

Impact

Sunset from RV Virginia bridge
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Fall 2019 / Winter 2020 Newsletter

Virginia Institute of Marine Science

OYSTER AQUACULTURE IMPACTS CHESAPEAKE BAY WATER QUALITY

The rapid growth of oyster aquaculture in the Chesapeake Bay has raised questions about its effects on water quality. Proponents tout its benefits, including reduction of water-column nutrients and increased clarity. Others point to drawbacks such as enrichment of sediment nutrients and altered patterns.

A new field study by VIMS researchers shows that, in fact, there are minimal impacts from oyster aquaculture overall. Findings suggest that low-density oyster farms in well-flushed areas are unlikely to hurt local water quality. The published study was authored by VIMS doctoral

student Jessie Turner along with Drs. Lisa Kellogg, Grace Massey, and Carl Friedrichs. Partial funding was provided by The Nature Conservancy.

"We found differences in water quality and current speed inside and outside the farms," said Turner, "but they were minor."

The team's findings suggest room for growth in oyster aquaculture in the bay, as long as growers continue using low-density culture with well-spaced cages.

"Even though we detected no effects in the water column during a single tidal cycle," Turner said, "we

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VIMS Ph.D. Student Danielle Tarpley holds a sediment core collected from the oyster farm in Broad Bay of the Lynnhaven inlet.
© J. Turner/VIMS.



VIMS students take a public policy trip to Washington, DC.

NEW MASTER'S IN MARINE SCIENCE OFFERED

The School of Marine Science at VIMS recently added a new master's degree program to its offerings. The new professional M.A. in Marine Science is a degree program designed for students who want to study marine science and intend to pursue careers in policy, education, business, non-profits, and other professional areas.

Through coursework and training, students gain advanced marine science knowledge

along with skills that will enhance their ability to translate, integrate, and apply marine science in a variety of settings and allow them to work effectively in partnership with academics, decision makers, the public, and other professionals.

"Each student will work one-on-one with a VIMS faculty member and an external advisor to design and conduct a research project on an important marine science issue that is relevant to them," said Linda Schaffner, associate

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SOPHISTICATED TECHNOLOGY SOUGHT FOR VIMS FLAGSHIP

VIMS has embarked on an ambitious campaign that will enable the purchase of a sophisticated sonar suite for its new flagship research vessel, the *Virginia*.

"Maintaining a technologically advanced fleet of research vessels is critical to achieving VIMS' goals of restoring the Chesapeake Bay, sharing groundbreaking marine research with the world, and developing top science leaders," said VIMS Dean and Director John Wells. "The 93-foot R/V *Virginia* is already the most advanced ship in its class; the sonar suite will add advanced technology to help us fulfill our mission."

The sonar suite includes a multibeam that uses sound waves to collect data for conversion into high-

resolution maps and images and an echosounder, which will enable collection of data on species of marine life anywhere in the water column.

The campaign kicked off in Richmond this fall with the announcement of a generous \$400,000 challenge grant from the Mary Morton Parsons Foundation. VIMS must raise at least \$400,000 by June 2020 to meet the challenge. Scientists at the event showcased their research and shared how the sonar suite will help improve data collection on important fish species and add to VIMS' extensive record of bay data, provide information critical to policy makers, and offer insights into marine ecosystem changes.

Contact Susan Maples at susan@vims.edu for more information.



VIMS Foundation Board Vice President Jeanette McKittrick spoke about her shared passion for the Chesapeake Bay and the impact of VIMS' research.

NUNNALLY ICHTHYOLOGY COLLECTION REACHES IMPORTANT MILESTONE

The Nunnally Ichthyology Collection contains in excess of 500,000 fish specimens and serves as a repository for fishes from all over the world, with an emphasis on fishes of the Chesapeake Bay, Virginia freshwater, the coast of Virginia, and the Western North Atlantic.

Most of the support for the collection comes from private funding. Years ago, The Nunnally Foundation created an endowment to underpin the collection's care. With a generous \$100,000 gift from the foundation this year, the endowment, named in the family's honor, surpassed \$1 million.

"It's a substantial milestone," said Eric Hilton, VIMS professor and curator for the collection. "There's a recognized need for the collection, and support from inside and outside this institution reflects that. The support the Nunnallys have given will help ensure the collection will be cared for well into the future."

"We are charged with preserving and making available this piece of Virginia's natural history," Hilton noted.

What began in the 1950s as an uncatalogued collection of fishes gathered from research and used primarily for teaching and VIMS research, has grown into a magnificent global resource with a full-time collection manager.



Marine Science Day visitors examine the Nunnally Ichthyology Collection.

"The collection itself is a time capsule that allows us in 2019 to consider a specimen from the 1940s," Hilton noted. Researchers can compare what they see in a particular species of fish caught today with what they can see in a preserved fish caught decades earlier.

Everything in the Nunnally Ichthyology Collection is part of a vast fish collection database that is searched by people all over the world - scientists, resource managers, and private citizens. Closer to home, it helps inform fisheries management decisions, supports research conducted by VIMS graduate students, and provides opportunities for William & Mary undergraduate students to engage in original research.

Sarah Huber, curatorial associate and collection manager, loves to share the collection with the public, too.

"People get excited to see the diversity of fishes and learn about their biology," said Huber. "Most people are surprised to hear that we loan out thousands of fishes every year to scientists and educators throughout the world; we currently have specimens in research laboratories on every continent. It's a reminder about the importance of maintaining collections such as ours."

Each year, more than 1,000 people come for tours, peering into jars and peeking under lids to discover the diversity and wonder of these fishes. These public tours and programs include the annual Marine Science Day at VIMS and behind-the-scenes collection tours. Visitors of all ages marvel at preserved specimens ranging from anglerfishes measuring just a quarter of an inch long to a 400-pound great white shark and a rare coelacanth from the east coast of Africa that is nearly five-feet-long. Specimens from the collection are also loaned for use in public talks, seminars, and other outreach programs.

Learn more about the Nunnally Ichthyology Collection at www.vims.edu/research/facilities/fishcollection.



PAIR AUTHOR DEFINITIVE TEXT ON TUNAS AND BILLFISHES

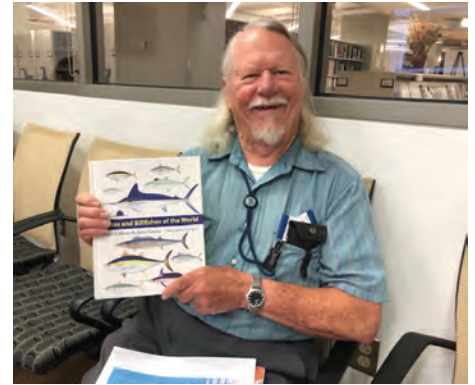
Bruce Collette and John Graves first met in the mid-1970s when Graves was a student at Scripps Institution of Oceanography in San Diego. Collette was already a well-established ichthyologist. Graves was a young geneticist embarking on graduate school. Fast forward to 2019, and the two men, now both established and respected in their fields, have authored a book together.

Tunas and Billfishes of the World provides an account of what is currently known about these fishes. It contains detailed descriptions of each of the 61 species, including information on their biology, size, habitat, fisheries, conservation status, and much more. It also includes full-color illustrations by renowned illustrator and self-identified fish geek Val Kells.

"We were trying to write for a broad audience," Collette said. "We wanted the book to be scientifically

accurate, valuable to ichthyologists, useful for those who manage fisheries, and smoothly enough written for a sports fisherman to enjoy it." Collette noted that publication of the book is timely because it can serve as a baseline for the upcoming 10-year reevaluation of the threat status of all the species as recommended by the IUCN (International Union for the Conservation of Nature).

Collette was a graduate student at Cornell in 1957 when he began studying tunas, and he continued to do so throughout his career. Today he is a research associate in the Division of Fishes at the National Museum of Natural History in Washington, D.C., senior scientist (emeritus) of the National Marine Fisheries Service Systematics Laboratory, an adjunct faculty member at VIMS, and chair of the Tuna and Billfish Specialist Group of the Species Survival Commission of the



Bruce Collette

IUCN. Graves, Chancellor Professor of Marine Science at VIMS, also serves on the Tuna and Billfish Specialist Group with Collette. Together with other experts from around the world they examine biological and fisheries data on tunas and billfishes, then determine their conservation status. Currently both groups have species that are considered threatened.

Since 1976, Collette has served on 18 graduate student committees at VIMS, including several with Graves. "Bruce has a real affinity for VIMS," Graves said. "He really enjoys working with graduate students, and he's been an excellent advisor." This summer he also coauthored a book with VIMS doctoral student Kate Bemis, titled *Order Beloniformes: Needlefishes, Sauries, Halfbeaks, and Flyingfishes*.

Support for students

It was not a surprise for Graves when Collette announced his intention to create the Sara E. and Bruce B. Collette Fellowship Endowment at VIMS this fall. The fellowship will support graduate students studying whole organismal biology, with a preference for fishes.

"I've been really lucky," said Collette. "I got a job doing something I love. When I finally retired, I started getting a retirement check, but I'm still in the same office working with the same people." When he and his wife Sara decided to give back, they made the decision to support students now, rather than with a bequest, so that they could enjoy seeing the impact of their donation.

In addition to the VIMS fellowship, the Collettes have established the Collette Postdoctoral Fellowship at the Smithsonian, focused on collections-based systematic ichthyology. "Basic morphology is often overlooked," Collette said. "I wanted to be sure that this field of study is still supported."

WELCOME CLASS OF 2019!

This fall, VIMS welcomed an incoming class of 21 students to campus. This new class has solid academic strength and research experience, to include Research Experiences for Undergraduates (REUs), internships, and work experience. They hail from California, Colorado, Florida, Iowa, Kansas, Maryland, Minnesota, North Carolina, Ohio, Pennsylvania, Texas, Virginia, Washington, and China. Four are studying aquatic health sciences, six are in the area of biological sciences, seven are in fisheries sciences, and three are in physical sciences. Five are Ph.D. students and 16 are master's degree students.



From L: Row 1 (seated): Kaitlyn Clark, Kayla Cahoon, Alexis Hollander, Christina Rarick, and Abby Golder. Row 2: Evan Flynn, Rachel Dixon, Alex Challen Hyman, Shannon Smith, Ashley King, Savannah Mapes, and Emily Goetz. Row 3: Luke Frankel, Elisa Aitoro, Alexandra Schneider, Malina Loehner, Xuqing Chen, and Taylor Walker. Not pictured are Julie Gross, Quinn Roberts, and Abby Sisti.



CAMPERS ARE MARINE SCIENTISTS FOR A WEEK

Each summer, for four fun weeks, kids come to VIMS to get wet and muddy in the name of science.

"The goal is to give students an opportunity to learn about marine science in a fun and hands-on way," said Sarah Nuss, education coordinator for the Chesapeake Bay National Estuarine Research Reserve (CBNERR) at VIMS. She has been leading summer camps at VIMS since they were introduced in 2009. "Kids learn how to do experiments. They learn about careers and about issues the Chesapeake Bay is facing. We want to inspire them to continue to learn after camp."

During a fast-paced week, campers in four age groups learn about wetlands, environmental stewardship, climate change, and general Chesapeake Bay exploration. Experiences such as mapping, seining, and buoy building leave campers with a deeper appreciation for the marine environments.

"Kids now are more aware of issues affecting the planet," Nuss noted. At

camp, they learn that the issues are complex. "We definitely see kids in tune with issues affecting oceans. Especially high schoolers. They want to learn advocacy. They want to talk to scientists and ask questions."

Through the years, the camps have been funded by individuals who love marine science and want a special camp experience for young people, no matter their financial situation. All campers attend for free, and 50% of the campers come from Gloucester and neighboring Mathews County. In the first 10 years, camps were offered for grades first through eighth. This year first and second grades ceded to high school, putting emphasis on ages exploring college and career choices.

"This gave us the opportunity to



A high school camper finds a fish while seining at summer camp.

have a camp for our junior counselors," Nuss said. "So many of them had aged out of camp but still wanted to be involved." Now, in addition to serving as counselors for younger campers, the older students have their own camp where there is more emphasis on exploring marine science jobs.

Each year, Nuss surveys parents of campers, and the results are overwhelmingly positive. "They always comment on the quality of the camp," Nuss said. "They are surprised by what their kids are coming home with. The words they know."

"They want a parent camp," Nuss said with a laugh.

Michelle Hodges heard about the camps from another mom and signed up her oldest child, Mark, last year. This year it was daughter Price's turn.

"They couldn't wait to go back each day," Hodges said. And though they had fun, Hodges said it was really challenging, too. "I heard a lot about the teaching marsh and the creatures they found."

Hodges was so enthusiastic that she offered to help support the camps when the program came to the end of its funding this year. "After my oldest went to camp, I said, 'we need to support this!' It was amazing. Definitely the best camp we've ever done, and we've done a lot of camps."

Nuss hopes the camps will continue. "My long-term goal is to have an endowment that would solidify support for the camp. I want to keep the momentum!"

Hodges noted, "I think the real value is in exposing kids to these experiences so they can learn for themselves and teach their parents about what they learn. It's an essential way to create change."

FOUNDATION BOARD WELCOMES NEW MEMBERS

This summer the VIMS Foundation welcomed two new members onto its board: James A. Carleton and Wayne King Johnson, Jr.

Jim Carleton retired from Pricewaterhouse Coopers with more than 30 years of public accounting experience. Following his retirement, he taught as an adjunct faculty member at William & Mary and taught finance at the University of Richmond. Carleton has been an active community volunteer and leader for more than 40 years. Leadership activities include serving as chairman of the Richmond Development and Housing Authority and as president of the Virginia Society of Certified Public Accountants. He resides in Richmond, VA.

Wayne Johnson is president and majority stock holder of Coldwell Banker Avenues, which was founded in Richmond, VA, in 1975. The company is a licensed real estate brokerage that consists of 27 licensed real estate agents and brokers. Johnson is a past director of the Richmond Board of Realtors and was a 15-year member of its Professional Standards Committee.



Jim Carleton



Wayne Johnson

Johnson holds a B.A. in Psychology from William & Mary. He resides in Richmond, VA.

This year the foundation board is once again led by President Phyllis Cothran of Richmond, VA, Vice President Jeanette McKittrick, also of Richmond, Treasurer Chip Hortenstine of Williamsburg, VA, and Secretary Bill Strickland of Deltaville, VA.

The VIMS Foundation advises and assists the Virginia Institute of Marine Science, promotes philanthropy to and stewards the philanthropic resources of the VIMS Foundation, and its members act as allies and ambassadors for VIMS.



PROFESSOR SAILS NORTHWEST PASSAGE

When VIMS associate professor Donglai Gong was selected to join a group of U.S. and Canadian scientists and students to traverse the Northwest Passage, it was more than just a great opportunity, it was the realization of a career goal.

"I have always wanted to sail through the Northwest Passage,"

Gong said. "In grad school I decided that I wanted to research the Arctic, and I told a buddy it was in my five-year plan." While he had made it to the Arctic, Gong had not undertaken the Northwest Passage until the voyage this summer. For 18 days aboard the Swedish icebreaker Oden, Gong and others from the Northwest Passage Project traversed the passage, conducting experiments, testing water quality, learning from indigenous people, and witnessing firsthand the dramatic changes happening in the Arctic.

"In 2007, the ice had dropped to its lowest point. Then in 2012 there was a more dramatic drop. It motivated me scientifically," said Gong. "The trend

is still going down. There's still ice on significant portions, but it is clear in places."

According to Gong, even when Oden encountered ice, it never needed more than two of its four engines to break through. The ice was frequently thin and broken, and temperatures rarely dropped below

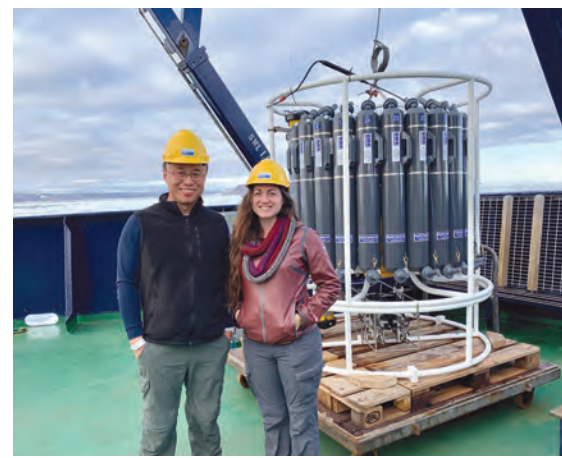
Gong's top three takeaways from the Arctic:

- What's happening in the Arctic doesn't stay in the Arctic. What happens there will affect all of us.
- There are indigenous people who know a lot about the environment and have the ability to help us.
- Change is happening so fast and so dramatically that we really need to do something now. Globally, we need to heed the warning of the Arctic.

freezing. "Some days, it was in the 50s," Gong noted. "It melted water and created ponding everywhere. If this is how it will be, the Arctic doesn't stand a chance. It doesn't take much to see what is happening and project that forward."

With funding from the National Science Foundation (NSF), sixteen undergraduate and graduate students from a wide range of disciplines – including medical, policy, and business – joined the voyage and worked alongside the team of interdisciplinary

scientists. "We were not trying to train a boat full of future scientists," Gong said. "They are young people who will be in other fields besides science, and they will be talking to people in other professions who need to understand what is happening to our climate."



Donglai Gong with Nicole Trenholm, a graduate student at the University of Maryland, Baltimore County. They are standing in front of a CTD (Conductivity Temperature Depth) rosette holding water sampling bottles and instruments that measure ocean temperature, salinity, dissolved oxygen, chlorophyll, and current velocities when deployed.

Gong was impressed by the students. "In the beginning, they were excited but didn't know their roles and impact. By the end, they felt empowered and valued by everyone on board. NSF invested a lot of time and energy in bringing students there so they could become ambassadors for the Arctic. Having young people drive change is really important. It's their future; their opinions should matter more."

Working with the students was good for the scientists, too. "It was good for helping me remember why we [educators] do what we do. Seeing that young people care gives you hope."

FLOATING HOUSES: FELLOW STUDIED OPTION TO LET HOUSES RISE WITH WATERS

Elevating homes keeps flood water out, but what about houses that could rise above the flooding—and still return to ground level once the water subsides? One technique called amphibiation allows houses to do



Zane Havens

just that. Amphibiated houses have a buoyant foundation tethered to poles that keep the house from drifting away while it floats. Special utility lines can stretch or safely detach when the house floats. The amphibious structure allows the house to adapt to standing floodwaters as high as 10-14 feet.

Zane Havens studied amphibiation as an adaptation technique while a postgraduate resilience fellow at the architecture and engineering firm Clark Nexsen. His fellowship was sponsored by Virginia Sea Grant, a seven-university partnership located at VIMS. The fellowship allowed Havens to visit potential sites for amphibiation and discuss the technique with professional experts. Specifically,

Havens investigated why this promising method isn't more widely used.

"I think the challenges are twofold: Getting the US government and building codes on board with this technology, which I think is a long process," Havens said. "Then the other component to this is getting people to embrace it. Right now, people think the only option when you're faced with flooding is to elevate your house."

Amphibiation costs less than permanent elevation, but hasn't taken off—in part because buoyant structures can't qualify for flood insurance under current FEMA codes. Havens said more engineering research and high-profile examples will help boost confidence in amphibiation.



CONSORTIUM EARNS FUNDING TO ENHANCE OYSTER BREEDING

A consortium of 14 shellfish geneticists from 12 East Coast universities and government agencies has won a five-year, \$4.4 million grant funded by NOAA Fisheries to develop new tools to accelerate and localize selective breeding in support of oyster aquaculture.

The project team was assembled by Stan Allen, professor and director of the Aquaculture Genetics and Breeding Technology Center at VIMS; Ximing Guo, distinguished professor and shellfish geneticist at Rutgers Haskin Shellfish Research Laboratory; and Dina Proestou, a scientist with the USDA's Agricultural Research Service.

"Our respective breeding programs at Rutgers and VIMS are at the core of the new consortium approach," Allen said. "The project is a terrific opportunity to develop further

ground-breaking approaches with Ximing's team and our other East Coast collaborators, and will hopefully deliver all the more results for industry."

Guo and Allen previously partnered to create the world's first tetraploid oysters at Rutgers in 1994.

Consortium partners will make improved brood stock available to commercial hatcheries, thereby sustaining the rapidly expanding, \$90 million enterprise of farming oysters along the East Coast.

During the past two decades, researchers in Allen and Guo's labs have used traditional methods of artificial selection to develop varieties of the eastern oyster *Crassostrea virginica* that are now quite tolerant of MSX, the parasite that devastated the oyster harvest in the mid-Atlantic beginning in the late 1950s.

These selective breeding programs have also substantially improved other traits, leading to faster growth and meatier oysters.

The sequencing of the oyster genome in

2012 unlocked a flood tide of new possibilities. "Now that the oyster genome has been sequenced," says Allen, "there's a lot of raw material to work with."

The consortium partners plan to advance the pace of genetic improvement by identifying the specific genes responsible for desirable traits. They will then strive to develop and share domesticated lines whose traits are customized to local conditions. With a native range from Atlantic Canada through the Gulf of Mexico, eastern oysters are exposed to significantly different conditions among regions.

"While disease resistance is the most important trait for the Eastern oyster, we hope to use the technology to select for other desired traits, such as fast growth and hardiness," says Guo.

Allen says the team will also look for markers associated with resistance to ocean acidification and Dermo disease, and a tolerance for low oxygen and low salinity. He notes that the latter became a major issue last year in the Chesapeake Bay, when record high rainfall and runoff diluted normally salty Bay waters to levels that were detrimental to oyster growth and survival.



Researchers in the ABC program at VIMS select oysters for desired traits such as disease resistance, faster growth, and greater meat content. From L: Vanessa Delpero, Jess Small, and Joey Matt. © Eric Guévelou/VIMS.

Oyster aquaculture impacts Chesapeake Bay water quality, continued from page 1

know oysters take up nitrogen and phosphorus through feeding and growth, and over time we would thus expect harvesting of farmed oysters to be of benefit to the bay." Excess input of these nutrients via fertilizers, wastewater, and other sources is a main reason for impaired water quality in the Chesapeake, with their reduction and removal a key goal of bay restoration efforts.

Andy Lacatell, Virginia Chesapeake Bay Director of The

Nature Conservancy, said "This important research demonstrates that, while the positive impacts on water quality may be small, just the presence of oyster aquaculture improves the health of the Bay."

Oysters are the fastest growing segment of Virginia's shellfish aquaculture industry, with a farm-gate value in 2017 of \$15.9 million.

FOR THE BOLD CAMPAIGN

Goal:
\$35 Million

Every gift to the VIMS Foundation underpins efforts to better understand and protect precious marine environments. Become a VIMS supporter by making a gift of any size at www.vims.edu/giving or by using the enclosed envelope.



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OUTREACH SHARES STEM PROGRAMS WITH BOYS & GIRLS CLUBS

Throughout the summer, and continuing through this fall and winter, VIMS has been providing STEM programs to members of the Boys and

Girls Clubs of the Virginia Peninsula. VIMS graduate students visit Boys and Girls Clubs in Hampton and Newport News and facilitate hands-on marine science lessons. They also talk to the youth about careers in marine science and their paths to graduate school. Several members of the clubs also attended a field trip to VIMS this summer, where they used seines to collect and observe plants and animals in the York River. They also visited research laboratories on the VIMS campus in Gloucester Point, including the Zooplankton Lab (pictured at left). The program was made possible through a grant from the Arconic Foundation.



Boys and Girls Clubs members visited VIMS in the summer and were able to do some beach seining.