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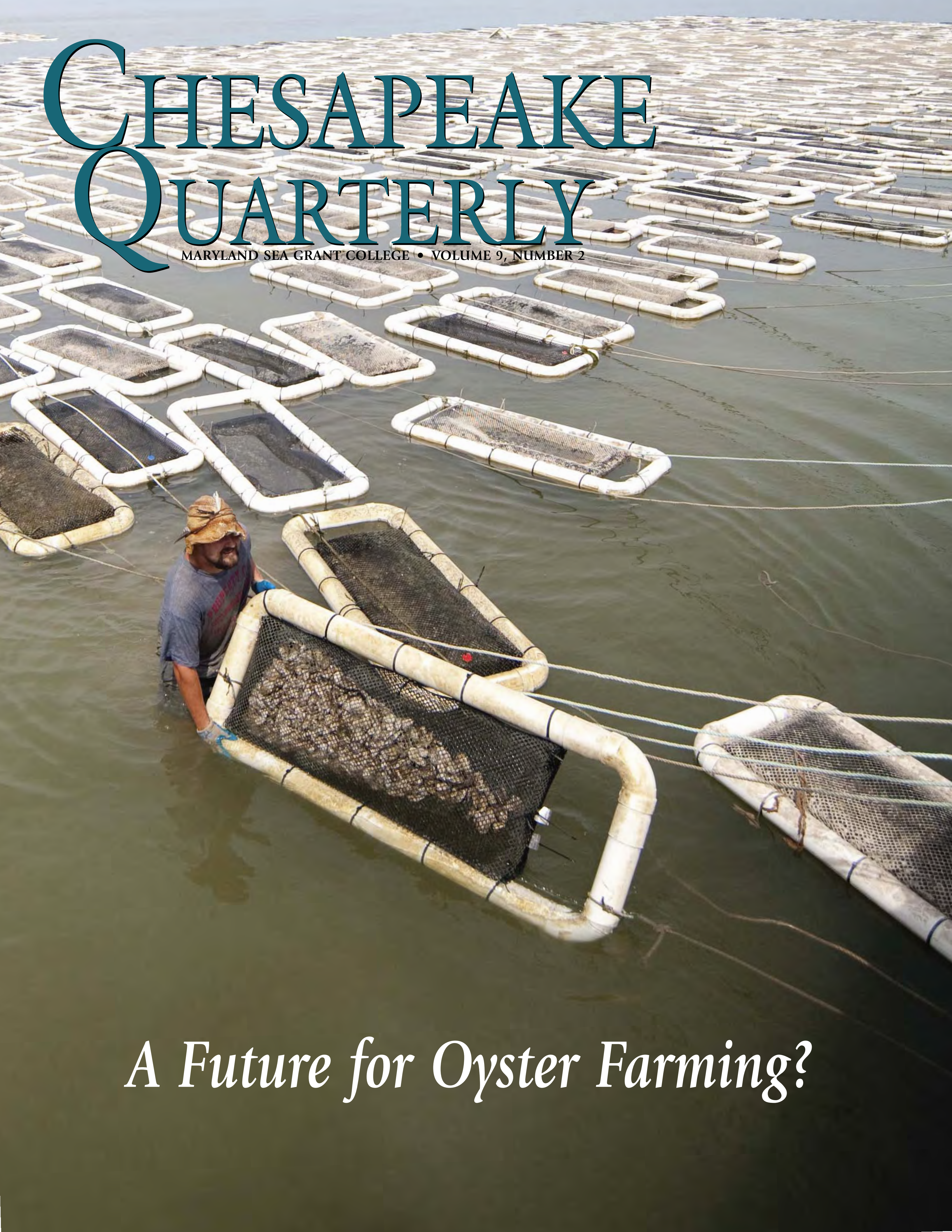

## *A Future for Oyster Farming?*

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*Chesapeake Quarterly* explores scientific, environmental, and cultural issues relevant to the Chesapeake Bay and its watershed.

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***Cover photo:*** *Bubba Parker works his way down a line of oyster floats at the Choptank Oyster Farm. Turning the floats helps burn off the algal biofouling that builds up on the underside.* ***Opposite page:*** *The Choptank Oyster Farm has its grow-out grounds on LeCompte Bay. Depending on the season and the market, the farm keeps 3,000 to 4,000 floats in the water, holding up to eight million oysters, including those newly spawned and those almost ready for harvest. The farm is operated by Marinetics, Inc.* PHOTOGRAPHS BY MICHAEL W. FINCHAM.

# UP FROM THE BOTTOM
## *Oysters for the 21st Century*

**Michael W. Fincham**

If oyster farms ever succeed in Maryland, and start making money for farmers, they might look a lot like the Choptank Oyster Company, a farm that is already growing oysters and already making money for itself and a name for its products.

*"The future is different from what it used to be." — Maryland waterman*

Driving west out of Cambridge, Maryland, you head past the gas station, the old shotgun cottages, and the new townhouses out in the fields along the edge of town. Take the left fork at Long's Store with its shuttered gas pump and keep heading west into the country. At Castle Haven Road, take a right and drive past the long swatches of loblolly pine broken by farm fields and patches of marsh and glimpses of the river. Drive all the way to the end, and then keep going past the stone gateway, past the fields planted with corn and soybeans, past the potholes in the dirt-packed road until you hit the water and the long pier and see spread out on both sides of the pier thousands of floating rafts, thousands of white-ringed rectangles holding dark green bags of oysters. You may have found the future of oyster farming in Maryland.

At least you've found one version of the future and one that seems to be working already. Kevin McClaren first drove down those roads, dodging potholes, in 1999, and as manager for the new company began building an oyster hatchery in a barn. The company didn't put its first oysters in the water until 2001 and didn't sell one until 2004, according to McClaren, who used to run fish farms in the hills of western Massachusetts before migrating to the water-soaked flatlands of Dorchester County. He's stocky, brown-haired, energetic and opinionated — hardly a rarity in the oyster business. The company, says McClaren, recently began making profit.

The first key to their success was the start-up funding and long-range investment plan worked out by the husband and wife owners, Robert Maze and Laurie Landau. A second key was the site McClaren found: he grows oysters along a gently curving beach out on the hook of land where LeCompte Bay meets the mainstem of the Choptank River, a spot where the ferry once offloaded visitors from Talbot County and points north. When McClaren came down from the north, he looked for a beach that had a good flow of water but was far from sewage plants or multiple septic systems or large animal operations. A third key to his success is the way he grows his oysters: up from the bottom in floating racks where the oysters enjoy a river flow that brings water rich in oxygen and in the algal food they like.

ONLY FIVE COMPANIES ARE listed as currently growing and selling oysters in Maryland's Chesapeake Bay, and all use some of form of off-bottom farming, either cages or more commonly floats, a technique that Max Chambers was using on the Nanticoke River some thirty years ago and Frank Wilde was trying on the West River. Most Maryland oyster farmers, however, grew their crop along the bottom in decades past — if they were lucky enough to get some bottom to lease in a state that did not encourage oyster farming. They usually had to prepare their leased grounds by first putting down shell as a firm substrate before planting seed oysters on top, seed that had to be hauled in from elsewhere. Most of those farms in Maryland, both off-bottom and on-bottom, were wiped out during the 1980s when droughts sparked epidemics of two oyster diseases, MSX and Dermo. By 1993 the Baywide Chesapeake oyster harvest — from farming and fishing — had hit its historic bottom.

Neither disease has disappeared yet, but oyster farming may be ready for revival now after a recent series of historic decisions.

Last year the Governor of Maryland put forward a new oyster aquaculture bill that removed many of the roadblocks that hampered oyster farming for more than 100 years. Influenced over the decades by politically savvy watermen who opposed private oyster farming, previous legislation set up restrictions on lease sizes and locations, and on non-resident and corporate ownership. Following up on last year's aquaculture bill, in May the state of Maryland opened 600,000 acres for future private farm leases, which can be held by corporations and nonresidents. The state also converted 25 percent of the viable public fishing grounds into oyster sanctuaries and stepped up its campaign against poachers.

The new changes in the law set phones ringing this spring in a number of state agencies, including the Department of Agriculture, which helps aquaculture businesses with permitting and regulation. The kind of oyster farming that is beginning to emerge in Maryland could be a mix that includes both on-bottom and off-bottom aquaculture, according to Don Webster (see box on p. 5), Maryland Sea Grant Regional Aquaculture Specialist and past chair of the Aquaculture Coordinating Council. On-bottom farms would mostly produce oysters for shucking and off-bottom farms would turn out single oysters designed for the pricier half-shell trade. The mix of farmers could include newcomers like McClaren, established seafood businesses looking for new supplies, and watermen who want to try another way of working the water.

For wannabe farmers, the roadblocks are down, but plenty of potholes remain, including bureaucratic delays, permits, surveys, start-up costs, disease risks, and

turnaround time. For watermen who would be farmers, the potholes can look like craters. After spending their work lives as solitary entrepreneurs, most watermen are not in a position to invest heavily in shell and seed and new gear, and then wait three years before harvesting.

"They don't have it, they can't borrow it, and they don't have any cans of money buried in the backyard to dig up," says Tommy Zinn, president of the Calvert County Waterman's Association. He puts the number of watermen who would try farming at fewer than one in twenty. Zinn thinks that one alternative could be a cooperative venture that shares the cost, the work, the risk, and the rewards. With a small group of local watermen, Zinn has begun experimenting with this option by planting 10 million baby oysters along the bottom of a creek off the Patuxent River.

Forty miles down the road from the profitable floats of the Choptank Oyster Company, down at the marshy tail end of Dorchester County, a group calling itself the Waterman's Trust is designing a different business option, an oyster farm on Fishing Bay that will hire watermen as farm hands. The start-up funding and the business savvy for the farm comes from the Waterman's Seafood Company, a small corporation run by two accountants that operates a profitable restaurant in Ocean City and recently partnered with waterman Jay Robinson to open a small seafood plant in the county. Their farm will focus on traditional bottom planting of spat on shell, but is hoping to try out triploids, the sterile, fast-growing oyster that many Virginia growers are using.

One of the goals of the Trust is "preserving the waterman's way of life," and the labor force for the new farm will come from dozens of watermen who live and work around a number of down-county fishing villages. Watermen would still work their own boats as individual contractors, but they would be keeping their boats at the company dock and working oysters off the company's leases. The work will be more than harvesting: it could include tasks like putting oyster larvae in setting tanks, planting spat on shell, washing oysters, and checking the grounds for disease and predation and poaching by other watermen. The way of life may stay the same, but the work will change. "It's going to be a different animal altogether," says Ryan Bergey, one of the founding partners.

The farm will be located next to Crocheron, a tiny town surrounded by huge swaths of wide, flat water where Fishing Bay and the Nanticoke, Honga, and Wicomico rivers all flow into and merge with the mainstem of the Chesapeake. Watermen have hunted this open range for wild oysters and crabs and fish for nearly two centuries, often with little concern for laws and leases, a history which has the owners of the new farm nervous about poaching. "It's key to have it real close," says Bergey. "So when we have harvestable oysters available for theft, we will have somebody there watching the radar." The person watching the radar would, most likely, be a waterman.

Eighty miles down the road from the Choptank farm, down in Crisfield, the oyster capital of the world during the late 19th century, Casey Todd is setting up a more traditional farm. It will be large scale — with 400 to 500 acres — but will operate essentially as an add-on to his existing business, Metompkin Bay Seafood, a company that has a track record of success and operates one of the state's last remaining shucking houses. For starters that gives him plenty of shell for preparing oyster bottom and for setting new oysters — and plenty of workers for shucking them. Operations like his have survived the Chesapeake's seafood declines by importing oysters from the Gulf Coast as well as crabmeat and soft crabs from Asia. His company currently employs 30 to 40 people, depending on the season, and the oyster farm, he says, could add 10 to 20 jobs to his payroll — if it succeeds.

Success is the big "if" in an estuary where MSX and Dermo still kill oysters in large numbers. Casey planted an oyster farm before, back in the 1980s, and saw his oysters all die from disease, an experience that tempers his hopes for his new farm. "This is the oyster business," he says. "I'm not an optimist. Just when you think you're doing well, an oil tidal wave comes over the horizon and wipes out your beds. Or a bunch of cownose rays comes in and munches them all up." He


***The Whole Foods Market in Annapolis*** *(above) sells Choptank Sweets and Choptank Salts for 99 cents an oyster, shucked or unshucked. Kevin McClaren (opposite page) promotes the local appeal of Choptank oysters, marketing heavily in the Baltimore and Washington area. "People are nostalgic for what's theirs," he told* Chesapeake Bay Magazine. *After working for fish farms in Massachusetts, he apparently hasn't yet transferred his own nostalgia from the Boston Red Sox to the Orioles or the Nationals.*

clearly has enough optimism, however, to try again.

The new hopes for oyster farming stem, in part, from lessons learned from earlier failures. The future, unlike the past, would be built around oyster seed created in hatcheries rather than around wild seed hauled in from elsewhere, a technique that helped spread disease around the estuary. Oyster larvae spawned in hatcheries are disease free, and selected strains can be crossbred for disease resistance and fast growth (see Survivor: Chesapeake, page 12). Farming around disease requires new tools like these as well as new oysters like the triploid oyster, an invented, sterile species that carries three sets of chromosomes (see Trials & Errors & Triploids, p. 6). This genetic redesign of an ancient oyster creates one that is fatter and can be sold year-round. Its biggest benefit may be fast growth. One key lesson seems to be: the best way to beat disease is to grow oysters fast and harvest them quickly.

Another lesson might be: the best way to grow oysters fast is to grow them off the bottom. That, at least, is one of the lessons offered by Kevin McClaren, the


energetic manager of The Choptank Oyster Company. The start-up costs for off-bottom are higher because of all the extra gear, but the oysters grow faster than they do on the bottom, and the final product, a fresh oyster on the half shell trade, brings a much higher price than a shucked oyster in a can. Is the future in off-bottom or on-bottom aquaculture? It's probably in both. For newcomers like McClaren and old hands like Casey Todd, the tradeoffs are tricky and the debate will still be in session a decade from now.

For now the Choptank Oyster Company with its floats full of oysters has traveled farther along the road to profit than other farms in the state, and the largest lesson in their success might lie in the marketing savvy and street hustle that McClaren has shown. He named his core product "Choptank Sweets," creating a catchy brand name that tells oyster eaters where the flavor's coming from. Oyster connoisseurs — like their cousins in wine criticism — love to evaluate the *terroir* of an oyster, that's the French term for the combination of land and water and weather and husbandry that create the unique flavor of a brand. "Wellfleets" and "Island Creeks," to cite two examples, now mean a Cape Cod Bay flavor, just as "Blue Points" once upon a time meant a flavor from the briny South Bay of Long Island Sound. "Choptank Sweets," according to various critics, means an oyster that is plump and sweet with a creamy texture and even a hint of burnt mineral.

McClaren also sells "Choptank Salts," a selection that has spent time soaking in Chincoteague Bay. Once he had oysters he could harvest and brands he could market, McClaren started singing their praises, getting his oysters into regional magazines and high-end restaurants and big-time retail outlets like Whole Foods.

For those just starting down the same road McClaren is willing to offer some cautions. "There are a lot of potholes," he says, perhaps trying to scare away competitors, "a lot of ways to screw it up." Growing oysters includes conditioning the brood stock, getting them to spawn and set, then grading and culling, cleaning and packing and shipping. All these steps have their missteps and most of the work has to go on through the heat of summer and the ice of January and the winds of March.

And all this work, he warns, is only 50 percent of the job. "The other 50 percent is getting out and hitting the streets and selling those oysters and making money off them," he says. "There's a lot of difference between the two."

— *fincham@mdsg.umd.edu*

## Commercial Oyster Aquaculture Resources

**Information**
Maryland Department of Agriculture
Seafood & Aquaculture
www.marylandseafood.org/aquaculture/

**Permitting and Regulation**
Aquaculture Coordinating Council Coordinator
Karl Roscher, phone, (410) 841-5724
email, roschekr@mda.state.md.us

**Training and Education**
Maryland Sea Grant Extension Regional Aquaculture Specialists
Don Webster
phone, (410) 827-8056
email, dwebster@umd.edu
Jackie Takacs
phone, (410) 586-8513
email, takacs@mdsg.umd.edu

**Spat on Shell and Oyster Larvae (Including Triploids)**
Horn Point Laboratory Oyster Hatchery
University of Maryland Center for Environmental Science — Sold through the Oyster Recovery Partnership
www.oysterrecovery.org

**Seed & Supplies (Private Companies)**
See box on p. 15 at the end of Homegrown Oysters, Homegrown Activists.

# TRIALS & ERRORS & TRIPLOIDS
## *Odyssey of an Oyster Inventor*

**Story & photographs by Michael W. Fincham**

One day in 1979, a young grad student was sitting hunched over a microscope in the attic of a hatchery when he realized he had created a new kind of oyster, an oyster nature had never designed.

Thirty-one years later Standish Allen still remembers the moment: he was counting chromosomes through a microscope in an unfinished attic with sawdust on the floor and exposed insulation along the walls. He was smelling the salty, seaweedy air of the Maine coast, and he was seeing, for the first time, a baby oyster with extra chromosomes.

His first reaction was something unprintable, followed by "We did it!" His second reaction was a typical grad school move: He stopped abruptly, jumped up, and hustled downstairs to find his thesis adviser so he could show him his results.

For more than a year Allen had been testing techniques for forcing additional chromosomes into the Eastern oyster, *Crassostrea virginica*, the native species that grows along the Atlantic and Gulf coasts of America. While nature gave oysters two sets of chromosomes, making them diploids, Allen was trying to pack his oysters with three sets of chromosomes, making them triploids. Those extra chromosomes would help Allen's oysters grow fat faster, and those qualities, in theory, should quickly turn these triploid seed oysters into a moneymaker for oyster farmers — not just in Maine but in any other coastal waters where oyster aquaculture was an option.

A triploid oyster, with its triple set of chromosomes, was designed to avoid the market drawbacks of traditional oysters. Nature's oysters are diploids, and they are seldom sold or eaten during the summer months when they're growing gonads to produce sperm and eggs. Those are the months, according to custom and common sense, when oysters are seldom good eating: too crammed with gonads or too watery after spawning. Come September, the first of the "R" months, spawned-out oysters are beginning to recover and fatten up with meat, and watermen and oyster growers can finally bring them to market.

*The work that Allen began as a grad student would one day change oyster farming around the world.*

Allen's oyster, on the other hand, was an oyster for all seasons. Triploids are sterile oysters. They usually don't grow gonads and don't bother spawning, letting them put all their energy year-round into growing meat. As a result the yield from an invented oyster is up to twice the yield from a natural oyster. These fat little oysters can go to market any time of the year — not just Thanksgiving and Christmas and Easter. Seafood lovers could start their crab feasts with appetizers of fresh, plump, summertime oysters.

It would take twenty-six years, however, for this invented oyster to travel from Maine to Maryland where it may now play an important role in reviving oyster farming in the state (see Up From the Bottom, p. 2). Standish Allen, the young grad student with the old New England name, would become a persistent pioneer who would change oyster farming around the world. When his oyster invention finally reached the Chesapeake Bay, it would land the soft-spoken biologist in the middle of a heated and historic debate about how to restore the ecological health of the ecosystem. And then his new oyster would help revolutionize oyster farming in this depleted estuary.

INVENTIONS OFTEN COME FROM unexpected people in unexpected places. The first airplane would be invented by two bicycle mechanics from Ohio, the first personal computer by two dropouts working in a garage, the first triploid oyster by a new grad student working in a state with no history of successful oyster farming. Not even a young Standish Allen could have expected that.

**On the tidal flats of the York River,** *researcher Standish Allen checks the work of his hatchery staff at the VIMS Aquaculture Genetics and Breeding Technology Center.*

The invention of triploid oysters in Maine in 1979 was a sudden leap for a career that had been slow off the mark. After graduating from Franklin and Marshall College, Allen had worked construction for two years building horse barns in Pennsylvania and swimming pools in his hometown of Foxboro, Massachusetts, all the while waiting for his girlfriend to finish college so they could marry and head for Maine. Once there, he worked odd jobs again before talking his way into graduate school at the University of Maine. And there he finally found a focus for his energies in the busy aquaculture scene that was being born in front of his eyes.

On a hill above the tree-lined Damariscotta River, scientists and grad students at the Darling Marine Center were pushing hard with Sea Grant funding to create an aquaculture industry in Maine. As an aquaculture student, Allen was learning the science alongside entrepreneurs who were learning the business. It was the birth and baptism by water of a hands-on "bucket biologist." The scientists he was working with were trying new techniques for farming oysters, hard clams, soft clams, scallops, and salmon. Anything that worked with one species was tested with others.

Sometimes what didn't work with one species was also tried on others. For his work with triploid oysters Allen adapted a technique Norwegians had tried on salmon. He tried forcing extra chromosomes into oyster eggs, using a chemical called cytochalasin B. While the chemical never worked well to create a salmon product for Maine, it proved one of the keys to inventing triploid oysters.

The other key was timing. The chemical, Allen learned, had to be applied during a small window of time shortly after an oyster egg meets up with an oyster sperm. After an oyster egg is fertilized, it begins to throw off female chromosomes it does not need as it takes up a set of male chromosomes. If Allen added cytochalasin B at the right moment, the egg would keep both sets of female chromosomes while still adding one set from the male sperm. Voilà: a triploid oyster with three sets of chromosomes.

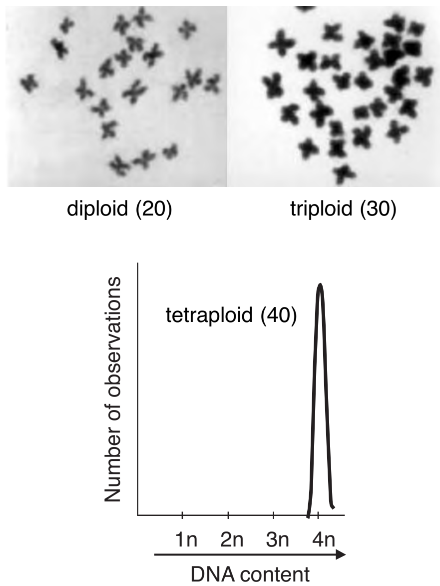
If he added the chemical too early or too late, if he added too much or too little, if the water was too warm or too cold, if the females were not ripe, if the males were not ripe, if dozens of lab steps were not followed exactly — he would get dead oyster larvae. The triploids he created in the lab soon proved themselves in field trials, emerging as fatter and juicier than most of nature's oysters. What Allen had discovered, through dozens of trials and dozens of errors, was a precise but painstaking lab technique. What he had proved was a principle: science could build an all-season oyster.

His advisor, oyster biologist Herb Hidu, soon clambered up to the attic and peered into Allen's microscope. His mentor, fish biologist John Stanley, reviewed his slides. Both confirmed his findings and shortly thereafter the University of Maine awarded the young grad student a Master's degree in Marine Biology.

AN INVENTION, ALLEN SOON discovered, can sometimes be an idea ahead of its time. While the telephone made Alexander Graham Bell a rich man, he died claiming his greatest invention was the "photophone," a device that could transmit sound on a beam of light. His concept is crucial to contemporary fiber optics, but it was irrelevant in the late $19^{th}$ century. The triploid oyster seemed destined for a similar fate.

The first time the newly invented oyster was tried for commercial farming, it flopped. It grew fast, but oyster farmers in Maine were not interested. The oyster industry, struggling to get started, was not ready to try a biotech invention that seemed to require a lot of laboratory manipulation with toxic chemicals. The triploid seemed an irrelevant invention.

### Counting Chromosomes




***Looking through a microscope*** *in 1979, Standish Allen knew he had invented a triploid oyster when he counted three sets of 10 chromosomes, for a total of 30 (top right). Natural oysters are diploid, with only two sets, for a total of 20 chromosomes (top left). The counting process took half an hour per oyster. By 1993, he could use a high-tech flow cytometer to do the counting for an oyster with four sets of chromosomes (bottom). That spike on the graph meant Allen and Ximing Guo had invented another new oyster — a* ***tetraploid.*** PHOTOGRAPHS AND GRAPH COURTESY OF STANDISH ALLEN.

When Allen left Maine, feeling shunned by the industry, he headed for the West Coast, where his invented oyster first began to pay off in commercial farming. Arriving at the University of Washington for his Ph.D. work, he discovered a thriving oyster industry with farmers and hatchery operators who wanted to try out triploids. Working in Kenneth Chew's lab with support from Washington Sea Grant, Allen teamed up with Sandra Downing, another grad student, to apply his chemical technique and create a triploid version of another oyster species, *Crassostrea gigas*. This Japanese oyster had been transplanted to the West Coast and renamed the Pacific Oyster.

Working with Coast Oyster Company, one of the largest commercial oyster companies in the world, Allen and Downing next adapted his tricky chemical techniques to the task of creating triploids in large batches. The solutions Allen and Downing came up with were sometimes messy but mostly successful, with their commercial batches averaging 70 to 90 percent triploids. The bucket biologist had joined the biotech revolution.

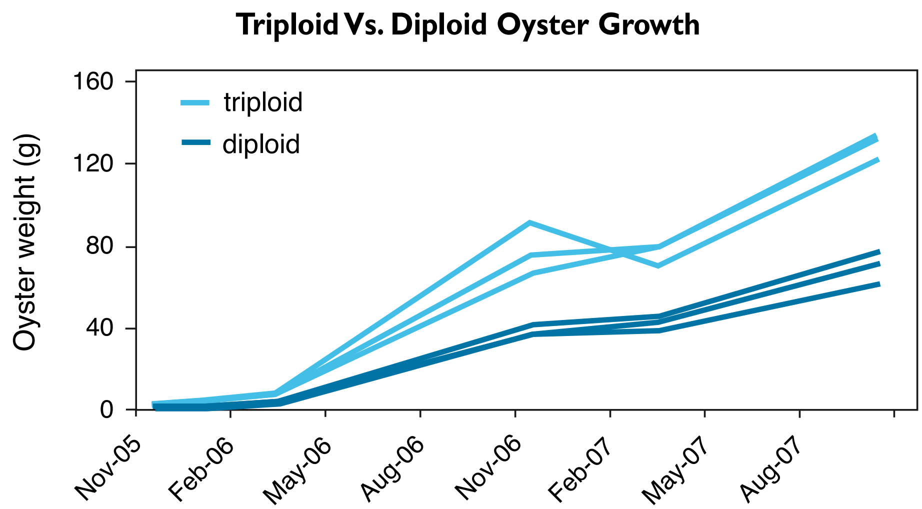
A technical video from that era shows Allen as a young-looking scientist lecturing on triploids. He's slim, sandy-haired, and clean-shaven, and wearing huge horn-rimmed glasses that give him the earnest look of an eager undergraduate. But now he had his Ph.D. And large oyster hatcheries on the West Coast were selling triploids to oyster growers, they in turn were selling them to restaurants, and restaurants were selling them to customers.

The day he passed his final exams, Allen and his friends celebrated at a Seattle bar where he could order triploid oysters on the half shell. Slurping down one of his invented oysters, he couldn't help joking, "My work here is done." Then he headed back to the East Coast where he would come up with his next oyster.

THE FIRST STEP IN THE INVENTION of his next new oyster came when Ximing Guo left China, the birthplace of aquaculture and the source for 70 percent of the world's farmed oysters. A native of Qindao, on the northern coast of China, Guo came to the University of Washington where he read Standish Allen's early work on triploid oysters and decided on his Ph.D. project: he would create another new species: a tetraploid oyster with four sets of chromosomes.

Guo tried and failed, then tried again and failed, and then kept trying. "There are probably five different ways to theoretically make a tetraploid from God's diploid creature," says Allen, "and in each case he met with failure." Guo's Ph.D. dissertation turned into a summary of all his failed attempts at creating tetraploid oysters.

If necessity can be the mother of invention, then sometimes serendipity can be the father, and in Allen's case, serendipity meant finding the right partner. It's hard to imagine Orville Wright without Wilbur, or Steve Jobs without Steve Wozniak. And it's unlikely Allen would have come up with his next




***A triploid clearly grows faster** than a diploid oyster, as the graph above demonstrates. In this trial in a high-disease area of the York River, triploid versions of* Crassostrea virginica*, the native Chesapeake oyster, grew 50 percent heavier than diploids in less than two years. With their fast growth, triploids usually go to market in less than two years. At right is a fat triploid oyster, just shucked and ready for eating.* GRAPH COURTESY OF STANDISH ALLEN.

invention if he hadn't hooked up with Ximing Guo.

Why struggle so long to invent yet another new oyster? Because Guo knew that tetraploid oysters would be the best way to create triploid oysters. In the math of mating, a tetraploid with four sets of chromosomes could be mated with a diploid, a natural oyster with two sets. The offspring would be triploid oysters with three sets — but triploids created without messing around with toxic chemicals. The magic chemical Allen used with triploids was also a major carcinogen, and the Food and Drug Administration was getting ready to ban its use in commercial hatcheries. The invention of tetraploid breeding could make triploid oysters commercially workable almost anywhere in the world.

When Allen landed his first full-time faculty job in 1989 at the Haskins Shellfish Research Laboratory in Bivalve, New Jersey, he remembered Ximing Guo and his theory about creating tetraploids. He also remembered that all of Guo's grad-school experiments flopped. The reason: diploid eggs, Guo found, were not large enough to hold two extra sets of chromosomes in their nucleus. Out of his multiple failures, however, came a hypothesis: perhaps the only way to create tetraploids was to start with large eggs from triploids.

It seemed a hopeless hypothesis since triploids weren't supposed to have eggs, and the search for a tetraploid oyster may have ended there, but for serendipity. In all his work with triploids in West Coast labs and hatcheries, Allen would occasionally spy through his microscope a triploid oyster with eggs. Never very many eggs — but perhaps enough eggs to test Guo's hypothesis. "On occasion, triploids will make eggs," he explains, "and on those occasions you can use the eggs because they are fertile." Biology, says Allen, is the science of exceptions, and in his lab work he had seen the exceptions.

Allen helped recruit Guo to the Haskins Lab, and in 1993 the two new faculty began searching for that uncommon creature — a triploid oyster with big eggs. An egg-bearing triploid is so rare, one researcher named it "the Blue Moon," and finding enough of them meant somebody had to slice open thousands of triploid oysters and examine the tissue of each one under a dissecting microscope. Allen now had grad students and lab workers to handle much of the grunt work, but once triploid eggs were found, he and Guo had to go back into the lab with the chemical cytochalasin B. Working in a controlled lab setting, they used the chemical to pack those triploid eggs with a fourth set of chromosomes, and then they grew their altered eggs into oyster babies. Finally they began counting their chromosomes.

Allen didn't have to use a microscope this time. Now he had access to a flow cytometer, an expensive device that could count chromosomes faster than 30 pairs of eyeballs squinting through 30 microscopes. Staring at the cytometer screen with his one set of eyeballs, Allen found himself waiting for a spike in the far right column. That would signal the presence of a fourth set of chromosomes.

On the first oyster in the first batch, Allen saw the spike pop up that said tetraploid. It was the second "we-did-it" moment in his life as a scientist. It's an instant that freezes the mind: verification or falsification, the verdict is announced, the envelope is opened, the winners are named. Sudden proof comes rarely in biology, a science built on the slow accretion of field observation and lab experiments and endless quantification. But for Allen the answer arrived in a second, in the blink of an eye. Allen and Guo had invented another oyster never seen in nature.

The new oyster would soon be patented — the second patent Allen has his name on — and their tetraploid technique is now used to create triploids for oyster farming in more than six states and nearly a dozen countries with more regions trying it every year. His second invention had saved his first invention.

Staring at the screen Allen flashed back to his first discovery moment 12 years earlier hunched over a microscope

***Anu Frank-Lawale examines one of the tetraploid*** *brood oysters at the VIMS Aquaculture Genetics and Breeding Technology Center. Tetraploid oysters are spawned with diploid oysters to create triploids for growout on oyster farms. Classically trained in genetics at Scotland's University of Stirling, Frank-Lawale now serves as Breeding Research Manager.*

## An Oyster Primer

Three species of oysters, one native and two imported, have been considered for aquaculture in the Chesapeake Bay.

***Crassostrea virginica*** — The Eastern Oyster is native to the U.S. where it has been fished and farmed from the North Atlantic down to the Gulf of Mexico. Disease epidemics of MSX and Dermo began devastating oyster stocks in Delaware Bay and the southern Chesapeake Bay in the late 1950s. New disease outbreaks in the 1980s reduced harvests from fishing and farming to all-time lows and raised interest in introducing a non-native oyster.

***Crassostrea gigas*** — This Japanese and Korean species has been renamed the Pacific oyster and transplanted for aquaculture to a number of countries, including the West Coast of the U.S., Canada and Mexico, the British Isles, France, Portugal, Australia, and New Zealand. The species was rejected for use in Maryland in 1932. Starting in 1993, *gigas* was tested in Virginia waters before also being rejected in 1998.

***Crassostrea ariakensis*** — Starting in 1998, the Chinese Suminoe oyster, native to coastal China, was evaluated for introduction into the Chesapeake. After laboratory experiments and field trials with sterile triploids, the species was rejected in April 2009, ending a long-time interest in using a foreign oyster to replace or supplement the native *virginica* oyster.

ILLUSTRATION SOURCES: *CRASSOSTREA VIRGINICA*, FROM THE AMERICAN OYSTER *CRASSOSTREA VIRGINICA* (GMELIN), P.S. GALTSOFF, 1964; *CRASSOSTREA GIGAS* AND *CRASSOSTREA ARIAKENSIS*, COURTESY OF CHRISTOPHER LANGDON.

in an attic in Maine. "Those are the two pinnacle moments of discovery," Allen now says. "In my career, it comes down to two." Once again, he had to show somebody. He stopped, grabbed a visiting researcher as a witness and had him sign his lab book.

A DECADE LATER, WEARING HIP waders and a Boston Red Sox baseball cap, Allen was sloshing slowly along the wide tidal flats off the mouth of the York River, checking on dozens of oyster bags lined up in neat columns in front of the hilltop home of the Virginia Institute of Marine Science. The year was 2003 and I was meeting with him to find out why triploids were needed in the Chesapeake Bay.

Stocky with a two-day stubble on a sun-baked face, Allen seemed to enjoy the wet work, the hands-on hauling of bags and racks that are the daily drill of oyster aquaculture. Reaching down, he hauled up a wire mesh bag full of the Bay's native oysters and shook it. The rattling oysters gave a dull sound like empty castanets clacking together. That comes from hollow boxes, oyster shells empty of meat, banging against each other. "That sounds like dead oysters to me," he said.

By 2003, triploid oysters seemed to be an invention whose time had come in the Chesapeake. With populations of native oysters devastated by MSX and Dermo diseases, the Virginia Seafood Council began using sterile triploids as a safe way to test foreign oysters before introducing them en masse into the Chesapeake Bay. As the inventor of sterile oysters Allen seemed a logical choice to organize the incursion — especially since he could now use tetraploids for creating large batches. In 1997 the state legislature gave the Virginia Institute of Marine Science (VIMS) new funds to recruit the godfather of triploids away from Rutgers.

Allen had already become a player in Chesapeake oyster politics. In their first love affair with a foreign oyster, Virginia growers had courted the Japanese oyster, *Crassostrea gigas* — and Allen had supplied the sterile oysters for field trials while still working from his hatchery at Rutgers. The affair, however, did not end well. Local consumers didn't find the new bivalve delicious, claiming it left a metallic taste on the tongue, and the Virginia Seafood Council in 1998 went looking for another love. The dismissal left a little bit of a bad taste with Allen, a biologist who projects a sober demeanor but often leaks sardonic humor at unexpected moments. "East Coast oyster eaters," he said, "are snobs about their oysters."

Wading forward across the shallows in front of VIMS, Allen led me to a heavier, fatter-looking bag. When he hoisted it and shook it he got a different sound: instead of empty castanets, he got thick, clunky thuds like rocks banging together. That comes from oysters chock full of live oyster meat. "This," he said, "sounds like money to me."

These oysters were triploids created from a Chinese oyster now called *Crassostrea ariakensis*. The oysters in the bag were large and healthy, fast-growing and disease resistant. They may have been the second choice after the Japanese species, but the Chinese oyster and the Chesapeake Bay seemed a marriage made somewhere in oyster heaven.

Any marriage, however, would have to survive a long, contentious engagement while scientists asked questions about the new love interest. Could the non-native oyster grow well and sell well to East Coast oyster eaters, could they reproduce well, could they could create reefs, could they filter large volumes of water? If the triploid trials came up with the right answers, the result could be a large-scale introduction of a reproducing Chinese oyster that might revive a commercial fishery and perhaps help restore Chesapeake Bay.

It was a challenge that excited Allen. His first job at VIMS had been to design and direct an Aquatic Genetics and Breeding Technology Center, and creating large numbers of Chinese triploids was one of its first achievements. Sitting outside the Center's hatchery, Allen was soon grasping for superlatives as he described the potential of *ariakensis*. "It's just phenomenal," he said. "It's like a super oyster." That was high praise from a thoughtful biologist who clearly had high hopes for this non-native. Solving the Chesapeake's oyster drought with either a native or non-native species could be "life-defining," he admitted. Right up there with three times inventing triploid oysters.

His career in the Chesapeake, however, would soon be full of unexpected experiences — not all of them pinnacle moments. When the early field trials showed the Chinese oyster to be a fast grower, the soft-spoken Allen found himself in the hot center of a historic debate. On one side were oyster farmers who saw a commercial payoff and scientists who saw an ecological payoff from a new reef-building, water-filtering oyster. Opposing them were scientists and environmentalists who argued just as passionately that the foreign oysters could introduce yet another new disease in the estuary or outcompete the native oyster for habitat. As the debate ramped up, Congress held hearings, the National Academy of Sciences ran a major review on the risks of non-native oysters, and the U.S. Army Corps of Engineers organized a multi-year Environmental Impact Statement.

All that interest brought down intense scrutiny on the triploid oyster factory Allen was running at the VIMS hatchery. While most triploid oysters born of tetraploids are sterile, a small percentage, well below one percent, can turn fertile and reproduce. For every batch of 1,000 Chinese triploids he sent out for field trials, Allen was allowed no more than one fertile reversion.

That proved a tough standard when he tried to launch his first million oyster field test. According to the original plan, ten oyster packers would each get 100,000 tiny Chinese oysters to plant, grow, and harvest — but only if his triploid batch passed the reversion test. In a sample of three thousand *ariakensis* oysters, however, Allen found four fertile oysters. That averaged out at 1.3 oysters per thousand, putting him over the limit, and requiring him, in effect, to flunk a million oysters. Allen was sitting in front of a flow cytometer when he saw the numbers, but doesn't remember the experience as a pinnacle moment.

Several days later on a sweaty August afternoon, he gave shovels to two of his young lab assistants and showed them where to dig a grave. The next day, on the grounds of the Virginia Institute of Marine Science, with a minimum of ceremony, with one reporter looking on, Allen and his crew buried nearly a million tiny Chinese oysters on a small knoll overlooking the York River. Not a pinnacle moment either, but an unusual moment in the history of oyster science.

When they finished shoveling dirt over the oysters and tamping down the grave, they went back to work breeding more Chinese oysters for more field trials. In all his crew would create nearly five million *ariakensis* oysters for test plantings in the Bay.

The death blow came in April of 2009 when the final decision on Chinese oysters came down. After spending five years and millions of dollars on an Environmental Impact Statement, the Army Corps of Engineers announced that the Chinese oyster was out, the native oyster was in. The decision makers on the study's Executive Committee included the natural resource agencies in Maryland and Virginia, the Potomac River Fisheries Commission, the Atlantic States Marine Fisheries Commission, and NOAA, EPA, and the Fish and Wildlife Service. As a filter feeder the Chinese oyster might accumulate viruses harmful to humans, they said. And it might outcompete the native oyster.

Oyster growers began lifting the last Chinese oysters out of the York, the Rappahannock, the Little Wicomico, the Yeocomico, Fishing Creek, and Folly Creek. By June 1, 2009, Allen's Chinese oyster was gone from the Chesapeake. For the Virginia seafood industry, an 18-year romance with foreign oysters had ended in a bitter divorce. For both aquaculture and restoration, Maryland and Virginia would be betting the farm on the disease-ravaged native oyster.

Over eight years of field trials, Allen had to perform five burials for Chinese

# Survivor: Chesapeake

## *An Oyster Reality Show*

Some oysters survive disease and some don't. When survivors mate with survivors, their offspring tend to survive even longer. Natural selection, nature's long-running reality show, will over time pick winners among the oyster tribes of the Chesapeake Bay and vote losers right out of the estuary. Eventually the Bay would hold an oyster population of winners, animals largely impervious to MSX and Dermo, the two diseases that devastated oysters in this estuary for more than 50 years.

Standish Allen wants to speed up the process of picking winners, at least for oyster farmers. A dozen years ago he began growing oysters on the tidal flats in front of the Virginia Institute of Marine Science, an area at the mouth of the York River where disease usually flourishes. Working with the Chesapeake's native oyster, *Crassostrea virginica*, he would wade out on the flats and pick out the hardiest survivors, both males and females. To make sure the survivors hooked up with each other, he would spawn them in his hatchery at the Aquaculture Genetics and Breeding and Technology Center. Their offspring would then head out to the flats to take their chances with disease.

Two to three years later, Allen would wade out again and start picking the winners among the offspring so they could also hook up together in his hatchery. "It's a little simplistic," says Allen. "It's just weeding out the ones that can't tolerate disease until you have just the right ones." By finding the right ones, generation after generation, Allen was hoping to amplify the trait of disease resistance. So far it's working: the oysters in each generation survive better than their parents.

Breeding begins with a simple concept — pick the right oysters — but it immediately gets more complicated. The right oysters for the tidal flats of the York River, for example, may not be the right oyster for other areas to the south or the north. So Allen now puts his oysters out on three different farm sites: the high salinity waters of the Lynnhaven Inlet down near the mouth of the Bay, the moderate salinities of the VIMS tidal flats, and the lower salinities of the Yeocomico River up near the state's northern border.

It gets more complicated again when you're also trying to breed resistance to two very different diseases at very different sites, all at the same time. MSX, Allen discovered, was the easier disease problem to solve. Since this disease attacks oysters at any age, young or old, MSX creates an immediate selective pressure, picking winners and losers as soon as new oysters go into the water. As a result, according to Allen, it takes only four to five generations to breed a line of oysters that are fairly resistant to MSX disease. Sometimes, apparently, you can speed up natural selection.

***Standish Allen leads the Aquaculture Genetics and Breeding Technology Center,*** *one of the few long-term oyster-breeding programs in the world. Here Allen checks a bag of his best-performing seed oysters, a line named "Lola" that is a crossbreed between oysters from low salinity waters in the Chesapeake Bay and oysters from Louisiana that carry resistance to Dermo. These Lola oysters survive and grow well in the Yeocomico River near Kinsale, Virginia, but no single line of crossbreeds does well everywhere in the Bay.*

And sometimes you can't. Since Dermo strikes oysters later in their life cycles, often at three years, Allen found it much more difficult to quickly create a Dermo-resistant oyster line. Thinking outside the box, he went outside the Bay and brought in oysters from the Gulf of Mexico where Dermo has been attacking oysters for much longer. He's hoping to tap into their hard-earned natural resistance by crossbreeding Louisiana survivors with Chesapeake Bay survivors.

First, of course, he had to expose the Gulf oysters to MSX, a disease new to them, and find which oysters could survive and which could not. Since he needed different oysters for different places, he created two lines of these crossbreeds. He calls his low-salinity Louisiana line Lola, and he named his high-salinity Louisiana line hANA.

His latest strategy for defeating Dermo seems, at first, counterintuitive. Two years ago Allen decided to stop selective breeding for disease resistance. "We have reached a level, a plateau of disease resistance that I think is acceptable for commercial purposes," he says. His alternative strategy for Dermo: breed for speed. Since Dermo attacks oysters in their third year, he wants to grow an oyster you can harvest at two years — or earlier. "You are doing an end run around the disease," he says. Disease becomes a moot point.

How fast are his oysters? Starting from seed phase, his natural oysters can already reach market size in 18 months — at least when grown in off-bottom floats or cages. "Our goal is to get it down to around a year," he says, "so that you put out an oyster, and in a year you can have a crop."

He's already reached that kind of fast growth rate with his triploid oysters, an invented oyster designed to carry three sets of chromosomes. Because they are sterile, non-spawning oysters, triploids grow faster, and they can be eaten year-round. To create triploids, Allen takes natural diploid oysters that carry two sets of chromosomes and breeds them with tetraploid oysters that carry four sets. His tetraploids all carry disease resistance — and so do their triploid offspring. Oyster hatcheries in Virginia and elsewhere can acquire tetraploid brood stock from the VIMS breeding center and then create their own triploids.

Disease and fast growth are only two of the numerous traits Allen has focused on with his breeding strategies. Oyster farmers, like oyster eaters, also want traits like meat weight, oyster size, shell shape. As a result, Allen has created more than 15 oyster lines, using natural selection, generation after generation, to nail down each specific trait.

His latest move may seem counterintuitive again, but now he is collapsing those lines, crossbreeding lines with specific traits in hopes of getting a couple lines that carry all those traits. "I hesitate to call them 'superlines,' " he says, "because that sets expectations too high." But that's what he calls them, at least among friends and reporters. In short: the final survivor in Standish Allen's reality show should be the perfect half shell oyster.

— *M.W.F.*

oysters, creating next to the VIMS hatchery a small cemetery of unmarked oyster graves. The symbolism was obvious to him. We do a lot of research, he told me, and then we bury it.

A YEAR AFTER HIS CHINESE oysters were voted out of the Chesapeake, Allen is back walking the beach in front of VIMS, showing me racks of oysters lined up in neat rows along the tidal shallows. Out on the flats, three of his hatchery workers are wading among the racks, lifting and moving bags of oysters. All these are native *virginica* oysters that he's been crossbreeding for fast growth and disease resistance, the traits that may represent the last, best hopes for oyster farming in the Chesapeake (see Survivor: Chesapeake, p. 12).

***Triploid oysters like these were an invention** worth a patent. When Standish Allen first created triploids in 1979, as a grad student working with the native East Coast oyster, he published his results. In 1984, while working on his Ph.D., Allen created triploids again, this time with the Pacific oyster. He was denied a patent on triploids because his technique was no longer original — as a result of his earlier publication. Ironically, his losing case,* Ex parte Allen, *became a landmark in legal history, since it established that patents could be granted on living animals altered by science. Allen is now one of the patent holders for tetraploid oysters, an invention he created in 1994.*

Allen's sandy hair is now streaked with gray, and he's grown a beard, also graying, that gives him a grizzled professor look that works well when he goes into sardonic mode. He can slip into that mode easily when he's talking about the *ariakensis* decision, but for the most part he's surprisingly optimistic — in his restrained style — about the future. And with good reason.

The long, failed courtship with Chinese oysters, according to Allen, launched nothing less than a revolution in oyster aquaculture in Virginia. For more than a century, most oyster farmers followed a simple routine: dump wild seed on productive nursery bottoms and come back three years later in hopes of a harvest. When disease began devastating oyster grounds in the late 1950s, most Virginia seafood packers went out of business, but some began buying oysters from out-of-state suppliers. Most of the oysters now shucked and sold in the Chesapeake region have come from elsewhere, especially from Gulf states like Louisiana where the recent oil spill may soon cut the supply of oysters to the whole country.

To take part in the Chinese oyster trials, however, Virginia processors had to adopt a more intensive approach. They had to use bags and floats and off-bottom cages and carefully monitor and record growth and mortality. "When they ran out of *ariakensis* to test," says Allen, "they were left with the gear that enabled them to try growing our native species."

Between 2005 and last year, more private hatcheries geared up, and the production and planting of hatchery-grown oyster seed more than quadrupled. By 2009, the sale of farmed oysters from Virginia had increased ten fold. "The whole *ariakensis* thing impelled native oyster aquaculture," says Allen. "It just shoved it out the door. They went from being packers to being aquaculturists."

As Chinese oysters made their exit, the oyster that began to take center stage was the one he first invented thirty years earlier. Oyster farmers in Virginia began trying a triploid version of the native *virginica* oyster. Call it an accident of history. During the large-scale field trials, oyster growers in Virginia were asked to plant a small sample of triploid natives (1,000 oysters) next to their large plantings of Chinese triploids (100,000 oysters). Scientists wanted to have an "equivalency test," a comparison of the two triploid species, native versus non-native. Virginia growers were soon impressed with how fast the Chesapeake triploids grew.

Those Virginia growers ended up as early adopters for Chesapeake triploids. "We are working with it because that's the available option we have," says A.J. Erskine, an aquaculture specialist with both Bevans Oyster Company and Cowart Seafood. "I would anticipate triploids are going to be much more valuable for us than diploids." The invented oyster grows fast enough that it can often be harvested before MSX or Dermo diseases can kill it off. And it can be harvested all year, says Erskine. "It allows us to market that oyster during the summer."

For Standish Allen, the man who created triploids out of three species — the native *virginica* oyster, the Japanese *gigas* oyster and the Chinese *ariakensis* oyster — this last payoff is a low-key kind of pinnacle moment: The inventor finally gets to see one of his inventions catch on in the Chesapeake Bay.

— *fincham@mdsg.umd.edu*

# Homegrown Oysters, Homegrown Activists

**Michael W. Fincham**

As he was building a home along a creek in southern Maryland, Jim McVey decided to order 1,000 baby oysters from an out-of-state hatchery. After they arrived in the spring of 2006, he took his tiny, quarter-sized oysters and packed them in small mesh bags where they clinked together like dark, misshapen marbles. When he hung his bag of oysters under his dock along Hellen's Creek, a small offshoot of the Patuxent River, McVey became the first person on record to grow a new, genetically altered oyster in Maryland waters.

Michael W. Fincham

***Jim McVey grows two kinds of oysters** under his dock. In his left hand: a single triploid, an oyster invented to be sterile and fast-growing. In his right hand: a shell with a clump of natural diploid oysters that started as spat. The triploid will end up on a dinner table. The diploid oysters will end up on a nearby sanctuary.*

He was the first, but he was not alone for long. Later that year Len Zuza began growing the same new oyster along Saint John's Creek, another nearby offshoot of Maryland's Patuxent River. Both men were growing an oyster called a triploid, a sterile, faster growing oyster that can be harvested and eaten all year round. First invented in Maine over 30 years ago, triploids were designed to give oyster farmers a profitable new product.

To date, however, the early adopters of triploids in Maryland have mostly been oyster gardeners like McVey and Zuza, for whom triploids are only a sideline. Their primary mission is growing native, natural (diploid) oysters at their docks to help restore water quality in Chesapeake Bay. The oyster gardening movement — and it is a movement — began in creeks. In the early 1990s the Magothy River Association had creekside gardeners raising oysters to replant an old reef. By the mid-1990s, local environmentalist John Flood was plunking oysters on a reef in Harness Creek, not to grow and sell and eat them, but to put the filtering power of oysters back to work in his home waters.

By 1997, large organizations were joining up. The Chesapeake Bay Foundation (CBF) began its own ambitious Oyster Gardening Program by hiring Michelle Cummins from the Magothy River Association. Another model, according to Bill Goldsborough of CBF, was the Tidewater Oyster Growers Association, a Virginia group that encourages amateur growers to raise oysters at their docks — not only for restoration, but also for food. In Maryland's programs, the focus for gardening has been restoration, with seed oysters usually provided by the Horn Point hatchery at the University of Maryland Center for Environmental Science.

Gardeners could now get training, seed oysters, and the gear to grow them. Once their baby oysters hit their first birthday, they could turn them over to the Chesapeake Bay Foundation or to the Oyster Recovery Program. Both organizations focus their planting on large sanctuaries that once held natural oyster bars. "We want to plant oysters," says Goldsborough of CBF, "where there is documentation they will grow." Their goal is restoration of the Bay.

Homegrown activism is still alive and still kicking up new organizations, however, and some of these new arrivals are trying to refocus the movement back where it began — on creeks. Down on St. John's Creek, for example, Len Zuza started the Southern Maryland Oyster Culture Society (SMOCS), a "creekroots" organization that promotes a "small waters strategy" of using homegrown oysters to clean up local creeks and rivers. Zuza calls it community-based oyster gardening. "People are far more strongly motivated," says Zuza, "if their oysters are going to stay nearby rather than be released 15 miles away on a huge oyster reef." Instead of turning over their oysters for other people to plant elsewhere, these gardeners want to pick the creek, create their own sanctuary, and plant their own oysters.

Oyster activists seem to get heard. When the state's Department of Natural Resources joined the movement two years ago, launching their Marylanders Grow Oysters (MGO) program, they promised gardeners they would plant homegrown oysters in the nearest river. The MGO website warns, however, that creeks or coves "seldom have suitable bottom for planting oysters."

The warning seems to have been heard, if not always heeded along all the creeks where gardeners live. The movement's we'll-do-it-ourselves philosophy is still alive in places like Mill Creek, Saint Leonard's Creek, and Battle Creek, where Zuza and SMOCS have been putting down shell to create "suitable bottom" for oysters. It's also alive along Hellen's Creek where Jim McVey does his oyster gardening with the Coastal Conservation Association (CCA). After setting up a network of gardeners, CCA asked the Chesapeake Bay Foundation for help in putting shell down to create bottom for an oyster sanctuary just downstream from McVey's dock on Hellen's Creek.

CBF turned them down — but only after internal debate about their own policy of planting only on natural oyster bars. "We talked it over and talked it over," says Goldsborough. "They had their hearts set on that creek. [But] it would call into question our policy."

So the first Sunday in June, 2010, volunteers from CCA began spreading 300 bushels of oyster shells to prepare the creek bottom for oysters. During the summer they'll plant over half a million baby oysters raised by 250 volunteers, including oysters raised under docks in the home waters of Jim McVey.

Oysters in small creeks will be closely watched — and not just by the gardeners who planted them.

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### Oyster Gardening Resources

**Expertise and Information**

Chesapeake Bay Foundation Oyster Gardening Workshops — www.cbf.org/Page.aspx?pid=796

Marylanders Grow Oysters — www.oysters.maryland.gov/

Maryland Sea Grant Oyster Gardening for Restoration and Education — www.mdsg.umd.edu/oystergardening

**Organizations**

Coastal Conservation Association of Maryland — www.ccamd.org/

South River Federation — www.southriverfederation.net

Magothy River Association — www.magothyriver.org

Project Oyster West River (POWeR) — www.westriveroyster.org

Severn River Association — www.severnriver.org

Southern Maryland Oyster Cultivation Society — www.smocs.org

Choptank River Eastern Bay Conservancy — www.crebconservancy.org

**Seed Oysters (Including Triploids)**

Horn Point Hatchery, University of Maryland Center for Environmental Science, distributed through the Oyster Recovery Partnership — www.oysterrecovery.org/

**Seed Oysters & Supplies**

Circle C Oyster Ranching Association — www.oysterranching.com

Johnny Oyster Seed Company — http://sites.google.com/site/theoysterguy

Choptank Oyster Company — www.marineticsinc.com

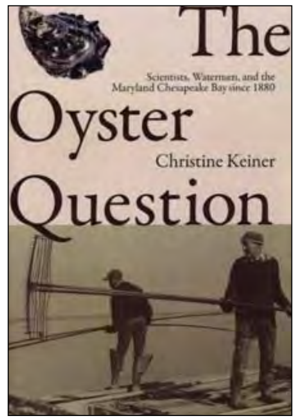
Gordon's Shellfish — www.lowershore.net/gordonsshellfish/aquaculture.htm

*Book Review*

# Maryland's Oysters: Thirteen Decades of Debate

**Jack Greer**

**The Oyster Question: Scientists, Watermen, and the Maryland Chesapeake Bay since 1880, by Christine Keiner, *The University of Georgia Press, 2009*.**




When the Governor of Maryland made it known that he was going to make the "oyster question" a top priority of his administration, his friend John Carroll wrote him a quick note.

"How you are going to satisfy the diversified interests and ideas of the Oystermen, God only knows and I do not envy the man who undertakes the job."

The governor in question was Albert C. Ritchie. The year was 1927. The unsolvable political morass was Maryland's oyster fishery and, more specifically, the battle between watermen and those advocating the private leasing of Maryland's oyster grounds. Governor Ritchie's plans to push through progressive oyster management did not go well. A journalist later commented that the governor's push for private oyster leases was such a political disaster that "No politician is likely to suggest it in a long time."

But of course politicians have suggested it, most recently Governor Martin O'Malley.

How this debate evolved over many decades takes center stage in Christine Keiner's *The Oyster Question: Scientists, Watermen, and the Maryland Chesapeake Bay since 1880.*

Keiner, in sharp detail, lays out the tangled history of Maryland's oysters — not only the leasing controversy, but the hunt for them, the struggle to manage them, the battle to bring them back.

*The Oyster Question* depicts early frictions between small-time tongers and dredge boat captains who often worked for rich bosses in Baltimore. Keiner tracks the flow of northern capital that led to booming packing plants and to railroads that connected them with the rest of the nation.

A major theme running through this 300-plus-page exposition is that Bay scientists and watermen have not seen each other very clearly across the wide waters of class and experience. She argues that early academicians like William K. Brooks alienated Maryland's oystermen by preaching the gospel of privatization. It's hard to debate Brooks's main point that blind greed essentially decimated the oyster reefs that were the region's "God-given birthright." But according to Keiner, watermen thought private leasing smacked of control by the processors. Oyster processors, they argued, already held the upper hand — at times owning the marinas, the ship's stores, and the gas pumps essential for a watermen's work. According to one tonger at the time, if you didn't sell oysters to the local processor, he wouldn't sell you gas.

*The Oyster Question* reaches beyond the purely political or economic to probe the oyster's rich place in our history. One of the book's main arguments is that Maryland's oyster past is not a simple case of the "tragedy of the commons." Instead, Keiner holds that Maryland's communal (state-run) shell planting program and its strict rules requiring old-time tools like tongs and sailing skipjacks actually maintained a fairly stable fishery for much of the 20th century — right up to the mid-

*Continued on p. 16*

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## Oyster Debate, *from p. 15*

1980s. That's when drought brought oyster diseases riding a high salinity wedge up the Bay into Maryland.

She concludes that many advocates for a more modernized oyster fishery failed to realize that for independent oystermen the fishery was not "just about the money." Only in recent years have scientists and watermen benefited from some efforts by anthropologists and others to bridge the conceptual gaps between them. Those discussions have centered not only on economics but also on basic assumptions and core values.

Keiner argues that the Chesapeake Bay nurtures more than the heritage of watermen, their families, and their communities. It also stands as a final piece of the American frontier, "a place at the edge of civilization."

Keiner's book is well researched, well thought out, and well written. Her attention to detail is impressive. Every library with marine-related holdings should have a copy. Indeed, for anyone wanting the deep backstory on Maryland's colorful oyster past, *The Oyster Question* is itself something of a treasure.

# Colwell Wins Stockholm Water Prize


John T. Consoli

Rita R. Colwell, internationally known microbiologist and University of Maryland faculty member, has won the 2010 Stockholm Water Prize. The King of Sweden, H.M. Carl XVI Gustaf, will present the award on September 9, as part of World Water Week in Stockholm. The prestigious prize recognizes world leaders in the field of water research and brings a cash award of $150,000.

Colwell, 76, said in a statement that she was grateful for this validation of research on water-borne diseases that spans her entire career.

That career has been remarkable. In 1972 the University of Maryland lured the young scientist away from Georgetown University with a tenured professorship in the Department of Microbiology. She brought a passionate interest in marine microbial ecology and especially in *Vibrio cholerae*, the bacterium that causes cholera. Her work showed that cholera bacteria can live in aquatic environments in association with other microorganisms, even in the absence of a disease outbreak. This ran counter to the conventional notion that cholera bacteria spread only through humans with the disease.

Her studies of the aquatic environment helped to document the ecology of cholera and other bacteria in rivers, bays, and coastal areas. A pioneer in the field of marine microbiology and marine biotechnology, she also broke glass ceilings for women in science and science administration.

In 1977 Colwell became the first director of the Maryland Sea Grant College, moving from the role of faculty member to that of administrator. As Sea Grant director she maintained an active laboratory, but also mobilized a broad research and outreach program that put her in close contact with state and federal agencies and with other researchers throughout the region and beyond. From there she became Vice Chancellor for Academic Affairs for the University System of Maryland and then director of the University of Maryland Biotechnology Institute.

In 1998, President Clinton appointed Colwell as the first woman director of the National Science Foundation. From that post she energetically expanded the nation's research capacities in a range of disciplines. After the end of her NSF appointment in 2004, Colwell returned to the University of Maryland as a Distinguished Professor and also accepted a joint position with the Johns Hopkins University.

According to a statement by the Water Prize Nominating Committee, "Colwell's pioneering research on the prevention of waterborne infectious diseases has helped protect the health and lives of millions." For more information, see www.siwi.org.