Chesapeake Quarterly

MARYLAND SEA GRANT • VOLUME 24, NUMBER 2

The Nature of Learning

Environmental Education for the Next Generation

in this issue

Volume 24, Number 2

Environmental science education equips students with tools to understand the natural world and shape their future. Engaging research institutions in K-12 learning can forge innovative programs—in this issue, programs on aquaculture, amphibians, and more.

This print edition of *Chesapeake Quarterly* includes the issue's feature story, "Experiencing an Education." Read more articles in our complete online issue by visiting chesapeakequarterly.net or scanning this QR code:

CHESAPEAKE QUARTERLY December 2025

Chesapeake Quarterly explores scientific, environmental, and cultural issues relevant to the Chesapeake Bay and its watershed. The magazine is produced and funded by Maryland Sea Grant, a state and federally funded organization that provides environmental research, outreach, and education.

Chesapeake Quarterly editorial team:
Director: Fredrika Moser
Assistant Director for Communications: Annalise Kenney
Writer: Ashley Goetz
Graphic Designer: Jill Gallagher

Maryland Sea Grant
5825 University Research Court, Suite 1350
University System of Maryland
College Park, Maryland 20740

Email: communications@mdsg.umd.edu

www.mdsg.umd.edu
www.chesapeakequarterly.net

Sea Grant MARYLAND

NOAA

Cover: *Students in YouthWorks program discover crayfish at Great Kids Farm in Baltimore.*
PHOTO, ASHLEY GOETZ/MARYLAND SEA GRANT

Experiencing *an* Education

Aquaculture in Action Teaches Hands-on Science

by Annalise Kenney

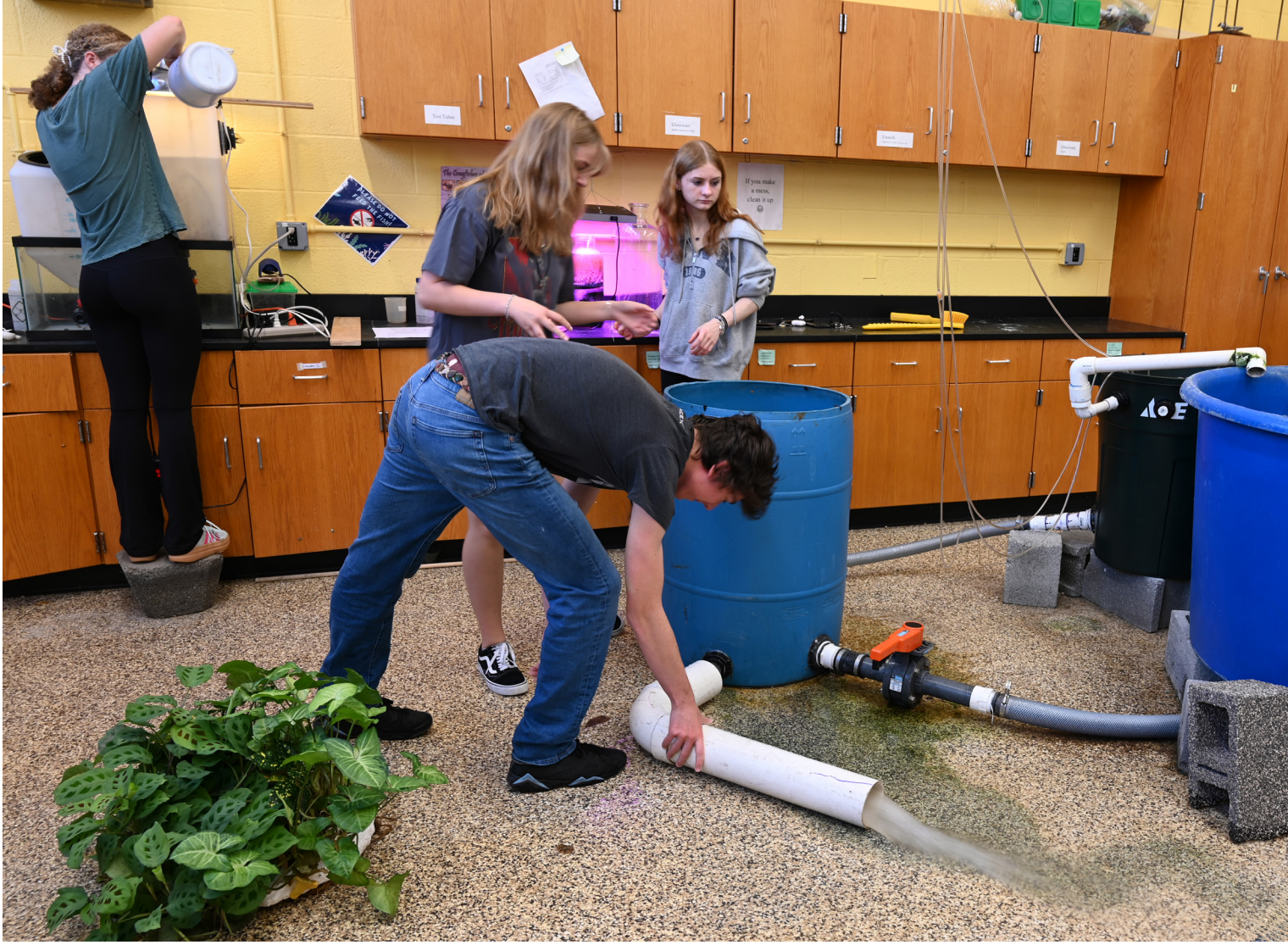
It is Tank Maintenance Tuesday in South Carroll High School's aquaculture lab. As the 7:30 a.m. bell rings, students scatter across a classroom filled with tanks, tubs, and aquaria.

"You all are going to want to move out of the way. We're draining this stinky sump," says one student. He and a classmate carefully pour greenish-brown water from a sump tank into a floor drain, wafting up a mucky scent. Nearby, another student stands on a ladder above a tank of cichlids, inspecting air lines dangling into the tank. Students tramp across wet floors, scrape slime from tank components, and call "watch the hose!" as they work to clean and refill large tubs containing schools of yellow perch (*Perca flavescens*), Nile tilapia (*Oreochromis niloticus*), bluegill (*Lepomis macrochirus*), and Atlantic salmon (*Salmo salar*).

This scene is unusual in a high school science classroom. Students are out of their seats and communicating with one another, fully engaged in the care of their classroom fish. Smartphones have been set aside; instead, students' hands are wet with tank water.

In the hubbub, it's easy to miss another departure from the typical classroom experience. The students, not the teacher, are leading this exercise. This educational approach is called project-based learning: students identify a need or problem, collaborate to

Fish tank housing tilapia at Baltimore Polytechnical Institute.
PHOTO, ADAM FREDERICK/MARYLAND SEA GRANT



South Carroll High School students work in the school's aquaculture lab. PHOTO, ANNALISE KENNEY/MARYLAND SEA GRANT

solve the problem, and describe their findings.

These South Carroll High School students are growing fish in their classroom as part of Aquaculture in Action, an educational program conceptualized by Maryland Sea Grant and University of Maryland Extension 30 years ago. Aquaculture, or raising aquatic organisms under controlled conditions, is a hands-on, interdisciplinary task and an effective teaching tool. Aquaculture in Action has been implemented in 35 schools in eight Maryland counties and Baltimore City.

To South Carroll High School science teacher Justin Howes, these hands-on learning opportunities are beneficial beyond the science lessons they impart, like measuring water quality, analyzing data, and understanding ecological systems.

"They're under so much pressure already, a lot of these kids, whether it's state testing or AP testing," he says. "This class gives them freedom to find out who they are as a student and who they are as a person."

Today, Howes circulates around the room, checking in with students. He hands one student a tool with a brief "You know how to use this?" The student nods and jets off to a tank full of hundreds of rainbow trout (*Oncorhynchus mykiss*). One girl shows Howes several young horseshoe crabs (*Limulus polyphemus*) the size of a pinky-finger print. They discuss the crabs' growth in the tank she constructed. "Mr. Howes!" hollers a student from across the room. "Come see if I did this right."

Maryland schools use aquaculture in many ways to teach environmental and physical science. Some schools embed aquaculture in formal science curricula and in Career and Technology Education (CTE) courses. Others maintain fish tanks as a complement to their environmental science curriculum, or host school aquaculture clubs that engage interested students in extracurricular learning.

Aquaculture set-ups look different across schools, too. Most classrooms use recirculating systems, which run tank water through filters to clean and reuse water. These systems can be small enough to place on a lab bench, similar to a home fish tank. Schools with more dedicated space work in circular tanks holding hundreds of gallons of water and larger fish. South Carroll High boasts a 4,000-gallon tank, which Howes' class used to grow 450 rainbow trout last year. In partnership with Trout Unlimited and the Maryland

Students at Francis Scott Key High School (top) and Baltimore Polytechnic Institute (bottom) grow fish in tanks of various shapes and sizes, depending on space, equipment, and species. PHOTOS, ANNALISE KENNEY/MARYLAND SEA GRANT

Department of Natural Resources, his class released the fish into a tributary of the Patapsco River.

Size, design, and species used in aquaculture systems vary, but every teacher working with fish in the classroom takes on extra responsibilities as they construct and maintain tanks and lesson plans. Keeping live fish demands the investment of time, from summer fish feeding when school is out to early morning mopping when leaks inevitably occur. School administration teams must be prepared to provide funds for parts and upkeep. Fish farming technology evolves, requiring teachers to continue learning about aquaculture systems. Despite these added responsibilities, many teachers say the results are worth the effort.

"Project-based learning can build competencies that lead to confidence," says Eric Oberlechner, farm manager at Green Street Academy in Baltimore who teaches agricultural science, including aquaculture. Biology, chemistry, physics, hardware design, computer and data science, and many other disciplines come into play as students measure water quality, track fish health, and consider the real-world applications of aquaculture. In taking care of living fish, students may even take on critical responsibilities, timekeeping, and personal ownership for the first time in their lives.

Hatching an Aquaculture Education Program

The Aquaculture in Action program was born from a veteran science teacher's experience. J. Adam Frederick joined Maryland Sea Grant to lead the program's education initiatives following nine years of teaching high school science. Frederick found traditional teaching methods did not always prepare students for engaging in real, hands-on science. As a result, he began to employ project-based learning in his own classroom.

"There's an issue where students are taught pieces of things but not overall concepts," says Frederick. For example, a classic lesson on the scientific method defines a series of steps to follow in designing and carrying out a scientific experiment: question, hypothesis, experiment, analysis, conclusion. Students are often given a written procedure and follow this list of steps to complete an experiment. But science is not so orderly in practice.

In project-based learning, students may design their own experiment based on their observations and curiosity. The process helps students practice asking their own questions, reassess their understanding and hypothesis, and start over as they learn new information. Projects are often inspired by a question, sometimes posed by a teacher. The starting question "How can we live more sustainably?" may set students up to calculate their ecological footprint and consumption habits. Project-based learning can be applied to disciplines other than science as well. For example, a project-based learning approach in

“Because [the Aquaculture in Action program] is grounded in project-based learning, it gives kids the opportunity to ask questions, to engage in science as scientists do.”

a US government class may prompt students to organize a hypothetical political campaign.

Researchers studying the impacts of project-based learning have found that this methodology can improve students’ learning outcomes compared with traditional teaching methods. The effects of project-based learning are influenced by variables like subject area, class size, and experimental period. One oft-cited 2023 study published in Frontiers in Psychology analyzed 66 research papers on the effects of project-based learning and found it contributes to students’ academic achievement, thinking skills, and emotional responses. The researchers emphasized that project-based learning benefits students beyond higher test scores, also positively impacting their creativity and higher-order thinking skills.

A few years into his career at Maryland Sea Grant in the late 1990s, Frederick worked with his former colleagues at Carroll County Public Schools and longtime University of Maryland Extension specialist Jackie Takacs to design a high school science curriculum based on aquaculture. He says working with aquaculture systems delivers content-area literacy, the scientific knowledge students are expected to gain from a curriculum. It also delivers disciplinary literacy—real-world, career-building skills. “Aquaculture gives you both,” he says.

Aquaculture became a cornerstone of Carroll County’s Science Research course, an elective science class offered in middle and high schools. Today, every high school in Carroll County has an aquaculture lab. Sarah Weaver, Carroll County Public Schools’ supervisor of secondary science, says Aquaculture in Action is “never seen as an extra project.”

Weaver’s job is to populate the county’s science curriculum with lessons, resources, and guidance for teachers. She says a highlight of Aquaculture in Action is its alignment with the Next Generation Science Standards. These standards set the expectations for what students should learn, including a trifecta of real-world research practices, core ideas from science disciplines, and interdisciplinary ideas. They were developed by a national team of states, including Maryland, under the guidance of the US National Research Council. Maryland adopted the standards statewide in 2013.

“Because [the Aquaculture in Action program] is grounded in project-based learning, it gives kids the opportunity to ask questions, to engage in science as scientists do,” says Weaver. “Those evidence-based strategies for learning science [do] so in authentic ways that honor students as researchers. And I think that’s unique, that you don’t always see in a textbook.”

Though Carroll County made the largest commitment by Maryland schools to the Aquaculture in Action program, many schools and teachers across the state have adopted aquaculture in their science courses. Frederick’s team leads professional development workshops and offers in-person assistance to educators.

Students at Westminster High School and Western School of Technology & Environmental Science carry out scientific research on fish species grown in aquaculture systems.

TOP TWO PHOTOS, COURTESY OF DON ADAMS/ WESTMINSTER HIGH SCHOOL; BOTTOM TWO PHOTOS, ANNALISE KENNEY/MARYLAND SEA GRANT

Aquaculture in Action

30 years of project-based learning in the classroom

In 1996, Maryland Sea Grant and University of Maryland Extension developed the Aquaculture in Action program for K-12 science teachers. This program, originally developed with Carroll County Public Schools, has been implemented in 35 schools across Maryland.

Students are encouraged to develop their own research topics to study, from water quality to food supply to fish disease. **Through project-based learning, teachers and students are connected with university research, applied environmental science, technology tools, and high-quality teacher professional development.**

Aquaculture education benefits students and teachers:

1 Scientific method

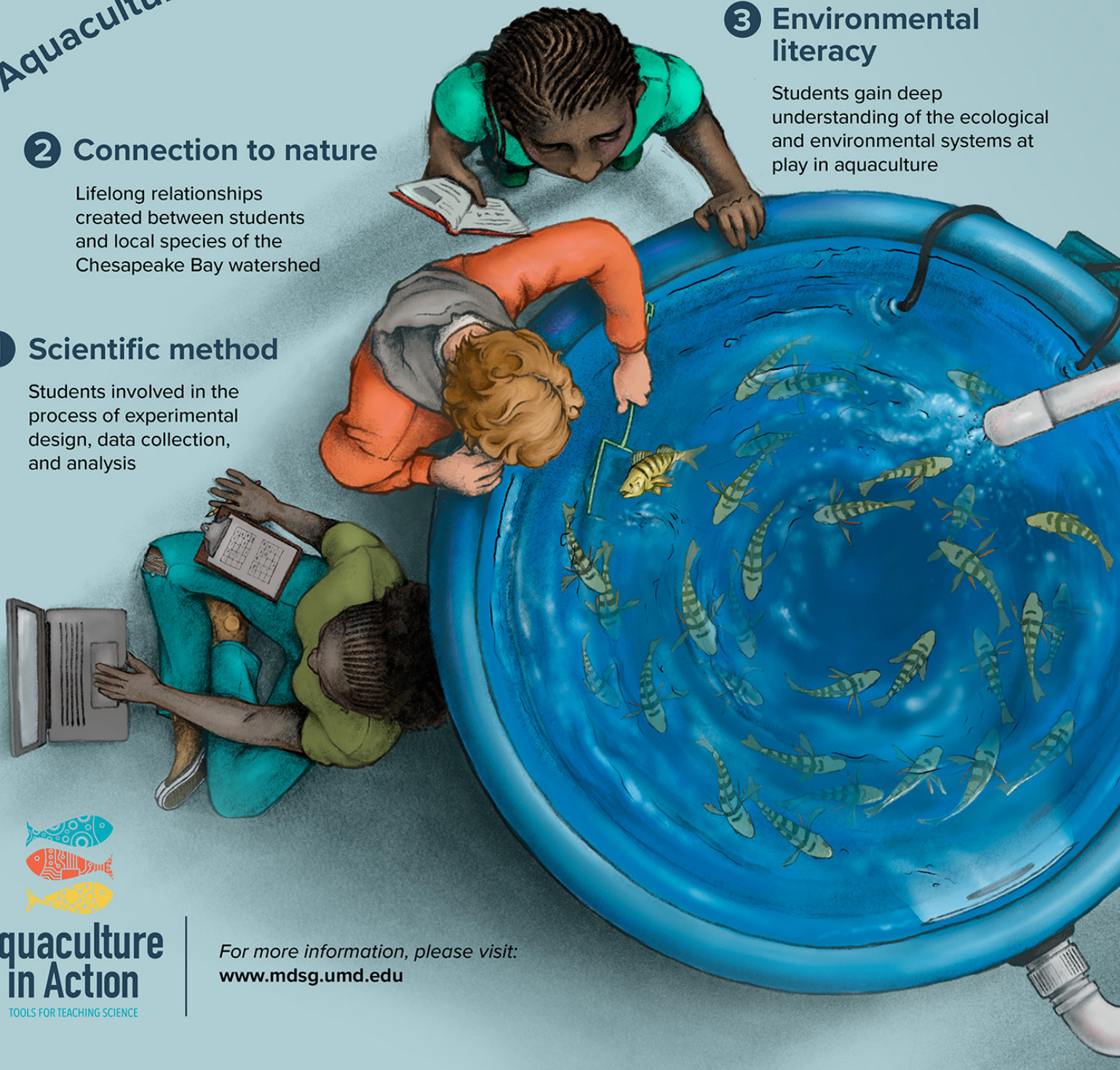
Students involved in the process of experimental design, data collection, and analysis

2 Connection to nature

Lifelong relationships created between students and local species of the Chesapeake Bay watershed

3 Environmental literacy

Students gain deep understanding of the ecological and environmental systems at play in aquaculture



Aquaculture in Action
TOOLS FOR TEACHING SCIENCE

For more information, please visit:
www.mdsg.umd.edu

How the system works

Round, opaque **tank** provides calm environment for natural schooling of fish in one direction

Biological filter provides area for growth of denitrifying bacteria to break down toxic waste (ammonia and nitrite) produced by aquatic organisms

External **water pump** links sump to biological filter

Water flows from tank to **sump**, which collects sediment and particulate matter to maintain water quality of the system

4 Teamwork

Students encouraged to work as teams to design and complete projects, offering ownership and a feel for the modern workplace

5 Hands-on education

Projects promote hands-on applications of physics (water flow dynamics), chemistry (water quality monitoring), biology (fish and plant culture), and engineering (system design)

GRAPHIC, TALIA MASTALSKI/MARYLAND SEA GRANT

Chris Flight, Maryland Sea Grant's aquaculture education coordinator, works with Frederick to provide in-person technical assistance to educators using Aquaculture in Action in their classes. "The program is incredibly authentic," he says. "Students can see their teacher did not stage this. They don't know what the result will be."

Aquaculture in Action is supported by funding from the National Sea Grant College Program. But funding alone does not make a program successful. The connections Frederick has built with partners over the years enable his team to provide materials, training, and curriculum development. Project partners often provide the essential ingredient in aquaculture systems: the fish. Most schools source easy-to-grow fish like bluegill, yellow perch, and largemouth bass (*Micropterus nigricans*) from hatcheries such as the Maryland Department of Natural Resources' (DNR) Joseph Manning Hatchery in Southern Maryland. DNR has donated thousands of fish to Aquaculture in Action. DNR also provides permits for Trout Unlimited's Trout in the Classroom Program, which provides rainbow trout to schools and nature centers.

Maryland Sea Grant's partnership with the Institute of Marine and Environmental Technology (IMET) contributes a backbone of real-world aquaculture research and expertise in recirculating systems. IMET's researchers have provided animal husbandry and aquarium health support to Aquaculture in Action since its inception. IMET regularly donates high quality equipment, such as tanks and filtration devices, to schools and has donated juvenile Atlantic salmon from its Aquaculture Research Center. IMET has also raised fish donated by DNR, preparing them over the summer for fall distribution to schools. These efforts are all part of IMET's desire for broad community impact, says Frederick.

Jonas Miller, a PhD student and researcher at IMET, has donated young Atlantic salmon to Carroll County and Harford County schools, providing students a rare opportunity to grow this popular food fish. "It makes me feel good," he says. "And it reminds me why I do what I do. I had a really good science teacher in high school who inspired me to pursue a biology degree." Teachers who receive fish from Miller and his colleagues have the invaluable opportunity to reach out to world-class researchers to troubleshoot systems or ask about fish health. Sometimes, students even mirror IMET research. For example, some students have modeled studies about how light conditions affect fish on real-world experiments taking place at IMET.

Teacher Mark Kather with students in the CTE program at Western School of Technology & Environmental Science. PHOTO, ANNALISE KENNEY/MARYLAND SEA GRANT

Seeding Student Success

At Western School of Technology & Environmental Science, a public magnet school in Baltimore County, Mark Kather's goal is to "encourage kids to enjoy learning and to become lifelong learners." Aquaculture is one tool he employs as a science teacher in the Environmental Technology strand of the Career and Technical Education (CTE) program. Kather attended a professional development workshop led by Frederick in 2017. His students already worked with fish, but Aquaculture in Action introduced new components, such as using microcomputing systems to measure water quality. It also gave his students access to fish supplied by IMET.

The Western Tech CTE program takes students through three years of hands-on learning about environmental science, engineering, and technology. Kather's students begin working with aquaculture systems in 10th grade, alongside instruction about environmental science. In small groups, students work together to design an ecological system in a tank, selecting fish and adding environmental features suitable for their growth. Throughout the year, they collect water quality data and graph these data to analyze environmental conditions. As students measure ammonia and nitrate, they learn how nitrogen from fish waste is cycled, both in tanks and in natural systems.

Kather says students gain proficiency in collecting and analyzing data. At first, "it takes them all period long—an hour and a half—to collect their data. [At year's end], they're done within a half hour." And along with these practical skills comes an understanding

of the processes underway in ecological systems. Kather notes that while there's plenty of action and activity, students are engaged in understanding what's happening around them. "You get kids moving, but they're thinking too."

In 11th grade, Kather's CTE students can opt into more advanced projects. One team of students works with a large tank housing native fish grown by DNR's Joseph Manning Hatchery or IMET—usually yellow perch, bluegill, or largemouth bass. They maintain the system, repair biofilters and pumps, and monitor and care for the fish. Meanwhile, the whole class engages in studies of a local stream, working with concepts like macroinvertebrate surveys, best management practices, watershed stewardship, and Geographic Information Systems (GIS). At the end of the year, with a full understanding of the stream's health, the class releases the fish into the stream.

Kather says the specialized equipment and hands-on engineering involved in aquaculture brings a technical facet to the CTE course. "The mechanics are different than what we get the rest of the time," he says.

Sharon Dorsey graduated from Western Tech in 2014, having completed the Environmental Technology CTE program. Ten years later, she is an environmental scientist with a master's degree in fisheries and wildlife sciences. She works on water quality monitoring in the Chesapeake Bay watershed. Dorsey joined Kather's CTE program steering committee this year, where she hopes her achievements as a Black, female scientist will inspire students. "I've really leaned back on high school experiences," she says. "I'm happy I've been able to do what I've loved since I was 13."

From working with aquaculture systems and GIS to exploring water quality in her local watershed, Dorsey says the hands-on aspects of the program helped her develop as a scientist. "In high school, you can make mistakes and mess up, but you still get that confidence to know what to do better next time," she says. Regardless of what careers students pursue following the CTE program, she says they benefit from project-based learning. "In any field, there's a component of the environment in it."

A Culture of Collaboration

That same hands-on, supportive approach Dorsey benefited from in the classroom shapes Frederick's professional development workshops for teachers. Frederick has been leading professional development since 1998. He brings teachers—both aquaculture veterans and novices—together for in-person training at least every other summer. The first workshops were funded by Chesapeake Bay Trust, and more recent workshops have been funded by the National Oceanic and Atmospheric Administration (NOAA), via the Bay Watershed and Education Training (B-WET) and Sea Grant programs.

Frederick says the goal of offering teacher workshops is "making the science teaching profession more professional." Teachers are overstretched and under-resourced, managing ever-growing class sizes and curricula. Many struggle to find time for professional development courses, and school systems cannot always provide funding for conferences and trainings. To inspire curiosity and encourage teachers to continue learning, Frederick invites researchers and subject matter experts to his workshops. These trainings also allow teachers to explore aquaculture tools and techniques in the same way their students will learn about them in the classroom.

"Every system has its own little personality," says Chris Flight. "And it's easier when you build it from scratch, because you've seen all the different iterations." He enjoys seeing teachers of different experience levels interact as they stack tanks and lay pipes to build systems. The dialogue they create in the

Aquaculture in Action teacher professional development workshops, such as this one led by Maryland Sea Grant's J. Adam Frederick (pictured at left), have engaged educators in building aquaculture systems, learning about water quality and microcomputing, and receiving updates on aquaculture science from experts.

PHOTOS, NICOLE LEHMING/MARYLAND SEA GRANT

process builds a community of aquaculture educators.

Since 2020, Aquaculture in Action has brought a dozen professional development trainings to educators, equipping them with the tools to enrich their science classrooms. These trainings alone represent more than $77,000 in value based on educator salaries. The ongoing technical support teachers receive from Maryland Sea Grant throughout the school year adds hundreds of thousands of dollars in resources and guidance.

"Programs like [Aquaculture in Action] don't really succeed because of tanks or technology. They really succeed because of people," says Sarah Weaver. "The relationships that have been built through professional learning, that have been built through collaboration, and that shared passion for kids and science learning is really what gives these programs their heartbeat."

Investing in Innovation

In the summer of 2023, 10 Maryland science teachers gathered at Green Street Academy for a six-day Aquaculture in Action workshop. The agenda was packed. In between hands-on sessions in which the teachers built their own recirculating aquaculture systems—which they took with them to their classrooms—they engaged in working sessions about aquaculture research, microcomputing and water quality, and collaboration within the Aquaculture in Action network.

One speaker at the workshop was Harry Berman, a retired NASA engineer and educator who has worked with Frederick since 2017. Following his 47-year NASA career as a systems and software engineer, Berman took a volunteer educator position at Baltimore Polytechnic Institute High School. The engineering classroom in which he worked was across the hall from a room with aquaculture tanks. Naturally curious, Berman noticed students taking water quality measurements by hand. "Gee, why don't we computerize this thing," he thought, and he set his engineer's brain to the task.

One day, while Frederick was dropping off young tilapia at Baltimore Poly, Berman showed him a new development in the aquaculture classroom: a software program he had designed to track pH using a Raspberry Pi microcomputer and water quality probes. Encouraged by Frederick's enthusiastic response and with help from colleagues at Baltimore Poly, Berman continued to refine the software. They eventually unveiled the PolyPonics System—named for its school of origin—an open-source software that provides continuous water quality monitoring in aquaculture systems. Updated versions of the system track a range of parameters, from dissolved oxygen and nitrates to light. They also include graphing and data visualization capabilities.

PolyPonics is designed to introduce students to systems engineering and software development. The system, including a free software package and manual, is widely available to aquaculture classrooms. "I love passing knowledge on," says Berman, who says the use of software in aquaculture allows real-world, interdisciplinary applications. "If you take a real, simple subject, the [scientific] concept just explodes."

Teacher professional development opportunities, like Berman's presentation at the 2023 workshop, encourage a sense of community within Aquaculture in Action. Carroll County Public Schools' Sarah Weaver and Justin Howes say the program is a "glue" that helps teachers feel connected. "Teachers feel invested to come back and support new teachers," says Weaver. "When teachers experience what their students are doing, that's what makes that learning feel real." The Aquaculture in Action website, which includes a database of student projects, is also a place of connectivity for both teachers and students.

"We upload our water quality data every Monday and Thursday to the database," says Howes. The website generates a graph, which helps students track long-term trends. Howes helps the students to consider data trends. "Okay, the last time our pH was low, what did we do to bring it back up?" he may posit. Students can reference previous research to understand and address issues.

Beyond aquaculture education, teachers value being able to share their knowledge with other professionals who have similar goals of inspiring inquiry in students. Laura O'Leary of North Harford High School says this program gives her "an outlet to be my best teaching self." O'Leary took an Aquaculture in Action workshop about 10 years ago, built a tank, and continued to embed various forms of aquaculture in her teaching since. "I am so grateful that I started with Aquaculture in Action," she says. "That way of teaching kids about research, it was really helpful to me."

Keeping the Pumps Running

Not every teacher has the resources, time, or teaching style preferences to use aquaculture and other project-based learning in their classroom. Sometimes, teachers have to find

Students learn to manually test water quality at Francis Scott Key High School. Students can build on this knowledge and develop computer science skills with the Polyponics software program.

PHOTO, ANNALISE KENNEY/MARYLAND SEA GRANT

Left to right: At IMET's Aquaculture Research Center, Jonas Miller scoops juvenile Atlantic salmon from a vertical incubator with Carroll County Public Schools' Sarah Weaver; Miller and Frederick bag the salmon. PHOTOS, ANNALISE KENNEY/MARYLAND SEA GRANT

creative approaches to fit aquaculture into their schools.

Extracurricular clubs can give interested students access to aquaculture. Vicki Mathew, science teacher at Baltimore Poly, says aquaculture is "part of the DNA of the school." Poly has had an aquaculture lab since 2014. The school aquaponics club, which grows vegetables from the waste produced by tanks of tilapia and other species, is thriving. The students took shifts over the summer to take care of the fish and clean the lab space, and they hope to put tanks around the school to help others learn about aquaculture.

At Francis Scott Key High School in Carroll County, science teacher Emily Fair started an aquaculture club this year. Every morning, a group of ninth graders gets to work siphoning and scrubbing tanks. Fair selected the students due to their interest in fishing and agriculture. Several have local family farms. Once the hard work is done, they feed the fish. Fair, who also uses the aquaculture systems for the Science Research course, says her lab prospers thanks to community involvement. Administrators and building supervisors at the school keep an eye on the systems. "And during power outages, some locals even text me to let me know the power is out," she says.

Eric Oberlechner, farm manager at Green Street Academy, says the Baltimore public charter school is stepping up their fish farming capabilities. The school is working to move their aquaculture set-up to a 3,000-foot greenhouse, providing more space than their old basement lab. Green Street has grown tilapia for harvest, as well as yellow perch for release into local waterways.

"One of the fun parts about teaching agriculture is the students get to see a process the whole way through," Oberlechner says. "They get to see how long things take in nature, and it kind of puts perspective on their own lives."

These programs take time. Most of the schools referenced in this article have been working with aquaculture for at least 10 years. Staffing issues, teacher turnover, and tightening budgets are real challenges, says Frederick. Just as an aquaculture system's components can wear out over time, schools can lose teachers, budgets, or administrative support—all valuable in keeping tanks in classrooms.

In October, with a new school year underway, IMET researcher Jonas Miller prepares to offer a fresh crop of juvenile Atlantic salmon to local teachers. Frederick joins him in IMET's Aquaculture Research Center to net fish into bags for distribution to schools. The plastic bags they fill resemble those used by aquarium stores, though each bag contains 250 tiny salmon drifting in cool water.

Meanwhile, students in their school aquaculture labs fill tanks, stabilize water quality, and plan for delivery day. There's an energy humming along with the labs' filtration systems—and it's not coming from the students alone. Sarah Weaver says aquaculture programs bring a fresh spark to science classes. As schools across the country strain to attract and retain teachers, schooling fish can motivate everyone in the classroom.

"It helps with sustainability, when teachers can try something new," she says. "When they can find another way to authentically connect students with science in their daily lives, it's really exciting."

—By Annalise Kenney, akenney@mdsg.umd.edu

Interested in bringing aquaculture to your classroom?

Check out Maryland Sea Grant's new start-up guide for educators: mdsg.umd.edu/topics/k-12-aquaculture-education

Maryland Sea Grant
5825 University Research Court, Suite 1350
University System of Maryland
College Park, Maryland 20740

Address Service Requested

Non-Profit Org.
U.S. Postage
PAID
Permit No. 04386
College Park, MD

Chesapeake Quarterly is printed on recycled paper, processed chlorine free, using soy-based inks.

Visit chesapeakequarterly.net or scan the QR code below to read the full issue, which includes these three stories about environmental education in Maryland.

Science Lessons by Salamander

Follow Maryland students as they raise spotted salamanders in the classroom, getting an up-close look at amphibian development and the unique symbiosis between salamander embryos and green algae.

PHOTO, ASHLEY GOETZ/ MARYLAND SEA GRANT

Building a Sustainable Food Workforce in Baltimore

Seven Baltimore City teens spent the summer engaging in science, caring for aquatic animals, learning how food is produced, and exploring new career paths. Along the way, they gained practical skills, confidence, and an understanding of how food, water, and community connect.

PHOTO, ASHLEY GOETZ/ MARYLAND SEA GRANT

Living and Learning Laboratories

Researchers at the University of Maryland Center for Environmental Science reach K-12 schools, teachers, and local communities with world-class access to environmental science. Explore this institution's legacy of youth education.

PHOTO, UMCES' HORN POINT LABORATORY

Follow us @mdseagrant on Facebook, X, and Instagram!
To see online articles and to send us comments, scan the code to the left.

Want to support this publication and our work? Donate online at mdsg.umd.edu/donate