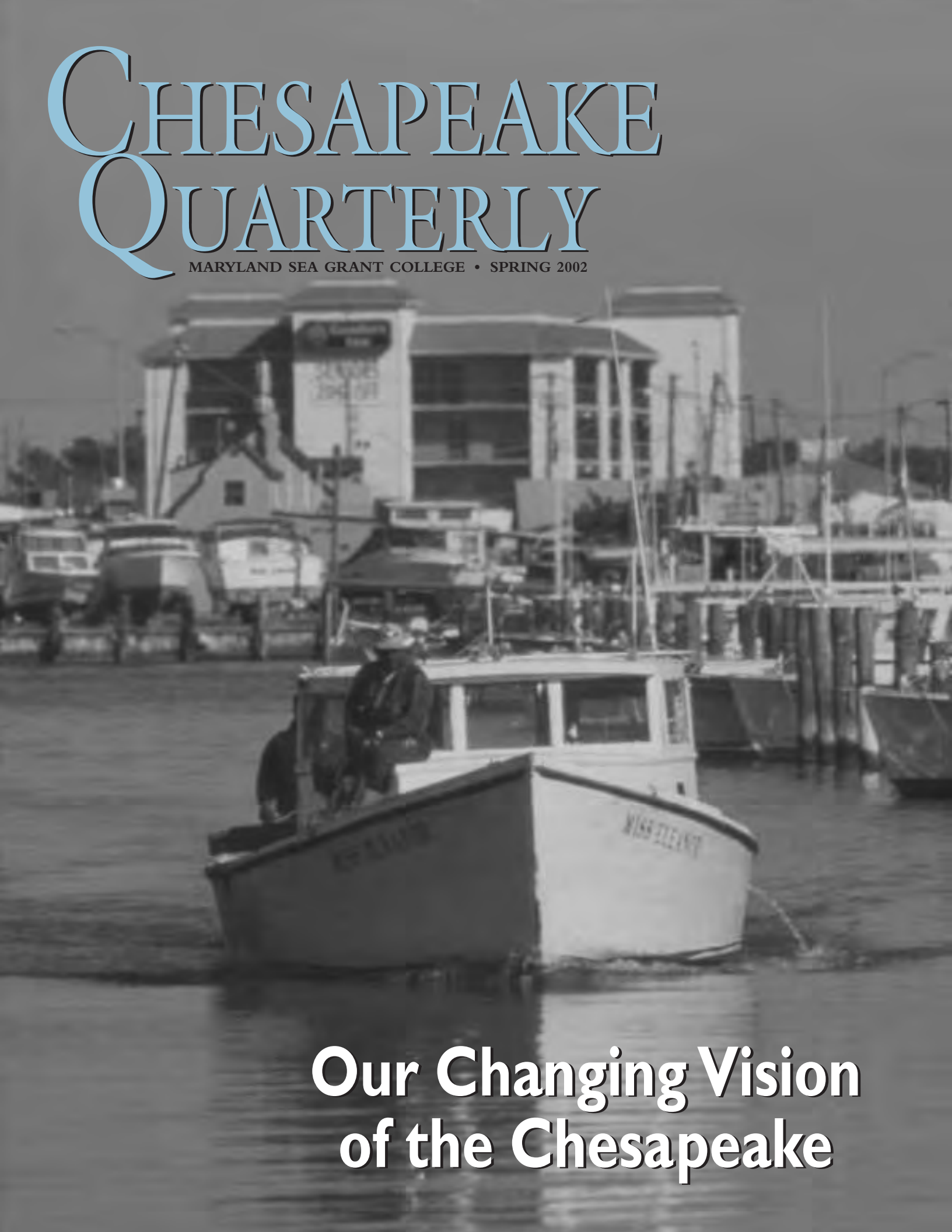

Chesapeake Quarterly

MARYLAND SEA GRANT COLLEGE • SPRING 2002

Our Changing Vision of the Chesapeake

Welcome to Chesapeake Quarterly

SKIP BROWN

In this inaugural issue of *Chesapeake Quarterly* we take a broad look at how attempts at restoring the Chesapeake Bay are faring two decades after the first Baywide study, funded by the U.S. Environmental Protection Agency, documented major threats from overabundant nutrients, noxious sediments and degraded habitats. Drawing on the experiences of several long-time policy experts and scientists, the lead article recalls the early days of the current Bay restoration effort, and takes stock of where some of them think we are now — and where we need to go over the next twenty years.

In our next issue we will pay special tribute to Grace Brush, a prominent Bay scientist who has helped explain what changes have occurred in the estuary, not only during the past several decades, but over the span of centuries. Future issues will include profiles of other marine scientists as we attempt to highlight the lifelong contributions made by a number of dedicated researchers to our understanding of the Chesapeake.

Chesapeake Quarterly replaces *Maryland Marine Notes*, the newsletter on research, education and outreach we produced from 1982-2001. When we first began publishing *Marine Notes*, few publications were available that focused on science and policy issues related to the Bay. Today there is a wealth of material from the EPA Bay Program, NOAA Chesapeake Bay office, the Alliance for the Chesapeake Bay, the Chesapeake Bay Foundation and others. What we bring to this mix, as part of the University System of Maryland, is an academic perspective on research and policy in the Chesapeake region.

In *Chesapeake Quarterly*, we will emphasize what we do best — synthesis and analysis of research and how it is used by managers, politicians, environmental groups and citizens to understand, manage and protect the Chesapeake Bay. This new format will enable us to include articles with more in-depth analysis, as well as higher quality photography and artwork.

The launching of *Chesapeake Quarterly* coincides with Maryland Sea Grant's celebration of twenty-five years of supporting research, education and outreach in the Bay region. As we look forward, we want to thank our many friends and supporters. We send a special note of appreciation to long-time readers of *Maryland Marine Notes*. A recent survey of those readers helped provide us with important guidance for shaping this new periodical, and we are grateful to the many who sent in comments, for their helpful criticism, kind words and encouragement. We hope that they, and all our readers, will enjoy *Chesapeake Quarterly*.

We encourage your observations, criticisms and suggestions, which you can send to us on paper or by e-mail to addresses listed in the masthead. If you have suggestions for articles, we would be delighted to hear them. We look forward to many more years of cooperation and collaboration, and to facilitating the ways in which research informs the process of protection and management of one of our most precious resources, the Chesapeake Bay.

— The Editors

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On the cover: This scene of the Solomons Island harbor reflects the sometimes conflicting commercial and recreational pressures on the Chesapeake — a waterman heads out for a day's catch against the backdrop of a motel where increasing numbers of people come to use the Bay for recreational fishing and boating. PHOTO BY SKIP BROWN.

SKIP BROWN

Twenty Years After
Our Changing Vision of the Chesapeake

Years of research have taught us to better understand what ails the Bay — why does the goal of restoration that we set out to accomplish still remain almost as far out of reach as when we started?

By Jack Greer

Back in the early 1980s a young scientist, rocking in a small skiff in the shallows off the Eastern Shore, stared out at where a wide swath of underwater grasses once blanketed the bottom. "Doggone it," he says, "grasses used to be all over this cove. Now you can't even find a sea grass plant."

These words, uttered with considerable dismay in the 1984 documentary, *Chesapeake: The Twilight Estuary*, were Walter Boynton's. Between the late 1960s, when Boynton began graduate school, and the late 1970s, when he returned as a research scientist to the Chesapeake Biological Laboratory (CBL), part of the University of Maryland Center for Environmental Science, much had happened in the Bay. Underwater grasses, often referred to as SAV (submerged aquatic vegetation), once thick along the Bay's shallow fringe, had begun to disappear. By the end of the 1970s, many of the grass beds Boynton once studied as a summer student were gone.

Today, according to Boynton, in those same coves, "The grasses have still not come back."

For more than twenty years scientists like Boynton, along with natural resource managers, conservationists, watermen and others, have labored to understand changes that have taken place in the Chesapeake system, and especially the causes of sea grass loss. With grasses covering only a fraction of Bay bottom compared with the early 1970s, with oysters and their filtering capacity at dismal levels, and with the inflow of nutrients still way too high, what kind of future does the Bay now face?

Mounting a Noble Charge

Like a flare spotted at sea, the die-off of underwater grasses signaled that the Bay was in trouble.

The response that followed drew from a shift in public attitudes and the rising influence of scientific study of the environment. These twin currents converged in 1975 when the U.S. Congress, thanks largely to the leadership of Maryland's Senator Charles "Mac" Mathias, funded a major study of the Bay, launched by the U.S. Environmental Protection Agency in 1976.

"Up until the EPA studies," says Fran Flanigan, "people always blamed 'Mother Nature.' 'It was a big system.' 'Things

moved in cycles.' After the EPA study, we realized that there were human impacts."

Flanigan, who served as Executive Director of the Alliance for the Chesapeake for some two decades, has spent a career in dialogue with citizens throughout the region. When the first Bay study results began to come in, she remembers, many citizens said, "I didn't realize it was so bad." As Flanigan says, looking back, we had a "knowledge deficit."

Armed with new scientific data and buoyed by a wave of public concern, a movement began to restore the Chesapeake — it did not begin in isolation. Along with increasingly sophisticated science, a number of important and eloquent books had begun to articulate for the public a new understanding of natural systems. For example, Aldo Leopold, in *A Sand County Almanac*, held that land and water possessed their own values, as integral parts of a large, rich and infinitely complex ecological tapestry. And in the Bay region William Warner, Tom Horton and others articulated a deep appreciation for the Chesapeake ecosystem and the water-dependent culture that had evolved on its shores. (See Sidebar, "Learning to Value the Bay.")

On a national scale, landmark works and environmental activism led to rising public awareness of environmental damage, often unwittingly wrought by America's highly industrialized society. In response to this public awakening, the U.S. Congress passed the National Environmental Policy Act (1969) and the Federal Water Pollution Control Act, commonly known as the Clean Water Act (1972), which joined the Air Pollution Control Act (1955) and Clean Air Act (1963, 1970), and other major legislation. The federal government also stepped forward to fund programs like the National Sea Grant College Program (1966) and such agencies as the National Oceanic and Atmospheric Administration (1970) and the Environmental Protection Agency (1970).

The Chesapeake Bay restoration effort began to serve as a model not only for the nation but for the world.

Private organizations, founded by concerned citizens, began to rally public support — in the Bay region, most notably the Chesapeake Bay Foundation (1967) and the Alliance for the Chesapeake Bay (originally the Citizens Program for the Chesapeake Bay, 1971).

Compelling scientific information and growing public support led, in 1983, to the signing of the first Chesapeake Bay Agreement. Backed by state and federal funds, and with commitments made at the highest levels by the governors and legislatures of the Bay states and the head of the U.S. Environmental Protection Agency, the Chesapeake Bay Program was born.

Building on the foundations of the 1983 agreement, the signatories — Maryland, Virginia and Pennsylvania, the District of Columbia, the Chesapeake Bay Commission and, for the Federal government, the U.S. EPA — made their goals more concrete four years later in the 1987 Bay agreement. An explicit nutrient reduction goal called for cutting both nitrogen and phosphorus loads to the Chesapeake by 40 percent relative to the baseline year of 1985.

Key to this new push, says Flanigan, was a concerted effort by scientists and other experts to communicate new findings. "They used maps," she says. "They used a consistent color scheme that helped to the get the point across. For example, *red* was *bad*." Also, Flanigan notes, these maps showed the entire Bay — it got people thinking about the whole estuary, not just the Maryland Bay or the Virginia Bay. As a result of these efforts, she says, people made real progress in understanding how the Bay works.

The story emerged that the Chesapeake system, like estuaries and coastal waters in many parts of the country, had served as a dumping ground for sewage and industrial wastes for more than two centuries. For years, Bay water quality had withstood these onslaughts — often with disastrous results, especially when untreated sewage led to deadly epidemics in growing Bayside communities. But it was not until after World War II that industrial pollution and a proliferation of nutrients began to draw serious attention to the Bay's general demise. By the 1970s, with population rising, with land clearance continuing, with chemical fertilizers in wide use, with more automobiles spewing nitrogen oxides, these assaults on the Bay had finally begun to take their toll.

The new Bay Program, bolstered by efforts of citizen groups like the Alliance for the Chesapeake Bay and the Chesapeake Bay Foundation, focused its efforts on improving water quality by reducing nutrients, especially from waste treatment plants. By reducing nutrients, the experts explained, we would decrease the frequency of light-blocking algal blooms, which shade underwater grasses and feed the rapid consumption of oxygen, especially in deeper waters during warm weather.

With an elaborate committee and subcommittee structure, the Bay Program also worked to address the problem of toxic pollutants in the Bay, as well as land use practices that increase runoff into the estuary, a widespread and recalcitrant problem.

Ann Swanson, Executive Director of the Chesapeake Bay Commission, speaks of that period as a time of "shared hope." The Chesapeake Bay restoration effort, with its multi-state-Federal partnership and its considerable funding — at some $20 million a year in Federal funds alone — began to serve as a model not only for the nation but for the world. At a 1997 coastal seas conference in Stockholm, for example, one international observer commented that there was only one

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Rivers of traffic *flow around and through the region's major urban centers, as seen here on the Washington beltway. The internal combustion engine has brought convenience but also air pollution, including nitrogen oxides that add to the flood of nutrients coursing through the Chesapeake watershed.*

real comprehensive watershed restoration program anywhere, and that was in the Chesapeake Bay.

A Long Hard Road

Then it got complicated.

When asked about the birth of the Chesapeake Bay restoration effort, Senator Mathias once said, "We all thought it [the main culprit] was going to be Bethlehem Steel."

According to Flanigan, "Everything seemed so simple then [in the 1970s]. "More clear cut. Now there is way more gray. Now people are almost deluged [with information]." In many ways, she says, the more we learned the more complicated it became.

The vision of closing off a pipe, or clamping down on a steel plant, began to blur, like a city street on a hot and smoggy summer day.

Complications began with the diffuse nature of nutrients. People asked, Where do these nutrients come from? The answer: From waste treatment plants. From farms. From factories. From urban and suburban runoff. From the air. The public began to realize that almost half of the Bay's watershed is drained by the Susquehanna River, a major source of nutrients flowing into the Chesapeake.

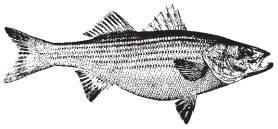
Even toxic compounds, once associated directly with industrial discharges, had become part of a diffuse mix of sediments and particles eroded from urban and suburban sites, and from the shifting bottom of the Bay itself.

Nearly twenty years after the comprehensive Bay study and the signing of the first Bay agreement, underwater grasses have still not rebounded, bottom waters frequently remain oxygen-poor, and oyster populations have hit all-time lows. (See sidebar, "Disease: An Unexpected Curve.")

Adding to the current challenge is a population that continues to increase. The Bay watershed, reaching from Tidewater Virginia to the northern hills of Pennsylvania and New York, has become home to more than 15 million people, and that population is projected to reach nearly 19 million by 2030. Population growth brings the likelihood of even greater clearing of forests, paving over of soils, increased runoff and inevitable waste products. Even more alarming are trends that show vehicle use and land consumption expanding at rates even higher than population growth.

At the same time, according to Flanigan, many feel that the Bay restoration effort has become mired in a "big bureaucracy." Whether or not they blame that bureaucracy for lack of progress is hard to say, but focus groups staged by the Alliance for the Chesapeake Bay and Maryland Sea Grant several years ago suggest that the public has a fairly vague understanding of the large governmental initiatives set in place to reverse the decline of water quality in the Chesapeake.

Learning to Value the Bay



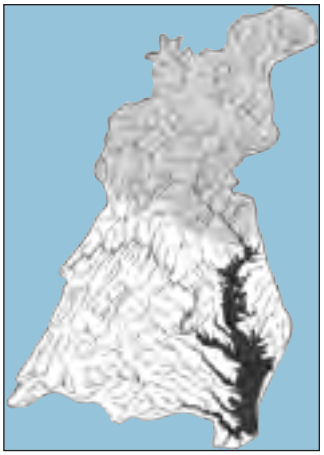
There is no question that our views of the Chesapeake Bay, and of nature in general, continually shift over time, moving through cycles of political and cultural change. Consider, for example, two excerpts, written at opposite ends of the Twentieth Century. The first comes from the 1923 edition of Swepson Earle's *The Chesapeake Bay Country*: "I think it very desirable that the attention of present and future generations be called to the thousands of acres of fertile lands with picturesque building sites awaiting the coming of those who wish to find homes in this delightful part of our country."

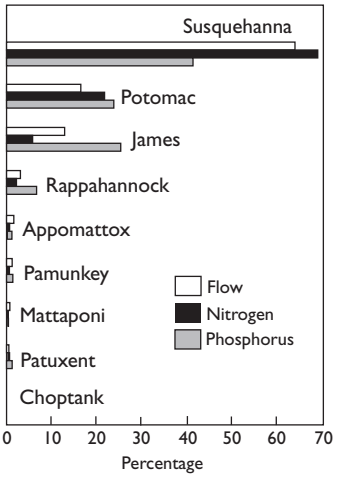
The second passage, published in 1987, comes from Tom Horton's similarly titled book, *Bay Country:* "We bay dwellers move in a far richer and more extensive matrix of subtle relations and ancient connections with nature than we can yet explain or admit. Often we sense it . . . in the vague, pleasurable homecoming we feel amid particular unchanged landscapes; and in the quick, secret dismay we feel, watching the legal rights of private property development overwhelm the rights of the forest and its wildlife."

Such passages trace a conspicuous swing between visions of the Bay as a place primarily for human habitation, a perspective Captain John Smith would have recognized, and the Bay as a place of natural mystery, a perspective Henry David Thoreau would have found familiar.

Part of this appreciation derives from a predictable nostalgia. Beyond a wistful wishing for the past, though, lies a more profound shift in sentiment.

Aldo Leopold, following a tradition launched in Europe in the nineteenth century and most notably in America with the writings of Emerson and Thoreau, helped to articulate in *Sand County Almanac* (1949) in a more modern, more technically savvy context, the value of the natural world. Rachel Carson's *Silent Spring* (1962) focused national attention on the threat of contaminants in the environment, and largely galvanized the modern environmental movement. Annie Dillard and William Warner, whose books *Pilgrim at Tinker Creek* (1974) and *Beautiful Swimmers* (1976) each won a Pulitzer Prize, shared intimate glimpses of the Blue Ridge and the Bay. These and other works articulate the ways in which we have come to value nature and the Chesapeake.





The largest river lying entirely within U.S. borders that empties into the Atlantic Ocean, the Susquehanna (covering the area shown in grey on the map) drains more than 40 percent of the Chesapeake Bay watershed. Though flows change from year to year, depending on rain and snowfall, the Susquehanna consistently delivers far more fresh water — and more nutrients — than any other river in the watershed. The bar graph shows the relative contributions based on representative data from the early 1990s. Graph adapted from the original in the U.S. Department of the Interior U.S. Geological Survey Fact Sheet FS-055-95.

"Haven't we *done* the Bay?" is an attitude that at times confronts Flanigan. "They didn't know it was going to get so complicated," she says.

For example, she senses that while many citizens now generally understand that the Bay is an ecosystem, they have difficulty grasping that their personal impact makes a real difference.

Getting people to focus on their own behaviors is going to be "terribly hard," Flanigan says. "It's easy to say, 'Don't drill in Alaska,' but will we cut down on our drive time in Maryland?" she asks. "It is amazing the standard of living we take for granted in this country," she adds. "We don't want to let go of that."

In 1982 there was "a sense of newness, a spirit of challenge" in the Chesapeake region, says Ann Swanson. People didn't "put up their hackles" at new laws, such as the Critical Area Law, for example, a law intended to protect a 1,000-foot buffer around Maryland's tidal shoreline. In many ways the Critical Area law may have gone forward, she says, because people didn't realize what it would mean to them, how hard it would be to give up some rights on their own property.

Twenty years ago, says Swanson, we had the naïve sense that you could turn the Bay around, "without too much money, without too many laws." Now, she says, people are asking, "Can it be done?"

The Evolving Role of Science

Can the scientific approach that first documented the damage done to the Bay help light the way for its recovery? Research efforts over this quarter century have been intense, far-ranging and impressive on many fronts — and they have taught us to see and understand the Chesapeake in ways we could not have conceived in 1976.

Consider the disappearance of the Bay's vast meadows of underwater grasses. It may be difficult to remember, twenty years later, that originally the primary suspect in their demise was toxic chemicals, either from large industries (one thinks of Bethlehem Steel) or from pesticides and especially herbicides used in agriculture.

Looking back now, it may seem obvious that the major culprit was nutrients and sediments — and especially nutrients. But remember that early on many felt that nutrients simply would not pose the kind of threat to an open estuary like the Chesapeake that they did in enclosed lakes, in the Midwest, for example.

Now an overabundance of nutrients is generally understood to constitute a major problem not only in the Chesapeake, but in coastal waters throughout the world. Researchers like Walter Boynton point out that while year-to-year variations in dissolved oxygen levels may correlate closely with wet years and dry years, the long-term trend is not tied to these variations but rather to a continuing increase in nutrients over the last fifty years. The real problem, he says, is this continuing increase in nutrients.

Convincing natural resource managers and political leaders that nutrients largely fueled the Bay's decline was not easy in the beginning.

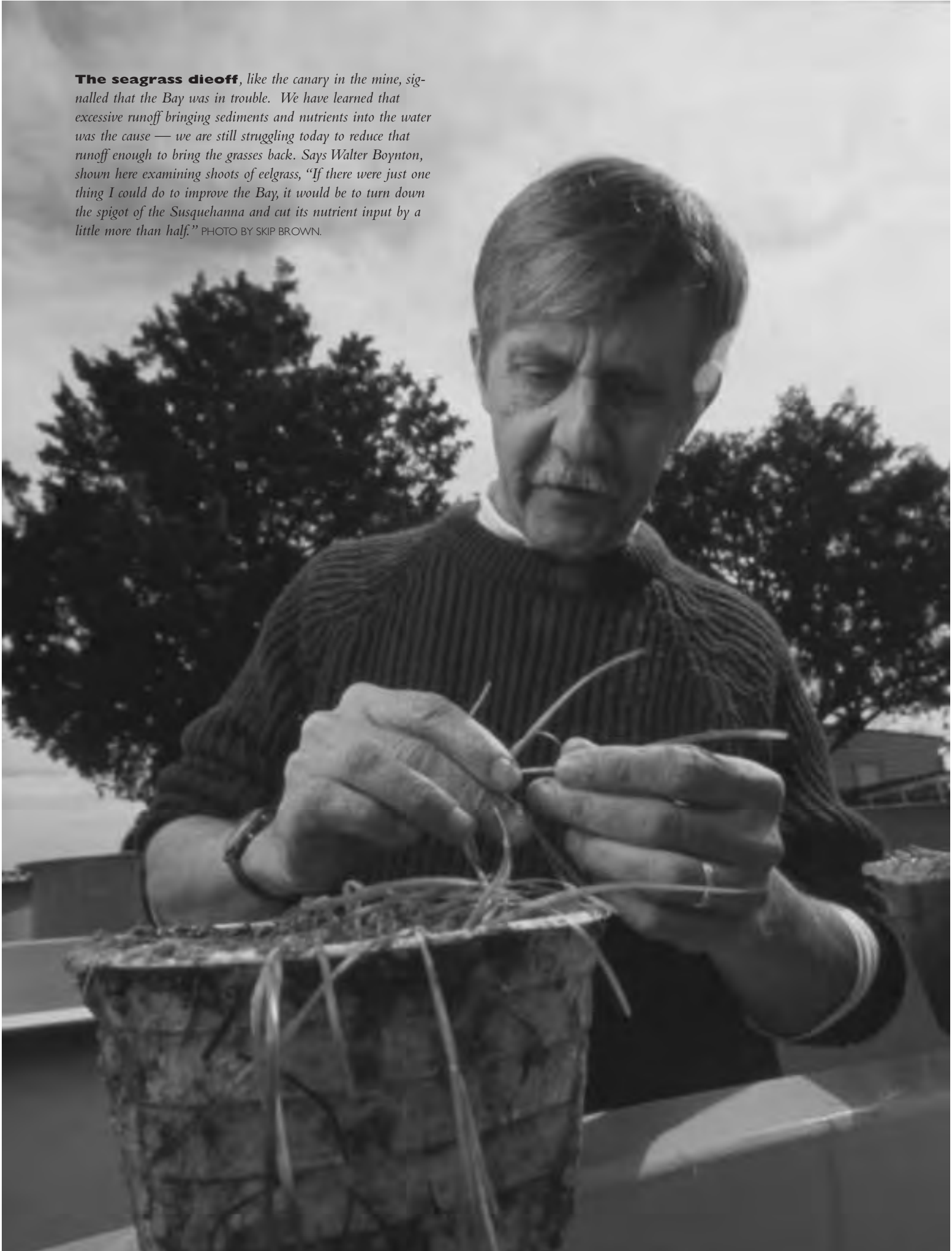
Boynton refers to researchers, like Chris D'Elia, Jim Sanders, and especially Don Heinle, at CBL from 1963 to 1980, who were there at the beginning of a sea change in scientific understanding. "At that time," Boynton says, "the state used to think, 'the more nutrients the better.' If you said anything was wrong with the Bay you were a traitor. It was like being accused of biting the hand that feeds you."

"People would ask, 'Is the Bay really worse? Are grasses really down? How do we know?' " It took a long time for many, he says, including those in the management community, to admit that there was a problem.

"We were twenty years dumber then," Boynton says.

Even after research and monitoring had clearly shown that something was wrong with the Bay, many still thought that "the only problem was point sources," says Boynton, especially discharges from industry and waste treatment plants. Then, as studies began to document that nutrient loading from a range of sources was causing declines in water quality, a debate raged over whether nitrogen or phosphorus lay at the root of those declines. "This was not the same kind of denial," Boynton says, "but more like a tactical argument over the facts."

The management community was



The seagrass dieoff, *like the canary in the mine, signalled that the Bay was in trouble. We have learned that excessive runoff bringing sediments and nutrients into the water was the cause — we are still struggling today to reduce that runoff enough to bring the grasses back. Says Walter Boynton, shown here examining shoots of eelgrass, "If there were just one thing I could do to improve the Bay, it would be to turn down the spigot of the Susquehanna and cut its nutrient input by a little more than half."* PHOTO BY SKIP BROWN.

Disease: An Unexpected Curve

One thing the signers of the 1983 Bay Agreement could not have foreseen was the reappearance, with a vengeance, of a scourge that had first struck the Bay 25 years earlier.

During the 1950s, first in Delaware Bay, then in Chesapeake Bay, a mysterious disease appeared, killing thousands and millions of oysters in its path. The nefarious parasite was named MSX (for multinucleated spheres unknown), a moniker as mysterious as its biology.

Now known as a haplosporidian (*Haplosporidium nelsoni*), the parasite has been genetically analyzed, and work by researchers at the Virginia Institute of Marine Science suggests that it is associated with the Japanese oyster, *Crassostrea gigas*, and probably arrived when experimental populations of the foreign oyster were brought to the Mid-Atlantic region in the 1950s.

The appearance of this puzzling oyster disease threw managers, focused on cleaning up "pollution" and restoring oysters, a wicked curve. Many conservationists pointed to environmental factors, such as toxic compounds in the water, that could be stressing the oysters and making them vulnerable to disease. Why else, after thousands of years of thriving in the Bay, would they suddenly begin to die?

While toxic compounds may indeed stress oysters, their doom likely shares less with oil-coated birds than with the American chestnut tree. Like the oyster, the chestnut was plentiful in the region, comprising, according to some estimates, about one-third of many forested areas in parts of the Bay watershed. Also like the reef-building oyster, the chestnut played a key ecological role in the region's biological infrastructure, acting as a dominant source of nuts or "mast" for squirrels and other foraging animals.

Then, like MSX, the chestnut blight arrived, introduced from Asia. Now, with the coming of warm weather, small oyster spat appear in the Bay and small chestnut shoots appear in the forests. When they reach a certain size, whether spat or shoot, waiting disease strikes them down. How long will it be before current scientific breakthroughs — perhaps with help from nature — devise a way around these two diseases, one of the forest, one of the estuary, both of devastating effect?

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Population growth *brings with it new roads and new houses and more clearing of land and runoff of soil. Essential to the future of the region will be protecting ecologically important lands that are left, especially near streams, creeks and the Chesapeake Bay.*

becoming more sophisticated, he says, and the scientists had much better data.

Michael Kemp, Boynton's long-time research associate at UMCES, agrees that the acceptance of science by management agencies took time. "We both came out of graduate school thinking that science should help guide policy. But then maybe we were a bit too cocky too," he says.

"About fifteen years ago, there were some impediments," Kemp says. "Managers and scientists and others all have their different cultures, their different reward systems."

It was frustrating, Kemp says, that the 1987 Bay agreement, which called for a 40 percent reduction in nutrients, made no real mention of Bay grasses. "We had discovered much about SAV," he says, "and that was not being captured."

That has all changed. The Chesapeake 2000 agreement explicitly names SAV as an indicator of Bay health and lists water quality criteria necessary to bring the grasses back. Those criteria — for dissolved oxygen, chlorophyll and water clarity — are the result of continuing research and monitoring efforts during the past decade and more, and from an improved level of information exchange between researchers and managers.

"Communication," Kemp says, "has grown enormously over the last decade."

What made the difference? He and Boynton both point to a number of factors. Key was the gathering of large amounts of scientific data over numbers of years, and critical to that was the availability of (mostly federal) research funds. "It's a lot easier to be cooperative with others when you're not starving to death," says Boynton.

Kemp credits scientists and managers coming to understand each other better, to "sharing beers" and "building trust." "We've all grown up with these problems," Kemp says. "There has been a maturation of the whole community — managers, oceanographers, experts in the physical, chemical and biological sciences. It's been very rewarding for me," Kemp says. "There has been a convergence." And, he adds, "We've mellowed."

The Bay Program's inclusive committee structure has created opportunities for communication, he says. Scientists and managers also mix at professional meetings, like the Estuarine Research Federation and, Boynton points out, many managers — including Maryland DNR's Rob Magnien, Paul Masicott, Dave Goshorn, and EPA's Rich Batiuk, as well as many others — came up through academic research programs. "There is a sophisticated group of managers now," Boynton says. Some of Kemp's former students, like the Chesapeake Bay Foundation's

"We had the naïve sense that you could turn the Bay around without too much money, without too many laws." Now we are asking, "Can it be done?"

Bill Goldsborough, have become leaders in the Bay community.

There have also been important efforts at bridge building, says Boynton, through Sea Grant and the Alliance for the Chesapeake Bay, and the Chesapeake Bay Foundation. "All have been contributing to a joint effort," he says. He singles out Tom Wisner, an early Bay educator, and Tom Horton, who has often shuttled back and forth among scientists and managers and environmentalists, helping to increase understanding among those groups.

While better understanding has come only with effort, and while Flanigan and others point out that for many in the political arena, the complexity of the Bay's problems seems greater than they originally thought, for Kemp this is not really surprising. "It's the job of an ecologist to think the world is complicated," he says.

"We have learned a lot," Kemp says. "We may not have the holy grail, but the process is working."

Clearly, the twin currents of public opinion and scientific knowledge have reshaped the way we think about the Chesapeake Bay. As well documented by Steven Davison and his co-authors in their book *Chesapeake Waters*, the Bay was originally perceived as a limitless source of seafood and a bottomless pit for sewage and other wastes. Gradually these two uses came into conflict, and science began to document how human waste can lead to disease. When an 1893 typhoid case was linked to tainted oysters, it caused an international uproar; in 1912 concerns over contaminated seafood led to the building of Baltimore's Back River waste treatment

Thinking Big, Thinking New

Concrete Actions to Foster Change

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Despite model results that suggest a 15 percent reduction in nitrogen entering the estuary between 1985-2000, monitoring data from the Bay's largest tributaries in 2001 revealed no discernable trends in nutrient loads. According to the 2001 Annual Report from the Chesapeake Bay Commission: "New analyses showed that a doubling, if not tripling, of current nutrient control efforts is needed to reach the C2K [Chesapeake 2000] goals. Roughly translated, restoring a 'clean Bay' will require reducing an additional 120 million pounds of nitrogen in the next decade , above and beyond the nearly 50 million pound reduction achieved over the past two decades. Clearly , business as usual will not work."

In order to make a real impact on reducing the flow of nutrients into the Bay, we will have to think big, both on the supply side (sources of nutrients) and on the demand side (uptake of nutrients).

Supply Side

- Continuing implementation of biological nutrient reduction (BNR) at wastewater treatment plants throughout the watershed. (The Chesapeake Bay Program predicts that by 2003, almost 100 major municipal wastewater treatment facilities will have BNR , treating about 63% of the wastewater flow in the region.)
- Full implementation of nutrient management plans on virtually all farmland in the watershed. (According to the Chesapeake Bay Commission, only 35 percent of the Bay's agricultural lands are currently under nutrient management.)
- Aggressive installation of limited impact development (LID) and stormwater control techniques, including rain gardens, wet and dry retention ponds, grassed waterways, rain barrels and porous driveways.

Demand Side

- Cover crops on farmland to take up nutrients before they can leave the farm field.
- Extensive underwater grass beds that, like cover crops, can take up nutrients in the water, and perhaps out-compete algae for nitrogen and phosphorus.
- Large oyster reef systems that will increase not only the filtering capacity of oysters, but also of all the many organisms that make their homes on reef structures, from barnacles to anemones to sea squirts.

Large-scale projects already underway, such as the breaking up of Baltimore's Memorial Stadium — about 10,000 cubic yards of it — for planting on the Gale's Lump oyster bar, point the way toward bold new efforts to make a real difference.

With the new criteria for Bay water quality detailed in the Chesapeake 2000 Agreement the focus will finally fall on outcomes: more oxygen, less algae and clearer water. It will take all we can do on both the supply and demand side to make the water clear again.

Changing our vision *of Bay restoration over the next twenty years may well call for scientific knowledge and action to become even more closely linked. Achieving restoration goals will also require a political and social willingness from all of us to accept responsibility for environmental stewardship.* PHOTO BY SKIP BROWN.

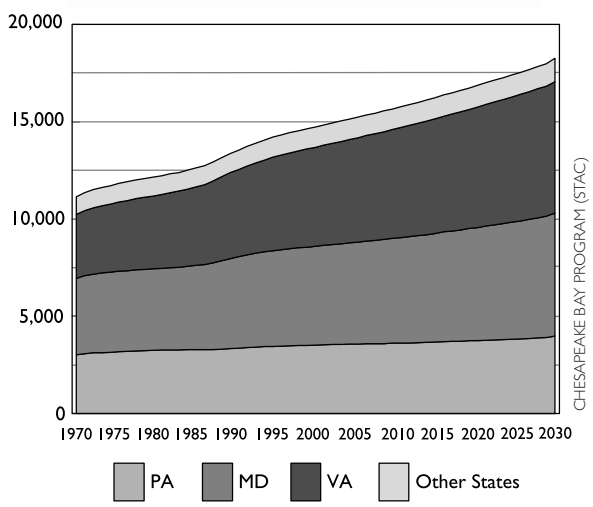
plant, state of the art for that time.

Then a more serious outbreak of typhoid in 1924 — resulting in 1,500 cases and 150 deaths and also linked to contaminated oysters — demonstrated once and for all that discharging sewage and harvesting seafood represented conflicting uses of the estuary. Washington D.C. built a sewage treatment system in the 1930s, and Norfolk finally followed in the 1950s.

Even after the heightened concern for seafood safety led to significant improvements in waste treatment in the Bay, for many years oysters and other Bay species remained "resources," put there to be harvested and used by humans. Only within the past decade or two have we begun to realize the extent to which oysters, like other keystone species, play a central role in the ecological functioning of the Bay. We are now beginning to understand, for example, that in losing such immense populations of oysters, we lost their once prodigious ability to filter from the water overabundant algae — and therefore nutrients. Those extensive oyster reefs may also have served as important breakwaters, buffers for wave action that slowed the eroding of shoreline and the scouring of sea grass beds.

After extensive study of the origin of the Bay's ills, it has become abundantly clear that one factor with an enormous effect on the estuary is the colony of human beings that has grown up throughout its watershed. As John Wennersten writes in *The Chesapeake Bay: An Environmental Biography*, "Of the 2,700 swimming, floating, and flying species that the bay supports, the most nettlesome by far is *Homo sapiens*." While continuing restoration efforts will focus on the biology of Bay organisms and the chemistry of water quality, the next major push must be to resolve how we as a people can lessen our impacts on the entire watershed and reverse the declines of the last half century.

Projected Growth in Population Chesapeake Bay Watershed, 1970-2030



Tomorrow's Bay: The Next Twenty Years

According to Fran Flanigan, this next step will need to be a "quantum leap." She emphasizes how hard it will be to do, pointing out that while policies can restrict emissions from industries through laws, permits and other regulations, it will prove extremely difficult to direct people's individual and collective behaviors — especially if people don't want to be directed. This will be particularly hard if people are not convinced by the scientific evidence at hand.

The laws we passed and the progress we've made, Flanigan says, relied on the scientific evidence — we had to make a case. In those instances, she says, "We had the knowledge."

Flanigan's statement matches views expressed by the authors of *Chesapeake Waters*, who write that it is our "limited scientific and technical capabilities . . . rather than any fundamental bounds in statutory authority" that often stymie pollution prevention legislation.

In the next phase of the Bay restoration effort, it may well be that knowledge and action will need to become even more closely linked, and may need to develop together. For example, while there is a growing sense that oyster reef and grass bed restoration in some areas may have to go hand-in-hand, the degree to which this is true can only be borne out by active building of reefs and planting of grasses on the one hand and careful scientific analysis of the results on the other.

As Walter Boynton notes, we will have to track not only the successes but the failures and determine what went wrong.

Joining such scientific advances — and building on strong links between research and management — are the great social and political challenges inherent in "revisioning" Bay restoration. Central to any next big step will be the role of political leaders, says Flanigan, those who are able to "listen" to the grassroots and to the experts, and who can at the same time provide the leadership to articulate the kind of vision that makes things happen.

Flanigan, Boynton and others agree that a key to the initial success of the Bay restoration effort was the early leadership of pivotal Bay leaders, including former Senator Mathias, former Maryland governor Harry Hughes, and former state senators Bernie Fowler (Maryland) and Joe Gartland (Virginia), among others.

All were important in promoting the changes in public support that have occurred over the past two decades.

The attitude became, says Boynton, "We've got some problems. Let's fix them."

"It was all these leaders together," Flanigan says, "and no one individual," though she does credit Harry Hughes with reaching out to the governors of Pennsylvania and Virginia, and playing a key coordinating role in the original 1983 Bay Agreement.

Now Flanigan worries that the Bay has become a "political issue" in the worst sense. Especially during the 1990s, she fears that the Bay became part of a partisan debate, whereas before it had been broadly nonpartisan. For her this turn of events represents "a great sadness."

Still, the important Bay laws haven't "gone away," Flanigan notes. "These laws [the Critical Area law, the phosphate ban, the tree conservation law] have lasted because they were the right thing to do," she says.

The right thing to do this time around will not prove easy. In some ways, says Flanigan, we are "back to where we were in 1980," and, she adds, if anything it will be harder from here on. "We have already gathered the low-hanging fruit," she says, and she fears that we may be "stuck in implementation gear."

Ann Swanson stresses that what is needed to "catalyze action" is an infusion of money, a new signal of interest at the federal level. "There simply is not enough funding," she says, "going into innovations such as limited impact development." She points to the important work of innovators like Larry Coffman in Prince Georges County, who have advocated new tools for slowing urban and suburban runoff. "Efforts like that need adequate resources," she says. "The Chesapeake Bay Program started because of interest and money," Swanson says. Some 13 federal agencies were involved, with others signing on over time. To provide the next level of environmental cleanup for the Chesapeake will, according to estimates by the Chesapeake Bay Foundation, require some $8.5 billion. But money can only go so far.

The Chesapeake 2000 agreement, the latest and most comprehensive Bay agreement, sets ambitious goals for land preservation, for the restoration of water quality, for the enhancement of fisheries. Reaching those goals will require not only political leadership but also a strong stewardship ethic and considerable courage.

One thing is certain. We will have to think big.

"We have to pursue restoration at a scale that makes a difference," says Boynton. "Too often we've been trying little dippy things. We need to do it big, and to measure hard while

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we're doing it. Dippy is not restoration."

Small plantings of sea grasses won't do, nor will small oyster reefs. The Bay needs large-scale restoration efforts, employing the kind of energy and ingenuity that built the Hoover Dam and tamed the Mississippi River. And while changes on a massive scale may seem unrealistic, consider that many worried that the banning of DDT, PCBs and unleaded gasoline — major controversial issues at the time — would each spell disaster for various sectors of the economy. Those threats did not materialize, and few would now question that the cost was worth the environmental gain.

Maryland has demonstrated national leadership in instituting new programs aimed at improving the environment. From the Critical Area law to smart growth, the state was among the first to pass legislation aimed at reducing the impact of land development; it has also implemented goals for telecommuting in order to reduce congestion and pollution. For the next "quantum leap," the Chesapeake Bay Foundation and others have pointed to efforts elsewhere as models, for example, the huge undertaking now underway in Florida to restore the Everglades, with $7.8 billion in Federal support.

Other states have stepped out in front on transportation issues — in California auto makers are required to produce 4,450 zero emission vehicles (ZEMs) beginning with 2003 models. Programs like these require that we reconceptualize our individual roles and change long-established habits — to carry out such visions will require a recommitment, a political and social willingness, and beneath that an ethic that includes an acceptance of responsibility for environmental stewardship.

Swanson believes that it will be the citizens who decide whether or not to support, through their taxes and donations, the restoration of the Chesapeake. It will be those same citizens, says Swanson, who, through their voluntary efforts and their lifestyle choices, will determine whether or not we will be able to bring back the bounty of the Chesapeake. "If all we can do is just hold the line," she asks, "what will that say to the world, to all those who have looked to the Bay as a model?"

Reading

Chesapeake Waters: Four Centuries of Controversy, Concern, and Legislation. Steven G. Davison, Jay G. Merwin, Jr., John Capper, Garrett Power, and Frank R. Shivers, Jr. Second Edition. Centreville, Maryland: Tidewater Publishers, 1983, 1997.

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Life and Death of the Chesapeake Bay. J.R. Schubel. College Park: Maryland Sea Grant College, 1986.

Turning the Tide. Tom Horton and William Eichbaum. Washington, DC: Island Press, 1991, 2002.

Web

EPA Chesapeake Bay Program
www.chesapeakebay.net

NOAA Chesapeake Bay Office
noaa.chesapeakebay.net

Alliance for the Chesapeake
www.acb-online.org

Maryland Sea Grant
www.mdsg.umd.edu

Maryland Department of the Environment
www.mde.state.md.us

Maryland Department of Natural Resources
www.dnr.state.md.us

Chesapeake Bay Foundation
www.cbf.org

Bay Journal
www.bayjournal.com

Four Maryland Students Receive Knauss Fellowships

Four University of Maryland graduate students, one in the Conservation Biology program and three in the Marine-Estuarine-Environmental Science (MEES) program, are recipients of Knauss Marine Policy Fellowships for 2002. Aleria Jensen is in the Conservation Biology program; David Scheurer, Stacy Swartwood and Lynn Takata are in the MEES program. The fellowship program, begun in 1979 and coordinated by the National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant Office, provides graduate students across the country with an opportunity to spend a year working with policy and science experts in Washington, D.C.

Aleria Jensen will spend her fellowship year in NOAA's National Marine Fisheries Service's Office of Protected Resources, Marine Mammal Division, under Division Chief Donna Wieting. She will work on large whale conservation and recovery management issues, focusing primarily on the North Atlantic Right whale. She will also help produce marine mammal outreach materials for the public. Jensen received her B.S. degree in biology and Russian from Macalester College in 1994. She spent the next several years working as a naturalist and educator for a marine conservation organization in Hawaii and for several ecotourism companies in Alaska. In 1999, she enrolled in the Sustainable Development and Conservation Biology graduate program at the University of Maryland and received her M.S. degree in May 2001.

David Scheurer will work at the Center for Sponsored Coastal Ocean Research in NOAA's National Ocean Service in the Center. His focus will be an ongoing Gulf of Maine ECOHAB and GLOBEC initiatives project to transition research models to operational science-based policy tools. Scheurer received his B.S. degree in marine biology from Florida Institute of Technology in 1990. After graduation, he was a research assistant at the Wilmer Eye Institute in Baltimore and also finished an M.A. degree in environmental science at Johns Hopkins University in 1995. His coursework focused on policy issues related to the Chesapeake Bay. Scheurer next entered the MEES program to pursue a Ph.D. in ecology; he is currently working on his dissertation. His doctoral work involved using a spatially-explicit ecosystem model to investigate the relative importance of physical and biological processes in controlling and maintaining spatial patterns in pelagic environments.

Stacy Swartwood will be located at EPA's Office of Wetlands, Oceans, and Watersheds in the Wetlands Division. Her work will focus on the incorporation of wetland and water issues into smart growth planning and strategies for state wetland programs. Swartwood earned a B.A. in biology from the University of North Carolina at Chapel Hill. After graduation she worked for a public health consulting firm on a USAID family planning project, then became an independent consultant. She enrolled in the MEES program in 1999 and did her research on mangrove and salt marsh model ecosystems under the direction of Patrick Kangas. Stacy was a graduate assistant in the College of Life Science's Office of International Programs, then spent 2001 as a research assistant at Maryland Sea Grant College. She is currently writing her thesis and plans to graduate this December.

Lynn Takata will work in NOAA's National Ocean Service, with the National Marine Sanctuary Program's Scientific Support Team. During the year, she will help design and implement a sanctuary-wide scientific monitoring program and assist with the Baja to Bering expedition — a scientific cruise running through west coast sanctuaries. Lynn completed her B.S. in biology at the University of California, San Diego in 1995. She spent a year in the AmeriCorps in Northern California, working on salmon population surveys and environmental education. She moved to Maryland in 1997 to work with the Smithsonian Environmental Research Center's Marine Invasions group, where she helped with studies on the ecology of invasive marine organisms. In 1999, she entered the MEES program, where David Secor directs her research on comparing recruitment and growth patterns of young bluefish that use different Maryland nursery habitats. She plans to complete her thesis this fall.

Knauss Fellowships run from February 1 to January 31 and pay a stipend of $32,000. They are awarded with the help of Sea Grant programs across the nation. The application deadline for the Knauss Fellowship program is April 1 of the year preceding the fellowship year. For more information, visit the fellowship web site at Maryland, www.mdsg.umd.edu/Policy/knauss.html, or at the National Sea Grant office, www.nsgo.seagrant.org/Knauss.html. Those interested in applying for a fellowship for 2004 should contact Susan Leet directly at the Maryland Sea Grant office, 0112 Skinner Hall, University of Maryland, College Park, phone 301.405. 6375, fax 301.314.9581, e-mail leet@mdsg.umd.edu.

Maryland Sea Grant Celebrates 25th Year

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This year the Maryland Sea Grant College is celebrating 25 years of research, education and outreach focused on coastal issues, and especially the Chesapeake Bay. Established on the College Park Campus in 1977, Sea Grant has supported marine-related science and education throughout the University System of Maryland and beyond. In 1982, the U.S. Secretary of Commerce, in accordance with the National Sea Grant College Program Act, named the University of Maryland a Sea Grant College, in recognition of its outstanding programs in marine-related research, education and outreach.

One of thirty such marine programs around the country, Maryland Sea Grant helps to draw the very best academic talent to issues of critical importance to those who live, work and play in the Chesapeake watershed and along the coast. In so doing, Sea Grant has helped to serve as a bridge between the public and the intellectual resources available throughout the university community. Maryland Sea Grant is administered by the University of Maryland Center for Environmental Science, the University's premier system of marine and environmental laboratories, in partnership with the University of Maryland College Park and the University System of Maryland. The program serves academic and research institutions statewide.

During its 25-year history, Maryland Sea Grant has funded groundbreaking work on the mechanisms that support living resources in the Chesapeake Bay, including the study of food web dynamics, dissolved oxygen processes and the movement of nutrients through the ecosystem. Of equal significance, Sea Grant has supported critical research on the Chesapeake's commercially important fish and shellfish, especially oysters, blue crabs and striped bass. The program has served as a catalyst for the development of innovative new technologies, ranging from biotechnology to aquaculture.

Linked to the research program, Maryland Sea Grant has forged a strong partnership with Maryland Cooperative Extension and various research laboratories to provide Sea Grant Extension programming to constituents statewide. Innovative programs in aquaculture, seafood technology, water quality and marine education form a tangible bridge between the resources the University provides and the constituencies it serves.

In addition, Maryland Sea Grant's outreach effort includes an extensive communications program that produces a wide range of products for various audiences. These include technical information such as reprints of peer-reviewed journal articles, scientific syntheses and book-length works to a number of award-winning videos and popular educational materials. Science documentaries such as *Chesapeake: The Twilight Estuary* have become classics in their own right, and are used by schools to teach the fundamentals of Bay ecology. Maryland Sea Grant has also published important texts including *The Eastern Oyster* and *Oxygen Dynamics in the Chesapeake Bay* — both are considered definitive references.

Popular books such as *Working the Chesapeake* or *A Bayside Guide to Weather* help describe how watermen still make a living from the water, drawing on generations of experience, and how weather shapes our seasonal activities on the Bay. Through fact sheets, educational briefs, web sites and newsletters such as *Maryland Marine Notes* — and now *Chesapeake Quarterly* — Maryland Sea Grant continues to provide useful information on marine science and policy to a broad and sophisticated audience.

In the years ahead Maryland Sea Grant will pursue its role as both a catalyst for new thinking and a connection among diverse stakeholders. Sea Grant's focus will remain squarely on issues central to the health, protection and wise use of Maryland's coastal waters.

NOAA Awards Funds to Maryland Sea Grant

The University of Maryland Sea Grant College received a $1.4 million award for February 2002 to January 2003 from the National Oceanic and Atmospheric Administration to support scientific research and education focused on the Chesapeake Bay.

Together with $800,000 in matching funds from the state of Maryland, Maryland Sea Grant will support forward-thinking Chesapeake Bay research, outreach and education projects throughout the state.

"This year," says Sea Grant director Jonathan Kramer, "we are supporting eight major research projects that address critical issues in the Chesapeake, namely the rebuilding of oyster reefs, the rehabilitation of underwater grasses, the protection of blue crab populations and improving water quality. These projects will go a long way toward helping management agencies and others as they work to reverse the declines we have seen over the last several decades."

For a list of research projects funded by Maryland Sea Grant, visit the web at www.mdsg.umd.edu/Research/current.html or call the College Park office at 301.405.6371.

Remote Sensing in the Chesapeake Bay

Maryland Sea Grant helped initiate a program in partnership with the NOAA Chesapeake Bay Office and NASA Goddard Space Flight Center to use new technologies in studying Chesapeake Bay. This program, entitled the Chesapeake Bay Remote Sensing Program (CBRSP), measures "ocean color" using airborne instruments mounted on light aircraft to estimate chlorophyll concentrations in the Bay. Chlorophyll is a photosynthetic pigment common to microscopic algae — phytoplankton — the main primary producers that comprise the base of the food web in the Bay. This important pigment imparts color to the water. Clear blue water has low chlorophyll and reflects strongly at low wavelengths in the visible spectrum, whereas green water has higher chlorophyll and absorbs strongly in the blue, reflecting light at longer wavelengths.

Data are collected using airborne radiometers that measure reflected light and concentrations of chlorophyll. This key property is one of the main ingredients necessary for estimating primary productivity and gauging the overall productivity of the ecosystem at higher trophic levels.

CBRSP provides a web site at www.cbrsp.org that makes data available from over 300 flights on the main stem of Chesapeake Bay conducted between 1989 and 2002 and gives other information about the program and related studies on Bay tributaries sponsored by EPA and NASA. These data have been used for a variety of purposes including basic science, management, education and outreach.

Summer Fellowships for Teachers

Supported by a grant from the National Oceanic and Atmospheric Administration's Chesapeake Bay Office, Maryland Sea Grant and the University of Maryland Center for Environmental Science are providing summer fellowships for middle and high school teachers in the Chesapeake Bay watershed. Ten teachers will work directly with scientists in one of four environmental laboratories: the Chesapeake Biological Laboratory, the Horn Point Laboratory, the Appalachian Laboratory (all UMCES) and the Center of Marine Biotechnology (University of Maryland Biotechnology Institute).

In addition to their laboratory experience, the teachers will work with Sea Grant educators to put science journals and Bay-related lesson plans on the web for use by other teachers in the region. Participating teachers will also share their ideas at the fall meeting of the Mid-Atlantic Marine Educators Association at the Virginia Institute of Marine Science.

Moving Day

At the end of June 2002, Maryland Sea Grant will move its offices to new quarters just off campus at 4321 Hartwick Road, suite 300, College Park, Maryland 20740, phone 301.403.4220, fax 301.403. 4255.

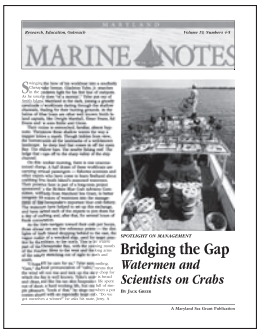
The fellowships form part of a larger NOAA-funded Bay education effort that is supporting teacher training, workshops and seminars in cooperation with the Sea Grant programs of Virginia, Maryland, Delaware and Pennsylvania. NOAA is also requesting proposals for additional work by nonprofits and other educational organizations to provide meaningful Bay experiences for students and children throughout the watershed. For more information contact Ms. Seaberry Nachbar at the NOAA Annapolis office: 410.267.5664. For more information on the Sea Grant fellowship program visit the web at: www.mdsg.umd.edu/Education/teachers.html.

Saving Trees

When planning *Chesapeake Quaterly*, we knew we wanted a quality publication. Key to that is choosing good paper. Equally important to us in choosing paper is saving trees and protecting the environment. We were happy to learn that it's cheaper and easier than ever to get good quality recycled paper — the one this magazine is printed on is a coated, 100% recycled sheet (with 50% post-consumer waste), processed chlorine free and affordable. According to *Utne Reader*, fewer than 5% of magazine publishers use recycled papers and environmentally responsible practices. Without sufficient demand, they say, mills will stop making such papers. To encourage its use, they joined several nonprofit organizations to form the Magazine Paper Project as a resource for publishers. Staff will provide free technical assistance to help find the right printer, the right paper and the right price for a job. For more information, call 415.643.4401 or visit the web at www.EcoPaperAction.org.

End Notes

Maryland Marine Notes Reader Survey


MARYLAND

MARINE NOTES

SPOTLIGHT ON MANAGEMENT

Bridging the Gap

Watermen and Scientists on Crabs

By Jack Green

A Maryland Sea Grant Publication

As we distribute this first issue of *Chesapeake Quarterly*, we'd like to take a moment to speak about *Maryland Marine Notes*, the publication it replaces. We mailed a survey a few months ago to our readers to ask for feedback about what was valuable and what needed improving, and to help us as we planned our new publication. Out of some 4,300 readers, 730 responded with praise, helpful criticism, and encouragement to continue doing what we were already doing. Their responses are summarized below.

Fifty-one percent of those who responded had received *Marine Notes* for more than five years; 44% had received it between one and five years. They represented a wide range of interests and fields: 25% government agency, 19% university/research, 17% interested citizen, 9% environmental issues and 6% or less in each of several fields, including education (K-12 and college), recreational boating, consulting, non-governmental organization, commercial fishing, seafood industry, marina industry and news media.

Ninety-four percent thought articles were about right, while 3% thought they were too technical/detailed and another 3% thought they were too superficial/vague. Readers indicated that they used *Marine Notes* in several different ways: 40% for keeping up with Bay science, 22% share them with others, 19% use them for research/background, 10% for teaching and 9% for management. Fifty-four percent rated the periodical overall very good, 35% excellent, 10% good and 1% average.

The topics respondents said they would find most useful in future issues, in order of most interested to least, were: commercial fishing, social and cultural issues, new publications, education, aquaculture, environmental issues, marine research, environmental research, and policy and management.

When asked if they accessed *Marine Notes* online, 80% said no, 17% said they hadn't and 3% said it didn't apply to them. Eighty percent said they preferred to receive a print copy and 20% said they'd prefer to receive an e-mail notice and read it online.

Among the many suggestions were that we improve the quality of our photographs, provide more web links and educational activities, expand its size so it is more like a scientific journal, and include more information about aquaculture in Maryland. The overwhelming consensus in the written comments was that we were doing a great job and should keep up the good work.

Thanks to all those who responded. We'll try to use well the advice you gave us in future issues of *Chesapeake Quarterly*.

***Chesapeake Quarterly* is also available on the web at www.mdsg.umd.edu/CQ**

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