

PUTTING
SCIENCE
to work!

Director's Letter

As a faculty member in the College of Earth, Ocean, and Environment (CEOE) for more than two decades, I have a somewhat different perspective on the Delaware Sea Grant Program (DESG) than its director, who traditionally wrote this letter to open the annual report.

As a researcher, I first knew DESG for its support of projects that produce useful knowledge with direct impacts on coastal communities. Sea Grant's approach to funding research is invaluable because of the way it insists on and evaluates real-world impacts. Rather than DESG deciding what Delaware communities could use, people from industry, non-profit organizations, and state and local government review proposed research projects to determine if they could provide helpful results. This report features several pages of information on the projects funded last year.

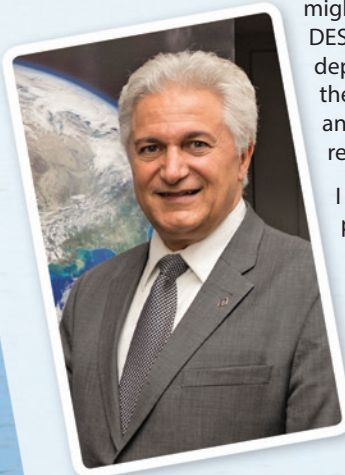
But in taking on the dean's role and its oversight responsibility for DESG two years ago, I have learned how much Sea Grant's work extends beyond its vital role in funding research. DESG uses outreach, education and extension services to facilitate impact in the community, putting science to work.

Because of years of research, DESG is able to help by sharing expertise and even directly implementing projects that benefit communities throughout our state, in one of the four focus areas of the National Sea Grant College Program: Resilient Communities and Economies, Healthy Coastal Ecosystems, Safe and Sustainable Seafood Supply and Environmental Literacy and Workforce Development. You can learn more about each focus area in the pages that follow.

The photograph on this year's cover is a perfect example of putting science to work for resilient communities and economies. For several years, DESG Coastal Communities Development Specialist and Acting Marine Advisory Service Director Ed Lewandowski has been working closely with the town of Laurel in western Sussex County to help it rejuvenate its economy. A story detailing much, though not all, of that work in 2016 can be found on page 7. The cover photo illustrates one of the most direct connections between research and impact.

Although part of the plan for Laurel was to encourage recreational use of Broad Creek, which runs through town, many residents and others were concerned there might be hazardous debris on the creek bottom. DESG arranged for a CEOE graduate student to deploy an autonomous kayak system that mapped the creek bed with sonar, showing it was clear and making possible a tangible step in Laurel's redevelopment.

I hope you enjoy learning more about that project and others in this year's *Reporter*. Thank you for your continued interest in Delaware's coast and Delaware Sea Grant.



Mohsen Badiey

Mohsen Badiey
Acting Dean, College of Earth, Ocean, and Environment

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Delaware Sea Grant 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 business 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.

Jennifer Adkins
Partnership for the
Delaware Estuary

Gene R. Bailey
Diamond State Port
Corporation

Bill Baker
Bill's Sport Shop

Chris Bason
Delaware Center
for the Inland Bays

Ruth Briggs-King
Delaware General Assembly

Kimberly Cole
Delaware Coastal Programs
DNREC*

Sarah Cooksey
The Nature Conservancy
Delaware

Gerard Esposito
Delaware Sea Grant
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Tidewater Utilities, Inc.

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Delaware River Basin
Commission

Brenna Goggin
Delaware Nature Society, Inc.

Kate Hackett
Delaware Wild Lands, Inc.

Simeon Hahn
National Oceanic and
Atmospheric Administration
(NOAA)

Jeanie Harper
Seafood Retailer (retired)

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Office of the Delaware
State Climatologist,
University of Delaware

Sharon Lynn
City of Rehoboth Beach

Dyremple Marsh
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Delaware General Assembly

Tonyea Mead
Delaware Department
of Education

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Authority (retired)

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Management Council

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& Visitors Bureau

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Sample, Inc.

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DNREC*

John Schneider
DNREC*

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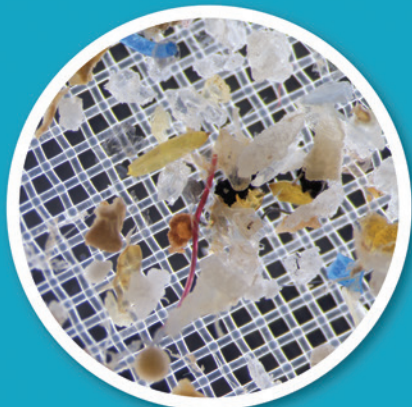
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* Delaware Department of Natural Resources and Environmental Control

DESG Marine Education Specialist Christopher Petrone and public school teachers spend time beachcombing the Delaware Bay near Bowers Beach.



Featured Project 2016



Microplastics collected from the Delaware Bay.

Delaware Sea Grant funds microplastics research

Microplastics—small pieces of plastic less than five millimeters long—are an emerging marine pollution issue with implications for the health of the ocean and aquatic species.

Through funding from Delaware Sea Grant (DESG), University of Delaware master's student Julie Steinberg has been working with DESG-funded scientist Jonathan Cohen to understand the distribution and concentration of microplastics in the Delaware Bay.

The researchers collected water samples from August to December 2016 at five pre-selected stations along the Delaware Bay off Cherry Island Landfill in Wilmington, Delaware; Bombay Hook, Bowers Beach and Broadkill Beach in central and southern Delaware; and in Cape May, New Jersey.

Steinberg used a density separator to extract the microplastics from the water samples, then analyzed the materials under a microscope.

"As you work, you remove a lot of different fibers and tiny plastics; most are invisible to the naked eye," she said.



Julie Steinberg / Jonathan Cohen

PUTTING SCIENCE TO WORK!

Early results indicate a higher concentration of microplastics in industrial areas near the bay, the majority of which were filaments. The scientists found higher concentrations of smaller microplastics (0.3–1 mm) at Cherry Island and Bombay Hook, but found that microplastics at Cherry Island were three times more likely to be 1–5 mm in size versus the smaller 0.3–1 mm size.

Study results will inform project partners at the Delaware Department of Natural Resources and Environmental Control (DNREC) who are developing a strategy to investigate the extent and implications of microplastics in the Delaware Bay, as well as state water quality regulators concerned about the potential impact for fisheries, including oysters.

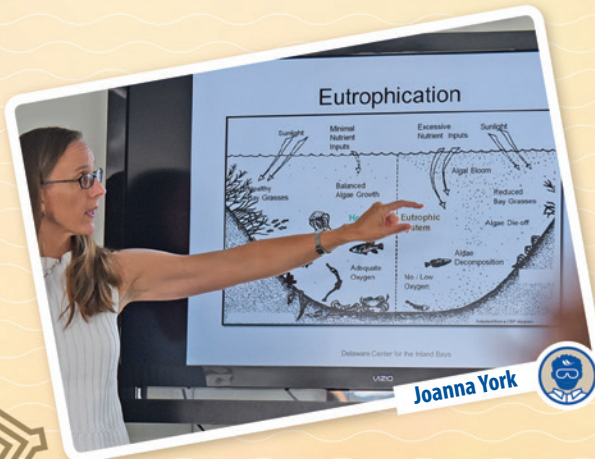
Marine organisms like fish that rely on zooplankton as a nutrient can mistake marine plastics for food. Zooplankton also can ingest microplastics, raising important questions about biomagnification, the idea that microplastics can work their way up the food chain when zooplankton ingest microplastics, fish feed on zooplankton and humans consume fish.

"The impacts on human health are not fully studied or known," Steinberg said.

There are environmental consequences too. Animals can ingest or become entangled in larger scale macroplastics. Plastic particles that are not ingested can degrade as they weather, potentially releasing toxic chemicals into the marine environment. They also can concentrate contaminants, such as organic pollutants and metals and serve as vectors for these contaminants throughout the food web.

Of particular concern are microbeads, minuscule particles from 5 micrometers (less than the width of a human hair) to 1 millimeter in size. This summer, the scientists will conduct a bay-wide survey and create a standard protocol for the sampling and identification of microplastics (50 μm –5 mm) in water and beach sediments.

Steinberg specifically is interested in understanding the role of policy in marine debris management in places where waterways are a shared resource between states. The Delaware Estuary is a prime example, shared between Delaware, Pennsylvania and New Jersey.



Joanna York



Investigating the role of groundwater-borne nutrients in structuring the phytoplankton community of the Inland Bays

Researchers designed a novel seepage meter, a device that has typically been used to measure the amount of groundwater seeping out of the ground to determine the amount of groundwater entering Delaware estuaries. They measured the quantities and types of nitrogen and phosphorus and resulting impacts on the phytoplankton community. They found that nutrient pollution enters the Inland Bays in different forms and concentrations, depending on the amount of oxygen in the groundwater. Microbial communities may interact with the nutrients as they are traveling through the landscape to the estuary and result in changing the forms of nutrients available. This research demonstrated that phytoplankton, including harmful algal blooms, were more plentiful in shallow brackish water with higher nitrate levels.



George Parsons



Managing for biodiversity and blue carbon in the face of sea level rise and barrier-island migration

Researchers are developing a model of optimal marsh restoration in a barrier system. The morphodynamic model describing barrier, lagoon and marsh dynamics will be coupled with an economic model that values the net present value of the blue carbon stock in marshes and considers marsh restoration costs. The model will be optimized with respect to the rate of marsh restoration (preventing marsh erosion). Yue Tan, a Sea Grant-funded student, will provide research assistance in developing the optimization program. In addition, researchers are developing a model to determine the best distance from shore for housing developments to avoid future sea level rise and housing relocation costs associated with a changing shoreline. Work will continue through January 2018.

Development of a high water mark database system for coastal flooding events in Delaware Researchers with the Delaware Geological Survey and the Delaware Environmental Observing System created a database of more than 1,700 water level observations, representing nearly 120 coastal flooding events from 1960 through the present. This database can show maximum flood depth at numerous locations throughout Delaware's coast, providing researchers, managers, emergency responders and decision-makers with a way to compare the impacts and severity among past storms and to better understand the vulnerability of each community. Analyses of peak storm tides over time show the impacts of coastal management practices, modifications of the built environment, sea level rise and changing meteorological patterns in coastal flooding.

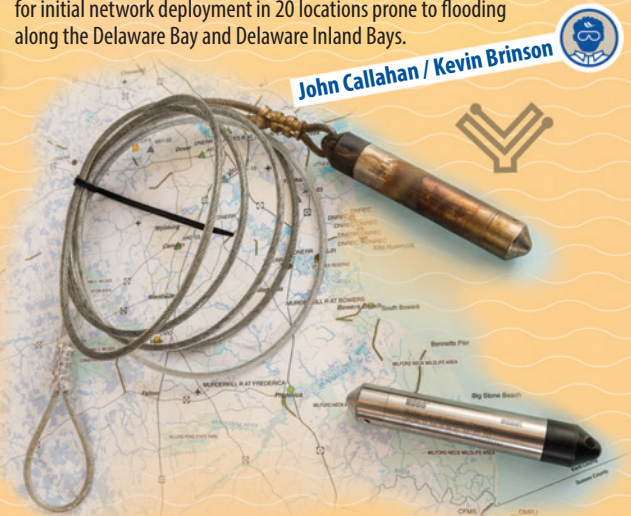


John Callahan / Kevin Brinson



Dynamic, low-cost, high water mark monitoring network installed

In conducting their research to create the high water mark database, investigators determined there are many places prone to flooding in Delaware that are not currently monitored. In consultation with agency partners, researchers determined that using commercially available technology would be cost effective and technically more feasible than custom-built sensors. Sensor packages were acquired, each with a pressure sensor, data logger, communications and other necessary components housed in a compact, waterproof container. Poorly monitored coastal communities were identified for initial network deployment in 20 locations prone to flooding along the Delaware Bay and Delaware Inland Bays.



John Callahan / Kevin Brinson



Healthy Coastal Ecosystems



Citizen science volunteers with Governor Jack Markell and DNREC Secretary David Small, accepting the Volunteer Research Group of the Year Award on behalf of UD's Citizen Monitoring Program.

To better understand sediment movement in tidal wetlands, a significant ecosystem in the Delaware Estuary, researchers used

30 +
tide gauge
sensors



computers

for data logging that continued around-the-clock for three weeks

Water quality monitoring program cited as DNREC Volunteer Research Group of Year

The University of Delaware's Citizen Monitoring Program was named the Volunteer Research Group of the Year in 2016 by the Delaware Department of Natural Resources and Environmental Control (DNREC), which noted that "Program volunteers also serve as the eyes and ears of DNREC and report potential environmental violations, discolored water, fish kills and nuisance algae accumulations..."

The Citizen Monitoring Program is a cooperative effort between Delaware Sea Grant (DESG) and DNREC dedicated to monitoring the Inland Bays and the Broadkill watershed for signs of pollution. UD research scientist Tye Pettay, whose studies of harmful algae are funded in part by DESG, noted that the program is vital for research as well.

"My research heavily depends on the Sea Grant-managed citizen monitoring program, which uniquely uses citizen volunteer scientists to monitor water quality throughout southern Delaware," Pettay said.

"Citizen monitors are often the first observers of harmful algal blooms."

Since 1991, more than 300 citizen volunteers have been trained, including 40 volunteers who monitored water quality at 44 different sites in 2016.

Trained by DESG staff, the program's dedicated volunteers regularly collect water samples throughout two coastal watersheds in southern Delaware to measure a broad range of important water quality characteristics, such as dissolved oxygen, nutrients, turbidity, chlorophyll and bacteria. In addition, the Citizen Monitoring Program has trained other coastal watershed groups to collect, manage and report their own data and to conduct outreach. In the past year, the program has trained and supported the town of South Bethany Water Quality Committee, the Delaware Center for the Inland Bays' "Your Creek" teams, the Inland Bays



40 citizen
water
quality
volunteers

Foundation and a citizen action group "Protecting our Indian River" to develop their own citizen science initiatives.

The data gathered provides scientists and resource managers with a clearer picture of the estuary's health and the trend information needed to understand and manage the ecosystem. The program also increases participation, on the part of the public, and supports the management and protection of the state's waterways as a result.

Citizen scientists provide high quality data and water quality outreach to support and complement local, state and national monitoring programs and goals. One of the Citizen Monitoring Program's top accomplishments has been lab staff providing timely analysis of bacteria and harmful algae to the DNREC Recreational Water Program.

The program also receives support from DNREC, the Delaware Center for the Inland Bays and the U.S. Environmental Protection Agency.



12 DESG research projects funded to support *Healthy Coastal Ecosystems*, and 8 students contributed to those studies

70 volunteer oyster gardening sites supported by DESG produced 24 bushels of fully grown oysters for the Delaware Center for the Inland Bays to transplant along 716 feet of rip-rap to improve water quality



Oysters are filter feeders. Each adult oyster cleans up to **50 gallons** of water per day—consuming algae, removing dirt and nitrogen pollution

DESG's Coastal Monitoring Program analyzed samples from

25 recreational beach sites at least once a week

to demonstrate cleanliness, which is used to promote exceptional water quality at Delaware's beaches



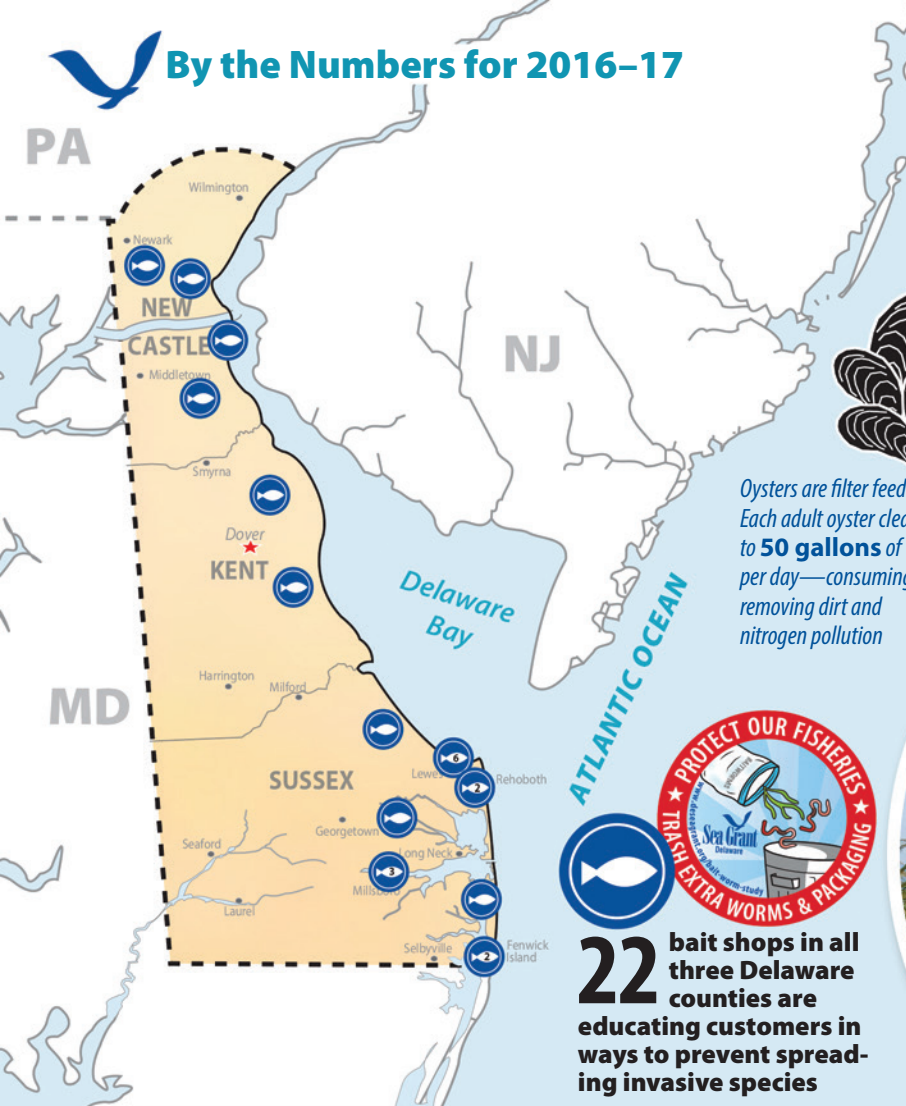
Five UD engineering students worked with DESG and the Sustainable Coastal Communities Initiative, led by Ed Lewandowski, one of DESG's marine advisory specialists, to create a floating wetland, featuring plants that remove excess nutrients. The structure will be deployed in Laurel this year. For more on DESG efforts supporting Laurel, see page 7.

Megalopa or crustacean larvae



22 bait shops in all three Delaware counties are educating customers in ways to prevent spreading invasive species

A UD undergraduate student working with researcher Jon Cohen further refined an automated zooplankton identification tool called ZooScan by adding megalopa from four species to its data set through three weeks of daily sampling from Roosevelt Inlet. The ultimate goal is to improve fisheries management by providing a rapid, semi-autonomous tool for species identification.



At Seaford officials' request, DESG worked with a private engineering firm and Jules Bruck, a UD landscape architecture professor, to develop a new design for the city's Riverview Park. The design features both a children's discovery playground and a living shoreline to help with habitat, resiliency, flood protection and water quality.

Highlights

Resilient Communities and Economies



Reinventing Laurel

Residents and visitors to the western Sussex County town of Laurel last year may have noticed increased use of Broad Creek through the center of town. Kayaking and paddleboarding along the peaceful tributary to the Nanticoke River should feel like a relaxing and natural activity for those enjoying it. But it is also the result of intensive community engagement, planning and support.

In 2016, the first element of the waterfront redevelopment plan produced by Delaware Sea Grant (DESG) became a reality as Nanticoke Rotary Club built a kayak launch, which the plan had identified as a community aspiration, on the north side of Broad Creek. DESG developed an initial stormwater management and landscape plan for the site and helped to organize about two dozen volunteers to plant the area.

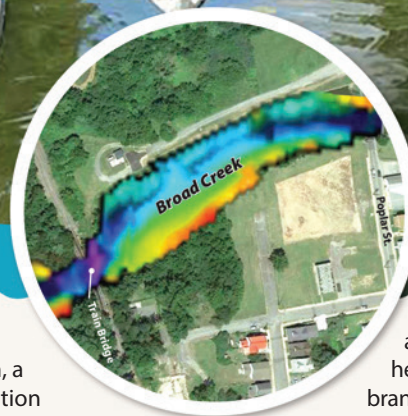
To ensure the safety of recreational kayakers and address town concerns, DESG arranged to have researchers from UD's College of Earth, Ocean, and Environment conduct a scan of the river bottom using a robotic kayak outfitted with sonar, which showed a creek bed free of debris or other dangers.

As hoped, building the kayak launch led to increased nature tourism on the Broad Creek.

Just two weeks after the ribbon-cutting for the launch, a kayak outfitter opened a location in Laurel that provides rentals and guided excursions two days a week. And in the fall, 15 kayakers participated in a Saturday Sojourn highlighting the recreational opportunity on the Broad Creek.

But promoting paddling activities in Laurel is only one small part of a comprehensive revitalization effort the town has undertaken. DESG Marine Advisory Service Acting Director Ed Lewandowski has been a key partner for town leaders and residents as they have moved through the process, from planning to implementation.

In addition to the waterfront redevelopment and the Nature and Heritage Tourism plans that led to the kayak projects, DESG



Bathymetry sonar mapping of the Broad Creek from Poplar Street to the train bridge. The blue areas represent deeper water, while the red areas are shallower. The data was collected by researchers from the Robotic Discovery Laboratories.

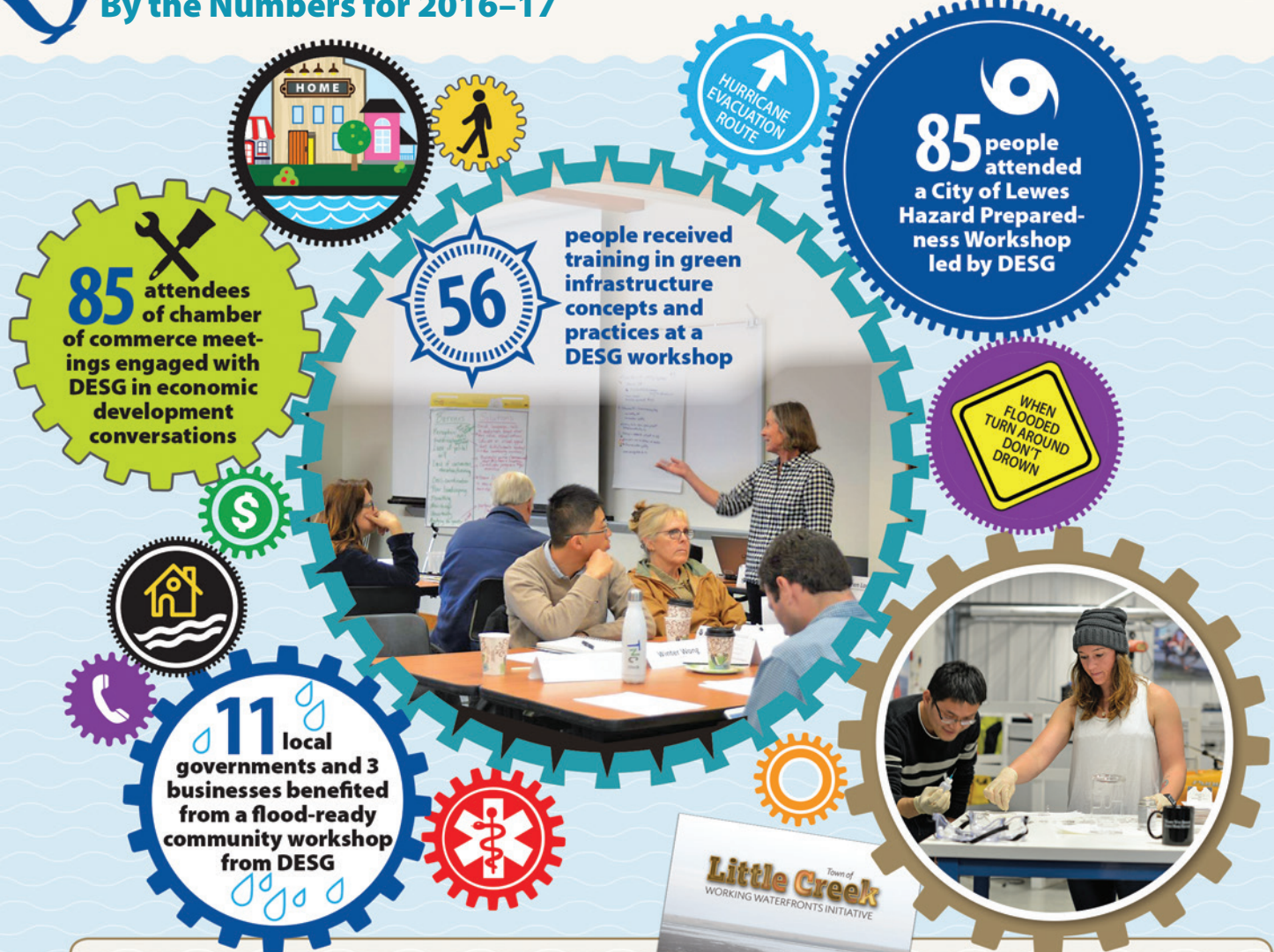
and Lewandowski helped Laurel with project branding that will promote the tourism opportunities the plans identified. A new slogan and logo—Laurel, Delaware: Great Things Come Naturally—was created in March 2016. To promote the town and its brand, 60 participants created a rolling mural by painting one of Laurel's iconic watermelon buses.

DESG and Laurel efforts aren't limited to promoting tourism. Other planning projects include everything from developing guiding principles to update its comprehensive plan, which drives development in the town, to winning designation as one of the state's Downtown Development Districts, which provides incentives for thoughtful and beneficial redevelopment of select towns throughout Delaware.

DESG also worked with the town and partners to develop a Housing Rehabilitation and Home Ownership Plan to address the residential needs of Laurel, as well as its economic development. This past spring, UD students helped to renovate one of several homes in town being fixed up by Sussex County Habitat for Humanity, for which Lewandowski serves as a board member.



Community members participate in painting a watermelon bus.



85 attendees of chamber of commerce meetings engaged with DESG in economic development conversations

56 people received training in green infrastructure concepts and practices at a DESG workshop

85 people attended a City of Lewes Hazard Preparedness Workshop led by DESG

11 local governments and 3 businesses benefited from a flood-ready community workshop from DESG

WHEN FLOODED TURN AROUND DON'T DROWN

Little Creek
Town of
WORKING WATERFRONTS INITIATIVE

Highlights

- In conjunction with the start of the 2016 hurricane season, DESG, the Delaware Small Business and Technology Development Center and partners convened Delaware Business Emergency Preparedness Summits in Sussex and New Castle Counties to help businesses prepare for different types of disasters—everything from hurricanes to cyberattacks.
- DESG and the National Weather Service (NWS) held a collaborative workshop to explore how to use Sea Grant outreach skills and NWS forecasting and other services to help communities, businesses, and governments understand and adapt to climate-related risks, as well as enhance and improve weather decision services for events that threaten lives and livelihoods.

➤ As part of the Working Waterfronts Initiative, DESG Coastal Communities Development Specialist Ed Lewandowski prepared a report for Little Creek, Del., summarizing possible efforts identified by residents and others engaged with the town that could help revitalize its economy.

➤ Stephanie Dohner, a UD doctoral student in oceanography, was selected as a Mid-Atlantic Coastal Storms Program graduate research fellow. She works with DESG to improve post-storm rapid response data collection techniques to help scientists and local communities more accurately predict local flooding and morphology changes during extreme events, improving coastal resiliency and management efforts.

>> Sustainable Fisheries and Aquaculture



Spat (seed oysters) are very small, only about 2–25 mm, but they grow into adult, market-size oysters of 3 inches long.



Spat attach to solid surfaces, as seen on the recycled oyster shells above.



Researcher Gary Richards is using oysters from DESG Aquaculture Specialist John Ewart in his research. Ewart raises the oysters from seed (spat).

USDA lab works for safe oysters with DESG support

For the past 19 years, Delaware Sea Grant (DESG) has been quietly providing support for a unique research enterprise that could benefit anyone who enjoys eating raw oysters, clams or mussels.

The U.S. Department of Agriculture’s Agricultural Research Service (ARS) has a small laboratory on the campus of Delaware State University in Dover. In one wing of a single-story, cinderblock building, Gary Richards and David Kingsley lead ARS’s only lab exclusively dedicated to shellfish safety.

Founded in 1998, their lab, the Microbial Safety of Aquaculture Products Center of Excellence, studies bacteria and viruses in oysters, clams and mussels that can threaten human health. Richards specializes in bacteria in the *Vibrio* genus, one species of which is the leading cause of shellfish-related bacterial illness and another of which is the leading

cause of shellfish-related deaths in the United States. Kingsley’s research focuses on viruses, primarily hepatitis A and norovirus, which causes 5.5 million illnesses a year, more than half of all foodborne illnesses.

Some of their research requires live mollusks, and when they need oysters, they often turn to DESG Aquaculture Specialist John Ewart.



Researcher David Kingsley in ARS lab, which is dedicated to shellfish safety.

“John has been very helpful to us for many years in providing us oysters that he has raised from seed,” Richards said. “It is nice to have a little bit of history on the shellfish.”

As opposed to oysters bought in the marketplace, having oysters for which they know where and in what conditions they were raised gives Richards and Kingsley several important advantages. They can more effectively acclimate the oysters to conditions in the lab and thereby avoid subjecting the

animals to undue stress, which adversely affects not only the oysters’ health, but also the outcomes of the experiments as a result. And knowing things like water temperature, salinity and location also allows the researchers to investigate whether those environmental factors affect oysters’ susceptibility to infection from the viruses and bacteria they study.

The ultimate goals for the ARS lab directly support Sea Grant’s focus on ensuring a safe and sustainable seafood supply. All of the work to understand *Vibrio* bacteria and viruses in shellfish builds to developing effective treatment of oysters and other mollusks after they have been harvested to make them safe to eat. Richards is using the oysters Ewart provided last year for a study of bacteria he has identified that appear to prey on *Vibrio* bacteria. He is testing whether these predatory bacteria can eliminate or reduce the levels of active *Vibrio* when added to tanks of seawater with infected oysters. If so, the process could be applied to fresh oysters before they are sold for consumption.



www.seafoodhealthfacts.org
was viewed by more than

50,000 people

Store raw seafood at
32°F

80+ consumers learned how to buy and prepare safe and sustainable seafood from DESG workshops

4,158 people used the Delaware Aquaculture Resource Center web page <http://darc.cms.udel.edu>



Seafood starts expiring when it leaves the water



300+ seafood and health professionals received DESG education on seafood quality, safety and health issues

Highlights

➤ DESG conducted field research on oyster nitrogen sequestration as part of an “economics of oyster ecosystem services” project funded by NOAA Sea Grant.



➤ A nursery culture protocol was developed to raise 0.5 mm (500 micron) hatchery post-set oysters to a larger size (25–30 mm) suitable for commercial field planting.

➤ DESG continued to assist DNREC with shellfish aquaculture development by serving as a source of technical, fact-based information for coastal residents ranging from prospective oyster farmers to the general public and coastal residents opposed to oyster farms for aesthetic and other reasons.



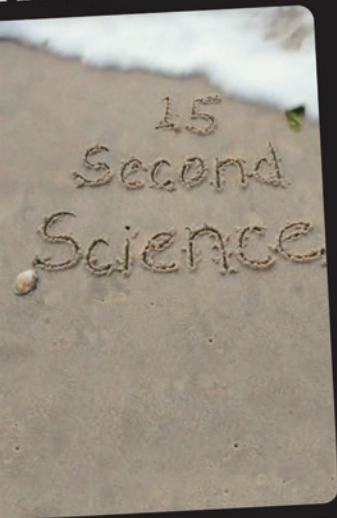
Oysters are ready to be planted when they reach the size of a quarter.

< 24.3mm



Delaware Bay oyster reef

Environmental Literacy and Workforce Development



Multimedia resources explore microbes, deep biosphere

The average human adult contains 10 trillion human cells but has 100 trillion microbes on their skin, hair, and mouth and in their intestines. Microbes protect us from harmful bacteria, help us digest food, even help change our mood.

Microbes are also found in the sediments up to 1.5 miles below the seafloor, invisible to the naked eye and most ordinary microscopes, where they play an important role in the underwater ecosystem.

Delaware Sea Grant (DESG), in partnership with the National Science Foundation-funded Center for Dark Energy Biosphere Investigations (C-DEBI), has expanded its collection of *15 Second Science* videos to include longer *Dive Deeper* videos and virtual reality tours that explore the deep biosphere and sub-seafloor life.

"Exploring the outreach potential of new media such as virtual reality to discuss microbes, dark energy and the disciplines, tools and techniques used to explore this

The VR viewer (below) brings DESG virtual reality tours to life.



extreme environment, is an exciting way to engage audiences," said Chris Petrone, DESG marine education specialist.

Topics covered included where microbes are found, why they are beneficial, how they survive in the extreme conditions on and underneath the ocean floor, and how scientists study the deep biosphere, among others.

New video segments are available monthly on the DESG website. Several of the *15 Second Science* episodes include a *Dive Deeper* segment where viewers can learn more. Many of the *15 Second Science* segments are also available in Spanish.

DESG's virtual reality tours enable viewers to immerse themselves in a laboratory or other environment using an iPad, computer or

smartphone—with or without a VR viewer, such as Google Cardboard. The unique tours received the Delaware Press Association's top award in the 2017 Communications Contest in the audiovisual category.

For teachers, the tools can expand lessons taught in the classroom. For children, it is a virtual field trip, offering a 360-degree tour of a real-life laboratory or other scientific environment and the opportunity to hear a scientist explain their work firsthand.

In 2016, over 200 educators and others on social media learned how to integrate the new media into their programs at conferences and workshops in the U.S. and abroad. A sample of the *15 Second Science* collection was featured during the American Geophysical Union (AGU) fall meeting's "AGU Cinema 2016" program to "showcase the increasingly important role video plays in communicating science and in science education."

DESG staff plan to expand the collection of *Dive Deeper* videos to include a focus on available marine careers. The full collection of *15 Second Science* episodes focused on the deep biosphere and sub-surface life is available at www.deseagrant.org/ProjectVideo.



Highlights

A UD landscape architecture class designed a green infrastructure project for the EPA's Campus Rainworks Challenge, and DESG taught the students public engagement methods to help ensure their design would meet community needs.

➤ DESG created protocols and an application for a new \$500 mini-grant program opportunity for Delaware Association for Environmental Education members to conduct more meaningful environmental education programs in a tough budget climate. A Delaware State Parks "BioBlitz" was the first mini-grant awardee.



➤ In professional development sessions last year DESG offered teachers the opportunity to experience a new learning "game," BreakoutEDU, which provided an opportunity to learn or review content material, while building teamwork, communication and critical thinking skills. DESG also provided information on how to obtain BreakoutEDU kits, funding opportunities, game ideas, templates and how to integrate gaming into existing curricula.

Featured Project 2016

Consumers valued the smell of the oysters the most, followed by saltiness, meat size and meat color.



Locally Harvested Oysters

16%

Consumers are willing to pay more

Oyster marketing: Studying consumers' oyster preferences

As part of an ongoing effort to support the development of a viable commercial aquaculture industry in Delaware, researchers funded by Delaware Sea Grant (DESG) conducted consumer and tourist preference surveys to determine whether consumers were willing to pay more for local versus non-local oysters.

The work is led by University of Delaware Professor Kent Messer, Unidel Howard Cosgrove Chair for the Environment and director of the Center for Experimental and Applied Economics with funding from DESG, the Delaware Economic Development Office, the National Science Foundation and the National Oceanic and Atmospheric Administration.

Understanding consumer preferences for oysters is key to effectively marketing the product in order for the industry to rebound. Oyster production in the Delaware Bay has decreased by about 90 percent, compared to historic population levels due to disease and overfishing. This presents a major environmental problem as high levels of nutrients have adverse effects on water quality, aquatic life and recreational use of water.



Oysters are a food product that also provide ecosystem services. A healthy bay oyster population and robust oyster industry will benefit Delaware's economy and local oyster consumption, while offering important ecological benefits, including habitat creation and water filtration.

In 2016, nearly 750 people participated in research surveys at the Cape May–Lewes Ferry terminal and the Delaware Department of Motor Vehicles. This survey built on previous data gathered over the past three years at other locations throughout Delaware—including UD's Ag Day celebration in Newark, at 16–Mile Brewery in Georgetown and at Famous Joe's Tavern in Wilmington—to gauge consumer preferences for local oysters.

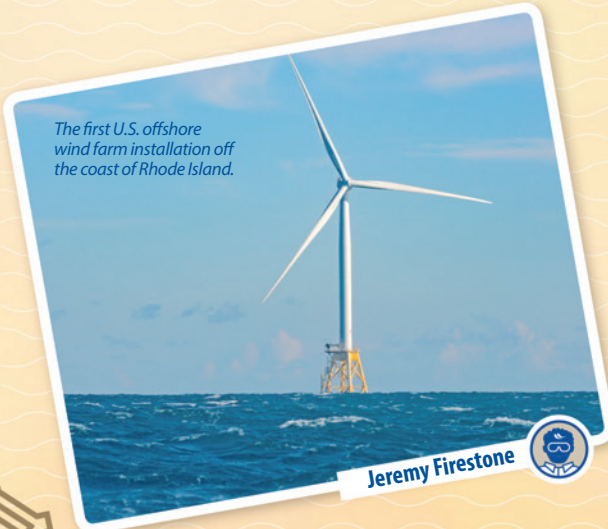
Overall study results showed that 28 percent of locals would pay a higher price for oysters branded with a logo showing they came from the Inland Bays, where DESG efforts have led to the state's first shellfish aquaculture plots, compared to 13 percent of tourists who would pay a higher premium. Additionally, the researchers found that consumers are

willing to pay 16 percent more for oysters that are harvested locally.

"It could be a good chance to not only sell Delaware oysters, but get a higher price for this product because now it's a branded name and it's something that you can't get elsewhere," said Messer. "This has public benefits for getting the oyster industry going, and it could improve water quality in our own state plus create jobs."

Consumers valued the smell of the oysters the most, followed by saltiness, meat size and meat color. Frequent oyster consumers preferred aquaculture oysters, whereas infrequent and first-time consumers preferred wild-caught oysters. In addition, female consumers were found willing to pay 33 percent less per oyster, compared to male consumers, and consumers overall were willing to pay higher prices for oysters that improve local water quality.

Scientists shared these research findings with industry professionals in February 2017 during a DESG-sponsored community workshop.

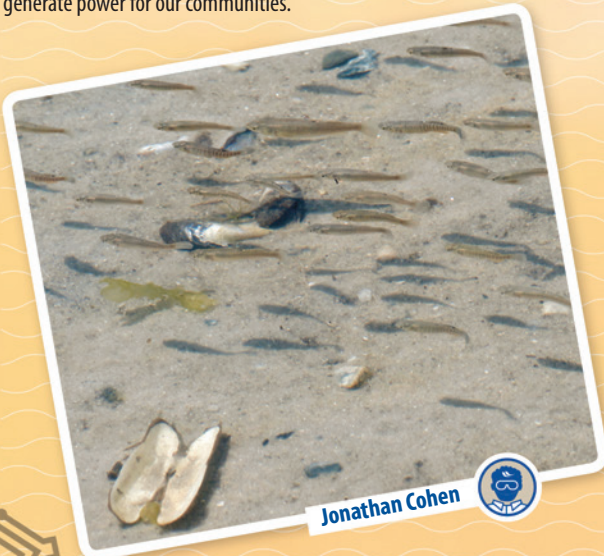


The first U.S. offshore wind farm installation off the coast of Rhode Island.

Jeremy Firestone



Public opinion survey on Delmarva offshore wind power shows strong support Ninety percent (90%) of respondents to a Delaware and Maryland survey overwhelmingly support or are increasingly supportive of offshore wind power development near Fenwick Island, Delaware and Ocean City, Maryland. A recent survey by Delaware Sea Grant researchers asked 981 residents if they would support building a 300-megawatt project approximately 11 miles offshore in the federally designated Maryland Wind Energy Area. The results indicate a high level of support for development of the wind resource to generate power for our communities.



Jonathan Cohen



New data on Delaware Bay's food web Researchers completed a study of zooplankton across Delaware Bay to identify which of the tiny creatures occur where and when, and then compared it to studies completed in the 1950s. Zooplankton consume algae and phytoplankton and serve as an important food source for animals higher in the food web, such as fish and shellfish. Seasonal shifts in the most prevalent zooplankton were observed, and spring abundances in the upper Delaware Bay were higher than in the 1950s. This may, in part, be due to improvements in water quality in the low salinity portion of the bay. Early life stages of crustaceans and mollusks, many of which have commercial value upon maturing, were most abundant in the summer.

Underwater sounds in Delaware Bay Acoustic monitoring in Delaware Bay provided new data on fish and dolphin activity and led to technology improvements prior to deployment of the tools in Arctic research. Marine animals live in an environment filled with sound, and researchers can listen for their presence or absence using acoustic monitoring. Sea Grant researchers captured patterns of fish behavior, ship traffic and dolphin vocalizations that were previously unrecorded in Delaware Bay. Atlantic croaker (*Micropogonias undulatus*) vocalizations dominated the sound profiles. Bottlenose dolphins (*Tursiops truncatus*) made their presence known through whistles and clicks, and their presence silenced the resident fish until a few hours after the dolphins' departure. Engine noise from both commercial vessels and small boats was present at most times. The tools that were fine-tuned during deployment in Delaware Bay were subsequently used in food web studies completed in the Arctic in 2017.



Bottlenose dolphin (*Tursiops truncatus*)

Mohsen Badiey



White perch in the Delaware Bay estuary: Distinct populations may support more specific consumption guidelines Delaware Sea Grant researchers developed a new tool to distinguish populations of white perch within Delaware Bay and its tributaries. White perch (*Morone americana*) is a commercially and recreationally important fish species that is used to monitor contaminant levels and to set consumption advisories for additional fish species in the state. Researchers demonstrated that white perch in at least some tributaries are reproductively isolated; their populations are separate from what might appear to be the same type of fish in another location. These separate populations are geographically distinct, and therefore are potentially exposed to different levels of contamination. A molecular technique developed by the research team may be used to inform more specific consumption guidelines for white perch and other species—and more effectively protect human health while maximizing the use of the fishery resources of the Delaware Bay.

Patrick Gaffney



White perch (*Morone americana*)





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

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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:



10 Things You Can Do to Help Our Ocean

- 1 Learn all you can about the ocean.
- 2 Be a smart shopper and seafood chef. Ask restaurants and grocery stores about the source of their seafood. Find out how to properly prepare your catch. Visit www.seafoodhealthfacts.org.
- 3 Conserve water. Be careful when taking a bath or shower, washing your car, watering your lawn.
- 4 Limit your use of household pollutants, including herbicides, pesticides, lawn fertilizers and nonbiodegradable cleaning products.
- 5 Reduce waste. Recycle, re-use and compost whenever possible.
- 6 Reduce automobile pollution. Use fuel-efficient vehicles or carpool. Recycle motor oil.
- 7 Protect ocean wildlife. Don't dispose of fishing line, nets, unused bait/packaging or plastic items in or near the water.
- 8 Be considerate of sea life and their habitat. Don't feed sea birds, turtles or marine mammals, or disturb their nursery grounds.
- 9 Get involved. Take part in a beach cleanup or other ocean-oriented activity.
- 10 Care about the ocean!
Pass on your knowledge!

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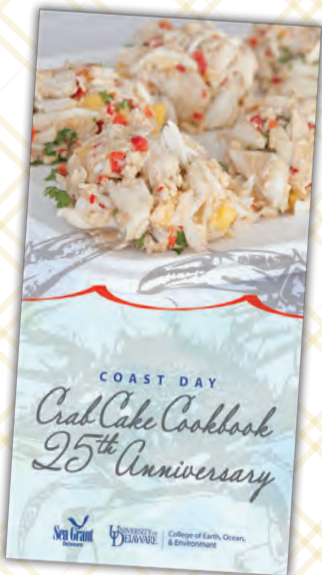


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25th Anniversary Coast Day Crab Cake Cook-off Cookbook

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!



2014 Finalist

Top-Notch Crab Cake

Sarah Titus, Salisbury, MD

2 lb. jumbo lump blue crab meat
2 c. finely ground saltine crackers
2 egg yolks
1 tbsp. Dijon mustard
2 tbsp. salad dressing
1 stick unsalted butter, melted
3 tsp. hot sauce

4 scallions, minced
5 tbsp. chopped cilantro
2–3 tbsp. dry sherry
(more if desired)
2–3 tsp. Old Bay seasoning
Lemon wedges for garnish

Using a rubber spatula, in a large bowl, gently combine crab meat, ½ c. crushed saltine crackers, egg yolks, mustard, salad dressing, 3 tbsp. melted butter, hot sauce, scallions, cilantro, dry sherry and Old Bay seasoning. Gently divide mixture into 10 equal portions and shape into tight, mounded cakes. Press each crab cake in cracker crumbs and transfer to a dish, crumb side down, cover and refrigerate for an hour. Grease a baking sheet with butter and transfer crab cakes to prepared baking sheet, crumb side down. Press thumb on top of each crab cake to make a slight indentation and drizzle with melted butter. Sprinkle a small amount of Old Bay seasoning on top of each crab cake and broil on medium until crab cakes are golden brown, about 12–15 minutes. Garnish with lemon wedges.



To order www.deseagrant.org/crab-cake-cookbook
or contact the UD Environmental Public Education
Office at 302-831-8083 or marinecom@udel.edu

Proceeds benefit Delaware Sea Grant.