CHESAPEAKE
BAY JOURNAL
June 2022 Volume 32 Number 4
Independent environmental news for the Chesapeake region

50 years later: Killer storm Agnes haunts Bay watershed

PAGE 18

CRAB POPULATION REPORT

Annual survey finds blue crabs at 30-year low PAGE 11

GROWTH & FOREST LOSS

Hi-res images reveal more development PAGE 10

ABANDONED BOATS

Derelict boats pose expensive, complicated problems PAGE 14

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CONTENTS

Desiree Greaver of the Back River Restoration Committee holds a water sample collected near the outfall of Baltimore's Back River wastewater treatment plant. Read the article on page 12. (Dave Harp)

NEWS

7 Wegmans site under construction in Brown Grove, VA
8 Fisheries managers tweak plan for restoring striped bass
9 Bay states to get $70 million for cleanup, restoration programs
10 High-res maps of Bay watershed reveal more development
11 Chesapeake Bay blue crab population hits 30-year low
12 Disgruntled residents monitor Back River for pollution
13 States challenge findings of Bay computer modeling
14 VA waters filled with debris when owners abandon ship
16 'Forever chemicals' found in more MD drinking water systems
17 Chesapeake dolphins still enthrall spotters, scientists
18 Killer storm Agnes continues to haunt Bay watershed
20 PA grazing project aims to save farmers, land and Bay
21 VA Conservation Corps intern receives national award
22 Scientists cast a wider net to study Bay's forage species
24 DE county backpedals on protections for wetlands
25 Pollution levels continue to increase in Appomattox River

TRAVEL

26 VA woodland preserves nature lover's final wish

FORUM

32 **Chesapeake Born** | Agnes: 50 years later
33 Sustainable communities are key to environmental justice
34 MD must stop pretending that poultry waste is clean energy

QUIZZES | EVENTS | RESOURCES

35 **Chesapeake Challenge** | Mosquitoes
36 **Bulletin Board** | Volunteer | Events | Programs | Resources

COLUMNS

38 **Steward's Corner** | We can all help control runoff
39 **On the Wing** | Ovenbird: Little warbler with a big voice
40 **Bay Naturalist** | Plant a native garden

EDITOR'S NOTE

The anniversary of Agnes

This month marks the 50th anniversary of Hurricane Agnes, which was a tropical storm by the time it reached the Chesapeake Bay watershed. Agnes didn't travel directly up the Bay. But the torrential rainfall was devastating and deadly. People lost their lives, homes, schools and businesses. The Bay's ecosystem was slammed with polluted runoff. As you'll read in our article by Jeremy Cox on page 18, the impacts on clams, shad and underwater grasses reverberate today.

In May, I listened to a panel discussion hosted by the Chesapeake Research Consortium about the lessons learned from Agnes. The guests spoke about the vast improvements in public warning systems, watershed science and stormwater management strategies. They generally agreed that, if such a storm were to hit again, there would probably be fewer lives lost. But — despite those gains in knowledge and practices — damage to the Bay and the region's infrastructure would likely be even worse.

That's a sobering irony. We know more now, but the environmental outcome may still be worse. There are several factors driving that prediction. Among them are the force of recent storms and rising water levels that spur even "sunny day flooding."

The panel guests also cited the extent to which we have paved and roofed our way over much of the landscape during the last 50 years, adding surfaces that amplify the speed and volume of runoff while robbing waterways of natural floodplains. When you read Jeremy's article, be sure to also read Tim Wheeler's report on high resolution imagery of the Bay watershed on page 10. Those images have revealed 45% more impervious cover regionwide than previously estimated.

Ultimately, storms the magnitude of Agnes are literally a force of nature. Many stormwater management practices can't be expected to withstand that kind of test. But as stewards of the land under our feet and the water that runs through it, we must ask why "knowing more" doesn't mean less damage. The lessons of Agnes, in a world out of balance, still wait to be heard.

— Lara Lutz

ON THE COVER

Water from Tropical Storm Agnes inundates homes in Wilkes Barre, PA, in late June 1972. (Courtesy of Wilkes University)

Bottom photos: Left by Dave Harp, center by Jim Lyons and right courtesy of the Vessel Disposal and Reuse Foundation.

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BY THE numbers

4,863
Feet, the height of Spruce Knob in West Virginia, the highest point in the Chesapeake Bay watershed

10
Feet, the average elevation of Virginia Beach, VA, near the mouth of the Bay

1–1.5
Miles per hour a mosquito can fly

1
Tablespoon, enough water for mosquitos to breed in

282 million
Estimated number of blue crabs living in the Bay

18.4 million
Estimated number of people living in the Bay watershed in 2020

Dolphins near and far

Researchers say that most dolphins making summertime visits to the Chesapeake Bay and its rivers seem to be starting their journeys from the Atlantic Ocean between New York and Florida. During their stay, they are mixing with other pods, foraging for food and even giving birth.

- A dolphin pod, or group of dolphins, can vary from two to 30 individuals.
- Bottlenose dolphins can live at least 40 years, and some females live 60 years or more.
- Female dolphins are pregnant for about a year and nurse their babies for about 20 months. They give birth every three to six years.
- Dolphins do not typically mate for life, but they can create long-lasting relationships with one another.
- Dolphins use echolocation to locate prey, producing short, high frequency pulses that sound to humans like "clicks." The pulses bounce back from other surfaces to provide location information to the dolphin.

DolphinWatch app user Peter Field submitted this photo from the Rappahannock River in Virginia on September 21, 2019.

bayjournal.com/podcast

LOOKING BACK

30 years ago

NY, WV discuss Bay roles

State and federal leaders in the Bay restoration effort met with officials from West Virginia and New York to explore adding them to the Bay Program partnership. ■

— *Bay Journal,* June 1992

20 years ago

Report calls streamside forests essential

The National Academy of Sciences said that the restoration of streamside buffers should be part of national policy aimed at restoring water quality and protecting biological diversity. ■

— *Bay Journal,* June 2002

10 years ago

Two thirds of Bay lacked adequate oxygen in 2011

Heavy spring rains and late summer tropical storms created enough oxygen-starved water to send Baywide dissolved oxygen conditions to their second poorest showing since 1992. ■

— *Bay Journal,* June 2012

ABOUT US

The *Chesapeake Bay Journal* is published by Bay Journal Media, an independent nonprofit news organization dedicated to environmental reporting in the Chesapeake Bay region. *Bay Journal* reporting reaches well over 250,000 people each month through news articles, columns, films and the *Chesapeake Uncharted* podcast.

The *Bay Journal* is available in print and by email and is distributed free of charge. The print edition is published 10 times a year, and bundles are available for distribution at offices, libraries, schools, etc.

The Bay Journal News Service distributes *Bay Journal* articles and opinion columns for free use in hundreds of newspapers across the region.

Publication is made possible by grants, reader donations and advertising revenue.

Views expressed in the *Bay Journal* do not necessarily represent those of any funding agency, organization, donor or advertiser.

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BAY JOURNAL NOTEBOOK

This pair of dolphins was photographed in September 2019 in Maryland's Patuxtent River by a DolphinWatch app user registered as Glen. (Courtesy of Chesapeake DolphinWatch)

Let's talk dolphins! Join us June 22 to learn about dolphins in the Chesapeake

Reports of dolphin sightings in the Chesapeake Bay and its rivers have surged in recent years, and their presence brings joy to many people. Among them: scientists. Researchers are seizing the opportunity to explore dolphin behavior specific to the Bay region, and especially in the Potomac River. Learn what they've discovered and what mysteries remain at a free reader event, taking place online from 7 to 8 p.m. on Wednesday, June 22. *Bay Journal* reporter Whitney Pipkin will host the discussion with guests from Chesapeake Dolphin Watch and the Potomac-Chesapeake Dolphin Project. Register at bayjournal.com/events.

We're honored that our entire reporting staff has been recognized with various awards for their work with the *Bay Journal* in 2021.

From the Maryland/Delaware/District of Columbia Press Association, **Karl Blankenship** received first and second place for environmental reporting for, respectively, his reporting on eels in the Susquehanna River and the decline of eelgrass in the Lower Bay. The eel article also took best in show.

Jeremy Cox and **Tim Wheeler** won first place and best in show for government reporting for their coverage of water quality violations at Valley Proteins. Tim received first place and best in show for continuing coverage of "forever chemicals" in streams, drinking water and the Bay. **Kathleen Gaskell** won first place and best in show for her Chesapeake Challenge headline, "Here's a peep at the pond's pop star." And **Dave Harp** took first place and best in show for his feature photo of a snorkeling researcher in search of the Maryland darter.

Ad Crable won two awards from the Pennsylvania News Media Association: first place for beat reporting on mining and the state's environment, and an honorable mention for investigative reporting on state tax breaks tied to farm conservation plans.

In the environment/health category, the Virginia Press Association awarded Karl second place for his eelgrass report and Whitney third place for her article on shrimp moving into Bay waters.

What a list! Congratulations and many thanks to this team. We hope you continue to enjoy their excellent work.

— Lara Lutz

NEWS briefs

LOCAL
REGIONAL
NATIONAL

PA scientists find method for tracking sources of algae blooms

Scientists at a Pennsylvania research center say they have found a way to trace algae blooms in streams and rivers back to the source, whether it be agriculture runoff, a sewage treatment plant or a leaking septic tank.

Researchers at the nonprofit Stroud Water Research Center used real-time chlorophyll sensors to determine if algae blooms were triggered by a nearby pollution source or washed into the test area from an upstream site. Results were published in the journal *Limnology and Oceanography Letters*.

Lead scientists Marc Peipoch and Scott Ensign used sensors to collect data about water quality and the levels and movement of algae every few minutes during storms in Brandywine Creek, a tributary to the Christina River in the Delaware Bay watershed. They found that changeable levels of chlorophyll near abundant algae indicated a local source, as opposed to being dislodged from farther away and floating downstream.

"This is an exciting discovery," Ensign said. "We've demonstrated for the first time a method to identify the sources of algae using the existing sensor technology. We believe that this method should be applicable at a variety of scales, from small shallow streams we see in our backyards to rivers as mighty as the Mississippi."

While not all algae are harmful, too much can be deadly. When algae blooms die, they feed bacteria in a process that robs the water of oxygen, killing fish and other aquatic life. The Chesapeake Bay and its major tributaries have experienced deadly fish kills through the years. Algae outbreaks can also sicken humans, their pets and marine wildlife.

In addition to human sources of algae blooms, warming temperatures from climate change and deforestation can stimulate algae growth.

— A. Crable

UPDATE: Troutless MD stream gets restoration green light

The Maryland Department of the Environment recently approved a proposal by the state's Department of Natural Resources to restore a portion of Jabez Branch, a tributary of the Severn River in Anne Arundel County.

Brook trout need cold, clear water to survive, which is typically found only in mountainous or hilly streams. For many years, though, Jabez Branch was an anomaly, with cool springs feeding it and trees lining its banks to cast shade.

But the trout have been struggling to hold on there since the late 1980s, as warm stormwater runoff began pouring into the stream from new highways, homes and commercial development. Three years ago, for the first time in 25 years, biologists were unable to find any brook trout in the headwaters of the Jabez, their traditional habitat.

DNR proposes to restore nearly a half-mile of one of the stream's prongs where storm flow has carved a deep channel into the land. The project will raise the stream bed with sand, gravel and wood chips, as well as enhance and enlarge 2.6 acres of wetlands bordering the stream. The plan also includes installing riffles and pools to slow the water's flow and capture some of the stormwater surges.

The project has the support of the Severn River Association and Severn River Commission. But a local chapter of Trout Unlimited objected, saying that the proposed "regenerative stream channel" restoration technique is untried on trout streams and would not deliver the needed water quality improvements. The group favors "natural channel design," which has been used successfully elsewhere, and stressed that strategies are needed to prevent overheated runoff from reaching the stream.

MDE approved DNR's plan, which it said was modified to address objections and appears likely to reduce stream temperatures and meet other water quality goals. As a precaution, MDE imposed 19 special conditions on the project.

The project, estimated to cost about $5 million, still needs final approval from the U.S. Army Corps of Engineers, which is expected soon. Construction would likely start in spring 2023.

— T. Wheeler

DC had big drop in air pollution during 2020 COVID restrictions

As vehicle traffic lightened and industry slowed during the COVID-19 stay-at-home period in 2020, air pollution decreased in many major cities across the United States.

A team of researchers at the University of Houston, led by associated professor Yunsoo Choi, looked at 11 metropolitan areas and discovered the biggest improvement in Washington, DC, which experienced

See **BRIEFS**, *page 6*

briefs

From page 5

a 21% decrease in pollution levels, followed by New York and Boston. Their findings are published in the journal *Atmospheric Environment.*

All but one of the cities the researchers examined experienced reduced levels of the pollutant PM2.5 — tiny particles or droplets in the air that are 2.5 microns or less in diameter. The negative health impacts of increased exposure to the pollutant include cardiovascular diseases, respiratory-related illnesses and similar conditions.

The researchers estimated and then compared PM2.5 levels from March through May 2020 — months when U.S. stay-at-home orders were tightest — to the same period in 2019.

— L. Lutz

Richmond receives environmental literacy grant

Richmond's Department of Parks, Recreation and Community Facilities was awarded a $149,437 grant from the National Oceanic and Atmospheric Administration's Bay Watershed Education and Training program, known as B-WET.

The funds will support a two-year project called The Richmond Environment: Students as Teachers in Their Watershed. The goal is to give public school students a greater understanding and sense of ownership of their local watershed.

Program partners, which include the James River Park System, Alliance for the Chesapeake Bay and Richmond public school system, will create an environmental literacy plan for the city's public schools, rooted at the "hyper-local level" and centered on the voices of people of color that have historically been suppressed in Richmond.

"We are excited at the scale and depth of work proposed by the ... planning team and specifically their commitment to advancing diversity, equity, inclusion and justice through the development of their environmental literacy plan," said Elise Trelegan, B-WET program coordinator for the NOAA Chesapeake Bay Office.

— L. Lutz

MD increases funding for farm conservation practices

The Maryland Department of Agriculture has raised the cost-share funding caps for 34 conservation-minded best management practices on farmland. Effective May 2, 2022, the cost-share ceiling for these BMPs increased from $50,000 to $75,000 per project.

Examples of projects eligible for the funding include cover crops, contour farming, fencing, pasture management, streamside tree planting, roofs and covers, stream crossings for livestock and wetland restoration.

Established in 1984, the Maryland Agricultural Water Quality Cost-Share Program provides farmers with grants to help cover the cost of installing conservation practices on their farms to protect water quality in streams, rivers and the Chesapeake Bay. In recent years, the program has introduced a menu of program changes to promote sustainable, regenerative agriculture practices.

"This program helps make a difference for natural resources and the Chesapeake Bay, while helping farmers become more resilient to climate change," said state agriculture Secretary Joe Bartenfelder.

Last year the program received authorization to provide farmers with up to 100% cost-share for more than 20 high-priority conservation practices.

Maryland farmers interested in applying for the cost-share grants should contact their local soil conservation district or call 410-841-5864.

— L. Lutz

Elizabeth River Project breaks ground on resilience lab

The Elizabeth River Project broke ground on May 18 for its new $8 million living laboratory and learning park designed to help urban coastal communities adapt to climate change and rising seas.

Among its many offerings, the Pru and Louis Ryan Resilience Lab and Learning Park will feature environmentally sustainable construction, changing research displays and a waterside learning park where visitors can explore how to live and work in an urban flood plain.

"Today's groundbreaking is a huge milestone for our organization, and a huge step into the future for our entire region," said executive director Marjorie Mayfield Jackson.

Norfolk Mayor Kenneth Alexander called it "one of the most promising projects to come about in my lifetime for a healthy Elizabeth River."

Designed by Norfolk architectural firm Work Program Architects, the 6,500-square-foot, solar-equipped lab is deliberately being built in a flood zone to demonstrate sustainable construction. The building has an intentional life span of 30–50 years to match predictions for sea level rise.

The Elizabeth River Project plans to place the property in long-term conservation using the nation's first "rolling conservation easement," pledging to remove the building once water levels reach a trigger point.

The lab is being funded through the philanthropy of its namesakes, Pru and Louis Ryan, a Norfolk couple, along with hundreds of public and private donations.

Construction is expected to accelerate in June and continue for eight to 12 months.

— L. Lutz

Wegmans site under construction in Brown Grove, VA

Opponents decry impact on historic Black community and nearby forested wetlands

By Whitney Pipkin

A judge has denied an appeal of a state board's decision to allow a Wegmans grocery distribution center to be built in Hanover County, VA, where construction has begun. But the Virginia Supreme Court has agreed to hear a separate appeal from residents who live near the Wegmans property and say construction will adversely impact them.

Wegmans has begun to clear trees and prepare for building. The 219-acre site is in a rural county where opponents have said it would negatively impact a historic Black community called Brown Grove and destroy forested wetlands.

The lawsuit that will be heard by the state Supreme Court argues that the Hanover County Planning Commission should have considered the impact of excess traffic, noise and light pollution on neighbors, among other factors. That court will decide whether neighbors have standing in zoning decisions such as these.

The Virginia Department of Historic Resources is in the process of deciding whether to designate the Brown Grove community as a rural residential historic district. The community includes two historic churches, gravesites and the remains of the 1927 Brown Grove School.

The designation would be the first of its kind in Central Virginia. The board intends to meet and vote on the designation on June 16.

The community is also fighting a new comprehensive plan that would allow part of the residential community to be rezoned as commercial, along with the proposed expansion of a nearby landfill.

"In essence, Brown Grove probably won't be in existence in 20 years if the comprehensive plan goes through," said Renada Harris, who grew up in Brown Grove and is related to most members of the Brown Grove Preservation Group.

Community members say nearby waterways have turned murky since Wegmans began construction on the site this spring, clearing portions that had previously been forested.

"In the past, we have been the community of least resistance," said Renada Harris, who grew up in Brown Grove, VA. She is related to most members of the Brown Grove Preservation Group, which formed over concerns about a Wegmans distribution center proposed for the property behind her. (Dave Harp)

Hanover County's website acknowledges the change in water quality and says that officials are still overseeing erosion and sediment controls.

"We are aware of the issue and we are monitoring, but this is not considered a violation," the county website states. "As mentioned above, the soil is a colloidal clay soil and it only takes a small amount to make water murky." ■

Fisheries managers tweak plan for restoring striped bass

Further catch limits possible if new study fails to see rebound

By Timothy B. Wheeler

Braced for possible bad news in the fall, East Coast fishery managers have tweaked their plan for rebuilding the coastwide population of Atlantic striped bass in a way that could further tighten catch limits next year on the prized but troubled finfish.

The Atlantic States Marine Fisheries Commission, which regulates inshore catches of migratory fish, adopted revisions May 5 to its interstate management plan for striped bass. Amendment 7, as it's known, most notably includes triggers requiring corrective action if new population estimates find unsustainable catch rates or low numbers of spawning age female fish. A new coastwide stock assessment is due in the fall.

A stock assessment in 2018 found that striped bass, also called rockfish, were being overfished along the East Coast and numbers of adult females had fallen far below the target for sustaining the population. It warned that catch-and-release fishing by anglers was killing many fish, especially in summer, when they are already stressed by warmer water and less oxygen.

The commission responded by ordering an 18% reduction coastwide in fishing-related mortality. It directed states to limit all anglers to one fish per day and set uniform size limits for keeping fish caught along the Atlantic Coast and in the Bay, which is a major spawning and nursery ground for the migratory species. States were allowed to deviate from those uniform cutbacks, though, providing their rules reduced overall fish losses by the same amount.

Virginia canceled its spring trophy season for catching large striped bass and limited anglers the rest of the year to keeping one fish per day, down from two. Maryland shortened its trophy season, closed fishing for all striped bass for two weeks in the summer and limited anglers to keeping one fish per day, though it allowed charter boat customers to continue two per trip.

Those and other catch restrictions enacted coastwide reduced the estimated mortality of fish by 28%, surpassing the commission's goal. It's unclear, though, if those measures have been enough to rebuild the stock by the commission's 2029 deadline. For the last three years, Maryland's annual surveys have found the numbers of juvenile striped bass far below average.

In hearings earlier this year, anglers and conservationists faulted the commission for not moving sooner to halt the fish's decline and demanded stronger measures in response to future warning signs.

"They sent us a very clear strong signal that they want us to take action quickly when we need to," said Martin Gary, chair of the commission's Striped Bass Management Board. Conservation groups generally praised the commission's action but cited shortcomings, including its decision not to address catch-and-release mortality.

"I just don't understand why that wouldn't be required when catch-and-release is a major cause of mortality," said Allison Colden, senior Maryland fisheries scientist for the Chesapeake Bay Foundation.

Gary, who is executive secretary of the Potomac River Fisheries Commission, defended the commission's decision to leave such measures to each state.

"This fishery is so different from place to place up and down the coast," he said, that "honestly, it's the only way to deal with this complexity."

Robert T. Brown Sr., president of the Maryland Watermen's Association, contended that the commission's rebuilding plan is unrealistic and would lead to further cuts in commercial harvest, which over the years has been curbed more than the recreational catch. He maintained that striped bass remain abundant in the Bay.

David Sikorski, executive director of Coastal Conservation Association Maryland, acknowledged that the fishery is so varied along the coast that "it's extremely difficult to take a broad brush and say doing this is going to really solve the problem." What's needed, he said, is "more precise regulation." ■

Bay states to get $70 million for cleanup, restoration programs

Influx of new funding to come from federal infrastructure act, USDA

By Timothy B. Wheeler & Karl Blankenship

As the Chesapeake Bay region faces an uphill struggle to meet its latest cleanup goal, federal officials in May announced that roughly $70 million is heading toward the Bay to speed action.

On May 9 in Baltimore, Janet McCabe, U.S. Environmental Protection Agency deputy administrator, said that the Bay will soon receive nearly $48 million — the first installment of roughly $238 million from the $1.2 trillion Infrastructure Investment and Jobs Act.

The funding sends $25 million to the National Fish and Wildlife Foundation, a congressionally chartered nonprofit, which will distribute the money via two grant programs. One targets small watersheds, and the other is focused on innovative ways to reduce nutrient and sediment pollution.

Grant recipients will include communities, nonprofit groups, conservation districts and others working to protect and restore local streams and habitats.

Another $15 million, McCabe said, will go to the six Bay watershed states and District of Columbia to fund projects in river and stream basins where runoff controls, mostly on farms, would be most effective at reducing nutrients and sediment. Of those funds, $5.59 million will go to Pennsylvania, $3.21 million to Maryland; $3.14 million to Virginia; $1.28 million to New York; $750,000 to Delaware; and $500,000 each to West Virginia and the District of Columbia.

Forty percent of that money is designated for communities already overburdened with environmental impacts.

The federal-state Chesapeake Bay Program will receive $7.8 million, to be used primarily for competitive grants for "on-the-ground" restoration projects.

Most of Maryland's congressional delegation was on hand for the announcement, which took place on the banks of the Patapsco River, as were state, local and other federal officials and representatives of nonprofit organizations.

"This will give us the opportunity to make real progress," said Sen. Benjamin Cardin, in reference to the nearly four-decade effort to restore the Bay's water quality.

Five days after McCabe's announcement, the U.S. Department of Agriculture said at a meeting of the Chesapeake Bay Commission in Lancaster, PA, it would spend an additional $22.5 million this year to help farmers install conservation practices in the Bay watershed.

Robert Bonnie, undersecretary for farm production and conservation, said the influx represents a 25% increase in the department's spending in the Bay region.

Farms cover nearly 30% of the 64,000-square-mile Bay watershed and are its largest source of water-fouling nutrient pollution. Controlling runoff from those lands has proven difficult, but the region is counting on more than 80% of nutrient reductions in coming years to be derived from agriculture.

"We know that the decisions farmers make every day — thousands of decisions on thousands of properties all over the Bay watershed — are critically important," Bonnie told the commission, an advisory group with representatives from state legislatures. "And that's our challenge."

Unlike the infrastructure funding announced in Baltimore, the increased USDA funding comes out of its annual appropriation, and the increase is not guaranteed beyond this year. But Sen. Robert Casey of Pennsylvania said he and other lawmakers from the region would seek to have the commitment maintained in future years.

Pennsylvania, which has the most farms and farm-related runoff in the Bay watershed is far behind in meeting its Bay cleanup goals, according to computer models. Casey said the stepped-up support is needed to help meet the goals.

"Farmers right here in southcentral Pennsylvania are some of the most important partners that we have," he said. "But again, we've got to give them help." ■

High-res maps of Bay watershed reveal more development

New images detail lost forests, urban trees, spread of pavement

By Timothy B. Wheeler

Making the struggle to restore the Chesapeake Bay even tougher, watershed states have been clearing more forest for development and paving over more landscape than previously believed, new data show.

A recently released analysis of high-resolution aerial imagery taken four years apart indicates the watershed has been losing more than 20,000 acres per year of pollution-fighting forest to development and adding more than 12,000 acres annually of runoff-inducing pavement and buildings.

Those are just two of the more notable findings in a federally funded project to map land cover and land use change across the Bay watershed using aerial imagery, which has a resolution that is 30 times higher than the satellite imagery previously used for this purpose. The project was conducted by the nonprofit Chesapeake Conservancy in collaboration with the U.S. Geological Survey, University of Vermont and federal-state Chesapeake Bay Program.

Those involved in gathering and parsing the data say it provides a much more precise picture of how the Bay region's landscape is being used and how quickly it is changing.

"It gives us insight into what is happening on the ground," said Joel Dunn, the conservancy's president and CEO. "We can look back and see what happened in incredible detail."

Officials hope to use the information to keep closer track of Bay states' efforts to reach their pollution-reduction targets by their agreed-upon 2025 deadline. Much of the progress to date has come from upgrading wastewater treatment plants across the six states and District of Columbia.

But what happens on and to the land plays a major role in how much nutrient and sediment pollution gets into the Bay via rain and snow runoff. On that score, the cleanup effort continues to fall short.

For the past 30 years, the Bay restoration effort has relied on satellite imagery to identify land cover and land use in the watershed. But those orbiting eyes in the sky can only see with accuracy features on the landscape that are at least 30 meters across. That can miss low-density housing and narrow streamside tree buffers, among other things.

Analysis of high-resolution imagery has revealed that pavement and buildings cover about 45% more of the Chesapeake Bay watershed than had previously been identified. (Dave Harp)

"Without that knowledge we're just stuck in this no man's land of uncertainty," said Peter Claggett, a USGS research geographer who coordinates the Bay Program's Land Use Workgroup.

So, with funding from the U.S. Environmental Protection Agency and USGS, project participants collected high-resolution aerial imagery of the region for the years 2013–14 and again for 2017–18. The surveys encompassed 99,000 square miles in 206 counties, including all of the land in counties just partially in the Bay watershed.

Analysts then painstakingly categorized the land use, whether in agriculture, homes, businesses or left to nature, by consulting other data, including records on parcel boundaries, mining activity, landfills, golf courses, utility transmission lines and timber harvest permits. Thus curated, the high-resolution imagery can indicate what's on the land down to a 1-meter scale, giving a far more detailed picture.

It revealed, for instance, that pavement and buildings cover about 45% more of the region's landscape than had been identified with the less precise satellite imagery, Claggett said. That's significant because these impervious surfaces prevent rainfall from soaking into the ground and serve as a conduit for pollution-laden runoff into nearby streams and rivers.

The imagery also shows 11% more new development than had been seen by satellite observations, Claggett said.

The biggest land use change between the two periods came from timber harvesting, with 175,000 acres of forest cut down across the watershed in the four-year span. That's a long-lasting but not permanent change, assuming those acres are reforested over time.

But nearly 83,000 acres of forest were cleared for development. Some trees remained on about one-third of those acres, though the undergrowth in those wooded areas had been replaced by buildings, pavement or turfgrass. Another 43,000 acres of forest were cleared in agricultural areas, which analysts assume went into cropland or pasture.

The high-resolution imagery also picked up a net loss of tree canopy in developed areas. While many communities planted lots of new trees, there was an overall decline in tree cover of about 12,000 acres in cities, towns, suburbs and even rural areas. Bay states and DC have pledged to add 2,500 acres of tree canopy by 2025 in urban areas alone.

Nearly 51,000 acres of new buildings and pavement spread across the landscape during the four-year span, with nearly the same amount of new turfgrass observed. There had been more low-density development in the past, with two to three times as much turf grass as impervious cover, Claggett noted. This recent change signifies more high-density development, he said, perhaps with more apartment buildings and warehouses.

As large as these shifts seem, they are relatively small when stacked up against overall land use. There are 34 million acres of forest across the region, for instance, and roughly 2.5 million acres of impervious surfaces, Claggett noted.

But land use is not uniform across the watershed, he added, nor are the changes. Much of the forestland is publicly owned or otherwise protected, Claggett said. So what's being developed is a significant share of the vulnerable natural areas.

The new data can identify those hot spots, project leaders say, and help state and local officials and concerned residents respond. Toward that end, the project partners have created maps of land cover and land use changes for each of the watershed's counties and plan to make them public.

"My hope is that these data will be used … to inform more strategic planning and conservation decisions," Claggett said. He also said he hopes it will raise public awareness of what's happening on the landscape and how that may or may not impact them locally.

The maps can help locate the most effective sites for restoring degraded streams or planting trees and identify environmentally sensitive lands in need of protection.

Such detailed analysis is not cheap. The project cost about $3 million over the last four years, according to the Chesapeake Conservancy. Even as analysts continue to vet the existing imagery, aerial surveys from 2021–22 are being compiled for analysis.

The conservancy's Dunn said he envisions that such detailed information on the Bay watershed's landscape and its changing use will empower community groups, businesses and even individuals to take steps to improve environmental conditions in their own neighborhoods.

"This is conservation innovation in action," he said. "You give people this killer data and there's all kinds of ways they can use it." ■

Biggest increases in impervious cover from 2013-14 to 2017-18

Sussex County, DE*	3,313 acres
Lancaster County, PA	2,424 acres
Loudoun County, VA	2,222 acres
Chester County, PA*	2,002 acres
York County, PA	1,770 acres
Cumberland County, PA	1,763 acres
Kent County, DE*	1,746 acres

*Only partly in the Bay watershed

Chesapeake Bay blue crab population hits 30-year low

Winter dredge survey reveals smallest number of crabs since 1990

By Jeremy Cox

Photo: Blue crabs harvested from the Chesapeake Bay are gathered in a basket on shore. (Will Parson/Chesapeake Bay Program)

The blue crab, the Chesapeake Bay's most valuable catch and a closely watched proxy for the health of its underwater ecosystem, is less abundant now than at any time since scientists began regularly tracking the species in 1990.

The new winter dredge survey conducted by the Maryland Department of Natural Resources and Virginia Institute of Marine Science and released May 19 found an estimated 227 million crabs in the Bay. The previous low was 270 million crabs in 2004.

Year-to-year population fluctuations, even dramatic ones, are common for the species. Fishery managers say the plunge wouldn't be so concerning except that it has been accompanied by a three-year streak of below-average reproduction.

And they aren't sure what's behind the decline.

"It's shocking in that we've had enough females over the last couple years to produce a good year class, and it hasn't happened," said Genine McClair, blue crab program manager for the Maryland DNR. "The question everyone has is: 'Why do we have this low recruitment?'"

Meanwhile, one of the Bay's leading advocacy groups described the survey results as worrying and called on regulators to take immediate actions to protect crabs, especially adult females.

"Fisheries regulators and scientists must work quickly to identify the key ecosystem factors influencing blue crab [juvenile] recruitment and survival so that they can be mitigated to ensure a healthy blue crab population in the future," said Chris Moore, a Chesapeake Bay Foundation scientist.

The juvenile downturn has gone on so long that crabbers can expect to find lighter loads in their crab traps, McClair said.

The overall adult population had been buoyed by a strong 2019 recruitment class. But now that their three-year life cycle is almost certainly over, only smaller classes remain.

"We were living off that big recruitment we had in 2019, so it would have been nice to have another big recruitment to keep the population at that higher level," McClair added.

Crabs have proved a difficult species to manage. In 2008, the U.S. Department of Commerce declared the Chesapeake commercial fishery to be a disaster, and both Maryland and Virginia responded with significant catch restrictions mostly aimed at ensuring the survival of adult females.

By 2019, fishery managers, crabbers and scientists were celebrating signs that the blue crab's recovery in the Chesapeake Bay was about to kick into a higher gear.

"You've had more crabs come ashore this year than any year in 54 years," an exuberant Terry Vincent, owner of Lindy's Seafood in Dorchester County, MD, told the *Bay Journal* in 2019, a year in which total abundance was more than twice as high as the current number. "Nobody's seen this."

Both states began easing some of their curbs. But since then, the crab's trajectory has veered downward, baffling experts.

To be successful, scientists say, blue crabs rely on a several overlapping dynamics: plenty of underwater grasses to live in; the right ocean currents to nudge larvae back into the Bay; enough clams and oysters for adults to feed on; and a little luck with avoiding predators, most notably the invasive blue catfish.

One factor is generally well accepted: Broad swaths of underwater grasses have been lost as wet weather is flushing more nutrients and sediment into the estuary.

"But that's not the only thing driving [the lower crab numbers]," said Adam Kenyon, deputy chief of the Virginia Marine Resources Commission's fisheries division. "To put your finger on one thing, that's where it's difficult."

Crabs don't appear to be overfished, regulators say. In 2021, commercial and recreational boats harvested crabs at a rate well below the adult female threshold established a decade earlier.

Still, the three jurisdictions that regulate the Chesapeake region's crab catch — the Maryland DNR, Virginia Marine Resources Commission and Potomac River Fisheries Commission — are likely to consider new harvest limits in the coming weeks. ■

Disgruntled residents monitor Back River for pollution

Community responds to lapses at wastewater treatment plant on ailing Baltimore river

By Timothy B. Wheeler

Karen Wolf's family has owned a house on Baltimore's Back River since the 1920s. Generations have grown up there, on and in the water.

Lately, though, Wolf has been questioning whether it's safe to let her grandchildren go out on their pontoon boat. She's worried they might get sick from being splashed by water tainted with sewage from the city's problem-plagued wastewater treatment plant upriver.

"The river used to be teeming with people and activities," she said. "What are we going to do if we can't use our river?"

Residents living along the waterfront in Baltimore County have been up in arms since March, when dead shad and "black poop" were reported in the river near the Back River wastewater treatment plant. An inspector from the Maryland Department of the Environment visited the plant, where he found badly broken equipment, poor maintenance and multiple pollution violations.

The plant's woes have drawn the scrutiny of the Back River Restoration Committee, a nonprofit that residents formed in 2009 with the aim of restoring the health of the tidal portion of the river.

Frustrated by what they see as a lack of urgency or openness by state and local officials, the committee has teamed up with the environmental group, Blue Water Baltimore, to begin monitoring the river's water quality themselves.

Back River has long been considered one of, if not the most polluted, of the Chesapeake Bay's tributaries. Every year since 1986, the Back River and nearby Patapsco River, which together bracket Baltimore, have earned the worst scores in the Bay health report cards issued by the University of Maryland Center for Environmental Science.

In recent years, though, UMCES detected an "improving trend" in the region. Residents thought they saw the same uptick, which seemed to coincide with a $285 million upgrade of the nutrient removal facilities at the city-owned Back River plant.

"We could see the water clarity was visibly improving," said Desiree Greaver, the Back River Restoration Committee's project manager. The most obvious problems, they thought, were litter washed into the river from the heavily developed watershed and swarms of "midges," gnat-like flies that plague boaters and waterfront residents in warm weather.

Mike Baumgartner, president of the Back River Restoration Committee, sniffs a water sample collected by Desiree Greaver, the committee's project manager, near the outfall of Baltimore's Back River wastewater treatment plant. (Dave Harp)

Then came news last August that state inspectors, acting on a tip from Blue Water Baltimore, had discovered serious pollution violations at the city's wastewater treatments plants on the Back and Patapsco rivers.

MDE demanded immediate corrective actions, then filed suit against the city in January. By late March, with a new inspection finding still more problems with equipment failures and maintenance lapses, state regulators seized control of the plant.

Residents' alarm spiked in mid-April, when water samples analyzed by Blue Water Baltimore detected elevated bacteria in the river, including one reading upstream of the wastewater plant that was more than 180 times greater than what's considered safe for human contact.

That prompted MDE and Baltimore County to announce they would begin regular sampling for bacteria in the river. MDE joined the state Department of Health to warn the public to avoid contact with Back River.

At the same time, the county posted a "water contact advisory" sign in Cox's Point Park across the river from the treatment plant. The sign has since disappeared, to the dismay of activists and residents. Greaver said she's been unable to get an explanation for its removal.

Harbor Waterkeeper Alice Volpitta instructs Back River volunteers on proper techniques for water sample collection. (Dave Harp)

Since then, water samples have mostly showed low bacteria levels, though MDE and Blue Water Baltimore both have reported intermittent spikes in bacteria above the safe level at the outfall as well as up and downriver from it.

But David Lykens, director of the county's Department of Environmental Protection and Sustainability, said that since late April, "we're finding pretty good levels, actually swimmable levels," in the open river.

He suggested that the high bacteria readings obtained by others were misleading, likely the result of heavy rains a day or two before sampling. Rainstorms tend to trigger sewage overflows from the aging, leaky sewer systems in the city and county. They also wash animal waste and other organic material off streets and parking lots into the river's tributaries.

Nevertheless, Blue Water Baltimore and the Back River committee have recruited local residents to collect water from their piers, shoreline or favorite spots along the river. Alice Volpitta, Blue Water's Harbor Waterkeeper, said the effort is an extra check on water quality, but it's aimed mainly at engaging local residents in the river's welfare.

"The folks in this area, they're experiencing what people in Baltimore city have been dealing with for decades," she said. Blue Water Baltimore has filed its own suit against the city over pollution violations at its treatment plants and has sought to hold the city accountable for its sewer system overflows.

While many Baltimore County residents think the river's woes are solely the city's fault because of the treatment plant, Volpitta said, it's their problem as well. Back River and most of its watershed is in the county.

Under state consent decrees, the city and county have collectively spent billions of dollars in the past 20-plus years to fix their overflow-prone sewer systems. The county also has spent more than $16 million since the 1990s on projects to limit stormwater pollution.

On a warm day in mid-May, about 30 county residents showed up at Cox's Point Park to pick up water sampling kits and learn how to use them. They planned to collect water from their docks or favorite waterfront spots just before Memorial Day weekend and publicize the results.

"Your voices combined," Volpitta told them, "that collective voice of all of you, saying, 'I care, this is what the water quality is like off my dock where I recreate, where I boat,' all of those voices combined are going to result in change."

Among those present to learn how to sample the river was Karen Wolf.

"We have to hold them accountable," she said. ■

States challenge findings of Bay computer modeling

Updated figures show little progress in reducing nutrient pollution from farms

By Karl Blankenship

State officials are voicing strong concerns about updated Chesapeake Bay computer modeling that shows little overall progress in controlling nutrient runoff from farmland.

The updated modeling suggests that meeting the Bay's 2025 cleanup goals — already highly unlikely — will be even more difficult than regional leaders believed just a few months ago.

If correct, the figures indicate that work over the past decade by farmers to plant cover crops, install stream buffers, construct manure storage facilities and undertake other conservation practices were largely offset by increased crop production, more fertilizer use and more livestock.

The model revisions also show greater increases in nutrient pollution from urban stormwater than previously estimated, but those were small compared to the farm changes.

States are questioning the findings, citing uncertainties with the underlying data. They also worry about creating the perception within the farm community, where distrust of Bay computer modeling is already high, that efforts to reduce runoff have produced few results.

The U.S. Environmental Protection Agency uses the computer model to track progress in meeting nutrient reduction goals under the Bay's total maximum daily load, or "pollution diet," established in 2010.

The TMDL set the maximum amount of nitrogen, phosphorus and sediment that can reach the Bay each year from states in the watershed. States are to implement all actions needed to achieve those goals by 2025.

The updated calculations show estimated annual nitrogen reductions from 2009 to 2020 being 6.25 million pounds less than what was calculated just a few months earlier, largely because of new data showing the intensification of farm operations, including a sharp increase in fertilizer use.

That means the region has achieved only about a third of the 71 million pounds of nitrogen reductions needed to meet the 2025 goal. And most of those reductions came from upgrading wastewater treatment plants, a job that is mostly completed. The vast majority of future nitrogen reductions must now come from farms and, to a lesser extent, urban stormwater.

The story was better for phosphorus as the figures showed 533,000 more pounds of reductions than previously estimated.

But the region was already on track to meet phosphorus goals, while significantly off track for nitrogen, which tends to have a worse impact on Bay water quality.

State officials have questioned the new data, and many contend that the model results sometimes show worsening nutrient trends in places where water quality monitoring shows improvements.

"We don't think that the data sources are the right data sources … or even the best," said Pat McDonnell, secretary of the Pennsylvania Department of Environmental Protection, at a May 17 meeting of senior state and federal environmental officials. "It just puts us, and I'm sure other jurisdictions, in a challenging position."

Scott Mandirola, deputy secretary of environmental affairs with the West Virginia Department of Environmental Protection, said the results showed a tenfold increase in fertilizer use in urban areas in his state's portion of the watershed, "which I don't believe anybody accepts as being factual."

Andrew Wheeler, a senior adviser to Virginia Gov. Glenn Youngkin, said officials in his state have "seen inconsistencies in the [nutrient] loading data" produced by the model when compared with water quality monitoring. He called for "transitioning to more monitoring, instead of modeling, [for] assessments of progress going forward."

Ann Swanson, executive director of the Chesapeake Bay Commission, which includes representatives from state legislatures, said the updated findings should be used, but that states should be allowed to achieve the additional 6.25 million pounds of nitrogen reductions after 2025.

"Right now, it's very clear that we will not reach the TMDL, [that] we will not make that pollution diet," Swanson said. "We will hold our heads very, very high. And we will get as close as we can. And we remain with our foot on that pedal."

EPA officials say all of the Bay states signed off years ago on the data and procedures used to produce the updated results. While concerns about some of the data have grown, states and the EPA have failed to reach agreements on alternative information sources or other fixes.

Despite the use of conservation practices on many farms in the Chesapeake Bay watershed, recent computer modeling indicates that very little regionwide progress has been made in reducing water pollution from farmland. (Dave Harp)

Joe Wood, senior scientist with the Chesapeake Bay Foundation's Virginia office, acknowledged that there are questions about some of the data but said the new figures should be used because they followed agreed-upon protocols.

Wood questioned whether states would be voicing similar concerns if the revisions had shown them to be making greater progress, instead of less.

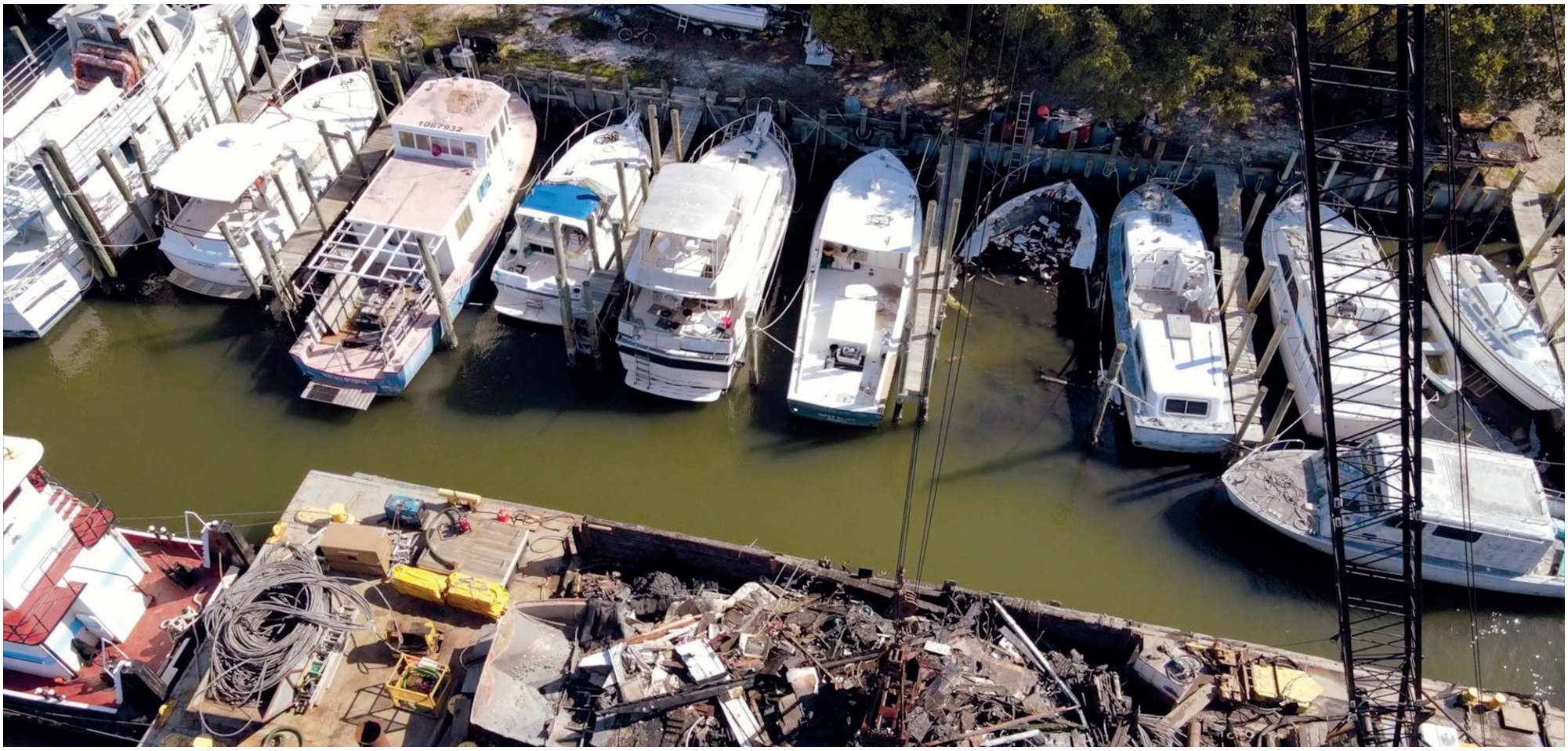
"If we had these anomalies, and all of a sudden everything looked a lot better than it previously did, would we have the same reaction?" Wood asked. "The process is what it is, and if you change it because it makes things look more difficult — that's challenging to me to wrestle with.

"The fact of the matter is, we're behind, and we're not getting where we need to go," he said. "Regardless of whether we change these numbers to reflect new data or not, we're still severely behind."

Under procedures followed by the state-federal Bay Program partnership, the model is updated every two years to incorporate new data, science and estimates of growth in the watershed. Those updates in the past have reduced estimated progress, but not by such a large amount — and they were farther away from the 2025 deadline.

"I think the intentions are good," said Lee Currey, director of the water and science administration at the Maryland Department of the Environment. "You want you want to use the best science. You want to incorporate [new] information every two years. But in the real world, that that can be really challenging.

"I think what's important is that you don't lose sight of the good things that have happened. A model doesn't erase those." ■



VA waters filled with debris when owners abandon ship

State considers strategies for funding more boat removals, providing better disposal options

By Whitney Pipkin

Whether lurking as hazards beneath the water's surface or becoming eyesores as they drift ashore, abandoned boats are a growing problem in Chesapeake Bay waters — especially in Virginia. And they're not as easy to get out of the water as they were to put in.

The U.S. Coast Guard has documented 170 abandoned and derelict vessels in Virginia waters since 2013, and state officials are building a list of even more that need to be removed.

Some boats are set adrift by storms and, in the absence of a fastidious owner, stay that way for months or years. Recreators who bought a boat during the pandemic may be realizing they no longer want to or can afford to maintain one.

Photo: The Vessel Disposal and Reuse Foundation removed this abandoned boat that had been disintegrating in the marina where it was stored near Dockside Seafood & Fishing Center in Virginia Beach, VA. (Courtesy of the Vessel Disposal and Reuse Foundation)

But one of the biggest concerns involves boats built during the affordable fiberglass boat boom that began in the 1960s, which are reaching the end of their lifespans. The number being abandoned appears to be on the rise.

"When luxury is built in," reads one 1980 ad for a 37-foot cruiser with a fiberglass hull, "it doesn't wear out." Made with reinforced plastic-and-glass materials, these boats don't blend into a marshy shoreline as they decompose, like their wooden forebears. Instead, they persist in the environment, shedding microplastic particles and leaching toxic materials over time.

The boats often end up left in a marina or set adrift because the owner feels like there aren't other options for disposal. Getting rid of a defunct boat can easily cost more than the boat is worth.

Unlike old cars, whose mostly metal frames can be sold or donated for scrap materials, the fiberglass components of a boat "are practically worthless and tend to cost more to remove, prepare for disposal and dispose of than their parts are worth," says a recent report from the Virginia Coastal Policy Center at William & Mary Law School.

Abandoned boats pose navigation problems for other boaters and are hazardous to the environment. Some slowly disintegrate in the marina where an owner has left them. Others drift into marshes or are purposely sunk near a shore. Fuel, oil, paint, sewage and chemicals leaching from batteries and cleaners onboard threaten the environment as the vessel drifts or sinks.

Not to mention, "the longer it's out there, the more expensive it is to remove," said Karen Forget, executive director of Lynnhaven River NOW, who has for years received calls from residents concerned about sinking or stranded boats near Virginia Beach. "They want us to come up with some kind of solution for what to do with it."

Once a boat is dead in the water, removing it costs thousands of dollars — even tens of thousands, depending on where the boat is located and how much it has already disintegrated. And getting it back out of the water — whether by towboat, crane or claw — comes with all sorts of red tape.

The Lynnhaven group, along with Virginia's Coastal Zone Management Program and the Clean Virginia Waterways project at Longwood University, has applied for a grant from the National Oceanic and Atmospheric Association's Marine Debris Program to fund more boat removals. The federal program funneled nearly $2 million into 10 marine debris removal programs in states in 2021, helping them tackle a backlog of derelict vessels decomposing in their waters.

The Coastal Zone Management Program, operated under Virginia's Department of Environmental Quality, has largely completed a report on the status of the state's abandoned boat problem. First drafted in the fall, the document includes policy suggestions for giving boat owners better options for disposal, funding removals and addressing the underlying issues contributing to an uptick in abandoned vessels.

As of late May, the report was waiting for approval by Gov. Glenn Youngkin's administration.

Meanwhile, the agency has been working on an inventory of abandoned boats to help prioritize removals once funding becomes available.

But Laura McKay, manager of the coastal management program, said the problem continues to grow.

"We have got to turn off that faucet, or we're just in big trouble," she said.

Bootstrapping boat removals

Mike Provost had recently retired from the U.S. Navy when he got curious about an abandoned 36-foot cabin cruiser left tied to a tree in Long Bay Pointe off the Lynnhaven River.

"I made a couple calls and quickly determined no one was going to do anything about it," he said.

Virginia's current approach to the problem of abandoned vessels is piecemeal and painstakingly slow. The authority to remove vessels is divided among several agencies, depending on where the boat is located and other factors. That leaves many structures in limbo as to who's responsible for removal.

So Provost began fundraising to remove the boats himself, ultimately starting a nonprofit, the Vessel Disposal and Reuse Foundation. He raised the $11,000 needed to remove that first boat, which eventually ran aground at First Landing State Park, with a GoFundMe page.

Since late last year, the organization has removed nine boats from the Lynnhaven River area. Many of them had been there for years. Provost learned a lot from that first removal and has since worked with a marine salvage contractor to do the heavy lifting.

If the boat were to leak oil while being removed, the person or group removing it bears the liability in many cases. If the person abandoning the boat did so illegally, they may have also removed any identification that would help find and transfer legal ownership of the vessel.

Through tracking down boat owners, Provost has developed a better understanding of the types of situations that lead them to abandon their vessels. Most, he said, are elderly, facing financial trouble, physically or mentally handicapped or addicted to illegal substances.

Provost estimates that his organization has removed more than 85,000 pounds of marine debris from waterways so far.

"That's like removing tons of beach trash, which is crazy to me," he said.

He's already begun raising an additional $75,000 to remove the next batch of vessels with plans to tackle a "boat graveyard" in the North Landing River, where an estimated 13 boats have been abandoned next to a natural area preserve.

Mike Provost, founder of the Vessel Disposal and Reuse Foundation, worked with Portsmouth, VA-based marine contractor H&H Enterprises to do the heavy lifting for recent boat removals. The crews removed five derelict vessels over two days in April. (Courtesy of the Vessel Disposal and Reuse Foundation)

Provost knows he can't keep up with the ever-growing inventory of abandoned boats if the underlying issues aren't addressed, and he hopes the state efforts will start to stem the tide.

Though Virginia considers it a Class 3 misdemeanor to abandon a vessel in a waterway, the $500 fine is much less than the potential cost of removing it. Without a clear process for safe disposal, many people abandon their boats out of desperation.

In the Chesapeake watershed, only Maryland has a steady source of funding to remove abandoned vessels, according to NOAA's Marine Debris Program. Maryland has for years funded its abandoned boat and debris program through a 5% excise tax on all boats purchased in the state. The money helps keep channels dredged for boat navigation and provides up to $500,000 per year for removing abandoned vessels, according the Virginia Coastal Policy Center report.

Florida, California and other coastal states have also developed ongoing funding mechanisms to pay for the removal of derelict vessels.

A draft of Virginia's abandoned vessels report suggests the General Assembly steer more funds toward boat removals, possibly through a new fee paid when a boat is registered. Those funds could also support programs to improve disposal options and prevent abandonments.

The Coastal Policy Center's paper suggests that Virginia legislators could also approve a "liability shield," similar to Maryland's, that protects agencies and individuals from the financial and legal risks associated with the removal of abandoned vessels.

Disposal options

Boat owners who want to dispose of a vessel properly will find it's not easy in Virginia. State websites don't offer guidance, leaving boat owners to call around and ask if local landfills will accept a large fiberglass hull they can't dispose of elsewhere.

Acknowledging that this is a problem in multiple states, one website suggests cutting a fiberglass boat into pieces with a chainsaw so a landfill will accept it. Some companies also offer boat removal services.

"An old car has scrap value of a few hundred dollars. But old fiberglass boats — there's usually nothing salvageable or salable and it costs money to dispose of them correctly," said Katie Register, executive director of Longwood's Clean Virginia Waterways.

State officials are looking into whether fiberglass from vessels can be shredded and burned as fuel or to produce usable ash for cement manufacturing. Internationally, burned fiberglass wind turbines are providing alternatives to coal ash for some cement plants.

Rhode Island has a vessel-recycling program that helps fuel cement manufacturing there. Virginia officials have begun discussions with a local cement plant to that end. The plant could need environmental permits, though, such as one for air pollution, to conduct a pilot project.

Other states offer vessel turn-in programs that, once disposal options are arranged, can save state agencies the cost and effort of removing vessels that might otherwise become abandoned.

"It's much less expensive to dispose of a boat if someone turns it in and shows they own it," Register said. "It costs one-tenth as much as a boat that's been abandoned in the environment."

Abandoned vessels are just one source of pollution addressed in Virginia's overarching Marine Debris Reduction Plan, first created in 2014 and updated in 2021. The state has made progress tackling other forms of plastic pollution such as bags, polystyrene and balloons. But the abandoned boats problem has risen as a recent priority as fiberglass vessels age out.

"I would argue that all of these are priorities," Register said. "We can stop using [plastic] straws at restaurants and prevent pollution from fiberglass boats. It's an all-hands-on-deck situation." ■

‘Forever chemicals’ found in more MD drinking water systems

Levels are below EPA threshold but some are above proposed limits in nearby states

By Timothy B. Wheeler & Jeremy Cox

Potentially harmful levels of “forever chemicals” contaminate some of the smallest drinking water systems in Maryland, the state’s latest round of testing shows.

The Maryland Department of the Environment reported in late April that its testing of 65 community water systems, which collectively serve about 81,000 people, detected per- and polyfluoroalkyl substances, or PFAS, in a little more than half of the wells sampled.

In an earlier round of testing, released last July, MDE found traces of PFAS in three-quarters of the 66 larger water systems it checked, which serve more than 4 million residents. Wells supplying drinking water to Westminster and Hampstead, both in Carroll County, had concentrations of two particularly problematic PFAS compounds that were above the recommended safety threshold established by the U.S. Environmental Protection Agency. Those wells were taken offline, according to MDE.

None of the smaller systems checked in the latest testing had PFAS contamination above the EPA health advisory level. But at least three small, private water systems had concentrations in excess of drinking water safety limits that have been proposed in neighboring Delaware and Pennsylvania, where state officials have made their own assessments of the health risks posed by PFAS.

Maryland Public Interest Research Group director Emily Scarr called MDE’s latest findings “alarming,” given the state’s decision against setting its own limits for PFAS in drinking water.

“We are disappointed that Gov. Hogan has not directed the Department of the Environment to take bolder action on PFAS contamination,” she said. “It’s time for Maryland to join states across the country that are picking up the slack where the EPA has failed by setting strong restrictions on PFAS in water and holding polluting industries accountable for cleaning up the mess they’ve made.”

PFAS are a group of more than 9,000 synthetic chemicals that have been in use since the 1940s in many industrial and consumer products, including nonstick cookware, waterproof clothing, stain-resistant carpeting, food packaging and

PFAS in small and large water systems throughout the state, but not always at levels above the EPA-recommended limit. (Dave Harp)

firefighting foam. Many of them dissolve easily in water but break down very slowly (ergo their nickname of “forever chemicals”). They also can build up in people, animals and the environment.

Exposure to at least some of these chemicals, even in small amounts over years, has been linked to serious health effects, including kidney and liver disease, developmental issues and cancer.

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) are two of the most widely used and studied chemicals in the group. They have been replaced by other PFAS in U.S.-made products, but they continue to be found in water samples.

There are no enforceable federal regulatory drinking water standards for PFAS, though the EPA has said it will propose maximum contaminant levels for PFOA and PFOS sometime this fall. Frustrated that the EPA had not acted earlier, at least nine states have adopted or proposed their own regulatory limits for those compounds, several of which are substantially below the EPA “advisory” threshold of 70 parts per trillion (ppt).

Pennsylvania’s Department of Environmental Protection has proposed maximum contaminant levels of 14 ppt for PFOA and 18 ppt for PFOS. Delaware’s Division of Public Health has chosen ceilings of

Donald Hill, sitting outside his home in Naylor Mill Village in Salisbury, MD, said he hadn’t heard until told by a Bay Journal reporter that PFAS had been found in the mobile home park’s water supply. (Jeremy Cox)

21 ppt for PFOA and 14 ppt for PFOS, with a cap of 17 ppt when the two compounds are found together. Some states have even lower limits — New York’s is 10 ppt for each compound.

The highest levels of PFOA and PFOS detected in the latest MDE sampling were found in wells serving two mobile home parks in Wicomico County on the Eastern Shore and one in Carroll County northwest of Baltimore.

At Naylor Mill Village mobile home park on the outskirts of Salisbury, MDE inspectors discovered concentrations of PFOA and PFOS of around 36 ppt in a well furnishing drinking water to residents. They also detected PFAS at the Gateway Village mobile home park in nearby Delmar. There, levels were slightly lower, at 28 ppt. Samples taken at Twin Arch mobile home park near Mt. Airy in Carroll County registered levels ranging from 31 ppt to 43 ppt.

At least three water systems tested in MDE’s first round of sampling had similar PFAS levels. The state report did not identify those systems. It also said in each report that there were 13 other systems with PFAS levels between 10 and 28 parts per trillion, meaning some of those also could be above the limits proposed other states.

Word of MDE’s findings has not reached many water system customers yet. At Naylor Mill Village, the home of Donald Hill, his wife and two adult children is just a couple doors away from the water system shed. He has lived there since 1992. Hill said he doesn’t recall receiving any notices about PFAS contamination in his drinking water. He wasn’t aware of the situation until a *Bay Journal* reporter brought it to his attention.

To date, he said, he hasn’t had any qualms about the community’s water. It tastes just fine, he said. The family routinely uses tap water for making iced tea and coffee. They’ve never given thought to using bottled water.

Hill said he isn’t too worried because neither he nor his family members present any of the symptoms of PFAS exposure listed in government guides. But now that he knows about the chemicals’ presence, he is concerned about what it might do to their future health.

“You definitely got to think of that,” Hill said.

Because the PFAS level in the Naylor Mill well is only about half of the EPA’s recommended limit, MDE is not requiring any corrective action. It is asking the park owner to test its finished water twice a year “if feasible” and share the results with regulators.

Erika Campbell, manager of the park, said she intends to do the requested testing and notify consumers of the PFAS discovery in the “consumer confidence report” that community water systems are required to provide their customers each July. There are 42 homes using the system now, she said.

Beyond that, Campbell said, she has received no directions or advice from MDE and is unsure about the feasibility and cost of acquiring a treatment system to remove the PFAS.

“As we need to, we’ll make the changes,” she said.

Until now, Maryland regulators have elected to wait for the EPA to set a nationwide drinking water standard, which may not be finalized until fall 2023. MDE spokesman Jay Apperson said the state is considering not waiting that long, but rather setting a limit sometime this summer, when the EPA’s science advisory board is expected to finish reviewing the latest research on the chemicals’ toxicity.

In the meantime, Apperson said, MDE plans to use some of the state’s expected influx of federal infrastructure funding to provide financial assistance for installing PFAS treatment systems, drilling new wells or connecting to other water systems, among possible options. ■

Chesapeake dolphins still enthrall spotters, scientists

Summer visits provide important research opportunities about dolphin health, behavior

By Whitney Pipkin

DolphinWatch app user Rhiana Scholz captured this image of a group of dolphins in the mid-Chesapeake Bay on July 3, 2018.

Dolphins that visit the Chesapeake Bay in the summer have been listened to, photographed, identified by their dorsal fins and documented in a crowd-sourced app for going on five years. But there is much more that scientists want to learn.

"Have they been coming sooner and staying later? It's hard to say," said Ann-Marie Jacoby, associate director of the Potomac-Chesapeake Dolphin Project and a doctoral student at Duke University.

More people have been spotting Atlantic bottlenose dolphins during the animals' summer visits to the Bay in recent years, but that could be for a host of reasons.

The Chesapeake DolphinWatch phone app, developed by the University of Maryland Center for Environmental Science, is heading into its fifth season as a way for citizen dolphin spotters to log their findings. The app has nearly 10,000 users and has made many boaters more aware of the dolphins' presence. Last summer, they logged more than 1,000 sightings, with researchers confirming 70% of them, said project coordinator Jamie Testa.

"That's a big sighting year for us," she said.

Lauren Rodruigez, a graduate research assistant with the DolphinWatch program, used the data from three years of spotting as the foundation of a May 2021 report on the trends of dolphin presence in the Bay. The paper informs environmental impact assessments at military facilities in the region, where dolphins may come near ships or shoreline assets more frequently than previously thought.

"Before, the data showed that dolphins only used the Lower Bay. But this data shows they use the whole Chesapeake and [we] need to take it into consideration," Rodriguez said.

In 2021, dolphins regularly appeared in the Upper Bay off Rock Hall, MD. They traveled well up the Chester River, too, Rodriguez said, "probably chasing prey and fishing boats, or just exploring."

Potomac River researchers have documented dolphins as far upstream as the Gov. Harry W. Nice Memorial Bridge, where U.S. Route 301 crosses the Potomac just south of Popes Creek, MD. That's nearly a 50-mile trip upriver, almost halfway to Washington, DC.

According to historical accounts, dolphins were spotted in 1884 as far up the Potomac as the Aqueduct Bridge, just south of Georgetown University in DC. Still, people consider spotting dolphins to be a relatively new phenomenon, especially in the Bay's upper reaches.

"We hear from people, anecdotally, that say they've lived here 25 years and have never seen a dolphin until now," Testa said.

She's talked to others who've been on the water for 40 years and say they see far more of the marine mammals now than they used to.

"Some people are still blown away," she said.

Data from DolphinWatch app can help predict when the mammals will arrive to summer in the Chesapeake. In the most recent years, they have begun showing up in April and were mostly gone by October. The numbers appear to peak in July. Patterns show that dolphins only visit the Bay's upper reaches in midsummer.

But their population dynamics and travel patterns are incredibly complex.

The dolphins that visit the Chesapeake come from waters up and down the mid-Atlantic, from Florida to New York. Some travel farther than others. Distinct groups that reside along the coasts of various states generally stay together during their visits, but they also overlap in ways that make it tricky to track travel patterns across the system.

"The marine environment doesn't have the same barriers as terrestrial populations, so there can be a lot of mixing between groups," Jacoby said.

That's one of the reasons Potomac researchers wanted to study dolphins here. The Chesapeake is hotbed of dolphin feeding and social behaviors and a great place to study both. Researchers who have been identifying, counting and following them for several years say they have now laid the foundation needed for additional work.

Melissa Collier, a doctoral student at Georgetown and field researcher with the Chesapeake-Potomac Dolphin Project, is studying disease transmission among dolphins. In 2013, in what scientists call an unusual mortality event, nearly 1,600 dolphins washed up along the East Coast, almost all killed by a respiratory disease.

Virginia beaches were the epicenter of that outbreak, with more than 400 dolphins stranded, most of them fatally. Necropsies revealed that the fatalities were largely from *cetacean morbillivirus*, a virus in the same family as measles. Collier and other researchers want to better understand how animals that spend most of their time underwater share a virus that is transmitted when they breathe, similar to the way COVID-19 is spread among humans.

"The thought process is that an epidemic occurs and natural immunity spreads to the population," Collier said. "So then it dies out and no individuals can get infected."

That is, until new generations are born without immunity, she said. The previous outbreak took place in 1987, causing researchers to speculate that, if the quarter-century cycle holds up, another could occur in the late 2030s. Meanwhile, researchers wonder if human disturbances, such as water pollution, could reduce dolphin immunity over time, making them more susceptible to diseases.

To study dolphin behaviors, including those that might spread disease, researchers do a "focal follow" on a particular dolphin or pod. They write down whether the animals appear to be feeding, mating and surfacing at the same time.

While tracking the dolphins this way, Collier, Jacoby and another researcher were on a team that witnessed the first dolphin birth in the Potomac River in 2019. Bottlenose dolphins are among the most studied species in the world, but a wild birth has only been documented in scientific literature once, in 2013 off the coast of Georgia.

The Potomac birth lends support to the hypothesis that dolphins come to the Bay in summer because it is relatively free of predators, compared to the open ocean, and therefore a safer place for newborns. Dolphins carry their young for 12 months, so it's possible that any born here were also conceived here. Predator avoidance could also explain why they seem to be swimming farther up the Bay than they used to.

And there are likely other factors — more food and less competition, for starters. Or it could be simple wanderlust, Collier said. "[Maybe] they just want to explore more habitat." ■

The Bay Journal is hosting a free webinar with Chesapeake Bay dolphin scientists at 7–8 p.m. June 22. Log in to ask researchers questions and learn what it's like to study these fascinating marine mammals. Register at bayjournal.com/events.

Killer storm Agnes continues to haunt Bay watershed

June marks 50-year anniversary of disastrous deluge

By Jeremy Cox

Tropical storm Agnes devasted communities along the Susquehanna River in late June 1972, including the town of Wilkes Barre, PA, shown here. (Courtesy of the National Weather Service)

Fifty years ago, Tropical Storm Agnes detonated a water bomb over the Mid-Atlantic. Over a handful days in June 1972, relentless rain triggered record-breaking floods.

The storm's human toll was monumental: a path of destruction through a dozen East Coast states; 122 people dead, 48 in Pennsylvania alone; and $3.1 billion in damage. It was the nation's costliest natural disaster at the time.

And the environmental consequences, in the eyes of contemporary observers, were simply unimaginable: a shock wave of filthy water pummeling the Chesapeake Bay from nearly every direction, replacing its fragile balance with chaos.

In some ways, North America's largest estuary, experts say, has never been the same.

"What's interesting, given that it's 50 years later, is we still see some of these alterations that have persisted," said Rom Lipcius, a longtime scientist with the Virginia Institute of Marine Science. "A lot of [the memories] have faded. The historical baseline shifts, and we think this is the way it's always been. And that's just not the case."

With half of a century's worth of perspective, let's look back at how the ecological blow from a devastatingly wet week continues to echo across the Chesapeake and its watershed.

Bay's problems become 'real'

Agnes forever altered the way the public regarded the Chesapeake Bay. And as the fourth employee at the Chesapeake Bay Foundation, Mary Tod Winchester had a front-row seat for the shift.

She grew up on the West River in Galesville, MD, a member of a family that has owned and operated a boatyard on the waterway for eight generations.

"When I was growing up, obviously, [the Bay] was really pretty healthy," Winchester recalled. "And then in the '60s is when we really noticed a change."

Underwater grasses, the centerpiece of the Bay's food web, were dying off. Problems such as diseases and overharvesting had ravaged oysters, crabs, clams and other important fisheries. But beyond a relatively small group of scientists and activists, few people paid much heed to the estuary's growing ecological woes, Winchester said.

Mary Tod Winchester was working for the Chesapeake Bay Foundation when Tropical Storm Agnes hit in 1972. She said the storm drew attention to the ecological woes of the Bay. (Dave Harp)

"And that was one of the things about Agnes," she said. "It was a wake-up call, and it really helped to ring the bells that there was a problem here."

Swirling and twisting its way northward from the Gulf of Mexico, Agnes could only muster sustained winds of 45 mph by the time it reached the Chesapeake region. But it literally rewrote the books on rainfall. The system stalled over the Susquehanna River basin June 21–24, dropping, dropping as much as 18 inches of rain.

Agnes heralded a decade of soggy weather and unusually high river flows, which unleashed tons of nutrients and sediment into the beleaguered Bay. As a result, Winchester said, the public and their elected representatives could no longer ignore the environmental disaster unfolding before their eyes.

"Everyone began to realize how important it was for Pennsylvania, Maryland and Virginia to be working together on Bay issues," she said.

The Chesapeake Research Consortium, a hub for Bay-related research, was born in the immediate aftermath of Agnes as scientists scrambled to understand the full breadth of its impact. By the end of the decade, Congress acted, funding a five-year, $27 million study to examine the Bay's rapid deterioration.

Winchester stayed with the Bay Foundation for more than 40 years, rising from the executive director's secretary in 1971 to vice president of administration. There were several important milestones as the advocacy group flowered into a powerful regional political force with nearly $30 million in annual revenue. But Agnes was certainly one of them, she said.

"It helped to energize CBF," she said of the organization, which formed in 1966. "It helped us show the public we're not just a bunch of hippies trying to say the Bay is dying and raising money so that we can, you know, pay people to have jobs. Agnes made it real."

Clamming up

Rarely is a single event to blame for the decline of a species. One exception may be the soft shell clam population of the Chesapeake Bay.

Soft shells (*Mya arenaria*), named for their brittle, oval shells, were so abundant in the Bay region during the 1950s and '60s that Maryland crowned an annual "clam queen" to promote the vibrant fishery. Their meat has been sought over the years as a staple in New England-style stews and for baiting blue crab pots.

Annual clam landings peaked in the state at 680,000 bushels in 1964 but remained higher than 500,000 through 1971.

Agnes' consequences were immediate and devastating. The storm delivered an onslaught of sediment to the Bay, slathering most of the clam's bottom habitat with a layer of thick mud.

About nine out of 10 soft clams died from the suspected combined stress of low salinity and abnormally high water temperatures, according to the Chesapeake Research Consortium. Scientists conducting painstaking surveys failed to locate a single living soft clam in the Rhode and South rivers near Annapolis in the months after the storm.

Maryland authorities temporarily banned clamming three months after the storm to promote its recovery. Over the next two decades, the population perked up somewhat but nowhere near its pre-Agnes levels. Today, the fishery is classified as a remnant of its former self.

Diseases and worsening water quality certainly played roles in suppressing the clam's numbers, experts say. But computer modeling by Lipcius and some of his colleagues suggests that Agnes was the tipping point for clams.

Blue crabs had always been one of their major predators. But with clam numbers significantly thinned after the storm, they couldn't reproduce enough to outpace the crabs' appetite.

"So, those are two species that got hit — one that has never recovered and one that did recover," Lipcius said.

The downfall of underwater grass

Beneath its surface, the Chesapeake Bay once abounded with a rich panoply of plants that thrive underwater. So, could a burst of additional water be a bad thing?

Agnes underscored that it can be.

The Bay's grass acreage had begun to backslide in the 1960s. Then Agnes wiped out about half of what was left, accelerating that downward trajectory in a phenomenon "unprecedented in the Bay's recorded history," wrote VIMS researchers Bob Orth and Kenneth Moore in an influential 1983 study. Unlike previous downturns, the 1970s die-off appeared to strike not just one plant species or one localized area but all species across the Bay, they said.

The submerged meadows are among the most crucial indicators of Bay health because they require clear water to survive. Under the Bay's multistate and federal restoration effort, nutrient-reduction goals are aimed at improving water clarity enough to reach a goal of 185,000 acres of grasses covering its bottom.

The Bay's underwater grasses had begun to backslide in the 1960s, and Agnes wiped out about half of what was left. (Will Parson/Chesapeake Bay Program)

In 2020, VIMS mapped a total of just 62,000 acres, barely one-third of the targeted amount. In the nearly 40 years since the Bay cleanup formally launched, the underwater plant coverage has had its ups and downs but has never surpassed 110,000 acres.

The persistently disappointing vegetation data likely contain a faint echo from Agnes, said Andrew Dehoff, executive director of the Susquehanna River Basin Commission, a state-federal compact with the authority to regulate water use within the river's 27,510-square-mile watershed. Had Agnes arrived at another time of year, the grasses, he said, might not have fared so poorly.

"The impact to the Bay was quite significant because the delivery of sediments and nutrient loads occurred in June, the critical part of the growing season for submerged grasses," Dehoff said. "Vegetation was inundated. And that's very difficult to recover from."

'Last nail' for shad

Inside a musty-smelling cannery that has been transformed into a museum for antique Chesapeake Bay workboats, Pete Lesher fixed his attention on one of the smallest vessels in the collection.

If paint had ever clung to its wooden surface, it has long since rubbed off. A sign gives its dimensions as 18 feet, 9 inches in length and 5 feet at its widest. But the most important feature, in Lesher's eyes, is its completely flat bottom, which ensured maximum stability and allowed it to be hauled directly onto the shore, if necessary.

Lesher, the chief curator for the Chesapeake Bay Maritime Museum in St. Michaels, MD, explained that this rustic-looking skiff was designed and built with a singular purpose: netting American shad from the Eastern Shore's Choptank River.

"Little local variations are these expressions of local culture," he said. "Note," he went on, "the way they specifically shaped this boat for this fishery in this place, the length of boat determined by the length of net that they're going to use, the depth of net determined by the depth of water."

After Agnes, Lesher added, this boat was pretty much obsolete.

Shad once numbered in the tens of millions during their spring spawning runs up the Chesapeake's rivers. But overfishing, increasing water pollution and dam construction sent their population into a downward spiral during the middle of the last century. Agnes all but finished it off, experts say.

"Agnes was the last nail in the coffin" for shad, Lipcius said. "The reason that they got hit hard is because that's when they are spawning. They've migrated upriver to the tributaries, and that's where the sediment and river flow hit the hardest. And so, boom, it just washed out the larvae."

Maryland banned Bay shad fishing in 1980, the Potomac River was closed in 1982 and Virginia shuttered its portion of the Bay in 1994. Today, the shad population remains at historic lows in the Bay region and throughout its East Coast range, hovering around 1% of its late-1800s abundance, scientists say.

The drastic reduction in shad was also a sharp blow to the Bay's aquatic life. The fish had served as a vital link in its food chain.

Small and unseen losses

In the wake of Tropical Storm Agnes, scientists who often didn't know how they were going to finance their work were nonetheless quick on the scene, trying to quantify and explain the environmental damage. That search continued for decades, yielding thousands of pages of research.

But some of the storm's consequences couldn't be measured with the tools available then or now. Like the loss of a girl's verdant playground.

Elizabeth Andrews still remembers the crayfish.

A winding path of yellow pavers, which the 10-year-old version of herself called the Yellow Brick Road, led down a hill from her family's house in Fairfax County, VA. At the bottom flowed a little stream, a tributary of Accotink Creek, that hummed with enough life to sustain a young girl's imagination.

"It was a beautiful natural setting to grow up in," Andrews recalled. "We played down in the lower part of the yard, which was all woods all the time. And there were crayfish, and there were ducks that came all the time to eat the crayfish."

During Agnes, the trickle behind her house morphed into a roar, carrying away anything unlucky enough to get in its way. When the flood finally receded, the fence along the the yard was strewn with trash.

"That was remarkable to me because I didn't think there was much trash in the area," Andrews recalled. "And the whole lower yard, of course, was covered with sediment. It was a mess and drowned out plants."

Andrews' love of nature spilled over into her professional life. She worked for a time as head of the environmental section of the Virginia Office of the Attorney General and currently oversees the Virginia Coastal Policy Center at the William & Mary Law School.

Agnes shook her 10-year-old world. But the real disaster came afterward, she said.

The county brought in a bulldozer to straighten the stream and festooned its formerly green banks with ugly chunks of concrete, ostensibly to ward off erosion during future storms, she said.

The ducks and crayfish never returned. The magic was gone. ■

Bay Journal podcast

Work is underway for a new series of *Bay Journal* podcasts to detail the impacts of Agnes and explore how the region may or may not be prepared for a similar storm in the future. If you have stories or photos to share, send us an email at Agnes@bayjournal.com.

PA grazing project aims to save farmers, land and Bay

New 'regenerative' product label offers incentive to farmers

By Ad Crable

Can a new organic milk line that relies on grazing, animal welfare, healthier cows, well-paid farmers and conservation practices help save both the Chesapeake Bay and struggling dairy farmers in Pennsylvania?

The multi-partner experiment known as the Dairy Grazing Project has launched in Lancaster, Lebanon, York and Dauphin counties. This area is a target of Pennsylvania's efforts to reduce agriculture-related nutrient pollution that not only fouls local streams but flows downstream to the Bay.

Funded in part by a three-year, $1 million grant from the National Fish and Wildlife Foundation, the coalition of eight nonprofits and private companies aims to persuade more than 50 small dairies to switch to rotational grazing and a steady diet of grass for their cows.

By doing so, they hope to convert 6,000 acres of crop fields to pastures and plant perennial hay for winter cattle forage on another 4,000 acres that are currently dedicated to grain crops, which are prone to generating polluted runoff.

That shift would reduce the amount of nutrients and sediment washed into waterways. Project managers estimate an annual reduction of 400,000 pounds of nitrogen, 9,000 pounds of phosphorus and 23 million pounds of sediment.

Project leaders also say that grazing at least 120 days a year on the land will save farmers money through reduced feed costs and healthier cows. At the same time, they contend that grazing will enrich or regenerate the soil rather than deplete it through tillage and cropping.

A linchpin in the experiment is for about 40 of the 54 farmers to produce milk under a relatively new "Regenerative Organic Certification" registered by the Cleveland-based Origin Milk Co. The company says it will result in the country's first regenerative organic, grass-fed milk supply that contains only the A2 protein and not A1. A2 milk is favored by many with milk digestion problems.

The regenerative organic label expands the environmental and animal-health guarantees of current organic standards listed by the U.S. Department of Agriculture.

Aaron Miller, an farmer in Lancaster County, PA, stands among cows grazing in a pasture. The family switched from traditional crop and grain-fed dairy farming to grass-fed rotational grazing in 2004. (Dave Harp)

For a producer to earn the label, cows must be free to roam and slowly eat grasses by rotating through pastures. Being constrained in individual barn stalls at night and during winter is prohibited. Calves are not to be separated from their mothers. And bull calves cannot not be immediately slaughtered for meat.

New model

This effort is taking place in the heart of Pennsylvania's milk country, where pastures have long been retired in favor of raising feed and commodity crops. Dairy cows spend most of their time confined inside barns where they are fed grains and receive antibiotics and supplements designed to boost milk production.

Rotational grazing, advocates say, is an alternative with many benefits. A study by project partner Pasa Sustainable Agriculture found that pasture-grazed soils are even more fertile than ones that are not tilled, thanks in part to manure droppings and aeration by cow hooves.

The grasses and soil soak up carbon, a greenhouse gas. And cutbacks of synthetic fertilizers reduce emissions of nitrous oxides, a powerful greenhouse gas. That more than makes up for slightly higher emissions of methane gas from cow burps.

Also, the soil is more resilient in the face of extreme weather.

"This legacy industry is fraught with a bunch of issues. That needs to change. We want to start at the ground up with regenerative farming practices," said Adrian Boto, CEO and co-founder of Origin.

As an incentive, the company will pay qualifying farmers $40 per hundred pounds of milk to supply the new organic line. Currently, farmers are getting a little more than $30 per hundredweight for organic milk and $22–$24 for non-organic milk.

Appetite for something new

On the surface, upending the dairy prototype seems to be a tough sell. Pennsylvania's plan to clean up its share of Bay pollution calls for converting 169,000 acres of farmland in the Bay drainage to rotational grazing, yet only 30,000 acres have been switched so far.

But project partners are banking on the willingness of financially strapped farmers to try something different. Grazing helps farmers save money by cutting down on commercial fertilizer, pesticides, planting equipment, seeds and feed supplements, they point out.

Leroy Miller, a Lancaster County Amish dairy farmer who switched from traditional crop and grain-fed dairy farming to grass-fed, rotational grazing in 2004, can vouch for that.

"My operating expenses are peanuts compared to what they used to be," said Miller, who grazes 35 Jersey dairy cows on a small 80-acre farm and sells various milk products at an on-farm market. He and his sons graze their cows 10 months a year and move grazing fences twice a day on average.

Regenerative dairy farming, he said, "just made sense for the whole ecosystem of how God designed the Earth for people to stay healthy."

While grass-fed cows produce less per milking than grain-fed cows, they tend to live longer and be healthier, requiring less veterinary care, studies show.

"There are grass-based dairies all over the country but here, if you are land limited, the allure of a great price per hundredweight is pretty strong, because it may be the only way you can continue," said Sue Ellen Johnson, a pasture specialist with TeamAg, a consulting firm and partner.

Much of the early interest in the project has come from Plain Sect farmers, who are especially driven to remain in farming.

For the lure of reduced production costs and high milk premiums to work, consumers will have to accept higher prices for milk that protects the environment and farmers.

"It's about grassroots and letting consumers be a part of a movement. They will spend 10–20% more because they are part of a movement and not just buying a product," Origin's Boto said.

The Chesapeake Bay Foundation, which has championed regenerative grazing, applauds the project. "It is a big change and can't happen overnight. Farmers are used to riding a tractor and fertilizing corn," said Beth McGee, the group's director of science and agricultural policy.

Lucas Waybright of Pasa Sustainable Agriculture is convinced that the dairy grazing movement will resonate with consumers who increasingly want a holistic approach to farm products.

"You have a healthy cow, you're getting healthier land and you're getting a healthy business model because you are less dependent on conventional feeds. I think this is unlocking something significant. A cow in a pasture strikes something in humans." ■

VA Conservation Corps intern receives national award

Native youth cited for excellence in his work at Werowocomoco

By Jeremy Cox

Growing up near the shipyards that snake along Norfolk's waterfront, Kalen Anderson pictured himself working there some day as a welder. He pursued the dream, graduating from community college with an associate degree in mechanical engineering.

Just as he was about to take the next step toward his industrial career, the COVID-19 pandemic intervened. The ensuing occupational detour led Anderson, a Native American and member of the Nansemond Tribe, to an internship with the Appalachian Conservation Corps.

Dispatched to work on a piece of land about an hour's drive north of his home, he found a new calling. And in March, the Corps Network, a national association of service and conservation corps organizations, recognized Anderson for his work, naming him one of four recipients of the Corps-member of the Year award, chosen from 25,000 program participants nationwide.

Now, the 21-year-old sees his professional life tied to the land he first encountered during that internship. Known as Werowocomoco, the 264-acre tract along the York River was once the seat of the Powhatan confederacy and is one of the most significant American Indian sites in eastern North America.

"To me, it is my Washington DC," Anderson said. "To walk in a place where your ancestors lived, walked and birthed kids, it holds a lot of sentimental value."

The National Park Service owns the Werowocomoco property and is developing a plan for its use through a collaboration with seven tribes in the region. Anderson envisions getting a permanent job at the site with the park service and working his way up the career ladder.

The park service and its partners on the Werowocomoco project are working to involve tribal youth wherever possible in its development, said Zach Foster, director of the Appalachian Conservation Corps.

"This site is sacred to several different tribes," Foster said. "Indigenous voices need to figure first and foremost in that conversation."

The events that took place at Werowocomoco are well known, even if its name is not.

Kalen Anderson received a national award for his work as an intern at Werowocomoco, a site along the York River in Virginia with sacred significance to Native Americans. (Dave Harp)

Kalen Anderson, an intern at Werowocomoco in Virginia and member of the Nansemond Tribe, contemplates a massive pecan tree along the site's waterfront. (Dave Harp)

The site overlooks Purtan Bay in Gloucester County and is believed to be where the English colonist John Smith first met the Algonquian leader Powhatan more than 400 years ago. In 1607, while exploring the Chickahominy River, Smith was captured by Indians and taken as a prisoner to the town. There, he met Powhatan, who was the spiritual and political leader of Native communities living throughout what is now called the Virginia Tidewater.

According to Smith, he also met Powhatan's daughter, Pocahontas, there and later boasted (in a much-disputed account) that she rescued him from execution.

The name Werowocomoco faded from history. Its exact location was uncertain until 2001, when riverfront landowners Bob and Lynn Ripley began meeting with archaeologists to discuss artifacts found on their property along the York River.

In 2002, archaeologists announced that evidence had confirmed the site's identity as Werowocomoco. The park service acquired the property from the Virginia couple for $7.1 million in 2016.

Now managed as part of the Captain John Smith Chesapeake National Historic Trail, the site remains closed to the public as the park service develops a management plan with its tribal partners: the Rappahannock, Upper Mattaponi, Mattaponi, Pamunkey, Nansemond, Chickahominy and Eastern Division Chickahominy.

"Werowocomoco" translates from the Virginia Algonquian language as "place of leadership." It turned out to be an apt description for Anderson, too.

"He's got an amazing work ethic. It's very refreshing," said Christine Lucero, a senior interpretation and partnership specialist with the park service. "I mentor a lot of youth, and he just stands out."

Anderson has been active in his community. He dances in a traveling American Indian troupe called Red Crooked Sky, which has performed at the John F. Kennedy Center for the Performing Arts and other venues across the region. And he has worked with his tribe on restoring oyster beds in the Nansemond River.

But he doesn't recall ever learning about Werowocomoco in school.

"We watched the *Pocahontas* movie in school, but that was it," he said, adding that the omission reinforces his desire to share its story as widely as possible. "We hope Werowocomoco can show people that we're more than just a Disney movie and history books. We're still here."

The internship program rotates young workers through several categories of park service tasks. They shadow employees, then take on many of the tasks themselves. Anderson rode alongside park service law enforcement officers on their rounds. He helped conduct water quality tests. He assisted archaeologists as they performed underwater surveys for artifacts.

For their capstone projects, Anderson and his fellow interns prepared presentations outlining their individual visions for the sacred land.

On one slide, he designed a Venn diagram with the word "Values" hovering inside a bubble at the center. Three bubbles overlapped its edges, each proposing its own priority. The typed letters read: "Education exchange for Virginia Natives and public," "Protect and conserve" and "Cultural and spiritual identity for Virginia Natives."

As Anderson sees it, Werowocomoco should foremost be a place where tribal members can practice their culture. But he sees room for other members of the public to enjoy its beauty and learn its history in a controlled setting.

"I don't want to keep it like nobody can come out there," Anderson said. "But given the importance of the site and how sacred it is, we don't want it to be exploited."

Anderson is now pursuing a bachelor's degree in environmental science through an online program at Southern New Hampshire University. He has returned to work full time as the lead intern at Werowocomoco. One of his favorite duties, he said, is offering guided tours of the site to Virginia tribal members who are experiencing it for the first time.

"They all fall in love with it," he said. Just like he has. ■

Scientists cast a wider net to study Bay's forage species

Small fish and other species have broad influence on ecosystem

By Whitney Pipkin

Left photo: A tray holds the remnants of some of the organisms found in the stomach contents of fish collected by the Chesapeake Bay Multispecies Monitoring and Assessment Program and the Northeast Area Monitoring and Assessment Program. (Will Parson/ Chesapeake Bay Program)

Right photo: Spawning herring, an important forage species in the Bay region ecosystem, travel a creek bottom in Caroline County, MD. (Dave Harp)

Aquatic forage species — the small fish, worms and other out-of-sight species that feed all the others — are the lifeblood of the Chesapeake Bay. So, to better assess the health of nation's largest estuary, scientists are getting better at measuring the pulse of these smaller species and explaining why they matter.

The call for increased study of forage species was made in the 2014 *Chesapeake Bay Watershed Agreement*. The Bay's buffet of these species was historically much larger and more diverse, and scientists are trying to understand how resilient this foundation of the food chain might be.

One of the biggest takeaways from their research is to think of forage species broadly and not just as small fish eaten by larger fish. Scientists understand that the food consumed by larger predators in the Bay is a group that goes well beyond small fish to include benthic invertebrates, worms, bivalves and crustaceans.

Each of these species helps to transfer energy, starting with the smallest plankton and detritus, up the food chain to larger and larger consumers. In the Bay, forage abundance indicates the health of shallow-water areas, which are the engine that keeps the rest of the ecosystem running.

"We've developed a lot of exciting science in a short time," said Bruce Vogt, ecosystem science manager for the National Oceanic and Atmospheric Administration's Chesapeake Bay Office. "What we're talking about now is tying that to questions [fisheries] managers have."

The work is steered by the Chesapeake Bay Multispecies Monitoring and Assessment Program. Their research, which started in 2002, not only measures the abundance of key species but also identifies the contents of their stomachs. Predators whose stomach contents have been detailed include striped bass, summer flounder, Atlantic croaker and white perch. That dissection provides helpful annual data about food the fish are eating.

Researchers were surprised to learn that Bay anchovies appeared to be a more important forage species than Atlantic menhaden. The anchovies, which measure 2–3 inches in length and live up to three years, are the most abundant fish in the Bay.

But anchovies haven't been as closely monitored as menhaden populations, which are regularly measured and managed as a commercial fishery. That's why we often hear more about them, Vogt said. Along with these species, juvenile fish also provide a rich source of food to larger predators. These include juvenile spot, weakfish, hake and river herring such as American shad.

Chris Moore, senior regional ecosystem scientist with the Chesapeake Bay Foundation, points out that even prime commercial species, such as blue crabs, can become forage, especially during their juvenile stages in Bay marshes. When pollution or habitat loss harms those species, he said, they impact everything up the food chain, too.

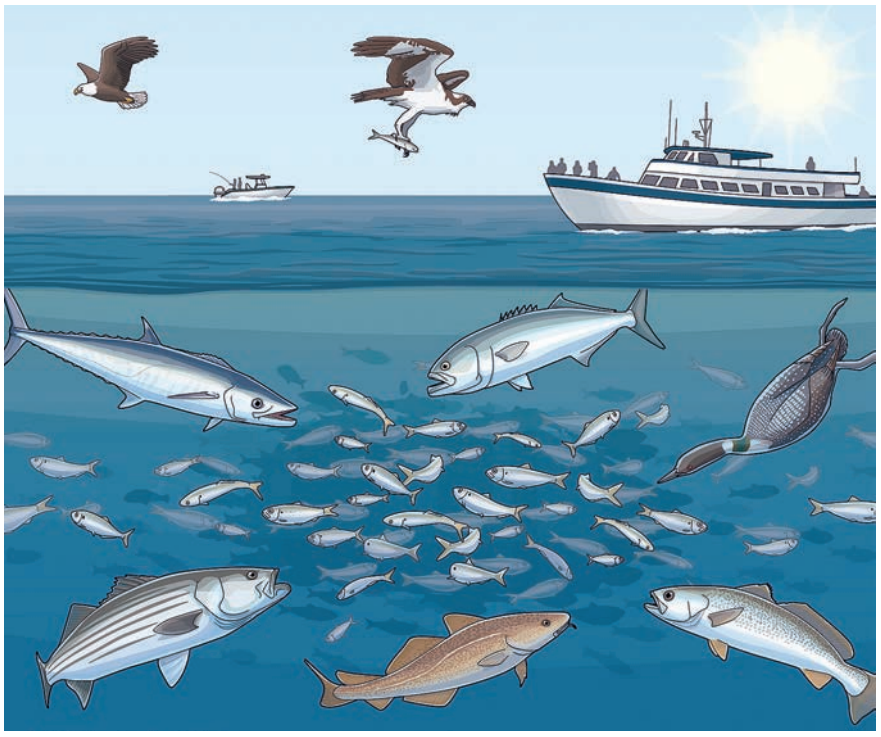
While the abundance of juveniles in many species waxes and wanes throughout the year, there are a few lesser-known foodstuffs that provide regular forage to predators in the Bay. Athough they may not travel in large schools, ready to be gobbled en masse by striped bass and others, they are still an important part of local diets.

Among those creatures are bristle worms, or polychaetes, a class of benthic organisms that can be as small as a few millimeters and are named for the hair-like bristles running down their sides. Mysids, another tiny benthic organism, are also a significant part of larger predators' diets, studies have shown. While not technically shrimp, these mysids are commonly called opossum shrimp because they look like their fellow crustaceans and carry their young in brood pouches like marsupials.

Zooming out

Given the variety in size and abundance of species that fill the bellies of Bay predators, researchers have broadened their work to understand the factors that might be impacting all of them. That has led scientists to focus on changes in overall forage abundance. Doing so also allows them to zoom out from the seasonal fluctuations of one species to look for trends impacting the whole.

Henry Legett, a researcher at the Smithsonian Environmental Research Center, pulls a temperature sensor and acoustic receiver from the Choptank River near Martinak State Park in Caroline County, MD. The data will help scientists learn about menhaden and river herring that spawn in the river's upper reaches. (Dave Harp)



Many types of larger fish in the Bay depend on a steady supply of forage species, like the menhaden shown here in the center, as part of their diet. (Pew Charitable Trusts)

This work also points to a shift in the scientific process: away from focusing on improving outcomes for one species at a time and toward a broader, ecosystem-based approach. Such an approach considers links between organisms — whether certain fish or humans are consuming more of a species than they used to, for example — and can more quickly identify trends that impact land and fisheries management decisions.

Joseph Gordon, project director of Conserving Marine Life at the Pew Charitable Trusts, said the relationship of Bay forage species to so many others — from ospreys in the summer to humpback whales off the coast — means it often makes sense to study them as a group.

"Although there are cycles for every species of growth and decline, there are also systemic problems [impacting] a healthy forage base," Gordon said. "It's increasingly important to maintain abundance and respond quickly to declines to maintain a strong foundation" for the entire system.

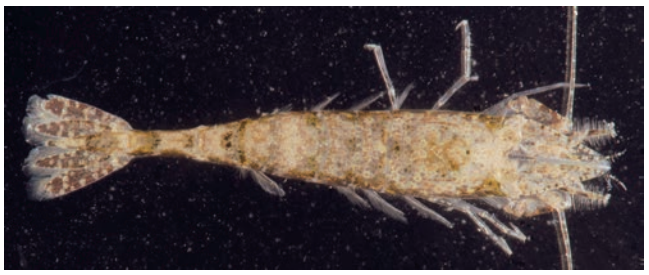
So far, scientists have identified a handful of factors that influence forage populations in general in the Chesapeake Bay. One study, for example, found that forage species are more abundant when the water warms more gradually from spring into summer.

"There's a relationship between the rate at which the water gets warm and the standing amount of forage during the summer," said Ryan Woodland, associate professor at the Chesapeake Biological Laboratory, part of the University of Maryland Center for Environmental Science. "[Summer] is a really productive time in the Chesapeake Bay, with lots of fish growing and adults feeding."

Scientists also found that the rate at which the waters warm has accelerated over the last half-century. Compared with temperature data that stretches back to the 1950s, Bay waters are reaching their summer warming point about two weeks earlier than they used to.

Woodland said that these shifts could affect the timing of natural processes for both forage species and their predators. For example, if larval fish appear when the water reaches a certain temperature but the blooming of their food — phytoplankton — is based on the availability of light, then the earlier arrival of warm temperatures could result in larval fish appearing weeks before their food supply.

"What's really important from a climate change perspective is if the timing of those events [stops] overlapping. Then you can really have a mismatch when they're starting to feed," Woodland said.



Sand shrimp (top) and razor clams are two of the Bay's important forage species. (Top photo by Robert Aguilar/Smithsonian Environmental Research Center; bottom photo by Budak/CC BY-NC-ND 2.0)

Impacting decisions

The team also looked at a growing body of research on living shorelines. In the process, they identified a threshold at which the amount of hardened shorelines strongly correlates with a reduction in forage species. Generally, once 10–30% of a shoreline is hardened with concrete or stone rip-rap, there is a related decrease in forage populations in nearby waters. For Bay anchovies, the threshold appears to be at the lowest end of that range.

"Knowing that threshold … can inform restoration and conservation priorities in the Bay," said Donna Marie Bilkovic, assistant director of the Center for Coastal Resources Management at Virginia Institute of Marine Science. Both Maryland and Virginia require landowners to implement living shoreline practices where they are suitable.

Bilkovic said that when a shoreline is hardened enough to impact forage species, the data show a decline in other resources, too — from benthic invertebrates and fish to marsh birds. Replacing marshy habitats with concrete ones, overall, "diminishes the production capacity of these shallow-water areas of the Bay," said scientist Ed Houde, professor emeritus at the Chesapeake Biological Laboratory.

Other recent research has focused on understanding exactly what conditions are needed for important forage species to thrive. To that end, a research team from VIMS set out to quantify and map suitable habitats for four common species of forage fish: Bay anchovy, juvenile spot, juvenile spotted hake and juvenile weakfish.

Using data from VIMS trawl fishery surveys between 2000 and 2016, the team created computer models to simulate environmental conditions at the sampling sites. Water depth, temperature, salinity, dissolved oxygen and current speeds were analyzed to see if they appear to have an outsized impact on the small species.

"It's kind of like going to see a physician. They don't just look at your heart rate. They look at your blood pressure, weight, height — they take a lot of indicators into account to say, 'OK, you're in good health,' " said Mary Fabrizio, chair of the department of fisheries science at VIMS, who worked on the study.

Overall, the factors that make a suitable habitat varied by species, but some common denominators became apparent. The effort helped to identify shoreline and tributary habitats that consistently provide good conditions for forage. These would be candidates for protection or restoration, Fabrizio said.

In the cases of Bay anchovy in winter and juvenile spot in summer, the study found that good habitat may depend largely on size — a minimum area required to produce a desired abundance of the fish. This sort of data form a baseline for helping fisheries managers evaluate conditions in a given year and understand what's impacting predator populations.

Mandy Bromilow, a fishery science expert at NOAA's Chesapeake Bay Office, is also looking for changes in the total amount of forage by reviewing long-term monitoring surveys.

The next steps for the forage research community will be communicating the latest science to decision-makers. Then, the effort will pivot to figuring out, more specifically, what some of the Bay's most ecologically and economically important fish species are eating.

"It's very likely that, if one key forage [species] isn't available, they are going to switch to another," Bromilow said. "The question is, at what point is [that] not enough to sustain them?" ■

DE county backpedals on protections for wetlands

Nontidal wetlands will be most vulnerable under new regulation

By Jeremy Cox

Under pressure from homebuilders, officials in Delaware's fastest-growing county have approved new regulations for construction near wetlands and streams that, in some crucial instances, will provide less protection than the county's previous 34-year-old code.

Evidence has been mounting for years that Sussex County's waters are becoming increasingly polluted with nitrogen and phosphorus, two nutrients that can trigger harmful algae blooms and lead to fish kills. In response, some officials in Delaware's southernmost county began to blame one of its most powerful interest groups: the building industry.

Sussex leaders turned their attention to the county's "buffer" ordinance. Enacted in 1988, the regulation dictates how closely new homes can be built next to streams and wetlands, but it is widely considered to be among the weakest rules of its kind in the Mid-Atlantic.

The changes approved by the County Council at its May 17 meeting expand the width of the buffer in most cases. But the changes also include weakening several of the protections recommended by the council's own expert panel.

"Our argument is the improvements could be even better," said Richard Borrasso of the Sussex Alliance for Responsible Growth.

The western half of the county drains westward into the Chesapeake Bay, via the headwaters of the Nanticoke River. The eastern half, where new subdivisions have been popping up at a faster rate, drains eastward into the Delaware River and the Atlantic Ocean, by way of the "inland bays" between Rehoboth and Bethany beaches.

According to the 2020 Census, the county's population has swollen by 20% since 2010, surpassing 237,000 residents. The major draws include proximity to ocean beaches, low taxes and a largely hands-off approach toward regulating new developments.

The previous buffer law rarely impeded developers' plans. From 2010 to 2017, Sussex County permitted the third-highest number of homes of any U.S. county with areas at high risk of future coastal flooding, according to a report compiled by Climate Central and Zillow. The county added 1,233 homes in the zone during that period.

Newly constructed "villas" in Laurel, DE, leave little room for a buffer between the buildings and Broad Creek, a tributary of the Nanticoke River. (Jeremy Cox)

After years of nearly unbridled new housing construction, the council appointed a panel of environmental advocates, land-policy experts and business representatives to draft a new buffer ordinance.

The result was a consensus document in which all sides gave ground to win other concessions, said Danielle Swallow, one of the panelists and the coastal hazards specialist with Delaware Sea Grant.

"There's a perspective that buffers reduce the density of development … because [they are] tying up land that could be developed," she said. "But the flip side of that coin is buffers actually protect property values and lives because they're providing a tremendous role in flood management and reducing pollutants going into waterways."

During the two years after the panel submitted its recommendations, county planners and council members suggested their own changes.

The new buffer rules are "a step in the right direction," Swallow said, but the protections still fall short of what neighboring counties and states have on the books.

An analysis conducted by the Delaware Center for the Inland Bays showed that the county's previous buffer policies were the most lenient in the region.

Most notably, Sussex enforced a 50-foot no-build zone next to tidal waters and wetlands. The buffer is 100 feet in Delaware's other two counties, 100–200 feet in Maryland and 300 feet in New Jersey, the nonprofit found.

The center urged county leaders to set the new width somewhere between 80 and 500 feet from tidal waters and wetlands. The newly adopted regulation falls just within that range, extending the development-free strip up to 100 feet, potentially doubling its width.

But there is wiggle room.

Under the measure, the closest 50 feet, designated as Zone A, must remain untouched. But in the outer 50 feet, designated as Zone B, developers have broad flexibility to expand or narrow the buffer's width. They can shrink the buffer in Zone B down to nothing as long as it's wider elsewhere, supplying the same amount of square footage as a constant 50-foot buffer would have.

In nontidal areas, developers have even more latitude to reduce buffer widths under the new code. The legislation lays out several alternatives. Under one scenario, a developer can reduce the total buffer next to a freshwater stream from 50 feet to just over 30 feet by creating a conservation easement — a legal vow not to build on the property — along the same waterway just outside the development's boundaries.

The ordinance gives developers so much negotiating power that they can build closer to certain freshwater streams than what even the previous regulations allowed. It sanctions development within as little as 25 feet from the water. The previous version enveloped those waterways in a nonnegotiable 50-foot shield.

"They claim that to be an enhancement, but it's essentially reducing a perennial stream buffer compared to what it is today," Borrasso said, adding that the wiggle room is about property value. "The only reason you'd be allowing any reduction in that buffer is to allow developers to build closer to the resource so they can charge more for the lots."

Borrasso argues that the county has no reason to offer the protection of off-site buffers as a bargaining chip. Those buffers would need to be protected anyway if the surrounding area were to be developed, he said.

At a County Council hearing in April, one elected official questioned the potential for loopholes in the nontidal stream language. "My impression was that in no case should buffers be less than 50 feet," said Councilman John Rieley, who also serves as a board member with the Sussex County Land Trust.

Hans Medlarz, the county's top engineer, attempted to downplay the loophole's significance, describing the type of waterway that would be affected by it as a "very rare animal" in the county. Many of Sussex's freshwater streams are bordered by wetlands, affording them additional protections. Others are constructed "tax ditches," publicly owned drainage systems whose margins are guarded by a maintenance right of way.

"It would truly affect a minimum number of [development] applications," Medlarz said.

As Borrasso sees it, tidal and nontidal wetlands are equally important ecologically and should receive equal protection from the county. But under the new regulation, tidal wetlands are eligible for a buffer measuring as much as 100 feet in width; their nontidal counterparts would only receive up to 30 feet.

Nearly three-quarters of the county's total wetland acreage are nontidal, so the vast majority of Sussex's wet areas stand to receive less protection.

Environmentalists also hoped the county would strengthen its definition of a buffer. The new language allows the space to consist of "natural forests" or "non-forest meadows." The meadow category can include "old field areas" potentially dotted with invasive trees and bushes. Environmental advocates say developers should be required to protect forests or, if forests aren't present in the buffers, to plant trees.

The new buffer rules are set to go into effect in November. ■

Pollution levels continue to increase in Appomattox River

Dam, forest loss could be adding to rise of nutrients, sediment

By Jeremy Cox

As the James Riverkeeper, it's Jamie Brunkow's job to know what's going on in his 10,000-square-mile watershed.

That includes the Appomattox River, a ribbon of water that flows into the James about 80 miles above its confluence with the Chesapeake Bay. But he admits that the latest update about its water quality from the U.S. Geologic Survey left him baffled and concerned.

The USGS reports annually on trends for nitrogen, phosphorus and sediment for nine major Chesapeake rivers. The agency's overall findings were unusually encouraging in 2021, showing improvement in the estuary's three largest rivers: the James, Potomac and Susquehanna. Declines were observed in several smaller tributaries, but the Appomattox was the only one backsliding on all three contaminants — as far back as 1985.

"I really don't know [why]," Brunkow said "[The numbers] stand out on the chart, for sure. It's a concerning trend when we see improvements elsewhere, and it needs more exploration to find out what's going on there."

Brunkhow isn't alone. No one seems to know what's behind the river's decline. But theories abound.

"We haven't come up with the answer on the Appomattox," said Doug Moyer, a USGS hydrologist based in Richmond. "We have a lot of hypotheses. Is it the reservoir? Is it upstream? Is it something else that isn't factored in? The answer is probably all of the above. It's all interconnected."

The only thing that's certain, Moyer added, is: "Change is afoot. Something is going on."

The Appomattox may be best known as the backdrop for Confederate Gen. Robert E. Lee's surrender to Union forces, marking the end of the Civil War. The nearly 160-mile river anchors much of the southern boundary of the Chesapeake watershed, but it tends to be viewed as a backwater by Bay researchers and activists, Moyer said.

"It's certainly the little brother to the big three — the Susquehanna, the Potomac and the James," he said.

Robert Wilson, executive director of the Appomattox River Water Authority, gives a boat tour of Lake Chesdin, the 3,100-acre reservoir on Virginia's Appomattox River that has been trapping sediment behind the Brasfield Dam for more than 50 years. (Jeremy Cox)

The science agrees. The Susquehanna, for example, is a much larger contributor of nutrients and sediment to the Bay, pumping about 150 million pounds of nitrogen into the estuary per year at the Conowingo Dam, according to the Chesapeake Bay Program, a multistate and federal partnership. The Appomattox, by contrast, only generates about 1.5 million pounds.

The Appomattox's smaller drainage area is part of the answer. So is the milder weather in southern Virginia, which leads to longer growing seasons and greater nutrient uptake by plants, Moyer said.

Around the Bay, restoration funding and public attention tend to gravitate toward the tributaries with the heftiest pollution loads. That makes sense when the goal is to get the biggest bang for the buck in cleaning up the Bay, Moyer said. But it can also create a class of have-nots, which tend to be smaller, mostly rural watersheds.

Like the Appomattox.

The USGS nutrient and sediment reporting system is one of the most closely watched indicators of the Bay watershed's health. The agency has collected data at each river's freshwater endpoint since at least 1985, but the data alone don't explain the causes of the trends.

"It's at the end of the pipe," Moyer said. "We don't know where the material came in."

But he has a strong suspicion. The USGS water-sampling station on the Appomattox lies a short distance downstream from Brasfield Dam. When completed in 1968, the wall of concrete flooded thousands of acres of farmland, transforming a 12-mile portion of the Appomattox from a narrow, free-flowing stream into a sluggish drinking water reservoir.

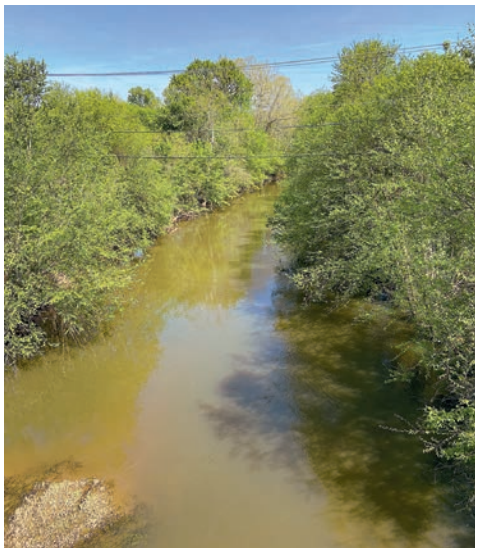
For the first few decades of its life, the impoundment acted like a giant pollution sponge, Moyer said. The decelerated flows above the dam — in what is now called Lake Chesdin — allowed nutrients and sediment to drift to the bottom instead of continuing their journey downstream to the James and the Chesapeake as they once had. That led to clearer, cleaner water below the dam at the USGS station.

But that is no longer the case. Moyer thinks it's because the lake is getting filled up with mud and is losing its capacity to trap pollutants.

The monitoring station's 37-year record of sediment data depicts a river in decline, he said. From 1985 to 1993, with the reservoir apparently in good form, the annual sediment total declined 20%, hitting an all-time low of 32.6 million pounds.

Since then, the downstream water has become muddier nearly every year. By 2018, more than 43 million pounds of sediment were gushing down the river, nearly 3 million more pounds than in 1985.

"All of a sudden, we're starting to see a greater release of sediment from the Appomattox," Moyer said.



A few dozen yards above Lake Chesdin, the Appomattox River appears largely as it did before the reservoir was created in 1968: narrow and winding. (Jeremy Cox)

The situation mirrors the Susquehanna River, he added. There, an impoundment above the Conowingo Dam shielded the Bay from a full onslaught of sediment and nutrients for decades until it lost nearly all of its pollution-trapping ability.

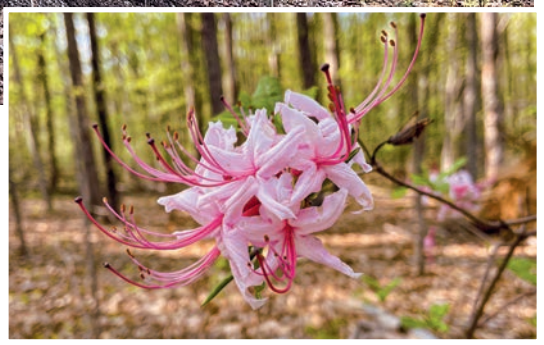
Lake Chesdin isn't quite there yet, said Robert Wilson, executive director of the Appomattox River Water Authority, which operates the reservoir. Since its creation more than 50 years ago, the lake has lost about 10% of its water-holding capacity from the sediment buildup on its bottom — not nearly fast enough to warrant concern, Wilson said.

But the land that surrounds the Appomattox is changing. Forests are being cut down to make way for subdivisions. An analysis of the watershed conducted by Mississippi State University researcher Kristina Delia shows that from 1992 to 2016, the watershed lost nearly 200 square miles of forested land and gained about 70 square miles of housing developments.

"It is clear that forested area went down in the 30-year study period, which would imply higher runoff of sediment into the river," Delia said.

Alecia Daves-Johnson, a founder of the advocacy group Friends of the Appomattox River, said she can tell something is wrong with the river just by looking at it.

"When we have rain events, the Appomattox just runs muddy and brown," she said. "And I think, 'Where is all this sediment coming from?'" ■



VA woodland preserves nature lover's final wish

By Jeremy Cox

In this era of exploding attendance at state and national parks, the concept of escaping to a place off the beaten path possesses fresh appeal. Exhibit A: the Scheier Natural Area.

This 100-acre preserve tucked into central Virginia's piedmont region is mainly frequented by a small but loyal following of hikers and bird enthusiasts.

The gently undulating terrain is ideal for a pleasant walk in the woods. Along its 3 miles of trails, visitors encounter mighty chestnut oaks, burbling streams and splashes of color from lady's slipper orchids and wild azaleas.

Here, solitude still rules. The closest significant civilization is a 40-minute drive northwest to Charlottesville.

Before we delve into this story, let's contend with its inherent conflict: As I publicize the bucolic virtues of Scheier to thousands of readers in print and online, could I be unleashing a stampede of human traffic? If so, wouldn't that undermine the peaceful vibe of this natural area?

Maybe.

So, let's make a deal. I'll tell you more about this semi-hidden gem, but you have to promise to go easy on it. It was just such a pact that made the preserve what it is today.

The wooded property is owned and managed by the Rivanna Conservation Alliance, a nonprofit environmental organization. The Charlottesville-based group is named for the river that flows 42 miles from its headwaters north of the city to the James River.

The Scheier Natural Area (pronounced "shy-er") lies about 8 miles west of the Rivanna River. But rain that falls on the preserve drains to the river through the middle and south forks of Cunningham Creek.

A kiosk near the preserve's gravel parking lot tells how the conservation society came to possess this oasis of isolation. Roger Black, one of the group's founders, met me at the site to help fill in the details.

Howard Scheier, the property's namesake, worked in a steel mill in his native Ohio. That is, until he suddenly quit and left for a new life. In 1949, he and his wife, Neva, packed all of their belongings into a Nash car and camper and spent the next several years traveling up and down the East Coast. They hunted and fished wherever they stopped as they searched for a permanent home.

The couple finally found what they were looking for on a 100-acre parcel in Fluvanna County, VA. They bought the property in 1953 for $519, or $5 per acre.

Howard Scheier earned a small income raising minnows and selling them as bait. In what the kiosk describes as a "considerable feat of engineering," he dug nine ponds along the southern edge of his land to serve as a hatchery. The gravity-controlled system enabled him to raise and lower water levels as needed.

He built a cottage across the road from the ponds. Adjacent to the home were dozens of acres of forested land where he fished, hunted and scavenged for mushrooms. He had his

Top photo: Roger Black admires a towering red oak growing in the Scheier Natural Area in Virginia's Fluvanna County. (Jeremy Cox)

Inset photo: A pink azalea adds a burst of color inside the 100-acre natural area. (Jeremy Cox)

routines and kept to them firmly, Black recalled.

"He was a pretty no-nonsense guy," said Black, who grew up a few miles from the Scheiers' homestead. Black worked as a forestry technician for the state Department of Forestry and now serves as head of Fluvanna's erosion and sediment control program.

Neva Scheier died in 1989 at the age of 84. The Scheiers had no children together. In his last years, Howard began contacting nonprofit organizations and universities about accepting his property as a donation after his death.

There would be strings attached, though. He wanted it to stay in its natural state and remain in the hands of its recipient.

Some groups indicated interest, vowing to place the property under a conservation easement that would bar further development. But they admitted that the parcel would be too remote to manage on their own and that they would probably sell the land to fortify their balance sheets.

The Rivanna Conservation Alliance alone agreed to Scheier's terms. Shortly after his death at 87 in 1997, the organization set up an easement on the land with the Virginia Outdoors Foundation. The preserve opened to the public officially in 2000.

Some people bequeath their properties to third parties for conservation purposes. There's nothing too unusual about that. But a stipulation in Scheier's will ensured that his eccentric, nature-loving spirit would live on through his donation: He decreed that trees there could only be cut down to control pests or if they had died and pose a threat to safety.

"His goal was to have a place that gave views of a forest that was not managed," Black said.

That means practices commonly used to manage forests' health, such as thinning and prescribed burns, would be prohibited. In his day, Scheier also practiced this hands-off approach. The only major deviation was the clear-cutting of a stand of loblolly pines in the mid-1990s to control a pine beetle infestation.

Today, Scheier's land looks and operates mostly as nature intended. Trees grow old, die and topple. Volunteers remove trunks and branches that impede hiking trails. Otherwise, the trees remain where they land. Decaying trees speckle the landscape.

Another consequence of Scheier's mandate is that tree saplings are allowed to shoot up into adulthood regardless of where they are located. In a managed forest, foresters remove young trees at regular intervals to ensure that the remaining ones have enough space to grow.

Despite this, the Scheier Natural Area retains a relatively uncluttered, parklike atmosphere beneath its canopy.

Amenities are few. Black and a couple other group members installed a compositing toilet at the edge of the forest and encased it in a wooden structure resembling an outhouse, complete with a half-moon cutout in the door.

Behind the cottage, the group is nearing completion on an educational pavilion, which has a roof but is open on three sides. Since 1998, a caretaker living on the property is responsible for maintaining the land, trails and house. Black served in that capacity from 2001–08.

The minnow ponds no longer function as a hatchery but are still full of life. The shallow, finger-shaped pits abound with frogs and turtles. In early spring, the chorus of amphibians can be downright deafening around dusk, Black said.

Howard Scheier was laid to rest in Ohio, but visitors would be forgiven for thinking that he never left his beloved acreage in Virginia. A pentagonal headstone squats next to the parking area. Near the apex, Howard and Neva Scheier peer out from an oval-shaped studio portrait. An inscription at the bottom informs visitors that they donated the surrounding property as a wildlife preserve.

"It was a generous thing to do," Black said. "He could have sold it and spent his final years fishing and hunting all over the place." ■

About Scheier Natural Area

The 100-acre nature preserve, with 3 miles of hiking trails through a pine and hardwood forest, is located at 917 Long Acre Road, Palmyra, VA. Admission is free.

Note that no dogs are permitted, except for service animals. Also no bikes, horses, camping or motorized vehicles.

For information, visit rivannariver.org.

Top left photo: Roger Black of the Rivanna Conservation Alliance takes a break from hiking at the Scheier Natural Area. (Jeremy Cox)

Top right photo: An outhouse contains a composting toilet at the Scheier Natural Area. (Jeremy Cox)

Bottom photo: A pink lady's slipper orchid shoots up among dried leaves. (Jeremy Cox)

Mallard ducks gather on a fallen tree in Miles Creek in Talbot County, MD. (Dave Harp)

Thank you! We won't duck our duty to cover the Bay

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A green frog surfaces in the iron-rich waters of Muddy Creek at the Smithsonian Environmental Research Center in Edgewater, MD. (Dave Harp)

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Agnes: 50 years later, still the biggest story I ever covered

By Tom Horton

I learned a lot from Tropical Storm Agnes, arguably the most impactful storm to hit the Chesapeake Bay in the several thousand years the current estuary has existed.

Not least among those lessons was the importance of timing. Agnes struck 50 years ago this June, before I had worked on the *Baltimore Sun* long enough to even get my name on the front page stories I wrote about the storm. I wasn't assigned them because of my reportorial skills; I had a big GMC pickup with enough clearance to traverse flooded roads.

Half a century later, of the thousands of articles and several books I've written about the Bay, the biggest story I ever handled is still the one that came just a couple of months into my career.

For the Bay, it was exquisitely bad timing, seasonally speaking. Agnes came when oysters were spawning, seagrasses were flowering, fish were hatching. Massive influxes of freshwater, extending for weeks well south of the Potomac River, were deadly to shellfish. Unprecedented volumes of sediment smothered great swaths of Bay bottom, wiping out thousands upon thousands of acres of underwater grasses.

"The storm broke all existing records, not by trivial percentages but by huge multipliers … all living things in the Bay were imperiled," wrote author James Michener in his 1978 bestselling novel, *Chesapeake*.

Chesapeake was, of course, fiction, and in the novel's timeline "the storm" was the Great Chesapeake Hurricane of 1886 — but as someone who reported on Agnes, it was clear to me where Michener got the basis for that chapter (*Voyage Eleven: 1886*).

Agnes on its way to the Bay seemed innocuous enough. Indeed, newspaper readers that fateful week may have been more intrigued by short stories about a burglary of Democratic campaign headquarters at the Watergate apartments.

Moving north from Yucatan, Agnes had been downgraded to a tropical storm by the time it hit Florida's panhandle June 19. Its winds would never top 45 mph.

But the rain, oh my. Beginning on the afternoon of Wednesday, June 21, Agnes would thoroughly soak Maryland and Virginia, move through Pennsylvania and then double back and stall, dropping enough water across most of the Bay's six-state watershed to raise the water level in the whole estuary by about 2 feet, had there been a dam at its mouth.

Agnes drowned more than a dozen motorists in Washington's Rock Creek Park and flooded 200 blocks of downtown Richmond. It blasted down Baltimore's Jones Falls with such sudden fury that it drowned three children as their mother was strapping them into car seats for an escape.

Hardest hit was Pennsylvania, where for a time, water roiling down the Susquehanna threatened to break through the Conowingo Dam, imperiling Port Deposit just downriver. The deluge did fracture one end of the mighty dam, which is anchored in bedrock and thick enough to carry U.S. Route 1 across the river. The road was closed for months while a quarter-inch gap was repaired.

My notes on the water gushing through Conowingo's floodgates describe it as "projectile vomiting," spewing virtually horizontally for many yards.

At Harpers Ferry, WV, where the Shenandoah River meets the Potomac, I ventured out over a railroad trestle where a loaded coal train had been parked to stabilize the crossing. I had to crawl, the whole affair was shaking so badly in standing waves where the two rivers collided. I estimated their height at 10 feet.

Another lesson was the power of "episodic" events. In a few days in June 1972, more polluting sediment washed into the Bay than it would normally receive in several decades. That included an estimated 20 million tons scoured from behind Conowingo Dam, where it had been collecting since the dam was built in 1928.

A post-Agnes view of Cartersville, VA, on the James River about 25 miles west of Richmond. The flood destroyed the Route 45 Cartersville Bridge, built in 1884, carrying away its four center spans. The two shoreside spans of the bridge still stand beside a new bridge and are preserved as historical sites. (Library of Virginia via Flickr Commons)

Just think. If you were a scientist studying how sediment entered the Bay for a whole, long career, everything you thought you knew would have been changed in the space of a weekend.

There is another lesson we should have learned but did not. Agnes' fury exquisitely exposed how much we had altered the watershed that it fell on: paving, developing, ditching, draining wetlands, doubling and tripling uses of fertilizers.

There is little doubt that the prehistoric Chesapeake saw storms the equal of Agnes or bigger. But that watershed had far more resilience. Its forests and wetlands and millions of beaver dams and ponds were able to retain and restrain the runoff, to let it soak in and filter through the groundwater. Also, oysters grew on massive reefs, closer to the surface, and were therefore less susceptible to smothering than today's flattened, dredged oyster beds.

Since Agnes, we have made a nod toward outfitting development with stormwater controls. But in the last decade, some 40 years after Agnes ran 12 feet deep down Main Street in Ellicott City, MD, two big rainfalls in the space of a few years inundated the town again.

Some scientists have noted that the Chesapeake ecosystem was never quite the same after Agnes. I think it was not Agnes so much as Agnes pulling the trigger.

After World War II, we had begun to seriously chip away at the Bay watershed's natural resilience. We added more and more potential pollutants to farmland, more and more septic tanks and sewage lagoons to suburban and urban lands.

But from the mid-1950s until Agnes, the Bay region was dry, with river inflows ranging from below normal to historic droughts. Agnes ushered in a decade that was wet, with rivers running high throughout the 1970s, even if you took Agnes out of the equation. Nature had covered our sins — until it didn't.

We will literally never see another Agnes. The National Weather Service has retired the name, along with the names of several dozen of our deadliest and costliest storms.

And on the bright side, all of that freshwater in 1972 depressed stinging sea nettle populations Baywide for years. ■

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.

Sustainable communities are key to environmental justice

By Jasmine Gore

Equal access to the decision-making process is a key element in environmental justice. Here, a group gathers for an empowerment forum in Newport News VA. (Darius Stanton/Chesapeake Bay Program/2017)

Environmental protection is a job for all of us. But local governments leaders are the secret weapon for strengthening the connections between residents, their communities and their environment to maintain sustainable practices over the long term and reach our local and common goals. Local elected officials especially have the opportunity to understand the complex environmental needs of their communities and voice those concerns.

The end result should be to create and maintain a resilient society that promotes ecological wellness and improved health for all, right? To achieve our common goals, we must have real and frank conversations about environmental justice.

The U.S. Environmental Protection Agency, defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies." The movement began during the Civil Rights era, when individuals fought against hazardous dumping sites that bordered their communities and caused numerous health concerns.

Similar documented cases of residents fighting for equitable support led to a first-of-its-kind toxic waste study by the United Church of Christ Commission on Racial Justice in 1987. The commission found that "over 15 million African Americans, 8 million Hispanics, and half of all Asian/Pacific Islanders and Native Americans resided in communities with at least one abandoned or uncontrolled toxic waste site." This study showed the disproportionate correlation between race and socioeconomic status and the placement of hazardous sites.

Unfortunately, these situations can be directly traced to redlining, a systemic practice of establishing neighborhood boundaries that limit or restrict access to certain amenities and services based on discriminatory social constructs. The concept originated during an era when color-coded maps of major cities informed lenders of mortgage risks in certain areas. Those neighborhoods were often "redlined" by lending institutions, which denied residents access to loans and other capital investments that could improve their housing and economic opportunities. The impact of environmental inequities on redlined communities still exists today.

Per the EPA, environmental justice is achieved when everyone has the same degree of protection from environmental and health hazards and equal access to the decision-making process that impacts the environment where they live.

It is important to remember that the goals of environmental justice do not pertain to low-income or racially marginalized communities only. It means equity among diverse societies and landscapes as well. For example, a bustling urban sector and an active coastal town do not experi2nence the same challenges. Factors associated with climate, population density, air quality, infrastructure and recreational access, to name a few, all vary by location and should not be generalized or dismissed out of hand.

Local elected officials must do their part to inform and engage their constituents on policies that help promote a sustainable society. More importantly, they have an obligation to translate how protecting the land we live on, the water we drink and the air we breathe are critical to the everyday lives of residents. We can do this by acknowledging our current needs, our goals and the truths related to environmental inequities.

So, what can local decision-makers do to begin challenging existing injustice in their communities? Sustainable neighborhoods are key. Here are some actions to consider.

Identify Smart Growth solutions. Smart Growth is a concept that prioritizes meaningful societal development by encouraging collaboration and "green" initiatives. It supports inclusive housing according to the culture of the community, safe walkable neighborhoods, incorporating green spaces and the analysis of innovative long-term development strategies.

Support efficiency measures within affordable housing. Many redlined communities lack high-efficiency appliances and amenities. It may sound costly, but the installation of energy-efficient devices within residential buildings and affordable housing can have many benefits. The EPA's *Energy Efficiency in Affordable Housing* guide for local governments analyzes the impact of energy-saving initiatives. It explains the benefits of energy efficiency, including, but not limited to, lowering housing costs for low-income communities and reducing greenhouse gas emissions to help meet environmental standards. Insufficient planning for residential neighborhoods, including both the misuse of energy-conscious external (windows, insulation, etc.) and interior materials (paint, indoor appliances, etc.), can lead to the overproduction of nearby industry, increased environmental and public health risks, and higher displacement of individuals or families.

Invest in green infrastructure. Focusing on infrastructure can provide long-term benefits to maintaining resilient communities. Streamside forest buffers or rain gardens help beautify the community while capturing polluted runoff and helping to combat climate problems. Green infrastructure may meet with reluctance for several reasons, though. Check out the EPA's guide to *Overcoming Barriers to Green Infrastructure*.

Consider workplace benefits. It's important to understand the return on investment received from establishing careers dedicated to the implementation and maintenance of green initiatives. Building a green workforce can stimulate the local economy, create opportunities for a diverse public and improve the value of sustainable practices on a consistent basis.

The impact of sustainable communities can be seen in increased life expectancies, a stronger local economy and the attainment of environmental goals — and that can affect a community for generations. So the next time you think about conservation, ponder the gaps between the communities you serve. Only together can we protect our local waterways, so let's encourage each other and get on the same page. Are you doing your part to fight for all through environmental justice? If not — talk about it. ■

Jasmine Gore is a councilmember in Hopewell, VA, and chair of the Local Government Advisory Committee to the Chesapeake Bay Executive Council.

MD must stop pretending that poultry waste is clean energy

By Lily Hawkins

Chickens take turns at an automatic water dispenser in a poultry house. (Dave Harp)

The climate crisis is intensifying. The most recent report out of the United Nations Intergovernmental Panel on Climate Change has outlined clear risks to people and the planet.

Critical ecosystems like the Chesapeake Bay, long an abused outlet for our region's pollution, will face even greater threats under a changing climate. While some take to the streets in protest to demand action, others are content to double down and profit from the crisis.

Cue the Delmarva poultry industry.

Debate about the poultry industry's polluting influence on our region is nothing new. Factory-farmed poultry in Maryland produces 400,000 tons of waste a year, according to research by my organization, Food and Water Watch, which has been sounding that alarm for years. There's no disputing that an unacceptable amount of nitrogen from that waste ends up in the Chesapeake Bay.

Agriculture is the leading source of nitrogen and phosphorus loads to the Bay, producing toxic algae blooms and dead zones. Simply put, the industrialized factory farming model encourages the production of utterly excessive amounts of waste — and much of it ends up in our water. This needs to stop.

Now, the factory farm industry is claiming it can solve its own waste problem. They have dressed it up with the term "renewable natural gas," but we prefer to call it what it is: factory farm biogas. And the truth is, it's all a ruse.

Poultry houses are lit by low rays of sun on the Bay's Eastern Shore. (Dave Harp)

Factory farm biogas is a false solution to the poultry industry's waste problem, and a false solution to the climate crisis. To create the gas, intermediary companies must concentrate massive amounts of poultry waste from factory farms and slaughterhouses into anaerobic digesters, where microbial processes, in the absence of oxygen, create methane from the waste. The company then refines the methane and transports it via truck to a pipeline.

This is not — repeat, not — "clean energy." Biogas produced from factory farm waste is chemically indistinguishable from fracked gas. Both emit potent greenhouse gases when burned, and both rely on fossil fuel infrastructure for distribution — from pipelines carved through forestland to "bomb trucks" on our highways.

But the Maryland poultry industry has friends in high places. Thanks to industry lobbying, Maryland's signature clean energy program, the Renewable Portfolio Standard, includes factory farm biogas as a "clean" energy source. And because ratepayer dollars earmarked in that program can finance projects in and out of state, that means Maryland utility customers would be funding a polluting waste-processing market that is propped up by a so-called clean energy program.

Two active proposals in Delaware are vying to become the country's first poultry biogas facilities; Maryland dollars could fund both of them. A proposal by Bioenergy DevCo to build an anaerobic digester near Seaford, DE, has the local community and more than 35 statewide groups in an uproar. The second proposed digester, from CleanBay Renewables, would be built in Georgetown, DE. The likelihood that these projects will lead to an expansion of pipeline capacity in that region has made clear the lines being drawn on biogas projects — it's people versus polluters.

A March poll from Goucher College revealed that a majority of Marylanders believe that climate change is having major impacts.

With 2022 an election year for the state's entire General Assembly, as well as the governor's office, candidates are actively debating how to move to a clean energy grid and do it quickly. But what they need to talk about more is what a clean energy grid actually looks like.

In 2020, more than a third of Maryland's "clean energy" dollars went to polluting energy sources, according to a report earlier this year by Public Employees for Environmental Responsibility.

Setting goals for 100% clean energy is critical, but it must be married with appropriate definitions of what counts as "clean." As the poultry industry vies for its share of public clean energy money, it is imperative that we close the definitional loopholes in Maryland's Renewable Portfolio Standard.

Biogas from poultry waste is not clean energy — let's stop acting like it is. Current elected officials and those running for office must commit to removing all polluting energy sources from the Renewable Portfolio Standard and cut the flow of Marylanders' public money to factory farm filth. ■

Lily Hawkins is the Maryland organizer with the national environmental advocacy group Food & Water Watch.

SHARE YOUR THOUGHTS

The *Bay Journal* welcomes comments on environmental issues in the Chesapeake Bay region.

Letters to the editor should be 300 words or less. Submit your letter online at bayjournal.com by following a link in the Opinion section, or use the contact information below.

Opinion columns are typically a maximum of 900 words and must be arranged in advance. Deadlines and space availability vary. Text may be edited for clarity or length. Contact T. F. Sayles at tsayles@bayjournal.com or 410-746-0519. You can also reach us at P.O. Box 300, Mayo, MD, 21106. Please include your phone number and/or email address.

CHESAPEAKE CHALLENGE

— Kathleen A. Gaskell

A

Making an elephant out of a mosquito

The headline above is a translation of how Germans express the idea of "making a mountain out of a molehill." The largest mosquito, the *Holorusia mikado*, though, has a wingspan of only a bit more than 4 inches, does not consume blood and is found in Asia. Here are some questions about mosquitos that are a little closer to home. Answers are on page 36.

1. Only the female mosquito needs to consume blood, and only while she is producing eggs. What do males and nonbreeding females eat?
   Nectar
   Phytoplankton
   Zooplankton
   Nothing

2. True or false? Mosquitos only prey on warm-blooded animals.

3. Which human blood type do mosquitos typically prefer?
   Type A Type B Type AB Type O

4. Yes or no? Do mosquitos sleep?

5. According to fossil records, how many millions of years have mosquitos been around?
   10 25 50 100

6. That high-pitched buzzy drone you hear when a mosquito is near is the sound of its beating wings. How many times can some species beat their wings per second?
   400 500 600 700

7. Which have fuzzier antennae, males or females?

8. The itch from a mosquito bite is our body's reaction to saliva injected by the insect. Why does scratching make it itch more?
   - It spreads the saliva to nearby skin cells.
   - It stimulates the body's immune response.
   - It makes the saliva more powerful.
   - It stops the body from healing.

9. What are mosquitos' roles in an ecosystem? More than one answer may apply.
   - Mosquitos and their larvae are food for dragonflies, fish, frogs, lizards, spiders and birds.
   - They pollinate flowers, including rare Arctic bog orchids.
   - The larvae eat (and thus recycle) microscopic organic matter in water.

B

Icon: Centers for Disease Control and Prevention

A: Asian tiger mosquito, Aedes albopictus (pexels.com)

B: The female common house mosquito consumes human blood, but she prefers the blood of doves and pigeons. (Alvesgaspar/CC BY-SA 3.0)

C: Female mosquitos have a long, thin proboscis, (mouthpiece) to inject their saliva and extract the host's blood. The saliva contains a lubricant to make it easier to insert the proboscis, as well as a numbing agent so the victim is unaware of what's going on and an anticoagulant to make the blood flow more readily. (Fernando da Rosa/CC BY-SA 4.0)

C

De-feasting mosquitos

Want to remove yourself from a mosquito's menu? Eliminate or reduce these foods in yours.

Boo-booze: A warm body makes a hot target for mosquitos, and alcohol increases body temperature. Beer drinkers, in particular, appear to be one of the pest's favorite cocktails. On the other hand, if a mosquito bites you, alcohol will do some good. Put it on the wound, though, not in your mouth.

Take the biter with the sweet? It was once thought that eating sugary food attracts mosquitos. Turns out, it's not the sugar. Mosquitos are attracted to the scent of lactic acid, and certain sweets increase the level of lactic acid emitted from our skin: frozen desserts, baked goods, jams, raisins, prunes, bananas.

Mosquito favorites: Foods containing large amounts of lactic acid — such as potatoes, cheese, lima beans, avocados, spinach, peas, tofu, sauerkraut and legumes — also make you tastier to mosquitos.

Snack attacks: Salt also raises your lactic acid level. Bye-bye bacon. Farewell french fries. Ciao chips. So long salami sticks.

Hold the cheese, please: Mosquitos go gaga over stinky feet. The bacteria that makes feet "fragrant" is also used to make limburger cheese! Keep it off the menu at your next outdoor gathering.

Chocolate mints, anyone? Good news at last! Mosquitos are drawn to the carbon dioxide we exhale. Some aromas throw off their scent detectors. These include mints and caramelized chocolate.

BULLETIN BOARD

VOLUNTEER OPPORTUNITIES

PENNSYLVANIA

Middle Susquehanna River
Get involved with the Middle Susquehanna Riverkeeper Association. Contact Riverkeeper John Zaktansky at 570-768-6300, midsusriver@gmail.com.
- *HERYN (Helping Engage our River's Youth with Nature):* Assist with youth outdoor activities.
- *Susquehanna Stewards:* Deliver programs, info to people in your region, help to develop new initiatives.
- *Water Reporter App:* Track fish health in the Middle Susquehanna watershed by sharing photos, info about catches via an app. Also upload pictures of river activities. Reports, interactive map available at middlesusquehannariverkeeper.org.

VIRGINIA

Reedville Fishermen's Museum
The Reedville Fishermen's Museum needs volunteers for docents and crew to operate the gift shop, boat shop, research collections/library. Info: rfmuseum.org, office@rfmuseum.org.

Cleanup support & supplies
The Prince William Soil & Water Conservation District in Manassas provides supplies, support for stream cleanups. Groups receive an Adopt-A-Stream sign recognizing their efforts. For info/to adopt a stream/get a proposed site: waterquality@pwswcd.org. Register for an event: trashnetwork.fergusonfoundation.org.

Goose Creek Association
The Goose Creek Association in Middleburg needs volunteers for stream monitoring & restoration, educational outreach & events, zoning & preservation, river cleanups. Projects, internships for high school, college students. Info: Holly Geary at 540-687-3073, info@goosecreek.org, goosecreek.org/volunteer.

Become a water quality monitor
Train online with the Izaak Walton League to volunteer or become a certified Save Our Streams water quality monitor. Follow up with field practicals, then adopt a site of your choice in Prince William County. Info: Rebecca Shoer at rshoer@iwla.org, 978-578-5238. Web search "water quality VA IWLA."
- *Stream Selfies:* Collect trash data, take photos of local stream.
- *Salt Watchers:* Test for excessive road salt in a stream.
- *Check the Chemistry:* Spend 30 minutes at a waterway with a handful of materials, downloadable instruction sheet.
- *Stream Critters:* Use app to identify stream inhabitants. Number, variety of creatures reveal the condition of a waterway.
- *Monitor Macros:* Become a certified Save Our Streams monitor with one day of training. Learn to identify aquatic macroinvertebrates, assess habitat, report findings, take action to improve water quality.

Chemical water monitoring teams
Help the Prince William Soil and Water Conservation District and VA Department of Environmental Quality by joining a chemical water quality monitoring team. Training provided. Monitoring sites are accessible. Info: waterquality@pwswcd.org, pwswcd.org.

Check out cleanup supplies
Hampton Public Libraries have cleanup kits that can be checked out year-round, then returned after a cleanup. Call your local library branch for details.

MARYLAND

Certify your pollinator garden
Gardeners whose yards are planted with native, pollinator-attracting species can apply for the Lower Shore Land Trust's Certified Pollinator Garden Program. Participants receive a sign for their yards. Web search "LSLT pollinator certify." Info for land owners interested in creating these landscapes: kculbertson@lowershorelandtrust.org.

Invasive Species Tool Kit
The Lower Shore Land Trust is offering a free, online Invasive Species Tool Kit to identify and remove weeds on your land. Residents can also report invasive clusters in their neighborhood, parks or on other public lands: lowershorelandtrust.org/resources.

Lower Shore Land Trust
The Lower Shore Land Trust works with individual landowners who wish to protect the natural heritage of their properties. Info: lowershorelandtrust.org/volunteer-sign-up.

Anita Leight Estuary Center
Remove invasive plants and install native species 9–11 a.m. June 12 at the Anita C. Leight Estuary Center in Abingdon. Volunteers, ages 14+, learn to ID problem plants, removal & restoration strategies. Wear sturdy shoes, long sleeves, work gloves. Weather permitting. Preregistration required: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

Severn River Association
Join the Severn River Association's 2022 water quality monitoring crew. Visit 51 stations from the river's mouth to its headwaters. Info: Jack Beckham at fieldinvestigator@severnriver.org.

Chesapeake Bay Maritime Museum
The Chesapeake Bay Maritime Museum in St. Michaels needs help with guided tours, programs, exhibitions & collections, as well as in its grounds & gardens, working shipyard and on-the-water & dockside with its Floating Fleet. Info: cbmm.org/support/volunteer.

Maryland State Parks
Search for volunteer opportunities in state parks at ec.samaritan.com/custom/1528. Click on "opportunity search" in volunteer menu on left side of page.

Patapsco Valley State Park
Volunteer opportunities include: daily operations, leading hikes & nature crafts, mounted patrols, trail maintenance, photographers, nature center docents, graphic designers, marketing specialists, artists, carpenters, plumbers, stone masons, seamstresses. Info: volunteerpatapsco.dnr@maryland.gov, 410-461-5005.

Delmarva Woodland Stewards
Delmarva Woodland Stewards is an outreach program by the Maryland Forest Service and U.S. Department of Agriculture's Forest Service to enhance forest & wildlife management practices, promote benefits of prescribed fire, pursue tree planting opportunities, highlight the need for low grade/biomass markets. For training, outreach to landowners and volunteers: Matthew Hurd at matthew.hurd@maryland.gov.

Annapolis Maritime Museum
The Annapolis Maritime Museum & Park needs volunteers. Info: Ryan Linthicum at museum@amaritime.org.

St. Mary's County museums
Join the St. Mary's County Museum Division Volunteer Team or Teen Volunteer Team.
- *Adults:* Assist with student/group tours, special events, museum store operations at St. Clement's Island Museum or Piney Point Lighthouse Museum & Historic Park. Work varies at each museum. Info: St. Clement's Island Museum, 301-769-2222. Piney Point Lighthouse Museum & Historic Park, 301-994-1471.
- *Students:* (11 & older) Work in the museum's collections management area on artifacts excavated in the county. Info: 301-769-2222.

National Wildlife Refuge at Patuxent
Volunteer in Wildlife Images Bookstore & Nature Shop with Friends of Patuxent Research Refuge, near Laurel, for a few hours a week or all day 10 a.m.–4 p.m. Saturdays; 11 a.m.–4 p.m. Wednesday–Friday. Help customers, run the register. Training provided. Info: Visit the shop in the National Wildlife Visitor Center and ask for Ann; email: wibookstore@friendsofpatuxent.org.

Ruth Swann Park
Help the Maryland Native Plant Society, Sierra Club and Chapman Forest Foundation remove invasive plants 10 a.m.–4 p.m. the second Saturday in May, June and July at Ruth Swann Memorial 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 Sierra Club Maryland Chapter office at 9 a.m.; return at 5 p.m. Carpool contact: 301-277-7111.

Submission Guidelines

SUBMISSIONS
Because of space limitations, the ***Bay Journal*** is not always able to print every submission. Priority goes to events or programs that most closely relate to the environmental health and resources of the Bay region.

DEADLINES
The ***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 issue. Deadlines are posted at least two months in advance.
July/August issue: June 11
September issue: July 11

FORMAT
Submissions to ***Bulletin Board*** must be sent as a Word or Pages document or as text in an e-mail. Other formats, including pdfs, Mailchimp or Constant Contact, ***will only be considered if space allows*** and type can be easily extracted.

CONTENT
You must include the title, time, date and place of the event or program, and a phone number (with area code) or e-mail address of a contact person. State if the program is free or has a fee; has an age requirement or other restrictions; or has a registration deadline or welcomes drop-ins.

CONTACT
Email your submission to kgaskell@bayjournal.com. Items sent to other addresses are not always forwarded before the deadline.

Answers to CHESAPEAKE CHALLENGE on page 35
1. Nectar. Females that hibernate in winter must eat enough sugar to sustain them until they eat again in spring.
2. False. Some feed only on reptiles or amphibians.
3. Type O
4. Yes, most during the day.
5. 100
6. 500
7. Males. It helps them locate female wingbeats during breeding season.
8. It stimulates the body's immune system.
9. All are true.

BULLETIN BOARD

Chesapeake Bay Environmental Center
Volunteer at the Chesapeake Bay Environmental Center in Grasonville a few times a month or more frequently. Help with educational programs; guide kayak trips, hikes; staff the front desk; maintain trails, landscapes, pollinator garden; feed or handle captive birds of prey; maintain birds' living quarters; monitor wood duck boxes; join wildlife initiatives. Or, participate in fundraising, website development, writing for newsletters & events, developing photo archives, supporting office staff. Volunteering more than 100 hours of service per year earns a free one-year family membership to CBEC. Info: volunteercoordinator@bayrestoration.org.

Chesapeake Biological Laboratory
Chesapeake Biological Laboratory's Visitor Center on Solomons Island needs volunteers, ages 16 & older, who can commit to at least two, 3– to 4-hour shifts each month in spring, summer, fall. Training required. Info: brzezins@umces.edu.

Citizen science: angler surveys
The Volunteer Angler Survey smartphone app helps the Department of Natural Resources collect species, location, size data used in developing management strategies. Surveys: artificial reef initiative, blue crab, freshwater fisheries, muskie, shad, striped bass. Win quarterly prizes. Info: dnr.maryland.gov/Fisheries/Pages/survey/index.aspx.

EVENTS / PROGRAMS

PENNSYLVANIA

Susquehanna floating classroom
The Middle Susquehanna Riverkeeper Association is offering Floating Classroom sessions aboard the *Hiawatha* paddleboat in Williamsport. All classes run 10–11 a.m. Info: click here.

- *Aquatic Mammals:* June 28: Bert Myers, of the Department of Environmental Protection, will discuss common aquatic mammals: otter, mink, muskrat; offer closer look at beavers, how they can impact an aquatic ecosystem.
- *Mining Heritage & Abandoned Mine Drainage:* July 12. Former coal miner Van Wagner's interpretive program relates the human story behind coal. Bobby Hughes, of the Eastern PA Coalition of Abandoned Mine Reclamation, will discuss current issues related to abandoned mine drainage.
- *Microplastics & Fish Anatomy*: July 19. Kim Dagen, of the Susquehanna River Basin Commission, will share an overview on plastics found in the river, sampling equipment used, hands-on experiments that demonstrate issues related to microplastics in our waterways. Vicki Blazer, of the U.S. Geological Survey, will discuss general fish anatomy via a dissection demonstration.

VIRGINIA

Junior Ranger Angler
Child will learn the basics of fishing, from responsible fishing habits to using a fishing pole 10 a.m.–2 p.m. July 16 at the Watermen's Museum in Yorktown. The free program also includes the history of fishing in the Chesapeake, fishing-inspired craft. Those who complete the activities receive a Junior Ranger Angler badge. Equipment provided; participants should dress for weather, wear sunblock. No registration. Info: Remi Shaull-Thompson at 757-856-1220.

MARYLAND

Tour Horn Point Lab
The University of Maryland Center for Environmental Science Horn Point Lab in Cambridge is offering 90-minute campus tours at 10 a.m. every other Tuesday through Labor Day. Walkers, ages 10+, learn about physical oceanography, eDNA, water quality, coastal resilience, oysters. Info: 410-221-8383, hpltours@umces.edu.

MD Park Quest: pollinators
The theme of Maryland Park Service's Park Quest 2022 is Parks for Pollinators. Quest participants will learn about these creatures and their habitats while visiting state parks and completing activities (many self-guided) before Oct. 31. Those who complete 12 or more quests are eligible for a prize drawing (stickers, magnets, bandanas, an Annual State Park & Trail Passport). While the quest itself is free, events and park day-use fees may apply. No preregistration. To print a free copy of the Park Quest 2022 Passport Booklet, web search "DNR park quest 2022." Details, including bonus events and monthly trivia questions for prizes, are found in the online Park Quest newsletter (chesapeakefamily.com/enewsletter-sign-up). Info: Melissa Boyle Acuti at melissa.boyle@maryland.gov.

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

- *Dove Tales:* Through December. Exhibit explores the history, construction, cultural significance of the *Maryland Dove*. Included with general admission. No registration. Info: cbmm.org.
- *Skipton Creek & Triple Creek Winery:* 9 a.m.–2 p.m. July 16. Adult paddle (intermediate skills), wine tasting. Bring sunscreen, water, snacks. $55/bring your kayak/PFD; $75 rent kayak/PFD from CBMM. Registration required: bit.ly/PaddlePrograms.
- *New to Paddling Workshop:* 9 a.m.–1 p.m. July 12. Age 16 & younger w/adult. On-the-water session focuses on basics: pre-paddling prep, equipment overview, self-rescue. $55/bring your kayak/PFD; $75 rent kayak/PFD from CBMM. Registration required.
- *Virtual Boater Safety Course:* 3-session course meets 5–8 p.m. July 19–21. Individuals & families (ages 10 & older) DNR course teaches basics needed to safely operate a vessel on state waterways. Anyone born after July 1, 1972, is required to have a Certificate of Boating Safety Education. Participants must attend all sessions and pass DNR exam to earn a certificate that is good for life. $25. Registration required. To register, go to bit.ly/BoaterSafetyCourses.
- *Built on the Chesapeake - 34th Antique & Classic Boat Festival & the Arts at Navy Point:* 10 a.m.–5 p.m. June 17, 18 & 10 a.m.–3 p.m. June 19 (limited displays). Craft include wooden & fiberglass classics, vintage racers, Chesapeake Bay-related boats. The event also includes juried fine artists, craftspeople, vendors selling nautical and maritime-themed items for boat, home. Admission (good for 2 days): $18/adults; $15/ages 65+, college students with ID; $14/retired military with ID; $6/active military with ID, ages 6–17; free/ages 5 & younger. Info: cbmm.org/antiqueandclassic, chesapeakebayacbs.org.

Wilma Lee skipjack cruises
The Annapolis Maritime Museum & Park invites the public to take a cruise on its historic skipjack *Wilma Lee* through October. Tickets, to be released in two-week increments, are available online or at the museum's front desk 10 a.m.–3 p.m. Tuesday–Sunday. $45/adults; $20/ages 12 & younger. Details about each cruise are found on the ticketing site: web search "wilma lee cruises."

Youth fishing rodeos
Youths, ages 3–15, are invited to take part in the Department of Natural Resources' Youth Fishing Rodeo Program. All events are free, but require registration (see info for each site). Most events provide bait or fishing gear and have volunteers on hand to help the kids learn to fish. Attendees should web search "MD DNR youth fishing rodeo" for any cancellations or rescheduling.

- *Frederick County:* 10 a.m. June 18. Burkittsville Town Pond. Info Sam Brown at 301-606-5479.
- *Garrett County:* 10 a.m. June 18. Glades. Info: Katie Lucas at 301-616-6776.
- *Montgomery County:* 9 a.m. June 18. DeSimon Pond. Info: Amy Potocko at 240-243-2303.
- *Washington County:* 9 a.m. June 18. Brownsville Pond. Info: Steve Kidwell at 240-344-0585.
- *Washington County:* 9 a.m. June 18. Pangborn. Bill Beard at 301-745-6444.
- *Worcester County:* 9 a.m. June 18 & July 17. South Pond. Info: Lee Phillips at 410-208-1575.

Pollinator garden tour
Take a self-guided tour of pollinator-friendly gardens across the lower Eastern Shore. 8 a.m.–4 p.m. June 24 & 25. Visit gardens landscaped with native plants, watch artists painting "en plein air." $25/in advance; $30/day of event. Web search "LSLT 2nd annual garden tour."

Eden Mill Nature Center
Here are upcoming programs at Eden Mill Nature Center in Pylesville. All require preregistration: edenmill.org, edenmillnaturecenter@gmail.com.

- *Wee Wonders:* 10–11:30 a.m. July 5–8. Ages 2–5 w/adult. Nature games & activities, story, craft, hike. $78.
- *Midsummer Camp:* 9 a.m.–3 p.m. July 11–15. Ages 6–11. Meet animals, explore trails & wetlands, play games, make crafts, learn to paddle a canoe. $175.

Anita C. Leight Estuary Center
Take part in any of these programs at the Anita C. Leight Estuary Center in Abingdon. Ages 12 & younger must be accompanied by an adult. Meet at the center. Payment due at time of registration. Info: 410-612-1688, 410-879-2000 x1688, otterpointcreek.org.

- *Nature Discovery Tots:* 10:30 a.m. June 11. Ages 0–6. Explore the Nature Discovery Area with a naturalist. Free.
- *Shoreline Bingo Hike:* 2–3 p.m. June 11. Ages 5+ Use provided bingo sheet to discover center's nature. Small prizes for those who get bingo. $10/family.
- *Fantastic Frogs:* 1–2 p.m. June 12. Ages 7+ Use dip nets explore ponds, puddles. $10/family.
- *Kayak Cruising on the Creek:* 10 a.m.–12:30 p.m. June 17. Adults. Explore Otter Point Creek, upper Bush River. $12/person.
- *Critter Dinner Time:* 10:30 a.m. June 18. All ages. Learn about turtles, fish, snakes while watching them eat. Free.
- *Father's Day Picnic at the Pier:* 12:30–2:30 p.m. June 19. All ages. Meet at Pontoon Pier. All ages. Marshmallows, campfire, games. $16/family.
- *Summer Solstice Celebration:* 10 a.m.–12 p.m. June 21. Ages 6+ Games, crafts, Search for creek critters using dip nets. Refreshments. $12/family.
- *Senses of Sharks:* 10 a.m.–12 p.m. June 23. Ages 6+ Learn about sharks' have six senses, survival adaptations. Craft, snack. $12/family.
- *Pond Explorations:* 10:30–11:30 a.m. June 25. Ages 5+ Use dip nets to observe amphibians and insects up close. $10/family.
- *Creek Exploration Canoe:* 8:30–11 a.m. June 26. Ages 8+ Search for wildlife. $15/person.
- *Meet a Critter:* 1 p.m. June 26. All ages. Live animal program. Free.
- *Around the World & Back Again:* Program meets 9 a.m.–3 p.m. June 27–July 1. Ages 5–7. Hikes, crafts, nature exploration compare animals, plants in other countries with those found here. $175/child.

Fishing report
The Department of Natural Resources' weekly Fishing Report includes fishing conditions across the state, species data, weather, techniques. Read it online or web search "MD DNR fishing report" to sign up for a weekly (Wednesday) email report.

Yard by yard, garden by garden, we can all help control runoff

By Jamie Alberti

Above: Jordan Gochenaur, DC green infrastructure projects coordinator for the Alliance for the Chesapeake Bay, leads a tour of a newly installed rain garden at St. Catherine Laboure Catholic Church in Wheaton, MD. (Photo by Adam Miller) Left: The same rain garden is seen here full of water after a rainstorm. (Photo by Jordan Gochenaur)

Summer is almost here and with it, some of our favorite weather. Rising temperatures drive us to the water, where we enjoy a range of outdoor activities, including watching thunderstorms! While afternoon storms are often accompanied by welcome cooler air, they also bring sudden downpours and large volumes of water that come too fast for the ground to soak up.

What happens to all that water? In many cases, gutters empty along driveways or across short stretches of lawn where the water eventually finds its way into the closest storm drain. Heavy rain can drop water so fast that it doesn't have time to soak into the ground before flowing into the nearest storm drain — or nearest creek.

Rainwater quickly flowing across the ground's surface, or along paths and roads, often carries sediment, nutrients from lawns and crops, soaps from car washing, waste from livestock and pets, oil and litter from streets, and many more contaminants. All of that ends up in the closest waterway, and eventually the Chesapeake Bay itself.

From the far-reaching headwaters of Pennsylvania and New York to the Chesapeake, stormwater is a major source of pollution affecting the entire watershed. However, it also offers residents of the watershed great opportunities to get involved and make a difference, starting in their own backyards.

Rain gardens are effective tools to reduce stormwater runoff. They come in all shapes and sizes, depending on the amount of water expected to enter them. A strategically placed rain garden acts as a bowl to temporarily collect and store stormwater runoff as it slowly drains into the underlying soil.

As with all plantings on your property, it's best to use species native to the Bay region. They not only provide habitat and food for native species as well as other ecosystem services, but typically require less maintenance than nonnatives. Because they are adapted to the climate and soil, they generally require little or no water, fertilizer or pesticides. They are also more likely to attract valuable native pollinators, from bees and birds to butterflies and beetles.

Native plants can also decrease the amount of lawn that must be mowed, saving time and, if gas-powered mowers and trimmers are involved, reducing air pollution. If you think your property may benefit by installing a rain garden, you may want to consult a professional, or at least consider these recommendations:

- Place the rain garden a minimum of 10 feet away from any building foundation or retaining wall. This will prevent water from finding its way into your basement or undermining retaining walls.
- Rain gardens should be placed in areas with a 2–10% slope to allow the adequate collection of water within the rain garden.
- Avoid placing a rain garden at the lowest point on the property. Allow an adequate area for water to overflow should it become full.
- Conduct a percolation test of the soil. Water needs to be able to infiltrate into the ground. If your soil is mostly clay, this location may not be suitable for a rain garden. Water should be absorbed into the ground within 24 hours of a rain event.
- In many cases, the top 18–24 inches of earth should be excavated and replaced with a bioretention soil mix — roughly 65% concrete sand, 20% topsoil, 15% compost/leaf mulch. It should be no more than 10% clay. Existing soil can be amended to the above specifications.
- The excavated earth should be used for the construction of the berm around the perimeter of the garden — which must be compact and level to provide an even overflow.
- If a downspout is piped to the rain garden, the pipe should have at least a 2% slope down and away from the house. Any pipe used more than 10 feet from the house foundation should be perforated. Ideally, the piping should be rigid to prevent it from being crushed or otherwise damaged.
- If the design incorporates a downspout extension, the extension pipe may be buried and should end at the upslope edge of the rain garden (instead of the bottom). If the downspout drains directly into the rain garden, there should be river rock or similar hard material at the outfall to prevent strong gushes of rainwater from washing away mulch and soil.
- Apply and maintain 2–3 inches of shredded hardwood mulch over the soil in your rain garden.
- Place water-tolerant plants toward the center of a rain garden. These plants will be inundated with rainwater for a period of time after a rain.

Small steps to diffuse and slow rainwater before it can enter a storm drain can have a significant impact on the water quality of local streams and rivers. Imagine the benefits if everyone redirected the water flow from just one of their downspouts. ■

Jamie Alberti is director of the Alliance for the Chesapeake Bay's Green Infrastructure Program.

Ovenbird: Little warbler with a big voice needs its space

By Mike Burke

The forest was cool and had the sweet smell of a recently fallen tree and the duff beneath our feet. In the dappled sunlight we could see midges swarming. Near and far, we heard birdsong. One of the delights of birding is opening our senses to soak in the natural world. This was a special place, and we were immediately enchanted.

A very loud and persistent *teacher-teacher-teacher* stood out among the avian tunes. The refrain was rapid-fire. Trusting my ears, we followed the sound. The bird obliged by repeating its song again and again. Carefully, we moved closer until I spied the singer on a low branch.

The ovenbird (*Seiurus aurocapilla*) is surprisingly small for having such a powerful voice. Its length is 4.3–5.5 inches, and it weighs up to an ounce. The bird spends most of its time on the forest floor looking for insects to eat. Here at the Patuxent Research Refuge, just outside Laurel, MD, it had found an ideal summer home.

The ovenbird's throat, breast and sides have bold black streaks that contrast sharply with the bright white undersides. The black-on-white pattern forms a chevron on this warbler's belly. On top, it is a uniform greenish brown from head to tail. A white eye-ring is distinctive, but the best field mark is a broad orange stripe, bordered by jet black stripes, on its head. The sexes look alike. It's a handsome warbler, but its good looks have a hard time competing with the male's voice.

This bird's song is incredibly fast. It repeats the "teacher" phrase as many as six times per second. And males on breeding territory can sing constantly. This certainly helps in finding the bird, especially as it isn't easily flushed by humans. Just follow the sound and approach slowly.

Ovenbirds require large swaths of undisturbed forest. The Patuxent refuge offers 13,000 acres of mostly hardwood or mixed deciduous-coniferous tracts. The conditions are ideal for ovenbirds, with plenty of mature trees, a closed canopy and lots of dead leaves on the forest floor. Ovenbirds live deep in the woodlands, where they feed, raise their young and find places to sing, sing, sing.

Ovenbirds spend much of their time on the forest floor feeding on insects and beetles in the leaf litter, but they will also forage in the trees for insects. (Steven Kersting/CC BY-NC-ND 2.0)

These are neotropical migrants. Each spring they leave the tropics and move through most of the eastern United States, reaching Virginia in April. Quickly thereafter they spread across the Chesapeake Bay watershed. About one-third of the ovenbird population stops to nest in the northeast quadrant of the U.S., from North Carolina over to Missouri and north to the border. According to the Breeding Bird Survey, the remaining two-thirds breed in a huge band across the Canadian provinces, from the Atlantic Maritimes to the eastern edges of British Columbia.

The female ovenbird assumes almost all breeding duties. She starts by fashioning a canopied nest on the forest floor. The hidden entrance is tilted slightly downward. Inside, she makes a small, shallow nest, which she lines with deer or horsehair. The entire structure is meticulously woven over five days or so. The nest is nearly invisible from above, shielding chicks from overhead predators like hawks and crows. The finished home looks like an earthen oven (without a chimney). That resemblance inspired the bird's name.

Male and female ovenbirds look more or less alike — greenish-brown on top with a heavily streaked white breast and a black-lined orange stripe on the crown. (S. Maslowski/Courtesy of U.S. Fish & Wildlife Service)

She lays three to six eggs, typically four. Eggs require 12–14 days of incubation, all provided by the female. Hatchlings are born helpless but develop quickly. Seven days after hatching they begin to leave the nest, hopping and fluttering about. Both parents feed the young.

Ovenbirds eat what they find in the leaf litter: beetles, ants, fly larvae and the like. They can be flexible, too. An outbreak of insects feeding on leaves will send ovenbirds flying up to branches to feed. In cold weather, when insects are scarce, they will also eat berries.

The population of this warbler has held relatively steady for decades — a rarity in a world of dramatic declines in avian populations. A major threat looms, though. Forest fragmentation disrupts the territory that the birds need. Large stands of woodlands suddenly sliced up by roads or powerlines become noticeably less productive. Construction that carves out substantial stands of trees can have the same effect.

Development threats at Patuxent are constant. A proposed MAGLEV line would take up to 328 acres off a corner of the refuge. A widening of MD Route 197, a perennial threat, would rip through the heart of Patuxent (including several avian research facilities).

Meanwhile, there was a plan afoot last year to sell an unused 105-acre wooded parcel of the NASA Goddard Space Flight Center, which provides a buffer on the refuge's southwest boundary, to the highest bidder (most likely a developer). The plan has been blocked for now, but the threat still exists.

The ovenbird is not the only bird being threatened at Patuxent. The scarlet tanager, the unofficial mascot of the refuge, also breeds there. The same holds true for the brown creeper and other species that need plenty of undisturbed space to breed successfully.

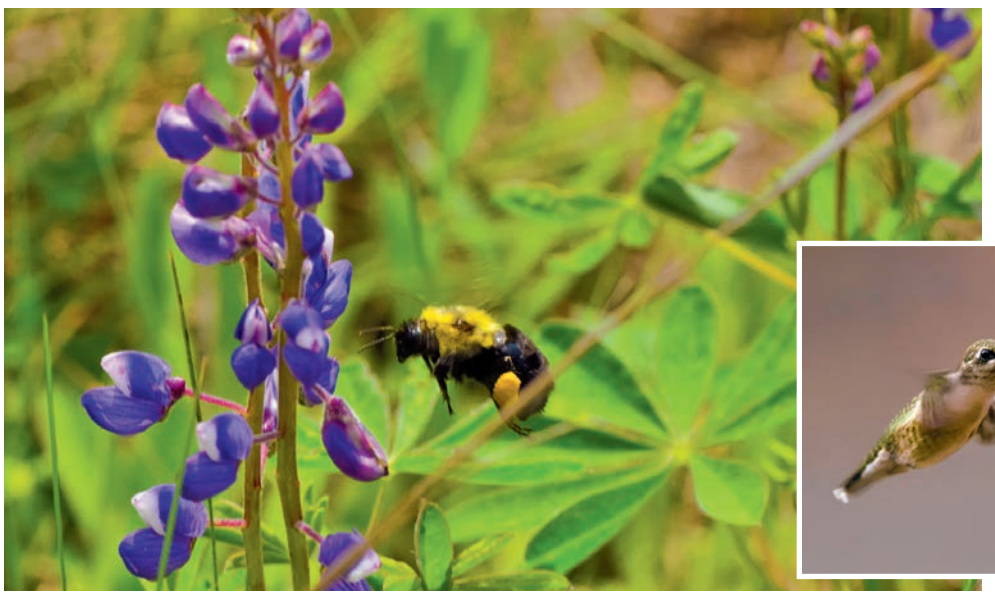
We need to put an end to such threats. We can start by permanently protecting our federal resource lands. States and localities should follow suit. In fact, we should be seeking opportunities to expand these irreplaceable forests, wetlands, prairies and waters. We have already lost too many.

President Biden has set a goal of providing such protection to 30% of U.S. land and waters by 2030. It is a worthy goal. And surely one the ovenbirds would loudly endorse. ■

Mike Burke, an amateur naturalist, lives in Mitchellville, MD.

Plant a native garden, then wait for pollinators to pop up

By Kathy Reshetiloff



Above: A black swallowtail (left), zebra swallowtail and two tiger swallowtails feed on the summer blossoms of a butterfly milkweed bush. (Kathy Reshetiloff/USFWS). Left: A bee visits wild lupine in the spring. (Joshua Mayer/CC BY-SA 2.0) Below: A hummingbird hovers at a cardinal flower, which blooms in the fall. (Rodger Evans/CC BY-ND 2.0)

As with many children, my first interaction with wildlife was watching pollinators — butterflies, bees, moths, beetles and other insects — as they flitted from flower to flower. Brightly colored swallowtail butterflies and furiously buzzing bumblebees were some of my favorites.

But these insects are not just beautiful to watch. As they move from flower to flower, drinking nectar or eating pollen, they also collect pollen on their bodies, then transfer it from male flowers to female flowers in the case of single-sex or "imperfect" flowers (which most are), or from the male part to the female part in "perfect" flowers, which have the reproductive structures of both sexes. This act of moving pollen, or pollination, allows plants to create seeds and reproduce.

About 80% of all plants, including many of those we eat, require pollinators to reproduce; the remaining 20% are pollinated by wind and water. But it's not just insects that do this important work. Some species of birds, bats and even small mammals are pollinators.

Pollinators service more than 180,000 plant species and more than 1,200 crops. One out of every three bites of food you eat is there because of pollinators.

Many pollinators are declining due to loss of feeding and nesting habitat. Pollution, misuse of chemicals, disease and changes in climate also contribute to shrinking pollinator populations. According to the Pollinator Partnership, there are at least 41 pollinators federally listed as either endangered or threatened — one fly species, three bats, five birds, eight bees and two dozen butterflies or moths.

What can you do? It's pretty straightforward: Create a garden with native flowering plants that supply pollinators with nectar, pollen and homes. And the emphasis there should be on *native plants*, which are the foundation of healthy ecosystems, providing food and habitat for native wildlife that depend on them.

A pollinator garden doesn't have to be large to be worthwhile; several square feet of native pollinator plants will attract butterflies, bees and other beneficial insects. And it can go just about anywhere — in a suburban yard, pasture or open field, schoolyard or commercial property. Even small city lots are opportunities to plant pollinator gardens.

The best garden in these terms is one that provides pollinators with a variety of food sources throughout the growing season. Here are a few excellent choices of native species — broken into prime flowering seasons so you can support pollinators in the Chesapeake Bay watershed throughout the year. Due to the growing popularity of pollinator gardens, many of these species can now be found at local nurseries.

Spring: eastern red columbine (*Aquilegia canadensis*), wild geranium (*Geranium maculatum*), foxglove beardtongue (*Penstemon digitalis*), squirrel corn (*Dicentra canadensis*), wild lupine (*Lupinus perennis*) and golden ragwort, (*Packera aurea*).

Summer: common milkweed (*Asclepias syriaca*), beebalm (*Monarda fistulosa*), joe-pye weed (*Eutrochium fistulosum*), butterfly milkweed (*Asclepias tuberosa*), woodland sunflower (*Helianthus divaricatus*) and narrowleaf mountain mint (*Pycnanthemum tenuifolium*).

Fall: white wood aster (*Eurybia divaricata*), gray goldenrod (*Solidago nemoralis*), New England aster (*Symphyotrichum novae-angliae*), cardinal flower (*Lobelia cardinalis*), wrinkleleaf goldenrod (*Solidago rugosa*) and white turtlehead (*Chelone glabra*).

This is just a sampling of plants native to the Northeast that support pollinators. The Pollinator Partnership has more detailed native plant guides for all U.S regions. Go to pollinatorpartnership.org and under "Resources" choose "Planting Guides." Depending on where you live in the Bay watershed, you'll want to download one of these guides: *Outer Coastal Plain Mixed Province, Southeastern Mixed Forest* or *Eastern Broadleaf Forest (Oceanic)*. Page 7 of each of those guides has a U.S. map showing the region's boundaries. The guides also have information on where you can purchase plants native to your state. ■

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