Last stand for eelgrass?

Poor water quality, climate change are causing one of the Bay's most critical habitats to vanish

By Karl Blankenship

It was a bad sign last spring when Bob Orth answered the phone and the words spilled out from the other end. "Where did all the grass go?" The fisherman on the line had for years been catching speckled trout in the large bed of eelgrass at Dameron Marsh near the mouth of the Potomac River.

Now, the caller said, it was gone.

Orth, a seagrass researcher at the Virginia Institute of Marine Science, and several colleagues shortly thereafter visited the marsh, a site where they had previously found lush beds of the underwater grass. Now, they found mud.

"I was shocked," Orth said. "We didn't find hardly any eelgrass at alI. It was a disaster."

Dameron Marsh isn't alone. VIMS scientists estimate that two-fifths or more of all eelgrass beds in the Lower Chesapeake Bay vanished the last two years. Lost with them are swaths of crucial habitat for blue crabs, speckled trout, waterfowl and a host of other species. "This is the sad state of affairs for eelgrass in most of the Bay now," Orth said.

It is an acceleration of a slow-moving ecological crisis that has taken place over the last quarter century, triggered by persistent poor water quality and, increasingly, by climate change as eelgrass does not tolerate the Bay's warming waters.

Beds of eelgrass once formed vast meadows in high-salinity parts of the Bay. It was so abundant in the early 1900s that people used it to insulate their homes and fertilize fields. As recently as the 1960s, its range reached north almost to the Bay Bridge. Today, it barely stretches into Maryland.

As a warming climate continues to bake eelgrass beds, scientists say it's less a question of whether eelgrass will mostly vanish from the Bay, but how long it will take.

For the Lower Chesapeake, the implications are huge. The Bay is home to about two dozen species of underwater grasses, but most live in fresh or brackish water. Eelgrass has historically been the dominant species in high-salinity water of the Lower Bay. The only other species that will tolerate high-salinity water can occupy only some of the areas where eelgrass meadows once existed, and it does not perform all of the same functions.

As eelgrass declines, more areas of the Lower Bay will increasingly look like Dameron Marsh.

"In a world that is getting warmer and wetter, it's kind of hard to summon up a lot of optimism for eelgrass," said Jonathan Lefcheck, a research scientist with the Smithsonian Environmental Research Center in Maryland. "If I were a betting man, I'm not sure I would bet heavily on the future of eelgrass here."

Lots of value

The Bay is home to more than 3,500 species of plants and animals. So why is the loss of one so important? "Well, eelgrass connects a whole bunch of things," said Rich Batiuk, the former associate director for science at the U.S. Environmental Protection Agency Chesapeake Bay Program Office. "Once you pull that thread out, that quilt unravels around you…The reverberations from an economic, recreational or ecological perspective are profound."

Lush meadows of eelgrass provide critical habitat. When juvenile blue crabs enter the Bay from the ocean each spring, they take refuge in eelgrass beds, the only ones available near the Bay's mouth at that time. They're a haven for a host of invertebrates that fuel the aquatic food chain. Speckled trout and silver perch spend much of their lives in eelgrass beds, eating those invertebrates. Snails and shrimp hang out in them. Meanwhile, striped bass forage for all of the above. The beds attract seahorses and turtles. Even Chessie, the wandering manatee that visited the Bay in the late 1990s, spent much of her time amidst eelgrass.

Unlike many underwater grasses that die back during the winter, eelgrass provides shelter nearly year-round. That also makes it an important food source for wintering waterfowl.

Photo: Eelgrass has historically been the dominant underwater grass species in high-salinity waters of the Lower Bay. (Dave Harp)

There's more: Their dense meadows and deep root systems keep sediment from being churned up. Their thick beds buffer shorelines from erosion. And, like other underwater grass beds, eelgrass beds play an increasingly important role in a warming world. They help to store huge amounts of carbon. An acre of underwater grass can sequester more carbon from the atmosphere than an acre of temperate forest.

All of that adds up. In a 2017 paper, researchers estimated the economic impact from lost Bay productivity, carbon capture and other services after a smaller eelgrass die-off in 2005 at $2.54 billion.

"We're talking about potentially billions of dollars for an economy that has historically been rooted in coastal fisheries," said Lefcheck, the lead author of the paper. "I mean, that's the history of Chesapeake Bay. It is a real problem."

No one has to guess at what happens when an area loses its eelgrass. On the Atlantic side of the Delmarva Peninsula, disease and hurricanes eradicated eelgrass in the coastal lagoons in the 1930s.

Gone with the eelgrass, lamented sportsman Eugene V. Connett in 1947, was "wildfowl, the cream of salt-water fishing, most of the clams and crabs, and all of the bay scallops."

A tough move

All plants have their roots in the ocean. Around 450 million years ago, green algae moved onto the land, eventually leading to today's forests, marshes and meadows.

Underwater grasses are not plants that stayed in the ocean. Rather, they are the descendants of land plants that recolonized the water 100 million years ago.

It was a tough move. The oxygen-starved sediment in water is deadly to plants, so the grasses modified their environment by becoming living pumps that move oxygen into the soil. That takes a lot of energy and means that underwater plants need more sunlight than those on the land. Their survival hinges on clear water.

That's difficult in the Chesapeake. Sediment running off the land clouds the water. Excess nutrients spur growth of algae blooms as well as tiny plants, called epiphytes, that grow directly on the leaves of the grasses.

That was clearly taking a toll on the Bay's underwater vegetation by the 1970s, but there was debate as to whether it mattered. One person who recognized the problem was Maryland Sen. Mac Mathias, an avid goose hunter. One winter he was sitting in a blind, but there were no geese. "What's going on?" he asked his guide, who replied, "the seaweed's all died." (The guide made a common mistake. Underwater grasses are not seaweed, which are a form of macro algae.)

Mathias secured funding for the U.S. Environmental Protection Agency to study the Bay's health. It flagged the loss of underwater grasses as one of the main problems. When the state-federal Bay Program was formed in 1983, clearing the water and restoring grass beds became a major goal.

It had a long way to go. Some believe the Bay may once have been blanketed by hundreds of thousands of acres of underwater grasses. By 1984, when an annual aerial survey of grass beds began, it counted only about 39,000 acres.

Scientist Bob Orth, with the Virginia Institute of Marine Science, examines an eelgrass bed in 2006, a year after they suffered the first heat-related die-off. (Dave Harp)

At that time, eelgrass accounted for nearly half of the area covered by underwater grasses in the Bay. By 1993, eelgrass was making a comeback, reaching 31,000 acres, according to estimates by VIMS scientists. That level was never seen again.

Feeling the heat

After the mid-1990s, even as other underwater grasses were on the rise, eelgrass began a slow but steady decline, as did water clarity in high-salinity areas of the Bay.

Then came 2005, and a new threat. It was an unusually hot year and, late that summer, Virginia scientists noticed that huge beds of eelgrass were dying.

It was the heat. Eelgrass prefers cool temperatures, and the Chesapeake is near the southern edge of its range. Eelgrass already needs more sunlight than most underwater grasses in the Bay, but warmer water requires it to pump even more oxygen, which means it needs more sunlight.

It suddenly became obvious that eelgrass wasn't struggling with just murky water, but also a changing climate. "When we saw the 2005 dieback, which was when we had our very first Baywide hot summer, that's when things really started to change dramatically," Orth said.

Eelgrass beds recovered a bit, but another hot year in 2010 knocked them back. Again, it recovered some, but never approached earlier peaks.

Then came 2018 and 2019. The Bay watershed was drenched by record-setting rain, driving salinity levels below anything seen in decades. It washed huge amounts of nutrients and sediment into the Bay, clouding the water. And the summers were hot.

Heat, poor water quality and low salinity in consecutive years brought disaster to overstressed eelgrass beds. "There was a triple whammy," said Chris Patrick, a seagrass researcher at VIMS. "Eelgrass in much of the Bay died out."

In 2019, nearly 40% of the Bay's eelgrass disappeared — by far, the greatest single year drop seen since annual monitoring began. Only about 13,000 acres remained according to estimates by VIMS scientists, the lowest ever reported.

While 2020 data is not fully analyzed, the Bay suffered further losses in places like Dameron Marsh.

A grim outlook

Although eelgrass recovered some of its losses after 2005 and 2010, scientists fear that will not be the case this time in many areas.

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Here's why: Eelgrass can reproduce two ways. Underwater shoots, called rhizomes, can sprout new plants. The plants also produce seeds. If the plants and rhizomes die, they can still bounce back the next year from those seeds.

But there's a catch. It takes two years for those seedlings to mature and produce a new batch of seeds. Die-offs in back-to-back years mean there are no rhizomes or seeds for a comeback.

That's what scientists believe may have happened in 2018–19, leaving vast swaths of the lower Bay with few — if any — plants to spur their return.

"If you have two years in a row where the eelgrass gets stressed in an area, there's really no seed bank to come back from," said Ken Moore, an emeritus professor at VIMS who worked extensively with eelgrass.

It leads to a downward spiral. If the plants are gone, or mostly gone, they no longer hold sediment in place or filter water. Water clarity deteriorates further, making it hard for seedlings — which require more light than adult plants — to survive. "Once it's gone from an entire area, it's very difficult to get back," Moore said.

With the region predicted to be hit by both warmer temperatures and more frequent intense storms, scientists worry that

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When juvenile blue crabs enter the Bay from the ocean in spring, they take refuge in eelgrass beds. (Dave Harp)

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the remaining eelgrass will continue to lose ground.

"Eelgrass used to inhabit cooler deeper waters and do pretty well," said Brooke Landry, a biologist with the Maryland Department of Natural Resources and chair of the Bay Program underwater grass workgroup. "Over the last decade or so, it's experiencing a squeeze into the shallows because of the light limitations. Once it gets pushed into shallow water, eelgrass experiences more heat stress."

If the water was clearer, scientists say, eelgrass could tolerate higher temperatures because the plants would more efficiently get sunlight. In places with poor light, Moore said, eelgrass is suffering when water temperatures are in the mid-70s. But with better clarity, they can survive in the 80s.

No clear substitute

Most scientists believe it will take decades for eelgrass to disappear from the Bay, if it even does. "Nature can be resilient," Lefcheck said. "It's possible that pockets of eelgrass will persist in refuge areas and adapt."

But its ecosystem role of providing habitat, stabilizing sediment and clearing the water will be greatly reduced, not unlike what's happened to the Bay's greatly diminished oyster population.

The only other species that can tolerate high salinity in the Bay is widgeon grass. It dominates mid-salinity areas and today is the most abundant, and widespread, grass in the Bay, moving into some places as eelgrass retreats.

But scientists say widgeon grass cannot fully replace eelgrass. It won't grow in the deeper water where eelgrass can. It lacks eelgrass' extensive root system, so it is less helpful for holding sediment in place and protecting shorelines from erosion. Nor can it withstand as much wave action.

While widgeon grass can persist in some areas of the Bay through the fall and winter then regrow in the spring, in many places it dies back completely.

It's notorious for boom-and-bust cycles. After being present for years, it disappears from an area and may not come back for years, suddenly reappearing from dormant seeds. That makes it a less reliable habitat.

"It can pick up a portion of the area if eelgrass is lost," Moore said. "It certainly won't pick up all of it." He estimated that widgeon grass might be able to replace half of the area once occupied by eelgrass.

But wideon grass does have one great advantage: It will tolerate much higher temperatures than eelgrass.

Hello to *Halodule*?

The loss of eelgrass will be such an ecological jolt to the Bay that some people are pondering whether to consider a drastic action: importing a nonnative species to take its place.

"We don't know when, but we do know with certainty that with the trends in climate change that are baked in already, *Zostera marina* [eelgrass] will be extirpated from the Bay," said Mark Luckenbach, associate dean for research and advisory services at VIMS.

The replacement people point to is *Halodule wrightii*, or shoal grass, a southern species that has migrated into North Carolina's coastal lagoons in recent decades. It lives in similar areas and even looks a lot like eelgrass; both species grow side-by-side in North Carolina.

No one advocates importing an eelgrass replacement now, but many, like Luckenbach, say scientists should begin to study whether *Halodule* could be the right species to replace it. Would it provide a similar habitat? Would it pose threats to species already here? Would it even survive in the Bay?

Moving species around the globe has been frowned on for decades because of potentially negative impacts. Two decades ago, the Bay region debated more than five years about whether to import an oyster from China to supplement the Chesapeake's native species. The idea was deemed too risky. In recent years, though, some biologists have begun advocating for "assisted migration" to move species in response to climate change.

Warmer temperatures could eventually drive *Halodule* to the Bay unassisted. But if that won't happen before eelgrass is mostly gone, some say help might be warranted. Still, "it should never be done lightly," Luckenbach said.

Jessie Jarvis, a marine biologist with the University of North Carolina Wilmington, works with underwater grasses in North Carolina and studied the Bay's 2005 eelgrass die-off while a student at VIMS. She is skeptical about bringing *Halodule* to the Bay. In North Carolina, it is at the northern edge of its range, and it is as sensitive to cold winters as eelgrass is to hot summers. Jarvis doubts *Halodule* would survive here. "I've gone diving in January," she said. "And the water gets a lot colder."

While eelgrass and *Halodule* look very similar, there are differences. *Halodule* grows more densely, she said, which means some creatures might not be able to use it.

There is another solution for the Bay, Jarvis said: Clean it up. The Chesapeake Bay region has long had nutrient and sediment reduction goals aimed at clearing the water but those efforts are lagging. North Carolina's coastal lagoons are the southernmost extent of eelgrass. While it is declining, eelgrass there has avoided mass die-offs, even though the water is warmer. The difference, she said, is that the water is clearer.

Murky water would not be fixed by importing another species. "*Halodule* still needs light," she said. "I mean, it's still a seagrass."

Thriving in VA, just not in the Bay

Virginia does, in fact, have vibrant and expanding beds of eelgrass — on the Atlantic side of the Delmarva Peninsula where the writer Connett had mourned their loss in 1947.

In the late 1990s, Orth tossed eelgrass seeds in the water there. Unlike planting efforts in the Chesapeake, they took root. In 1999, VIMS began working with The Nature Conservancy to try to restore the eelgrass. Two decades and 70 million seeds later, they have achieved the largest seagrass restoration in the world: 9,600 acres across four coastal bays.

Now, 73 years later, Connett's wish is coming true. Invertebrates have increased dramatically, as well as the fish that eat them, such as silver perch and pinfish. So have bay scallops, which once supported a major fishery. Some report increased waterfowl as well.

Virginia's coastal bays stand as a stark contrast to the Chesapeake. They are just a few miles apart, separated by a spit of land, but moving in sharply different directions.

The coastal bays, though, have advantages. There is little development to contribute nutrient or sediment runoff. And, even if water temperatures get warm, the incoming tides bathe the beds with cool, clear ocean water twice a day.

A look at those beds is like peering into the Chesapeake's past. The question is, do people care enough to keep places like Dameron Marsh from being its future? ■