Virginia
# MARINE RESOURCE
BULLETIN
Volume 45, Number 1 Winter 2013

## Working Waterfront Inventory

## International Aquaculture Training

## Coming Together on Sea Level Rise

Virginia Sea Grant • Virginia Institute of Marine Science • The College of William & Mary

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To see how it works, use your smart phone's QR scanning app to follow this code and check out an article about VASG Fellow Wendi Quidort's research.

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VASG Graduate Research Fellow Wendi Quidort (left) and undergraduate assistant Katie Reece sample an experiment on Sarah's Creek to measure the persistence of human adenovirus in estuarine water.

# In This Issue




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# Taking Stock of Working Waterfronts

**Virginia's coastal inventory is helping communities plan for the future of water access.**

By Janet Krenn


Chad Ballard, owner of Cherrystone Aquafarms, can tell you where his company has been. He knows the ins and outs of its more than 100-year history on the Eastern Shore. But ask him where his business is going, and the answer isn't quite as certain.

A few years ago, Ballard hoped to plant an additional 20 million clams by expanding his shellfish aquaculture operations along the seaside of the Eastern Shore, but he lost docking privileges at the nearest boat ramp when the Wise Point National Wildlife Refuge decided to phase out docking for commercial vessels.

"It's their land; I understand that. But it's put a damper on our ability to grow,"



Ballard says. To have the growth he had planned without docking access at Wise Point, Ballard says he'd need to invest in diesel trucks and trailers to transport heavy boats and equipment from his bayside facility to the seaside. That would take an initial investment of around $200,000 with about another $30,000 annually to operate and maintain vehicles.

These challenges are not unique to Cherrystone Aquafarms or the clam farming industry. Access to the water is shrinking as historic access points become restricted, fall apart, or are sold. But before Virginia's localities can start prioritizing and preserving working waterfronts, they need to know where these sites are. To conduct such an inventory, Tom Murray, the Virginia Sea Grant (VASG) Marine Extension Program Leader, teamed up with the Virginia Coastal Zone Management Program (VA CZM). When complete, the inventory will be a tool to promote economic sustainability in Virginia's coastal communities.

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**Above:** Shellfish tanks at Cherrystone Aquafarms. **Previous pages:** Sites photographed for Virginia's working waterfronts inventory. **Facing page:** Three working waterfront sites included in the Maryland inventory.

A working waterfront is any waterfront property or facility that enables waterfront businesses to operate. Murray, who is also an economist at Virginia Institute of Marine Science, has been at the center of the working waterfronts movement for more than five years. In Virginia, he is credited with bringing together commercial and recreational users, who would normally compete with one another for space, to work together to preserve access for both interests. Today, working waterways and waterfronts is a national movement that has sparked collaboration between states and national legislation to preserve coastal business.

The working waterfronts inventory includes digital maps, photographs, and information about services, such as dockage and sewage, in waterfront facilities in Hampton Roads, the Northern Neck, the Middle Peninsula, and the Eastern Shore.

Murray says that despite a trend toward decreasing access, preliminary results suggest some redundancy among access sites. The discovery that multiple sites fill the same niche will enable localities to start making strategic decisions. Localities can use the inventory to prioritize investments for improvements that provide the most benefit to businesses. Investments might range from dredging and other waterway maintenance to bringing electricity or sewer service to a site.

Prioritizing public access points is especially important as private access decreases. For example, Doug Meredith of the Gloucester County Economic Development Department notes that within the past five years, two local seafood processors closed their doors when the owners passed away or retired. The loss of those waterfront facilities could have serious consequences for watermen who need access to processors located near their fishing sites.

"If you work in the Upper York, you're not going to [the Lower York River] to off-load. The cost of fuel becomes inefficient for business," says Meredith. Watermen "need short runs to break even. If they can't get those runs, they can't go out." In other words, you need the right access sites in the right places.

Ballard's company also relies on private landowners for access. He says that his crews have approximately 15 access points on private property throughout the Eastern Shore.

"We are working with a lot of great landowners that allow us to use their property to access the water," says Ballard. "However, we are only able to operate on a small scale at those locations because of their residential nature."

These private agreements work for now, but if the land is sold, it will be up to the future owners to decide whether he can do business there.

"To get the kind of access we truly need, you would have to build a good-size ramp with parking and docking," Ballard says.

With the rising demand for coastal property, many aren't optimistic that future private owners will be so willing to cooperate with businesses. According to U.S. census data, Virginia ranks in the top five states for coastal population increase.

The population of coastal counties increased nearly 50% from 1980 to 2003, and more than 180,000 building permits were issued for single-family and multifamily residences in Virginia's coastal counties from 1999 to 2003.

Maintaining working waterfronts is an upstream battle, but for coastal communities in Virginia, it is the key to maintaining economic diversity and balancing future development with current industry.

"Working watermen are an integral part to this economy and community," says Meredith. "You certainly don't want to kill historic industry in your county to get those developments."

Photos ©MD CZM/VASG

## Old-Fashioned Legwork in VA and MD

In partnership with the Maryland Coastal Zone Program and Maryland Sea Grant, Virginia Sea Grant conducted a working waterfronts inventory for Maryland in parallel with Virginia's inventory.

Project leader Tom Murray enlisted Don McCann of Tranquil Waters Marine Services to document working waterfronts infrastructure in Maryland.

When McCann describes the process, it becomes clear that identifying working waterfronts requires perseverance and persistence—and a car.

"I visited a boat builder in Denton, and he told me to talk to so-and-so farther down the way. So I go there next. On many occasions you don't find the person you're looking for right away, and you just keep going ahead until you come across someone to help," says McCann. "Those individuals who are deeply involved in the local area, they provided us with many sites that we might have missed."

With a list of sites in hand, McCann visited and documented each one, taking coordinates and photographs as well as inspecting the location for electricity, pump-out, sewer access, water access, dockage, and other services important to working waterfronts.

"It's not rocket science," says McCann, and he's optimistic that old-fashioned legwork will produce useful information to help the state of Maryland decide where to focus its efforts to preserve and improve commercial waterfront access.

# Up Close

## What a Tiny Fish Tells Researchers About Restored Shorelines

A Virginia Sea Grant-funded research team spent the summer investigating the suitability of living shorelines—man-made grassy banks that stop shoreline erosion—as habitat for an important feeder fish called a mummichog.

Mummichogs are finger-length fish that eat mosquito larvae and other small critters in and around muddy shores. More importantly for humans, however, blue crabs and striped bass eat mummichogs. If living shorelines could serve the dual purpose of stopping shoreline erosion and providing habitat for these little fish, the grassy banks could indirectly support some of Virginians' favorite seafood species.

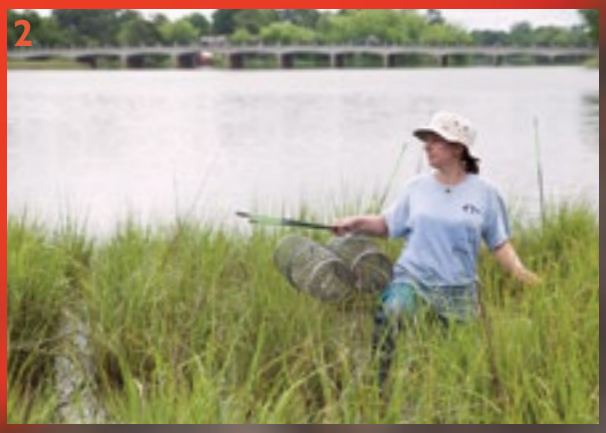
To determine whether living shorelines provide suitable habitat, Christopher Newport University (CNU) professor Jessica Thompson and her students examined the growth and behavior of mummichogs released near living shorelines.

In May, the research team implanted tiny orange tags under the belly skin of more than 3,400 mummichogs from 6 living shoreline sites along the Lafayette River in Norfolk. Team members measured the length of each fish and then released all the fish from each site at a single location within that site.

The team returned to each study site throughout the summer and set traps at different places along the shoreline. If the fish had found desirable habitat near living shorelines, most of the tagged mummichog should have shown up in traps near the release sites.

At some living shoreline sites, the researchers did recapture many of the tagged fish. "That's a good sign that even in a living shoreline, they're not moving much," Thompson said. However, other sites seem not be as good for mummichog habitat, perhaps due to higher wave action or the width of the man-made shoreline.

(1) Thompson and undergraduate students from CNU unload fish traps and buckets and don "mudders," plastic shoe attachments that keep them from sinking into the marsh. (2) Thompson wades into the living shoreline on the coast of the Lafayette River to set minnow traps. (3) The minnow traps catch mummichogs, some of which were tagged and released by the team at an earlier date. (4) Tiny orange tags inserted under the fish's skin allow the team to track how many of the released fish are recaptured, giving them a better idea of whether the fish find the living shoreline to be a good habitat and thus chose to stay there.




Scan this QR code or visit http://bit.ly/2012mummichog to read more and see additional photos of this research.

Photos © Kathryn Greves and Janet Krenn/VASG


LIVE PREY

# Global Aquaculture Starts at Home

## Training programs promote domestic production while improving the safety and quality of imported seafood.

by Janet Krenn

Talk to any of the five interns at Virginia Tech's Seafood Agricultural Research and Extension Center (VSAREC) in the days leading up to the cobia larval run, and the word that you'll hear is *intense*. Or as Hannah Mark, a second-year student at Dalhousie University in Canada, puts it: "I'm equal parts excited and terrified."

The larval run marked the end of this summer's international marine aquaculture internship offered by Virginia Sea Grant Extension at VSAREC. The internship program has trained (and terrified) about six interns annually since 2004 and is just one of the ways VSAREC leads the global development of safe, profitable aquaculture.

The larval run is a process in which fish hatch and are gradually coaxed into eating pellet food. This is essential to making finfish aquaculture profitable. Pellets cost less than live algae or feeder fish and can be conveniently stored on a shelf. But it takes a lot of effort to convince a carnivorous baby cobia to accept a pellet diet.

For the first two weeks of life, the aquacultured cobia eat live microscopic animals called rotifers and artemia. They're fed four times per day—every six hours. Starting on day 15, the cobia get three servings of pellets at each feeding, spaced out over 45 minutes, followed by one serving of live food 15 minutes later. The idea is that offering the pellets at the beginning of a feeding, when the little fish are hungriest, will encourage them to give pellets a try.

This schedule goes on for nine days, and then things get busier. Feedings stretch out to three hours each, with pellets offered at 30-minute intervals followed by a daily decreasing amount of live food until the cobia are completely dependent on pellets.

### Fine-Tuning the Run

This around-the-clock intensive feeding process makes the cobia run feel more like a cobia marathon. But Steve Urick, VSAREC's Hatchery Manager says the schedule is essential to successful cobia aquaculture.

"It's like somebody offering a person lobster and filet mignon everyday—wonderful and beautiful foods. Then they take it away and say, 'You're going to have to eat cornflakes the rest of your life,'" he explains.

In a commercial hatchery, the fish continue on their pellet diet until they reach fingerling length, about two to three inches. Then the hatchery sells them to another business that raises the fish to market size. Ideally, hatcheries follow tested and proven guidelines for the weaning process that produce enough fingerlings to turn a profit.

For newer aquaculture species like cobia, these guidelines still need fine-tuning. Currently, about six fingerlings per liter of water survive

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**Above:** Intern Hannah Mark cleans the filter from a cobia tank. **Previous page:** Intern Amandene Lecrenais pours live food into a cobia tank to feed larval fish.

the weaning stage. In contrast, established aquaculture species survive in much greater numbers. About 60 flounder fingerlings per liter make it through weaning and as many as 150 seabass fingerlings per liter.

"We actually have some of the best cobia numbers in the industry, but there's still a long way to go," says Mike Schwarz, VSAREC Aquaculture Extension Specialist. When it comes to international aquaculture, Schwarz is a key figure. Not only did he found VSAREC's international internship program, but this fall, he also became President-Elect of the World Aquaculture Society.

## Safe Aquaculture at Home and Abroad

Schwarz and the VSAREC team see international collaboration as the way to raise the bar on seafood production and safety today while advancing the industry of tomorrow.

"Through international collaboration, we get to share information with other laboratories and learn more together than we can by ourselves," says Schwarz. "It's already rapidly accelerated our research and extension efforts because we're not duplicating effort; we're learning from it."

The cobia larval runs conducted at VSAREC are just one piece of a national push to increase domestic aquaculture and close the seafood trade deficit. Currently, at $10 billion annually, seafood imports are second only to petroleum. Half of seafood imports come from aquaculture. So in the meantime, keeping imports safe is an equally pressing priority.

To help address international seafood safety, the VSAREC staff has teamed up with the U.S. Food and Drug Administration's Train-the-Trainer program. The program sends seafood experts around the world to teach best aquaculture practices that reduce disease and minimize the need for antibiotics. Currently, the program focuses on America's number one seafood import—shrimp.

Schwarz and Mike Jahncke, VSAREC Director and an expert in food safety, have helped lead trainings in seven countries to date. Already, Jahncke sees evidence that the program is working.

In 2009, buyers from the European Union detected the presence of antibiotics in freshwater shrimp from Bangladesh. To head off the problem and avoid getting banned from the EU market, Bangladesh opted to stop exporting shrimp to the EU for six months while working to eliminate the use of these antibiotics.

To keep its future shrimp products safe, Bangladesh hosted Train-the-Trainer workshops on good aquaculture practices in 2009, 2010, and 2011. In 2011, scientists from Bangladesh came to the United States for advanced training. These trainings seem to have had a lasting impact on aquaculture in that country, Jahncke says, noting that a few Bangladeshi universities have incorporated the Train-the-Trainer program content into their course offerings.

"I was very impressed with how Bangladesh took this and ran with it," Jahncke says.

## Training for the Future

Back in the VSAREC hatchery, Amandene Lecrenais is admittedly exhausted on day 21 of the larval run, but she has no regrets. Lecrenais, an intern from France, learned a little bit about rearing larval cobia when she worked with adult cobia during an internship in Madagascar. At the time, the facility didn't have the capacity to have a run.

"It's important for me to learn this process," she says. She believes that between her work with larval and adult cobia, she'll have the well-rounded experience needed to give her a leg-up when she starts job hunting. But for Lecrenais, these experiences will be the gateway to more than just a career. She sees it as an opportunity to contribute to global society.

"I think aquaculture's the future of food production," she says, "and I want to be in on that."

Virginia Sea Grant NEWS

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## 2013 Knauss Fellows Head to Washington

The Dean John A. Knauss Marine Policy Fellowship matches highly qualified graduate students with "hosts" in the legislative or executive branch of government in the Washington, D.C. area, for a one-year paid fellowship. Virginia's 2013 Knauss Fellows will begin their fellowships in February.

**Theresa Davenport** (left) will spend her Knauss fellowship as an analyst in National Oceanic and Atmospheric Administration (NOAA) Office of Policy, Planning, and Evaluation (PPE). She will help set the course for NOAA by helping to develop a five-year strategic plan for research and development and by helping the office stay up-to-date on emerging science and policy issues.

Davenport, who has a master's degree in marine science from VIMS, says she looks forward to being part of the team that helps shape NOAA's research direction and ensuring that the best available research is used to inform policy decisions. "My main goal for the Knauss fellowship is to gain an understanding of how scientific research can be designed and communicated to better accommodate the needs of end users," she says.

**Gabrielle Saluta** (right) will be a Legislative Fellow for U.S. Representative Madeleine Bordallo of Guam. She will be responsible for assisting the representative with a variety of environmental and fisheries issues by preparing for and attending committee meetings and hearings, tracking relevant legislation, helping to draft legislation, and meeting with constituents.

"I chose Guam because of the wide breadth of interesting issues, from protecting coral reefs to managing indigenous fishing practices," says Saluta, who holds a master's degree in marine science from VIMS. "This year in D.C. will not only be informative but it will be instrumental in helping me choose a career route in management, policy, or education."

**2014 Knauss Fellowship Applications Open**

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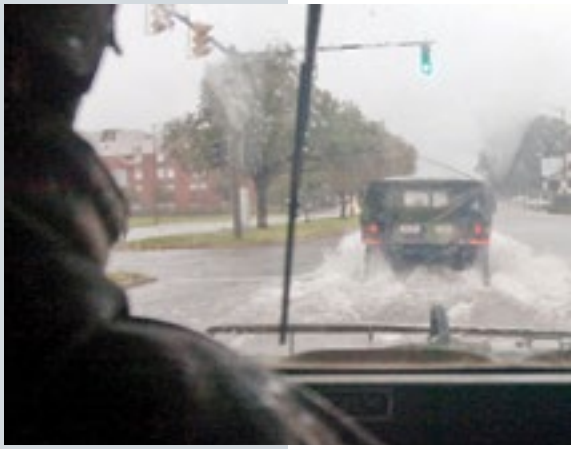
# Sea Level Rise and Flooding Forum Connects Hampton Roads Communities

As Superstorm Sandy barreled up the East Coast at the end of October, a group of planners, administrators, engineers, emergency managers, and scientists in Hampton Roads found themselves in the strange position of postponing a meeting about flooding due to the threat of impending flooding. When the Hampton Roads Sea Level Rise and Flooding Adaptation Forum finally convened in Suffolk in mid-November, the significance of the postponement was not lost on its participants.

In the face of increasing impacts from flooding, localities within the region have recognized the need to coordinate and share best practices. In 2011, Old Dominion University's (ODU) Climate Change Initiative organized several workshops aimed at facilitating this sharing process.

Now VASG has helped secure funding for a total of four additional forum meetings over the course of the next two years. The forum is cosponsored by ODU and the Hampton Roads Planning District Commission (HRPDC). In addition to bringing together staff from cities, counties, and federal facilities, the project will also include two public meetings and an online system to help local officials continue to share advice and experiences.



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Virginia National Guard soldiers conduct a patrol in Norfolk during Superstorm Sandy.

After presentations by local experts on the science of sea level rise and adaptation strategies, forum participants at the November meeting had a chance to share their own lessons learned from the storms and flooding events that have affected the region in the past decade, going back to Isabel in 2003.

Local planners and emergency managers have made big changes since Isabel—from efforts to get more information online to help residents understand and prepare for storm events to purchasing military surplus trucks for rescuing residents stuck in high water. Although Sandy's impacts on southeastern Virginia were, thankfully, relatively minor, local officials are keenly aware that

## What do kings' grants, imperialism, and British common law have to do with climate change?

Lawyers, legal scholars, historians, and scientists came together to discuss them all at a symposium on "History, Property, and Climate Change in the Former Colonies." Sponsored by Virginia Sea Grant through a grant from the National Sea Grant Law Center, the symposium was the brainchild of Washington and Lee Law professor Jill Fraley, who directs the University's Center for Law and History.

"I'd been encountering examples of property doctrines that are colonial legacies," explains Fraley. These colonial holdovers cause problems in the present day because they make it difficult to adapt the way property is managed in the face of a changing coast. For example, when a shoreline moves due to sea-level changes, these doctrines can prevent legal adjustments to the property's boundaries to match the new shoreline.

Presenters at the symposium spoke about examples of these colonial impediments to change, ranging from private ownership of underwater property and dams in Virginia to responses to flooding in post-colonial British Guyana. Others presented on more general approaches to the intersection of history, science, law, and climate change.

Legal historian David Schorr of Tel Aviv University argued that there is a deep connection in legal culture and political theory between property rights and climate and that "these connections resonate in current policy debates."

By bringing together researchers in these diverse disciplines, organizer Fraley hopes that the symposium and the resulting papers will bring a new perspective to some of these more vexing challenges of climate change policy. "Historians don't often talk about climate change," she says, "but they may have just the right perspective to understand how to change property doctrines in order to help communities adapt."

their communities was spared the worst of the damage. Many have been closely watching events to the north and taking notes. Some of the biggest surprises from Sandy stem from the sheer size of the storm. Teams of emergency responders coming to the Northeast to help after Sandy had trouble finding places to stay close to damaged communities and facilities because of the wide extent of the damage.

After the large group discussions, an afternoon break-out session rounded out the Adaptation Forum. Three groups—focused on emergency management, facilities and roads, and land use and planning—discussed critical needs, as well as topics for future forum meetings. These conversations generated several common themes, including an interest in regional coordination, a desire to discuss strategies for communicating to the public about sea-level rise and flooding, and the need to consider how Virginia's legal framework impacts adaptation and planning.

The next symposium will be held in spring of 2013 and will continue to provide a venue for local officials to network, learn, and share experiences.

"Often in local government, people get siloed into doing a particular task in a particular department," says HRPDC's Ben McFarlane. "We see these forums as an opportunity to cross-pollinate."

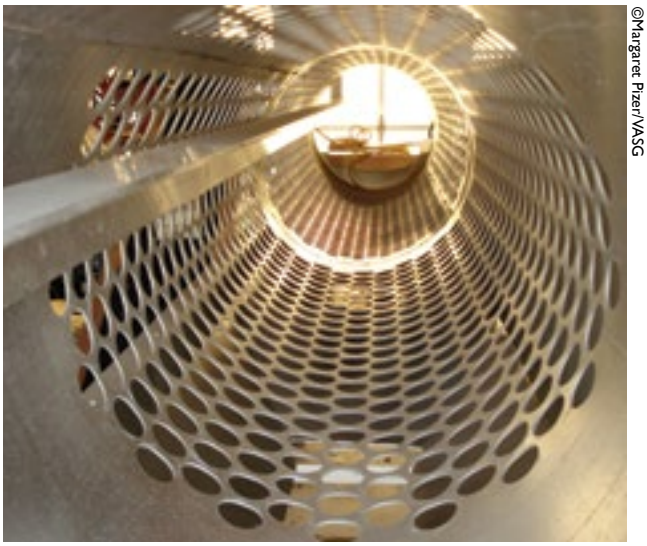
# New Publications for the Shellfish Industry

A new enterprise budget for Virginia's oyster aquaculture industry aims to help lenders and potential aquaculturists better understand what goes into a successful oyster-growing business. The oyster crop budgets consist of a set of spreadsheets that allow users to estimate costs and earnings, along with a manual to help guide users through the spreadsheets. Enterprise budgets have been widely used for traditional farm crops to help farmers and their investors make business decisions.

Karen Hudson and Tom Murray of the Marine Extension Program at Virginia Sea Grant (VASG) and Virginia Institute of Marine Science (VIMS) prepared the budgets and manual along with Dan Kauffman of VASG and the Virginia Seafood Agriculture Research and Extension Center and independent economic consultant Alexander Solomon.

The project was initiated in response to requests from lenders, who are increasingly being asked to finance new and growing aquaculture operations as the industry expands. Virginia's oyster aquaculture sector, which sold fewer than a million oysters just seven years ago in 2005, topped 23 million oysters sold in 2011.

"These new enterprise budgets provide a dynamic tool for assessing investment in new enterprises as well as evaluating the costs and returns associated with changes in existing oyster aquaculture operations," says Murray.



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**Above Right:** Sorters are one of many equipment expenses that oyster aquaculture operations may incur.

### Download Shellfish Resources

Scan here with your mobile device or visit http://bit.ly/VIMSaquauculture for more information. Available publications include the oyster aquaculture enterprise budgets and the *Harmful Algal Bloom (HAB) Primer for the Virginia Shellfish Industry*—a new booklet with information about the effects of HABs on shellfish and guidelines for sampling and reporting HABs.

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