Sea Grant Delaware

UNIVERSITY OF DELAWARE
EARTH, OCEAN & ENVIRONMENT

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DEEPENING ENGAGEMENT ACROSS DELAWARE

DESG Coastal Communities Development Specialist Ed Lewandowski has worked on the revitalization of Laurel for several years, coordinating closely with colleagues in Laurel's business, nonprofit and government sectors as well as the University of Delaware College of Agriculture and Natural Resources. Among the many projects they have undertaken is creating a community event around painting watermelon buses, like the one shown here at Coast Day 2018. *Read more in the story on page 9.*

DIRECTOR'S LETTER

DELAWARE SEA GRANT

The Delaware Sea Grant (DESG) College Program has experienced tremendous change and progress over the past year, and I am excited to share this annual report with you.

After a number of retirements from DESG's extension team, the Marine Advisory Service (MAS), we spent 2018 rebuilding and ended the year with several new staff members, new skills and new energy. We have emerged with a renewed focus and the ability to deepen our engagement throughout the Delaware community.

This report highlights the work we have undertaken in the four focus areas of the National Sea Grant Program: Healthy Coastal Ecosystems (page 7), Resilient Communities and Economies (page 9), Sustainable Fisheries and Aquaculture (page 11) and Environmental Literacy and Workforce Development (page 13). Before we get to those details, we would like to share some information about the newest members of our team and how they are bringing new opportunities to our program.

DESG exists to serve the people of Delaware, protecting our shared environmental resources and promoting the health of our coastal economy. In our state, that effectively includes all of our land, water and communities because each part of our three counties, from the hills upstate to the ocean downstate, is closely connected to the coast.

We are keenly aware of our mandate to serve the entire state, and through some of our new hires, like Associate Director Christian Hauser, we are working to engage different partners in new areas to increase the good we can do for Delaware. Likewise, additions to MAS staff have expanded our areas of expertise and interests, leading to new connections with new communities and strengthening relationships with others.

This year has been one of change, all of it guided by a steady principle: to broaden our impact and deepen our engagement with partners and stakeholders statewide. I hope you find the information in this report interesting and useful. If you want more information or have ideas for ways that Delaware Sea Grant could help your community, please visit www.deseagrant.org for current news and contact information.

Kathryn Coyne
Director, Delaware Sea Grant College Program

DESG Marine Advisory Service and Management team.

ADVISORY COUNCIL

The Delaware Sea Grant Advisory Council—the statewide external advisory body to the Delaware Sea Grant College Program—was created in 1974. Its members hail from marine-oriented businesses and industry, resource management and engineering firms, state government, public interest groups, the pre-college educational sector and the media. Working within the national priorities identified by the National Sea Grant College Program, the council helps further define priority coastal issues relevant to Delaware.

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Delaware Center for the Inland Bays

Mark Biddle
Watershed Assessment, DNREC*

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Sharon Lynn
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Dave Saveikis
DNREC*

Guy Simmons
Sea Watch International, Ltd.

Halsey Spruance
Delaware Museum of Natural History

Namsoo Suk
Delaware River Basin Commission

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New Energy & Ideas Flow into Marine Advisory Service

Over the past year, DESG's Marine Advisory Service (MAS) has brought on several new staff members to help answer the needs of Delawareans on a wide and growing range of topics.

Christopher Petrone, director of MAS, said that it has been great to get people into the roles who offer different perspectives, while also having years of professional experience—three new MAS specialists came from the Delaware Department of Natural Resources and Environmental Control (DNREC), and the new education specialist joined DESG from the National Aquarium in Baltimore.

"They all have new ideas, energy and a host of experiences to draw from," said Petrone. "They want to jump into projects and start working with stakeholders. It's exciting and it's energizing for all of us to get these new folks on board and share ideas."

Danielle Swallow joined the team in December 2017 as the Coastal Hazards Specialist. She works with communities and individuals on preparedness for and resilience to various hazards, such as flooding and big storms, many of which may increase due to global climate change. In 2018, she organized a workshop focused on emergency preparedness for older adults and those with special needs, and she provides training and technical assistance through the statewide Resilient and Sustainable Communities League (RASCL).

Ed Hale, Ph.D., joined MAS in July as the Fisheries, Aquaculture and Seafood Specialist. On aquaculture, Hale partners with Dennis McIntosh, Ph.D., MAS Aquaculture Specialist and professor at Delaware State University (DSU), and the two of them are helping oyster growers, retailers and others in the industry as it becomes established. The commercial fishing industry is also being well served by Hale, who came to DESG from DNREC, where he served as a fisheries biometrician. Hale has worked with fishers to help MAS understand what their needs are within the state.

Kate Fleming started in October as a Coastal Ecology Specialist. She works to address aquatic invasive species, living shorelines, and marine debris challenges such as derelict crab pots and microplastics. Fleming works with researchers, stakeholders and resource managers across the state to identify other coastal issues that merit Sea Grant assistance.

David Christopher is the most recent hire in MAS, joining in 2019 as the Marine Education Specialist. Christopher will work on teacher professional development and student programs on campus, as well as in classrooms and nature centers. He works closely with researchers and others at the University of Delaware (UD) to provide science-based programming on coastal or marine topics of interest.

Petrone also said that in addition to these new hires, MAS is evolving in the way that it looks at issues, taking into account social issues that can be addressed through their work, a focus particularly important to Jamē McCray, Ph.D., the environmental social scientist in MAS. McCray predates the newest round of hires, but represents some new blood herself, having joined in Spring 2017.

"We have new energy, new ideas, and it's really exciting," said Petrone. "Now that our team is complete again, we can better serve the needs of our stakeholders."

Arts Integration

Environmental Social Scientist Jamē McCray joined MAS in 2017, but she represents a part of the new approach DESG is taking to stakeholder engagement, similar to the other recent additions to the MAS team.

Together with Kimberly Schroeder, director of UD's dance minor, McCray has taught a four-week course over the past two winter sessions during which the students first learn about an environmental science topic, then work with their teachers to create a dance embodying what they've learned. The dances were then performed at UD's exhibit at the Philadelphia Flower Show the past two years, reaching members of the public in a unique and engaging way.

In addition to reaching new audiences with environmental information, the class is an example of the educational benefit of the emerging field of arts integration, an innovative approach to merging science and art. While it is understood that people learn in different ways, classrooms still need more tools to reach some of those who thrive when learning by doing. McCray explains these kinesthetic learners best absorb new knowledge through movement. McCray has used the process for education outside of the classroom as well. In April 2018, she engaged professional dancers and other members of the community to create a National Water Dance performance in Wilmington.

The benefits of arts integration go deeper than reaching new audiences and better serving certain students. McCray's role in MAS focuses on community engagement and evaluating the social impact of Sea Grant work with members of the public. Arts integration provides a tool for engagement, and her social science background allows her to measure its effectiveness, providing for better approaches in the future and building the academic literature on this emerging field.

When used in the community, arts integration can lead to more productive engagement around environmental issues in two ways. It can encourage more creative approaches to solving environmental problems by avoiding conventional thinking. And it can "circumvent the non-conversations that currently go on about environmental issues," as McCray explains it, using climate change as an example.

"You say climate change, and party A immediately says this and party B immediately says that and nobody is talking to each other. But if you see a play based on a situation that happens because of climate change, then the conversation you are going to have is about the characters and the story," McCray said. "Arts integration allows us to have conversations about how we are going to move forward and what we are going to do."

Benefits of Arts Integration

- Reaching new audiences through engagement and performance
- Improving educational effectiveness for kinesthetic and tactile learners
- Encouraging creativity in problem-solving
- Enabling conversations about contentious issues (by approaching them through human connection rather than political debate)
- Engaging people's emotions when dealing with science-based issues

Overview of Delaware Sea Grant funded research projects for the 2018 2020 period:

Setting the Sediment Budget for Prime Hook—Chris Sommerfield, UD CEOE (See page 6)

Hydrodynamics and Beach Morphology During Extreme Events—Jack Puleo, UD College of Engineering

Conservation and Recovery of Atlantic Sturgeons in the Delaware River Estuary—John Madsen, UD CEOE and Dewayne Fox, DSU College of Agriculture, Science and Technology (See page 12)

Morphology and Tidal Inundation of Tidal Wetlands in the Delaware Estuary—Thomas McKenna, UD CEOE and Delaware Geological Survey

A Risk Assessment Analysis of Microplastics in Delaware Bay: Physical Controls and Biological Effects of an Emerging Pollution Issue—Tobias Kukulka and Jon Cohen, UD CEOE (See page 8)

Phytoplankton Dynamics and the Role of *Heterosigma akashiwo* in Promoting Blooms of the Toxic Dinoflagellate, *Dinophysis acuminate*—Tye Pettay, UD CEOE

Implementing a Subgrid Scheme for Improving Marsh Inundation Estimates in the Community Model FVCOM—Jim Kirby, UD College of Engineering

Widener University

Wesley College

Delaware Technical Community College

Delaware State University

Delaware Sea Grant Deepens Ties with State's Universities

In August 2018, Delaware Sea Grant (DESG) hired a new associate director, Christian Hauser, to help implement our vision of increased participation from colleges throughout the state and to diversify the kind of research being funded by the program. In particular, with DESG's emphasis on making connections between coastal science and real-world applications that would serve coastal communities, increasing the interdisciplinary research combining natural and social sciences was a priority.

Hauser brings nearly a decade of experience managing environmental projects at AECOM, a large international consulting firm. Hauser's technical skills are helpful at DESG, but it is his experience building coalitions among diverse stakeholders that he is using the most in his new role.

For more than 40 years, most of DESG's work has been with University of Delaware researchers. To increase DESG's impact, Hauser has reached out to other higher education institutions throughout the state, developing relationships with Delaware Technical Community College, Delaware State University (DSU), Wesley College and the Widener University Delaware Law School.

In advance of issuing the Request for Proposals for DESG's next research cycle, Hauser held information sessions at DSU and Wesley College, as well as UD, to encourage researchers to seek innovative partnerships, with each other or academics at other institutions. Hauser also designed the RFP itself to provide a new option for more support for projects that were interdisciplinary in nature.

Beyond research, Hauser has found ways to deepen ties with other institutions through facilitating internships. At DSU, Marine Advisory Service (MAS) specialist Dennis McIntosh is mentoring a graduate student working on educational and other initiatives to promote aquaculture within the state. Wesley College undergraduate Savanah Love is working as an environmental literacy intern with Jamē McCray, another MAS specialist, and contributed to the development and evaluation of UD's Philadelphia Flower Show exhibit.

DESG and Del Tech are creating a collaborative professional development program focused on the construction of green infrastructure projects, which Hauser explains as "building with nature to promote natural ecosystem functions and processes so that communities are more resilient to changing environmental conditions," something that will become even more important in the future as sea level rises and coastal storms intensify. DESG is interested in promoting green infrastructure projects statewide and is working to build capacity for Delaware companies to implement this type of project.

Including these other institutions expands the work of DESG and marks the beginning of a new wave of environmental protection and education within the First State.

"Collaboration benefits Delaware Sea Grant because our goal is to work throughout the state of Delaware," said Hauser. "We want to work with as many people within the state as possible to have a positive change. By working with different universities, we're covering a wider geographic area and having a broader impact."

▲ *Associate Director Christian Hauser joined DESG from private industry, where he worked on coastal restoration projects like those seen on this page.*

Setting the Sediment Budget for Prime Hook

The Prime Hook National Wildlife Refuge in southern Delaware has been undergoing a restoration project to return the 10,000-acre area to a naturally functioning tidal marsh and barrier beach capable of harboring migrating birds while preventing coastal flooding.

One of the ways to accomplish this goal is by re-introducing natural tidal flows for wetland grasses, specifically *Spartina alterniflora*, to grow and thrive in the ecosystem.

To do that, Delaware Sea Grant is funding research to help to characterize key physical dynamics that are important to the long-term health and stability of the wetland system by developing what is known as a sediment budget. The budget will help researchers understand if there is a net import or net export of sediment in the wetland complex.

Chris Sommerfield, professor in UD's College of Earth, Ocean and Environment (CEOE), explained that to keep up with sea level rise, salt marshes need a certain amount of imported suspended sediment that gets deposited by the tides.

The sediment concentration is important to know because when the suspended matter is deposited, it provides material that increases the volume of the soil.

With sea level rise, the marsh needs to grow vertically through a process known as accretion, which occurs through a combination of plant root material and sediment that gets trapped in the plant canopy during the tides.

"When the root material dies, it combines with the sediment to create soil that lifts the marsh platform upward, but that can only happen if the plants are getting enough nutrients and if there's enough suspended matter to contribute to the soil volume," said Sommerfield.

Four monitoring stations maintained in and around the wetland provide continuous data on water flow, temperature, salinity and turbidity. There is also an automated device at each station that takes water samples several times a day. The samples are analyzed for suspended sediment conditions weekly. Sommerfield focuses on the sediment dynamics and Carlos Moffat, a physical oceanographer in CEOE, focuses on the hydrodynamics of the system.

Now a year into the project, the researchers have learned that there's a mean non-tidal flow of water from the refuge to the surrounding wetlands, which is probably driven by fresh water drainage into the refuge. Currently, the refuge is exporting more suspended particulate matter than it's importing.

Sommerfield said that this is probably due to the destabilization of the soils that occurred during the construction of new tidal channels, as part of the restoration project.

"The soils are a bit more erodible than they would be under natural conditions, and it's probably not going to be until the salt marsh grass completely grows back that the net export of sediment will reverse to net import," said Sommerfield. "In many natural wetlands, it's common to get a net import of sediment particularly during spring tides and storm surges."

◀ *Researchers measure the salt marsh tide in Prime Hook National Wildlife Refuge.*

Courtesy of Chris Sommerfield

▲ *Smooth cordgrass* (Spartina alterniflora) *is the dominant vegetation in a healthy salt marsh. In the late summer, it can reach more than 6 feet in height.*

HEALTHY COASTAL

Meredith Kurz (on right in hat) traveled to Hawaii, Colombia and Canada as part of her fellowship with the National Oceanic and Atmospheric Administration s (NOAA) Ocean Acidification Program.

Courtesy of Meredith Kurz

Meredith Kurz Works with NOAA During Her Time as a 2018 Knauss Fellow

Meredith Kurz worked as an international liaison for coordination and capacity development at NOAA's Ocean Acidification Program as her assignment for the John A. Knauss Marine Policy Fellowship, a prestigious program run by NOAA's National Sea Grant College Program.

Kurz was nominated for the Knauss Fellowship by DESG and explored the intersection between climate and the ocean, as well as tackled the international aspects of ocean policy.

Representing NOAA's Ocean Acidification Program to the Global Ocean Acidification Observing Network, Kurz traveled and interacted with scientists from different countries and helped them increase their ability to conduct ocean acidification research through sharing knowledge and resources.

Kurz focused on building capacity in three different regions—Africa, Latin America and the Pacific Islands—and training qualified applicants who were already scientists to measure

UD graduate Meredith Kurz traveled around the world and helped build capacity in many developing countries while working for NOAA's Ocean Acidification Program during her Knauss Fellowship.

ocean acidification with pieces of equipment purchased for use in their home countries with grant money from the U.S. Department of State and the Swedish International Development Cooperation Agency.

"I think it's valuable to transfer knowledge and technology when the end result is for the common understanding of our ocean and the common good of managing it," said Kurz.

At workshops organized by Kurz and her colleagues at the nonprofit Ocean Foundation, expert scientists showed the trainee scientists how to conduct measurements in the lab, as well as how to process water samples to get the necessary chemical parameters. They also granted the trainee scientists a field pH sensor that could take continuous pH measurements in a location of significance.

For one of these capacity trainings, Kurz traveled to Hawaii to train scientists from Pacific Islands, such as Fiji, Vanuatu and Papua New Guinea.

"Because of this capacity training, a place like Vanuatu has someone doing ocean acidification observations, and there has never been those chemistry observations in Vanuatu before," said Kurz.

Kurz traveled to Santa Marta, Colombia for another capacity training involving South American countries. In addition, she went to Poland for the Global Ocean Acidification Observing Network's (GOA–ON) 2018 executive council meeting, which was held at the Polish Academy of Sciences Institute of Oceanology.

She also traveled to Ottawa, Canada as the Ocean Acidification Program has a direct relationship with Fisheries and Oceans Canada, and worked on a Pier2Peer GOA–ON program that matches early career scientists, particularly those in developing countries, with senior scientists in the field.

Kurz said it was interesting getting to know scientists from different countries and learn about their priorities and she is thrilled with everything that Sea Grant has allowed her to do in her academic ventures.

"My graduate research was also Sea Grant-funded, so I've been benefiting from Sea Grant support for years," said Kurz. "I love being involved in Sea Grant projects. It's such a cool program, and I like that they do applied community-based science. You don't see that as much in other grant programs, so I like that and admire that about Sea Grant."

ECOSYSTEMS

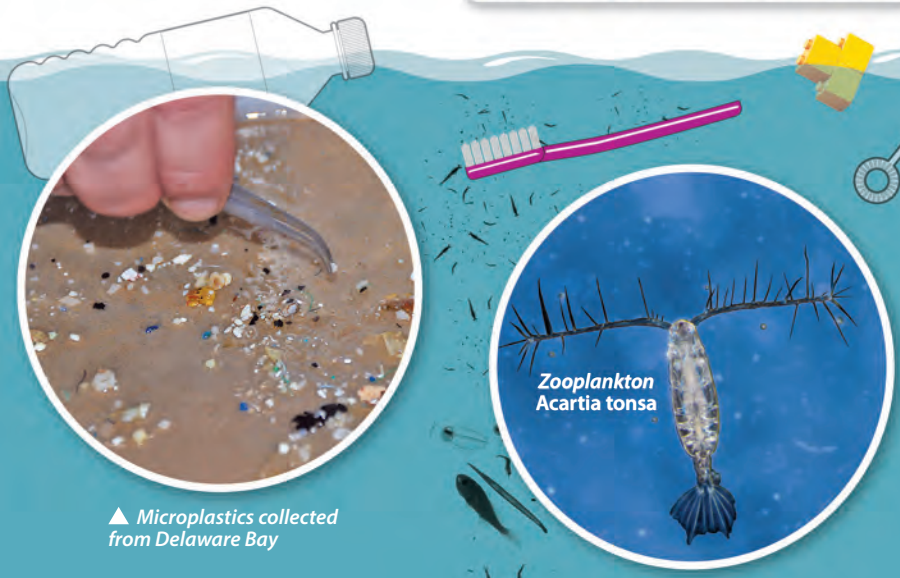
Healthy Coastal Ecosystems (HCE) **are at the heart of not only DESG's work, but also our lives and economies throughout the state. As a focus area, HCE is addressed in many ways, as you can see in these briefs, each of which is dealing with plastics through outreach, research and education.**

Businesses for Better Bags

At the end of 2017, University of Delaware marine science and fashion design students proposed a program that encouraged Lewes businesses and their patrons to cut down on single-use plastic bags and switch to a unique reusable bag created for the program. Thanks to support from DESG, the Lewes Chamber of Commerce and the Green Team at St. Peter's Episcopal Church, the students' idea became a reality, and bags were available in downtown stores in July 2018.

Marine Debris Workshop

In a unique professional development session called Marine Debris for Makers, educators learned about the hazards of debris in the ocean, including microplastics, then conducted their own beach cleanup, which was structured as a lesson they could take back to their classes. They took the trash and sand samples back to the classroom, where they learned how to examine the sand for microplastics, then used the trash for an art and engineering challenge as part of the day's secondary lesson on makerspaces and the potential for the maker approach in education.



▲ *Microplastics collected from Delaware Bay*

Understanding Microplastics

Plastic particles below 5 mm, or microplastics, are emerging as potential hazards to marine organisms. Currently, little is known about how microplastics affect marine populations and communities. Given the pervasive nature of microplastics, DESG is supporting research into the ecological effects of microplastic pollution in Delaware Bay. The goal is to develop a framework to quantify distributions of microplastics in the bay and assess their impact on coastal ecosystems, specifically studying the impact of microplastics on the dominant zooplankton *(Acartia tonsa)* in Delaware Bay.

Resilient Communities

Watercolors and Watermelons

In Laurel, Delaware, watermelons are not just a part of the local agricultural economy, they are an integral piece of the town's agricultural history.

Since its popular farmers' auction market opened in the 1940s, the town has enjoyed a reputation for high-quality produce. None of that produce is more associated with Laurel than watermelon, a fruit that together with cantaloupe and other melons sells around 2 million units every summer and takes up 6,000 acres in Sussex County.

As a result, the presence of "watermelon buses"—recycled and modified school buses used to harvest and transport melons to the auction market and distributors—are a staple of Laurel summers, making the buses themselves local icons.

It was this iconic status that led Bill McGowan, then the state director for the United States Department of Agriculture (USDA) Rural Development, to take the buses and turn them into something that embodies Laurel's history and culture and brings its community together.

McGowan, a Laurel local, proposed the idea originally in a branding meeting held as part of an effort organized by DESG to seek ways to revitalize the town.

Since 2016, McGowan, along with the assistance of John Donato, a local artist, and local Laurel residents, have converted one or two locally donated watermelon buses each year into beautifully painted and fully functioning rolling murals.

The event, aptly titled "Watercolors," takes place in downtown Laurel and attracts between 50 and 70 participants.

According to Ed Lewandowski, coordinator of UD's Sustainable Coastal Communities Initiative—the program that provides funding for the event—what makes the buses particularly special is that they continue to function in their typical roles during the harvest season and are also put on display at parades and community events.

"We're trying to develop a sense of pride in the community, an identity," said Lewandowski.

As a now semi-retired consultant for community development, McGowan continues to act as the main planner and quasi-chair for the event.

Though the format of the event has remained the same, each year the organizers pursue a different theme for the mural and this year's event featured two buses that were painted.

One bus was collectively sponsored by a watermelon buyer and an irrigator of watermelon fields. The result was a bus with two different visual stories: on one side the story of the watermelon harvest, and on the other side, that of the irrigation process.

DESG sponsored the second bus and told the story of protecting the water quality of the local Broad Creek, which runs through Laurel.

Though the event has already proven successful, McGowan is continuing to look toward the future. His aspirations include turning the event into a regional community painting competition, possibly even getting the watermelon pickers themselves in on the fun.

He also aspires to turn it into more of an annual fair, intent upon making the Watercolors event a bigger and better celebration of Laurel's cultural identity and history.

Sea Grant Educates Residents on Emergency Preparedness

DESG's Coastal Hazards Specialist Danielle Swallow organized an emergency preparedness workshop in September 2018 for older adults and people with disabilities "to connect them to information that is tailored to their unique situation and help grow their support network and develop contingency plans for any health and mobility needs in an emergency."

Workshop participants heard from the emergency managers for Sussex County and the City of Lewes, as well as the director of the nonprofit Greater Lewes Community Village. The workshop also helped to sign them up for the Smart911™ and CodeRED emergency notification services.

The workshop was co-sponsored by the City of Lewes and the Greater Lewes Foundation. In addition, support was provided by Sussex County, Beebe Hospital and the Delaware Emergency Management Agency.

Tidewater Screening

Increasing awareness about sea level rise and the risk of coastal flooding is a necessary first step to engaging the community in discussions about how to build coastal resilience. In Delaware there is a particular need to ensure residents understand these risks extend beyond the shoreline, upriver and even along some tributaries. In Newark in March 2018, DESG and CEOE screened Tidewater, a movie detailing the struggles related to these issues in the Hampton Roads area of Virginia. The movie was followed by a Q&A session led by Danielle Swallow *(top)* and CEOE professor Chris Sommerfield *(bottom)* to help dozens of community members think through the risks we face and the ways we might address them.

Resilient Communities and Economies (RCE) **is an essential focus area for DESG for many reasons. Our state has the lowest mean elevation in the country, so intensifying coastal storms and sea level rise are important hazards we must address. And many of the economic drivers of our communities have shifted over the years, whether away from agriculture or manufacturing or responding to changing natural resources. DESG helps our towns and communities look to the future and prepare for the lives they want to have.**

Focused on the Coast

Mayors, town planners and members of communities along the Delaware coast discussed offshore wind energy development at two Focus on the Coast workshops organized by DESG & UD's Center for Carbon-Free Power Integration (CCPI). DESG's Environmental Social Scientist Jamē McCray and CCPI's Bonnie Ram organized conversations on topics including the cost of electricity, the effects wind turbines have on birds and marine mammals, offshore wind developers in Delaware and Maryland and the perceptions of offshore wind.

▲ *UD's Bonnie Ram opened the "Focus on the Coast" sessions with an overview of offshore wind in the region, providing some common background for participants as they began their discussions.*

Sustainable Fisheries

▲ *Dan Casey shows Gov. John Carney (left) some of the immature oysters he and his father, Mark Casey (right), are growing as Delaware Cultured Seafood, one of several new businesses launched to participate in the new oyster aquaculture industry in the Inland Bays.*

First Inland Bays Oysters Available in 2018 After Years of Work

Delaware gastronomes and environmentalists alike had something to cheer in 2018 when aquaculture oysters were harvested from Rehoboth Bay for the first time in more than 30 years. From helping create the laws and regulations allowing shellfish aquaculture in Delaware's Inland Bays to helping growers raise and market their products, DESG has been integral throughout the process of bringing oysters, and eventually clams, back into commercial production.

Shellfish aquaculture meets DESG's dual focus on improving the coastal economy and the environment on which it depends. The Inland Bays have struggled for years with excess nutrients, largely from agricultural runoff, which contribute to algal blooms detrimental to water quality and other life in the bays. Oysters are filter feeders and can help by consuming algae and other nutrients, leading to cleaner and healthier waters.

At the same time, oysters are a popular and nutritious food that connoisseurs find have unique flavors based on the place where they are grown, much like the impact of soil and climate on coffee beans or the grapes that become wine. Aquaculture oysters represent a large industry in other East Coast states, worth $120 million along the Atlantic in 2016.

DESG was established in 1968 for oyster research and an aquaculture specialist has been a key member of the MAS extension team ever since. The role has evolved since that time, from providing technical support and even oyster spat in early years to facilitating the development of a robust and supportive shellfish aquaculture industry currently.

In the past five years, other aspects of DESG got involved as well. The community development specialist in MAS worked with a U.S. Department of Agriculture Rural Business Enterprise grant and a National Sea Grant College Program aquaculture grant to develop a brand all growers could use to promote their products: Inland Bays Oysters—A Southern Delaware Delicacy.

That work then informed research funded by DESG in its 2014–2016 cycle, when UD's Kent Messer, a professor of experimental economics in the College of Agriculture and Natural Resources, studied how consumers valued local oysters and the best ways to market them. Results from that research showed buyers would pay a premium for local oysters.

Now that the first oysters have been harvested, growers, restaurateurs and aficionados have found the oysters and the market for them are living up to the research.

"The branding work that was done before I became an oyster farmer, and the outreach to area businesses (before oysters were even available) was tremendous," said Chris Redefer, owner of Dewey Beach Selects, which brought the first Inland Bays Oysters to market in Fall 2018. "This work allowed me to walk into local businesses and have recognition from the start. It had also generated excitement."

Additional oyster growers in Rehoboth and Indian River Bays are bringing more oysters to market. Not all acreage available in the Inland Bays for shellfish aquaculture has been leased, and clam aquaculture in Little Assawoman Bay is developing a little more slowly than the oyster efforts. All of which means we can expect the Inland Bays shellfish market to continue to grow, benefiting water quality and increasing economic activity in Sussex County and beyond.

Don't Chuck Your Shucks

DESG partner the Delaware Center for the Inland Bays runs a shell recycling program to build new living shorelines and help oyster gardeners.

Sustainable Fisheries and Aquaculture (SFA) **is perhaps the clearest example of Sea Grant's dual focus to protect our coastal communities' interdependent economies and ecosystems. In Delaware, the emphasis has been on shellfish aquaculture for many years, efforts that have begun to pay dividends as shown in the story on the facing page. But in 2018 the program began to diversify its efforts to address other fisheries and their stakeholders.**

Helping Local Fisheries and Aquaculture Communities

Every other month, members of the Delaware aquaculture community gather at UD's Lewes campus for an aquaculture forum hosted by DESG.

Led by MAS Fisheries and Aquaculture Specialist Ed Hale and DSU Professor and Aquaculture Specialist Dennis McIntosh, the forums serve as a vehicle for information exchange, with presentations from local experts, as well as networking opportunities between growers and industry representatives. Presentation topics in 2018 ranged from the benefits of forming a cooperative to small business plan development and ways to properly market aquaculture products.

Hale also organized four fishery forums with DSU Professor Dewayne Fox and DNREC Fisheries Administrator John Clark that aimed to foster industry dialogue. The goal of these forums is to help the fisheries and aquaculture communities at-large develop environmentally sustainable practices while simultaneously enhancing economic opportunities.

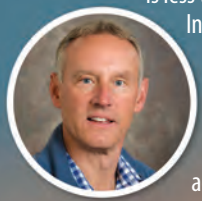
Tyler Mitchell

Out & About Oyster Stout

Delaware Sea Grant partnered with Wilmington's Out & About Magazine on its launch of a collaborative brew for Wilmington Beer Week celebrating the publication's 30th year. The magazine and brewers chose an oyster stout to highlight the importance of this fishery to our state and efforts like those at DESG to help rebuild the economy surrounding the food. Fisheries, Aquaculture and Seafood specialist Ed Hale spoke at the opening night for the celebration, and DESG provided information about oysters and their return to the Inland Bays for the magazine to use in articles and table tents at events.

Conservation and Recovery of Atlantic Sturgeons in the Delaware River Estuary

At the start of the 20th century, the Delaware River supported the world's largest caviar fishery thanks to Atlantic Sturgeon, which numbered approximately 360,000. Today, the remnant population is less than 0.5% of the estimated original stock. In 2012, the species was listed as endangered.



In research funded by DESG, John Madsen *(left)* and Dewayne Fox *(below)*, from UD and DSU, are examining habitat characteristics, food sources and sturgeon distribution to determine why adult and large sub-adults congregate in the lower portion of the estuary. The goal is to provide a more detailed picture of sturgeon habitat use in Delaware waters to enable sound, science-based decisions concerning the designation of critical habitat for this endangered species.

STURGEONS ARE A PROTECTED SPECIES

If you accidentally hook a sturgeon...

- **Keep fish in the water and remove hooks or cut line.**
- **If you need to remove fish from the water, use wet hands or a wet rag and support the belly.**
- **Always support fish in the water until it is able to swim away.**

ATLANTIC STURGEON *(Acipenser oxyrhynchus)*

SHORTNOSE STURGEON
(Acipenser brevirostrum)

Follow all state fishing regulations!

Environmental Workforce

◀ *Chris Grasso (left) spent his summer internship collecting water samples from several DE sites like Lums Pond State Park where paddle boarding has become a popular sport.*

Delaware Sea Grant Arranges Internships to Enhance Student Success and Serve the Community

DESG arranged summer internships for Chris Grasso and Emily Ruhl, graduate students in UD's CEOE, who gained hands-on learning opportunities that helped prepare them as they made the transition from graduate work to future careers.

Grasso spent the summer traveling throughout Delaware collecting samples from various bodies of water as part of his internship, overseen by MAS specialist Ed Whereat, program coordinator for UD's Coastal Monitoring Program.

Grasso, who completed his master's in marine biosciences, looked at samples of freshwater lakes and ponds for cyanobacteria, a type of bacteria that get their energy through photosynthesis like many other algae and land plants.

Grasso said it's important to develop accurate, quick and simple protocols for state agencies to implement in order to identify any potential dangers associated with cyanobacteria in Delaware's freshwater ponds and lakes.

"Cyanobacteria are a completely normal part of most freshwater ecosystems, but can start to cause problems when they grow in large quantities," Grasso said. "Blooms have become more common in recent years, and my research will hopefully provide a strong base for monitoring efforts in the future."

Grasso was thankful for the opportunity to work with cyanobacteria, as he had conducted his master's work with Kathy Coyne, DESG Director, on a class of algae called "dinoflagellates" and natural methods for preventing and controlling them in the Delaware Inland Bays system.

"The skills I learned and developed in the lab this summer strengthened my base of microbiology knowledge, and I'm appreciative to both Dr. Ed Whereat and DESG for the opportunity," said Grasso.

Ruhl worked with the Delaware Center for the Inland Bays (CIB), helping with outreach and educational programming, specifically a new program where CIB partnered with Sun Otter Tours to help "citizen scientists" learn about and be involved with programs such as oyster gardening, horseshoe crab counting and fish surveys.

Ruhl also helped CIB develop a pamphlet for stakeholders and policy makers explaining the benefits of living shorelines, a method of shoreline protection or restoration that is built using natural materials and native plants to mimic natural coastal habitats instead of hard structures like bulkheads or seawalls.

In addition to the summer internship, Ruhl has been involved in many outreach projects while at UD.

"I've worked with Chris Petrone (MAS director) a lot throughout my time here, volunteering at science fairs or doing outreach talking about my research," Ruhl said.

Communicating science to the public is important to Ruhl in order to spread environmental awareness. She said it was eye opening to see the inner workings of an environmentally focused nonprofit, which is something she is interested in getting involved with in her career.

"There's really not a lot of people that work at CIB, and it's amazing how much they're able to accomplish. They do a good job of getting the community involved in restoration and in trying to clean up the bays," Ruhl said.

◀ *Emily Ruhl (left) spent her summer internship at CIB helping with outreach programs explaining the benefits of living shorelines.*

LITERACY & DEVELOPMENT

Environmental Literacy and Workforce Development (ELWD) means outreach to all interested members of the community and students from preschool through graduate school. DESG views ELWD as an essential focus area closely integrated with all the others, educating the public and preparing the next generation of scientists, community planners and policy makers.

Chesapeake Bay Bowl

DESG hosted the regional competition for the National Ocean Sciences Bowl for the third time in 2018, providing a venue for high school students to test their knowledge of ocean and aquatic environments in biology, chemistry, policy and more. The event is designed to engage students interested in careers in the marine sciences and to encourage science and ocean literacy in general. Twelve teams from four states competed, and the winner, Montgomery Blair High School Team A from Maryland, ended up winning the national competition in April in Boulder, Co.

▲ *During a 3-day MADE CLEAR professional development workshop, Petrone taught K–12 educators from Delaware and Maryland how to bring climate change and Earth systems into their classrooms.*

Communication Awards

DESG's communication team took home awards in three categories of the 2018 Communications Contest of the National Federation of Press Women (NFPW). The team earned first place for two efforts for Coast Day 2017, the event poster, designed by Art Director Tammy Beeson, and the collection of highlighted exhibits, which won for best community outreach campaign and featured ways DESG staff and CEOE researchers answer scientific questions and educate the public.

Karen Roberts, who was DESG's science writer in 2017, won second place in the NFPW category for specialty articles in science and technology.

Education Awards

MAS Director Chris Petrone received the 2018 President's Award and the Informal Educators Award from the Mid-Atlantic Marine Education Association (MAMEA) for his service to the organization and for his role in educating the public on ocean and coastal science.

Before becoming MAS director in 2018, Petrone served as DESG education specialist for seven years, creating and running programs in marine science and wind energy for schools, scout troops, 4-H groups and others. He led teacher workshops and reached many in the public as a driving force and on-camera presenter for 15 Second Science videos.

Petrone has a long history of service to MAMEA since 2005, when he was the education specialist at Virginia Sea Grant.

RESPOND BY
Dec. 31, 2019

Your chance to win a Coastal Prize Package
Fill out and mail your survey today!

2019 Readership Survey

Complete the brief survey on the reverse side of this card and mail to be entered to win the coastal prize package valued at over $200.
Or you can enter online at **www.deseagrant.org/survey**.

PLACE STAMP HERE

DELAWARE SEA GRANT COLLEGE PROGRAM
REPORTER

University of Delaware
Environmental Public Education Office
222 South Chapel Street, Suite 102
Newark, DE 19716-3530

1. Do you use Delaware's bays, beaches or coastal areas for recreation or pleasure? ☐ Yes ☐ No

2. When compared to 10 years ago, do you think the health of our coastal and marine resources are:
☐ Much better ☐ Somewhat better ☐ About the same ☐ Somewhat worse ☐ Much worse ☐ Don't know

3. Which broad issues affecting Delaware's coast are most important to you? *(Check your top three choices.)*
☐ Safe and sustainable seafood supplies
☐ Vibrant and economically sustainable coastal communities
☐ Communities resilient to coastal storms and hazards
☐ Healthy coastal ecosystems
☐ Climate change and/or sea level rise
☐ Environmental literacy for all age groups

4. If Delaware Sea Grant could help to solve one major coastal problem in Delaware, what should it be?

_____

_____

5. After reading this issue of *Reporter,* which actions, if any, do you plan to take within the next six months? *(Check all that apply.)*
☐ Read more about environmental issues
☐ Attend an environmental event
☐ Take part in a Sea Grant workshop, lecture or seminar
☐ Visit **www.deseagrant.org**
☐ Visit DESG on YouTube, Facebook, Instagram or Twitter
☐ Other *(Please specify):* _____

_____

6. How would you rate the overall quality of this report?
☐ Excellent ☐ Very Good ☐ Average ☐ Good ☐ Poor

Comments or suggestions:

_____

7. How would you prefer to receive future issues of this report?
☐ Print ☐ Printable PDF ☐ Website ☐ Online video digest

8. What is your age? ☐ Under 20 ☐ 20–29 ☐ 30–39 ☐ 40–49 ☐ 50–59 ☐ 60–69 ☐ 70 +

9. Is your occupation directly/indirectly related to Delaware's coastal environment? ☐ Yes ☐ No

10. May we contact you about future Delaware Sea Grant activities?
☐ Yes, by mail ☐ Yes, by email ☐ Yes, by phone ☐ No thanks

11. Other comments or suggestions:

_____

Name _____

Address _____

_____

City _____ State _____ Zip _____

Daytime Telephone _____

☐ I would like to subscribe to Delaware Sea Grant's e-newsletter.

(Provide email address) _____

JOIN US!

SUNDAY, OCT. 6, 2019
11 A.M. TO 5 P.M.

UD HUGH R. SHARP CAMPUS
1044 COLLEGE DRIVE
LEWES, DELAWARE 19958

LEWES, DE
UD Coast Day

WWW.DECOASTDAY.ORG

Sea Grant Delaware

25th Anniversary Coast Day Crab Cake Cook-off Cookbook

In celebration of this local tradition, we published a cookbook featuring the top three recipes from the past 25 years. Start cooking seafood with the WINNING recipe below!

2018 Finalist

Veni Vidi Vici Crab Cakes

Kristie Schley, Severna Park, MD

2 lbs. lump crab meat
3 cloves garlic, peeled, divided
1 tsp. anchovy paste
3¼ c. grated Parmesan cheese, divided
½ c. mayonnaise
½ tsp. Worcestershire sauce
½ tsp. Dijon mustard
1 tbsp. lemon juice, divided
½ tsp. ground pepper, divided
3 tbsp. olive oil, divided
2 c. day old bread, cubed
8 medium eggs
Zest of medium lemon
¼ c. flat leaf parsley, chopped
¼ tsp. salt
6 romaine heart leaves

Mince 1 clove of garlic and place in a small jar. Add in anchovy paste, ¼ c. grated Parmesan, mayonnaise, Worcestershire sauce, mustard, ½ tbsp. lemon juice, and ¼ tsp. pepper. Shake to combine. Refrigerate until ready to use.

Heat 1 tbsp. of oil in a skillet over medium heat. Cut remaining 2 cloves of garlic into quarters and add to hot oil. Cook stirring until garlic is fragrant, about 3 to 4 minutes. Remove cloves from pan. Add bread to pan and cook, turning frequently until lightly brown. Remove bread cubes from oil and cool. When bread cubes are cool, place in a food processor and pulse until they are bread crumb consistency.

Add 2 eggs to a large bowl and beat lightly. Stir in reserved Caesar dressing, bread crumb mixture, lemon zest and parsley. Gently fold in crab meat and chill for a ½ hour. Form into 6 slightly flattened cakes. Heat the remaining oil in a large skillet over medium heat. Add crab cakes and fry until golden brown, about 5 to 7 minutes per side.

For each frico egg, heat a 6-inch nonstick skillet over medium heat. Add ½ c. Parmesan cheese. When cheese bubbles and melts, add egg to center, cover pan and cook egg to soft. Repeat with remaining 5 eggs. Sprinkle each egg with salt and remaining pepper. Arrange romaine leaves on a large platter. Place crab cakes on leaves and top each with a frico egg. Squeeze remaining lemon juice over each serving.

To order contact the UD Environmental Public Education Office at 302-831-8083 or marinecom@udel.edu

Proceeds benefit Delaware Sea Grant.

DELAWARE SEA GRANT COLLEGE PROGRAM
REPORTER
UNIVERSITY OF DELAWARE
NEWARK, DELAWARE 19716-3530

About Delaware Sea Grant

The Delaware Sea Grant College Program helps people wisely use, manage and conserve our state's valuable marine and coastal resources. We do this through an integrated program of research, education and outreach built upon active partnerships with state and federal agencies, local businesses, nonprofit organizations and community members.

Sea Grant Delaware

Delaware Sea Grant is one of 33 Sea Grant programs nationwide, in every coastal and Great Lakes state, as well as Guam and Puerto Rico. The National Sea Grant Program was created by Congress in 1966 and is part of the National Oceanic and Atmospheric Administration.

Whether educators, communicators or extension agents, Delaware Sea Grant staff and the researchers supported by the program conduct their work on local issues within the four focus areas of the National Sea Grant College Program:

Healthy Coastal Ecosystems

Protecting and restoring Delaware s environment and the valuable natural resources it provides

Sustainable Fisheries and Aquaculture

Advancing sustainable commercial fishing in Delaware s waters and fostering local aquaculture

Resilient Communities and Economies

Helping Delaware communities prepare for a changing environment and economy

Environmental Literacy and Workforce Development

Training and supporting the next generation of environmental and scientific leaders

UNIVERSITY OF DELAWARE
EARTH, OCEAN & ENVIRONMENT

NOAA

***www.deseagrant.org* | 302-831-8083**