people must kill the fish if they catch them).

G. Predicting Climate Change Impacts on Aquatic Invasive Species (AIS) in Pennsylvania (Sara Grisé, PA Sea Grant)

Sara Grisé, PA Sea Grant, gave a presentation describing the prediction of climate change impacts on AIS in Pennsylvania. There has always been a natural cycle of warming and cooling, but since the start of the Industrial Revolution in the 1800s, the climate has begun to warm at a more rapid and unpredictable rate. Human sources are the most likely cause of more than 50 percent of the increase in global average temperatures. Even if we were to eliminate anthropogenic emissions completely, greenhouse gases such as carbon dioxide, methane, and nitrous oxide could persist for tens of hundreds of years.

The Intergovernmental Panel on Climate Change (IPCC) has identified seven potential scenarios associated with global warming. Sara described three of them: high (A1), medium (A1B), and low (B1). The high (A1) scenario would be "business as usual," with rapid economic growth and fossil-fuel intensive technologies. Pennsylvania contributes 1 percent of the world's emissions, and is third in the U.S. (after California and Texas). This high scenario could lead to a 5 degree change in temperature by 2100.

The medium (A1B) scenario also assumed rapid economic growth, but with newer and more efficient technologies. Under this scenario, there would be a balance between fossil and non-fossil fuel technologies. In the medium scenario, there is a possibility of a 3.5 degree F rise in temperature by 2100.

The low (B1) scenario assumed a reduction in material intensity and an emphasis on global sustainability. Energy sources would be focused on efficiency and less on fossil fuels. However, there would still be a 2.5 degree F increase in warming under this scenario.

There will be climate change impacts on Pennsylvania. Average daily temperatures are expected to increase 2.5 degrees F between 2010 and 2039. Precipitation is expected to increase by more than 5 percent seasonally (less in the summer, more in the winter). Even with this extra precipitation, Pennsylvania is expected to get warmer and drier because precipitation amounts will not be enough to compensate for the warming. The number of snow-covered days in the state is expected to decrease, affecting winter recreation and Concord grape crops. Severe storm events and flooding are also expected increase.

Sara said that the combination of climate change and AIS invasions may create one of the greatest environmental threats of our time. She is currently working on her thesis, which is called "A Framework for Evaluating Risk of AIS Range Expansions in a Changing Climate for Pennsylvania." Her work addresses new challenges for invasive species management.

Direction and rate of spread are important factors in determining adaptive management options. Current Pennsylvania AIS management tools do not account for future climate changes. Sara is posing three questions: (1) How vulnerable are Pennsylvania's ecosystems to species movement and introduction under various climate scenarios; (2) Can climate projection models help us predict range expansions of AIS; and (3) How will these ranges shift under the different climate scenarios and can we track and map this visually?

Sara took a random, taxon-stratified sample of species (fish, plants, and invertebrates) from the USGS AIS database. Her requirements for species selection included the following: species not currently present in or north of Pennsylvania (or present in limited areas); no hybrids or intentionally stocked species; and species south of Pennsylvania that have the potential to move northward with climate warming. Her methods were to determine if sufficient information is available on temperature and moisture requirements, if the species is likely excluded from Pennsylvania due to climate as opposed to other factors, and whether various shifts in temperature or precipitation would allow the species to expand its range into Pennsylvania. About 34 percent of fish species in the USGS database fit the criteria, with 60 percent having information available on temperature tolerances. Twenty-seven percent of plant species fit the criteria, with 60 percent having information available. Finally, 33 percent of invertebrate species fit the criteria, with 50 percent having enough information available. .

Next, Sara will review the information on climate projection models, especially those that can be focused on Pennsylvania. She will see how the models relate to the three emission scenarios previously discussed. Then she will select three to five species that are representative of the different taxa for case studies. CLIMEX software will be used to assess overall invasion risk and prioritize destination-specific management actions. The model determines suitability of species to survive in certain areas based on parameters such as temperature, moisture, light, etc., and matches it with the projected climate (from weather station data in Pennsylvania).

Sara hopes to incorporate a component on climate change and risk assessment in the Pennsylvania AIS Management Plan. She also hopes to produce species-specific maps for each emission scenario and develop indices focused on those species of most concern. This will help identify areas that are of greatest risk of invasion. Sara hopes that this research will help to describe and map the potential distribution of invasive species; enable resource managers at the state and local levels to make rational decisions about invasive species management and control; and provide a framework for predicting future ranges of additional species not used in this analysis.

H. NYSDEC's Perspective on Aquatic Invasive Species Management Plans (Steve Sanford, NYSDEC)

Steve Sanford is Director of the Office of Invasive Species Coordination (OISC) within the New York State Department of Environmental Conservation (NYSDEC). New York's AIS actions are guided by a 2005 Task Force report, a Council, and an Advisory Committee. Funding for invasive species work has been provided through the state Environmental Protection Fund since 2005. The Task Force report recommends the following actions: formalizing New York State invasive species policy and practice, coordinating and streamlining regulatory processes, and influencing Federal actions to support invasive species prevention, eradication, and control.

New York has several new regulatory approaches to help control the spread of invasive species, including stricter requirements for the use of bait fish and firewood. Quarantine procedures are in place for controlling the spread of Asian long borer and emerald ash borer. However, New York does not have comprehensive laws to prevent the introduction of invasive species as a result of boat transport. Ballast water is also another problem, and the Coast Guard has developed draft regulations and discharge standards. Steve believes these standards should be developed and applied at national and international levels.

The Aquatic Nuisance Species (ANS) Management Plan focuses on prevention. Non-regulatory approaches include outreach, monitoring, and Best Management Practices (BMPs). Regulatory approaches include general permits and commerce restrictions (such as importing and selling species, etc.). New York prefers to work with the regulated parties on right-of-ways for utilities and pipelines, natural gas well drilling, and wind farms. OISC wants these parties to prepare invasive species management plans as part of the permitting process.

Water withdrawals can be a potential pathway for the spread of invasive species, particularly if it is moved to a different waterbodies. New York is concerned with Chinese mitten crab, didymo, spiny waterflea, and water milfoil. Each invasive species has different pathways for transport, so preventing the spread of AIS is a challenging issue.

OISM would like to create an official list of invasive species, and has initiated work on a comprehensive list. The focus would be on purposeful introductions in commerce such as nurseries, food, pets, etc. Interim lists are not yet formally promulgated, but include widely-recognized invasive species in an effort to help inform managers and permitting authorities. One

way to decrease the likelihood of AIS transfers is to get people to look at invasive species in the same way as pollutants. However, invasive species can be worse than pollutants because they are alive and can reproduce. OISM recommends that people adopt the HACCP (Hazard Analysis and Critical Control Point) Approach. This approach originated in the food industry and could be used as a system analysis, and is described in greater detail below.

I. Additional Discussion Regarding Development of AIS Management Plans (Jennifer Hoffman, SRBC, and Mark Hartle, PA Fish and Boat Commission)

Jennifer Hoffman, SRBC, and Mark Hartle, PA Fish and Boat Commission, led a discussion regarding development of AIS management plans. Mark described HACCP (Hazard Analysis Critical Control Point), which is "a systematic preventative approach to food safety and pharmaceutical safety that addresses physical, chemical, and biological hazards as a means of prevention rather than finished product inspection." The principals are as follows: (1) Conduct a hazard analysis; (2) Identify critical control points; (3) Establish critical limits for each critical control point; (4) Establish critical control point monitoring requirements; (5) Establish corrective actions; (6) Establish record keeping procedures; and (7) Establish procedures for ensuring the HACCP system is working as intended.

Mark explained how the HACCP system could be applied to natural gas development projects. There are several critical control point risks (CCPRs) to consider. A contaminated source could lead to the potential spread of AIS where present in source water/watershed. Incoming equipment could cause a potential spread of AIS if contaminated (e.g., infected with AIS from other states). Transportation and transmission could spread AIS through leakage or discharge of water to and from the sites. Storage such as frac tanks and impoundments could spread AIS from contaminated water. Disposal is also a CCPR because contaminated waste could spread AIS or create conditions favorable for AIS (e.g., golden algae liking high total dissolved solids like chlorides).

Mark and Jennifer developed a worksheet (Attachment B) to help facilitate the AIS management plan discussion. Meeting participants brainstormed ideas on critical control points and control measures and assigned priority levels to each one. Jennifer will send the worksheet out to the committee for further review and comments.

J. Activities of Others and Open Discussion (All)

Jennifer and Mark will send out the worksheet mentioned above to the committee members. Dave Heicher will check on SRBC GIS mapping activities for AIS, and will identify coverages that have already been completed and ones that could potentially be created. Dave will send out the meeting minutes and suggest dates for the WQAC fall meeting.

Attachment A

Participant List

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HACCP Concepts & Development of Aquatic Invasive Species Management Plans Worksheet – Draft 2 (June 30, 2010)

Priority	Critical Control Point / Control Measure	Application (Local, regional or basin)
High	**1. Source of Unknown AIS Presence** Risk: Potential spread of aquatic invasives where present in source water/watershed	
	Control measure(s): • *Require disinfection if uncertain about AIS presence; site-specific disinfection if AIS presence known* • *Dedicated withdrawal equipment to site* • *Preclusion of withdrawal if an AIS hotspot* *Other Concern: potential concern re: disinfection materials (i.e., chlorine, hot water) – spills, safety*	
High	**2. Incoming Equipment** Risk: Potential spread of AIS through use of contaminated equipment new to the job	
	Control measure(s): • *No equipment from out of state crosses the border without certified inspections* • *Inspection stations at state line* • *Disinfection at state line or river basin boundary – certified for single or multiple cooperating jurisdictions* • *Regulatory agency makes decontaminated equipment a condition of the permit* • *Inspection process as a contracted service or government run service*	
High/Low	**3. Transportation/Transmission** Risk: Potential spread of AIS through leakage/discharge during transport	
Depends	*Control measure(s):* • *Disinfect at the source of withdrawal* • *Use high density plastic pipelines or other heavy-duty materials* • *Marking decontaminated water by dye* • *Use of groundwater sources, especially in areas of heavy AIS infestation* • *Use of pipelines v. trucking* *Other concern: pipelines leaving impoundments (risk of recontamination?); frac tank cleaning stations; Upper Susquehanna Coalition did a study for Millenium Pipeline and found that anything in the water was dead at the end of the testing process*	

Low?	**4. Cross contamination** Risk: Potential transfer & distribution of AIS through cross contamination of equipment	
	Control measure(s): Disinfect at the source of withdrawal *Other concern: frac tank cleaning stations; gravel trucks passing between NY and PA often have water in the beds (are we concerned about these too? – is it capricious to be concerned about only equipment for natural gas development?)*	
Medium	**5. Storage** Risk: Potential spread of AIS from contaminated stored water	
	Control measure(s): • *Storing water in frac tanks instead of impoundments* • *On-site placement of frac tanks – hatches/valves on tanks should be visible for inspection* • *Berming sites to contain spillage* • *Careful inspections of the integrity of the liner or storage solution* • *Combination of a variety of measures as required industry-wide BMPs* *Other concern: frac tank cleaning stations*	
Medium	**6. Disposal** Risks: Potential spread of AIS through disposal of contaminated waste Creation of conditions favorable for AIS through waste disposal (e.g. elevated Cl-)	
	Control measure(s): • *Strict requirements for reuse of water* • *Water quality criteria/wastewater requirements should reduce the creation of conditions favorable for AIS* *Other concerns: Is AIS death by injection valid?; need to research if AIS can survive hydrofracing; concern that discharging contaminated water through wastewater disposal facilities could aid in spread of AIS*	
	7. Other (specify) Field inspectors and biologists crossing watershed boundaries	
	Control measure(s): • *Need for state/agency disinfection plans for equipment/waders/etc.*	