Chesapeake Quarterly

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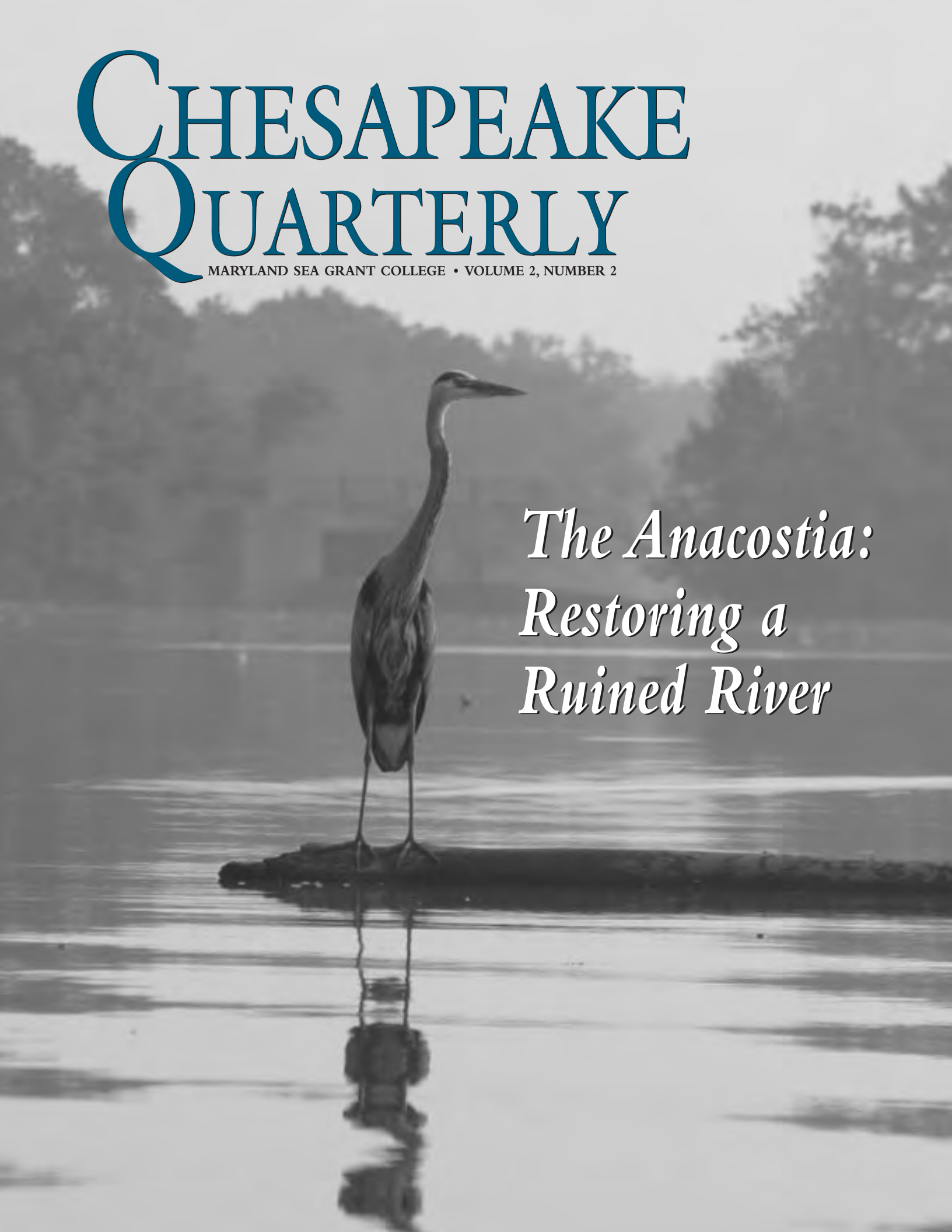

The Anacostia: Restoring a Ruined River

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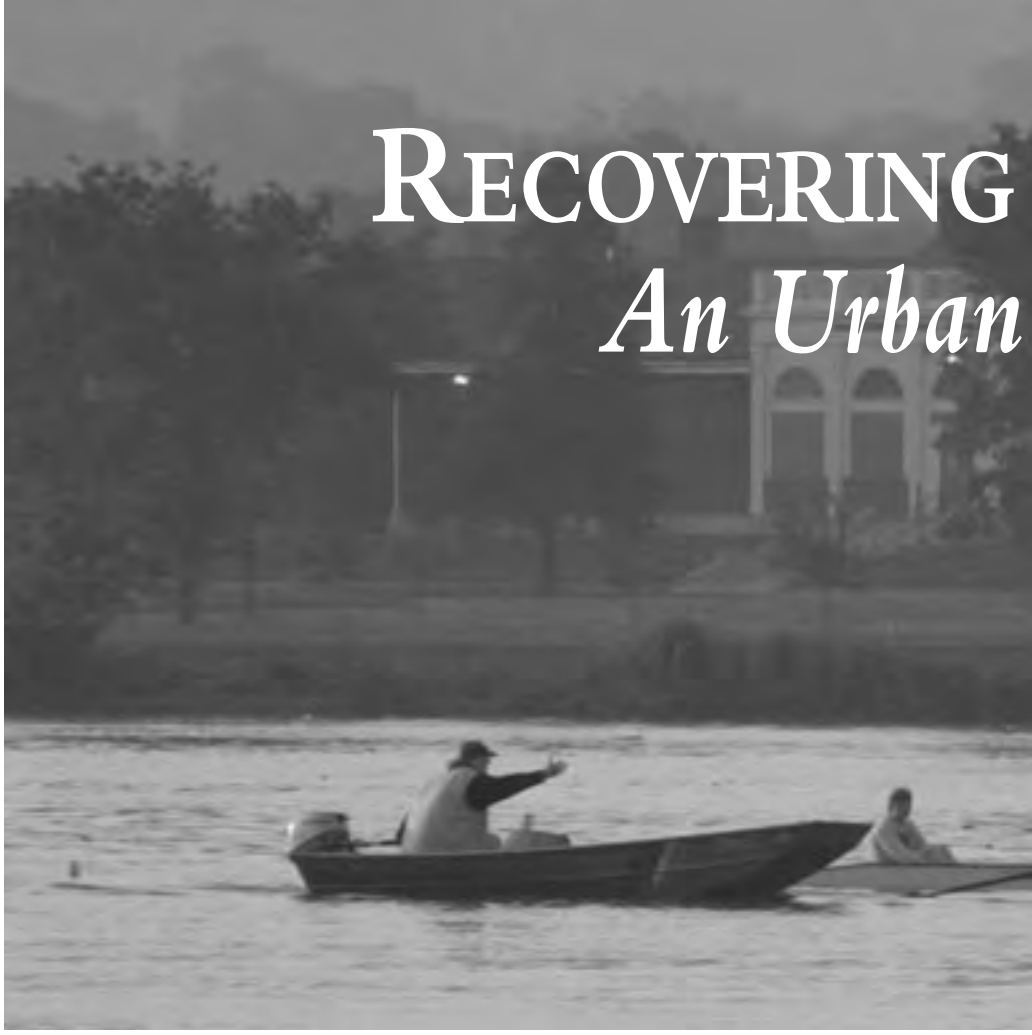
Cover. Precariously balanced, a great blue heron seems at ease on the Anacostia River. The river provides a home for abundant wildlife, though it flows through the highly urbanized landscape of Washington, D.C. **Above.** One of a number of local rowing teams that practice on the Anacostia in the early morning light. *Photos by Skip Brown.*



Recovering *An Urban*

In the dawn light, sleek racing shells skim the surface of the water — against the summer green of trees on the far shore, this could be the Eastern Shore's Chester River or one of many rivers in Chesapeake Bay country. But this is the Anacostia, a more than eight-mile-long urbanized river that runs through the heart of Washington, D.C. — past the Navy Yard, Washington Gas and Light, and beneath four bridges within a mile of each other that carry thousands of commuters into and out of Washington each day. In the midst of all this commotion, natural and human rhythms persist — ospreys nest here, cormorants and blue herons feed along the shore, marinas are busy, fishermen cast their lines.

And yet, there are also the invisible realities of a river that the American Rivers Association has listed as among the most polluted in the nation. Fish advisories recommending limited consumption of fish from the river have been in place for many years — water quality is poor, especially because of bacterial contamination, and sediments are so degraded that the Chesapeake Bay Program has designated the Anacostia, along with Baltimore Harbor and the Elizabeth River in Norfolk, as one of three Regions of Concern in the Chesapeake.

The bacterial and contaminant assaults that have brought the river to such a low ebb come from a number of problematic sources, including combined sewer overflows, discharges of wastes and runoff of heavy metals and toxic compounds directly to the main stem. The Anacostia is also at the mercy of freshwater flow that brings with it sediment and a stew of heavy metals and organic compounds such as PCBs and PAHs.

This means that any plan for realistically joining the river to a measure of health depends on bringing together resources not only across jurisdictional

THE ANACOSTIA *Watershed and its Future*

BY JOHN R. WENNERSTEN

Skip Brown

lines in the District of Columbia and Maryland's Montgomery and Prince George's counties, but also among federal agencies, scientists, legislators, industry and civic organizations such as the Anacostia Watershed Society.

The stakes are high. In the words of Tom Arrasmith, who chairs the Anacostia Citizens Advisory Committee, "We can't build a prosperous community on top of a ruined river."

A History of Assaults

The history of the Anacostia River, like many urbanized river systems, tells a complex tale of interaction between the land and its people. Centuries of development in the watershed have led to runoff of soils, waste disposal, industrial discharges and increasingly, a host of toxic compounds that end up in the sediments and remain there. Since the 1980s, government agencies, civic groups and other organizations — among them the Anacostia Watershed Restoration Committee, the Anacostia Watershed Toxics Alliance and the Anacostia Watershed Society — have formed to try to reverse the river's decline. Scientists have worked together with federal and local agencies to identify sources of contaminants, the extent of their presence and their dynamics in the river. The goal is to develop science-based strategies for curbing those sources, remediating the legacy of contaminants that years of abuse have left behind and making waters healthy enough so that by 2010 — the timetable set by the U.S. Environmental Protection Agency — they are fishable and swimable.

A laudable goal. However, given the legacy of toxics in the river, continuing runoff from the land, and shoreside development still on the rise (more than 30,000 new residential units over the next 25 years according to the District of Columbia's Office of Planning) how realistic is that goal?

The poor state of the Anacostia is hardly new. "We have spent a long time destroying the watershed," says Cameron Wiegand, watershed manager for Montgomery County's Department of Environmental Protection. That destruction began at least as far back as Colonial settlement in the early 1600s when tobacco growers first cleared the original hardwood forests to grow tobacco and other crops. A major port soon followed at Bladensburg, Maryland, at the upper reaches of the river, for shipping tobacco abroad. By 1720, water quality problems stemming from its unprotected shorelines were already occurring in the Anacostia.

Early on, farmers tried to curb erosion from their plantations by constructing dikes along the shore — their efforts failed and by 1830 the main channel had become so silted in that commercial ships could no longer sail upriver to Bladensburg. Over the next 50 years, development along the river

The Northeast and Northwest branches in Maryland account for more than 70 percent of the freshwater flow into the Anacostia and are a conduit for sediments, trash, heavy metals and organic compounds.

Skip Brown

Afloat in a sea of trash, *a kayak makes its way through plastic bottles, cans and other debris that wash down through the storm drains of Washington, D.C. and suburban Maryland. The sluggish push and pull of daily tides tends to trap much of what washes into the Anacostia.*

continued to expand, eventually including industry, the Navy Yard and housing and businesses to support a growing population. One consequence has been a 90 percent loss of wetlands — buffers that could help trap sediment runoff and contaminants. At the same time, the river has also been on the receiving end of heavy upstream flows.

The mainstem of the Anacostia begins at the confluence of its Northeast and Northwest branches, which together drain dozens of creeks in Prince George's and Montgomery counties. These two branches account for more than 70 percent of the freshwater flow into the Anacostia — they are a conduit for sediments, trash, heavy metals and organic compounds that eventually wash into the main stem of the river.

Naturally slow moving, the river is an inevitable sink for contaminants that have accumulated for years in bottom sediments where they are recycled over and over again by storms and taken up in foodwebs — for example, by fish that feed on contaminated bottom-dwelling organisms. If these legacy contaminants were the only problem, the potential for containment by capping them with non-toxic soils or removing them by dredging might greatly improve water quality. But the Anacostia, like so many river systems, is still on the receiving end of bacterial pollution and toxic chemicals — through land runoff, sewer overflows (on average, raw sewage flows into the river every three days), groundwater and airborne deposition.

Management Begins with Science

Researcher Margaret Palmer is well acquainted with the many ways that water finds a path to the Anacostia — and she argues that the fight for the Anacostia needs to take place both upstream and downstream. A professor of biology at the University of Maryland and recent recipient of an Ecological Society of America's Aldo Leopold Fellowship, Palmer leads a national task force called the National River Restoration Science Synthesis Project. Sponsored by American Rivers and other partners, this task force draws on the expertise of freshwater ecologists and others to focus on the restoration of streams and rivers across the country, including the Potomac and the Anacostia. Palmer knows that the Anacostia's problems begin in the many streams that drain Prince George's and Montgomery counties, and she is trying to figure out what to do about it.

"We cannot rely on just what's left," she says, speaking of the remaining buffers and wooded areas in the watershed. She also adds that even healthy buffers may not help, if a watershed is highly developed. She points to places in the Northwest Branch and Paint Branch where GIS maps show stormwater pipes penetrating buffers. In those cases, she says, while a buffer can still provide shading and other benefits, it will do little to slow the inflow of stormwater.

"We need to join together channel restoration and land use planning," she says. Palmer has worked hard to link her studies of stream ecology with the needs and plans of managers in the watershed. She notes that there is more uncovering or "daylighting" of streams, and that more people are beginning to understand that natural features — such as fallen trees — are actually good for a stream and part of its ongoing cycling of nutrients. (See sidebar: "An Ecologist on the Anacostia Watershed.")

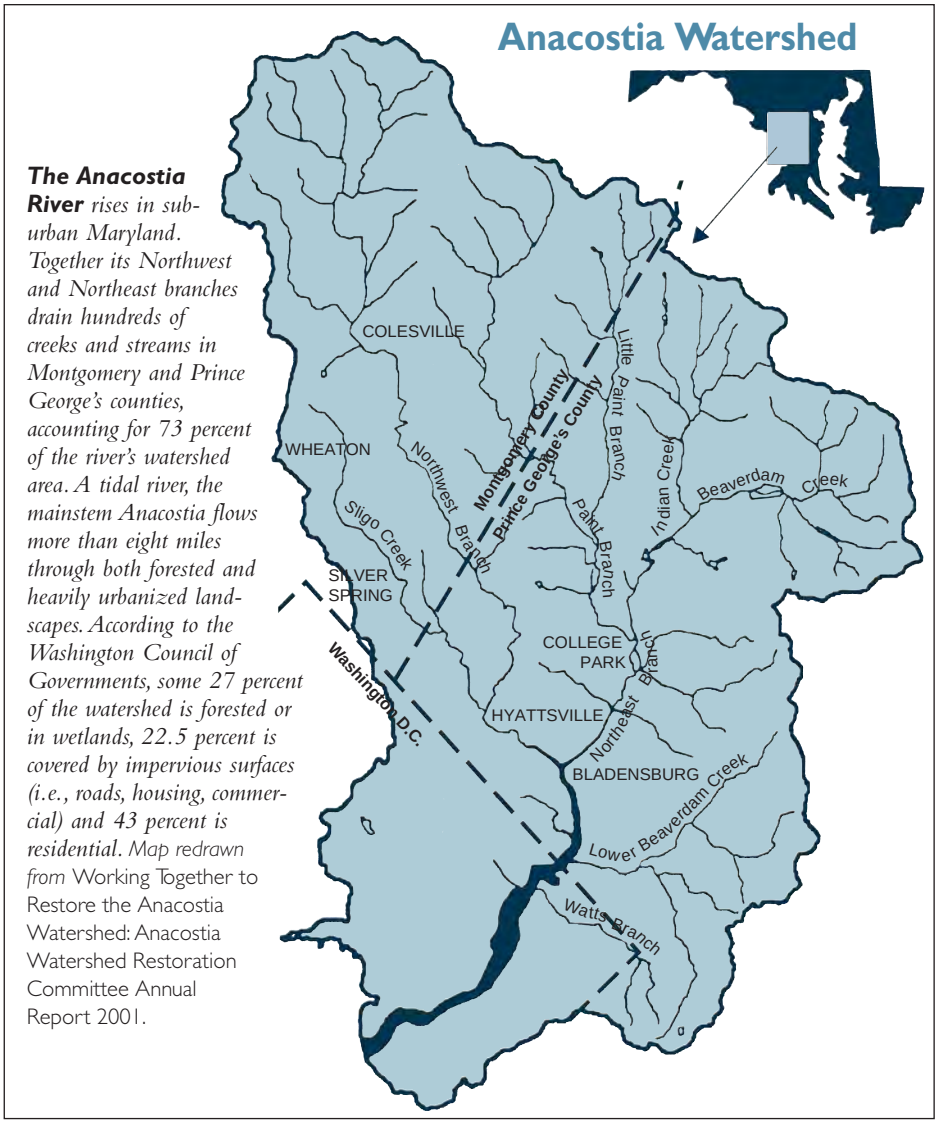
But what can be done about toxic chemicals and other contaminants that have already arrived in the Anacostia? Answering this question requires finding those contaminants, measuring their concentrations and analyzing their biological impacts. David Velinsky is one of a number of scientists who have been tracking contaminants in the Anacostia's sediments and water column, measuring concentrations of PCBs (polychlorinated biphenyls), PAHs (polyaromatic hydrocarbons) and heavy metals, charting their movement through food webs, and especially, their impacts on fish and ultimately on human health. A scientist with the Academy of Natural Science

in Philadelphia, Velinsky's findings, and those of Gerhardt "Fritz" Riedel (also of the Academy) and Fred Pinckney and Beth McGee of the U.S. Fish and Wildlife Service, have gone a long way toward detailing what we know today about the nature of contaminants in the Anacostia. They found that:

- Contaminant hot spots occur in the tidal Anacostia as a result of downstream flow from Maryland, together with specific sources to the river such as combined sewer overflows and runoff from the land occurring throughout the entire stretch, including the District of Columbia.
- Analysis of sediment grain size correlated with chemical contaminant data indicate that most of the sediments (perhaps 90 percent) entering the Anacostia from the Northeast and Northwest branches in Maryland are retained in the lower portion of the river.
- High levels of PAHs correlate with cancerous skin and liver tumors in brown bullhead catfish (*Ameiurus nebulosus*).

The knowledge gathered by these and other researchers is providing "hard-edge" numbers that modelers such as James Collier of the District of Columbia Department of Health and Cherie Schultz of the Interstate Commission on the Potomac River Basin need in order to refine mathematical simulations of sediment and toxic movement in the Anacostia. For example, says Schultz, "we took a toxics-transport model and tried to predict the patterns that Velinksy observed."

If such models could predict observed concentrations of PCBs, PAHs and other contaminants under different rainfall and waterflow conditions, then resource managers could play what-if scenarios — for example, if sediment flow at the head of the river were reduced by a certain volume, how much would that reduce PCB or PAH loading at so-called "hot spots" farther down the river?



The Anacostia River *rises in suburban Maryland. Together its Northwest and Northeast branches drain hundreds of creeks and streams in Montgomery and Prince George's counties, accounting for 73 percent of the river's watershed area. A tidal river, the mainstem Anacostia flows more than eight miles through both forested and heavily urbanized landscapes. According to the Washington Council of Governments, some 27 percent of the watershed is forested or in wetlands, 22.5 percent is covered by impervious surfaces (i.e., roads, housing, commercial) and 43 percent is residential. Map redrawn from* Working Together to Restore the Anacostia Watershed: Anacostia Watershed Restoration Committee Annual Report 2001.

Mathematical models are only as good as the data that go into them — that's why measuring concentrations of contaminants under different flow conditions remains so critical. "They provide the calibration data for the models," Velinsky says. In October 2002, he explains, there was "a perfect storm" in the Washington area for taking a suite of measurements — he and his colleagues collected samples before and during the storm and eight days afterwards.

How good are the model predictions? We still have a ways to go, Collier admits — it's one thing to do a model, he says, another to use it in cleaning up the river. We still don't know exactly where the PCBs are coming from, he says, or how much is coming from runoff, combined sewer overflows, groundwater and airborne deposits. While the model cannot "partition" the sources of PCBs among these different sources, there is also a difficulty in getting enough accurate measurements. The kind of high quality work that researchers like Velinsky are doing, says Schultz, is very expensive. "This means there is very little data. We're trying to use data from three or four storms — consequently our results are based on numbers with large uncertainties."

Despite these uncertainties, both the research and the models are providing new information that agencies can use to try to make a difference. The question remains, however, how will

Continued on page 8

***Knee-deep in Paint Branch** Creek, Margaret Palmer tracks a stream ecosystem threatened by heavy development in the watershed. Paint Branch passes right through Palmer's academic home on the College Park campus of the University of Maryland, which recently signed an agreement to help protect the urban stream.* Photo by Skip Brown.

An Ecologist on the Anacostia Watershed

By John R. Wennersten

Stepping into the fast-moving waters of Paint Branch Creek, Margaret Palmer lifts a stone and turns it to the light. On the bottom she spots a small brown bump of pebble and sand — a caddis fly case. She points out that while the caddis fly's winged life lasts for only a few days, its waterborne larvae can live from six months to two years, often beneath rocks and stones. As well as these cases, the larvae also spin silky nets.

"Some riffles," she says, "can be virtually covered with these filmy nets." Palmer has learned that the nets actually cause micro-turbulence in the stream, creating tiny eddies that help to entrain food — a phenomenon scientists have witnessed in marine organisms as well. According to Palmer, the larvae actually function as suspension feeders, much like oysters in the Chesapeake Bay, potentially helping to clear the water. A paper in the journal *Nature* by Palmer and her colleagues further describes how these ecological processes work. Describing precisely how human beings affect a watershed like that of the Anacostia, on the other hand, is proving a more daunting task.

As a watershed ecologist, one might say that Palmer has been swimming upstream a long time. For the past fifteen years her work as a biology professor at the University of Maryland, College Park, has centered on solving problems of streams and watershed tributaries in metropolitan areas.

This is a tough task but Palmer, an avid angler and outdoorswoman, maintains a realistic perspective. By focusing on the upper streams of the Anacostia, Palmer has worked with a team of scientists to provide well-grounded research-based models that will, she says, provide policy makers and managers with projections of future environmental impacts, assuming different rates of population growth, shifts in technology and changes in the regulatory environment.

Skip Brown

Hidden on a stone's *dark underside, a caddis fly case tells the story of a stream's health. During rainy periods, heavy flow from paved surfaces and storm drains can flush out stream life, which may require weeks to recover.*

Often, she says, those who work on watersheds employ scientific models based on the historical hydrology of streams and tributaries. But Palmer argues that there is little chance that we can restore the hydrology of a watershed to its pristine state. We need to be looking at the watershed as a "process" in terms of nutrients and contaminants, she says, while at the same time factoring in the consequences of public policies.

It is hard to help rebuild a watershed when people use what her economist colleagues call "hedonic property models" — the pursuit of maximum residential space with little thought of long-range consequences. But like many other variables, property development has to get factored into the scientific research equation, she argues. "To work effectively in the Anacostia and other urbanized watersheds," says Palmer, "we are going to need intensive collaboration among environmental professionals from diverse fields."

While Palmer has worked on rivers and streams throughout the U.S., Paint Branch Creek has a special significance for her, since it runs right through the College Park campus. In fact, the University of Maryland has recently signed an agreement with the Anacostia Watershed Restoration Committee in an effort to improve its stewardship of the river's tributaries. The Agreement notes that the campus is "prominently located at the center of the Anacostia watershed," and many agree that with large areas of ongoing construction on campus, strong environmental stewardship on the part of the University becomes imperative.

Palmer and her colleagues have worked directly with land planners and environmentalists in the watershed — and pored over a host of variables from insect life to nutrients to the more difficult analysis of demographics, water flow and public conservation policy. For example, along with University of Maryland faculty members Nancy Bockstael, an economist, and Glenn Moglen, an engineer, as well as the University of Delaware's James Pizzuto, Palmer and her team have worked with Montgomery County's Cameron Wiegand and Keith Van Ness to map the evolution over time of four watersheds in Maryland.

Using aerial photography from the Maryland Geological Survey and ancillary tax data, the research team developed a method for modeling land use change at annual intervals. These models, Palmer says, have very high spatial resolution, so they can model changes in peak discharge as a function of location within the watershed. According to Palmer, this work has shown that relying on data from stream gauges

alone may not necessarily reflect the conditions at small scales within the watershed. This could be especially important, Palmer and her colleagues point out, when measuring total maximum daily loads (TMDLs) of pollutants, where measurements at finer scales may be key.

They are hoping that, with adequate support, they can carry on this spatially explicit work, tightly integrating hydrological and ecological models in order to better predict how changes in land use will affect the health of streams and their watersheds.

"Margaret's work has been invaluable to us," says Cameron Wiegand of Palmer's collaborative efforts. "She and her team of water scientists from all over the country were able to conduct important nitrogen studies and other biomonitoring. She gave us important data that we could use in our restoration work. It shows that collaboration with scientists in stream restoration work really pays off."

"We can have a much better Anacostia," urges Margaret Palmer. She points to a successful case study in Montgomery County, which involved placing a by-pass pipe that redirected stormwater from a subdivision surrounding the tributary. The pipe eliminated a thermal barrier to trout entering the stream by keeping the water cool and by reducing peak flows during storms. Decreasing water temperatures by less than one degree allowed young trout to flourish in water that once was uninhabitable.

It all begins with small improvements in the streams of the upper watershed, she says. "This kind of local restoration work shows that we can have a watershed that is clean and cool enough for juvenile and adult trout to thrive. We all benefit from that in the long run."

For a description of the National River Restoration Science Synthesis Project, visit the web at www.amrivers.org/feature/riverrestoration.htm.

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resource managers prioritize, how will they determine what to go after.

"If we did business as usual, we would never be able to completely characterize an area and therefore would never be able to begin any clean-up actions in the river," says Nick DiNardo of the U.S. Environmental Protection Agency. DiNardo is a member of the Anacostia Watershed Toxics Alliance, which represents 25 different agencies, institutions and community groups. A voluntary public-private partnership formed in 1999, the Alliance works to take directed action on toxic problems.

"We have legacy contaminants and ongoing current sources — the combination is contributing tremendous loads of contaminants to the sediments and waters," says DiNardo. "With any hope of realistic remediation in a reasonable time," he says, "we have to come up with approaches that draw on the resources of all our stakeholders working collectively."

Using measurements and current models, about a half-dozen PCB hot spots have been identified in the main stem, DiNardo says, including one around Kingman Island on the east bank. According to DiNardo, there was no apparent source for contaminants, until the Park Service identified a landfill, which could be the culprit. The Park Service will try to shut off any flow from the dump, says DiNardo, by isolating the landfill so that groundwater will go around it. At the same time, he says, "we want to try to stabilize the hot spot itself so that PCBs in the sediment are not released back into the water. One way is to cover the hot spot with a "reactive cap," a somewhat permeable material that should degrade PCBs moving through the cap material.

In a pilot project, several types of capping materials will be compared for their effectiveness. What is the prospect for success if PCBs are still entering the river and, because of flow dynamics, settling into the hot spot? Though there will still be PCBs coming in even if the Park Service is successful in reducing PCB flow, answers DiNardo, the hope is that their concentrations would be much smaller because the reactive cap should not only degrade contaminants below, but also new deposits of contaminants that settle on top of it.

By keeping stormwater on the land, natural hydrological processes associated with grasses, trees and soils can filter out pollutants.

Cleaning up Contaminants — What Will It Take?

One key to a healthier Anacostia lies in reducing destructive pulses of rain water overloading Washington's outdated combined sewer system — each year about 2.14 billion gallons of raw sewage overflow goes directly into the Anacostia. The District of Columbia and the Washington Area Sewage Authority have developed and approved a $1.6 billion capital program to control combined sewer overflows. The city will rehabilitate pumping stations, close sewage outfalls and use storage tunnels to intercept and store 49 million gallons of sewer overflow during peak periods; it will also undertake aggressive retrofitting campaigns.

But this long-term project will not be sufficient for curbing the quantities of organic chemicals such as PCBs and PAHs and heavy metals that enter the river from diffuse sources throughout the watershed. Because there is no one way to curb such runoff, it will take a suite of different approaches depending on location, topography and available land.

Low impact development (LID) represents a relatively new approach for

reducing the flow of stormwater from developed areas. In the past, stormwater management was based on moving massive flows of water off the land as efficiently and quickly as possible, channeling them into drainage systems, sewers and rivers.

"This had a devastating impact on the region's biomass," says Tom Schuler, Director of the Center for Watershed Protection in Ellicott City. The task now, he says, is to reduce the harm caused by mass drainage from so-called "impervious surfaces" — roads, parking lots and paved areas surrounding shopping malls and housing developments. By keeping stormwater on the land, natural hydrological processes associated with grasses, trees and soils can filter out pollutants.

One technique, the humble rain garden — a dry pond or fixed area of grasses and other vegetation that absorbs stormwater runoff — could eventually play an important role in stemming runoff. Scientists estimate that rain gardens can trap 94 percent of sediment, 70 percent of nitrogen and 43 percent of phosphorus that is washed off the land by rain. Low impact development for the Anacostia means using nature to "volatilize" or break down some toxic compounds in water.

Neil Weinstein, the head of the Low Impact Development Center in Beltsville, Maryland, believes that vegetation has tremendous ability to treat pollution and reduce runoff. A single 30 by 20-foot vegetation rain garden can filter the runoff of a large parking lot, he argues. Weinstein was instrumental in the planning of a rain garden in Bladensburg at a restaurant (IHOP) parking lot that is becoming an environmental showpiece for the Anacostia. Proponents of LID approaches to landscape engineering for minimizing runoff offer cost-effective approaches to hydrology that allow businesses to meet regulatory and resource goals.

Larry Coffman, Associate Director of Environmental Resources in Prince George's County and a national expert on maintaining the ecological functions of watersheds, has been instrumental in helping developers plan innovative projects, such as the 80-acre Somerset development in Prince George's. This community of 199 homes on 10,000-square-foot lots uses LID practices to reduce the stormwater management burden. By showing developers how to use swales, rain gardens and other bioretention areas, Coffman helped developers reduce the cost of a finished lot by $4,000. Better for the environment, the lots were also more aesthetically pleasing.

Throughout the Prince George's section of the Anacostia watershed, Coffman has spearheaded the use of rain gardens, which have proven cost effective for developers and enormously beneficial for the area's hydrology. Says Coffman: "If you can disconnect runoff and distribute your drainage, you can reduce stormwater volumes by up to 50 percent and it doesn't cost anything. In the long run it is easier to deal with stormwater at the source rather than at the end of the pipe."

Coffman admits that it has been difficult to change conventional thinking about controlling stormwater. "When we first talked about rain gardens, we were ridiculed," he says. "Now bioretention is the new mantra of watershed management." The task at present, Coffman reflects, is to educate residents in the watershed and get property owners' participation in LID efforts. "If we're going to recover the Anacostia, we need to come up with better technologies that mimic natural processes to save these ecosystems."

The U.S. Army Corps of Engineers is currently playing a significant role in retrofitting the Anacostia for low impact development. Over the past several years the Corps has spent more than $17 million on the restoration of wetlands, stream restoration and stormwater management. Corps spokesperson Stacey Underwood points out that while we have lost 2,600 acres of wetlands in the Anacostia, we're working with a lot of agencies and organizations to rebuild those watersheds. The approach now, adds Underwood, is "to start at the headwaters of the watershed and work our way down. This is why we are building economic partnerships with Montgomery and Prince George's to improve stream management." Stacey Blersch, the Corps's environmental affairs specialist for the lower Anacostia, also points out that the "Corps has recently done important work in the area of Kingman Island to enhance wildlife habitat by creating more area for bird species. We are trying to get the older hydrologic regime back as much as possible."

Skip Brown

Bubbling between the fall line's *enduring rocks, spring-time waters of the Northwest Branch rush downstream toward the mainstem Anacostia. As noted by scientists and conservationists alike, restoring the river will require efforts in the streams of suburban Maryland, as well as downstream in the tidal waters of Washington, D.C.*

The Good News So Far

Do we see some effects of these actions yet? The answer is a qualified yes, depending on location. Perhaps Montgomery County provides the best case example where watershed manager Cameron Wiegand points to efforts at improved wetlands and stormwater hydrology that have returned 10 species of fish to Sligo Creek and other county

tributaries. Since 1997 Montgomery County has monitored 23 watersheds in its boundaries in order to identify healthy waters and improve unhealthy ones. "What we are proud of," says Wiegand, is that "we have raised the bar in terms of what we do with our streams." Wiegand's staff found that 75 percent of the sediment load in county streams came from stream bank erosion and that is where they have concentrated their energies. Streams are constantly downcutting, destroying old channels and eroding their banks. On upper Sligo Creek the county has installed three stormwater ponds that have proven successful in preventing large sediment runoff during storms.

"We have a lot of tools in our box to help make our portion of the Anacostia watershed better," says county environmental engineer Daniel Harper. The placement of rock to resist bank erosion — riprap interspersed with willow planting — is a favored technique. As the willows become established, roots invade and permeate the rock and underlying soil, binding them together into an erosion-resistant mass. The willows also impart a more "natural" look to the shoreline.

Restoration efforts can succeed but they take work to make a difference. "Finally you have to look at history," Wiegand concludes. "Here in Montgomery we have been working about 12 years to repair these problems. It is not an overnight process."

Meanwhile the Anacostia does not lack bold initiatives. In Bladensburg the Anacostia Watershed Society (AWS) is working to develop wetland nursery projects in the river. "Right now," says AWS president Robert Boone, "we are restoring wild rice in what is left of Anacostia wetlands. Wild rice is an amazing filtration device for nutrients. We call wild rice the river's kidneys." Rice was once a dominant species in the watershed and bringing it back will help the river to regain its health. The AWS is also planting bulrush, pickerelweed and arrow arum to improve plant life in the new marshlands.

Skip Brown

In the heart of the nation's capital *kayakers may be surprised to find wooded shorelines, abundant waterfowl and active recreational marinas.*

"By involving students in planting the marshes," adds Boone, "we can weave the wetlands into the lives of local citizens who will become stakeholders in the river's health." The AWS is also continuing its vision of saving the watershed by planting thousands of trees to rebuild the forest buffer and working in partnership with other agencies like the Army Corps of Engineers. The AWS is putting in large stands of plant life that will improve water clarity, oxygenate the water, improve fish habitat and attract marsh birds like the sora rail, bobolink and grasshopper sparrow.

"Clearly some things are now in place that will greatly benefit the Anacostia River," says Bill Matuszeski, a consultant and former director of the U.S. EPA's Chesapeake Bay Program. The new Combined Sewer Overflow Plan for the District of Columbia will correct many of the district's sewage problems, he says, by ameliorating some of the major degrading effects on the water quality of the Anacostia River. Environmental activist Larry Silverman adds that "given all the political and other issues affecting the District, it is remarkable that they have made the efforts they have to focus on the Anacostia and its stormwater and sewage problems."

Washington, as its famous resident Frederick Douglass once quipped, is a city of "magnificent intentions." Now those intentions are slowly being directed towards rescuing a once "ruined river" and a poster child for abused urban waterways. Currently there is strong public interest in healing the watershed; and despite its environmental troubles, the Anacostia has been nominated as an American Heritage River. "For the first time in decades," says David Baron, "we are really discussing serious measures about reducing sewage overflows and cleaning up the river."

The Civic Dimension

"We just want to see people and government comply with the Clean Water Act," says David Baron, an attorney for Earth Justice, an environmental defense organization.

Baron's view resonates locally. Citizens in the African-American community in the District have fought government policies that would turn settled neighborhoods and parklands into amusement parks and parking lots. Says civic leader Herbert Harris, "We have to keep a close watch on things at the local level if we want to protect our community from rampant growth and environmental degradation."

The future of the Anacostia will center not only on environmental quality but also on environmental equity, believes Cole. "The conservation stuff just doesn't get the work done without a good balance between nature and human beings."

Environmentalists have done a lot of good, he notes. "But the important thing," he says, "is that local civic organizations are taking ownership of the river and are protecting it from corporate interests that would harm it."

Others in the community worry about the future of the Anacostia. As redevelopment and property values near the river begin to rise, what will happen to settled neighborhoods? Community activist Carl Cole believes that access to the river is key. "We were fenced off from the river by junkyards and polluters in the past. We certainly don't want to be fenced off by gated condo communities." Cole believes that the future of the Anacostia will center not only on environmental quality but also on environmental equity. "The conservation stuff just doesn't get the work done without a good balance between nature and human beings," he says.

The Anacostia, Cole points out, flows in the shadow of the Capitol and provides the focal point for a neighborhood of historic sites essential to understanding the African-American experience. Community revival is in the air. In Cole's view, the Anacostia is inching towards the intent of the Founding Fathers of this country. "The Anacostia historically was designated by our early leaders to be the river that was graced by beautiful federal buildings, ministries and homes of Congressmen. We are now seeing eastward development at last in that direction." (See sidebar, "Child of the Urban Wilderness," highlighting Cole's involvement with Anacostia restoration.)

The city's new Anacostia Waterfront Initiative, for example, proposes to open up a shoreline 90 percent of which is owned by the National Park Service, the Department of Defense and the District of Columbia. Central to the initiative is a cohesive mixture of commercial, residential, recreational and open space uses that will give citizens of the District greater access to their own waterfront.

Community attitudes in the district towards the river, says Reginald Parrish, have overcome their "historical disconnect." Parrish, the EPA Liaison to the Anacostia River, believes that previously "folks in the district were too much concerned with public safety and job issues to give much thought to the environment. Now they are beginning to see the river as part of the picture of future job growth and community development." In concert with the District, the EPA is developing programs to get area youths jobs in low-impact development projects in the watershed. With the new Anacostia Waterfront Initiative, other jobs in tourism and recreation in the watershed will follow.

No doubt the Anacostia will experience significant challenges in the future, while still trying to deal with the legacies of the past. Changes in precipitation, temperature, and storm patterns combined with growth will profoundly affect water systems in this area, as elsewhere in the United States. Regardless, Robert Boone argues that we have to act now in terms of our moral stewardship of the watershed. "Any place can be beautiful if you take the trouble to discover what there is to love," he urges. "We can't wait for some future generation to save the Anacostia."

Merrill Leffler and Jack Greer contributed to this article.

For More Information

Video Clips

To see video clips about science and restoration in the Anacostia watershed, visit the electronic version of the magazine, *Chesapeake Quarterly Online*, at www.mdsg.umd.edu/CQ/.

Web Sites

Anacostia Watershed Toxics Alliance (AWTA) – www.chesapeakebay.net/awta/guide/home/awta.html
Represents more than 25 different groups, agencies, institutions and community groups. Formed in 1999 as a voluntary public-private partnership to address toxic problems in the river.

Anacostia Watershed Network – www.anacostia.net/
The network, sponsored by the Metropolitan Washington Council of Government's Anacostia Watershed Restoration Committee (AWRC), is designed to provide comprehensive information on resources within the Anacostia watershed.

Anacostia Watershed Society (AWS) – www.anacostiaws.org/
A non-profit environmental organization dedicated to restoring and protecting the river through programs of education, action and advocacy.

Chesapeake Ecotox Research Program – www.mdsg.umd.edu/CERP/
This multi-institutional, five-year research effort aims at developing a means for predicting the effects of contaminant reduction strategies on living resources in the Chesapeake Bay. Sediments used in these studies come from the Anacostia River, Baltimore Harbor and the Elizabeth River in Virginia.

Interstate Commission on the Potomac River Basin (ICPRB) – www.potomacriver.org/
The commission's mission is to enhance, protect and conserve water and land resources of the Potomac River basin and its tributaries through regional and interstate cooperation.

JOHN R. WENNERSTEN is the author of *The Oyster Wars of Chesapeake Bay*, *Maryland's Eastern Shore: A Journey in Time and Place*, and most recently *Chesapeake: An Environmental Biography*. A professor of history for many years at the University of Maryland Eastern Shore, Wennersten now lives on Capitol Hill, not far from the Anacostia

Child of the Urban Wilderness

By Jack Greer

Back in 1958, as a Boy Scout in troop 1205, Carl Cole undertook a project he entitled, "My Urban Wilderness." He explored up and down the river and documented the birds, deer and raccoons he found living there. For him the Anacostia was as intriguing as any national park or wildlife area.

Cole, who "just turned 60," says that in his view the Anacostia has always been "fishable and swimable," because he has always fished and swum in it. "I love where I live," he says, referring not only to the river and the nation's capital, but to other nearby amenities, such as the Langston Golf Course — the first, he says, designed for African-American patrons.

For Cole, the Anacostia flows near the very heart of the nation's history. In Colonial times, he says, the Anacostia was Washington's deeper river, with ships carrying through to Bladensburg. During the nation's early days, Cole says, Washington Navy Yard was the capital's principal port, where diplomats landed. That began to change in the 1850s, according to Cole, when the river rapidly began to fill with sediment.

"There is a lot of history here," Cole says. He refers to battles during the War of 1812, and to the place where Lincoln's assassin, John Wilkes Booth, escaped across a bridge here. He also relates how convicted co-conspirator Mary Surratt, along with three others, was hanged here at Fort McNair, on July 7, 1865. The river, he says, played a central role in the nation's early decades, and planners envisioned the Anacostia as the site of statesmen's homes.

Industrial development changed much of that vision, and parts of the Anacostia became the capital's back door. "This has nothing to do with race," Cole asserts, pointing out that until relatively recently, many of the Anacostia's neighborhoods were not populated by minorities but by whites, including areas largely inhabited by the military and their families.

Skip Brown

Cole believes that the best way to help the river is by example. Above, all, he says, we need to get people out on the water.

Cole believes that the best way to help the river is by example. Above, all, he says, we need to get people out on the water. "Get them used to it," Cole says. "Get people out racing in dragon boats. That's how you make a difference."

In 1987 Cole became the founding president of the Organization for Anacostia Rowing and Sailing (OARS). Now the Capital Rowing Club is here, as well as the Gonzaga High School rowing club. There are also other clubs and "scholastic teams." Some of these teams, whether in racing shells or dragon boats, have been regional and national champions, he says.

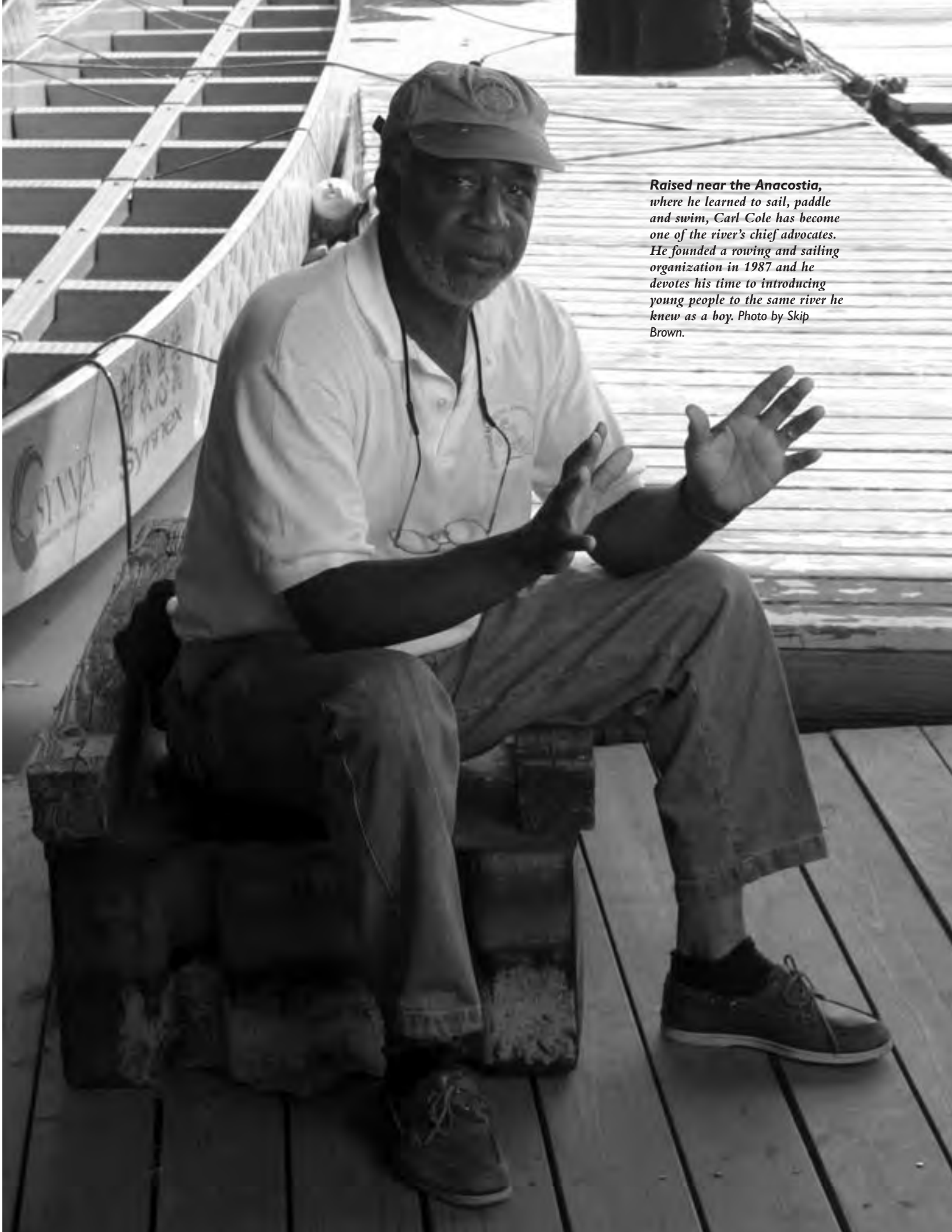
The rowing clubs use an old brick boathouse, now refurbished, that stands on National Park Service land, between the Navy Yard and shoreline belonging to the Army Corps of Engineers. "The Army Corps has been a good neighbor," Cole says, and has helped them from time to time. He also says that the Navy has been "very active" in helping.

"This is a dream of mine," Cole says of the restored boathouse, the stacks of racing shells and brightly painted dragon boats.

"Still," he says, "people are afraid of this river. Because of the rhetoric." What we need, Cole says, "is human interaction and not a search for demons."

One of Cole's personal goals is to introduce young people to the same river he knew as a boy, and he now participates in a program designed to get young people out on the river called "Kids Set Sail."

"You educate people about the river when you get them on the water," he says. "The river is like a library. To learn from it, "you have to use it."



Raised near the Anacostia, *where he learned to sail, paddle and swim, Carl Cole has become one of the river's chief advocates. He founded a rowing and sailing organization in 1987 and he devotes his time to introducing young people to the same river he knew as a boy.* Photo by Skip Brown.

Summer Students Explore the Bay

This summer marks the fifteenth year of Maryland Sea Grant's undergraduate fellowship program, an effort that has brought college students from Maine to Hawaii to the Chesapeake Bay to participate in marine research. Supported by a grant from the National Science Foundation, the Research Experience for Undergraduates (REU) program pairs students with scientist-mentors at three estuarine research labs, the Horn Point Laboratory (HPL) and the Chesapeake Biological Laboratory (CBL) — both part of the University of Maryland Center for Environmental Science — and the Academy of Natural Science Estuarine Research Center (ANSERC).

Listed below are each student's home campus, summer topic and advisor for 2003.

Sandy Rodgers

Sarah Henson, The College of St. Rose, Albany, New York – The Biogeochemistry of Seagrass and Sediment in Contrasting *Ruppia maritima* Beds. Advisors: Mike Kemp and Laura Murray, HPL

Tamara Kroboth, State University of New York, Stony Brook – Trace Mercury Uptake by *Spartina alterniflora* in Mesocosm Simulating Capping, Marsh Restoration, and Phytoremediation. Advisor: Fritz Riedel, ANSERC

Alessandra Paolicchi, Texas A&M University, Galveston, Texas – Binding Capabilities of Polychlorinated Biphenyls (PCBs) to Dissolved Organic Carbon and Activated Carbon. Advisor: Joel Baker, CBL

Bill Kaminski, Southampton College, Long Island, New York – Feeding Ecology in the Lined Seahorse, *Hippocampus erectus*, in the Chesapeake Bay. Advisor: Dave Secor, CBL

Rebekah Duncan, Eckerd College, St. Petersburg, Florida – Grazing Habits of *Eurytemora affinis* and *Acartia tonsa* in Turbid and Non-turbid Environments. Advisor: Mike Roman, HPL

Jesse Phillips-Kress, University of Notre Dame, Indiana – Temporal and Spatial Variability of the Planktonic Food Web in the Patuxent River. Advisor: Denise Breitburg, ANSERC

Miranda Hoover, Wittenberg University, Springfield, Ohio – Flow Cytometric Indicators of Phytoplankton in the Chesapeake Bay. Advisors: Jason Adolf and Larry Harding, HPL

Keith Douglass, Roger Williams University, Bristol, Rhode Island – The Impact of Ammonium on the Recruitment and Growth of *Arenicola cristata* in its Different Life Stages. Advisor: Roberta Marinelli, CBL

Janet Krenn, University of Illinois, Champaign – The Influence of Microphytobenthos on Resuspension in Shallow Estuaries: A Comparison between Florida and Chesapeake Bays. Advisor: Jeff Cornwell, HPL

Christina Geierman, Michigan State University, Lansing – Linking Oysters and Seagrasses: Using Breakwaters as an Analogue to Oyster Reefs. Advisor: Eva Maria Koch, HPL

Stephanie Hurder, Richard Stockton College, Pomona, New Jersey – Use of Fluorescent Particles to Determine the Zone of Oyster Biodeposition Under Field Conditions. Advisor: Roger Newell, HPL

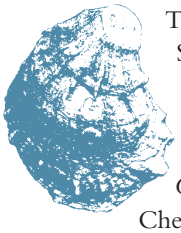
Laura Rubiano-Gomez, Massachusetts Institute of Technology, Cambridge, Massachusetts – Characterization of Suspended Particle Sinking Speeds in the Upper Chesapeake Bay. Advisor: Larry Sanford, HPL

Emily Maung, Old Dominion University, Norfolk, Virginia – Development of a Novel Approach to Determine the Effects of Protist Grazing on Marine Bacterial Diversity. Advisor: Marcelino Suzuki, CBL

Alex Bogler, State University of New York, Stony Brook – Evaluating DNA Damage in the Blue Crab (*Callinectes sapidus*) Collected from the Chesapeake Bay and its Tributaries Using the Comet Assay. Advisor: Carys Mitchelmore, CBL

For more about the REU program, student fellows, their projects and publications, see www.mdsg.umd.edu/Education/REU or contact Dr. Fredrika Moser, 301.403.4220, x 16.

Report, Research Assess Non-native Oyster



The National Academy of Science released in August its report on the risks and benefits of introducing the non-native oyster *Crassostrea ariakensis* to the Chesapeake Bay. The report largely echoed a number of white papers issued during the past year by Bay area scientists, calling for careful study and rigorous protocols. Maryland Sea Grant was one of about nine agencies that helped fund the study.

Under the auspices of the National Research Council, the NAS panel of experts cautioned against the introduction of reproductive populations of *C. ariakensis* as a quick fix to the devastating losses of the Bay's native oyster, *Crassostrea virginica*, from entrenched parasitic diseases.

Impetus for the study came from intense pressure in Virginia and Maryland for importing *C. ariakensis* to the Chesapeake because of its potential for surviving MSX and Dermo, the diseases that have so pummeled *C. virginica*.

The NAS study examined three possible options: (1) no use of non-native oysters, (2) open water aquaculture of triploid [sterile] oysters, and (3) introduction of reproductive diploid oysters. Of the three options, the NAS committee considered the first risky because it might encourage rogue introductions by individuals, and the third "imprudent" since the introduction of a reproductive population would likely prove irreversible. Option two, they concluded, would present the least ecological uncertainty, while enabling researchers to learn more about *C. ariakensis* and its behavior in the Bay by experimenting with sterile triploid oysters.

The report concludes, "If regulators enforce strict protocols for accountability . . . this management option could provide useful information to support decision analyses and risk assessments regarding the future use of non-native oysters in the Chesapeake Bay."

Two research studies on *Crassostrea ariakensis* funded by NOAA Sea Grant are currently getting underway at the University of Maryland Center for Environmental Science. In one, under the Invasive Species Program, Roger Newell and Victor Kennedy are looking at potential predation on *C. ariakensis*. In the second, under the Oyster Disease Research Program, Ken Paynter and Don Meritt are comparing the growth and survival of sterile (triploid) *C. ariakensis* with that of sterile *C. virginica* in several rivers in Maryland's portion of the Bay.

Understanding Contaminants

Understanding how chemical contaminants behave in the open environment, and how they affect living organisms, requires coordinated research by ecologists, toxicologists, population modelers and other experts. To foster such understanding, the Chesapeake Ecotoxicology Research Program (CERP) has brought together scientists with diverse scientific backgrounds from the University of Maryland Center for Environmental Science (UMCES), the Virginia Institute of Marine Science (VIMS), the Academy of Natural Sciences Estuarine Research Center (ANSERC) and the Old Dominion University (ODU).

Scientists engaged in this collaborative five-year program are focusing on the Bay's toxic hot spots in the Anacostia River, Baltimore Harbor and Norfolk Harbor (the Elizabeth River). Their research centers on sub-lethal levels of contaminants, especially in Bay sediments, and the potential ways in which these pollutants could alter size-structure in estuarine populations and otherwise reduce the reproductive fitness of Bay organisms, slow their growth rate or alter their distribution or behavior.

The CERP project is overseen by the Chesapeake Bay Environmental Effects Committee (CBEEC) and funded by the National Oceanic and Atmospheric Administration (NOAA) Chesapeake Bay Office, through the Sea Grant programs of Maryland and Virginia. For more on CERP, visit www.mdsg.umd.edu/CERP/ or contact Merrill Leffler at 301.403. 4220, ext. 20, or leffler@mdsg.umd. edu.

Research Fellows Symposium

Eight Maryland Sea Grant Research Fellows presented their research findings at a June symposium held at the UMCES Chesapeake Biological Laboratory in Solomons. The audience for the talks included faculty, staff and Research Experience for Undergraduate (REU) Fellows studying for the summer at marine labs on the Chesapeake Bay. The research fellowships, which provide a stipend, tuition remission and other benefits, are awarded through a competitive process to students working on Maryland Sea Grant-funded projects.

Presentation highlights included a talk by Larry Taylor, a Ph.D. candidate, on his molecular biology research concerning a novel marine bacterium that can degrade various types of plants and shell material. This research has important implications for the global carbon cycle as well as the recycling of waste. Sarah Kolesar, also a Ph.D. candidate, presented her results about the interaction between ctenophores and fish larvae. This research will increase our understanding of jellyfish occurrence and persistence in the Chesapeake Bay. Olaf Jenson, an M.S. candidate, gave a presentation on the spatial distribution of blue crabs in the Chesapeake Bay. His approach, using a Geographical Information System to map blue crab occurrence and habitat, will provide new information that could help to improve blue crab fisheries management strategies.

Other presenters were Jason Adolf, Patrick Campfield, Jessica Davis, Rebecca Holyoke and Laurie Bauer. Abstracts of the talks will be available on the Maryland Sea Grant web site and will also be published in a special symposium volume.

A Blueprint for the Bay's Future?

As population growth, poorly planned development and stubbornly persistent nutrient problems continue to plague the Chesapeake Bay, concerns have heightened about the future of the nation's largest and historically most productive estuary. Precisely what does the future hold for the Chesapeake?

In order to answer that question, a group of scientists launched a multi-year project to provide their best estimates of what the Bay will look like in the year 2030, depending on what courses of action we pursue now.

Entitled *Chesapeake Futures: Choices for the 21st Century*, the study was undertaken by the Scientific and Technical Advisory Committee (STAC), an independent group of scientists, engineers and other technical experts appointed to advise the multi-state/Federal partnership known as the Chesapeake Bay Program. The committee chose three different scenarios for their projections: Recent Trends (maintaining the status quo), Current Objectives (largely fulfilling current Bay agreements), and Feasible Alternatives (putting in place a range of progressive technologies and programs).

The outcomes for the three scenarios varied dramatically. For example, under Recent Trends, if the same land use patterns witnessed during the past several decades were to continue, by 2030 an additional two million acres of farm and forest land would fall to development, and water quality would worsen. In fact, with population approaching some 19 million people in the watershed by 2030, *Chesapeake Futures* predicts that without new efforts total loadings of nitrogen would grow by about 30 million pounds by then — about 10 percent over current levels — representing the loss of more than half the hard-won load reductions achieved between 1985 and 2000.

Beyond this, the scientists remind us that nature remains highly variable, and that our best models and projections must take into account the uncertainties of sea level rise, climate change and other environmental unknowns. They point out, for example, that wide fluctuations in runoff — from one year's drought to the next year's deluge — can drive changes in flow to the Bay's tributaries that actually overwhelm nutrient reduction efforts for any single year. At the same time, they say, long-term trends will continue to reflect overarching patterns in the watershed, such as land use decisions now being made in local jurisdictions throughout the region.

A 160-page report summarizing the study's results, edited by Donald F. Boesch and Jack Greer, is available on the website of the Chesapeake Research Consortium at www.chesapeake.org/stac. To request a paper copy of the report, write CRC, 645 Contees Wharf Road, Edgewater, Maryland 21037.

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

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