Reprint

ALLIANCE FOR THE CHESAPEAKE BAY

BAY JOURNAL

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The draft designated uses and water quality criteria are to be finalized early next year. Photo by Mary Hollinger courtesy of NOAA

Bay Program unveils draft criteria for clean Bay

By Karl Blankenship

WHEN Bernie Fowler and about 80 companions locked arms and walked in the lower Patuxent River this June, they didn't lose their footing, although they quickly lost their feet.

At a depth of 31 inches, the water was so murky they could no longer see their shoes. After a decade of slow improvements, water clarity during Fowler's annual "wade-in" has declined for the second straight year since reaching its peak of 44 inches.

At that point, Fowler had seen signs of recovery: Underwater grasses were beginning to come back. Since then, the grasses have faded away, along with the water quality.

Fading with it are Fowler's hopes of a comeback for the river he's lived along for 75 years. "I don't have the strong, optimistic feeling I had several years ago," said the former waterman and state senator.

For more than three decades he has campaigned to restore the river, highlighting its condition with the annual wade-in and telling people stories from his youth, when he could wade chest-deep in the river and clearly see blue crabs scurrying among the underwater grasses.

"I'm concerned that the river has reached a point where it is just holding its own, or maybe even getting a little worse," Fowler said. "But it is definitely not improving. And if that is true of the Patuxent, is may be true for the Bay as well."

Now, the Bay Program is on the verge of promising that by the end of the decade, the 6-foot Fowler will be able to wade into water over his head and still see his feet.

> *"That's the one dream, one vision, one hope, one prayer I have, that someday I would be able to look down — my eyes will tell me when its right — to see that crystal clear water one more time."*
>
> — Bernie Fowler

It's a guarantee the Bay states are willing to put into writing, in the form of updated water quality standards.

Over the past two years, the Bay Program has outlined what a clean Chesapeake would look like from the perspective of the creatures living in it: fish, clams, underwater grasses — even worms that burrow into the bottom sediment.

That has been translated into a series of habitat zones (called designated uses) and water quality conditions needed to protect aquatic life in those zones (criteria) which will be adopted as legally binding water quality standards by Virginia, Maryland,

Delaware and the District of Columbia, the four jurisdictions with tidal waters.

The draft designated uses and water quality criteria will go out for review this summer; they are to be finalized early next year.

Attaining the new standards is expected to require huge nutrient reductions, perhaps twice as much as has been accomplished since 1987. The Chesapeake Bay Foundation recently estimated the job could cost $6.5 billion over the next decade.

Reaching the standards wouldn't mean a pristine Bay; they recognize that a watershed which is home to more than 15 million people is not likely to return to anything like what was seen by Capt. John Smith.

"It won't be what it was during the 1600s," said Rich Batiuk, associate director for science with the EPA's Bay Program Office, "but it brings us closer to a Chesapeake filled with high-quality habitats, from shallow water areas hugging the shore, to the deep water oyster beds."

That means there will be fewer oxygen-sucking algae blooms and more habitat-rich underwater grass beds.

Once the standards are achieved, the oxygen-depleted "dead zone," which can cover as much as a third of the Bay's bottom today — essentially rendering it useless for habitat during the summer — should cover no more than about 5 percent of the bottom. And the water should be clear enough to for the return of grass beds to hundreds of thousands of acres of the Bay; they now only cover about 69,000 acres.

And Bernie Fowler should be able to wade into the Patuxent and still see the bottom, even when the water is 6 inches over his head.

THAT picture of a clean Bay stems from the rare convergence of legal, political and scientific factors.

The legal issue was the emergence of a once-obscure section of the Clean Water Act that called for states to develop cleanup plans, known as Total Maximum Daily Loads, for waters that fail to meet water quality standards.

The TMDL requirement was overlooked for almost 20 years until lawsuits began forcing their development for impaired waterways. That hit home for the Bay when it was placed on the EPA's impaired waters list several years ago, meaning a TMDL would have to be developed for the Bay by 2011.

But TMDLs can be highly regulatory, and potentially expensive. That's where the politics came it.

Last year, the Chesapeake Executive Council — the governors of Maryland, Virginia and Pennsylvania; the mayor of the District of Columbia; the EPA administrator; and the chairman of the Chesapeake Bay Commission (representing state legislatures) — decided it was better to clean up the Chesapeake before 2011. Avoiding a TMDL allows states more flexibility in crafting cleanup plans and could stave off the lawsuits that tend to mark the whole TMDL process.

In the Chesapeake 2000 Agreement, the Executive Council pledged to "correct the nutrient and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters."

There's one problem with that goal, though. The Bay was listed as impaired largely for failing to meet its water quality standard for dissolved oxygen, which is 5 milligrams of oxygen per liter of water (mg/l).

Although four centuries of development have severely degraded the Bay, some deep parts of the Chesapeake, scientists agree, *never* had that much oxygen during the summer, even when Capt. John Smith arrived.

Solving that problem by reducing the 5 mg/l dissolved oxygen standard would not work because many fish — especially their eggs and larvae — need that much or more to survive.

So the agreement called for establishing new standards that "achieve the water quality conditions that protect aquatic living resources."

That's where the science comes in. For more than 15 years, the Bay Program has been identifying "habitat requirements" for important resources, from ducks and underwater grasses to blue crabs and striped bass.

That research identified the amount of oxygen needed by sensitive fish eggs in tidal tributaries and by adults swimming in deep parts of the Bay; the amount of sunlight needed by underwater grasses; and the types of algae preferred by oysters and grazing fish.

Although that information has been available for years, it was used only in an advisory role in making water quality decisions. With the new criteria, habitat needs move front-and-center.

Gone are the arbitrary nutrient reduction goals of the past which sought to gradually improve water quality, but had no science-based endpoint. Now, the restoration of habitat will dictate the level of nutrient and sediment reductions.

In effect, the Bay Program is moving toward a fish-eye view of the Chesapeake.

WHAT a fish sees, though, is a highly diverse Chesapeake Bay.

There are shallow areas that are important for spawning, and grass beds that serve as nursery areas for their young. There are also large areas of open water where they feed on algae or other fish. Deep areas, where they may rarely venture during the summer, are important refuges from winter cold.

The new criteria and designated uses seek to take that diversity into account by essentially zoning the Bay. They divide the Bay and its tidal tributaries into five "designated uses" based on the types of species that inhabit a particular area.

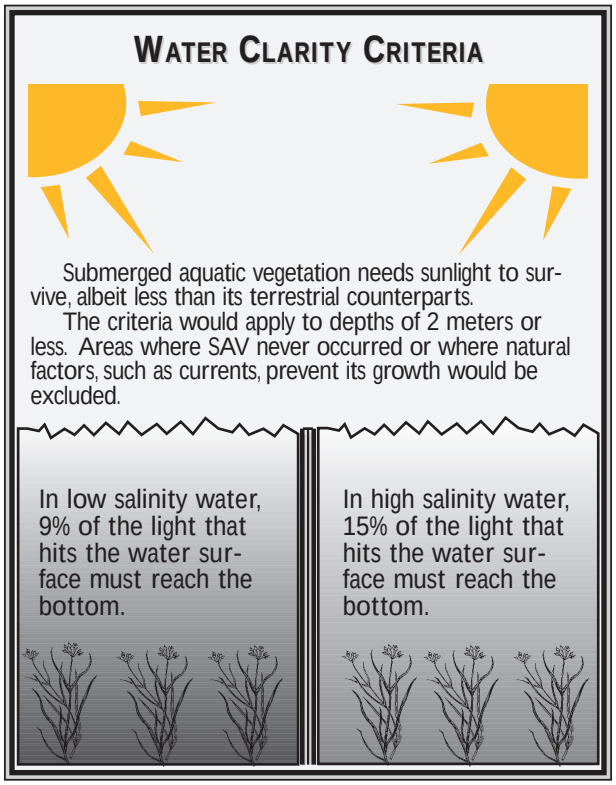
Those habitat zones include: shallow water, open water, spawning and nursery areas, deep water, and deep channel. Different criteria would be applied to each use based on the species found there: grasses in shallow water, adult fish in open water, oysters in deep water, and so on.

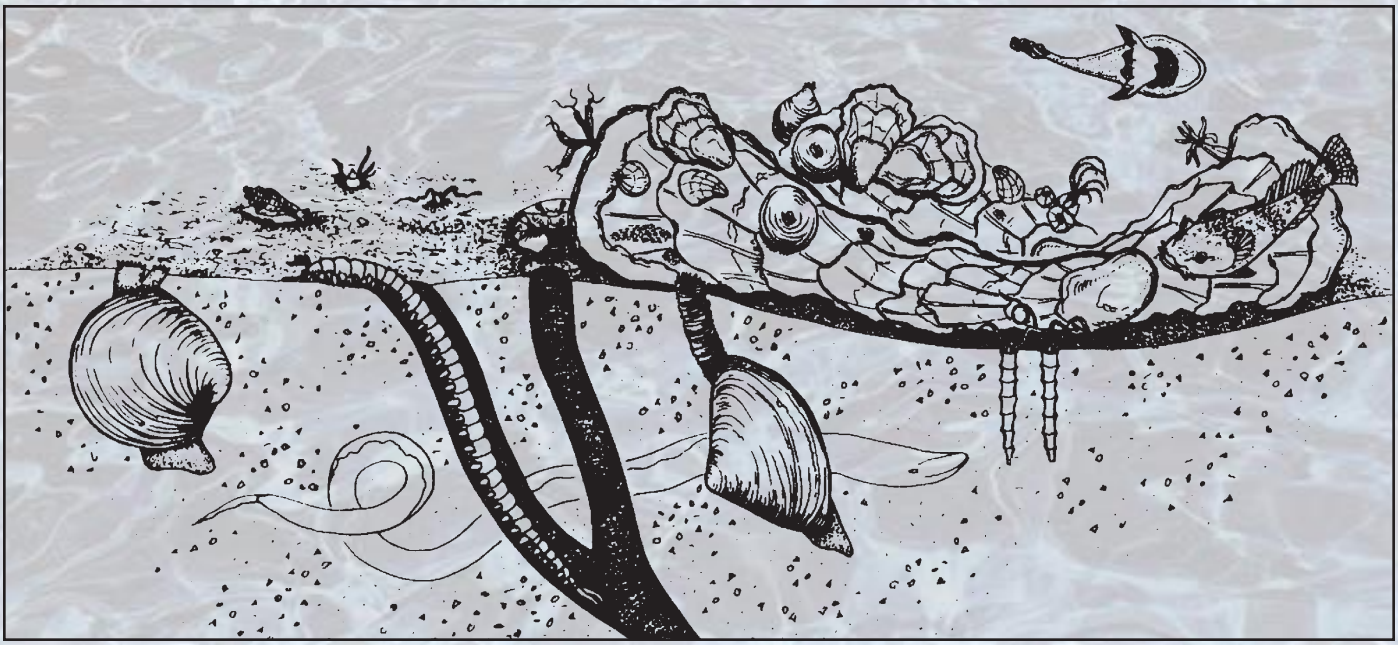
That criteria is no longer the old one-size-fits-all 5 mg/l dissolved oxygen criteria. It's being tossed out in favor of a more complex mix of criteria that look at more than just oxygen.

The new criteria cover:

❏ Water clarity, which will ensure that adequate sunlight for important underwater grasses can reach bottom in most shallow areas of two meters or less.

❏ Dissolved oxygen, which will ensure that enough oxygen is available — in the right places and at the right time of the year — to support everything from sensi-





Benthic species, many of whom are unable to move away when oxygen levels in the water get too low, would be protected under the proposed criteria. Illustration by Sandra Janniche courtesy of U.S. Fish & Wildlife Service.

NUTRIENTS, SEDIMENT ROOT OF MOST WATER QUALITY PROBLEMS IN BAY

While the new water quality criteria change the cleanup goal for the Bay, the route to getting there remains the same: the reduction of nutrients and sediment, which are the root of most water quality problems in the Chesapeake.

Excess nutrients spur algae blooms which, along with sediment, cloud the water, preventing sunlight from reaching underwater grass beds that provide food for waterfowl and shelter for juvenile blue crabs and fish. They also help to pump oxygen into the water and buffer shorelines from erosion.

Because of poor water quality, however, grasses cover only about a tenth of the area they once occupied.

Also, the blooms of algae caused by nutrients tend to be small phytoplankton species that discolor the water with mahogany or green tides. The small algae generally are not the species favored by fish and other predators. Their dense masses not only block light for underwater grasses, but also other types of algae, which are more beneficial to the food chain and tend to grow deeper in the water.

Reducing chlorophyll *a* levels should not only decrease blooms of harmful species, but also bring back the more balanced phytoplankton community that serves as the building block for the entire Chesapeake food web.

When there is more algae than can be consumed by predators, it sinks to the bottom and is decomposed by bacteria in a process that depletes the water of oxygen.

When oxygen levels get too low, it squeezes out species that are able to move — reducing the amount of habitat available — and can kill those that are not able to move.

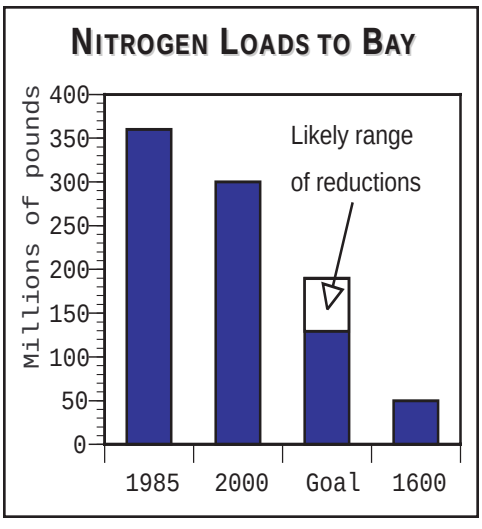
In the Chesapeake, as much as 1,500 square miles of bottom waters can be depleted of oxygen during bad years. That's about a third of all the bottom.

tive fish larvae to adult striped bass and oysters.

❑ Chlorophyll *a*, which aims to reduce blooms of harmful, water-clouding algae, while promoting the growth of the phytoplankton that feed the Chesapeake's food chain.

No single criteria would apply Baywide. Instead, the numbers for the criteria would vary from place to place — and sometimes even from season to season.

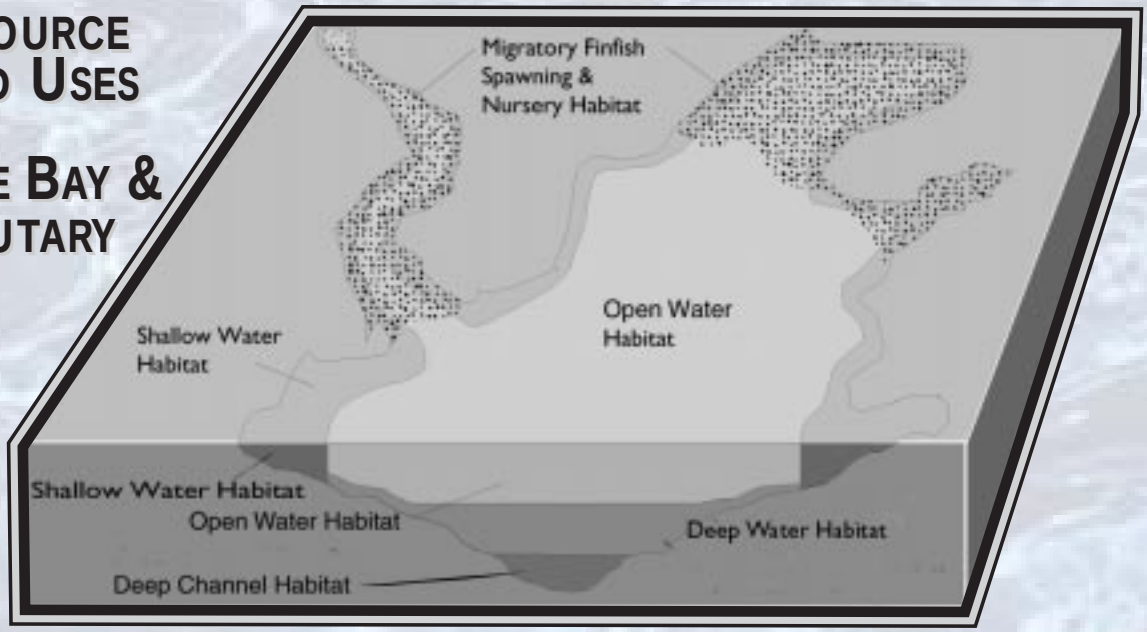
The criteria recognize that natural factors limit the water quality that can be attained in some places. Tidal blackwater rivers on the Eastern Shore would never attain water clarity at 2 meters. Chlorophyll levels naturally vary from place to place based on salinity and other factors. And deep waters below the pycnocline — a natural barrier that keeps water on the surface from mixing with water on the bottom — will always have less oxygen during the summer.



Still, the criteria applied to each designated use is intended to be protective of the most sensitive life stages (usually eggs or juveniles) that are found in that area.

The fish-eye zoning recognizes that in spawning areas, oxygen levels ought to be higher than required today. And in parts of the Bay — both above and below the pycnocline — oxygen levels should be increased to fully protect important species such as bay anchovy, the most abundant fish in the Chesapeake and a critical part of the food chain. "It reflects what the fish, the crabs and the grasses need," Batiuk said. "When they need it

LIVING RESOURCE DESIGNATED USES FOR THE CHESAPEAKE BAY & TIDAL TRIBUTARY WATERS



MIGRATORY SPAWNING & NURSERY

Designated Use: Promote the growth of balanced native populations of ecologically, recreationally and commercially important anadromous and semi-anadromous fish species.

Boundary: From the upper extent of tidal waters to the lower reach of existing spawning and nursery habitats, and from the water surface to the bottom or to the pycnocline where it exists.

Representative Species/Life Stages: Adult spawning, egg, larval and juvenile life stages of striped bass, American shad, hickory shad, alewife, blueback herring, white perch and yellow perch and other migratory species not listed here.

Critical Support (food, shelter) Communities: Phytoplankton, zooplankton, underwater grasses, forage fish and bottom-dwelling worms and clams.

Seasonal Use Application: The migratory spawning and nursery designated use applies from mid-February to early June; during the rest of the year, the shallow water and open water designated uses apply.

Applicable Bay Water Quality Criteria: Dissolved oxygen and chlorophyll a. Migratory spawning/nursery criteria apply from Feb. 15 to June 10.

SHALLOW WATER

Designated Use: Promote the growth of balanced, native populations of ecologically, recreationally and commercially important fish, shellfish and underwater grasses.

Boundary: Tidal waters to a 2-meter depth, measured from low tide.

Representative Species/Communities: Largemouth bass, pickerel, juvenile speckled sea trout, blue crabs and underwater grasses.

Critical Support Communities: Phytoplankton, zooplankton, forage fish and bottom-dwelling worms and clams.

Applicable Bay Water Quality Criteria: Dissolved oxygen, chlorophyll a and water clarity.

OPEN WATER

Designated Use: Promote the growth of balanced, indigenous populations of ecologically, recreationally and commercially important fish and shellfish species.

Boundary: Tidal waters extending vertically from a 2-meter depth into the water column to the bottom, or to the pycnocline in areas where it exists.

Representative Species: Menhaden, bay anchovy and striped bass.

Critical Support Communities: Phytoplankton, zooplankton and forage fish.

Applicable Bay Water Quality Criteria: Dissolved oxygen and chlorophyll a.

DEEP WATER

Designated Use: Protect the propagation and growth of balanced, indigenous populations of ecologically, recreationally and commercially important fish and shellfish species.

Boundary: Tidal waters below the depth of the pycnocline or, in the absence of a measured pycnocline, below a certain depth that would vary in different parts of the Bay based on geographic conditions.

Representative Species: Blue crab, oyster, softshell clam, hard clam, spot, croaker, flounder and catfish.

Critical Support Communities: Bottom-dwelling worms and clams, and reef-inhabiting forage fish.

Applicable Bay Water Quality Criteria: Dissolved oxygen. Deep water criteria apply from May through September; open water criteria apply from October through April.

DEEP CHANNEL

Designated Use: Refuge for balanced, indigenous populations of ecologically, recreationally and commercially important fish species that depend on deep channel habitats for overwintering during the months of October through April; and for the propagation and growth of benthic infaunal and epifaunal worms and clams that provide food for bottom-feeding fish and crabs during the months of May through September.

Boundary: Very deep water column and adjacent bottom surficial sediment habitats located principally in the channels at the lower reaches of major tidal rivers and along the spine of the upper and middle mainstem Bay.

Representative Species: Blue crab, migrating striped bass, white perch, Atlantic croaker, shortnose sturgeon and Atlantic sturgeon.

Critical Support Communities: Bottom-dwelling worms and clams.

Applicable Bay Water Quality Criteria: Dissolved oxygen. Deep channel criteria apply from May through September; open water criteria apply from October through April.

Source: Chesapeake Bay Program

DISSOLVED OXYGEN CRITERIA

MINIMUM AMOUNT OF OXYGEN MG/L OF WATER NEEDED TO SURVIVE BY SPECIES

MIGRATORY SPAWNING & NURSERY AREAS

6 mg/l averaged over 7 days with a 5mg/l 1-day minimum from mid-May to mid-June.

This is intended to protect larval and early juvenile stages of freshwater species in upper tributaries and the Upper Chesapeake Bay. The early life stages are often more sensitive to low oxygen levels than adult fish

SHALLOW OPEN WATER AREAS

5mg/l as a 30-day average, with a 7-day average of 4mg/l & a 1-day minimum of 3.5 mg/l

This provides enough oxygen for the survival of larval and juvenile fish found in these areas. The minimum level is enough to prevent lethal effects for the Atlantic and shortnose sturgeon, the latter of which is listed as an endangered species.

DEEP WATER USES

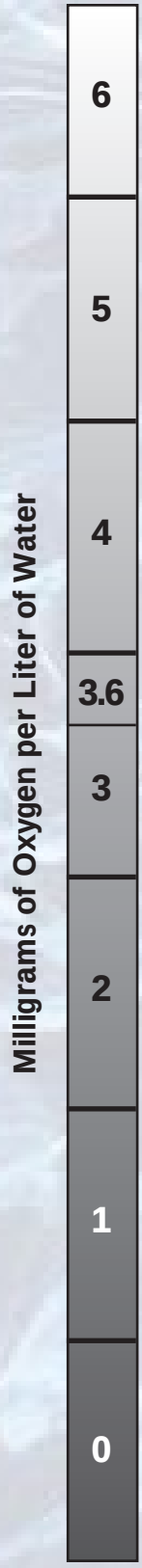
3mg/l as a 30-day average, with a 1-day minimum of 1.7 mg/l. From October through April, the shallow open water use criteria applies.

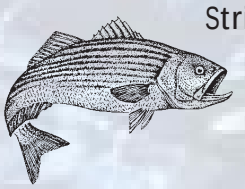
During the summer, these oxygen levels would protect eggs and larvae of bay anchovy, one of the most abundant fish in the Chesapeake and a critical link in the food chain.

DEEP CHANNEL USES

1mg/l from May through September, with an absolute minimum of 0.2 mg/l in areas where a combination of natural factors, such as stratification and circulation create deep holes that trap pockets of water, causing exceedences of the 1-day minimum. From October through April, the shallow/open water use criteria would apply

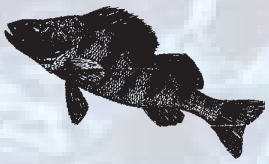
These levels are intended to protect worms and other bottom dwellers that can tolerate low oxygen levels during the summer. In winter, these areas are important foraging areas for blue crabs and finfish that seek refuge in these deeper, warmer waters.

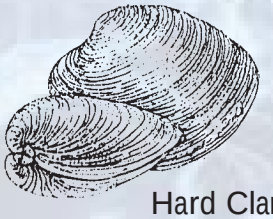



Striped Bass: 5–6


American Shad: 5


White Perch: 5

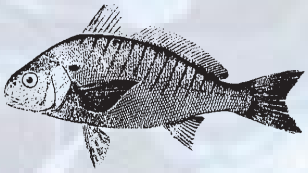

Yellow Perch: 5


Hard Clam: 5


Alewife Juveniles & Adults: 3.6
Alewife Eggs & Larvae: 5


Blue Crab: 3


Bay Anchovy: 3


Spot: 2


Worms: 1

OXYGEN: THE BREATH OF LIFE

Like their terrestrial counterparts, all aquatic life — from worms burrowing in the Bay's bottom to striped bass swimming along the surface — needs oxygen to survive. The amount of oxygen needed varies by time of year and by species, even the life stage of a species; young species tend to be more sensitive to low oxygen conditions than adults. Also important is the duration of periods with low oxygen. Most species can survive short periods of reduced oxygen, but suffer during longer periods.

and where they need it."

It is thought to be the most complex set of water quality criteria developed for any waterbody in the nation. (The designated use for most waters is vague — that they be "fishable and swimmable.") Their development has involved officials from all six states in the Bay watershed and the District of Columbia. "No one," Batiuk said, "has attempted to get agreement by seven jurisdictions to a package of criteria and refined designated uses."

Involving everyone is important because attaining the new "clean Bay" could require massive nutrient and sediments reductions that everyone will have to share.

THE Bay Program estimates that about six to seven times as many nutrients are flushed into the Chesapeake today as what entered when Capt. John Smith explored the estuary in 1607, proclaiming it to be a "faire bay."

With the new criteria, the Bay Program can use its computer models to begin estimating the amount of nutrient and sediment reductions needed to meet them. Preliminary estimates, based on efforts needed to achieve the dissolved oxygen goals, suggest the watershed will need to reduce the amount of nitrogen entering the Bay by more than 100 million pounds from the 300 million estimated to enter the Chesapeake today.

(By comparison, about 360 million pounds of nitrogen were entering the Bay annually when nutrient reduction efforts began in 1987.)

Those are steep reductions, requiring more to be accomplished in the next nine years than was achieved in the past 14.

The system of achieving nutrient reductions will dramatically change as well. EPA officials in meetings have indicated that benchmarks showing steady cleanup progress will likely be required over the next nine years. Otherwise, a TMDL could be imposed sooner. That's a change from the Bay Program's old nutrient reduction goal, in which most of the controls that were implemented took place within the last few years.

A few tributaries are likely to need significantly more reductions than others because of local conditions or because of their impacts on neighboring waterways.

"The habitat goals are based on what we want to achieve," Batiuk said. "Therefore, it is going to drive a tailored set of nutrient and sediment reductions."

He cautioned that while attaining the standards guarantees good water quality, it doesn't guarantee a restored Bay.

The Bay may reach the water quality needed to support grass beds and diverse fish populations, but actually restoring depleted fish and oyster populations may require new fishery management efforts, while bringing back grasses could mean replanting areas where they have been gone for decades, leaving no plants or seeds to reproduce. "But without improved water quality conditions, you cannot get a restored Bay," Batiuk said.

For Fowler, attaining the new goals means waiting until he's 85 to fulfill the vision he's had for decades.

"That's the one dream, one vision, one hope, one prayer I have, that someday I would be able to look down — my eyes will tell me when its right — to see that crystal clear water one more time. But things are going to have to move a little faster."

If it doesn't, Fowler worries that memories of a clean Chesapeake will fade away for everyone. Every day, there are fewer people like himself to remind people about what the Bay used to be like. Eventually, he said, the only memories anyone will have are those of a dirty Bay with depleted fish populations.

"And people will start accepting it for what it is. That's why it is important to keep tightening up on the screws until somebody listens and we get something done."

For Fowler — and the Bay — the ultimate test for the Bay Program will be whether it delivers on its guarantee.

CHLOROPHYLL *a*

Chlorophyll is the pigment that allows plants (including algae) to convert sunlight into organic compounds (photosynthesis). Of the several kinds of chlorophyll, chlorophyll a is the predominant type in algae.

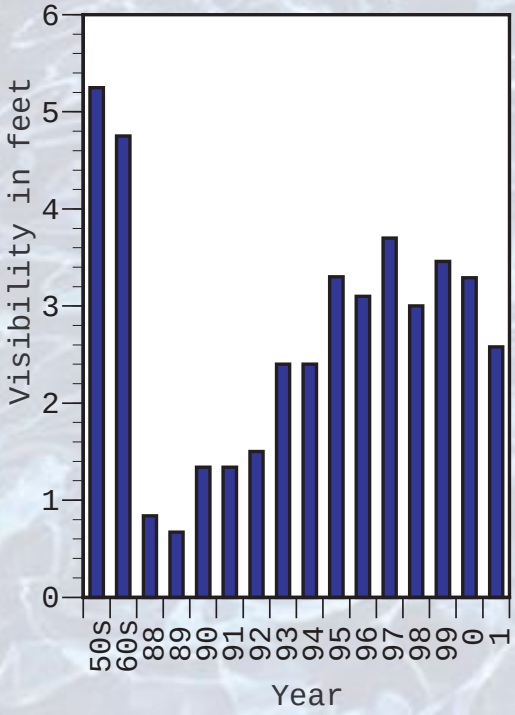
Measuring chlorophyll concentrations in water is a surrogate for an actual measurement of algae biomass, which is far more expensive and time consuming.

Excessive amounts of chlorophyll indicate the presence of blooms. Blooms usually consist of a single species of algae, typically one that is not desirable for consumption by fish and other predators. Unconsumed algae sink to the bottom and decay, depleting deeper water of oxygen.

On the other hand, too little chlorophyll a would mean that not enough "fish food" is available to fuel the food web.

The criteria, which are being refined, will identify seasonal chlorophyll a concentrations for different shallow water and open water areas of the Bay (and areas with varying degrees of salinity) which represent high-quality algae communities that supply adequate food without causing blooms.

BERNIE FOWLER'S WADE-IN



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