STATE *of the* BAY 2022

CHESAPEAKE BAY FOUNDATION

Saving a National Treasure

Far too much pollution still reaches our waterways.

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TIFFANY RICHARDSON

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DAVE HARP

The Chesapeake Bay watershed weaves together rivers, streams, and communities across 64,000 square miles. More than 18 million of us, along with 3,600 species of plants and animals, call it home. Our biennial *State of the Bay* report shows there is still a long way to go to create a watershed that works for all of us.

In 2022, the State of the Bay score remained unchanged at 32, a D+. Of the 13 indicators assessed, three improved and three declined. A big gain for oysters was tempered by a worrying drop for blue crabs, while pollution and habitat indicators showed only modest change.

These mixed results reflect the struggle between restoration efforts and powerful forces that are reshaping the watershed.

Far too much pollution still reaches our waterways. As our *State of the Blueprint* report outlined last fall, states are not on track to reduce pollution fast enough to improve and sustain water quality over the long term. Further progress requires meaningfully addressing agricultural pollution, especially in Pennsylvania, and growing pollution from urban and suburban development.

At the same time, the job is getting harder the longer we wait. The fingerprints of climate change are undeniable in this year's report. In just one example, sea level rise threatens almost 250,000 acres of tidal wetlands and coastal lands in the region. [1]

The Bay's remarkable resilience keeps me hopeful and is a sign that restoration efforts, for now, are holding the line. If we follow the science, commit to work together, and keep every partner in Bay restoration accountable, we can still leave a healthy watershed for the next generation.

Hilary Falk

—Hilary Harp Falk, President and CEO, Chesapeake Bay Foundation

How We Create Our Report

The *State of the Bay* report is based on the best available information about the Chesapeake Bay for indicators representing three major categories: pollution, habitat, and fisheries. Monitoring data serve as the primary foundation for the report, supplemented by in-the-field observations. We measure the current state of the Bay against the healthiest Chesapeake we can describe—the Bay known by the region's Indigenous peoples and European settlers in the early 1600s, a theoretical 100. We assign each indicator a score and then average the scores in the three categories to determine the overall state of the Chesapeake Bay. Our number scores correlate with letter grades as shown below.

70 or better	A
65–69	A–
60–64	B+
55–59	B
50–54	B–
45–49	C+
40–44	C
34–39	C–
30–33	D+
25–29	D
20–24	D–
19 or below	F

STATE of the BAY

2022 HEALTH INDEX: 32 D+

No change from 2020

	Indicator	2022 Score	Change From 2020	Grade
POLLUTION	Nitrogen	17	0	F
	Phosphorus	29	+2	D
	Dissolved Oxygen	44	0	C
	Water Clarity	16	–1	F
	Toxics	28	0	D
HABITAT	Forest Buffers	56	0	B
	Wetlands	42	0	C
	Underwater Grasses	22	0	D–
	Resource Lands	32	–1	D+
FISHERIES	Rockfish	51	+2	B–
	Oysters	17	+5	F
	Blue Crabs	55	-5	B
	Shad	7	0	F

See page 2 for scoring methodology.

CRYSTAL ROBINSON

KRISTA SCHLYER/ILCP

POLLUTION

Excess nitrogen and phosphorus are the Bay's two primary pollutants, fueling algal blooms that reduce water clarity and deplete the water of oxygen when they die and decompose, causing the Bay's dead zone. In 2022, the amount of this pollution and the size of the Bay's low-oxygen dead zone were both below average, in part due to state and federal efforts to reduce pollution under the Chesapeake Clean Water Blueprint. Overall, though, far too much pollution still reaches waterways, and states are behind in their commitments to reduce it. Progress to date has relied heavily on pollution reductions at wastewater treatment plants. To ensure long-term water-quality improvements, efforts to reduce pollution from agriculture and urban and suburban runoff must accelerate—especially in Pennsylvania, which remains far off track. The influence of climate change, which scientists expect will intensify storms and wash more pollutants into waterways, must also be addressed.

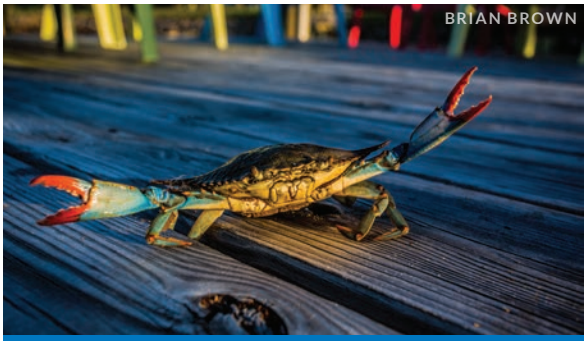
See pages 6 and 7 for details on nitrogen, phosphorus, dissolved oxygen, clarity, and toxics.

HABITAT

Forests, wetlands, and underwater grasses are critical to the health of the Chesapeake Bay. They provide food and shelter to wildlife like blue crabs, ducks, brook trout, and many other species. They serve as natural filters that reduce pollution flowing into rivers, streams, and the Bay. In communities, they slow flood waters, produce oxygen, and provide green spaces.

Unfortunately, efforts to restore wetlands and plant forest buffers along waterways are languishing, with states meeting just a fraction of the goals established by the Chesapeake Bay Watershed Agreement. At the same time, approximately 95,000 acres of farms and forests transitioned to development across the Bay watershed during the most recent reporting period. Climate change also threatens the watershed's critical habitats—thousands of acres of wetlands are at risk from rising sea levels, and underwater grasses are vulnerable to intensifying storms that wash more pollution into the water.

See pages 8 and 9 for details on forest buffers, wetlands, underwater grasses, and resource lands.



FISHERIES

Overfishing, pollution, and habitat loss have reduced many of the Bay region's fish and shellfish populations from their historic levels, but fisheries continue to support thousands of jobs and generate billions of dollars each year. The past few years have been a tumultuous time for key species. After dropping precipitously in 2020, rockfish (striped bass) populations are slowly improving following new management actions. For oysters, record reproduction in both 2020 and 2021 provided the species a boost even as the availability of reef habitat remains a concern. These positive trends, however, are tempered by a concerning decline in blue crabs. In 2021, the total number of blue crabs reached the lowest level on record and marked a third consecutive year of below-average numbers of juvenile crabs. In all cases, science-based management remains critical for rebuilding and sustaining populations, as well as efforts to reduce pollution and improve habitat—a growing challenge amid climate change.

See pages 10 and 11 for details on rockfish, blue crabs, oysters, and shad.

NITROGEN & PHOSPHORUS

17 F (No change from 2020) **29 D** (+2 from 2020)


ISTOCK

In 2022, the amount of nitrogen and phosphorus pollution flowing into the Bay from all major rivers was below the 10-year average, in part due to implementation of the Chesapeake Clean Water Blueprint, the Bay's long-term restoration plan. However, most states in the watershed remain behind on their Blueprint commitments to reduce pollution, and climate change threatens progress.

Much of the nitrogen and phosphorus pollution comes from runoff—rain and snow that washes the pollutants from farmland and developed areas in cities and towns. Nitrogen and phosphorus move differently through the environment, which explains why the scores for the pollutants aren't always the same.

States are relying on farms to achieve roughly 90 percent of the remaining pollution reductions needed. Recent increases to state and federal funding for conservation practices, like the $22.5 million the U.S. Department of Agriculture set aside in 2022 for the Chesapeake Bay States' Partnership Initiative, are welcome but must be sustained to address the problem.

Furthermore, climate models suggest the Bay region will experience more frequent and severe storms, like the record-setting rainfall that caused a spike in pollution in 2018 and 2019,[2] adding to the challenge of achieving restoration commitments.

DISSOLVED OXYGEN

44 C (No change from 2020)

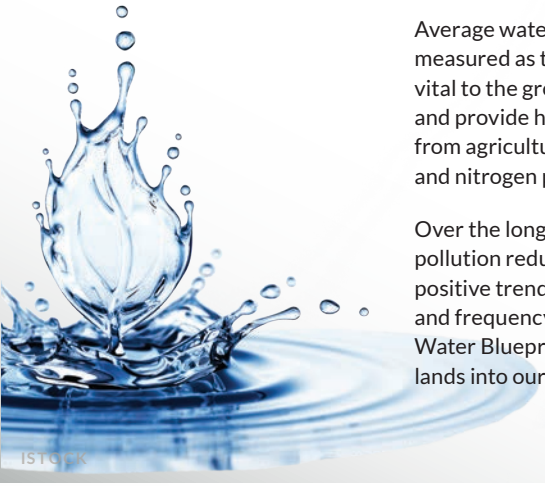

ISTOCK

The size of the summer dead zone (areas in the Bay with low or no oxygen) is driven largely by the amount of nitrogen and phosphorus washed into the Bay each spring by rain and snow runoff. In excess, these nutrients feed large algal blooms that eventually die and are decomposed by oxygen-consuming bacteria, leaving little to no oxygen in the water for Bay species to thrive.

Scientists predicted a smaller-than-average dead zone in 2022 due to below-average spring runoff. While the dead zone was indeed smaller than the historical average for the third consecutive year—a promising trend—its size was not substantially different than in 2020.[3] Scientists have found that efforts to reduce nitrogen and phosphorus pollution, over the long term, have played a role in shrinking the dead zone and increasing the Bay's resilience to adverse environmental conditions. However, the Bay's warming temperatures, which decrease how much oxygen is in the water, have offset part of this progress, and future warming puts restoration efforts at additional risk.[4]

WATER CLARITY

16 F (-1 from 2020)



Average water clarity decreased slightly between 2020 and 2022.[5] Water clarity is measured as the depth in the water column to which sunlight can penetrate. Sunlight is vital to the growth of underwater grasses, which trap sediment, add oxygen to the water, and provide habitat for aquatic organisms. Water clarity is negatively affected by runoff from agricultural and urban lands, which carries water-clouding sediment and phosphorus and nitrogen pollution that fuels light-blocking algal blooms.

Over the long term, three decades of data show improvement in water clarity due to pollution reductions from watershed restoration efforts.[6] Climate change threatens this positive trend by washing more pollution into the Bay through increased storm intensity and frequency. It is therefore even more critical to implement the Chesapeake Clean Water Blueprint and reduce the amount of pollution that runs off agricultural and urban lands into our local streams, rivers, and ultimately the Chesapeake Bay.

TOXICS

28 D (no change from 2020)

The most recent data from the U.S. Environmental Protection Agency's (EPA) Toxics Release Inventory (TRI) indicate that industrial sources released more than three million pounds of toxic chemicals into waterways in the Chesapeake region in 2020,[7] an amount similar to previous years.

Recently, EPA added PFAS (per- and polyfluoroalkyl substances) to the list of reportable chemicals in the TRI. PFAS, a group of man-made chemicals widely used in products such as nonstick cookware and fire-fighting foam, can be very persistent and accumulate in fish, other foods, and people's bodies. There is evidence of adverse effects in humans and wildlife[8]—in 2022, EPA issued health advisories for some PFAS.[9] One study of these chemicals in the Chesapeake watershed detected PFAS in 75 percent of samples taken from drinking water supplies in Maryland.[10]

Monitoring and additional research, along with efforts to reduce polluted runoff from the land, are necessary to address the challenging issue of toxics—including PFAS, microplastics, legacy pollutants like mercury and polychlorinated biphenyls (PCBs), and others.

FOREST BUFFERS

56 B (No change from 2020)

ISTOCK

Streamside forest buffers filter nutrients and sediment from agricultural and urban runoff and reduce pollution reaching our waterways. Forest buffers also provide additional benefits, including capturing and storing carbon, improving air quality, stabilizing stream banks, reducing downstream flooding, and providing shade and habitat. They are one of the most cost-effective practices to improve water quality in the Bay.

Despite these benefits, forest buffer implementation remains far off track from the goals established in the 2014 Chesapeake Bay Watershed Agreement and state pollution-reduction plans.

Programs like the Pennsylvania Keystone 10 Million Trees Partnership are increasing the installation of forest buffers in critical parts of the watershed. The partnership, established in 2018, has planted more than five million trees to date, including one million in 2022 alone. In Virginia, the James River Buffer program provides "one-stop shopping" for landowners interested in installing buffers, and Maryland's Tree Solutions Now Act of 2021 calls for planting five million trees over an eight-year period. Continued support for these and similar initiatives is crucial.

WETLANDS

42 C (No change from 2020)

EDWARD EPISCOPO

Wetlands provide habitat and nursery areas for fish and wildlife. They also trap and remove pollutants, especially nitrogen, from the rain and snow runoff that flows into waterways from farmland and urban and suburban areas.[11] In addition, their ability to act like a sponge that reduces flooding and dampens storm surges is particularly critical as the region experiences more intense storms and sea level rise due to climate change. Despite these benefits, restoration of wetlands in the Bay region is languishing, and existing wetlands face serious threats.

According to available data, only 11 percent of the Chesapeake Bay Watershed Agreement goal of restoring 83,000 acres of wetlands on farmland has been achieved.[12] Sea level rise threatens almost 250,000 acres of tidal wetlands and coastal lands in the region,[13] and court cases challenging wetland protections under the federal Clean Water Act are not yet resolved.[14] Moreover, there has been no watershed-wide assessment of wetlands in more than a decade, making it difficult to discern their true status. A concerted region-wide focus on wetlands restoration is clearly needed to accelerate restoration of this critical and valuable habitat.

UNDERWATER GRASSES

22 D- (No change from 2020)

ISTOCK

Underwater grasses provide essential food, habitat, and oxygen that Bay creatures need to survive. Grasses, which need clear water and sunlight to thrive, are also a good indicator of water quality. In 2021, the Virginia Institute of Marine Science (VIMS) mapped an estimated 67,470 acres of underwater grasses in the Chesapeake Bay and its tidal rivers. This is an improvement in grass abundance since the record-low acreage measured in 2019, but the recovery has been slow.[15]

Increasingly frequent and intense storms, like the watershed experienced in 2018 and 2019, wash more pollutants and sediment into the water, compromising water clarity and putting the recovery of underwater grasses at risk. Continued efforts to reduce pollution are therefore all the more critical to restore this habitat—scientists have identified a strong link between underwater grass abundance and the amount of nitrogen and phosphorus pollution entering the Bay.[16] We encourage federal and state agencies to ensure continued funding for the long-term monitoring of grasses, which is important for assessing the Bay's condition and recovery.

RESOURCE LANDS

32 D+ (-1 from 2020)

ISTOCK

Undeveloped resource lands—such as forests, natural open areas, and well-managed farmland—are vitally important to water quality. However, these lands are being lost as significant development continues.[17] New, more precise measurements of land-use change show that approximately 95,000 acres of farms and forests transitioned to development across the Bay watershed during the most recent reporting period, from 2013/14 to 2017/18.[18]

This is far too much. Pennsylvania, Maryland, and Virginia all experienced significant forest clearing, reversing prior net reforestation gains in some regions. Virginia accounted for more than half of the total forest cleared in the watershed—over 30,000 acres. Development of farmland was moderate in all three states.

The rate of new land protection has slowed slightly in Maryland and Pennsylvania, while Virginia continues to accelerate conservation efforts. In Maryland and Pennsylvania—states with nationally-recognized conservation programs—strong financial commitments for land preservation should help get efforts back on track over the next two years.

ROCKFISH

51 B- (+2 from 2020)

ISTOCK

Rockfish (striped bass) spend the first three to eight years of their life in the Bay before migrating annually up and down the East Coast as adults. The survival of the population is dependent upon both the health of the Bay and wise management of the fishery. In 2020, fishery managers in Maryland and Virginia changed regulations to reduce the number of fish harvested and the occurrence of catch-and-release mortality. These measures have reduced mortality to more sustainable levels and, if fishing rates remain low, should allow rebuilding of the striped bass population by 2029. However, the population is still depleted. Recent surveys indicate that numbers of juvenile striped bass are still well below average in Maryland, while they are at or slightly above long-term average levels in Virginia.[19,20]

Recent modeling indicates that the availability of suitable habitat for striped bass in the Bay is extremely limited during spring and summer and has decreased in extent over time.[21] Continued conservative management of striped bass and improvement in habitat is required to ensure the population rebuilds to its target by the 2029 deadline set in the Atlantic States Marine Fisheries Management Plan.

OYSTERS

17 F (+5 from 2020)

ISTOCK

Both 2020 and 2021 were record years for oyster reproduction, with Maryland and Virginia reporting the highest number of oyster spat (juvenile oysters) in the past 30 years. This, coupled with several years of below-average mortality from disease and predators, could provide oysters a much-needed boost.

However, past increases in oyster reproduction have been quickly exploited by increases in harvest, limiting their contribution to longer-term oyster recovery. Breaking this boom-and-bust cycle will require responsible management of the oyster fishery that tempers increases in oyster harvesting during times of relative abundance. Stock assessment updates in Maryland indicate that certain areas of the Bay still experience overfishing, despite improvements in oyster numbers.[22]

Additionally, the Bay's oyster population still suffers from a lack of oyster reef habitat. Successful large-scale restoration efforts are ongoing, with restoration complete in eight out of 10 tributaries identified for restoration. A significant expansion of such efforts would be needed to fully recover the oyster population, which remains at a fraction of historic levels. A lack of the materials used for restoration, specifically oyster shell, significantly limits large-scale reef building.

BLUE CRABS

55 B (-5 from 2020)

ISTOCK

The 2020 and 2021 blue crab winter dredge surveys, which assess blue crab abundance at more than 1,500 locations throughout the Bay, brought concerning and disappointing results. In 2021, the total number of blue crabs reached the lowest level on record in the survey's 33-year history and marked a third consecutive year of below-average numbers of juvenile crabs.[23]

Despite the recent declines, the blue crab fishery, which is managed based on the number of adult female crabs, has not exceeded any triggers that would require fishery managers to take immediate action. The number of adult females is above the level considered sustainable, and the number of crabs harvested by the fishery is within bounds.

Managers and scientists have committed to pursuing an updated assessment of the population to determine the cause of the recent declines and whether they require changes to the way the blue crab fishery is managed. In the meantime, efforts to increase important nursery habitats for juvenile crabs—including underwater grasses, marshes, and living shorelines—will help protect young crabs as they grow to maturity.

SHAD

7 F (No change from 2020)

YURI HUTA

Shad once supported the largest and most valuable fishery in the Chesapeake Bay. Despite a moratorium on shad fishing since the 1980s, populations have failed to rebound significantly. An updated 2021 assessment of shad in the watershed indicated that only populations in Virginia's Rappahannock and York Rivers are considered stable.[24] All other Chesapeake Bay populations are too data-poor to assess or are considered unsustainable.

Significant challenges to shad recovery include access barriers to historic habitat and the emerging threat of invasive predators like blue catfish. Blue catfish are known to be voracious predators of native species, including shad, and are abundant in nearly every river system in the Chesapeake Bay watershed. Supporting efforts to remove blue catfish through commercial fisheries will help reduce mortality of shad and other species. Fortunately, historic levels of federal funding are currently available for fish passage projects to help shad and other species bypass dams and other barriers to their spawning areas. This funding, if directed to priority projects in the Bay region, could provide a significant benefit to shad recovery efforts.

More than 90 percent of the remaining pollution reductions needed to achieve the Chesapeake Clean Water Blueprint must come from agriculture. Investing in farm conservation practices will not only improve water quality, but would also inject an estimated $655 million annually into the region's economy.

Read more at cbf.org/agecon.

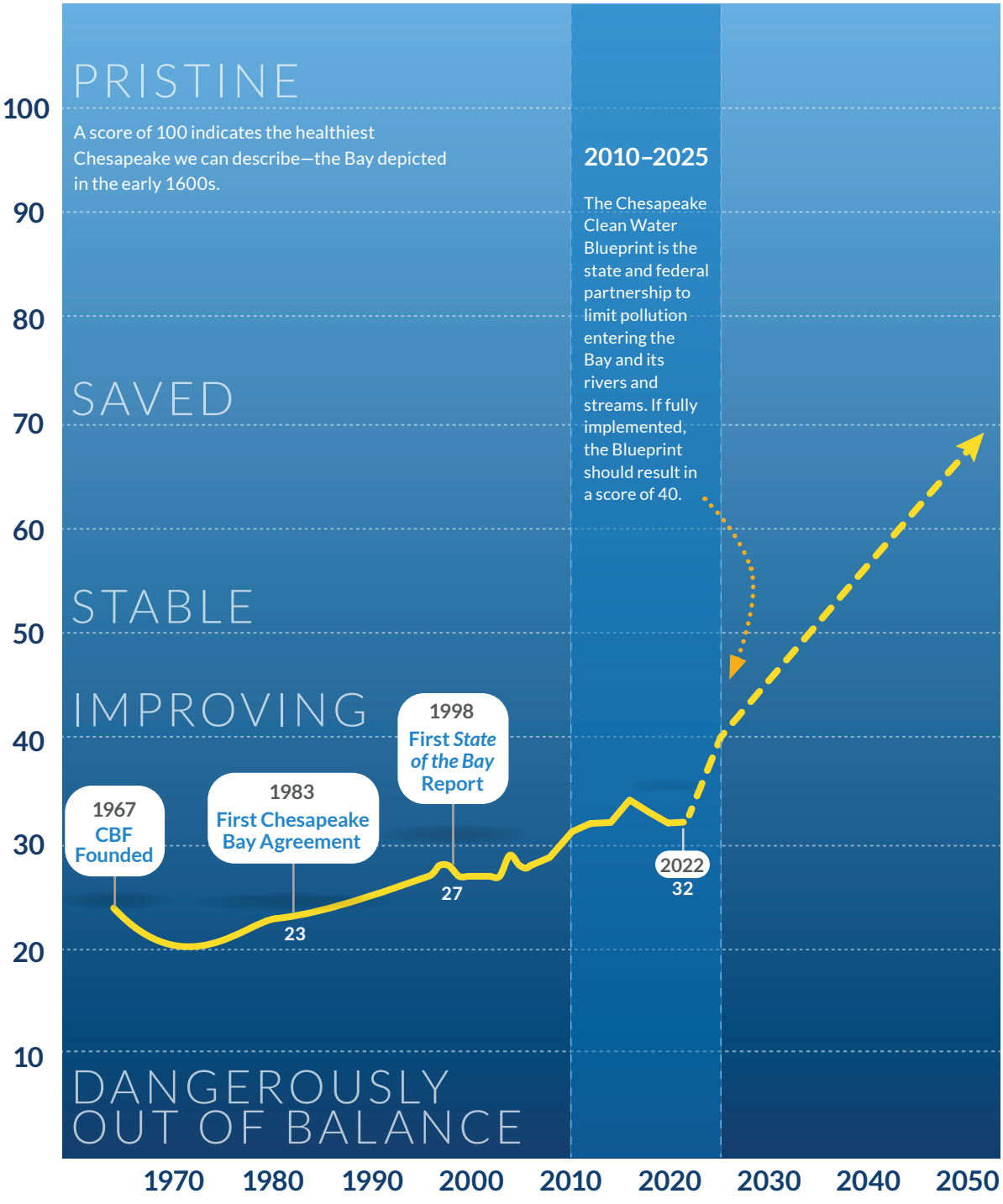
ISABELLE GHOLL

Conclusion

The Chesapeake Bay, and the thousands of rivers and streams that feed it, are not as healthy as they can—and should—be. We feel the effects every day. Too many waterways are unsafe to swim and fish in; too many communities face hazards to their health; and too many fish and wildlife struggle to survive.

The science on the Bay, among the best in the world, has been very clear for nearly 40 years. To achieve a healthy watershed, we have to reduce nitrogen, phosphorus, and sediment pollution. Changing the status quo requires all of the Bay states and partners working for restoration to reduce these pollutants faster, in a way that will sustain water quality over the long term. That means massively accelerating pollution reductions from agriculture, the largest remaining source, and addressing growing pollution from urban and suburban development in accordance with the Chesapeake Clean Water Blueprint, the Bay's science-based federal and state cleanup plan.

Restoration work is all the more urgent due to the increasing pressures of climate change. Robust scientific monitoring and research are critical to guide restoration in a dramatically changing world and create the watershed we want to see: a resilient ecosystem that nurtures wellbeing and dignity for all its residents and allows nature to flourish.


PRISTINE
A score of 100 indicates the healthiest Chesapeake we can describe—the Bay depicted in the early 1600s.
SAVED
STABLE
IMPROVING
DANGEROUSLY OUT OF BALANCE
100
90
80
70
60
50
40
30
20
10
2010–2025
The Chesapeake Clean Water Blueprint is the state and federal partnership to limit pollution entering the Bay and its rivers and streams. If fully implemented, the Blueprint should result in a score of 40.
1967 CBF Founded
1983 First Chesapeake Bay Agreement
1998 First State of the Bay Report
23
27
2022
32
1970
1980
1990
2000
2010
2020
2030
2040
2050

ENDNOTES

1 Tidal wetland resilience to increased rates of sea level rise in the Chesapeake Bay: Introduction to the special feature | U.S. Geological Survey (https://www.usgs.gov/publications/tidal-wetland-resilience-increased-rates-sea-level-rise-chesapeake-bay-introduction)

2 http://www.chesapeake.org/stac/Pubs/climchangereport.pdf

3 Chesapeake Bay Hypoxia Reports (maryland.gov) https://dnr.maryland.gov/waters/bay/Pages/Hypoxia-Reports.aspx

4 Frankel, L. T., Friedrichs, M. A., St-Laurent, P., Bever, A. J., Lipcius, R. N., Bhatt, G., & Shenk, G. W. (2022). Nitrogen reductions have decreased hypoxia in the Chesapeake Bay: Evidence from empirical and numerical modeling. *Science of the Total Environment*, 814, 152722.

5 https://www.chesapeakebay.net/what/downloads/cbp-water-quality-database-1984-present

6 Testa, J. M., Lyubchich, V., & Zhang, Q. (2019). Patterns and Trends in Secchi Disk Depth over Three Decades in the Chesapeake Bay Estuarine Complex. *Estuaries and coasts.*

7 https://www.epa.gov/trinationalanalysis/watersheds

8 https://www.epa.gov/pfas

9 87 Fed. Reg. 36848, 21 June 2022, Environmental Protection Agency, Lifetime Drinking Water Health Advisories for Four Perfluoroalkyl Substances.

10 https://mde.maryland.gov/PublicHealth/Documents/PFAS%20Public%20Water%20System%20Study_Phase1Report.pdf

11 For example, Data on denitrification and ecological characteristics of nontidal floodplains, Chesapeake Bay watershed, USA, 2013-2016 - data.doi.gov (https://data.doi.gov/dataset/data-on-denitrification-and-ecological-characteristics-of-nontidal-floodplains-chesap-2013) and Type of Wetlands Affect How Much Nitrogen is Removed from the Bay's Tidal Rivers | U.S. Geological Survey (https://www.usgs.gov/centers/chesapeake-bay-activities/science/type-wetlands-affect-how-much-nitrogen-removed-bays-tidal)

12 Wetlands - Chesapeake Progress https://www.epa.gov/trinationalanalysis/watersheds

13 Tidal wetland resilience to increased rates of sea level rise in the Chesapeake Bay: Introduction to the special feature | U.S. Geological Survey (https://www.usgs.gov/publications/tidal-wetland-resilience-increased-rates-sea-level-rise-chesapeake-bay-introduction)

14 See "Waters of the U.S." listing here: Active Litigation Cases - Chesapeake Bay Foundation https://www.cbf.org/about-cbf/our-mission/litigate/active-cases.html#clean-water

15 https://www.vims.edu/research/units/programs/sav/reports/2019/index.php

16 Lefcheck, J. S., Orth, R. J., Dennison, W. C., Wilcox, D. J., Murphy, R. R., Keisman, J., ... & Batiuk, R. A. (2018). Long-term nutrient reductions lead to the unprecedented recovery of a temperate coastal region. *Proceedings of the National Academy of Sciences*, 115(14), 3658-3662.

17 Our biennial calculations use a variety of data from the best and most accurate federal and state sources we can find. Because of when these are updated, however, for some statistics we are not always able to use the same source each reporting period. We apologize for this discontinuity.

18 https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/lulc-data-project-2022/

19 https://news.maryland.gov/dnr/2022/10/20/chesapeake-bay-2022-young-of-year-survey-results-announced/#:~:text=The%202022%20young%2Dof%2Dyear,with%20the%20right%20environmental%20conditions.

20 https://www.vims.edu/newsandevents/topstories/2022/sbss_2022.php

21 https://cbtrust.org/wp-content/uploads/FINAL_Report_CBT_SB_Habitat_Assessment_7.15.22-1.pdf

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