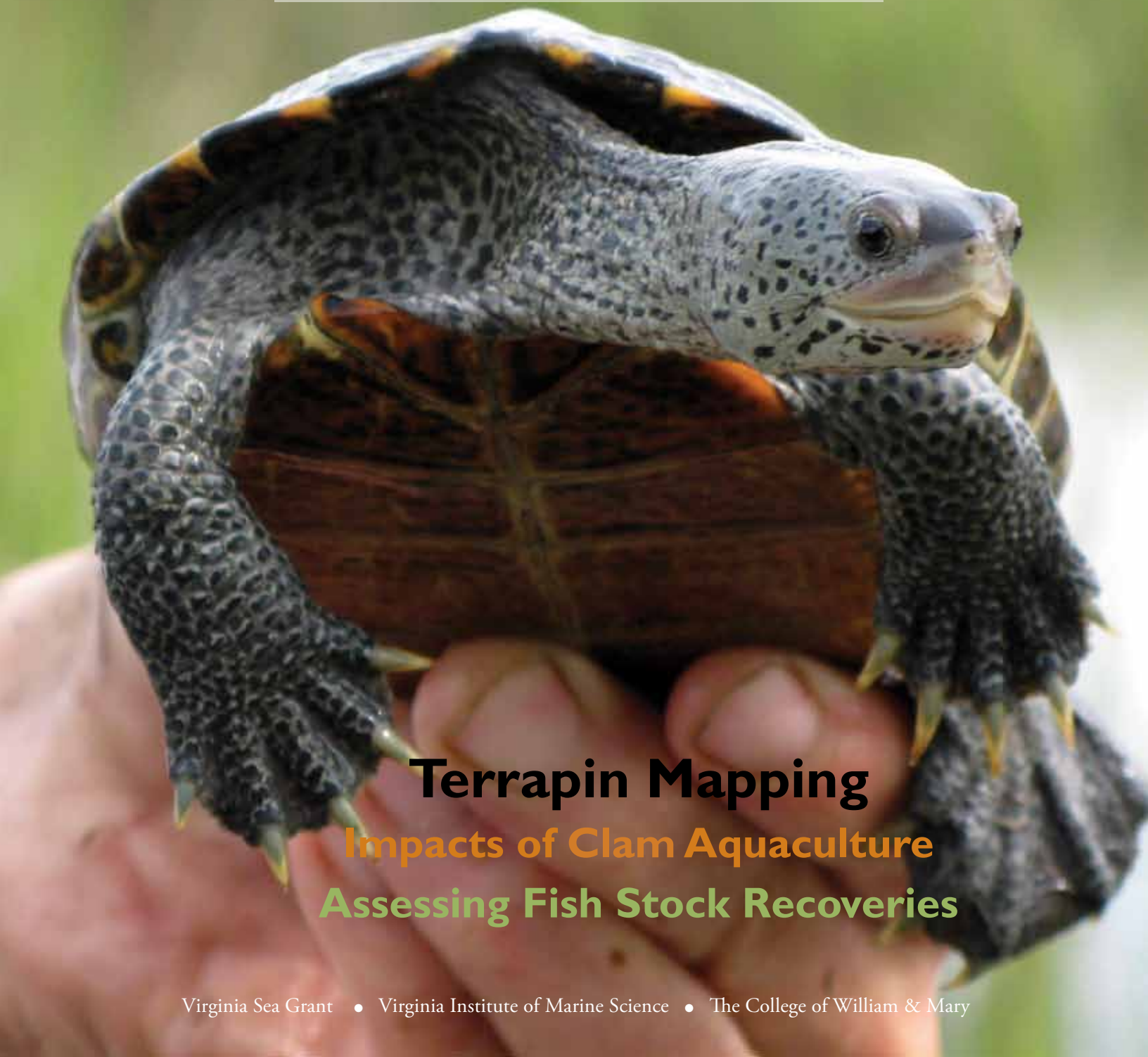
Virginia
MARINE RESOURCE
BULLETIN
Volume 44, Number 2 Summer 2012



Terrapin Mapping
Impacts of Clam Aquaculture
Assessing Fish Stock Recoveries

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

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Cover photo: Diamondback terrapin (*Malaclemys terrapin*). ©Timothy Russell

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Follow the Codes

In this issue, we're using QR codes to direct your smart phone to online video, audio, and photos related to the articles. To use the codes, first download a free QR scanner app onto your phone. Then scan the codes, and your phone will take you directly to VASG resources!

To see how it works, use your smart phone's QR scanning app to follow this code and check out more photos of research conducted by a fisherman to reduce bycatch of endangered Atlantic sturgeon.

No smart phone? Go to http://bit.ly/2012frg-trice-photos.

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U.S. Fish and Wildlife Services Virginia Fisheries Coordinator Albert Spells measures a striped bass while testing fishing gear designed to reduce sturgeon bycatch for a Virginia Fisheries Resource Grant Program research project.

In This Issue

Virginia Marine Resource Bulletin

Volume 44
Number 2
Summer 2012

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This work is a result of research sponsored in part by NOAA Office of Sea Grant, U.S. Department of Commerce under Grant No. NA10OAR4170085 to the Virginia Institute of Marine Science and Virginia Sea Grant. The U.S. government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear here.

Research Ready

Virginia Sea Grant (VASG) supports research efforts in a wide range of disciplines—from ecology to oceanography and from animal health to social science—all providing benefits to Virginia's coastal environments and communities. VASG offers funding opportunities for graduate student projects, preliminary and pilot research, and larger-scale studies.

Core Research

VASG's Coastal and Marine Science Request for Proposals (RFP) supports research projects conducted by faculty and staff at Virginia higher education institutions. Funding priorities are guided by the VASG strategic plan, which has four focus areas: safe and sustainable seafood, healthy coastal and ocean ecosystems, sustainable and resilient coastal communities, and coastal and ocean literacy.

Twelve core research projects on topics ranging from Bay scallop restoration to mercury contamination in fish are currently wrapping up, and three core research projects began receiving funding in February of 2012.

VASG also collaborates with other Sea Grant programs in the Mid-Atlantic region to fund research on topics in marine and coastal science and social science that impact the entire region.

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VIMS ABC Breeding Research Manager Anu Frank-Lawale fertilizes oyster eggs that will be used in research aimed at improving the economic value of farmed oysters.

Program Development Funding

VASG also offers less formal funding opportunities for small-scale and exploratory projects, which allow researchers to collect enough preliminary data to prove a concept or strengthen an application for a larger grant.

Recent program development grants have supported research on living shorelines by a new faculty member at Christopher Newport University, preliminary investigation of selection for larval production in oysters at VIMS Aquaculture Genetics and Breeding Technology Center (ABC), and several studies on microorganisms that affect the safety of Virginia's shellfish for human consumption.

Emerging Opportunities

As part of the national network for Sea Grant programs and the National Oceanic and Atmospheric Administration, VASG administers a variety of funding opportunities that emerge from those national programs. Several current research projects in this category focus on climate change adaptation, and others relate to Virginia's aquaculture industry.

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Christopher Newport University student Lauren Davis carries minnow traps at the Virginia Zoo. Davis is working with professor Jessica Thompson to investigate the effects of fringe marsh width on mummichogs to help managers design more effective marsh conservation strategies.

Graduate Research Fellowships

VASG has always supported graduate research, but this funding is now the central focus of the VASG Graduate Research Fellowship Program. Five fellows have been chosen to be part of the first cohort of this grant, and their research and outreach efforts are described on page 16 of this issue.

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Atlantic moonfish (*Selene setapinnis*) with their stomachs dissected for VASG Graduate Research Fellow Mark Stratton's research on East Coast fish communities.

For more information about VASG research, visit vaseagrant.vims.edu/category/research, or contact Susan Park (spark@vims.edu).

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Terrapin Files

Researchers survey the distribution of threatened turtles

by VASG Science Communication Intern Kate Schimel

When Randy Chambers approached resource managers about his plan to study diamondback terrapins (*Malaclemys terrapin*), they made a deceptively simple request. "They told us, 'well why don't you tell us how many turtles there are in the Chesapeake Bay?' We had no way to do that," Chambers recalls.

The diamondback terrapin is classified as a species of high conservation need in Virginia, and it is in decline throughout its range, which extends from Massachusetts to Texas. But before managers can act to conserve the terrapin, they need basic information about the turtles and where they live—information that no one has collected systematically in the Bay.

Chambers, director of the Keck Environmental Field Laboratory at the College of William & Mary, is part of a Virginia Sea Grant (VASG)-funded research team that has just finished collecting basic information about where terrapins live along the York River's saltwater marshes. The team is using data about these habitats and nearby land development to build a model to predict where terrapins might live elsewhere in the Bay. This information will help target terrapin protection and research efforts to the most important areas.

A targeted approach is important, says Donna Bilkovic, the lead investigator on the project and a researcher at the Center for Coastal Resources Management (CCRM) at Virginia Institute of Marine Science (VIMS). Human activities, including shoreline development and crabbing, affect terrapin survival. By limiting conservation efforts to areas where these activities overlap

with terrapin habitat, managers can reduce costs to industry and communities while effectively protecting the species.

Curiosity Killed the Terrapin?

There's something about crab pots that attracts terrapins. Like crabs, smaller male or immature female terrapins crawl into crab pots and become trapped. Strangely, terrapins are just as likely to get caught in unbaited pots as in baited, active pots.

"I think the turtles are inquisitive," Chambers suggests. "We put the traps in the water, without bait, and the turtles just swim into them." The terrapins' attraction to crab pots frustrated Chambers on one sampling trip when he pulled up a pot containing a mature female terrapin that seemed too large to have fit through the opening. He spent half an hour extracting the animal only to watch her climb right back in as soon as he let her go.

Previous page: A small terrapin does not fit through an orange bycatch reduction device (BRD) on a crab pot. **Below:** Randy Chambers, Donna Bilkovic, and Matthias Leu pose with a crab pot fitted with BRDs.

©Will Sweatt/VASG

Unfortunately, this curiosity can kill. Traps are usually checked only once a day; however, terrapins must surface about every hour to breathe, so the trapped animals frequently drown. Often, terrapins follow each other into the traps, further increasing fatalities. One study in Georgia reported 94 terrapins in a single trap, and Chambers himself has caught as many as 7 in an unbaited trap.

One way to keep terrapins from making the fatal mistake of entering a crab pot is to attach a small plastic rectangle to the entrance of the pot. This bycatch reduction device (BRD) prevents terrapins from entering. Studies done at VIMS by Rom Lipcius and Rochelle Seitz indicate that the device effectively keeps terrapins out while still letting crabs in. BRD use is not mandatory although a voluntary program to promote their use is underway.

However, Bilkovic, Chambers, and their team are reluctant to advocate that BRDs be required on crab pots throughout the Bay; instead, they suggest using the devices only in places where it would matter most—where terrapins are likely to be found. Unnecessary requirements could hamper a local industry already faced with strict regulation.

Another important approach to protecting terrapins from being trapped in crab pots is the removal of derelict and abandoned pots that continue to catch and kill turtles, fish, and crabs long after the pots' owners have moved on. More than 32,000 lost crab traps were removed from the Bay and its tributaries in Virginia during a 4-year program run by CCRM and the Virginia Marine Resources Commission (VMRC) that employed crabbers themselves to survey for and remove derelict pots.

Mapping Terrapin Habitat

Of the thousands of crab pots in the Chesapeake Bay, Chambers predicted that relatively few would overlap with terrapin habitat.

To confirm this assumption, the team had to figure out where terrapins live. Rather than sur-

vey the entire Chesapeake Bay, they examined a stretch of the York River shoreline for terrapins and gathered information about these places to start drawing broader conclusions about the habitats the animals prefer. They have found that healthy marsh habitats and nearby nesting beaches are crucial to terrapin success.

Terrapins tend to remain in the same area for their entire lives. On one beach in Rhode Island, observers have reported seeing the same female nesting over the course of 20 years. This consistency leaves terrapins vulnerable to localized habitat loss and predation.

Coastal development and shoreline hardening also threaten the marsh habitat where terrapins live. According to a report from CCRM, more than 11 percent of Virginia tidal waters have already been hardened with seawalls or other structures for erosion prevention and protection from sea level rise. The VASG-funded research team did not observe any terrapins in hardened areas.

Female terrapins are especially vulnerable to the effects of development since they have to leave the marshes to nest. Erosion and sea level rise eat away at nesting beaches, and increased development has resulted in large numbers of road-kill deaths among females, that cross roads while searching for places to lay their eggs.

Terrapin young are further threatened by increased predation on nests and hatchlings by raccoons and birds. "In developed areas there's a link [between terrapin declines and] increased raccoon populations," says Bilkovic. "Raccoons feed voraciously on terrapin eggs." At one study site in the Goodwin Islands near the mouth of the York River, researchers recorded 87 percent mortality in terrapin nests due to predation.

A Model of Collaboration

The results of the VASG-funded study suggest that only about 15 percent of the area surveyed along the York is in conflict, meaning that it is used by both terrapins and crabbers. The next step for the team is to create a model that predicts terrapin distributions more broadly in areas that have not been directly surveyed for terrapins. Although the team collected turtle survey data in the field, much of the information that will shape the model comes from other sources.

For example, the team is using maps of coastal development to show where predation and habitat loss are expected to be greatest. Because many of these data sets already exist for other regions, the research team believes they can use their work to look beyond the York River and start predicting where terrapins might be found in other rivers and in other states.

"We'd like to create a model that could be extended to all of the Atlantic states," says Bilkovic.

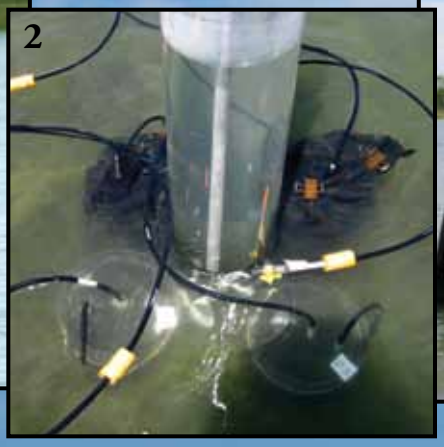
To develop such a complicated model, Bilkovic has assembled a team of experts in addition to herself and Chambers. Matthias Leu is a William and Mary conservation biologist and modeler and Timothy Russell is a William and Mary Geographic Information System (GIS) expert. Kirk Havens, CCRM's Assistant Director, is leading the effort to recover derelict crab pots, will contribute data on where the pots have been found.

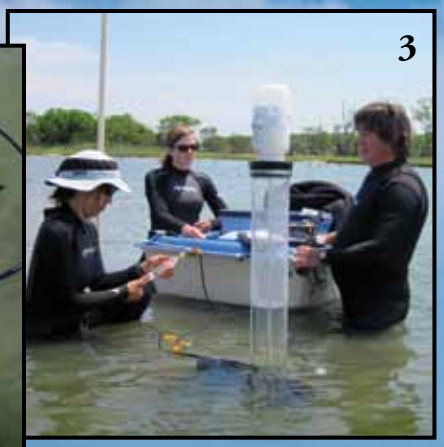
"We put all of these people together who have their different expertise, and I'm really fascinated to see how this product is going to develop," says Chambers. "I think, collectively, we've covered all the different pieces you would need to make a model—a validated, good model. So I'm very excited about the project."

©Diane Tulipani

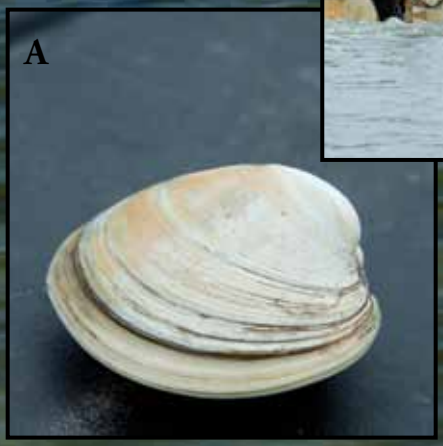
Terrapin eggs are vulnerable to predation by raccoons and birds, and female terrapins are particularly at risk when they are laying eggs or traveling to nesting sites.

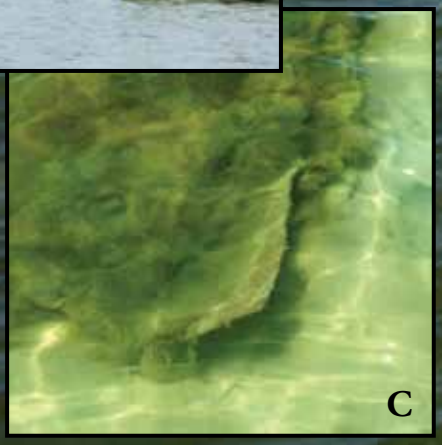
For more information, visit http://bit.ly/ccrm_terrapins.





(A) The hard clam *Mercenaria mercenaria.* (B) A group of clam farm workers ride a barge to the clam grounds to tend their plots. (C) The corner of a clam net in Cherrystone Inlet. Clams are planted directly in the mud of the bay and covered by large nets to protect them from predators. The nets form a substrate for a thick growth of algae, which clam farmers must periodically remove from the nets to allow the clams good access to water and food.





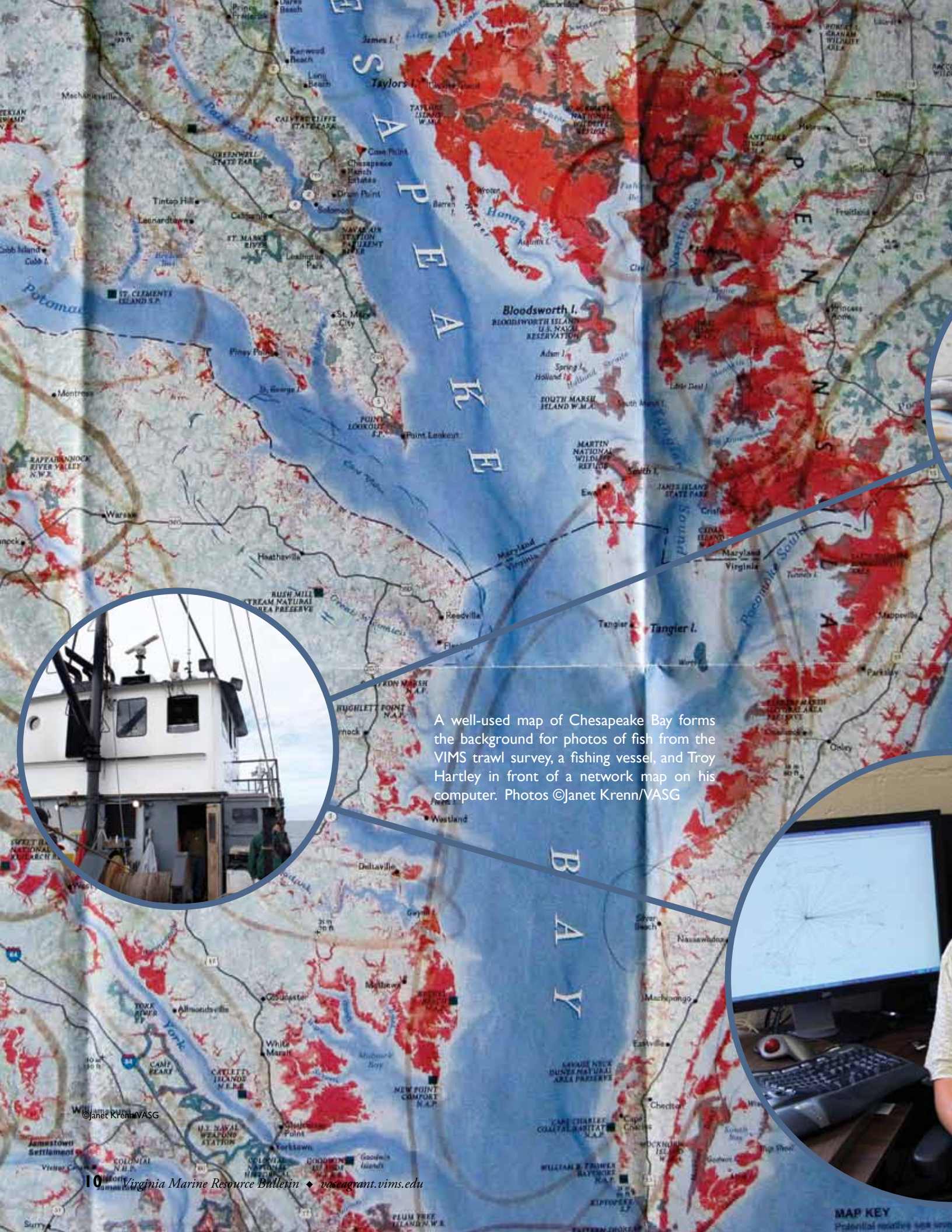
Photos ©Margaret Pizer/VASG

Nutrient Flow in Clam Aquaculture

Virginia's hard clam industry produces between $20 and $30 million of clams annually, and individual clam farms cover areas ranging from 10's to 100's of acres. A Virginia Sea Grant-funded research team led by VIMS faculty members Iris Anderson, Mark Luckenbach, and Mark Brush is investigating the effects of these large-scale aquaculture operations on the flow of nutrients in Bay ecosystems. The results will help managers and clam farmers make sure the industry can function sustainably for years to come.

In the background photo, plots of clams in Cherrystone Inlet show up as dark patches separated by lighter alleys, while the VIMS team samples data from several sets of cores.

Top left: (1) Mark Luckenbach plants a set of four cores in a clam bed. The tube shown here contains a stirrer that will keep water circulating within each of the cores that surround it. (2) Four cores surround the central tube—two in the dark and two in natural light. The cores enclose clams, mud, and water for several hours so that the researchers can measure the change in nutrient concentrations over time as the clams filter water and excrete waste. Some cores also contain algae, while algae has been removed from others. (3) Marine Scientist Jennifer Stanhope, VASG Graduate Research Fellow Annie Murphy, and Mark Luckenbach take water samples from the cores over the course of the day to measure the nutrient concentrations in the water. **Bottom Right:** (4) Iris Anderson and Shellfish Culture Specialist Paige Smith use a modified can crusher to push a water sample through a filter. The sample will be tested for nitrogen, phosphorus, and other nutrients. (5) The team also samples the algae that grow on nets covering clam beds, as these algae are an important component of the clam farm ecosystem. (6) VIMS Masters student Gar Sechrist filters water to measure its chlorophyll content.



A well-used map of Chesapeake Bay forms the background for photos of fish from the VIMS trawl survey, a fishing vessel, and Troy Hartley in front of a network map on his computer. Photos ©Janet Krenn/VASG

Mapping Fisheries Management

Sea Grant director serves on National Research Council panel

by Janet Krenn

When Troy Hartley uses words like map, connector, and bridge, he isn't talking about a road trip. He's referring to his research results, diagrams in which lines originate from one point, meet at another, and then radiate out again. To a novice, these illustrations look like abstract line art, but in the right hands, they can help improve the way fisheries are managed.

This kind of research, called network analysis, involves surveying people involved in a community or a management decision to learn who talks to whom and why. This information can act as a guide to more efficient communications and information sharing across the network.

Network analysis shows how governments and stakeholders coordinate and implement programs, and Hartley, Virginia Sea Grant Director, is one of the few researchers applying this method to fisheries management. He's used it to advise the managers of the multi-million dollar New England Atlantic herring fishery and counsel managers about the myriad regulatory networks in the Chesapeake Bay.

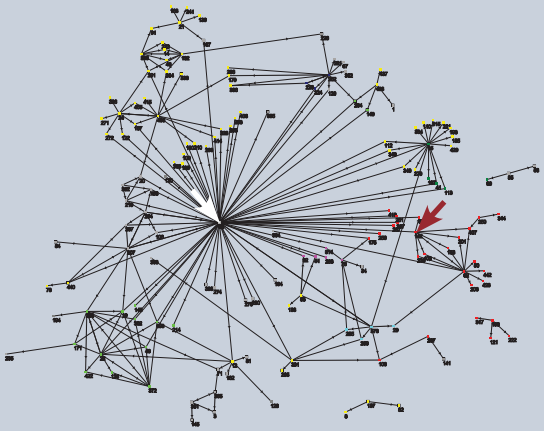
Now Hartley is taking his rare skills on the road. In March, he was appointed to the National Research Council (NRC) Committee on Evaluating the Effectiveness of Stock Rebuilding Plans. The committee was formed at the request of Congress to better understand how well efforts to increase fish populations—called stock rebuilding—have worked across the country. The 11 biologists, ecologists, mathematicians, and social scientists on the committee will evaluate the progress of stock rebuilding measures and assess the biological, social, and economic factors underlying the success or failure of stock rebuilding plans.

Hartley's role on the NRC Committee is to focus on the socioeconomic factors. After all, he says, "Fisheries management regulates the behavior of people—not fish."

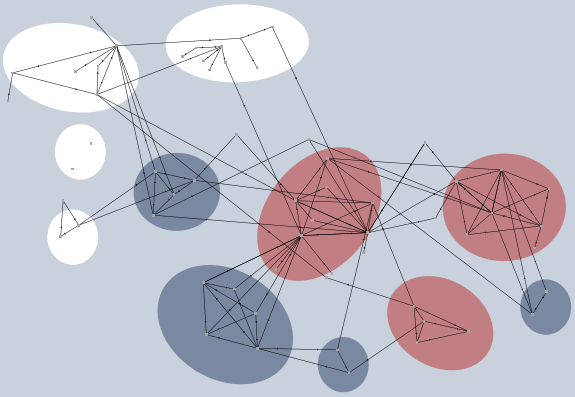
Keys to the Herring Network

In some cases, the number of people affected by fisheries management can far outnumber those doing the fishing. This is the case in the New England herring fishery.

Herring is a small oily fish found on both sides of the Atlantic. Along the U.S. coast, it ranges from North Carolina to Canada. Herring is pickled and canned for human consumption and sold as bait for lucrative lobster, crab, and tuna fisheries. And it is worth big money. According to the National Oceanic and Atmospheric Administration (NOAA), more than 145 million pounds of herring, worth some $19 million, were landed in the U.S. in 2010 alone.



Atlantic Herring Fishery Management



Chesapeake Bay Ecosystem-Based Management

The fishery is managed by rotating fishing areas, opening an area to the approximately 100 U.S. vessels and then closing it when the total catch weight reaches a pre-set limit. According to Lori Steele, Herring Plan Coordinator for the New England Fisheries Management Council, the fishery is in pretty good shape and isn't showing signs of being overfished, but there are still challenges.

"The management becomes complicated because there are so many stakeholders whose businesses rely on the fishery," she says. For example, whale-watching businesses need herring as a food source for the whales, and fishermen target tuna or striped bass, two species that also eat herring.

"Every stakeholder opinion is weighed by the Council," explains Steele, "and we need to ensure all of the opinions and input are included in the process."

When Hartley conducted his network analysis of New England's herring fishery in 2006 and 2007, he found that many groups were involved, but these groups weren't talking to each other. Instead, communications were getting passed through only a few people.

Having so few individuals connecting all of the stakeholders can be risky. In a network like this, some groups might not have access to information, and the network can be vulnerable to interruption when key employees change jobs or retire.

What's more, when groups don't share information directly with each other, it is harder for them to solve problems together. As Hartley points out, "A basic level of mutual understanding is often an essential prerequisite to reach common ground or discover innovative solutions."

Hartley's research indicates that the herring fishery relies heavily on Steele and a few others to hold the network together, and that official job descriptions do not always provide clues to who is most important in network function. His work also identifies opportunities to improve this function. For example, a strategically placed communication link—a weekly or monthly meeting, phone call, or email—could open up channels for groups to interact in new ways.

Managing an Ecosystem

Managing one fish species is complicated enough. Now try creating a management plan that takes into account multiple fish species, environmental conditions, human activities, and local, state, and federal regulations and policies. The Chesapeake Bay Program is committed to this holistic approach, called ecosystem-based fisheries management (EBFM).

For EBFM to work, managers need a lot of scientific information on how the ecosystem and its components function for fish. The data are there, says NOAA Chesapeake Bay Office Director Peyton Robertson; "We have probably the most robust set of science anywhere in the world."

But EBFM also requires plenty of interaction. Managers not only have to deal with more information about fish, but they also need to work with more individuals from across all the affected fisheries and with local and state agencies addressing habitat and water quality issues. In

Left: Diagrams of weekly communication frequency illustrate insights about how networks function. The Atlantic herring network has a few key individuals (red and white arrows) responsible for linking many participants and groups. In the Chesapeake Bay network, that bridging function is distributed among a greater number of individuals, but some individuals play more critical roles in making links between institutions (outlined by white ovals for universities, red for regulatory bodies, and blue for NOAA offices).

total, the Chesapeake Bay network includes more than 400 local, state, and federal organizations and five fisheries across two states. Says Robertson, "It sets up a fairly tall hill to climb."

To start scaling that hill, Robertson enlisted the help of Hartley and Maryland Sea Grant's then-Director, Jon Kramer, to learn more about how to effectively coordinate EBFM in the region. While Kramer identified needs for scientific research, Hartley and a team of policy interns began mapping the way different groups across local, state, regional, and federal levels do—or do not—interact and communicate.

What Hartley and interns Jennifer Reichle and Jessica Eckerlin found was that scientists interact closely with management, but ties between local, state, and federal agencies are much weaker.

"The divide is pretty big sometimes," says Hartley. "We saw a lack of connection between levels of government. Current working relationships across local, state, regional, and federal boundaries are insufficient to achieve the Bay Program's challenging implementation goals."

This insight was useful for Robertson in planning the membership of his executive committee, which includes fishery managers and a broader group of stakeholders.

It's not just science that leads to effective management, Robertson emphasizes. "It's critical that we understand the relationships between people and the role they play in governance, and [Hartley's] work helps us get there."

A National Committee

Working to understand the relationships between people and management is exactly what Hartley will be doing on the NRC Committee on Evaluating the Effectiveness of Stock Rebuilding Plans.

For Hartley, working on an NRC committee is an honor. Not many researchers have the opportunity to contribute so directly to their government's understanding of science, and the NRC study could influence future changes to the federal fisheries law. At the same time, Hartley points out, the committee is a natural extension of Virginia Sea Grant's research and advisory roles in the Commonwealth.

"Sea Grant is recognized as a source of cutting-edge science," says Hartley. "We also have our boots on the ground working with communities to achieve their environmental, economic, and community goals. We understand the human dimensions of making management actions effective."

Although fish populations are the ultimate measure of stock rebuilding success, the NRC committee will also look at the social and economic outcomes and preconditions of rebuilding strategies. In fact, the Committee's objectives include evaluating these human factors and understanding the interconnection of biological and social policy objectives in fish rebuilding plans.

"This tight coupling of biological and socioeconomic policy remains inherent in today's fisheries management," says Hartley, "but our capacity to understand the human dimensions and to integrate that knowledge into our understanding of fisheries management is still evolving."

The inclusion of social scientists like Hartley in fisheries management discussions reflects a growing appreciation of how important that connection between stock rebuilding efforts and socioeconomic factors can be. "Fishery and social policy objectives are connected," Hartley says, "and the human consequences of management decisions cannot be ignored. Once a stock is rebuilt, society needs people around to fish it."

The Committee on Evaluating the Effectiveness of Stock Rebuilding Plans will meet at least four times throughout 2012, in the Northeast, Northwest, and Gulf of Mexico. Afterward, the Committee will finalize it report for Congress, NOAA, and other fisheries stakeholders. The Committee was formed by the National Academies of Sciences National Research Council, which has been convening scientists to advise Congress, government agencies, industry, and others since 1916. **http://bit.ly/nrc_stockrebuilding**

NEWS From the Point

Students lead exploration of community-supported fishery concept

The VASG–College of William & Mary (WM) partnership to investigate local interest in establishing a community-supported fishery (CSF) is continuing this summer, with two WM interns working in the VASG offices at VIMS. Rising WM Mason School of Business senior Yangyang Zhou is continuing market research initiated by students in Michael Luchs' marketing class in the spring while 2012 WM graduate Katie Thatcher is helping VASG director Troy Hartley investigate models for the organizational design of CSFs.

©Janet Krenn/VASG

Blue crabs go into the steamer at a local seafood processor.

CSFs allow watermen to bring seafood directly to consumers who purchase a share of the catch and receive regular deliveries of fresh seafood. "We're optimistic that a viable CSF can be established in our area," says Hartley. "These interns are helping do the groundwork to make that happen."

Read more at http://bit.ly/vasg-csf.

Tagger Ken Neill sets record for Virginia Game Fish Tagging Program

In April of 2004, Ken Neill tagged an 11.5 inch tautog off Cape Henry. Neill didn't think about that fish again for a long time, until it was recaptured on January 5, 2012 by Joe Stagnato, close to the location where it was tagged. The fish was at large for 2,826 days, only three months short of 8 years—setting a new record for the Virginia Game Fish Tagging Program (VGFTP).

Neill is no stranger to catching big "togs." In late February he caught one of his own tagged tautogs on the same wreck where he had tagged it nearly 7 years ago. Originally tagged at 16.75 inches, the fish had grown to two feet.

"Ken's recaptures are exciting because they help tell the story of these fish," says VIMS Marine Recreation Specialist and Co-coordinator of the VGFTP, Susanna Musick. "We know that these fish haven't moved far (or not at all in the case of the second tautog); we know how much they've grown, and we know that we've had success with tag retention in a structure-oriented species."


©VGFTP

Ken Neill holds a tautog that was retagged after a record 2,826 days.

Since 1995, the VGFTP has tagged ten species of recreationally important finfish with the help of volunteer anglers. A co-operative effort between the VASG Marine Advisory Program at the Virginia Institute of Marine Science (VIMS) and Saltwater Tournament at the Virginia Marine Resources Commission (VMRC), and it is funded by state saltwater license funds and VIMS.

Learn more about the VGFTP at http://www.vims.edu/vgftp.

Bishop Sullivan wins fifth straight Blue Crab Bowl

For a record fifth year in row, Bishop Sullivan Catholic High School (Virginia Beach) took first place at the annual Blue Crab Bowl, Virginia's marine and ocean science quiz competition. This year's Blue Crab Bowl was held at Old Dominion University on March 3. Other placing teams included Chesapeake Bay Governor's School (Glenns) in second, Seton School (Manassas) in third, and Grafton High School (Yorktown) in fourth.

Read more at http://bit.ly/2012bcb.

©Janet Krenn/VASG

Bishop Sullivan's Blue Crab Bowl Team deliberates over a tough question.

Grow your own oysters?

Visit http://www.youtube.com/VirginiaSeaGrant or scan this QR code to see our latest videos, including instructions for building oyster floats thanks to the Tidewater Oyster Gardeners Association.

Visit http://bit.ly/2012stateofvasg or scan this QR code to see video of the 2011 State of Virginia Sea Grant Annual Report.

2012 Project Participants' Symposium

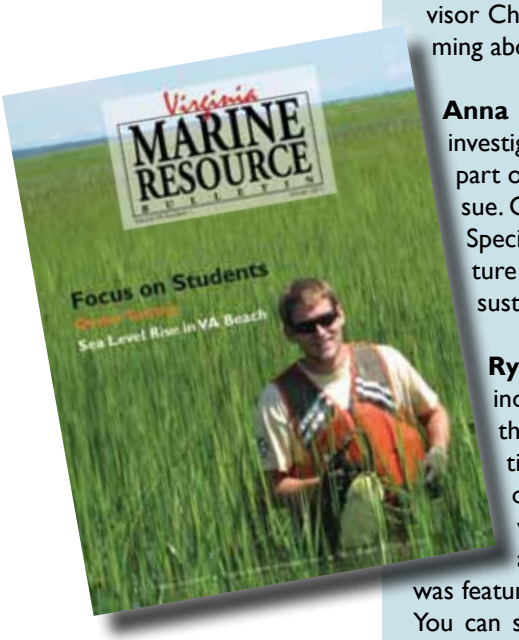
On Wednesday, February 1, VASG held its 3rd annual Project Participants' Symposium—a meeting that enables VASG partners to network and learn more about the organization while helping to plan the future of VASG. About 100 researchers, students, and other partners gathered in Richmond for the Symposium, which was followed by the annual Seafood & Wine Reception. The Reception, cosponsored by VASG and the Virginia Seafood Council, drew more than 200 attendees, including VASG institutional partners, state legislators, and agency representatives.

This year's symposium featured a keynote session on communicating science, in addition to Director Troy Hartley's State of Virginia Sea Grant annual report.

VASG welcomes 2012 class of graduate research fellows

Virginia Sea Grant has awarded two-year Graduate Research Fellowships to five students at Virginia institutions. The fellowship supports Ph.D. students engaged in coastal and marine research relevant to Virginia and the VASG strategic plan. The program emphasizes communication skills, and fellows work with outreach or end-user mentors to ensure that their research results are used by stakeholders.

Billur Celebi is advised by Dick Zimmerman at Old Dominion University. She is studying the effects of climate change on eelgrass, and she will work with outreach advisor Chris Witherspoon of the Virginia Aquarium to develop educational programming about seagrass for a variety of ages and audiences.



Anna Murphy is advised by Mark Luckenbach and Iris Anderson at VIMS. She is investigating the flow of nitrogen in areas of intense clam aquaculture. Murphy is part of the research team featured in the photo-essay on pages 8 and 9 of this issue. Outreach mentor Karen Hudson, the VASG Commercial Shellfish Extension Specialist, will work with Murphy to help her make contacts in the clam aquaculture industry and discuss her results with them to help keep their farming efforts sustainable

Ryan Schloesser is advised by Mary Fabrizio at VIMS. His research investigates indicators of health in juvenile fishes and the impact of these characteristics for the dynamics of striped bass, summer flounder, and Atlantic croaker populations in the Bay. Schloesser will work with outreach advisor Robert O'Reilly of the Virginia Marine Resources Commission (VMRC) and will have the opportunity to participate in fisheries management discussions that VMRC is involved in. Schloesser was featured on the cover of the Winter 2012 issue of the *Bulletin.* You can see more photos and learn more about his research at http://bit.ly/ryan2011fr or scan this QR code on your smart phone.

Mark Stratton is advised by Rob Latour at VIMS. He will characterize the ecology of the nearshore fish communities of the U.S. East Coast by studying the abundance, distribution, and diets of fishes found in several trawl surveys. He will work with outreach mentor Geneviève Nesslage of the Atlantic States Marine Fisheries Commission

(ASMFC) to incorporate his results into efforts to model, understand, and manage multiple fish species simultaneously using ecosystem-based fisheries management.

Xiaoyu Xu is advised by Michael Newman at VIMS. For her thesis work, she has created a database of mercury concentrations in commonly eaten fish species in the Lower Chesapeake Bay and is modeling the mercury exposure of specific populations of people in the region based on their fish consumption. Outreach mentor Erica Holloman of Southeast Care Coalition is advising Xu in the creation of outreach materials based on her research to communicate the benefits and risks of fish consumption to local people.

Credits clockwise from top left ©Janet Krenn/VASG, Margaret Pizer/VASG, Margaret Pizer/VASG, Carly Rose/VASG, Xiaoyu Xu.

Graduate Research Fellows at work (above clockwise from top left) Ryan Schloesser, Mark Stratton, Anna Murphy, Billur Celebi, and Xiaoyu Xu.

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