CHESAPEAKE
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A 252-acre property on the edge of Fones Cliffs will be preserved from development and transferred to the U.S. Fish and Wildlife Service this month. The dramatic cliffs along the Rappahannock River are referenced in explorer Capt. John Smith's journals from 1608 and were the site of Smith' interactions with local tribes. (Dave Harp)

Fones Cliffs property to be preserved

≈ Conservation efforts hit a milestone for Virginia site, ecologically valuable and sacred to the Rappahannock Tribe.

By Whitney Pipkin

For more than a decade, an empty blue house perched on the edge of an otherwise houseless sweep of cliffs along the Rappahannock River loomed as a symbol of its future — which included plans for two housing developments in an ecologically and historically significant area of Virginia's Northern Neck. But, when the U.S. Fish and Wildlife Service completes its purchase of that Fones Cliffs property this month, dismantling that house will be among the first priorities.

In its place, a different story about the generations of people and wildlife who have lived around these 100-foot cliffs has already begun to emerge. Conservationists hope that narrative will persuade neighboring landowners — one of whom filed for bankruptcy on its development project in May — to consider conservation, too.

Since purchasing the property at the end of 2018 from longtime owner Terrell Bowers, The Conservation Fund has been preparing to transfer it to federal hands this month. If all goes as planned, its 252 acres of forests, fields and deep ravines will become part of the Rappahannock River Valley National Wildlife Refuge, protecting habitat for one of the largest concentrations of bald eagles in the country while adding to the refuge's 9,000 protected acres along the Northern Neck.

But not every acre is created equal, and the few that cozy up to the edge of those breathtaking cliffs — offering panoramas of the river's curves below — are the ones conservationists are most eager to protect.

"The fact that other people are going to be able to come out here and see and understand this landscape is so important," said Heather Richards, The Conservation Fund's Virginia state director and program manager,

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Biologists fear catfish spread after last year's record deluge

≈ Decades after introduction, the species is a boon for some anglers, but worries about impact on other species remain.

By Karl Blankenship

Last year's record-setting rainfall brought more into the Chesapeake Bay than pollution and debris. Biologists say the freshwater deluge helped the non-native blue catfish, which was already invading the estuary, to spread farther in the region's rivers.

"The gate is open," said Martin Gary, executive director of the Potomac River Fisheries Commission. "They have left and dispersed everywhere."

Blue catfish, which can grow to lengths of 5 feet, were released into Virginia's Bay tributaries in the 1970s as part of an effort to build a sport fishery.

Since then, they have reached numbers beyond what anyone imagined in rivers from the James to the Potomac, and they had begun spreading to other places in recent years. Biologists and state fishery managers had hoped to stem further expansion, fearing harm to native species such as blue crabs, yellow perch and white catfish.

Those hopes were washed away with 2018's persistent rain. Blue catfish prefer fresh or slightly salty water, which somewhat constrains their movement into lower reaches of tidal rivers and the Bay itself. The heavy rain dramatically reduced salinities in rivers and most of the Bay, allowing the catfish to spread almost everywhere.

On the Potomac, blue catfish are generally found north of the Route 301 bridge. But last year, they spread throughout the lower river and beyond. A Baywide fish survey, which had never before found catfish in the main-

CATFISH CONTINUES ON PAGE 23

CHESAPEAKE BAY JOURNAL

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Correction

Sharp-eyes readers alerted us to a photo of a fish in the April issue that was mislabeled as a walleye, but it was a pickerel.

In the May issue, a photo showing equipment in a farm field was described as a spreader for commercial fertilizer but the process under way was seeding.

The Bay Journal regrets the errors.

Editor's Note

Bay Journal, staff receive awards from peers, Jug Bay

We're pleased that three *Bay Journal* staff members won awards from the Maryland/Delaware/District of Columbia Press Association in its annual contest for excellence in journalism. Our work was judged in a category for large nondaily newspapers, and our writers were recognized for the following work that they produced in 2018:

- *Tim Wheeler:* 1st place in the general news category for his reporting on Ellicott City, where stormwater-related flooding is becoming more severe and frequent.
- *Jeremy Cox:* 2nd place in the general news category for his reporting on Smith Islanders putting their faith in both God and $6.9 million jetties, as a bulwark against the rising tides that threaten their island.
- *Tim Wheeler:* 2nd place in the investigative news category for his reporting on the dramatic falloff in the planting of streamside forest buffers — one of the most effective runoff controls — across the Chesapeake watershed.
- *Jeremy Cox:* 1st place in the public service category for his reporting on the ultimately successful effort to keep the Eastern Neck National Wildlife Refuge open to the public in the face of budget cuts.
- I won 2nd place in the environmental reporting category for my package of stories about the region's efforts to meet its 2025 nutrient reduction goals.

We appreciate the recognition and extend our congratulations to all of the other winners for their work last year.

Friends of Jug Bay Jug Award

We were greatly honored by Maryland's Friends of Jug Bay when their organization recognized our work with an award at their annual meeting in April.

The Jug Bay Award, fittingly, is an actual — and really cool — hand-crafted ceramic jug, given in recognition of the *Bay Journal's* work since 1991 in informing the public about issues facing the Chesapeake.

The Friends of Jug Bay is a nonprofit group of citizens and citizen-scientists who work to preserve the Jug Bay Wetlands Sanctuary and support its education and research programs. We greatly appreciate the honor — we just need to figure out how to share the jug amongst our dispersed staff!

— Karl Blankenship

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Clockwise from left:

Nihal Dennis, a student at Virginia's George Mason University, holds plastic collected from the Occoquan River during a trash trawl on May 10. More study is needed to determine the effects of plastics, especially microplastics on waterways and their inhabitants. See article on page 10. (Whitney Pipkin)

A ruby-throated hummingbird. To learn about Pennsylvania's project to create pollinator habitat along roadsides, see article on page 13. To test your knowledge about ruby-throated hummingbirds, see quiz on page 38. To learn what plants to add to your garden to attract hummingbirds and other pollinators, see Bay Naturalist *on the back page.(Bill Buchanan / U.S. Fish and Wildlife Service)*

The annual winter dredge survey provides insight on the Bay's blue crab population, which grew during 2018 despite record rainfall. See article on page 9. (Dave Harp)

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RiverSmart helps turn home sweet home into home sweet watershed

By Laura Todd

Standing in a forested wetland, you are surrounded by native sweetbay magnolia (*Magnolia virginiana*) trees. The sweet, lemony scent of magnolia blooms fills the summer air. You are lucky to bear witness to a rare plant community — the magnolia bog.

The National Park Service has determined that only 13 of these wetland areas, rich with clusters of native magnolia trees, remain in the Atlantic Coastal Plain. Four of these 13 exist within the boundaries of Oxon Run Parkway, a 126-acre forest in the District of Columbia that is managed by the National Park Service.

The survival of magnolia bogs, though, is threatened by habitat fragmentation and other stressors associated with increasing urbanization. Oxon Run, the stream for which the parkway is named, flows across the entire width of the urban park and is a tributary of the Potomac River. The run's watershed is roughly 12 square miles, originating in Prince George's County, MD, before flowing into the District via the parkway.

More than 50% of the Oxon Run watershed is developed. Residential use counts toward the majority of that development. This increase in development creates a larger footprint of impervious surfaces, which contribute to increased volumes of stormwater runoff as well as the degraded quality of that runoff. According to the Chesapeake Bay Program, stormwater runoff is the fastest-growing source of pollution impacting the Chesapeake.

Oxon Run, a tributary of the Potomac, is the object of efforts to reduce stormwater runoff through the RiverSmart Homes Program. (District of Columbia Department of Energy and Environment)

In the Oxon Run watershed, the Asheford Court neighborhood is a successful model of residential stormwater mitigation. The overwhelming majority of homes in the loop-shaped neighborhood have at least one best management practice installed through the River-Smart Homes Program, a partnership between the Alliance for the Chesapeake Bay and DC's Department of Energy and Environment. The program helps DC residents install numerous BMPs: rain barrels, rain gardens, BayScape gardens, shade trees, permeable pavement and impervious surface reduction.

Because the Oxon Run watershed is entirely within the District's Municipal Separate Storm Sewer System, or MS4, everything that enters a storm drain — water, trash, sediment, pet waste or other pollutants — goes directly to the local waterway without treatment. These and other on-the-ground efforts from area residences are imperative to reduce the total volume of stormwater runoff.

ALLIANCE for the Chesapeake Bay

There has not yet been the same level of involvement in Ward 8 outside of the Asheford Court neighborhood, but the increased participation in the River-Smart Homes Program there is indicative that there is opportunity for growth.

The Alliance and DOEE are leading a free walking tour of RiverSmart Homes at 10 a.m. Saturday, June 15. All are welcome to take the tour, which begins at Malcolm X Elementary School. Its goal is to educate local residents about stormwater and engage them in practices at their homes to make a difference in their watershed and community.

Attendees will get a close look at numerous best management practices that their neighbors have installed. They can also participate in a question and answer session with DOEE auditors and a tree identification and maintenance workshop with arborists from Casey Trees.

A limited number of DOEE Storm-water Audits will take place at homes in the neighborhood. In addition, partici-pants will be able to mark storm drains to remind their neighbors that these drains go directly to their local stream. Activities for children will be available, too.

This event is made possible through a partnership with the Asheford Court Homeowners Association. While residential stormwater mitigation is gaining local traction in the Oxon Run watershed, additional planning is also in effect to restore the stream itself.

In the District, challenges to future restoration projects include roadway crossings and nearby sanitary sewer pipes. While formal restoration efforts have yet to take place, the planning process is under way. A few years ago, the DOEE and the U.S. Army Corps of Engineers completed a flood study to determine whether nearby properties would be negatively impacted by the removal of a concrete channel. The channel, in southern portion of Oxon Run, was constructed in the 1960s to alleviate nearby flooding issues. Ideally, all of the concrete will be removed in favor of restoring a more naturalized stream channel and surrounding landscape.

Josh Burch, a watershed protection specialist at the Department of Energy and Environment described a restored Oxon Run as having "a low, wide floodplain bench so that when storms come in and water levels rise, flood flows have room to spread out." He said that while the site certainly has its design challenges — it is adjacent to an old firing range and has a flood control dam overcome with sediment — there are also plenty of design opportunities. When restored, Oxon Run should be a vibrant natural area with increased opportunities for recreation, including fishing.

Not everyone resides within a stone's throw of a rare magnolia bog, but we all have a part to play in protecting our local waterways. Increased rainfall is exacerbating the harmful effects of stormwater runoff, and the streams and tributaries of the Chesapeake Bay are feeling the consequences. In the District, the Oxon Run watershed has long been subject to this and numerous other environmental challenges.

But for the magnolias and the communities near the stream, there is opportunity in Oxon Run.

Laura Todd is a program coordinator for the RiverSmart Homes Program.

Impact of voluntary Clean Marina program hard to gauge

≈ Participants pick which best management practices to use in an effort designed to head off potential mandatory regulations.

By Jeremy Cox

Marinas, boatyards and yacht clubs across the mid-Atlantic have joined an effort to curb water pollution: the Clean Marina program.

The title, awarded by marine officials in 32 states, is reserved for facilities that take steps to reduce contaminants from boats and boatyards that would otherwise foul the waters beneath their docks. Participants affix specially designed logos to their brochures and websites and fly flags that boaters can easily spot from the water.

The program grew out of Congress' 1990 update of the Coastal Zone Management Act. Instead of handing down more regulations, the National Oceanic and Atmospheric Administration and U.S. Environmental Protection Agency partnered to oversee a voluntary, state-managed cleanup of the marina industry.

The first Clean Marina program took effect 20 years ago — in Maryland. Elsewhere in the Chesapeake Bay watershed, initiatives in Delaware, New York, Pennsylvania and Virginia were all operating by 2006. Although the campaign has improved stewardship practices at many facilities, their measurable impact is largely unknown.

Pat Shugars at Knapps Narrows Marina bags large pieces of shrink wrap into bags for recycling. The plastic material is used to cover boats in the winter. (Dave Harp)

A marina is a potential hotbed for water pollution. In many cases, it's a one-stop shop where boaters can pressure-wash and paint their hulls, pump out sewage tanks and gas up their engines at fuel pumps. Copper, zinc, mercury, nutrients, untreated sewage and other harmful contaminants have been traced to those and other marina activities.

There's little margin for error, too, because marinas lie directly on and beside the water, giving pollution a direct path to waterways. The facilities also tend to be enveloped by impervious surfaces — asphalt parking lots and concrete boat ramps — that don't absorb or filter pollutants.

To become certified in Maryland, facilities implement a number of "best management practices" outlined by state officials in the *Maryland Clean Marina Guidebook*. The practices include steps such as locating maintenance areas "as far from shore as possible," "discouraging" underwater hull cleaning, avoiding the use of creosote-treated wood and planting vegetation around parking lots.

Facilities are inspected every few years to ensure compliance in each state. But, in part because the program is voluntary, there is virtually no tracking of how water quality responds to the activities undertaken by marina owners. In Maryland, stormwater discharge permits — a regulatory requirement — trigger quarterly monitoring at marinas, but the tests consist of "visual inspections" performed by a marina employee.

Scholarly databases display little research on the subject. One of the

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few researchers who has examined the Clean Marina program said he struggled to find a journal publisher interested in his article.

"I had to frame [marinas] as a transportation hub," said Bill Ritchie of James Madison University in Harrisonburg, VA.

Even if the Clean Marina program's environmental benefits were more clearly understood, the modest number of participating facilities has likely watered down its impact. About 25 percent of Maryland's 600 marinas and their brethren have become certified. In Virginia, the rate is at most 20 percent of its 350–400 facilities.

Asked how he gauges the program's performance, Peter Hall, a former marina owner who has been managing Virginia's program since its director stepped down eight months ago, points to testimonials.

"A lot of that stuff is not tracked," he said. "But I think you have to be sort of observing it from the [perspective of] guys who are on the inside, the marina owners. They're seeing increases in their customer base. The boaters are coming in because the marina is clean. It's neat and well kept."

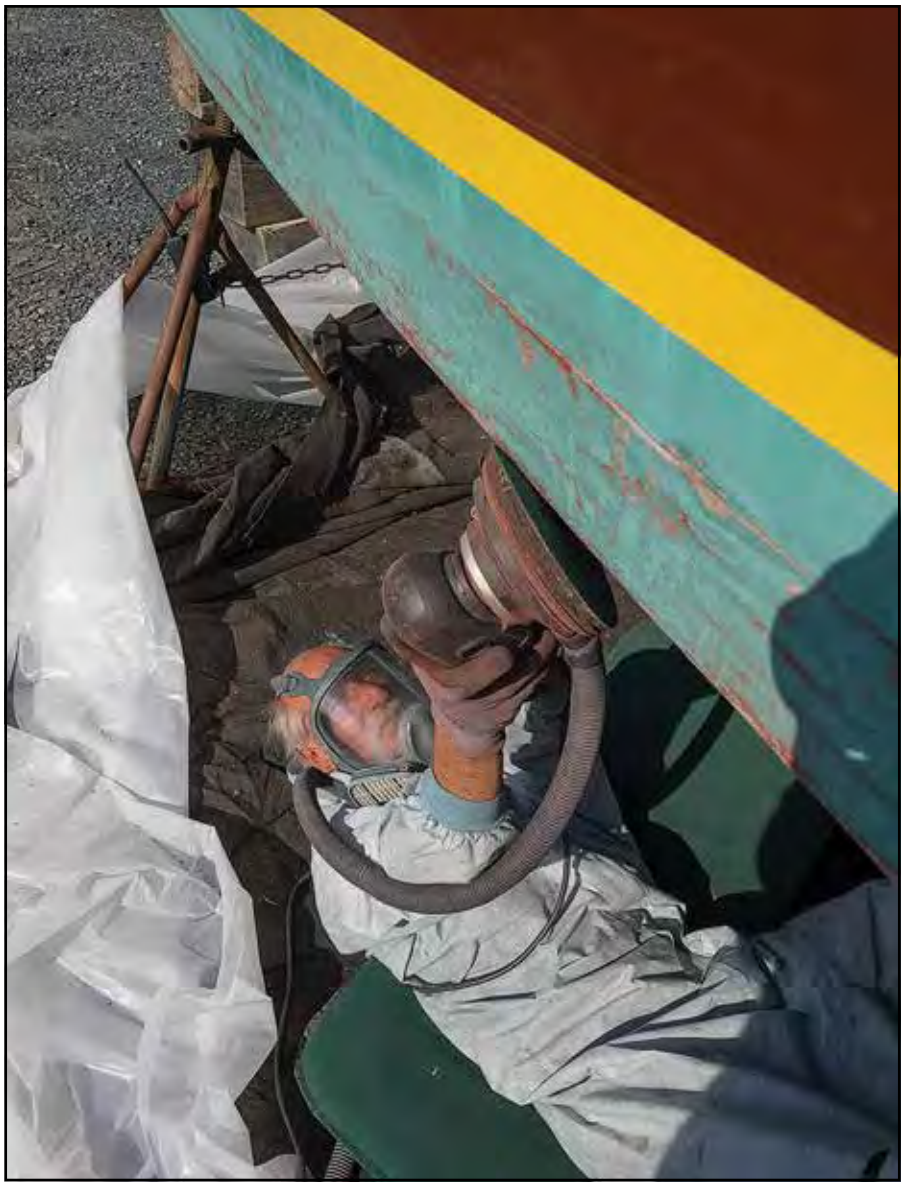
Like Hall, many participants describe the program's returns in both financial and environmental terms.

"People know if you're certified you're going to be a decent marina," said Emily Fletcher, office manager at Bay Boat Works in North East, MD, an early adopter of the Clean Marina standards. The locally owned, 140-slip facility received about $100,000 in state grant money to bring itself up to the Clean Marina standard in 2002.

Bay Boat Works spent about a year making necessary upgrades. Owners Don and Mary Green bought a boat whose sole purpose was to meet vessels in the water and pump out their sewage holding tanks. They placed a sewage pump-out system on its docks and installed a cloth-lined drain to capture wash water. And staff members devoted countless hours to environmental training.

"It was nice to be green," said Mary Green, adding that it allowed the facility to get out in front of future water quality mandates. "You could see the writing on the wall: These regulations were going to be enforced one way or the other."

In 2011, for example, Maryland began requiring marinas to capture and process the wastewater discharged by pressure-washing boat bottoms if it was too polluted to begin with. Today, all but a few have either installed systems that loop the wastewater back through the washer or rout the water into public sewer drains.



At Knapps Narrows Marina, Joe Bradley uses a vacuum-assisted sander that keeps dust from toxic paint on the boat's bottom from becoming airborne. (Dave Harp)

Knapp's Narrows Marina in Tilghman, MD, was ahead of the curve. It began catching the pressure-washing water long before the requirement went into effect. Becoming a Clean Marina was about more than a logo, said Pat Shugars, the marina's general manager.

"We didn't like all the waste that was going on," he said, adding that he hopes other marinas make the effort to get certified as well. "It's time for people to wake up and say, 'If you want crabs and you want oysters, you'd better watch what you put in the water.'"

Not everyone is impressed by what the program offers, though. Norm Turner, owner of Horn Harbor Marina in Port Haywood, VA, said he doesn't see the need for voluntary actions when those prescribed by government stormwater and wastewater permits are already strong.

"Yeah, it's a sticker or stamp that says you abide by these guidelines," he said, "but the truth is marinas abide by their own stringent standards to begin with."

In 2001, EPA researchers investigated water quality at five marinas on Lake Texoma on the Texas-Oklahoma border, focusing on MTBE, a gasoline additive suspected of causing cancer in humans.

They discovered that the chemical appeared in the water only from May to October, a period coinciding with the boating season. Samples taken of water beneath the boat docks turned up with the most detections, suggesting the spills typically occurred upon engine startup, they said.

That issue is less glaring today, though. Statewide bans and gas companies' concerns over legal liability have largely phased out the use of MTBE in gasoline.

In 2018, a study of hundreds of Florida beaches led by University of Miami researchers found that those with nearby marinas were more prone to levels of fecal bacteria high enough to trigger swimming advisories or closures. And an Australian paper in the late-1980s suggested marinas could have a "major impact" in sediments from the buildup heavy metals and petroleum hydrocarbons but concluded that the levels were "similar to those in other areas affected by human activity."

Studies on Clean Marina programs are rarer still. In Ritchie's case, the topic rests at the intersection of two of his greatest passions: sailing and quality management in the commercial sector.

In a 2017 article for the journal *Transportation Research*, Ritchie and two colleagues looked at the traits of participating marinas in Florida's program. The state has signed up 325 marinas, about 16 percent of the total number of facilities.

The early adopters tended to be those located within a cluster of marinas, they found, suggesting a bandwagon effect. The state has created a Clean Marina flag (complete with a pelican silhouette) that facilities can display, signaling to passing vessels their participation in the program. For some customers, that may be the deciding factor that makes them stop at one marina over another, the management professor said.

Marinas located in areas with a lower concentration of competition had less incentive to stand out from the crowd and were slower to get on board, if at all, he said.

The phenomenon his team observed underscores a larger issue with such voluntary initiatives, Ritchie added. "What we have is a public benefit, not a private benefit," he said. "That's a big question for business owners: 'What's in it for me?'"

Officials in Maryland and Virginia are careful to highlight the potential marketing benefits while making their case for the program to potential applicants. Both offer "Clean Marina" flags business can fly and logos they can weave into their advertising materials. Both also list participating marinas on their official websites. Improvements can also result in insurance premium savings, officials say.

To sweeten the deal, Virginia has partnered with marina trade groups to offer 5 percent discounts to participants in conferences and training workshops. Newly added Maryland marinas receive a certificate signed by the governor, lieutenant governor and the secretary of the Department of Natural Resources. A press release issued statewide announces their inclusion, and they can attend an annual awards ceremony for new members.

Donna Morrow, who manages the Maryland Department of Natural Resources' program, said those who participate generally are the ones who already pride themselves on being clean facilities. She would like to see more join, but she doesn't expect significant growth to occur.

"It would be great to have more, but it's a voluntary program," Morrow said. "It's up to these businesses that are often small businesses with competing priorities."

Atlantic white cedars helped to build nation, now need help rebuilding their population

≈ As sea level rise is quick to take over trees' habitat, efforts to replant saplings are slow to take root.

By Jeremy Cox

A flock of sixth-graders fanned out across a field pocked with thorny vines and a curious congregation of evergreens.

"I've got two more trees!" called out Travis Anthony, a crew leader with the Maryland Conservation Corps. "Who wants them?"

"Trees" was putting it politely. These reedy specimens looked more like Christmas trees that only Charlie Brown could love. Nonetheless, two girls immediately thrust their hands into the air and were soon nudging the lower extremities of their saplings into the soft earth.

In this swampy furrow, surrounded by pine plantations and chicken farms on Maryland's lower Eastern Shore, re-establishing a landscape of Atlantic white cedars has been the top order of business for 10 years. The Nature Conservancy, which owns and manages the 15,000-acre Nassawango Creek Preserve, partners with the National Aquarium in Baltimore to connect schoolchildren with nature by having them plant thousands of cedar seedlings at the site.

From Maine to Mississippi, the fragrant conifers are disappearing despite restoration efforts like the one at Nassawango. Since European settlers arrived in what is now the United States, fires, hurricanes, urban sprawl and poor forest management have conspired to wipe out at least three-quarters of the stands that Atlantic white cedars once dominated.

Now, experts say the tree that literally helped build the nation — look no further than the cedar shingles on the roof of Independence Hall in Philadelphia — faces a serious existential threat as rising seas push saltwater into coastal forests.

Luna Lorance, left, and Peyton Redmond, sixth graders at Berlin Middle School in Maryland, plant Atlantic white cedars in The Nature Conservancy's Nassawango Creek Preserve. (Dave Harp)

"We're sort of sitting on the edge of our seats waiting for the trees to die and the salt marsh to move in," said LeeAnn Haaf, a wetlands coordinator at the Partnership for the Delaware Estuary who has studied cedar landscapes for years.

To understand the severity of *Chamaecyparis thyoides*' plight, first check in with another prized timber species: *Pinus palustris*, or longleaf pine. Similar forces reduced its scope from 92 million acres to about 3 million. Alarmed conservation groups, landowners and regulators banded together in the 1990s to save the longleaf pine. The movement coalesced behind the Longleaf Alliance, a nonprofit that has planted thousands of acres of new stands while coordinating research conferences and promoting sustainable forestry.

Atlantic white cedars, though, began with only about 500,000 acres and now find themselves with about 100,000 acres left.

For more than two decades, organizers behind the Atlantic White Cedar Initiative have tried to emulate the alliance's strategy — with mixed success. Biannual conferences raised the tree's profile in academic circles, but little coordinated restoration activity followed.

The group has been inactive in recent years, said Eric Hinesley, a retired North Carolina State University horticulture professor. He joined the organization in the mid-1990s and writes most of the material for its website.

"We really haven't done anything or talked in the last several years," he said. "Our numbers are kind of shrinking."

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CEDARS FROM PAGE 7

Bob Williams is president of Pine Creek Forestry, a consulting firm based in New Jersey. His unofficial title could be the "Johnny Appleseed of Atlantic white cedar." He has worked with landowners to plant millions of cedars, primarily in his home state. But that's just a drop in the bucket compared to what's needed, he said.

"How do I compete with the loss of thousands of acres per year?" Williams asked.

He has grown frustrated with what he sees as a lack of top-down effort to bring the species back from the brink. Time is running out, he said.

"Overall, my feeling is this ecosystem is in deep trouble," Williams said. "What we have is a lot of people who say they're concerned, but they do nothing. We need to get on with it."

The species grows along a margin of coastline stretching up to 100 miles inland from the sea from southern Maine to north Florida and across the Gulf Coast as far west as Mississippi. Most can be found in the Pine Barrens of New Jersey and along the North Carolina coast.

Despite their name, white cedars are members of the cypress family. They're finicky, preferring moist, acidic soils. They can tower up to 75 feet tall, forming dense clusters, usually along streams with hardly any other tree types mixed in.

"It's like a cathedral," Williams said.

The cedar's decline, according to experts, can be traced to an endless string of setbacks. A resurgence of the deer population during the 1900s resulted in a seedling feeding frenzy. Many cedar stands thinned out because of too many wildfires — or too few. Others were converted to agriculture or suburban development.

The timber industry took perhaps the biggest toll. Aromatic and decay-resistant, Atlantic white cedar wood has historically been used for making everything from buckets and fences to channel markers and Adirondack chairs. Cut into shingles, white cedar helped 18th-century houses in Philadelphia and Wilmington, DE, withstand decades of mid-Atlantic summers and winters. Farther south, they were sawed and sanded into the hulls of shad boats that became the backbone of the Outer Banks's shad fishery.

For much of the industry's history, profits and expediency outweighed maintaining the health of the forests, Williams said. After the saws fell silent, there often weren't enough left to seed the next generation of trees.

"They just cut it and walked away, and sometimes it came back and sometimes it didn't," he said. "There was no effort to sustain the resource."

Deborah Landau, ecologist for the MD/DC chapter of The Nature Conservancy, is dwarfed by a stand of Atlantic white cedar. The trees were planted on the Nassawango Creek Preserve in Wicomico County, VA, 10 years ago. (Dave Harp)

The loss of white cedars reverberated across the ecosystem. Studies on their role in nature depict them as environmental superheroes. An analysis in the Great Dismal Swamp National Wildlife Refuge, which straddles the Virginia-North Carolina border, found twice as many birds in cedar stands than in the surrounding hardwood forest. In northern Florida, a sparse population of black bears showed its preference for cedars by slashing at the bark with their massive paws.

Restoring cedar's place in the coastal landscape isn't easy. A 1989 report prepared for the U.S. Fish and Wildlife Service prescribed a restoration process that involves felling all existing trees on a site and returning repeatedly to weed out unwanted sprouts. The report labeled such endeavors "costly" and predicted that they "will be decidedly limited in application."

That assessment has largely proved prescient. Take what happened at the Great Dismal Swamp. (About 20% of the refuge's land lies in the Chesapeake Bay's watershed.)

In 2003, Hurricane Isabel felled one the largest pure stands of white cedars in existence, downing a swath across 3,600 acres of the refuge, said Chris Lowie, the refuge's manager. The trees are highly susceptible to wind damage because of their shallow root systems.

The federal government hired a contractor to salvage the toppled trees, clearing space for a new generation to take root. But just weeks before the contractor's work was set to be completed in 2008, a wildfire scorched the area. Three years later, a second blaze burned it again.

The fires destroyed the mucky layer of decaying leaves and other organic matter, known as peat, on which white cedars thrive. The loss of peat lowered the land 3-6 feet. Most of the cedar's habitat inside the refuge is now permanently under water.

"Much of that area that was burned over now is a lake," Hinesley said. "It's a really sad legacy that there is no real mature white cedar left in the swamp."

Although they sprout along the coast, white cedars can't tolerate salt. So, the future of the species, Haaf said, depends on preserving and expanding stands farther inland, where they are unlikely to be poisoned by rising seas.

In Anne Arundel County, MD, environmental officials make sure to include white cedars in their plantings at stream restoration sites. "The state of the tree is such that incorporating it into restoration efforts is a good way to preserve the genome and get it more broadly established," said Erik Michelsen, head of the county's watershed restoration program.

At Nassawango preserve, the focus is white cedar.

"They've done a lot of site surveys here to know this is where they can survive," said Maura Duffy, conservation project manager with the National Aquarium. "Here's this tiny sliver of the Eastern Shore where they could possibly be."

The preserve lies roughly halfway between the peninsula's Chesapeake and Atlantic coasts, making it a relatively safe bet to survive at least several decades of rising waters. Another positive sign is the presence of fellow white cedars, though not nearly as many as there once were.

The restoration takes a herculean effort. First, the loblolly pines have to be cut down, and drainage ditches created for former tree farms have to be plugged, Duffy said. The idea is to create a swamplike footing where the trees can settle in with just the right amount of moisture. Once that's done, the Nature Conservancy installs a fence around the perimeter that will keep hungry deer at bay until the trees are about 8 years old.

Only then can the students take the field to plant the cedars.

Then comes the vigilance. Workers come out regularly to spray herbicides and remove stray tree species. Even so, some of the earliest restoration plots are dotted with pines and sweet gum. The cedars themselves appear to be thriving, with some reaching more than 15 feet tall, Duffy said.

So far, the effort has restored about 35 acres of white cedar forest.

But to remain a meaningful part of the U.S. landscape, thousands more acres will have to follow suit, experts say. And it's unclear whether there's enough will and resources to make it happen.

Chesapeake blue crab population grows despite 2018's rains

≈ Tougher regulations aimed at protecting females credited with increase in numbers.

By Jeremy Cox

Last year's never-ending loop of storms may have rattled the Chesapeake's ecosystem, but it didn't scuttle the estuary's blue crab population.

Results from the annual, Baywide winter crab survey, released May 6, showed a 60% increase in the crustacean's numbers over 2018. At 594 million crabs, it was the highest count since 2012.

"This is good news," said Ellen Bolen, deputy commissioner of the Virginia Marine Resources Commission, which regulates the fishery in the commonwealth's waters. "But crab stocks can vary like they have in the past, so we want to make sure we have a balanced plan going forward to ensure the stability of this resource."

Blue crab populations can vary widely from year to year, experts say, because they are heavily influenced by climate conditions. Young crabs spend the first several weeks of their lives drifting in the ocean after they are spawned during the summer and fall, and weather conditions greatly affect the number that return to the Bay.

A female crab dredged from the York River in Virginia during an annual winter survey displays a numerical tag placed on it by a graduate student at the Virginia Institute of Marine Science. (Dave Harp)

Genine McClair, blue crab program manager for the Maryland Department of Natural Resources, spent the winter worrying that the strong currents produced by last year's rain had pushed the juveniles too far out to sea.

Instead, their abundance nearly doubled, to 323 million, according to the survey. That figure is seen as a good omen for the crab harvest in late summer and fall.

In the meantime, there are plenty of adult crabs for watermen to dredge. A mild winter ensured better survival, producing an estimated 271 million adult males and females — a figure that is well above the 30-year average of 199 million crabs. The bonanza has already begun at one crab-processing company on Maryland's Eastern Shore.

"You've had more crabs come ashore this year than any year in 54 years," said Terry Vincent, owner of Lindy's Seafood in Dorchester County. "Nobody's seen this."

Last year's Baywide harvest was 2% higher than the previous year, the survey showed. Watermen hauled in 55 million pounds of crabs, which was on par with the totals from the previous four years.

The Maryland season runs from April 1 to Dec. 15. The Virginia season is from March 17 to Nov. 30.

The Virginia Institute of Marine Science and Maryland DNR have been conducting the survey since 1990. Investigators use crab dredges to sample blue crabs at 1,500 sites around the Bay during the winter, when crabs are typically buried in sediment and not moving.

To boost the number of crabs after a decade of paltry counts, management agencies since 2008 have imposed regulations offering greater protection to female crabs with the hope that more would survive and reproduce. The number of spawning-age females was estimated at 190 million in the most recent survey, well above the "minimum safe" threshold of 70 million crabs.

The survey's results offer "further proof and a shining example that our efforts to protect Maryland's blue crab population, while ensuring the health of our state's most important natural asset, have been successful," Maryland Gov. Larry Hogan said.

Microplastics are everywhere, but how do they harm the Bay?

≈ Stakeholders discuss studies, what's still needed to answer that question.

By Whitney Pipkin

Extremely small bits of plastic are everywhere, and the Chesapeake Bay is no exception. The so-called microplastics, often 5 millimeters or less in size, can be scooped from the surface waters of the Patapsco River and combed from the Bay's underwater grass beds.

Microplastics that originated as tiny beads in some face scrubs, soaps and toothpastes are now banned by federal law. But most microplastics begin in much larger pieces: chunks of litter and debris — water bottles, car tires and even plastic piers — that break down into increasingly smaller pieces but don't biodegrade for hundreds of years. Those plastic bits can leach chemicals or become a carrier of toxins and invasive species they pick up as they float through the water.

Scientists now know that single-celled organisms in the aquatic environment can easily mistake the smallest particles of plastics for food. Those bits then travel up the food chain, eaten by larger and larger fish that are eventually eaten by humans.

The Chesapeake Bay Program, a state-federal partnership that leads the Bay restoration effort, has identified microplastics as a contaminant of mounting concern. But, for all of the headlines and anxiety microplastics have generated, a looming question remains unanswered: What harm are they causing in the Bay?

The Bay Program Scientific and Technical Advisory Committee convened a two-day workshop in late April to begin finding answers.

"We might have an idea of the exposure, but on the effect side, we're not so sure," said Jerry Diamond, an ecotoxicology and risk management expert with the consulting firm Tetra Tech, at the outset the meeting.

"With a chemical, we can say that this concentration of copper has this effect, so if you have this much in the water it's not good," Diamond said. "For microplastics, we don't have that."

Research on microplastics and their impact is accelerating around the globe. Scientists know plenty already — though not all applies directly to the Bay or its suite of species. At the workshop, a consensus emerged that more work is needed to measure not just the presence but also the potential harm that microplastics cause when they're prevalent in the region's habitats, the bellies of fish and shellfish, and even drinking water.

Marcy DeLos and Nihal Dennis, both students at Virginia's George Mason University, fetch a plastic water bottle from the Occoquan River during a trash trawl on May 10. A workshop at the university's Potomac Science Center just downstream focused on determining the impact of microplastics in the Chesapeake Bay region's wildlife, habitats and humans. (Whitney Pipkin)

A student holds a rainbow-colored selection of small plastic pieces and microplastics picked out of the Occoquan River. George Mason University recently acquired equipment that uses lasers to identify types of small plastics, which lays the groundwork for further plastics research in the Potomac. (Whitney Pipkin)

Connecting data to action

A 2014 report on the presence of microplastics in four Chesapeake rivers appears to be the only peer-reviewed study of its kind in the region. Conducted by the University of Maryland's Lance Yonkos, and referenced throughout the workshop, the study confirmed that microplastics are more plentiful in surface waters near urban and suburban centers and after heavy rains — and they were found in all but one of 60 samples collected in the Corsica, Magothy, Patapsco and Rhode rivers in 2011.

Yonkos, who has continued to research the abundance of microplastics related to nearby land use, said at the workshop that his study generated as many questions as answers for him.

"Just because we found [microplastics] doesn't mean they came from there," Yonkos said. "We need to look more at transport to understand the source."

Researchers also are beginning to get results from a batch of samples collected from the Bay in 2015 by Trash Free Maryland. The nonprofit group worked with a lab at the University of Toronto to quantify and classify microplastics gathered from the water in 30 locations. They found the highest concentrations in waters near Baltimore and the District of Columbia. Most of the debris has been categorized as fragments from larger plastics, followed by fibers and films.

In 2017, students at Old Dominion University found that microplastics have the potential to carry harmful bacteria and human pathogens such as species of vibrio in the Elizabeth River.

While the scientific work continues, state and federal governments have begun taking action. The District of Columbia, for example, has charged a 5-cent fee for plastic bags since 2010. And this year, New York state enacted a ban on most single-use plastic bags. In 2015, Congress banned the microbeads used as exfoliants in some cleaning products and, this year, Maryland passed a ban on polystyrene foam food containers. Three jurisdictions touching the Anacostia River, including the District and Montgomery and Prince George's counties, had already passed bans on the products, commonly found in the river.

Since that first bag fee in 2010, several Bay states have considered similar measures. The Chesapeake Bay Commission, made up of legislative representatives from each state, has received questions about how the language of several disparate bills would impact Bay water quality and whether it could be improved. When the commission turned to the scientific community for help, it found a lot of gaps in the research, despite the fact that some jurisdictions were already passing related legislation.

"As a scientist, I thought that, to give people useful information for a piece of legislation, I had to have 95% certainty and all this data," said Denice Wardrop, a scientist at Penn State and member of Bay Program's Scientific and Technical Advisory Committee. "You don't. People are willing to use a legislative tool or management action at a lower level of certainty than we assume."

That sentiment became Wardrop's

PLASTIC CONTINUES ON PAGE 11

Plastic from page 10

mantra at the April workshop, where scientists grappled with the gap between what they know and what they still need to know about microplastics — and the need to generate a recommendation for the Bay Commission.

Next frontier

Growing evidence suggests that several species in the Bay and its rivers are ingesting microplastics from the water column or in other habitats. More work is needed — and some has already begun — to determine what impact the plastics could have on the health of fish, shellfish and the humans who eat them.

"We're never going to get down to zero plastics," said Kay Ho, a marine ecotoxicologist with the U.S. Environmental Protection Agency, who attended the April workshop. "But can we quantify how much is too much?"

Christine Knauss, a Ph.D. student at the University of Maryland Center for Environmental Science at Horn Point, is trying to answer that question for hatchery-spawned oysters. Existing research found that Pacific oyster larvae not only consume polystyrene microbeads but also experience impacts to their growth and reproduction because of it. Knauss wanted to see if the same is true for a Bay oyster species.

After including tiny plastic beads in the feed mix for *Crassostrea virginica* larvae, Knauss has so far found that the plastics seem to have an impact during their first six days in the larvae's system, before the larvae excrete most of the beads. During that period, the larvae had higher respiration rates and seemed to clear out their guts more quickly, though growth and mortality did not seem to be heavily impacted.

"I always get [asked] the question of whether [the beads] are actually inside the larvae," Knauss said, showing a video of the plastics, marked with fluorescent dye, swirling inside a tiny oyster. "They do eat them, and they do get into the gut."

Ben Rhodes, a junior in environmental and sustainability studies at George Mason University, paddles back with a haul of trash from the Occoquan River. Large and small plastics often break down into microplastics as they make their way to the Potomac River and the Bay. (Whitney Pipkin)

Knauss said more studies are needed not only in the lab but also in the field, where a combination of factors — from pollution and plastics to climate change and predation — impact the larvae's ability to grow.

Susanne Brander, a researcher at Oregon State University studying how microplastics impact black sea bass, agreed. Brander, while at the University of North Carolina, began a two-year project on the important East Coast fishery, which visits the lower Chesapeake Bay, where microplastics were found in 60% of black sea bass in the wild.

In the lab, she found that *Centropristis striata* larvae often discriminated between floating foodstuffs and microplastics — but the single-celled organisms they ate did not. She showed images of microscopic organisms vacuuming tiny plastics into their guts, where they remained when they were eaten by the sea bass.

So far, small black sea bass that consumed microplastics seem to have decreased immune responses and higher cortisol levels, which indicate stress. Their respiration does not appear to have been affected, Brander said.

"Quantifying mortality can be challenging in the lab," Brander said. "If you think about it, plastics are one more pressure added on top of many other pressures. We always say that more research is needed."

Bill Ball, executive director of the Chesapeake Research Consortium, said studies like these could be enough to trigger more policy changes in the watershed.

"We need evidence that it's clearly a pollutant and that it's harmful. Then society can look at how to reduce it," he said.

The District of Columbia and Maryland jurisdictions already remove thousands of pounds of trash from the Anacostia River each year under a federal pollution limit that is being rewritten. Trash removals like these and other voluntary programs help quantify where and how plastics enter the river, and they also chip away at removing the debris that's both an eyesore and a future source of microplastics.

Research on the impact of microplastics, though, has in some ways just begun.

Water treatment processes may come into play too, as scientists learn more about the presence of microplastics in drinking water. The Hampton Roads Sanitation District is working with the Virginia Institute of Marine Science to understand what types of microplastics might be making it through the plant's treatment process. That question seems more urgent now that the plant is infusing some of its processed water back into the aquifer, where it could become a drinking water source for the future.

Yonkos, the author of that sole Bay-focused microplastics report, is looking for microplastics inside worms and mussels in the Anacostia River to see if they could serve as markers of ecosystem health. He's also collecting sediment cores from Bay rivers that might now contain microplastics to compare with cores stored away in the lab from the early 1980s.

Even as the body of research around tiny plastics begins to grow, policy makers at the workshop encouraged the group to act quickly to apply new information. The flow of plastics to local waters isn't expected to ebb anytime soon.

"We don't want to wait another five years while these animals and habitats are getting clogged with more plastics," said Kimberly Grubert, a coastal planner at the Maryland Department of Natural Resources, at the close of the workshop. "We need a sense of urgency."

Report: 40% of PA rivers, streams violate water quality standards

≈ Farm runoff and acid mine drainage, followed by stormwater runoff, are three largest causes.

BY AD CRABLE

Pennsylvania's latest water quality report has found that 40% of its 85,000 miles of streams and rivers are violating the state's water quality standards in some way, with agricultural runoff and acid mine drainage mostly to blame.

That includes a stretch of the Susquehanna River, which flows into the Chesapeake Bay and has a major impact on the Bay's health. The 46-mile segment of the middle and lower river, which has been plagued with sick fish in recent years, was found to be impaired for aquatic life because of high pH levels.

The draft *2018 Integrated Water Quality Monitoring and Assessment Report* was released in May for public comment before submission of the final report to the U.S. Environmental Protection Agency.

The state also recently released a draft plan for meeting its share of the Chesapeake Bay cleanup goals, outlining the need to invest $485 million a year — more than twice what it is currently spending.

While that would help address some of the issues identified in the new water quality report, the state would need to spend significantly more to fix all of its stream health problems.

Not surprisingly, agricultural runoff of soil, nutrients and chemicals are the cause of the most miles of impaired waterways across the state — 5,741 in all. High concentrations of nutrients cause algae blooms in the Bay, reducing oxygen needed by aquatic life. Those blooms, along with sediment washed into the Bay, also block sunlight from reaching underwater grasses. And sediment can bury emerging grasses.

The amount of waterways impacted by agricultural runoff is actually 680 miles fewer than the last water quality assessment in 2016. On the surface, that appears to be an encouraging and logical trend because the amount of nutrients and sediment flowing down the Susquehanna into the Bay has been declining somewhat for years.

But the decline described in the report may be partly due to more accurate stream assessments rather than a direct result of stream improvements, said Dustin Shull, environmental group manager for the Pennsylvania Department of Environmental Protection.

The second-largest source of poor water quality was runoff from abandoned mines. When water draining from the old mines flows over exposed sulfur-bearing rock and materials, it becomes highly acidic. When flowing into streams, the mix kills or restricts aquatic life. The state reported that 5,575 miles of waterways are impacted by such runoff, a slight reduction from 2016.

An eroding stream winds through a farm field in Lancaster County. Pennsylvania is targeting such streams on farms where lack of fencing to keep livestock out of the streams and little or no streamside vegetation sends nutrient pollution to local waters and the Bay. (PA Department of Environmental Protection)

Stormwater runoff, the third major source of pollution, picks up fertilizers, soil, pesticides and other contaminants and flushes them into streams. The amount of impacted waterways was 3,066 miles, up by 164 from 2016. Again, Shull said the figures may not mean a worsening of the problem but rather better assessment methods.

Pennsylvania, like every state, has to evaluate the water quality of its streams and rivers every two years to see if they meet water standards designed to protect such things as aquatic life, water supply, fish consumption and recreation. States submit the reports to the EPA, including a list of waterways that should be officially designated as "impaired." The EPA reviews and approves the list, and the state must then develop plans showing how they will clean up those waterways.

For the first time, Pennsylvania's 2018 report gauged the health of aquatic life on the lower and middle sections of the Susquehanna River and the Juniata River, a major tributary.

All wadeable streams in the state had been assessed for aquatic use previously but this was the first time that sections of the Susquehanna and Juniata were assessed.

The sections of both rivers were found to be impaired because of poor results for aquatic insects that are an important part of the food web and for high pH levels, a violation of water-quality standards.

The section of the Susquehanna now considered impaired for aquatic life runs from the mouth of the Juniata River at Duncannon downriver to Columbia, in Lancaster County.

If the EPA approves the report, the state will have to develop a cleanup plan for both sections of the rivers. The report does not identify a cause for the impairments, which will be required before a cleanup plan is made. But it notes that high pH levels are often tied to algae growth from high levels of nutrients, and Bay cleanup plans target nutrient reductions. Shull noted that there was evidence of algal blooms.

A 4-mile section of the Susquehanna was listed as impaired for recreation, as it was in the 2016 report, mainly for the presence of fecal coliform. The cause was not listed but sources could be manure from livestock, sewage treatment plants or industries.

The increased focus on the mainstem of the Susquehanna and Juniata has been driven by an alarming die-off of prized smallmouth bass beginning in 2005. About a year ago, scientists identified the cause as manmade chemicals, largely from ag-related herbicide runoff and reproduction-altering pharmaceuticals, as well as a virus and parasites.

The Pennsylvania Fish and Boat Commission has repeatedly requested that the state declare the lower Susquehanna impaired, which would require the state to come up with a plan to identify water-quality problems and fix them. But the administrations of two governors refused, instead launching detailed monitoring of the river.

Ironically, the bass have recovered to near-record levels in recent years while the Susquehanna has come under closer scrutiny and has now, indeed, been listed as impaired.

"DEP should have addressed this in 2005, when we had a major fish kill, but they're finally taking the first step in admitting there's a problem," John Arway, the now-retired executive director of the Fish and Boat Commission told *Pennsylvania Outdoor News.*

The unprecedented sampling of the Susquehanna also has found troubling levels of "contaminants of emerging concern" — a group of pollutants that include hormones, pharmaceuticals and certain pesticides. The findings also have contributed to Pennsylvania initiating a statewide search for the cancer-causing group of chemicals known as PFAS that has been generating concerns nationwide.

As far as required cleanups of impaired waterways in the state, there is a clear priority by state environmental officials to address streams and rivers that drain into the Chesapeake Bay. About half of the state does.

"We're telling the public that Pennsylvania DEP is focusing on agricultural impairments right now as a priority to restore," Shull said.

One visible sign of that initiative is the creation of 28 "restoration priority watersheds." All but three are in the Chesapeake Bay drainage and all but two are impaired because of agriculture runoff. "These are the places where we need to have our most restoration successes," Shull observed.

The full report and supporting documents may be found online at depgis.state.pa.us/2018_integrated_report/index.html. The site includes, for the first time, an online interactive map where users can click on any stream in the state, see if it is impaired and, if so, the reasons for the problems.

PennDOT hopes plantings will put pollinators on road to recovery

≈ Less mowing, more growing along selected sites designed to attract birds, butterflies, bats – and volunteers.

By Ad Crable

The roadsides, rest stops, interchanges, traffic islands and even urban intersections across Pennsylvania may soon look a little more unkempt or sprout what passing motorists may mistake for weeds out of control.

But it's really "conservation mowing" and carefully planned plantings as part of a new initiative by the Pennsylvania Department of Transportation to help struggling bees and other pollinators that are vital to the state's agriculture.

PennDOT is reaching out to civic and environmental groups, scouts, gardening clubs and willing individuals in a search for volunteers who can establish and maintain carefully sited pockets of plantings and small meadows as part of the agency's Pollinator Habitat Plan.

It's an expansion of the agency's highly popular Adopt-A-Highway program aimed at litter cleanup and the Adopt-And-Beautify program that plants splashes of colorful flowers along roads and intersections.

The new project aims to establish key plants that provide food and support the reproductive cycle of pollinators such as bees, bats, hummingbirds and other species. The highway agency also will do less mowing. This "conservation mowing" will encourage pollinator plants to grow.

State and federal agencies have been given marching orders to help pollinators under a presidential memorandum by former President Barack Obama in 2015. With 110,000 acres of scattered rights of way, PennDOT is positioned to make a difference.

"We really need the public's help," said Toni Zawisa, a biologist in PennDOT's Environmental Analysis Unit. There is no funding allotted for the program, so success will depend on groups of volunteers to obtain plants and seeds, as well as conduct maintenance.

PennDOT is seeking volunteers to help with its new initiative to increase plantings for pollinators along state roadsides, intersections, traffic islands and rest stops. Included will be meadow-like plantings, above. (Pennsylvania Department of Transportation)

Groups such as Pheasants Forever are already on board to install meadow plantings at suitable sites. So are Master Gardeners.

The striking decline of honey bees has been well documented. But the threat to pollinators extends to many other species. A federal ruling is expected this month on whether the monarch butterfly should be listed under the Endangered Species Act. Also being considered are the yellow-banded bumblebee, regal fritillary butterfly and frosted elfin.

Pollinators are not just pretty creatures in the landscape. In Pennsylvania, they are vital to the state's agriculture industry, especially fruit and vegetables. The number of crops dependent on pollination in Pennsylvania, about 75 percent, is near the highest of all states. There are more than 300 species of bees that pollinate crops in Pennsylvania.

But habitat loss, fragmentation of landscapes, pesticide use and introduced diseases have done a number on pollinators nationwide. Pennsylvania has fared better than most with its smaller farms and variety of habitat, "but we still have our problems," Zawisa noted.

To do its part, PennDOT will modify its mowing techniques on roughly 58,000 acres of rural roadside rights of way — which is to say, there will be less of it, allowing milkweed and other native plants favored by pollinators to grow up.

"A lot of people believe that beauty is a mowed lawn. As we modify some of our practices to accommodate pollinators, people may see less of that. This is a way of enhancing pollinator habitat and the diversity of these species throughout the state," Zawisa said. The public may also see more spot spraying of herbicides to weed out invasive plants along roadways.

Close-cropped mowings will continue right against roads to maintain safe sighting conditions for motorists. And no plantings will be made in the medians on interstate highways.

PennDOT also will continue its practice of cutting trees in the rights of way, called "daylighting." Done initially for safety reasons, opening the rights of way to more sunlight encourages milkweed and nectar-producing plants.

Plantings to attract bees, butterflies and other pollinators along roads will not cause more of them to collide with vehicles, Zawisa contended, because roadside plantings give pollinators what they are looking for and less reason to fly across roads looking for habitat. "When you put in pollinator habitat, research has shown that vehicle contact is lower than without," she said.

And with less mowing, fewer deer will be attracted to roadsides, likely cutting down on deer-vehicle collisions, she said. That's because deer are drawn to the tender new growth that constant mowing leaves in its wake.

The new plantings will also add color to the routes. For example, a preferred pollinator mix includes 21 types of wildflowers mixed with grasses.

Interested in signing up as a volunteer? An application may be found online at dot.state.pa.us/public/PubsForms/Forms/M-461A.pdf. The application, which ideally includes a description of the project and a sketch plan, needs to be sent to the roadside specialist in your PennDOT district. Phone numbers of districts are on the form. Individuals may be assigned to a group project.

Opponents of new Bay Bridge pushing for alternatives

≈ Official says ferry system and mass transit, though, would not do enough to alleviate traffic.

By Jeremy Cox

As Maryland officials prepare to take a critical step toward deciding how people will cross the Chesapeake Bay for decades to come, they face growing criticism that the effort is bypassing options that don't involve building a new multibillion-dollar bridge.

Maryland's Bay Bridge consists of two adjacent spans between Annapolis and Kent Island: a two-lane bridge constructed in 1952, which serves as the eastbound route, and a three-lane westbound span that opened in 1973. After more than two years of study, the Maryland Transportation Authority, which operates the 4-mile structures, plans to release a narrowed-down list of possible routes for a potential third span in the coming months.

The $5 million analysis is expected to name a "preferred corridor alternative" by December 2020. Under the most sanguine time line, a new bridge would still entail a decade or more of planning and construction before it could open, planners say.

As the study nears its next stage, many environmentalists and smart growth advocates are questioning the necessity of a third bridge. They want the state to explore alternatives, such as expanding mass transit or launching a ferry service.

"Given how much money is involved and the time frame for the construction of a new bridge, there needs to be consideration of other options," said Kimberly Golden Brandt, director of Smart Growth Maryland.

Based on what is publicly known about the study, though, some observers doubt that the state is doing that.

Earlier this year, the MDTA released a report on the *Purpose and Need* for a third Bay crossing in Maryland, stating that the study's aim is to "consider corridors for providing additional capacity and access across the Chesapeake Bay." Transportation planners presented a "no-build" option but only to show how congested the existing spans will become by 2040 unless another bridge is built.

An MDTA spokesman declined to comment or make anyone within the department available for an interview for this report.

But at a recent meeting about the crossing study, a top official with the Maryland Department of Transportation threw cold water on suggestions that a ferry, a rail service or buses could alleviate the Bay Bridge's traffic woes.

In rural Kent County on Maryland's Eastern Shore, "No Bridge" yard signs have begun sprouting up. Meanwhile, a state senator from the Western Shore's Anne Arundel County unsuccessfully pushed fellow lawmakers to grant the county veto power over a third span — a power currently given to the nine counties across the Bay. (Timothy B. Wheeler)

No fewer than six studies were conducted between 2000–07 to look at the possibility of connecting the Eastern and Western shores via a ferry service, said Heather Murphy, MDOT's planning director.

The ferry option that would remove the most traffic from the bridge — a low-speed ferry shuttling between Chesapeake Beach and Cambridge — only managed a cut of 917 vehicles, less than 1% of the peak summer season congestion. Talk of a ferry system needs to be "decoupled from that of a third bridge," a governor-appointed ferry committee concluded in 2007.

"They didn't see how that would relieve enough traffic off the Bay Bridge," Murphy said.

A rapid transit bus service or rail system could siphon off about 1,250 vehicles from the bridge's eastbound lanes during busy summer weekends, she said, citing a 2007 MDTA report. But that would still represent only about a 1% traffic reduction and come with a price tag ranging from $400 million for bus service between Annapolis and Kent Island to nearly $30 billion for a heavy rail system extending from Washington, DC, to Ocean City.

"You really need a lot more density than we have" to make a mass transit option work economically, Murphy said. "Yeah, you could take some of the traffic of the Bay Bridge and put it on mass transit, but it would be nowhere near the numbers we would need and at a very high cost."

In February, a map showing 14 potential crossing sites leaked onto social media. It depicted bridges vaulting across the Bay as far north as Harford-Cecil counties and as far south as St. Mary's-Somerset.

Murphy was the opening speaker at an April 18 workshop run by the Eastern Shore Land Conservancy at the Chesapeake Bay Beach Club, with sweeping views overlooking the two bridge spans. She isn't involved in the MDTA crossing study beyond "keep[ing] tabs on it," she said later.

Lindsey Mendelson, who tracks transportation issues for the Maryland Sierra Club, listened to the presentation with growing dismay. "I was pretty upset by that portion," she said.

The studies Murphy cited were nearly two decades old in some cases and no longer reflect current traffic patterns or technologies, Mendelson said. The ferry and transit studies, as Mendelson sees it, rely too heavily on how much traffic they can divert off the bridge. What about, for example, the environmental benefits?

"That's problematic because we're living in a time when transportation is the No. 1 source of carbon pollution in Maryland and the No. 1 source of climate change emission in the country," she said.

While bridge traffic is light or moderate during most periods, it is racking up the heaviest congestion scores possible during typical weekday afternoon rush-hours and summer weekends, according to MDTA statistics.

The annual number of vehicles using the bridge has remained steady over the last decade at around 26 million — a phenomenon many planners attribute to the Great Recession.

With one recent analysis projecting 14-mile backups at the Bay Bridge by 2040, though, the public debate has largely shifted away from whether a third span should be built to where it should be built.

The issue has become a flash point on both sides of the Bay.

In rural Kent County on the Eastern Shore, "No Bridge" yard signs have begun sprouting outside people's homes and on the edges of cornfields. Meanwhile, a state senator from the Western Shore's Anne Arundel County unsuccessfully pushed fellow lawmakers to grant the county veto power over a third span — a power currently given to the nine counties across the Bay.

In February, a map showing 14 potential crossing sites leaked onto social media. It depicted bridges vaulting across the Bay as far north as Harford-Cecil counties and as far south as St. Mary's-Somerset. The MDTA and Federal Highway

BRIDGE CONTINUES ON PAGE 15

Bridge from page 14

Administration created the map but labeled it as "pre-decisional" and "deliberative."

The new study is set to project fresh cost estimates for a third bridge, a figure expected to range well into the billions of dollars. What if that money was invested in an alternative to road construction? asks Jay Falstad, executive director of the Queen Anne's Conservation Association.

"We don't feel these alternatives have been explored in any meaningful way, and it would just be ridiculous to add a costly third span without exploring these alternatives," he said.

About 8 million visitors flock to Ocean City during the summer. Falstad suggested staggering their check-in and checkout times to spread out the traffic that currently piles up on the weekends.

During a separate presentation at the conference, Dan Nataf, a pollster at Anne Arundel Community College, said surveys show that at least two-thirds of the county's residents support expanding the existing bridges or bus service across the Bay. But just 31% would support a higher toll fee to cover the cost.

"I'll tell you why everything you want to do that costs any money isn't politically feasible," he joked.

A bridge won't just be expensive; it will take years, if not decades, to build. By then, the combined effects of sea level rise and sinking land might have put the approaches to the new bridge underwater, Brandt said.

She hopes that the state's analysis — and ensuing public debate — includes the impact of a new bridge on the land and communities inland from the Bay's shoreline.

"There's so much discussion about the bridge, but what does the bridge connect to?" she asked. "Are you building new roads or expanding existing roads to accommodate the bridge traffic? So, the impacts obviously go far beyond the bridge."

Critics say a new bridge may be self-defeating. Building new lanes to ease current congestion may encourage more people to drive, creating "induced demand" that quickly snarls traffic once again.

When a panel of transportation experts was asked about induced demand at the conservancy workshop, one replied that it has already happened on the Bay Bridge. In 1985, more than 13 million vehicles were crossing the spans annually, and jams were starting to get on drivers' nerves.

Steve Cohoon, Queen Anne's public facilities planner, said Gov. William Donald Shaefer responded with a litany of congestion fixes under the banner "Reach the Beach." The annual number of vehicles crossing the spans doubled by 2005.

The annual number of vehicles using the Bay Bridge in Maryland has remained steady over the last decade at around 26 million — a phenomenon many planners attribute to the Great Recession. (Dave Harp)

Hopewell's revival strategy recognizes that all roads lead to the rivers

≈ Greenway designed to slow stormwater flow is quickly attracting the public to its restored habitats and access to James and Appomattox.

By Sarah Vogelsong

A "regenerative stormwater conveyance system" in Hopewell, VA, controls stormwater runoff from an adjacent neighborhood before it flows into a local stream and out into the Appomattox River. (Sarah Vogelsong)

Nestled in the crook of the James and Appomattox rivers, the small Virginia city of Hopewell has for more than a century been synonymous with industry and pollution. But recently, ambitious efforts to address stormwater runoff and reconnect residents to nature are rewriting that familiar story.

"I feel like Hopewell is on the cusp of returning to its former glory," said Ann Jurczyk, the Chesapeake Bay Foundation's Virginia director of advocacy and outreach. "It's got a bad rap because of all the chemical plants that are there, and there's some legacy sediment issues that are horrible, but I feel like it's poised to rebound."

Nowhere is that more evident than the Riverside Park Stormwater Greenway. This roughly half-mile-long haven for wetlands, a restored stream and native plants cuts a green swath through the heart of Hopewell. At its head sits a cemetery where almost 6,800 Civil War soldiers lie, heavily used ballfields and an active osprey nest perched atop a stand of lights that illuminate one of the baseball diamonds. At its foot sits the city's busy marina, kayak launch and fishing areas.

In between, Riverside Park — formerly known as Jaycee Park — was once what Hopewell stormwater program manager Joseph Battiata called "a haven for illegal activities."

"There would be squatters living in these woods for weeks or months at a time," he said.

Part of what made these squatters' camps possible was the hardening of the unnamed stream that flows down the greenway into the marina, where it joins the Appomattox. As Hopewell developed into an industrial powerhouse, much of its 11 square miles was paved. With so much impervious surface, stormwater runoff increased, and its higher volume soon transformed the city's innumerable small waterways into deeper, faster channels.

In Riverside Park, that evolution led to the partial disappearance of wetlands and the disconnection of the stream from its floodplain.

While the drier land allowed squatters to make the park their home, the faster streamflows allowed high loads of sediments, nutrient pollution and trash to be deposited into the Appomattox.

The Riverside Park Stormwater Greenway was first proposed as an effort to reduce that pollution in response to federally mandated cleanup goals for the Chesapeake Bay and its tributaries.

"We can't change the volume of runoff. The city's been paved. We're getting more rain," Battiata said.

So, he said, "The goal is to use nature to process all those nutrients and sediment."

Funding was cobbled together from multiple sources: the Virginia Department of Environmental Quality's Stormwater Local Assistance Fund, the National Fish and Wildlife Foundation, the Chesapeake Bay Foundation and the city of Hopewell.

What resulted was the restoration of a stream that now winds through the floodplain, lined with native plants, trees and pocket wetlands. By raising the channel at the top of the greenway and installing structures like log sills and cross-vanes — which direct water toward the center of a stream — engineers were able to slow the stream's speed, reduce erosion and help overflows spread out across the floodplain, where excess nutrients and sediments could filter through the soil instead of being dumped directly into the river.

At the top of the greenway, a "regenerative stormwater conveyance system" helps to funnel runoff from the adjacent neighborhood through a series of pools constructed with layers of rock and sand before the water ends up in the stream. An overflow pipe lets water bypass the cells if heavy rainfall threatens to overwhelm their capacity — an important consideration as precipitation increases.

At the bottom, permeable pavement and a bioretention basin installed by the Chesapeake Bay Foundation help to catch runoff just before it flows into the waters of the marina.

Altogether, the city estimates that the project will prevent about 1,600 pounds of nitrogen, 450 pounds of phosphorus and 78,800 pounds of sediment from flowing into the Appomattox annually.

> *The goal is to use nature to process all those nutrients and sediment.*
>
> — Joseph Battiata
> Hopewell stormwater program manager

But while the greenway quickly became a centerpiece of Hopewell's efforts to clean up its waterways, it also signaled a renewed focus on the city's water quality.

"In a place like Hopewell, everything is 50 years old. The infrastructure's been neglected for so long. And it's an industry town," said Battiata. "We have a list a mile long."

While the city looks downward to replace its aging sewer pipes, the Chesapeake Bay Foundation is looking upward for solutions — to the tree canopy.

"Part of our problem now with rainfall is that it's coming in these really high-intensity storms," Jurczyk said. Trees "hold part of that intensity during that first flush," while "their roots create spaces to make the land itself more pervious, so the land is more spongelike and is able to hold water better."

In this way, trees can significantly reduce nutrient and sediment runoff. The state-federal Chesapeake Bay Program estimates that every acre of tree canopy planted reduces 1.9 pounds of nitrogen runoff, 0.23 pounds of phosphorus and 22.6 pounds of sediment.

Compared with other cities in the region, though, Hopewell's canopy is woefully lacking. A Bay Foundation study funded by the National Fish and Wildlife Foundation found that while the tree canopy covers about 42% of Richmond, 43% of Waynesboro and 47% of Charlottesville, it only shades 30% of Hopewell.

That does more than impact stormwater runoff. It also lessens quality of life, especially in lower-income areas where residents may not have access to air-conditioning and are impacted by the "urban heat island," where pavements and developed areas become hotter than the surrounding air.

Research has shown that poorer areas tend to have less tree canopy than more affluent ones, a relationship described by conservation organization American Forests as "tree equity."

The Bay Foundation sought to be "mindful" of that phenomenon as it embarked on efforts to increase Hopewell's canopy, Jurczyk said. Trees have been planted in the city's Woodlawn and Arlington parks, as well as outside the community center, which sits a stone's throw from many of Hopewell's industrial plants.

In the upcoming year, an additional grant from the National Fish and Wildlife Foundation will allow the foundation to plant 250 additional trees in neighborhoods with the lowest amount of canopy. Trees will be placed along streets, where they can catch rainfall before it meets the impervious surface of roads and sidewalks. A tree stewardship class will also ensure that when the foundation's work is complete, residents will have the knowledge and expertise to keep the trees alive.

All of the partners in the efforts to improve Hopewell's stormwater runoff are aware that it's still early — but for Battiata, progress is clear.

"We're kind of at a point where we can begin to see the benefits," he said.

Small-scale study finds no link between poultry farms, fouled streams

≈ VIMS study on Chesapeake's Eastern Shore casts doubt on pollution connections but draws from small pool of data.

By Jeremy Cox

Fresh evidence collected in a corner of Virginia where chicken farm construction has boomed in recent years casts doubt on one of the most enduring criticisms of the industry: that the operations contaminate local streams with nutrients and harmful bacteria.

A Virginia Institute of Marine Science study found no "smoking gun" to suggest a link between chicken farms on the state's Eastern Shore and downstream pollution, said Richard Snyder, the report's lead author.

His samples revealed a mixed bag of results. Streams near poultry sites typically had higher amounts of nitrogen and bacteria associated with animal guts than those not affected by farm runoff. But they also had lower ammonia and phosphorus counts.

Because no strong pollution links emerged one way or the other, Snyder and co-author Paige Ross wrote, the information "does not suggest stormwater runoff impacts from poultry operations."

Poultry industry leaders embraced the findings as proof that modern stormwater management practices are paying off. Chickens produced for the region's meat-packing companies are raised inside large, shed-like "houses," and their manure is stored in covered buildings until it's ready to be used as fertilizer on nearby cropland.

"What we're doing seems to be working," said Holly Porter, executive director of the Delmarva Poultry Industry trade association.

Environmentalists applauded the VIMS researchers for trying to answer water quality questions that have long loomed over the industry. But they are raising questions about the study's usefulness.

"I think we're hesitant to make any drastic conclusions from it," said Joe Wood, a Virginia-based scientist with the Chesapeake Bay Foundation. "Every little bit of data helps, but from our perspective, it's hard to interpret this very difficult issue from a small pool of data."

In Accomack County, VA, the industry's epicenter on the Delmarva Peninsula, land owners have built 218 poultry houses since July 2014. (Dave Harp)

The Snyder and Ross report relies on samples taken at three different times — one during dry weather last July, another after a heavy rain later that month and a final one during a November drizzle. That's not enough to draw conclusions from, Wood said.

The researchers took water samples at about 40 spots along ditches and streams where they crossed beneath roads. Wood said he would have liked to have seen them taken at the outfalls of the facilities. Taking them farther downstream all but ensures that pollution concentrations will be diluted and other factors, such as other pollution sources, will come into play, he added.

The study doesn't make clear the exact location of the poultry houses within the examined watersheds or whether they were in full operation, said Sue Mastyl, a board member of the nonprofit Virginia Eastern Shore Clean Water Council. It also doesn't say why the sampling sites were chosen. "It would seem to me that to draw any conclusions at this point is premature," she said.

Snyder described the analysis as intended "mostly for local information purposes." He doesn't plan to submit it to a peer-reviewed journal. It has too few samples to garner serious consideration for publication, he said.

He had no funding outside of money he could scrape together from his own budget. And he didn't have time to travel very far. But he wanted to do something, he said, amid growing scrutiny of the poultry industry.

"This has been a big issue since I got here in 2015," said Snyder, director of the VIMS Eastern Shore Laboratory in Wachapreague. "The first question I got asked was where do I stand on the poultry issue. I was kind of reluctant to get into it in the beginning."

In Accomack County, the industry's epicenter on the narrow peninsula, land owners have built 218 poultry houses since July 2014, according to the county's planning department. Accomack had 254 chicken facilities when the building boom started.

The surge prompted the county's elected leaders to pass a raft of protections that required farmers to plant buffers around their properties and build farther away from existing housing developments. Local outcry also persuaded state environmental officials to begin enforcing groundwater withdrawal limits at the large operations.

The construction of new houses appears to be tapering off. Since the beginning of 2018, the county has seen just 11 houses approved for development.

Studies like the one conducted by VIMS will help show whether the new state and local regulations are working, said Jay Ford, an outreach coordinator for the CBF in Virginia. The slowdown in construction, he said, gives lawmakers an opportunity to examine whether more needs to be done to protect residents and the environment.

The VIMS study concentrated on the southern half of Accomack, where much of the new construction has taken place. Even though the industry's activities happen largely indoors, Snyder said he was concerned that air vented by the houses' giant fans might be spreading ammonia and contaminated dust that could be deposited into streams.

For the most part, he found low amounts of ammonia in the water. Nitrogen levels spiked above the safe limit on 16 of 58 samples, but there was no difference in the concentrations whether they were downstream of a chicken operation or not, according to the study.

Snyder said he hopes to continue sampling to see if those trends continue. But, he added, "If anything was going to show up, I think it would have in one of those three events."

Proposal to aerate Bay: Breath of fresh air or pipe dream?

≈ Despite potential pitfalls, some wary scientists think proposal to oxygenate the dead zone might be worth a closer look.

By Timothy B. Wheeler

What if the dead zone that plagues the Chesapeake Bay could be eliminated now, not years down the road — and at a fraction of the billions being spent annually on restoring the troubled estuary?

Fanciful as it sounds, Dan Sheer figures it's technically doable. Whether it's the right thing to do is another question. Bay scientists are wary of potential pitfalls, but some still think it's worth taking a closer look.

Sheer, founder and president emeritus of HydroLogics, a Maryland-based water resource consulting firm, has suggested that the oxygen-starved area down the center of the Bay could become a thing of the past if enough air could be pumped into the depths and be allowed to bubble up through the water.

"It pretty much gets rid of the problem," he said during a recent presentation to scientists at the University of Maryland, Baltimore County. And it's not just him saying that. The federal-state Chesapeake Bay Program ran his oxygen-bubbling calculations through the computer model it uses to simulate water quality in the Bay, and the preliminary results appear to back him up.

Dan Sheer, founder and president emeritus of a Maryland water resources consulting firm, guides his sailboat, Pegathy, up Rock Creek, where aerators have been used since 1988. They successfully dealt with low-oxygen conditions there that generated a rotten egg odor. He has calculated that a large-scale deployment of aerators in the middle of the Bay could eliminate the dead zone that forms every summer. (Timothy B. Wheeler)

The dead zone, as it's called, is produced when algae blooms fed by excessive nutrients in the water die and decay, consuming the dissolved oxygen that fish, crabs and shellfish need to live. This zone of low to no oxygen forms near the bottom in the deep trough down the center of the Bay every spring and grows through summer, until finally receding in fall when algae growth ends.

The Bay Program has been laboring since the 1980s to reduce nutrient pollution and raise dissolved oxygen levels enough to eliminate the dead zone, but the effort has been costly and challenging. The region missed two earlier cleanup deadlines and is now working toward another target date of 2025, when all projects and programs needed to meet nutrient reduction goals should be in place. That's looking increasingly unrealistic as well.

Aerating the Bay would be quicker, Sheer contends, and potentially less expensive. His idea: Lay 16 pipes across the deepest part of the Chesapeake at 5-mile intervals from Maryland's Bay Bridge to the Potomac River, with a series of openings in them to release streams of tiny air bubbles. The oxygen in the bubbles would dissolve into the water and help sustain aquatic life.

Sheer isn't the first to suggest bubbling the Bay like an aquarium. It's been brought up repeatedly over the last 30 years, only to be dismissed as unworkable and inordinately expensive — harebrained, even.

In the late 1980s, Maryland tested floating aerators in a cove off the Patuxent River, but gave up after they produced a barely detectable change in oxygen near the bottom. In 2011, the nonprofit Blue Water Baltimore, in partnership with a consulting firm, placed a small aerator in Baltimore's harbor, with similar results.

Aeration has been used with some success elsewhere in freshwater lakes and reservoirs that suffer from nutrient pollution. And, it has helped water quality in some rivers, such as the Thames in the United Kingdom.

Pumping air into big open bodies of tidal water is more problematic. Scientists in Sweden and Finland have looked at and tested aeration as a possible remedy for severe algae blooms in the Baltic Sea. But they've held back from trying it on a large scale, in part because of uncertainty about its costs and effectiveness.

Given that history, reaction to Sheer's proposal has been mixed.

"I'm enthusiastic about the idea in a lot of ways, but there are a lot of questions," said Bill Ball, director of the Chesapeake Research Consortium, a nonprofit that coordinates Bay studies among seven universities and labs in the region.

Sheer, who holds a doctorate in environmental engineering from Johns Hopkins University, said the idea of aerating the Bay mainstem came to him about 18 months ago while listening to a presentation at UMBC about the costs and complications of the federal-state restoration effort. When he stood up and asked why not try bubbling the dead zone away, he said others in attendance ticked off a litany of flaws they saw in his proposal.

"The room sort of turned into a shooting gallery," he recalled, "and I was the target. I had lots of objections … 'you're fixing the symptoms and not the problem,' 'you can't possibly pump enough air,' 'it's way too expensive, takes too much energy' " and more.

After that, Sheer set out to see if his critics were right.

"It looks like it really will work," he said.

Sheer pointed out that aeration has long been in use in one small corner of the Bay watershed, where he happens to keep his sailboat. Rock Creek, a tributary of the Patapsco River near Baltimore, has had aerators since 1988. They were put there in response to complaints about the rotten-egg odor given off by the creek in summer.

A 2014 study by researchers with the University of Maryland Center for Environmental Science rated the Rock Creek aerators a success. They raised oxygen levels near the bottom enough to stop hydrogen sulfide from bubbling out of the sediments — another byproduct of low-oxygen conditions.

"The aerators were incredibly effective at restoring dissolved oxygen to the creek," said Lora Harris, an associate professor at the UMCES Chesapeake Biological Laboratory and lead author of the study. Water quality improved even downstream, she said, nearly to the mouth of the tidally influenced creek.

Rock Creek is relatively shallow and small, compared to the water bodies where aeration has been tested before. The aerators there also were placed on the bottom, rather than floating on the surface.

The Rock Creek aerators cost $285,000 to install and about $7,000 a year to run, according to Janis Markusic, a planner with Anne Arundel County's watershed restoration office. The county is now replacing the original aerators, she said, to the tune of $1 million.

Doing it in the Bay mainstem would likely cost much more. Working with scientific colleagues, Sheer has estimated that it would cost $10 million–$20 million to install the piping network, bubble diffusers, air compressors, oxygen generators and other equipment. To run it would take another $11 million a year, by their estimates, with much of that spent on electricity to power the air compressors, pumps and other equipment.

While not cheap, that's far less expensive than the current Bay cleanup tab, Sheer pointed out. In fiscal year 2017 alone, the six Bay watershed states and federal government spent

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nearly $2 billion on the restoration effort, according to Bay Program figures.

Sheer said the Bay Program model runs showed his aeration proposal would do just as much to raise oxygen levels in the Bay's depths as the last round of nutrient-reducing cleanup plans drawn up by the watershed states and the District of Columbia.

The model also indicated aeration would actually outperform the Bay pollution diet in another, important way. Artificially increasing oxygen levels would reduce the release of algae-fueling phosphorus and nitrogen back into the water from bottom sediments where they had built up over time. That recycling of nutrients from the sediments has long been viewed by scientists as a potential hindrance to the Bay restoration.

Scientists with whom Sheer has consulted — and Sheer himself — are quick to point out that his proposal relies on some unproven assumptions and could have unintended negative consequences, what engineers and scientists call "revenge effects."

"There's a lot we don't know," Sheer said. "There's a lot we think we know that might be wrong."

Ball, an environmental engineering professor at Johns Hopkins, said that from his experience with aeration in wastewater treatment plants, he's not sure how well bubblers will work at raising oxygen levels in the Bay's depths.

"He's relying a lot on the sloshing of the tides," Ball said, adding that "there's a lot more work to do to figure this out."

Jeremy Testa, an assistant professor at the UMCES lab, called the Bay Program model results "intriguing," particularly in regard to limiting the flux of nutrients back into the water from sediments. But there are potentially significant downsides, he said.

One is that if the current rate of nutrient pollution isn't reduced, he said, the phosphorus and nitrogen may simply continue to build up in the sediments, and then pour out into the water in one huge algae-blooming pulse if the bubblers ever shut down, even for a short spell.

That's what Lora Harris said that she, Testa and other colleagues found at Rock Creek. They also found that the creek was emitting significantly more nitrous oxide — a climate-warming greenhouse gas — than other comparable water bodies.

There's even a possibility, Harris noted, that pumping oxygen into nutrient-enriched waters could increase the formation of toxic methylmercury, which can build up in fish and is already one of the top two causes for fish consumption advisories in the Bay.

Aeration has successfully treated low-oxygen conditions in Maryland's Rock Creek, where they causes a rotten egg odor and prompted complaints from local residents. Anne Arundel County is currently replacing the original aerators at a cost of approximately $1 million. A similar project in the Bay would cost much more and not address the underlying problem of nutrient pollution. (Timothy B. Wheeler)

(Lucidity Information Design, LLC)

There's also some concern that a series of aerators would create "bubble curtains" in the water that would impede fish movement.

"You never know what's going to happen when you start manipulating the environment," Testa said.

Others say that even if technically feasible, aeration is just treating one of the symptoms of a distressed Chesapeake without fixing the causes of its woes.

While aeration could engineer a remedy for low dissolved oxygen, Testa warned that if nutrient pollution isn't reduced, "we're still going to have problems" with algae blooms, sediment-clouded water and important habitat like sea grasses not getting enough light to grow.

"Frankly, from a policy perspective, I think it's a horrible idea,'' said Beth McGee, director of science and agriculture policy with the Chesapeake Bay Foundation. It would "let people off the hook," she contended, weakening public and political pressure to make pollution reductions that would benefit the whole Bay watershed, including its rivers and streams — not just the dead zone.

Indeed, the 2014 Bay Watershed Agreement lays out 10 different goals that go beyond improving water quality to seeking such things as sustainable populations of fish, shellfish and black ducks, increased conservation of land and enhanced public access to the Bay and its tributaries.

Sheer acknowledges that aeration is not a substitute for the nutrient and sediment reductions states are having to make under the Baywide Total Maximum Daily Load set in 2010 by the EPA. But rather than sap public interest in saving the Bay, he suggested that it could actually boost it. "If you have a big success," he said, "maybe you'll increase momentum to finish the job."

Lewis Linker, acting associate director of the EPA's Bay Program office, said that model runs testing Sheer's proposal are very preliminary and need much more study. But he said "no way, no how" would he see aeration replacing the restoration effort's current multi-goal approach.

At best, Linker suggested, aeriation might serve as an "add-on," after all needed pollution reductions have been made, to help maintain healthy oxygen levels in the Bay's mainstem even under extreme weather conditions.

The only way to find out if aeration can help, Sheer said, is to test the idea someplace in the Bay, with a pilot project costing around $2 million.

"This is not ripe to go out and do," Sheer said, "but it is ripe, really ripe to go out and do a pilot. … I really think what we need to do next is put a station out there and see what the hell happens."

Some of the scientists with whom Sheer has consulted agree that for all of its potential pitfalls, it's still worth further study.

"It's not necessarily the complete solution," Harris said, to the Bay's nutrient overenrichment. But, she said, "It's potentially nudging one of the symptoms that we do care about. … We have an obligation to think about all sides."

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as she watched storm clouds roll in from far across the river. "Pictures don't really do it justice. You have to be out here to really understand it."

The property will eventually be open to the public as other refuge sites are, though officials will first have to deal with safety issues such as poor road conditions and the cliff's 100-foot drop-off.

The view that made this property prime real estate has long convinced historians and contemporary Rappahannock Tribe members that the region's earliest inhabitants would have lived along these cliffs, too. Last month, a group of archaeologists from St. Mary's College of Maryland scraped together the funds to do a little digging.

Scott Strickland, an archaeologist and GIS manager at St. Mary's, said after just a few days of shallow, dispersed digs on the site that evidence indicates a man named Indian Peter likely lived as a tenant on the property in the early 1700s. A native, likely from the Rappahannock Tribe that still inhabits the region, Indian Peter's name shows up in the 1697 will of landowner Angelo Jacobus. In the will, Jacobus gifts Peter clothing, a horse and a saddle, along with a promise of his freedom from indentured servitude two years later, Strickland said. At that time, Garlands Creek, which runs near the property, went by the name "Indian Peter Creek."

"The dates of these artifacts correspond well with when he would have gotten his freedom in 1699 (according to the will), along with the name of the creek," Strickland said. "The puzzle pieces seem to fit."

During a mid-May visit along the cliffs, Strickland shared his findings with the Rappahannock Tribe's chief, Anne Richardson, and Cora Peirce, a cultural field specialist who helps identify ceremonial lands for the Narragansett Indian Tribe Historic Preservation Trust.

Peirce was quick to identify the cliffs, with their lofty views and high concentrations of eagles (the tribe believes they carry ancestral messages), as a ceremonial landscape. While at the site, she burned an aromatic piece of cedar and sprinkled shells to acknowledge the site's spiritual value. And she said the Indian Peter story sounds likely, too.

"Usually, we do have natives that are overseeing ceremonial landscapes, even if they're indentured servants, at that time," she told Strickland as he showed her the artifacts.

Among the Colonial era findings concentrated near the cliff were fragments of tobacco pipes, imported European ceramics and part of a glass wine bottle, all of which would have been commonplace in an early-1700s home. The archaeologists also found some "lithic materials" — small quartz flakes that could have been used to make or sharpen stone tools such as projectile points and blades. Natives would have used these tools long before Europeans arrived in Virginia, but Strickland said the fragments could not be positively dated.

Cora Peirce, a cultural field specialist with the Narragansett Indian Tribe Historic Preservation Trust, and Rappahannock Tribe Chief Anne Richardson (center) talk to Scott Strickland, an archaeologist from St. Mary's College of Maryland, about his findings during digs at a newly conserved site along Fones Cliffs. (Dave Harp)

Strickland later came across a piece of a projectile point lying on the ground at his feet on the way to his car. It was a base of what he later identified as a Vernon projectile point that dates back 4,000–5,000 years.

The archaeologists have found points like these at almost all of the sites along the Rappahannock, and "it does point to the use of the site dating back at least that far," Strickland later noted.

Strickland and his colleague, St. Mary's archaeologist Julia King, have spent months surveying land along the Rappahannock River for Indian artifacts under a grant from the National Endowment for the Humanities. But, until recently, this property was off-limits.

The archaeologists have plans to continue looking for evidence of three Indian villages that, based on explorer Capt. John Smith's records, they believe were located along these cliffs in 1608. Smith described the villages "situated high upon white clay cliffs" just downstream of Tappahannock, across from marshlands.

"There's only so many places along the river that that could be," Strickland said. "When we had the opportunity to come out here and survey, we were trying to look for places that might fit that [description]. We don't think we've found that village."

The crews hope to look for evidence of Rappahannock cliffside communities on properties on either side of the former Bowers property that are still privately owned. Chief Richardson said finding those villages is critical, "in case they can be preserved," too.

"It's very important, not just for my people but for people in general," she said. "We're very grateful for the work that all of the conservation agencies have done to preserve this place."

The 4-mile stretch of Fones Cliffs is still largely in private hands, though the Fund's Richards said she hopes that preserving this 252-acre chunk in the middle will clear the way for surrounding properties to be at least partially conserved.

"This is the foothold. It's not the biggest piece, but it is the central piece," Richards said. "We're hoping to say to the other owners that, 'Hey, we're here and we're willing to talk to you about a conservation solution.' "

A more than 1,000-acre property to the south of the former Bowers tract is owned and managed by Northern Neck Lumber Co., which has not expressed plans to develop or sell it.

To the north is another 1,000-acre parcel, bought in 2017 by Virginia True Corp., which plans to develop the land into a luxury golf resort with 205 single-family homes, 513 multi-family units, 18 cabins and a 116-room lodge, along with retail facilities. Those plans could now be on hold as the company, facing lawsuits from the state and other parties, filed for bankruptcy in early May.

Virginia True owes the Diatomite Corporation of America, the property's previous owner, $7 million, according to the company's filing for Chapter 11 reorganization in the U.S. Bankruptcy Court in New York, where Virginia True is based. The Virginia Department of Environmental Quality is its second-largest creditor, owed $250,000, with several contractors owed about $150,000 in addition.

Virginia True's plans to develop the Fones Cliffs property got off to a rocky start in late 2017 when the company cleared more than 13 acres of trees near erosion-prone banks without acquiring the proper permits. A few months later, a portion of the cliff face near that clearing sloughed off into the river after several days of rain.

State environmental regulators levied a series of fines and orders to get the site back into compliance over the course of 2018. But, in October, Attorney General Mark Herring sued Virginia True over the violations, saying in a statement that he would seek the maximum allowable penalties for "significant and repeated environmental violations." That filing stated that those penalties could run up to $32,500 per day for each violation.

Conservation groups were still trying to make sense of the bankruptcy filing in late May and how it would

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MD oyster sanctuaries likely to boost crab, perch fisheries

≈ Restored reefs expected to attract organisms that finfish and shellfish prey on.

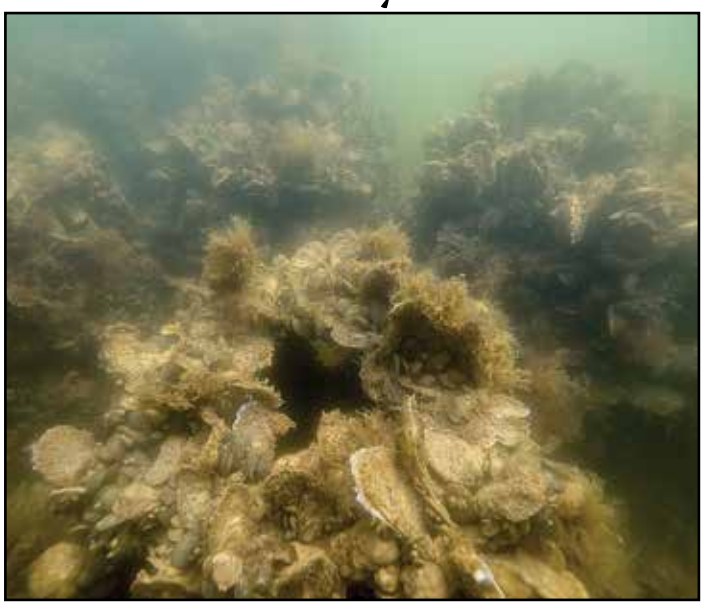
By Tim Wheeler

The restoration of reefs in Maryland oyster sanctuaries may be unpopular with watermen, but a recent study predicts the effort will eventually yield a bonanza for the commercial seafood industry, with bigger harvests of blue crabs and white perch.

Ecological modeling done by Morgan State University's Patuxent Environmental and Aquatic Research Laboratory in Calvert County projects an 80% increase in blue crab harvests and a 110% jump in white perch catch in the Choptank and Little Choptank river systems, where large-scale oyster restoration projects have been under way since 2011.

The Morgan study, underwritten by the National Fish and Wildlife Foundation and the National Oceanic and Atmospheric Administration, assumed that the restored oyster reefs will attract and support a diverse community of marine organisms, such as barnacles. Those, in turn, will draw crabs and finfish, which feed on them.

"There are potentially large benefits to commercially valuable species from an enhanced food web in this area," said Scott Knoche, the lab's director.



While oyster harvesting is prohibited in the Maryland sanctuaries where restoration took place, crabbing and fishing are still permitted. (Dave Harp)

While another computer modeling study last year found that the restored reefs in Harris Creek were helping to rid the water there of nutrient pollution, this is the first research into the potential economic impacts of large-scale oyster restoration. While oyster harvesting is prohibited in the sanctuaries where restoration took place, crabbing and fishing are still permitted.

Overall, the study concludes, increased harvests of all fish and shellfish could put extra money in watermen's pockets, including an additional $4.5 million in dockside sales just from a more bountiful crab catch. That could boost the local economy as the additional income from seafood harvests is spent on goods and services in the region.

Maryland and Virginia have pledged to restore native oyster habitat and populations in a total of 10 Chesapeake Bay tributaries, five in each state. In Maryland, restoration work is complete in Harris Creek and partially done in the Tred Avon and Little Choptank rivers. When finished, those three projects are expected to restore 964 acres of reefs at a total cost of $72 million.

The projects have drawn fire from watermen, who contend that they are ineffective and exorbitantly expensive. They have pressed the state to let them resume limited harvests in at least some sanctuaries.

It's not clear how long watermen should have to wait before they can realize the increased crab and perch harvests. Tom Ihde, a Morgan research assistant professor and the study's co-author, said it could be three to eight years after all restoration is completed before the effects of an increased marine food web start to materialize.

One factor could undermine the study's projections: Watermen have complained that reefs built of stone in Harris Creek and the Tred Avon interfere with their use of trotlines to harvest crabs. Trotlining — deploying a heavy, baited line in the water — is the only allowable gear for commercial crabbing in Maryland's tributaries.

"There's things that we're not able to account for," Knoche said. "One of those challenges is the way fishers use their gear and how the different environment might affect the use of that gear." He suggested that would warrant a further study.

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bode for the property's future. Joel Dunn, president and CEO of the Chesapeake Conservancy, which has advocated for more of the cliffs to be preserved, said the filing "comes as no surprise" given the property's history.

"This project was ill-conceived from the start, and all that has been accomplished to date are a series of environmental violations," he said. "We will continue to advocate for a conservation outcome and will remain vigilant to any and all issues that affect this irreplaceable resource."

This time last year, it seemed unlikely that any of the properties along Fones Cliffs would be preserved. Terrell Bowers had for years oscillated between conserving his property and turning it into a 45-home development, saying he hoped to recoup the costs of purchasing the land near the height of the housing market in 2002.

Joe McCauley, who worked at the Fish and Wildlife Service for more than 30 years before becoming a Chesapeake fellow at the Conservancy, said he first talked to Bowers about conserving his property within a year of his buying it, but that deal and others over the years had fallen through.

Joe McCauley, Chesapeake fellow at the Chesapeake Conservancy, and Heather Richards, The Conservation Fund's Virginia director and program manager, stand at the edge of a cliffside property that the Fund purchased late last year to sell to the U.S. Fish and Wildlife Service this summer. (Dave Harp)

Bowers said in a press release in October that "an incredible twist of fate" led him to pivot toward conservation and away from development. That same week, he had planned to seek approval from Richmond County officials to build 10-story condominiums on the river's edge instead of single-family homes. But his wife's car broke down in South Carolina while escaping the predicted path of Hurricane Florence, and Bowers decided to forsake the county meeting to help his wife and instead take the Fund up on its offer.

The Conservation Fund paid him $3.96 million for the property, which the Fish and Wildlife Service will reimburse this summer using money that was freed up with the help of Virginia representatives like Republican U.S. Rep. Rob Wittman when another federal land deal fell through, Richards said.

"It's been a long time coming, that's for sure," McCauley said in mid-May, standing on the edge of the cliffs during a visit with Richards, tribe representatives and the archaeologists. "We're just really grateful that the Fund was able to bring it across the finish line."

After years of bemoaning the latest developments at Fones Cliffs, Richard Moncure, tidal river steward for the Friends of the Rappahannock, said he still finds it hard to believe a piece of it will now be preserved.

"The thing we wanted to happen for so long is finally happening," he said. "Sometimes I just have to pinch myself."

Community works more than a little magic to preserve woodlot

≈ In Baltimore, Fairwood Forest's neighbors turned neglected land into a natural area worth saving.

By Timothy B. Wheeler

For years, Daisy Sudano-Pellegrini and her neighbors in the Glenham-Belhar community have tended to this once-neglected swath of woodland surrounded by homes and apartments. As unofficial forest stewards, they've repeatedly removed trash and invasive vines, blazed trails, documented its flora and fauna and strove to persuade its owners to spare it from being developed.

"This entire area was nothing but kudzu, all the way out to the street," Sudano-Pelligrini recalled recently as she stood just inside the copse of trees. It's been a constant struggle, she said, but with the vines cut back, they were able to harvest enough fruit from a wild cherry there to make a pie.

Now, the community's labors have paid off in a more lasting way. Most of this nearly 4-acre forest patch has been permanently preserved. Residents gathered there on May 4 to celebrate the donation of three-fourths of the woods to Baltimore Green Space, a nonprofit environmental land trust that worked with them to reclaim and protect it.

Since its founding in 2007, the land trust has succeeded in securing 15 community gardens and unofficial pocket parks across the city that were vulnerable to being developed.

Fairwood Forest is the first woodland the trust has acquired, but there are plenty more in need of such help. Twenty percent of Baltimore's tree canopy is in small privately owned forest patches. If they aren't protected and taken care of, the city will have a much harder time reaching its goal of covering 40 percent of the landscape with tree canopy — it's at just 28 percent now.

Daisy Sudano-Pellegrini, right, leads a group stroll through Fairwood Forest. Following her are neighbors Eugenia Argires and Michael Karasik, and Katie Lautar and Miriam Avins of Baltimore Green Space. Raven, Sudano-Pellegrini's cat, tagged along. (Timothy B. Wheeler)

Daisy Sudano-Pellegrini tacked little gnome images to trees in Fairwood Forest as a way of giving the forest a bit of magic and encouraging others to explore it. (Timothy B. Wheeler)

Many of these patches, left undeveloped because of rough terrain or lack of easy access to utilities and roads, are choked with litter and invasive plants. But they can still offer the same ecological benefits associated with larger forests, advocates say, and research tends to back them up. The trees absorb climate-warming carbon dioxide and filter out other air pollutants, as well. Forest vegetation and soils help to reduce sediment and nutrient pollution in streams and provide habitat and food for birds and other animals.

They also benefit people, offering cooling shade that reduces the "heat island" effect in paved-over cities, as well as supply food for those willing to forage for wild cherries and the like. Places like Fairwood Forest also offer city children and their parents a chance to experience nature.

"You know, there's a social justice component to this," said Eugenia Argires, another neighbor. "It shouldn't be that only families and children from affluent communities get to enjoy the benefits of a forest walk. And I think that's really important, because, you know, our community is not affluent."

Neighbors say Fairwood Forest, with 24 species of trees, is a natural gem supporting part of a hawk migratory flyway and a wildlife area where visitors can see foxes, raccoons, opossums and salamanders. One birder is said to have identified more than 200 species there since the 1990s.

"The dogwoods are so beautiful right now," said Miriam Avins, executive director of Baltimore Green Space, who is stepping down after leading the group the last 12 years.

Through regular, twice-monthly cleanups, neighbors have been reclaiming the woods and nurturing the comeback of native vegetation, such as Solomon's seal, which covers the ground with long, arching stems and clusters of bell-shaped flowers. At another spot, Sudano-Pelligrini pointed to a patch of mayapples in an area she said was once overgrown with poison ivy.

To try to make the forest even more fun for people to explore, Sudano-Pelligrini tacked little fairy and gnome images to trees and set up a scavenger hunt, hiding coins in various places for children to seek out. Part of that, she explained, is to overcome perceptions built up over years of neglect that the woods are an unsavory place to be.

"We want to do more community events to show people this is not just an eyesore. It is cared for; it's not a scary place," she said.

The campaign to preserve Fairwood Forest began six or seven years ago when neighbors noticed some little survey flags in the woods and learned of one property owner's plans to build homes on a few of the lots there. With help from Baltimore Green Space, neighbors organized, began to clean up the woods and spread the word about its value to the community.

Then, a couple years ago, the effort kicked into "hair on fire" overdrive, as Argires put it, after she overheard two men standing by the woods discussing plans to cut down a big swath of the trees.

Katie Lautar, Baltimore Green Space's program director, recalled how the land trust and neighbors researched the ownership of the various parcels that make up the forest and dug into the regulatory and economic hurdles any developer of the tract would face. They enlisted the Glenham-Belhar community association to help, as well as their local city council member.

They ultimately succeeded in getting a pair of owners of three-fourths of the woodlands to donate the land, but then had to raise about $15,000 to cover property taxes, transfer fees and other costs to complete the handover. As part of the deal, the community signed a written long-term agreement to maintain the woods.

"The only reason we protect it is because the community is caring for it," Avins said.

The forest is not yet completely free of development threats. Parcels at either end remain in private hands. But residents say they intend to remain vigilant.

Lautar, who is slated to succeed Avins as executive director, said the organizing and tactics employed in securing Fairwood Forest serve as a template for future campaigns to preserve other threatened forest patches. She said she also hopes to persuade city officials to tighten Baltimore's tree ordinance to protect the many small woodland patches. The city now only steps in when a landowner plans to remove at least 20,000 square feet of trees — but elsewhere the city code defines a forest as half that size or smaller, Avins pointed out.

Catfish from page 1

stem of the Chesapeake, caught dozens off the mouth of the Potomac last fall.

Virginia biologists were surprised when the fish turned up in small creeks on the lower Eastern Shore — an area they thought might be safe from the invaders because of its normally high salinity.

"With all of the rain we've had, we are starting to see reports of blue catfish in a lot of areas that have never seen them before," said Patrick Geer, deputy chief of the fishery management division of the Virginia Marine Resources Commission.

With the door open to new habitats, biologists say that blue catfish numbers will likely grow for the foreseeable future and are uncertain that much can be done about it. Virginia is poised to allow electrofishing by commercial harvesters to ramp up removals. But "whether or not we can curb the population, I don't know for sure," Geer said.

Most agree on one thing. Blue catfish are here to stay. What that means for the Bay, no one knows.

Too much success?

Depending on one's perspective, the blue catfish may or may not be a success story. A native of the Mississippi River and the Texas Gulf Coast, it is the largest catfish species in North America.

It can live for more than two decades and reach monster sizes of more than 100 pounds, making it popular not only in its native range but for anglers and fish managers looking to import new species.

That's what happened in the 1970s, when the Virginia Department of Game and Inland Fisheries began placing hundreds of thousands of them into Bay tributaries, primarily the Rappahannock and James rivers, to build a new sport fishery.

Though frowned on today, such introductions were once common. In this region, it led to the introduction of species such as channel catfish, smallmouth bass and brown trout.

For nearly two decades, blue catfish persisted without much notice. But in the mid-1990s, their numbers surged as the species proved surprisingly adaptable to the region's tidal rivers.

That created a world-class blue catfish trophy fishery worth millions of dollars a year. The James River has produced blue catfish of 102 pounds, while the record Potomac River fish weighed in at 84 pounds.

"All of us guides get people from all across the United States and Canada coming here to the James River because it is such a great fishery," said Hunter Tucker, who has been guiding anglers on the river for more than a decade.

But the region's large, nutrient-enriched tidal waters are ideal food factories for blue catfish, allowing them to reach incredible abundance.

Maryland DNR biologist Tim Groves nets a blue catfish caught using electro-shocking gear in the Potomac River in 2014. (Dave Harp)

Mary Fabrizio, a Virginia Institute of Marine Science fisheries professor, said she could find no precedent for an invasive fish reaching such densities. Fabrizio led a recent study on the James and found that 1.6 million blue catfish were living in a 12-kilometer stretch near the mouth of the Chickahominy River. That equates to 544 per hectare (2.47 acres).

The lionfish, a Pacific Ocean species that has invaded coral reefs in the Bahamas and devastated native fish populations, number 101 per hectare. Invasive carp in South Dakota lakes are at 35–255 per hectare. The northern snakehead, the feared "frankenfish" that snared headlines when it appeared in the Potomac River in 2004, averages about 3 per hectare.

"Everything else pales in comparison," Fabrizio said.

The study, part of nearly $1 million of blue catfish research funded by the National Oceanic and Atmospheric Administration Chesapeake Bay Office, estimated that 19.8 million could be living between Richmond and Smithfield, the bulk of its range in the James.

The commercial blue catfish harvest around the Bay last year totaled more than 5 million pounds, while striped bass harvests were less than 3 million.

Striped bass are considered to be overfished, but the blue catfish harvest hasn't dented its population. A recent study by Virginia Tech biologists concluded that the "harvest will need to increase substantially over current levels to influence the biomass of blue catfish."

Everything is on the menu

Blue catfish can be significant predators, especially when they reach larger sizes. Some popular Bay species are among their prey, including the blue crab.

The study by Virginia Tech biologists estimated that the fish could be eating 1.12 million pounds of the crustaceans a year in the three rivers systems it examined — the James, York and Rapahannock.

That's equivalent to 4.4 percent of Virginia's harvest. Fishery managers say that estimate might be low, because the overlap between blue catfish and blue crab habitat is in moderate salinity water, where the electrofishing gear used to collect fish for the diet study is less effective.

At the same time, the study — which examined 16,110 blue catfish stomachs — cast doubt on the notion that they are voracious, ecosystem-altering predators.

Mostly, the study found, blue catfish are omnivores, eating whatever is abundant in the river. All sorts of things turned up in their stomachs, even muskrats, snakes and birds. Overwhelmingly, they eat vegetation and invertebrates, but as they get larger, their diet turns toward fish.

The size at which that switch takes place varied from river to river. In the James, it happened at around 20 inches. In the Mattaponi and Pamunkey, it didn't occur until the fish were almost 36 inches.

So, while there are vast numbers of blue catfish, those feeding primarily on other fish is only a fraction of the population — about 20% on the James, 5% on the Rappahannock and 2% in the Mattaponi and Pamunkey.

"The large catfish are not the common fish in the population," said Virginia Tech's Don Orth, who oversaw the study.

He said concerns that blue catfish are depleting populations of American shad and river herring, species whose populations are near record lows, are likely overstated. Both were relatively uncommon in catfish guts.

"The dominant prey that we've found in these big catfish were the most abundant fish in the rivers, which are gizzard shad and other blue catfish," Orth said.

Still, Orth and others say it's hard to state conclusively that blue catfish predation is not impacting other species — simply because they're so plentiful.

"When you say perhaps this isn't a large component of the diet, that may be true," Fabrizio said. "But the fact that there are so many catfish has to be factored into that."

A small portion of the overall catfish diet could still account for a significant chunk of the population of a depleted species.

Hard to predict

Because blue catfish eat anything, with a diet that varies with age and location, it's hard to predict what will happen as they spread.

"They are going to end up impacting different species only because that's what's available in these different systems," said Mary Groves, a fisheries biologist with the Maryland Department of Natural Resources. "We have such a variety of river systems that it makes it very hard to come up with any kind of general statement."

Considered a big-river fish, they are nevertheless turning up in smaller and shallower waterways, and in places with higher salinities.

In Maryland, biologists are particularly interested in learning how the catfish

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behave in the Patuxent River, where they arrived several years ago. The river has different habitats and food sources than the larger rivers where they have been found for decades.

"We are looking for where they are spawning and where they are overwintering," Groves said. "Right now, on some of our river systems like the Patuxent, we don't know where that would be because it doesn't have the type of habitat you would normally see in the Mississippi drainage where they are from."

Also, scientists cannot always predict how the blue catfish will interact with native fish. On the Potomac River, DNR biologists became worried after they detected yellow perch eggs in the stomachs of the catfish.

Those eggs have a coating that makes them distasteful to other native fish, protecting them from predation. It does not appear to protect them from blue catfish, Groves said.

"It doesn't phase them," she said. "For those river systems in Maryland where we've been trying to restore the population of yellow perch, that's not very good news to hear."

Another problem is that the blue catfish appear to be out-competing other fish for spawning habitat, including the native white catfish and nonnative channel catfish, which was introduced more than a century ago.

"We've seen evidence that a big blue catfish can go in and take over a nest site that is used by a white catfish," Orth said. "They are very aggressive, and the male guards his nest site and chases anything else out."

Fishing for a solution

Citing concern about such conflicts, management agencies have encouraged a ramped-up commercial harvest. But no one knows how many blue catfish would need to be caught to reduce potential conflicts with other species — or whether a market exists for that large a catch.

Tim Shugrue is vice president of Congressional Seafood in Jessup, MD, which is the largest processor of blue catfish around the Bay. He estimated the catch would need to increase tenfold.

Handling that many would be a hurdle. Part of the problem is a provision in the 2008 Farm Bill that requires processors to have a U.S. Department of Agriculture inspector on site when handling catfish. That change, which went into effect two years ago, caused some to limit what they handle, and it effectively makes blue catfish off-limits to smaller processors that have to arrange for inspections for relatively small numbers of fish.

"It has become a choke point. It actually limits what we can produce," said Pat Welsh, president of Reliant Fish Company, in Jessup, MD. "Is that going to change? Doubtful."

This juvenile blue catfish was caught in a trawl net by Delaware Fish and Wildlife biologists on the Nanticoke River in March. (Dave Harp)

Even if that issue was resolved, significant obstacles remain to building a market that could absorb enough catfish to make a difference for the Bay, Shugrue said.

Right now, Congressional Seafood and others in the region employ workers who cut blue catfish by hand and produce high-value fillets that can snatch up to $9 a pound in grocery stores.

But catfish are harder to fillet and produce less meat than striped bass or tuna, Shugrue said. About 70% of a tuna can be turned into fillets, compared to about 25% of a blue catfish, he said. "It is three times as expensive to fillet a pound of cat as it is to fillet a pound of tuna. You just don't have the labor to devote to it."

Competing with catfish farming operations for a lower end market would be difficult, he added. Shugrue recounted a visit to a massive catfish farm in Alabama, where a seine net could quickly pull 25,000 pounds of catfish out of a pond and into a truck, which then unloaded the fish into a mechanized processing machine.

"From the time they open up the door on that tank, to the time 25,000 pounds of fish is filleted and boxed at the other end of the plant, it takes 53 minutes," Shugrue said. "For us to do 25,000 pounds, it would take at least five days."

Expanding the market to encourage such investments would be difficult, especially because catfish are perceived to be a muddy tasting, bottom-dwelling fish. Advocates say that doesn't apply to wild caught catfish from around the Bay.

"It cooks up great. There is no fishy taste to it," Welsh said. "It is really a fantastic fish to eat. But when somebody hears the word catfish, they think something that is exactly that — fishy."

Bay lacks a strategy

Despite the threat — and opportunities — there's no overall blue catfish strategy in the region. After an initial burst of interest and concern, the state-federal Bay Program in 2012 launched an Invasive Catfish Task Force to make recommendations.

Some, such as promoting a commercial fishery, have had a bit of success. Others, such as having a coordinated Bayside monitoring effort, have languished: No one can say with certainly exactly where blue catfish have taken up residence.

It also recommended developing a comprehensive management plan for the species. Without it, the region would lack basic information about how many blue catfish inhabit rivers and how many should be removed to protect native species. But no plan was ever developed.

Given the prospect of further expansion, some say it's time to take another look at crafting that strategy.

"This is a significant ecological concern," said Martin Gary of the Potomac River Fisheries Commission, which last year reported a blue catfish harvest of nearly 2.3 million pounds from the river — a 44% increase from just two years earlier. "There is a strong need for additional research because they are loose. They are no longer confined to certain areas."

The lack of clear management objectives seems to be producing a result no one wants, at least in the Virginia rivers where blue catfish were initially introduced. Those systems may now be approaching their carrying capacity, said Bob Greenlee, Eastern regional fisheries manager with the Virginia Department of Game and Inland Fisheries.

They are producing vast numbers of slow-growing small catfish, with significantly fewer reaching trophy sizes than a decade ago. In the James, it once took the fish 11 years to reach 20 pounds, Greenlee said. Now it takes 15. In the Rappahannock, it takes about 15 years to reach 5 pounds, he said.

It's a change that has hurt guides such as Tucker, as rivers like the James become choked with small fish, but produce fewer of the trophy-size fish that lure anglers. "It was really good for a long time," Tucker said. "But we have seen a significant change in the number of big fish in the past few years."

The trend toward huge numbers of small slow-growing fish hasn't been seen in places where the blue catfish are recent arrivals — such as the Potomac. No one knows whether it will follow the same trajectory.

But there's little consensus on whether the management priority should be to build a commercial fishery, protect native species or maintain a recreational fishery for monster-size fish. Each could require a different approach.

Many agree that getting more blue catfish out of rivers like the James and Rappahannock would be beneficial and potentially help the recreational fishery, as long as the catches were aimed at thinning out the smallest fish and allowing others to reach trophy size.

But differences spill over between agencies. The Virginia Marine Resources Commission, after conducting a pilot project for several years, is pushing a plan that would issue four permits to use electrofishing gear as part of an effort to sharply ramp up the harvests to protect priority species such as blue crabs.

Low-frequency electrofishing can selectively stun catfish, sending them to the surface where they can be scooped from the water with dip nets. But the practice is controversial with some who fish commercially and recreationally and also with the state's Department of Game and Inland Fisheries, which is concerned that the technique may harm other species, such as sturgeon.

To promote more regional dialogue, the Bay Program has transformed its task force into a permanent workgroup and expanded membership to include more diverse views, including recreational interests and the U.S. Department of Agriculture.

"Representation beyond scientific and management communities will be key to going forward," stated a memo establishing the new workgroup .

On the Potomac, Groves of the DNR sees both sides. She is worried about the blue catfish's potential impact on other species. "It's not something you can ignore," she said. "It can get to be 100 pounds. There's quite a lot of fuel that is needed to get a fish of that size."

At the same time, she acknowledged, there's value to the interest it generates among anglers.

"You can't beat having a little kid pull on a fishing pole and have a 30–40 pound fish on the other side," she said. "You are helping to build a future angler and conservationist with that."

Hole lot of fun: Natural swimming pools in the Blue Ridge

By Leslie Middleton

Many strategies for dealing with mid-Atlantic summer heat involve cool water: outdoor pools, ocean waves or slow-flowing rivers.

But there's nothing quite like plunging into a boulder-strewn, tree-lined swimming hole for that special respite that only a mountain stream can provide — and the Blue Ridge mountains in Virginia have plenty of offerings.

On the eastern flank of Shenandoah National Park, west of Charlottesville, the Moormans River gathers the springs and seeps from ancient rocks into its north and south forks above the Sugar Hollow reservoir at the end of VA Route 614.

One of the swimming holes here is known locally as the "Snake Hole," but the name doesn't deter visitors. You'll find it by taking a forested trail from the reservoir along the north fork of the Moormans. The trail follows a 20-foot ledge carved out of sandy sediment during the high flows of hurricane rains in the 1990s.

Where the trail levels off, stepping stones across the river form a shallow pool just right for testing the waters. The swimming hole lies about 500 yards ahead, deep enough for full-body immersion and a possible water slide through smooth boulders from the pool just above.

Mila Zimmerman, a Charlottesville acupuncturist, spends at least one day here with her children and their friends every summer. "We just lose our sense of time, playing with the elements at hand," Zimmerman said.

"The flowing water, the smells, the creatures they encounter," she said, are more than enough to fill the day.

Like many swimming holes, the Moormans River is no hidden gem. On a summer day, the parking lot can be filled by visitors headed here or up a trail along the southern fork to the Blue Hole, less than a half mile from the parking area.

But the popularity of these places is no reason not to visit them — or any others in the Blue Ridge Mountains, where the elevation change alone can provide 5 to 10 Fahrenheit degrees of cooling relief. Making the swimming hole or waterfall a hiking destination adds a particular satisfaction.

To the south in Augusta County, the St. Marys River collects water flowing from the western side of the Blue Ridge down through the St. Marys Wilderness Area. From the wilderness area parking area off Virginia Route 608, the trail weaves along the river through lush summer vegetation fed by periodic overflows during summer storms. Your destination is a 25-foot waterfall, but there are plenty of spots along the way to cool off.

A series of pools along Overall Run in Shenandoah National Park are among many spots in the Blue Ridge Mountains of Virginia where visitors can cool off on a summer day. (Mon Zamora / whatwedidlastweekend.com)

On a western spur of Shenandoah National Park, south of Front Royal, Overall Run flows toward the valley between the Blue Ridge and Massanutten mountains. A quarter-mile hike from the Thompson Hollow Trailhead leads to a series of pools along the stream. Farther up is Overall Falls. At 93-feet, it's the tallest waterfall in the park.

There are several options in Washington National Forest along Passage Creek. You'll find several in the heart of the Elizabeth Furnace National Recreation Area, named for the iron ore furnaces that once dotted the landscape. The creek is a tributary of the Shenandoah River's North Fork and flows through the valley between the two spine-like ridges of Massanutten Mountain.

One of the deepest spots on Passage Creek is yet another "Blue Hole," a short hike from the recreation area campground. Walk a bit farther to reach Buzzard Rock Hole, just as satisfying and reported to be a tad less busy in the summer.

There are a few things to consider when visiting any swimming hole. Start by making sure that you won't be trespassing. While many swimming holes are detailed online, keep to those on public lands.

Mon Zamora and Raisa Lea, avid hikers and authors of *20 Weekend Trips Near Washington D.C.*, remind readers to watch their step whenever traversing the rocks and shallows of these kinds of swimming holes. On a camping trip to Overall Run, a slip on an algae-covered rock sent Zamora to the emergency room for stitches.

Consider, too, that water levels vary in the summer and with the weather. A small chute of flowing water sliding into a pool can become a dangerous torrent after a heavy rain. Investigate the bottom of any beckoning pool before jumping in lest you collide with hidden rocks. Don't venture out alone, and always respect the power of water.

Remember that these creeks are sustenance for wild animals and home to fish and other aquatic species.

Protect yourself from the sun and insects, but sparingly, and practice "leave no trace" ethics when in the wild, no matter how many other people are present.

But do pack a snack and fresh water and linger awhile. Investigate what's under that palm-sized rock on the bottom — dragonfly or stonefly larvae? — before gently returning it to the stream. Shiver in the shade of overhanging trees, then soak up the heat of a sun-drenched rock.

And when you leave at the end of the day, you're likely to feel, as Zimmerman puts it, "tired and dirty and happy."

Ready for a dip? Know before you go:

- Shenandoah National Park Alerts: nps.gov/shen/planyourvisit/alerts.htm
- George Washington & Jefferson National Forest Alerts: fs.usda.gov/alerts/gwj/alerts-notices
- Maps & Publications: fs.usda.gov/main/gwj/maps-pubs
- Elizabeth Furnace Swimming Holes: www.beyondthecapital.com/2014/08/three-swimming-holes-just-over-hour.html
- St. Marys Falls Trail: vawilderness.org/saint-marys-wilderness.html

Kayak tours serve up unique view of Baltimore harbor

Inner Harbor kayak tour escorts Kelsey Hincke, Kyle Sanders and Kirsten Perry (left to right) paddle past the USS Constellation, a sloop-of-war that was the last sailing vessel built by the U.S. Navy in 1854. The Baltimore City Recreation and Parks Department offers escorted Inner Harbor kayak tours twice every Sunday, weather permitting, from April through October.

Story and Photos
By Timothy B. Wheeler

Baltimore's Inner Harbor might not make anyone's top 10 list of places they've dreamed of exploring by kayak. It can be a busy — and at certain times, funky — body of water in the heart of the second largest city in the Chesapeake Bay watershed.

In warmer weather, it's bustling with pleasure craft, tour boats and water taxis. It's also a working harbor, with freighters, tour boats and other large vessels moving in and out. And there's trash and debris littering the water's surface in places, especially after a rainfall — not to mention unseen contaminants from street runoff and sewage overflows.

Even so, it's a fascinating place to paddle, rewarding intrepid kayakers with intriguing sights and sounds not easily obtained by walking or driving around the harbor. It's a great way to get a different perspective on this historic port city and to witness firsthand the progress Baltimore has made in its ambitious campaign to clean up the harbor.

Members of the public who want a kayaking experience in Baltimore's harbor have a variety of options. I tried one of the two guided tours offered every Sunday from April through October by the city's Department of Recreation and Parks.

That morning in early April, a thick fog blanketed the city. It turned out that I was the only paying customer waiting in front of the Maryland Science Center when the Rec & Parks kayak team showed up. Lucky me — it meant we could tarry at times to take photographs and talk without worrying about the group getting strung out or someone (like me) being left behind.

Before setting out, my escorts and I spent a little time on a grassy spot by the science center previewing the tour and setting me up with a comfortable life vest and kayak. Then, we carried the kayaks and gear a short distance down to the water taxi landing.

Getting in the kayak required a bit of finesse because the water was about a foot or two below the landing's brick and concrete surface. But my escorts held the kayak steady as I climbed in and sat down. Once everyone was in, we set off, paddling along the promenade toward the pavilions of shops and restaurants. The fog had lifted a bit by then, but low clouds still obscured the skyline, shrouding the waterfront landscape.

The first few strokes were through a noisome patch of water covered with swirls of yellow pollen and cluttered with chip bags, candy wrappers and other litter — all of it probably pushed into that corner of the harbor by prevailing winds and tides. It didn't last long, but it was a reminder of the harbor's water quality challenges.

The city and its suburban neighbor, Baltimore County, are working under federal and state orders to clean up the trash, repair sewage leaks and overflows, and reduce other pollutants in the harbor. And, they are spending hundreds of millions of dollars to do it. In 2011, to give added impetus to the effort, the nonprofit Waterfront Partnership launched a campaign to make the harbor swimmable and fishable by the end of next year. It doesn't seem that deadline will be met, but water sampling in 2017 found bacteria levels improved enough to meet safe swimming standards from 50 percent to 88 percent of the time, depending on the location.

Those water quality issues are no deterrent for wildlife. We saw mallards paddling around, while sea gulls swooped overhead. A handful of resident Canada geese eyed us warily from piers, and one gave us a honking serenade. At one point, a big splash nearby punctuated the morning quiet, as some large fish broke the surface.

We got close looks at Baltimore's maritime heritage, paddling first around the USS Constellation, the last sail-only warship designed and built by the U.S. Navy. Joining the Constellation at Pier 1 that morning was the Pride of Baltimore II, a reconstruction of an early 19th-century Baltimore clipper ship. Crewmembers could be seen performing chores on deck and in the rigging.

Next up were other historic ships permanently moored in the Inner Harbor, including the submarine U.S.S. Torsk and lightship Chesapeake.

Kirsten Perry, a kayak tour guide with the Baltimore City Recreation and Parks Department, checks out a small floating wetland by the National Aquarium.

Left: Fog shrouded portions of the waterfront during an April morning kayak tour of Baltimore's Inner Harbor.
Above: A kayak enjoys a close encounter with Mr. Trash Wheel, which helps to reduce trash in the Baltmore Harbor. Powered by sun and water, the wheel lifts litter and other debris from the Jones Falls before it enters the harbor and deposits it into a floating dumpster.

We ducked in between Piers 3 and 4 by the National Aquarium to check out its floating wetland, a small artificial island covered with marsh grasses. This and other floating wetlands in the harbor have attracted fish, including striped bass, spot, Atlantic menhaden and white perch, as well as blue crabs and grass shrimp. On our visit, white shells — likely either barnacles or oysters — could be seen just beneath the water's surface, clinging to the sides of the wetland platform.

Next, we paddled around Pier 6 to visit Mr. Trash Wheel, the google-eyed floating janitor that's become an international media sensation. Since its installation in 2014, the wheel has scooped up 1,124 tons of trash and debris washed from suburban and city streets down the Jones Falls into the Inner Harbor. It spawned two other trash wheels around the harbor, and Adam Lindquist, coordinator of the Waterfront Partnership's Healthy Harbor initiative, said that funds are being raised to install a fourth.

We proceeded past the built-up area of Harbor East, with its hotels, restaurants and offices. Then came Harbor Point, the former site of a chromium ore-processing plant that has since been cleaned up and is undergoing redevelopment.

Just past that came Fells Point, one of the oldest neighborhoods in Baltimore, now a dining and nightlife hotspot. Its past is recalled at the Frederick Douglass-Isaac Myers Maritime Park, which recognizes the contributions of African Americans in Baltimore's maritime industry. The site also is the campus and headquarters of the Living Classrooms Foundation, which offers educational and workforce development programs for city youth.

From there, we paddled across the Northwest Branch of the Patapsco River toward the Domino sugar refinery on the other side of the harbor. We peered up at a large freighter tied up by the hulking brick factory, which for more than 95 years has been processing sugar from imported cane.

As we paddled back up the harbor, we passed the Baltimore Museum of Industry, plus a stretch of marinas and waterfront condos before returning to the science center. My escorts held my kayak steady while I clambered onto the water taxi landing, in time for brunch. After paddling about 4 miles, I had worked up an appetite.

Since their start in 2013, the Inner Harbor kayak tours have proven increasingly popular, leading the city to expand its offerings. Last year, about 900 people picked up a paddle and tried it out.

"It's a great way to see what the city has to offer," said Kirsten Perry, boating program coordinator for the city Department of Recreation and Parks, "especially if you've never been to Baltimore city."

For those who have toured Baltimore's waterfront by land, Perry said, "it's just nice to be able to get out and see something different. … We have this awesome river that runs through [the city], and I would like to get more people out on it."

Kayakers on the Inner Harbor tours will pass modern and historic sites and share the waterfront with private boats, tourist boats and cargo ships.

Baltimore Harbor kayak tours with the Department of Recreation & Parks

- *Inner Harbor Kayak Tours:* 9 a.m.–12 p.m. or 1–4 p.m. Sundays, April through October. For experienced paddlers only, ages 13 & older. Fee: $20/city resident, $30/nonresident. Preregistration required. Info: kayakbaltimore.com.
- *Sunday Afternoon Paddle Tours:* 10 a.m–2 p.m. April through October. Groups of up to 20 paddlers can explore the Middle Branch of the Patapsco by kayak or canoe. Fee: $20/city resident, $30/nonresident. Preregistration required. Info: bcrp.baltimorecity.gov/outdoor-recreation-programs.
- *Sunset Paddles:* 6–8 p.m. Fridays, April through May and September through October; and 7–9 p.m. June through July. All ages. 10 kayaks and 10 canoes are available for self-guided tours and tips or group lessons. Fee: $5/city resident, $20/nonresident. Preregistration required. Info: bcrp.baltimorecity.gov/outdoor-recreation-programs.
- *Canoe & Scoop:* 9 a.m.–12 p.m. Saturdays, April through October. Ages 12+ can paddle for free while helping to clean up litter and debris along the shoreline of Middle Branch Park. For info or to register a group, email bcro.boats@baltimorecity.gov.

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A mayapple blooms along the bank of Tuckahoe Creek in Maryland. Tucked under the broad leaves of the plant, the bloom is often hidden from the casual hiker. (Dave Harp)

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PA program for inmates answers growing demand for green jobs

By Rebecca Chillrud

"I don't want to say like I'm a tree lover because, you know, we do cut trees," said Gregory Clegg, a professional tree climber in Hampton, VA. "It's just something that I look at differently now, you know? And I think a lot of people would, if they learned about how trees work and the science behind them and plant life, and how important our environment is, then maybe it would open their eyes a little bit more."

Clegg didn't learn about the science of trees in a traditional classroom. He was part of an innovative program at the State Correctional Institution at Rockview, in Bellefonte, PA, that prepares inmates for a career in tree maintenance and management.

"I really think rehabilitation can occur by getting out into nature," said Shea Zwerver, the community engagement coordinator for TreeVitalize, a partnership-based urban forestry program under Pennsylvania's Department of Conservation and Natural Resources. Motivated by interests in environmental conservation and social justice, she reached out to the Pennsylvania Department of Corrections in 2017 with the idea to provide job training in arboriculture—or tree cultivation and management—to inmates.

SCI Rockview has about 2,600 forested acres, a tree nursery and a forestry camp where about 70 soon-to-be-released inmates live and work. Inmates already cut trees for firewood at the camp and care for the plants in the nursery, so Zwerver saw it as the perfect place to pilot the training.

She wanted to offer a program that would allow the men to pursue green jobs in tree management once released—a sector in desperate need of a skilled workforce. According to the U.S. Bureau of Labor Statistics, the tree care industry will need 30,000 new workers in the next five years.

"There's a demand for people with these arboriculture and forestry skills," Zwerver said. "Trees have tons of benefits — environmental, economic and social, too." Trees can help clean air and water, reduce energy costs by providing shade, increase property values and provide valuable habitat. For those benefits to be fully realized, trees need to be properly managed.

The demand for a tree management workforce has also increased as states in the Chesapeake Bay watershed, along with the District of Columbia, committed to increasing urban tree canopy by 2,400 acres in the most recent Chesapeake Bay Watershed Agreement.

Inmates at the Pennsylvania State Correctional Institution at Rockview participate in the Arborist Short Course on the institution's 2,600 forest acres in Bellefonte. (Will Parson/Chesapeake Bay Program)

Training also helps those released from prison find jobs, something that can be a serious challenge. The Prison Policy Institute reports that the average unemployment rate for the formerly incarcerated is 27 percent, and is even higher for formerly incarcerated people of color.

"[The program] is reassuring," said Michael, an inmate who participated in the program. "People coming out of prison oftentimes have a very hard time finding employment and having a skill like this is just one more tool to being successful."

In the fall of 2017, the first group of 15 inmates at the forestry camp signed up to take the Arborist Short Course program, an 18-hour training offered by Penn State Extension. Zwerver, who hopes to run the program annually and potentially expand to other Pennsylvania prisons, recruited volunteers from various industries and backgrounds to lead the classes, which range from tree biology to knot tying.

During the classroom training, the participants expressed interest in getting hands-on experience. That got them outdoors to learn how to identify different species, prune branches and even safely climb trees.

The instructors and participants agreed that the experience out in the field is vital. "No tree or situation is the same. The more hands-on experience they have, the more they can apply it," said Wade Renninger, forest and nursery manager at Rockview.

Being 60 feet off the ground and trusting your knots to keep you safe can be daunting, especially for inmates like Devin, who laughed when asked if he had a fear of heights: "Very much so."

But the participants agreed that getting the experience is worth it. "Your own life is in your own hands up in a tree. So, you've got to take it seriously," said Anthony, another inmate at Rockview. "Being outside, working with our hands — just having that gives you a little bit of grit to be able to go out there and strive to do something with yourself. It gives you courage, gives you confidence."

Courage, confidence and employable skills are all invaluable to these men upon release, as Clegg can attest.

"I'm a success story," Clegg said. "I learned as much as I could in there and I got out and I'm actually living a life off what I've learned and actually raising a family with it, off my earnings from it. I'm actually staying out of trouble."

Clegg was one of the first men who went through the program to be released from prison. He reached out to Zwerver, who helped him create a resume and put him in touch with contacts in the industry. Within two weeks, he had a job offer. Now, more than a year later, Clegg is continuing work in tree management.

"My life before this, before the program, was basically either like death or prison," Clegg said. "Prison actually turned out to be a blessing for me because it changed my life in so many ways, especially the forestry camp and having the opportunity to do that: Complete that program and learn so much there. It opened the doors."

"Now I have a purpose," he explained. "And I actually get up every morning and like going to work."

Having steady employment that you enjoy can be crucial to successfully re-entering society. Before going through the program, Clegg said he was in and out of prison. Now, he's been out and employed for more than a year. "There's no question that this type of training does help to reduce the recidivism rates," Renninger said. In Pennsylvania, 60 percent of released inmates are re-arrested or return to prison within three years.

Growing up, Clegg's parents owned a landscaping business, so he's had a connection with the outdoors since his youth. Despite that, he said he wouldn't have considered pursuing a green job without the forestry camp. "I think I was always interested in being outside, but the program gave me a different outlook on the environment as a whole," Clegg said. "As soon as I went to the forestry camp, I made the decision that this is what I want to do. The program just resparked that passion."

That passion is something he's now able to pass on to his children. "We get outside a lot," Clegg said. "It is kind of neat because my middle daughter, she's always asking me, like, 'Daddy, what kind of tree is that?' And she wants to learn how to climb someday."

Rebecca Chillrud is a Chesapeake Bay Program communications staffer with the Chesapeake Research Consortium.

Forum

Commentary • Letters • Perspectives

Leave it to beavers: Species' ability to alter land should be revisited

By Tom Horton

A pair of young beavers perch atop their lodge in a Nanticoke River wetland. (Dave Harp)

Notes to myself on preparing to teach my Chesapeake Bay course at Salisbury University for the 10th year:

Teach oysters? Always, but this time I'm also going bigger, with beavers. Both are "keystone" species, and Castor canadensis, *aka the North American beaver, is potentially the more important, even if restoring bivalves gets more press.*

Sewage treatment? Can't ever ignore 17 million toilet flushers, but as with beavers over oysters, I'm moving inland, traveling upslope, emphasizing the lands of the Bay's watershed vs. the Bay itself.

And that word, "watershed," let's reimagine it — it only entered the language around 1800, by which time we'd already eliminated most beavers and their dams and ponds throughout the Chesapeake region. And, that fundamentally altered and accelerated the way water moved off the landscape.

So what's a better word — waterkeep? Waterseep? Waterooze? Waterhold? …Something to get us back conceptually to the way it was when the Bay was healthy, its lands more fiercely retentive of life (water equals life).

You want to tell students everything you know. But when you have just 16 three-hour classes a semester, and you're trying to spend four or five of those sessions outside with watermen and farmers and scientists, or paddling through climate-changed landscapes, you have to choose.

Recently, my choices have moved upslope, come ashore, for a couple of reasons.

Land use is most of the ballgame in our estuary, more so than almost any other on Earth. The watershed/waterkeep is about 16 times the area of the tidal waters into which it drains. And the Bay is so shallow that there's astoundingly little volume of water given its long, broad surface — clearly too little to dilute the runoff from 48 million acres.

The other reason is that the advanced sewage treatment and air pollution control technologies that have carried the Bay restoration to its current, modest success don't have enough juice left to get us to our 2025 cleanup goals.

This is especially so in light of a growing population — and in light of no population-control policies at any level of government, or even among most environmental groups.

Chesapeake Born

Success by 2025 is going to depend more and more on how well we can halt pollution running from the land — specifically the land that our population radically alters wherever it goes.

Stormwater controls from developed landscapes are better designed than ever, but expensive. It's uncertain they will be deployed, maintained, inspected and enforced anywhere near 100 percent. Sediment control, for example, decades after it became law in places like Maryland, remains inadequate.

Agriculture, a far larger pollution source, is moving in some good directions with a new phosphorus-based manure control mandate in Maryland and the increasing use of winter cover crops that suck up fertilizers from groundwater before it carries them to the Bay.

But this is not happening everywhere, particularly not in Pennsylvania; and even where it *is* happening, we still don't have convincing evidence that we'll get big enough pollution reductions from the intensive row cropping and concentrations of animals that typify modern farming.

Add to this the real possibility that national policy may soon call for greater use of corn-based ethanol in gasoline. It saves little or no energy and would likely result in clearing more acres around the Bay for more corn.

There are promising programs to counteract polluted runoff, such as planting thousands of miles of vegetated buffers along rivers and streams. But those efforts are far behind schedule, and they don't specifically call for the vegetation to be forest, the best buffer.

And while such greening of the Bay's lands is good, we know that far better would be green and wet; and that's where we need to reconsider and actively restore the beaver.

No creature on Earth, save for modern humans, has more capacity to transform a landscape; and in designing a landscape that produces excellent water quality, the beaver has no equal.

Beavers ruled the hydrology of North America for a million years or more, until just the last few centuries, when fur trapping reduced populations from an estimated 100 million or more to less than half a million. In the Chesapeake, from millions to thousands is a fair estimate.

Through damming and ponding, beavers stanched the shedding of water from the watershed, cleansed it, filtered it, held back floods, let rain soak in to keep water tables high and streams running even in drought. They created luxurious habitats for a stunning variety of amphibians, fish, waterfowl and mammals.

In recent decades, beavers have come back to the point where a solid body of science in Canada and the United States confirms they were this continent's most important keystone species — a species whose functioning underpins a whole ecosystem.

My class this year listened to a young man in the stream-restoration business say that in many cases, the work that his company does might be done as well or better by just releasing beavers.

But it is illegal to do that, he said.

That's a mindset that needs to change. It will take education to overcome prevailing views of beavers as tree-chewing, property-flooding nuisances. They can be, but there are technologies to help us coexist — piping that keeps beaver ponds deep enough for the animals without flooding, for example.

You will hear more about beavers in my future columns — and in the news, I hope. A good place to start: Should the Chesapeake restoration effort include a beaver goal?

In the meantime, we must emulate the animal any way we can, creating wetlands throughout the landscape wherever there is opportunity, moving rapidly toward a "slower" watershed, one that sheds water only grudgingly.

Tom Horton has written about the Chesapeake Bay for more than 40 years, including eight books. He lives in Salisbury, where he is also a professor of environmental studies at Salisbury University.

Forum

Commentary • Letters • Perspectives

Money doesn't grow on trees; luckily you don't need money to grow them

By Nick Carter

Tim Wheeler's *CREP program interruptions hinder streamside tree planting efforts* (April 2019) raises points not frequently recognized. Whereas the Conservation Reserve Enhancement Program's cost-sharing doubtless encourages landowners to put their marginally productive lands into water quality protective uses, the reforestation of riparian or other lands need not depend on government funding.

Reforestation can be done for essentially zero dollars. All that is necessary is to stop tilling and/or mowing the area we want to become forest.

My wife, Margaret, and I have lived in the same house on the same land for more than 50 years.

When we bought this approximately 30-acre place in 1966, the half of it nearest the house was in pathetic corn tillage. "Pathetic" because the Galestown C Sand soil is acidic, droughty and relatively sterile by nature. It was only being cropped to obtain a subsidy. There was one red maple tree in a low place in the front 15 acres, a couple of black walnuts and sassafras and six silver maples in the old house yard.

Nick and Margaret Carter turned their 30-acre property into a forest filled with wildlife at almost no cost to them. (Dave Harp)

We stopped the tillage agreement immediately. The winds, the birds and the squirrels took over the planting. We gathered hickory nuts and holly berries from roadside trees and threw them, along with apple cores, randomly. We stuck in the free wildlife management "game food" shrub packets that the state gave away: crabapples, dogwoods, bush honeysuckle and autumn olive.

In the first spring, the land produced broom sedge, horse weed, camphor weed, trumpet vine, partridge pea, Japanese honeysuckle and sandburs. Those herbaceous volunteers trapped moist air and raised the humidity down close to the soil. Box turtles found shelter under them in the heat of the summer.

In three to four years, seedling loblolly and Virginia pines appeared, blown in by northwest winds from along that edge of the old fields. Some are now 18 inches in butt diameter.

Sassafras and wild cherry seeded out from the margins, moved by birds that ate those fruits. An occasional tulip poplar appeared, and an osage orange from we know not where. The single old red maple in the low place produced thousands of offspring. They have competed for light and moisture: Many have failed; the strongest survive.

Sweet gums, viewed as trash by many people, are now 50–60 feet tall. Their seeds are eaten by at least 18 species of birds and mammals.

Blocking an old ditch has created vernal pools and a sphagnum bog with skunk cabbage, cinnamon and royal fern, and Virginia magnolia.

As volunteers increased, as habitat changed, as shading and humidity increased, seedlings of southern red oak, willow oak and American beech appeared. These are small-seeded hardwoods, whose seeds can be moved, lost, planted and forgotten by meadow mice, deer mice and blue jays.

Squirrels plant the black walnuts. Persimmons are started by droppings from foxes, coons and possums. Ground covers that can tolerate shade have appeared: ground pine/running cedar, partridge berry, spotted wintergreen, fly orchis, ebony spleenwort, greenbriar, poison ivy. Most of the ground remains covered year-around with organic debris — mulch — fallen from the trees.

We have recorded more than 80 species of birds, 20-odd species of mammals, and a similar number of reptile and amphibians species. All of these animals and plants are cycling mechanisms: harvesting the elements, the fertility, the nutrients of the earth through their living, growing, reproducing, defecating and dying. They keep those elements of life here, uphill, up drainage — preventing their excess discharge to the rivers and the Bay.

Most of the precipitation is evapotranspired back into the atmosphere; much of the rest infiltrates through the very pervious forest floor into groundwater, emerging downhill as cool spring flow to maintain the streams through the dry seasons. There is nearly no surface runoff, and what does is slowed and filtered by the forest's litter fall. There is zero sediment export.

So we have allowed nature to heal itself. Except for the mostly native plant garden and yard Margaret has created around the house, our now 50-plus-year-old forest — in fact, a young forest — has not cost us any financial outlay.

The rivers and the Bay need this — a lot of it. From something like 95% forested 400 years ago, the watershed is now only about 58% forested, and that, very unequally distributed. Any satellite photo of the Eastern Shore reveals how little forest that very agricultural area still has. The watershed of the Choptank, the seventh largest Bay tributary, is only about 26% forested.

If landowners want free reforestation, they need only quit tilling or mowing the location. Nature will take care of the rest.

If anyone would like to see this first-hand, we are glad to show it to visitors. We are at nmcarter1@verizon.net. Nick Carter is a retired Maryland Department of Natural Resources biologist.

Letter to the Editor

Average striped bass numbers don't add up

Your recent article re-enforced my belief that our understanding of striped bass population dynamics hasn't advanced over the past half-century and, perhaps, is regressing.

Biologists before my time noted the absence of any spawning stock/recruiting correlation.

Perplexingly, huge year-classes could occur when spawning stock was low. More important than numbers would be maintaining a female spawning stock, including all ages and sizes. Old females open the long — 2-month — spawning season that ends with young, first-time females. This scenario ensures the presence of fertilized eggs whenever volatile spring conditions are favorable to fry survival: water temperature and quality, prey vulnerability — zooplankton densities vary greatly over time — and any other factors involved.

The present young-of-year survey that I designed in the early 1960s is an indispensable management tool. Disturbingly, collected data are often misinterpreted and misused. Any values calculated by averaging or extrapolation is generally meaningless and misleading.

A simple example: Obtaining a value of "12" by averaging a 20-fish-per-haul and a four-fish-per-haul is nonsensical math. A 20-per-haul doesn't represent five times more fingerlings than four-per-haul. Reality is much higher — 20, 30, 40 — who knows?

Why? Sampling sites are shallow with a firm, generally sandy bottom — prime fingerling striped bass habitat. When numbers are low, most of the population can occupy this preferred habitat and find sufficient prey. Conversely, "dominant" year classes necessitate massive expansion into marginal, unmonitored waters.

Stress mortality of hooked striped bass, particularly of larger fish during months of elevated temperatures, has been known for many decades.

Restricting sports harvest through higher and higher minimum size limits is contrary to science and common sense. Perhaps fish management would benefit by more biology and less math.

Joseph Boone
The letter writer is a former fisheries biologist with the Maryland Department of Natural Resources

Forum

Commentary • Letters • Perspectives

Wall Street, government need to put more stock in Bay's economic value

By Joel Dunn

Private investment in conservation is needed to help the Bay now and to help create a sustainable world for future generations. (Steve Droter / Chesapeake Bay Program)

I was lucky enough to grow up in the 1980s catching frogs, hooking sunfish, and exploring the mossy banks of Waden Pond, which Henry Thoreau turned into a symbol of nature and the need to protect it. There, I found the inspiration that led me toward a career in conservation that eventually brought me to the Chesapeake.

Today, I still find inspiration from Walden Pond, but now in the form of the book, From *Walden to Wall Street,* by James Levitt, which was published back in 2005. Ahead of its time, the book predicted that the future of the planet depends on private capital for conservation.

Now in my 40s, local headlines like *New State Plans Reveal Tough Path to 2025 Cleanup Goals,* and international headlines like *"1 Million Species Threatened with Extinction,"* have led me to join our generation's most notable conservationists, such as E. O. Wilson's work to conserve *Half Earth,* to save our planet, and Hansjörg Wyss's *Campaign for Nature* to conserve 30% of the planet by the year 2030. (See: *This 'half measure' might be enough to save Bay for next generation,* December 2018.) While there's significant interest in these conservation goals, there is always the daunting question of how we pay for it.

Specifically, here in the Chesapeake, a movement is growing to conserve and restore 30% of the Chesapeake's working lands and natural lands for the future of our region by 2030, and 50% by 2050. At the same time, we are deploying advanced technology and intense collaboration to move from an effort-based initiative to a results-oriented community, making this land conservation goal and overarching water quality goals feasible, measurable and intertwined. (See: *Data the new driver in conservation decisions regarding Bay,* June 2018.)

While the states in the Bay watershed have collectively appropriated more than $300 million in each of the last two fiscal years to conserve important lands, and have received some complementary federal funding, these levels will be inadequate to conserve another 3.1 million acres of land by 2030 to achieve the 30% goal.

Government funding will be imperative, such as Maryland's Program Open Space, Virginia's Land Preservation Tax Credit, Pennsylvania's Keystone Fund or the federal Land and Water Conservation Fund, but government funding alone will not protect our water quality, wildlife or way-of-life. This stark realization, and the necessity to move quickly, brings me to private investment in conservation.

Surveys by the Ecosystem Market Place have documented the continued increase in private investment in conservation over the period of 2004 through 2015 totaling $8.2 billion worldwide. The U.S. portion of this total is $1.7 billion. Investors are finding that nature can indeed provide quantifiable economic benefits by preserving or restoring clean water, protecting habitat and providing sustainable sources of fiber and food. This funding source is very real and growing.

In 2016, McKinsey and Company found that from 2015 to 2030, global demand for new infrastructure — transportation and energy networks and waste and water facilities — could amount to more than $90 trillion, almost double the estimated $50 trillion value of the world's existing stock. (Enter into search engine: Financing change: How to mobilize private sector financing for sustainable infrastructure.) Because of sustainable economic development commitments by governments, significant public and private capital will flow into sustainable energy, water, and transportation systems and green infrastructure, which will necessarily include land conservation.

According to the 2016 State of Private Investment in Conservation survey, there are several motivations for conservation investors other than profit, including fulfilling their own organization's conservation objectives, economic prosperity, corporate social responsibility plans and diversification of their investments.

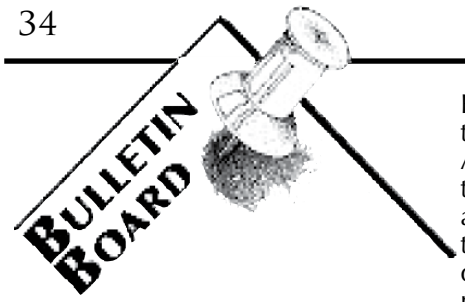
We have officially entered the era of socially responsible and sustainable investments, where people expect to make the world a better place as well as make money. Take Baltimore's Brown Advisory and their Sustainable Growth Fund. Or look at Goldman Sach's 2018 Sustainability report, which indicates that they have surpassed $80 billion in their goal to finance or invest $150 billion in clean energy by 2025.

Given our region's need to significantly increase the scale of land conservation and restoration, combined with population growth projections, we need to increase existing public funding programs and create the conditions necessary to attract large amounts of private capital investment. For-profit environmental firms like Ecosystem Investment Partners, Quantified Ventures, GreenVest, Resource Environmental Solutions, Lyme Timber, ACRE Investment Management, LLC, and others have successfully demonstrated that restoration opportunities in the Chesapeake can deliver excellent conservation and restoration results as well as provide necessary returns to private investors.

A recent conference convened in April by the Chesapeake Conservation Partnership, Alliance for the Chesapeake Bay, and Land Trust Alliance presented several tools used to attract private return-seeking investments to conservation projects. We also explored the risks, drivers and barriers in the Chesapeake region.

When we face the prospect that Pennsylvania's pollution reduction plan falls short of its 2025 goal, or that New York has suggested that they may not even follow their stated plan, both primarily due to funding limitations, then we need to come up with another way. Government leaders and Wall Street must hear this call to fund the restoration of the Chesapeake and conservation for the planet by increasing public funding and attracting sources of private capital investment. The future of our Chesapeake Bay, and indeed our planet, depends on it.

Joel Dunn is president and CEO of the Chesapeake Conservancy.



VOLUNTEER OPPORTUNITIES

Gunpowder Valley Conservancy

The Gunpowder Valley Forest Conservancy in Baltimore County needs volunteers for these workdays:

≋ *Forest Steward Workshop:* 9:30 a.m.–2:30 p.m. June 29. Bee Tree Preserve, Parkton. Ages 12+ Learn invasive plant identification, removal techniques, native plant identification & installation. Bring a water bottle, bag lunch. Preregistration required. Info: gunpowdervalleyconservancy.org/event/forest-steward-june-29.

≋ *Tree Maintenance:* 10 a.m.–1 p.m. June 8, 15 & 22 and July 6, 13, 20 & 27. Loch Raven Skeet & Trap Center, Phoenix. Ages 13+ Remove invasive plants, make sure newly planted trees are growing properly. Bring a water bottle. Preregistration required. Info: gunpowdervalleyconservancy.org/calendar.

CBMM Volunteer Fair

The Chesapeake Bay Maritime Museum in St. Michaels, MD, invites the public to its *Volunteer Fair*, 10 a.m.–12 p.m. June 27. Mingle with current volunteers and staff to learn about volunteer opportunities, including education, exhibition maintenance, gardening, boat building, marina operations and administration. In addition to training and enrichment trips, volunteers receive invitations to special events, library privileges and discounts in the museum store. Free. Preregistration is encouraged. Info: cbmm.org/volunteerfair.

Lynch Cove Run Cleanup

Clean Bread and Cheese Creek, Inc. needs volunteers of all ages and abilities to help with its *Lynch Cove Run Cleanup* 9 a.m.–2 p.m. June 22 along Bear Creek in Dundalk, MD. Trash bags, gloves, snacks, water and lunch will be provided. A limited number of tools are available for loan; please bring your own if possible. Meet at the North Point Government Center parking lot. The event supports the Smithsonian's traveling exhibit, *Water/Ways*, on display at the Historical Society of Baltimore County through July 6. Contact: 410-285-1202, Info@BreadandCheeseCreek.org.

MD Volunteer Angler Survey

Anglers of all ages can become citizen scientists by helping the Maryland Department of Natural Resources collect scientific data through the *Volunteer Angler Survey*. Anglers record basic information from their catch such as species, location and size directly to the survey on their smartphone. Biologists use this data to develop, plan and implement management strategies. The artificial reef initiative, blue crab, freshwater fisheries, muskie, shad and striped bass programs have upgraded to mobile-friendly methods. Participants are eligible to win quarterly prizes. Info: dnr.maryland.gov/Fisheries/Pages/survey/index.aspx.

Severn River Association

The Severn River Association in Annapolis is recruiting volunteers to join their team of citizen scientists monitoring water quality on the Severn River and its creeks. The weekly tours take place Wednesday and Thursday mornings, and last roughly four hours. The season goes to October. Volunteers can sign up for as many tours as they'd like. Info: TAGuay@severnriver.org, 443-569-3556, info@severnriver.org

Anita Leight Estuary Center

Anita C. Leight Estuary Center in Abingdon, MD, needs volunteers for these events:

≋ *Juvenile Fish Survey:* 6–8 p.m. June 26 and July 12 & 27. Ages 16+ Help collect fish population data that will be used by the Otter Point Creek Alliance to determine the status of tidal freshwater fish in the upper Bush River. No experience is required. All training, equipment provided.

≋ *Invasinators Workday:* 9–11 a.m. June 30. Ages 14+ Remove invasive species, install native plants. Learn why nonnative invasive plants threaten ecosystems, removal and restoration strategies, how to identify problem plants. Wear sturdy shoes, long sleeves, work gloves for field work, weather permitting.

Registration is required for both workdays. Info: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

Thomas Point Shoal Lighthouse

The National Historic Landmark, Thomas Point Shoal Lighthouse, restored by the U.S. Lighthouse Society, which operates tours in partnership with the Annapolis Maritime Museum, needs volunteers. Info: volunteer@amaritime.org.

Irvine Nature Center

Irvine Nature Center in Owings Mills, MD, needs *Weekend Weed Warriors,* ages 14 & older, to remove oriental bittersweet and multiflora rose June 15 & 29. Training and tools are provided. Wear sturdy shoes that can get wet/muddy and bring water and nonrefrigerated snacks or lunch. Meet at the main entrance. Info, including hours: 443-738-9230, fertigb@explorenature.org.

Workday Wisdom

Make sure that when you participate in cleanup or invasive plant removal workdays to protect the Chesapeake Bay watershed and its resources that you also protect yourself. Organizers of almost every workday strongly urge their volunteers to wear long pants, long-sleeved shirts, socks and closed-toe shoes (hiking or waterproof). This helps to minimize skin exposure to poison ivy and ticks, which might be found at the site. Light-colored clothing also makes it easier to spot ticks. Hats are strongly recommended. Although some events provide work gloves, not all do; ask when registering. Events near water require closed-toe shoes and clothing that can get wet or muddy. **Always bring water.** Sunscreen and an insect repellent designed to repel both deer ticks and mosquitoes help.

Lastly, most organizers ask that volunteers register ahead of time. Knowing how many people are going to show up ensures that they will have enough tools and supervisors. They can also give directions to the site or offer any suggestions for apparel or gear not mentioned here.

Volunteer at the CBEC

The Chesapeake Bay Environmental Center in Grasonville, MD, has a variety of volunteer openings for those who only want to drop in a few times a month to assist with a project or event, or help out on a more regular basis. Openings include: helping with educational programs, such as *School's Out* or *Summer Camp* and *Creepy Crawler*; guided kayak trips or hikes; staffing the visitor center front desk; maintaining trails; working on landscape projects; the Pollinator Garden; feeding or handling captive birds of prey; maintaining birds' living quarters; and participating in the CBEC's team of wood duck box monitors or other wildlife initiatives. Other opportunities include participating in fundraising events and behind-the-scenes operations, including website development, writing for newsletters and events, developing photo archives and supporting office staff. Volunteers donating more than 100 hours of service per year receive a complimentary 1-year family membership to the CBEC. Info: volunteercoordinator@bayrestoration.org.

Cromwell Valley Park

Cromwell Valley Park in Parkville, MD, needs volunteers of all ages (12 & younger w/adult) for its *Habitat Restoration Team / Weed Warrior Days* 10 a.m.–12 p.m. June 8, 19, 22 & 26 and July 13, 17 & 27. Help to remove invasive species, install native ones and maintain habitat. Service hours are available. Meet at Sherwood House parking lot. Registration required. Info: Ltmitchell4@comcast.net.

Little Paint Branch Park

Help the Maryland-National Capital Park and Planning Commission remove invasive species 11 a.m. to 3 p.m. the last Saturday in June, July and August at Little Paint Branch Park in Beltsville. Learn about native plants. Sign in for a safety orientation. Gloves and tools are provided. Info: 301-442-5657, Marc.Imlay@pgparks.com.

Adopt-a-Stream program

The Prince William Soil & Water Conservation District in Manassas, VA, wants to ensure that stream cleanup volunteers have all of the support and supplies they need for trash removal projects. Participating groups receive an *Adopt-A-Stream* sign in recognition of their stewardship. To learn more, adopt a stream or get a proposed site, visit waterquality@pwswcd.org. Groups can register their events at trashnetwork.fergusonfoundation.org.

Magruder Woods

Help Friends of Magruder Woods 9 a.m. to 1 p.m. the third Saturday in June, July and August remove invasive plants in the forested swamp in Hyattsville, MD. Meet at farthest end of parking lot. Info: 301-283-0808, Marc.Imlay@pgparks.com, (301-442-5657 the day of event); or Colleen Aistis at 301-985-5057.

Become a VA Master Naturalist

Virginia Master Naturalists are a corps of volunteers that help to manage and protect natural areas through activities such as plant and animal surveys, stream monitoring, trail rehabilitation and teaching in nature centers. Basic training covers include ecology, geology, soils, native flora and fauna, and habitat management. Info: virginiamasternaturalist.org.

American Chestnut Land Trust

The American Chestnut Land Trust in Prince Frederick, MD, needs volunteers for invasive plant removal workdays 9–11 a.m. Thursdays and 10 a.m. to 12 p.m. Wednesdays. All ages (16 & younger w/adult) are welcome. Training, tools and water are

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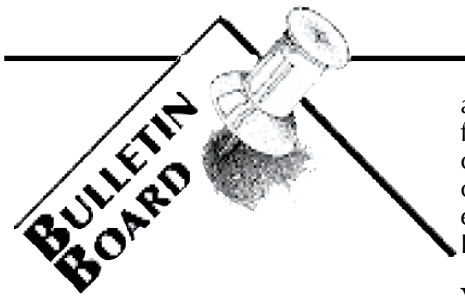

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provided. Preregistration is required. Info: 410-414-3400, acltweb.org, landmanager@acltweb.org.

Ruth Swann Park

Help the Maryland Native Plant Society, Sierra Club and Chapman Forest Foundation 10 a.m. to 4 p.m. the second Saturday in June, July and August remove invasive plants at Ruth Swann Park in Bryans Road. Meet at Ruth Swann Park-Potomac Branch Library parking lot. Bring lunch. Info: ialm@erols.com, 301-283-0808, (301-442-5657 day of event). Carpoolers meet at the Sierra Club MD Chapter office at 9 a.m. and return at 5 p.m. Carpool contact: 301-277-7111.

Creek Critters app

Audubon Naturalist's *Creek Critters* app empowers people to check their local streams' health through finding and identifying small organisms that live in freshwater streams, then generating health reports based on what they find. The free app can be downloaded from the App Store and Google Play. Info: anshome.org/creek-critters. To learn about partnerships or host a *Creek Critters* event: cleanstreams@anshome.org.

Floatable monitoring program

The Prince William Soil & Water Conservation District in Manassas, VA, needs volunteers to help assess and trace trash in streams as part of an effort to reduce nonpoint source pollutants in urbanized and industrialized areas in relation to the County's Municipal Separate Storm Sewers (MS4) permit. Cleanup supplies are provided. Info: waterquality@pwswcd.org.

Resources

Stormwater class

The Alliance for the Chesapeake Bay has released the online Municipal Online Stormwater Training Center's *Dig Once Course*. Developed by the Local Government Programs staff and the University of Maryland's Environmental Finance Center, the course offers local leaders ways to integrate green infrastructure into community capital projects such as road construction and school and park improvements. Through interactive lessons, videos, and knowledge checks in a user-friendly format, the center provides communities with tools to better communicate about, build and enhance local stormwater programs. Info: mostcenter.org.

Wetlands Work website

The Chesapeake Bay Program has launched *Wetlands Work* (wetlandswork.org). The site, developed by the Wetlands Workgroup, connects agricultural landowners with people and programs that can support wetland development and restoration on their land.

Turf / lawn programs

For information on the Prince William (County, VA) Soil & Water Conservation District's *12 Steps to a Greener Lawn / Building Environmental Sustainable Turf BEST Lawns* programs, low-cost, research-based programs for lawn education, contact: 703-792-4037, bestlawns@pwcgov.org.

Severn River video library

The Severn River Association invites the public to view videos of its *John Wright Speaker Series* presentations to learn about activities and challenges on the Severn River. The videos are available at severnriver.org/category/speaker-series.

Stormwater management

Prince William County, VA, businesses and nonprofits interested in landscaping and turf management, stormwater pond management, wildlife concerns, recommendations for maintaining landscapes, protecting water quality and pollution prevention can call the county at 703-792-6285 to schedule a free site visit.

Bay Backpack

Provided by the Chesapeake Bay Program's Education Workgroup, *Bay Backpack* is an online resource for educators with information about funding opportunities, field studies, curriculum guides and lesson plans related to the Chesapeake. Info: baybackpack.com.

5 MD libraries offer fishing gear

The Maryland Department of Natural Resources' Aquatic Resources Education Program is providing rods and reels, tackle and fishing books geared toward children to the Eastport-Annapolis Neck Community and Mountain Road Community libraries in Anne Arundel County; Westminster Branch Library in Carroll County; Brunswick Branch Library in Frederick County; and Joppa Branch Library in Harford County. The goal is to foster the next generation of anglers by cultivating a passion for outdoor recreation and an appreciation of nature. The libraries, which are close to public fishing areas, have partnered with local fishing clubs to ensure inventory levels and maintenance of the equipment.

New Submission Guidelines

The *Bay Journal* regrets it is not always able to print every notice it receives because of space limitations. Priority is given to events or programs that most closely relate to the preservation and appreciation of the Bay, its watershed and resources. Items published in *Bulletin Board* are posted on the online calendar; unpublished items are posted online if staffing permits. Guidelines:

- **Send notices to kgaskell@bayjournal.com.** Items sent to other addresses are not always forwarded before the deadline.
- *Bulletin Board* contains events that take place (or have registration deadlines) on or after the 11th of the month in which the item is published through the 11th of the next month. Deadlines run at least two months in advance. See below.
- Submissions to *Bulletin Board* must be sent either as a Word or Pages document, or as simple text in the body of an e-mail. PDFs, newsletters or other formats may be considered if there is space and if information can be easily extracted.
- Programs must contain all of the following information: a phone number (include the area code) or e-mail address of a contact person; the title, time (online calendar requires an end time as well as a start time), date and place of the event or program. Submissions must state if the program is free, requires a fee, has age requirements, has a registration deadline or welcomes drop-ins.
- **July-August issue: June 11**
- **September issue: August 11**

Forums / Workshops

Future Harvest CASA workshops

Upcoming workshops offered by the Future Harvest Chesapeake Alliance for Sustainable Agriculture include:

- *Water, Water Everywhere!* 12:30–4:30 p.m. June 17. Piedmont Environmental Council Community Farm in Aldie, VA. Learn about agricultural water risk assessment and best practices. Fee: $20.
- *Introduction to Permaculture:* 11 a.m.–6 p.m. June 29–30. Bryan Park Nature Center, Richmond. Learn the basic principles of permaculture, an ecological design system modeled after patterns found in nature. Fee: $75/one day; $135/both days.
- *Introduction to Permaculture: Site Analysis for Permaculture Design:* 1–4 p.m. June 30. Pearlstone Center, Reisterstown, MD. In collaboration with Pearlstone Center, Patty Ceglia, a permaculture design expert & Greg Strella, Pearlstone's chief stewardship officer, will demonstrate and guide participants through practice site analysis, map sketching, zone planning. Fee: $25.

Preregistration is required for each workshop. Enter Future Harvest CASA into your search engine.

Events / Programs

DC RiverSmart walking tour

The Alliance for the Chesapeake Bay and the District of Columbia's Department of Energy and Environment invite the public to tour *RiverSmart Home*s 10 a.m.–12 p.m. June 15 in DC's Oxon Run watershed. The tour includes a Q&A with DOEE auditors, an interactive storm drain-marking activity, a tree planting demonstration, on-site stormwater audits and children's activities. Info: ltodd@allianceforthebay.org.

Elizabeth RIVERFest

The Elizabeth River Project invites the public to *Elizabeth RIVERFest* 11 a.m. to 4 p.m. June 23 (rain date 6/30) at Back Bay's Farmhouse Brewing in Virginia Beach. This free outdoor environmental festival, which celebrates the river's restoration, includes visiting the *Science Dome* to learn what's in your river; the Chesapeake Mermaid; earning a free River Star Homes Garden Flag; children's activities; Scoop the Poop Cornhole; organic lawn & garden experts; organic produce sale; local food trucks, beer & cider; eco-friendly vendors; and live music. Those who come by bicycle receive a free bike bell while supplies last. Info: cshaw@elizabethriver.org, 757-399-7487, Elizabethriverfest.org.

Edna E. Lockwood heritage tour

Edna E. Lockwood, the last historic sailing bugeye in the world and queen of the Chesapeake Bay Maritime Museum's floating fleet, has embarked on a heritage tour, traveling to ports around the Bay through September. Each stop features free, experiential programming and interpretation of traditional Chesapeake Bay boat-building techniques and the oystering industry. Upcoming stops include the National Harbor, MD, June 16; District Wharf Marina, Washington, DC, June 17–23; and Havre de Grace (MD) Maritime

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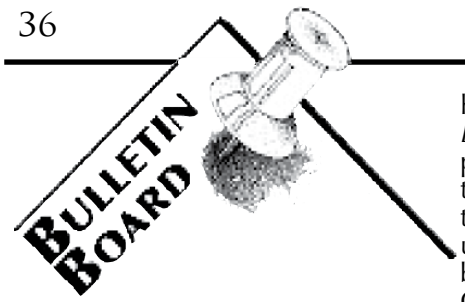

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Museum, July 6-8. All ports of call are weather dependent. The full schedule is found at cbmmshipyard.org/ednalockwood.

Plankton program at Ladew

Ladew Topiary Gardens in Jarrettsville, MD, is presenting *Family Nature Explorers / Playing With Plankton* 10:30 a.m.–12 p.m. July 13. Participants (ages 3+ w/adult) will look at these tiny animals through a microscope and hike along the Nature Walk trail to explore water features for microscopic aquatic life. Fee: $18/ adult; $15/senior & $9/ child. Preregistration required. Info: ladewgardens.com, 410-557-9570.

Mount Harmon Plantation

Mount Harmon Historic Plantation and Nature Preserve in Earleville, MD, invites the public to a *Sultana-Guided Kayak Paddle & House Tour*, 10 a.m.–12:30 p.m. June 13. Launch from the plantation's waterfront to explore the pristine headwaters of the Sassafras, which includes some of the best blue heron habitat on the Bay. Later, tour the manor house. Fee: $30. Preregistration required. Info: mountharmon.org, 410-275-8819, info@mountharmon.org.

Sharks at VA Living Museum

The Virginia Living Museum in Newport News invites the public to its summer exhibit, *SHARK ZONE*, which run 9 a.m. to 5 p.m. daily through Sept. 2. Guests can view life-size replicas of six shark species; touch live catsharks and skates; enter a shark cage to come face-to-face with a full-size great white shark replica; use a computer kiosk to track more than 20 tagged great white shark locations in the world's oceans; and explore websites with shark-themed games & quizzes. In the Shark Research Station play area, children can capture one of five plush shark species and use medical equipment to perform critical tests before releasing them back into the ocean. Outside, at Fossil Beach, visitors can dig in a pit for real fossil shark teeth, identify the shark they came from, then take home a souvenir fossil shark tooth. In the photo gallery, *SHARKS: On Assignment with Brian Skerry* features 35 large-scale images and videos highlighting this *National Geographic Explorer* and award-winning photojournalist's lifelong commitment to the conservation of sharks and the oceans. His work is on display until Aug. 4, when it will be replaced by Virginia shark photography. Companion programs include:

≋ *Shark Guts:* 12:30 & 1:30 p.m. daily June 15–Sept. 2 at the summer outdoor amphitheater. Get up-close with a variety of shark meals, learn how a shark's teeth determine what it eats.

≋ *Shark Secrets:* 12, 1 & 2 p.m. daily June 15–Sept. 2 on the museum's main level. Learn how sharks survive in an array of environments — and meet some animals up-close.

Museum admission is $20/adults; $15/ages 3-12. Info: thevlm.org, 757-595-1900.

Thomas Point Shoal Lighthouse

The Annapolis Maritime Museum is offering tours of the Thomas Point Shoal Lighthouse 9–11 a.m. & 12–2 p.m. June 15 and July 6, 13 & 27. The tour include 30-minute boat rides to and from the lighthouse, with opportunities to photograph it from many angles, and a one-hour interior tour, where visitors, who must be 12 & older, learn about the light's history, the life of a keeper and the role of the U.S. Coast Guard. Tours require some physical exertion. Tickets are $80 and help fund the lighthouse's restoration. Info: amaritime.org, uslhs.org.

Boating safety classes

U.S. Coast Guard Auxiliary Flotilla 25-08 is offering *Boating Safety* classes 7:30 a.m.–5 p.m. June 15 and July 20 at the Washington Farm United Methodist Church in Alexandria, VA. Learn about boat handling and regulations, nautical "rules of the road," trailering and required gear. Virginia, Maryland and the District of Columbia have varying requirements for boaters before they may legally operate certain motorized vessels on their respective waterways. Each jurisdiction has some requirement for a safe boating class. Preregistration is required. Info: jdburt@verizon.net, 703-307-6482. The auxiliary's website, wow.uscgaux.info/content.php?unit=B-DEPT, also features boating safety tools, materials.

MD youth fishing rodeos

The MD DNR Fishing & Boating Services are running a free *Youth Fishing Rodeo* for ages 3–15 at 8:30 a.m. July 13 at the Bay 7 Street Ponds in Easton. Participants learn basic angling skills; develop an understanding of the environment and natural resources; and have an experience that fosters interest in conservation and fishing. Because of space limitations, would-be attendees must register. Info: Calvin Yowell, Easton Elks Lodge #1622, 410-820-8935.

Cromwell Valley Park

Upcoming programs at Cromwell Valley Park's Willow Grove Nature Center in Parkville, MD, include:

≋ *Law of Claw & Fang:* Drop in program. 1–2 p.m. June 15. All ages. Learn about food chains, help to feed the park's animals. Free. No registration.

≋ *Father's Day Nature Quest Hike:* Drop-in program. 10 a.m.–3 p.m. June 16. All ages. Bring Dad and Wegmans *Nature Quest* booklet (or get booklet at park). Hike to find *Quest Trail* markers. Later, return to the center to pick up a CVP sticker. Free. No registration.

≋ *Summer Solstice Campfire:* 8–9:30 p.m. June 21. All ages. Bake s'mores around the fire. Fee: $5.

≋ *Wild Summer Salad on Your Own Pizza:* 1–3 p.m. June 23. All ages. Collect wild edibles, bake a pizza in the earth oven. Fee: $7.

≋ *Identifying Pollinators:* 1–2 p.m. June 29. Ages 5+ Without pollination, there would be no food, flowers, or trees. Discover which pollinators live in the park. Free.

≋ *Summer Adventure Trek:* Drop in program. 10 a.m.–3 p.m. June 30. All ages. Start at the nature center for a self-guided journey, then return to pick up a prize. Free. No registration.

≋ *Poisonous Plants & Animals:* 1–2:30 p.m. July 6. Ages 5+ Learn how to identify, avoid poison ivy, cherry leaves, nightshade, copperheads. Fee: $4.

≋ *Wild Edibles:* 1–3 p.m. July 7. Adults. Collect wild edibles, use the earth oven to cook what is found. Fee: $7.

≋ *Boy Scout Day:* 1–3 p.m. July 13. Lion, Tiger & Wolf Cubs. Meet some of Maryland's animals, go outside to explore their habitat. Participants receive a Cromwell Valley Park patch. No siblings. Fee: $5.

Ages 12 & younger must be accompanied by an adult. Except where noted, preregistration is required for all programs. Info: cromwellvalleypark.campbrainregistration.com, 410-887-2503, info@cromwellvalleypark.org, cromwellvalleypark.org. For disability-related accommodations, call 410-887-5370 or 410-887-5319 (TTY), giving as much notice as possible.

Patuxent Research Refuge

Upcoming programs at the Patuxent Research Refuge's North Tract [T] and National Wildlife Visitor Center [C] in Laurel, MD, include:

≋ *Family Fun / Welcome Wildlife To Your Yard:* Drop-in program. 10 a.m.–1 p.m. June 14 & 15 [C] All ages. One doesn't need a big yard — even a small balcony can provide a mini habitat. Learn how to attract, help wildlife. Hands-on activities, crafts. No registration.

≋ *BSA Environmental Science Merit Badge:* 9 a.m.–1 p.m. June 15, 22 [C] Ages 10–17. Some pre/post work is needed.

≋ *Owl & Kestrel:* 12:15–12:45 p.m. June 15, 22 & 29 [C] All ages. Meet two of North America's smallest birds of prey: the American kestrel and eastern screech owl. No registration.

≋ *Discovering Lichens:* 10–10:45 a.m. June 23 [C] Ages 10+ Look for this delicate group of fungi growing on trees, logs. Bring water bottle, magnifying glass if possible. Walk is weather dependent.

≋ *Bird Walk at Cash Lake:* 8–10 a.m. June 29 [C] Ages 5+ (no strollers, parent participation & registration required)) Take a leisurely 2-mile walk searching for birds. Bring binoculars, water bottle. Walk is weather dependent.

≋ *Bicycle Ride:* 1–3:30 p.m. June 30. [T] Ages 10+ Learn the importance of reducing one's footprint, leaving no trace on 12-mile guided ride. Discover local wildlife, plants, historical sites. Bring bike, energy bar/snack, water bottle, helmet. Ride is weather dependent.

All programs are free; donations are appreciated. Except where noted, programs are designed for individuals/families and require preregistration. Contact: 301-497-5887. For disability-related accommodations, notify the refuge, giving as much notice as possible. Info: fws.gov/refuge/Patuxent, fws.gov/refuge/Patuxent/visit/PublicPrograms.html.

Anita Leight Estuary Center

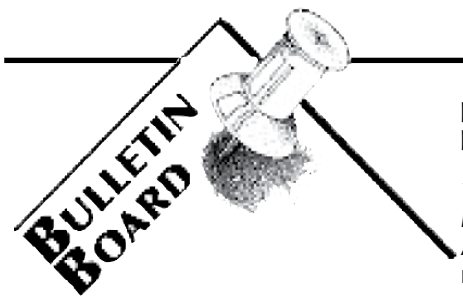
Programs at the Anita C. Leight Estuary Center in Abingdon, MD, include:

≋ *3rd Annual Youth Fishing Derby:* 9–11 a.m. June 15. Meet at ACLEC Pontoon Pier. Ages 6–13. Learn the basics of fishing. Participants may bring their own rods & reels and tackle; a limited number will be available to borrow. Sponsored by the Otter Point Creek Alliance and the Izaak Walton League of America, Harford County Chapter. Fee: $5.

≋ *Hart Miller Island Adventure Kayak:* 9:30 a.m.–2:30 p.m. June 15. Meet at Rocky Point Beach Park. Adults / experienced kayakers. Paddle roughly 1.5 miles from Rocky Point to north of Drum Point on Hart-Miller Island. Bring a lunch to eat on the beach. Take a bird hike on island trails. Fee: $16 plus admission to Rocky Point Beach Park.

≋ *Children's Garden Club:* 10:30–11:30 a.m. June 15. Ages 5–8. Cook,

BULLETIN CONTINUES ON PAGE 37



Bulletin from page 36

create, explore while discovering a garden's connection to the wild world. Fee: $5/child.

≋ *Critter Dinner Time:* 1:30 p.m. June 15. All ages. Learn about turtles, fish, snakes while watching them eat. Free. No registration.

≋ *Father's Day Fishing Fun:* 1–2:30 p.m. June 16. Ages 5+ See how many kinds of fish are caught with a 100-foot seine net. Participants will get wet. Fee: $3.

≋ *Kids-n-Canoes:* 10–12 p.m. June 22. Ages 5+ Young children will be taught paddling safety, basic strokes before venturing into Otter Point Creek. Fee: $12.

≋ *Summer Solstice Celebration Canoe:* 1–3:30 p.m. June 22. Ages 8+ Learn about solstice lore. Fee: $12.

≋ *Tails & Tots:* 3:30 p.m. June 23. Ages 6 & younger. Listen to stories, learn new songs, move like the animals. Free. No registration.

≋ *Chesapeake Canoers Camp:* 9 a.m.–4 p.m. June 25–28. Ages 11–15 (parents do not attend). Paddle Harford County's waters learning about their plants, animals. Fee: $120.

≋ *Caught on Camera:* 10 a.m.–1:30 p.m. June 29. All ages. Learn from wildlife cameras what animals have been lurking in the park's woods. Take a short hike to retrieve cameras, return to center for the reveal. Free.

≋ *Broad Creek Kayak:* 1–3:30 p.m. June 29. Ages 8+ Meet at Broad Creek Public Landing. Explore this tributary of the lower Susquehanna River. Fee: $12.

≋ *What's the Buzz?* 1–2:30 p.m. June 30. Ages 8+ Learn about pollinators. Treat included. Fee: $3.

Except for camp, ages 12 & younger must be accompanied by an adult for all programs. Events meet at the center and require preregistration unless otherwise noted. Payment is due at time of registration. Info: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

Eden Mill Nature Center

Upcoming programs at Eden Mill Nature Center in Pylesville, MD, include:

≋ *Child & Adult Paint Evenings:* 6-8 p.m. June 14 (*Turtle*); June 28 (*Fish*); July 5 (*Sea Turtle*); July 12 (*Gecko*). Ages 5–10 w/adult. Child & adult each complete a 14"x 18" acrylic painting on canvas. Instruction provided during event. Fee: $50 per pair per session.

≋ *Owl Prowl:* 8–9:30 p.m. June 14. Ages 8+ Learn about, look for Maryland's native owls in the woods. All minors must be accompanied by a registered parent/guardian. Fee: $7.

≋ *Weeklong Adventure:* 9 a.m. –3 p.m. June 17–21 or July 15–19. Ages 6–11. Explore the trails, participate in experiments, make crafts, play games, end the week paddling on Deer Creek. Fee: $175 for each week.

≋ *Eden Mill Summer Paint Night / Dragonfly:* 6–8 p.m. June 21. Adults. Complete a 14" x 18" acrylic painting on canvas. Instruction provided during event. Fee: $40.

≋ *Introduction to Tandem Canoeing:* 9 a.m.–4 p.m. June 23. Ages 14+ Learn to launch, maneuver a 2-person canoe in flatwater conditions Basic information on canoes, equipment, safety and rescue techniques included. Fee: $50.

≋ *Wee Wonders Summer:* 9:30–11:30 a.m. July 15–19. Ages 2–5. Nature games, activities, story, craft, hike. Fee: $90.

≋ *Sunrise/Sunset Canoe Trips*: 5:45–8:15 p.m. Tuesdays & Thursdays in June, September & October through Oct. 13 and 9–11:30 a.m. Saturdays in July & August. 5:45–8:15 p.m. Thursdays, in July & August. Fee of $8 includes all equipment.

Preregistration is required for all programs and closes 24 hours in advance of each program. Weekend program registration closes at noon on the prior Friday. Info: 410-836-3050, edenmillnaturecenter@gmail.com, edenmill.org.

Kayaking at the CBEC

The Chesapeake Bay Environmental Center in Grasonville, MD, is offering kayak tours and classes to increase the appreciation, knowledge and stewardship of the Chesapeake ecosystem:

≋ *Guided Kayak Tour:* 10 a.m. June 23. Beginner to intermediate kayakers. Look for wildlife while exploring Marshy Creek with a self-provided snack break at the halfway point. Instruction on equipment, paddling/safety techniques, loading & unloading vessels included. Fee of $20 includes kayaks, equipment. Preregistration required: bayrestoration.org/guided-kayak-tours.

≋ *ACA Level 1 – Introduction to Kayaking:* 10 a.m.–5 p.m. July 7. Beginner to intermediate kayakers interested in traditional decked kayaks, inflatables, and sit-on-tops (spray skirts not used in this course). Classes include two hours of dry land instruction and three hours of on-water instruction on calm, flat water with certified ACA Kayak Instructors at a 5-to-1 ratio. Course includes pre-paddling preparation; equipment overview; stroke development; maneuvers; self-rescue; rules of the water. This is a skills-based course with an optional assessment that provides the participant with an opportunity to receive documentation of having achieved a certain level of paddling ability. Cost: $80, plus a kayak and equipment rental fee of $20. Those seeking the optional assessment pay an additional $15 and will need to acquire an ACA membership prior to class. Preregistration required. Info: bayrestoration.org/kayaking.

Chesapeake Bay Maritime Museum

Upcoming events at the Chesapeake Bay Maritime Museum in St. Michaels, MD, include:

≋ *Blacksmithing Workshops:* 10 a.m.–2:30 p.m. June 15 or 16. Learn the basics of blacksmithing, techniques for forging small projects such as nails, wall hooks, forks, bottle openers. Bring home a hand-forged project. Materials, basic tools provided. Bring a lunch. Fee: $100. Preregistration required. Info: cbmm.org/shipyardprograms.

≋ *Ecology Cruise / Winnie Estelle:* 10–11:30 a.m. June 20. Board the buyboat Winnie Estelle for an exploration of the Miles River. Participants will learn how to monitor the water quality of the river, perform water testing, look for animals on an oyster reef. The route passes near Long Point Island, known for its eagle and osprey populations and heron rookery. Fee: $20. Preregistration required; Info: cbmm.org/onthewater.

≋ *Open Boat Shop:* 5:30–8:30 p.m. June 20, July 25 & Aug. 22. Experienced and novice woodworkers, ages 16+ (unless accompanied by an adult) can work on a small woodworking project, or bring ideas for a future project to receive guidance from an experienced shipwright and woodworker, as well as help with CBMM's machinery and tools while working on their project. Fee: $35. Preregistration required: cbmm.org/shipyardprograms.

≋ *Paddle with the President:* 5:30–7:30 p.m. June 25 (rain date 6/27). Join CBMM President Kristen Greenaway for a relaxed paddle on the Miles River, demonstration of how to use a Greenland paddle. Fee: $20/paddlers bringing their own kayak; $35/paddlers renting a kayak/gear. Bring water, head lamp. Preregistration required. Info: cbmm.org/Greenawaypaddle.

≋ *Winnie Estelle Cruise / Log Canoe Races:* 1:30–3:30 p.m. June 29 & 9:30–11:30 June 30. Watch the sailing log canoe races on the Miles River. With long masts and large sails, these boats keep upright as they accelerate to speeds of 10 knots or more, thanks to crew members climbing to the ends of 15-foot boards that hang off the side of the canoe. The cruises include photo opportunities, commentary from CBMM's docents, crew. Cruises are dependent on marine conditions. Fee: $35. Preregistration required. Info: cbmm.org/onthewater.

Chesapeake Challenge

Answers to *Eating on the Fly* on page 38.

1. Chimney Swift 2. Eastern Phoebe 3. Chuck-will's widow
4. Acadian Flycatcher

Bay Buddies

Answers to Ruby Throated Hummingbird on page 38.

1. D 2. B 3. D 4. True, they can only shuffle along a perch. 5. C
6. A 7. D 8. D 9. True 10. B

Feeder Tips for Happy & Healthy Hummingbirds

Want to put out a hummingbird feeder? Here are rules to remember:

≋ Place a feeder high enough so cats, which prey on birds, can't reach it.
≋ Do not hang the feeder close to windows, otherwise a bird might accidentally fly into them.
≋ Table sugar is best. Do not dye the water. It isn't necessary.
≋ Change the water before it grows cloudy or discolored, which are signs of bacteria.
≋ In hot weather, change the water frequently. Heat can quickly ferment the sugar into alcohol, which is toxic.

Eating on the Fly

Ever been in such a rush that you said, "After I eat, I have to fly?" These birds have you beat. They capture and eat their prey on the fly. Here are the descriptions of an Acadian flycatcher, chimney swift, chuck-will's widow and eastern phoebe. Can you match them up? Answers are on page 37.

1. This bird eats about a third of its weight every day in insects, and it is estimated that a pair of adults tending to three nestlings eat the weight equivalent of at least 5,000–6,000 housefly-size bugs per day. Flying insects — wasps, bees, whiteflies, stoneflies, mayflies, and even airborne spiders drifting on their threads — make up 95% of its diet.

This bird frequently hunts in a group. It is aided by its wide, gaping mouth and speed: It averages 18 –30 miles per hour, but can reach bursts of 100 mph.

This bird flies constantly, usually only landing at its nest (almost always attached to a manmade structure) or to roost for the night. It drinks and bathes midair by skimming water surfaces, shaking the water off in flight. It even breaks twigs off trees for its nest midflight.


Chimney Swift (Jim McCulloch / CC by 2.0)

When not flying, this species doesn't perch like most birds. It clings to vertical surfaces, a feat made possible by its very short legs and small feet with 4 long claws that resemble grappling hooks.

2. Twitching only its tail (a clue to its ID), this bird perches on a low branch, ready to swoop and capture any passing prey. Prey includes wasps, beetles, dragonflies, butterflies, moths, flies, cicadas, spiders, ticks, millipedes, ants, bees and grasshoppers, as well as small fish and crustaceans in shallow water. Occasionally, it hovers near foliage, picking off insects, fruit or seeds.


Chuck-will's Widow (Dick Daniels / CC by-SA 3.0)

This bird is found in open woodland and farms, often near water. It is increasingly found in suburbs where it builds its nest under eaves, overhanging decks and bridges, places that protect their young from weather and most predators.

It is a weather-hardy bird — one of the last migrants to leave in the fall and among the first to return come spring. While most birds learn to sing from others in its flock, this bird, even when raised in isolation, perfectly sings its song, which also happens to be its name.

3. This, the largest nightjar in North America at 11–13 inches, says its name in a repetitive, usually nocturnal, song.

This bird hunts at dawn and dusk, and occasionally on overcast afternoons. It is not unusual to see dozens of this bird together chasing insects — especially large moths and beetles. The long bristle-like feathers on its bill help to funnel insects into its mouth and prevent them from escaping. Its bill is only 0.5 inches, but it can open its mouth up to 2 inches wide, allowing it to swallow warblers, wrens and hummingbirds when insects are scarce. When it is molting, and not as adept at flying, this bird will eat small frogs.

This bird is found near swamps, dry woodlands and pine barrens. Its eggs are laid on a cushion of dead leaves on the ground. When the nest is disturbed, the parents will move the eggs or small nestlings to another spot.


Eastern Phoebe (John Benson / CC by 2.0)


Acadian Flycatcher (Tnolley)

It hates snakes! If the bird spots one, it lands nearby, hissing and opening its large mouth to try to scare the snake away.

4. This bird is an excellent flier, so maneuverable that it can hover and even fly backward. It has yet to be seen walking or hopping. It perches in the middle of a tree, then darts out to snag flies, mosquitoes, moths and flying ants. It also gleans spiders, caterpillars (and the occasional berry or seed) while hovering over plants. This bird bathes midflight by diving into water, then perching on a branch to shake off the water and preen. It breeds in beech-maple hemlock forests, usually near water or wet, wooded ravines in the eastern United States and southwestern Ontario. Both parents take care of the young, which fledge about 15 days after hatching. Mom usually starts to incubate another clutch at that point, while dad continues to tend to the fledglings. Hear an explosive *tee-chup/peet-sa* in the woods around twilight? Keep an eye out for this bird.

— Kathleen A. Gaskell

The ruby-throated hummingbird, which eats in midflight, is the most widespread of all hummingbird species. How widespread is your knowledge about this incredible bird? See page 37 for the answers and how to best and safely attract hummingbirds to a feeder.

1. What do ruby-throated hummingbirds eat?

A. Nectar from flowers, usually red or orange and tubular
B. Mosquitoes, gnats, fruit flies, small bees & spiders
C. Tree sap
D. All of the above

2. Which best describes a group of male ruby-throats at a feeder?

A. Aerial ballet
B. Aerial dogfight
C. Aerial huddle
D. Aerial jumping beans

3. Hummingbirds' metabolic rates are among the highest of any animal. The average normal heart rate for adult humans ranges from 60-100 beats per minutes. Normal breathing rates for adult humans range from 12–16 breaths per minute. How high have hummingbirds' heart rates been recorded? What is the breathing rate of a hummer, even at rest?

A. Heart rate up to 855 beats per minute; breathing rate of about 175 breaths per minute
B. Heart: 950; breathing: 200 breaths
C. Heart: 1,045; breathing: 222 breaths
D. Heart: 1,260; breathing: 250 breaths

4. True or false? Ruby-throats' leg are so short they cannot hop or walk?

5. Ruby-throats have the least number of feathers of any bird. How many do they have, on average?

A. 540
B. 780
C. 940
D. 1,180

6. Because of their tiny size, ruby-throats can fall prey to insect-eating animals. Which of these abilities is not a defense against predators?


The ruby-throated hummingbird is the only hummer to breed in the Eastern United States. (Bill Buchanan / U.S. Fish and Wildlife Service)

A. It emits a foul smell when being chased.
B. It can fly 25 mph.
C. Its dodging maneuvers include flying up, down, backward and sideways.
D. It can stop flying in an instant and change directions.

7. Ruby-throats mostly build their tiny, thimble-shaped nests on slender branches of deciduous trees, 10–40 feet in the air. What materials are used to make a nest?

A. Down from thistles & dandelions
B. Pine resin
C. Lichen, moss & spider silk
D. All of the above

8. Ruby-throats lay 1–3 eggs per brood, which hatch in 12–14 days. They are about the size of… ?

A. BBs
B. Cherries
C. Marbles
D. Peas

9. True or false? According to the North American Breeding Bird Survey, ruby-throat populations steadily increased every year from 1966 to 2014.

10. Ruby-throats, in just one flight, travel from the Eastern United States to the edge of the Gulf of Mexico (about 1,865 miles). There, they refuel before continuing to their winter homes in Central America. That's a lot of wing flaps! On average, how often do hummingbirds flap their wings per second?

A. 30–70 times per second
B. 40–80 times
C. 50–90 times
D. 60–100 times

— Kathleen A. Gaskell

Fed-ag partnership helps dickcissel to keep to cropping up in fields

By Mike Burke

We were driving slowly west along Powder Mill Road when my wife, Pat, spotted a blue bird perched on a post. I pulled over and carefully backed up a bit, just in time to see the indigo bunting fly off. But with no road noise, we could hear a different bird singing away nearby. It only took a minute to find the songster sitting atop a fence.

He made a couple of soft buzzy notes followed by a brief pause and then, "DIK-DIK-ciss-ciss-cissa." He repeated the song over-and-over again. This was a dickcissel (*Spiza Americana*) singing out his name.

Powder Mill Road bisects the Beltsville Agricultural Research Center, the U.S. Department of Agriculture's flagship research facility. Buildings, barns and fields are spread out over 6,500 acres. The dickcissel was near one of the dairy barns and its pasture.

Dickcissels are grassland specialists. Their core breeding area covers the continent's great prairie stretching from South Dakota to Oklahoma. So, what was it doing in Maryland? Dickcissels are great wanderers, spreading in small numbers from here to the Colorado foothills every summer.

Looking like a miniature meadowlark, the male dickcissel has a yellow breast with a large black V bordering its white chin. He has a bright yellow eyebrow and narrow vertical yellow stripes on his throat. The belly, vent and underwings are pale gray. On top, he's a mixture of browns and blacks with rich chestnut shoulders.

The female lacks the central black chest marking, and her colors are paler versions of her mate's. Both sexes have large, seed-crunching bills.

Dickcissels are among the most numerous breeding birds in North America. Partners in Flight estimates there are 27 million of them. Most migrate from South America, and they arrive in the United States in May and generally depart by September.

Nests are usually built in dense grasses, a bit off the ground. The female dickcissel constructs a small cup nest shortly after arriving in the breeding area.

She lays three to six eggs and will incubate them 12–13 days. Although they are born helpless and blind, chicks grow rapidly and fledge just eight to 10 days after hatching.

Male dickcissels are extremely protective of their territory. Vigilance is needed because males often stray into nearby territories to mate with other females. Most nests end up with eggs fertilized by more than one father.

Successful males drive out their younger and less experienced brothers, which is why so many birds in peripheral breeding areas are male. The dickcissel we saw fit that description.

Dickcissels are among the most numerous breeding birds in North America. Partners in Flight estimates there are 27 million of them. (RebelAt @ English Wikipedia / CC BY-SA 3.0)

Systematic recordkeeping of bird populations began with the advent of annual breeding bird surveys in 1966.

By then, the number of dickcissels had already declined because of constricting habitat. The decline continued for another decade before the population finally stabilized. (In a wonderful serendipity, the U.S. Geological Survey's office that administers the authoritative Breeding Bird Survey, is located at the Beltsville Agricultural Research Center.)

In the last dozen years or so, the USDA's Conservation Reserve Program has been effective in reclaiming grasslands in the mid United States. The program pays farmers a modest fee to voluntarily take some land out of production to foster conservation objectives. Tens of thousands of acres are now returning to native grasslands where dickcissels and other grassland species can thrive.

Dickcissels eat both insects and seeds during our summer. But during the nonbreeding months their diet is almost exclusively seeds. And that, as you will see, is a problem.

In the fall, dickcissels gather into ever-larger flocks before heading south. They range down through Mexico before settling in Central America and northern South America.

Just as its breeding range is sharply focused, so, too, is its winter habitat geographically centered. The seasonally flooded grasslands of Venezuela teem with dickcissels in January and February. Millions inhabit this area, called the llanos.

Today, biologists worry more about the bird's fate on its winter habitat in Venezuela than its breeding areas in the United States.

The llanos have been converted to cropland where farmers grow rice and sorghum. The growth of a perfect food source (seeds) in the region supports enormous flocks of dickcissels.

But farmers view the birds as highly destructive. Among the lethal countermeasures they have employed is heavy pesticide spraying at night where the birds roost. One farmer told researchers that he killed more than a million birds by spraying.

Today, it is unlawful to kill these birds using pesticides, but the conflict between farmer and bird continues. Adherence to the law is uneven, especially since the country's political turmoil began.

Back in Beltsville, the dickcissel seemed content to sit and sing. The bird's patience gave me a moment to consider the different treatments of the species between its breeding and winter habitats.

Here, the government works in a coordinated, albeit imperfect, way to help the species recover.

In Venezuela, near-anarchy prevails. Basic government services are faltering and programs to aid birds are an afterthought at best.

It is a stark reminder that government, when properly funded and efficiently run, can be both a partner with farmers and an effective agent for ecological good.

That powerful message is brought to us by a wandering dickcissel. We would do well to heed it.

Mike Burke, an amateur naturalist, lives in Chevrely, MD.

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Plants & pollinators: Can't have one without the other

BY KATHY RESHETILOFF

Plants, like animals, must create offspring for the next generation.

One way they do this is by producing seeds that contain the genetic information to grow a new plant. Seeds develop when pollen is transferred between flowers of the same plant species.

Pollination is the act of transferring pollen grains from the male part of a flower, the anther, to the female part, the stigma. About 80% of all plants are pollinated by pollinators, such as bats, birds and insects. The remaining 20% are pollinated by wind and water.

Plants and pollinators have co-evolved physical characteristics that make them more likely to interact successfully. The plants benefit from attracting a particular type of pollinator to its flower, ensuring that its pollen will be carried to another flower of the same species and result in successful reproduction.

Different plants have evolved to flower at different times throughout the growing season. This decreases competition for pollinators and provides pollinators with a constant supply of food.

The pollinator benefits from its adaptation to a particular flower type by ensuring that it will be able to find important food resources — nectar and pollen. The flower's shape, color, odor, nectar and structure varies by the type of pollinators that visit them.

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Pollinators provide services to more than 180,000 different plant species and more than 1,200 crops. That means that one out of every three bites of food you eat is there because of pollinators. In addition to the food that we eat, pollinators are needed for a majority of the native plants that provide food and habitat for other wildlife and are the foundation for healthy ecosystems.

Many pollinators are declining due to the loss of feeding and nesting habitat. Pollution, misuse of chemicals, disease and changes in climate are contributing to shrinking pollinator populations.

What can you do? Create pollinator-friendly habitat with native flowering plants that supply pollinators with nectar, pollen and homes. To find out what native plants are best for your area, visit Pollinator Planting Guides (pollinator.org/guides) and type in your zip code. Or, download The Bee Smart™ Pollinator Gardener app (pollinator.org/beesmartapp.htm) on your smart phone.

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A hummingbird moth visits wild bergamot. (Chelsi Hornbaker / U.S. Fish and Wildlife Service)

Flora to attract your favorite fauna

Here are a few common characteristics of flowers and the pollinators they attract. Note: This is not an all-inclusive list.

Birds
Color: Orange, red, white
Scent: None
Shape: Large funnel-like or cups

Bees
Color: Bright white, yellow, blue
Scent: Fresh, mild, pleasant
Shape: Shallow, with landing platform, tubular

A zebra swallowtail butterfly visits a butterfly weed. (Kathy Reshetiloff / U.S. Fish and Wildlife Service)

Butterflies
Color: Bright, including red, purple
Scent: Faint but fresh
Shape: Narrow tube with spur, wide landing pad

Moths
Color: Pale, white, and dull red, purple, pink
Scent: Strong sweet; emitted at night
Shape: Regular, tubular without a lip

Beetles
Color: Dull white, green
Scent: None to strongly fruity or fetid
Shape: Large, bowl-like

Flies
Color: Pale, dull to dark brown or purple flecked with translucent patches
Scent: Putrid
Shape: Shallow, funnel-like or complex & trap-like