

# MOTE

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SPRING 2023

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on dolphin deaths

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## Sarasota Magazine

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**On the cover**

Gretchen Lovewell uses an alternate light source forensics kit to investigate injuries on dolphins.

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*Photo by: Hayley Rutger*



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PHOTO BY KRISTIN PATERAKIS

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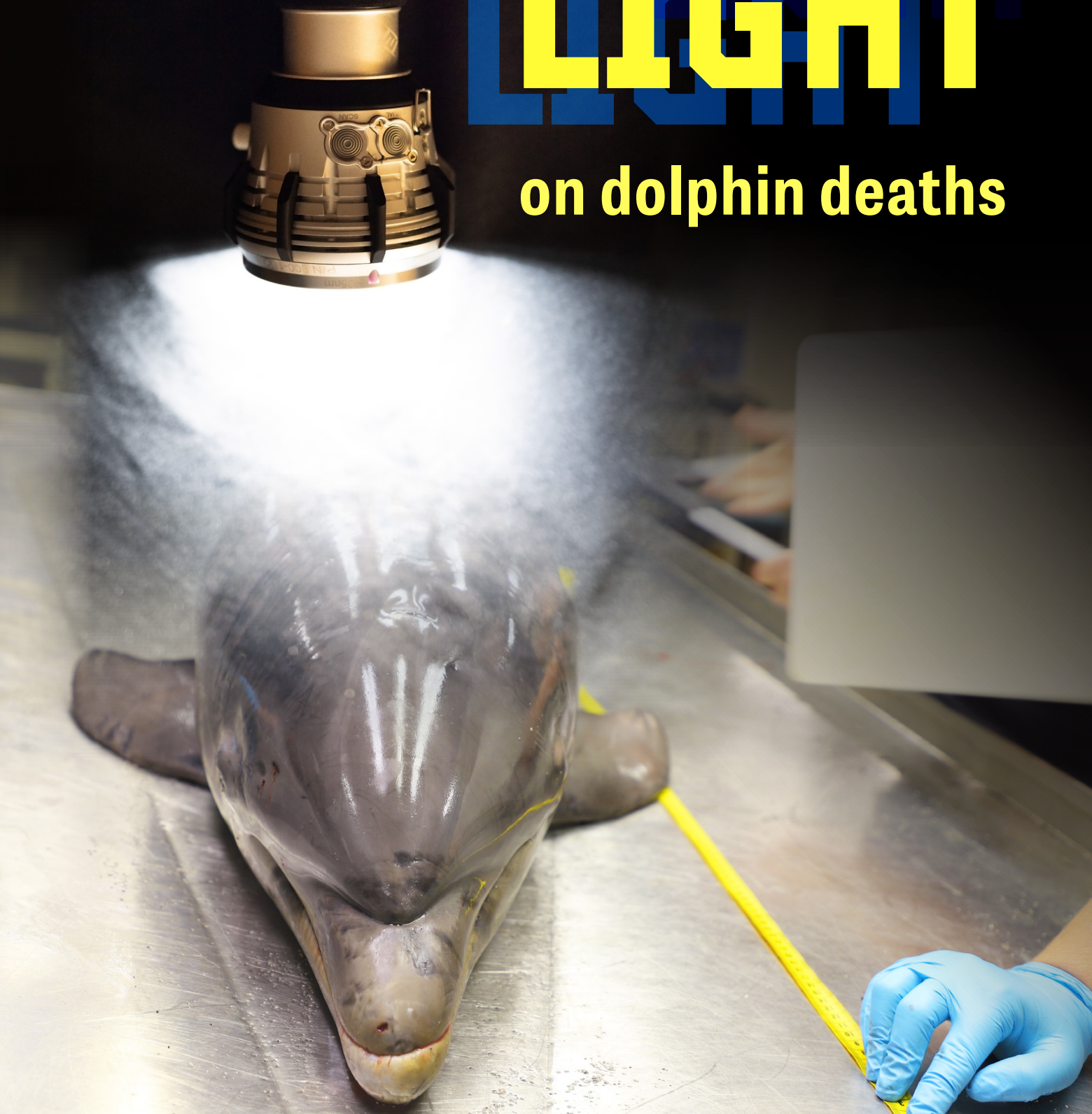
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shining a  
**LIGHT**  
on dolphin deaths





## IT'S ONE OF THE TOUGHEST JOBS

at Mote Marine Laboratory—recovering a dolphin found dead and investigating what happened. The physical and emotional toll is worth it, though: Each animal might offer clues about the dangers marine species face and how to protect them.

Above: Mote's Gretchen Lovewell and Jess Blackburn examine a deceased dolphin

BY HAYLEY RUTGER

Some cases are unsolvable, when a dolphin is found too decomposed, tissue analyses don't point to a cause of death, or the signs of injury are too subtle to interpret. However, some injuries become clearer when viewed in a new light.

Mote scientists and partners are testing alternate light source (ALS) imaging—a forensics technique new to marine animal rescue and recovery but familiar to crime-scene analysts—to better identify injuries on dolphins.

ALS involves shining light of specific wavelengths, which our eyes see as specific colors, onto people, animals or objects, and then viewing the result through colored glasses. When blue light is viewed through orange glasses, purple light through yellow glasses or green light through red glasses, it may become easier to spot certain substances, wounds, or other markings against their backgrounds.

Gretchen Lovewell, Manager of Mote's Stranding Investigations Research Program, held up a photo of a deceased dolphin's fluke (tail) she examined in 2020. "I thought the marks on the fluke were consistent with ones I've seen on animals entangled in fishing gear."

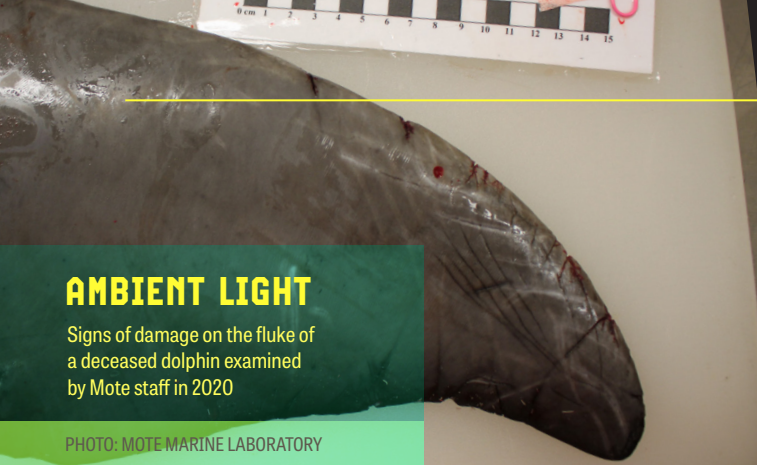
Lovewell suspected the dolphin had been entangled in a gill net. Gill nets have been illegal in Florida waters since 1994. In 2020, she and her team reached out to the Sarasota County Sheriff's Office to see if they could shed any further light on the case, and Sheriff's Office staff invited Mote's team to view the dolphin's fluke with their ALS.

"With the ALS, you see the crisscross mark here, and we knew it was a net mark," Lovewell said. "This convinced us that we wanted our own ALS kit."

"We thought that, if this works on a human it should work on a dolphin," said Adrienne Walls, a crime-scene analyst with the Sarasota County Sheriff's Office. "I told Gretchen, I'll help you maximize contrast (on the fluke image) but you'll have to tell me what you're looking for. When she showed it to me, where it crisscrossed, I totally saw it."

In short, evidence suggested that the dolphin was injured by, and possibly killed by, entanglement in a net in the environment. While this finding doesn't reveal who left the net, it's valuable for research that supports conservation and wildlife protection. Since 2001, there has been a strong upward trend in cetaceans (dolphins and whales) stranding with evidence of human interaction in southwest Florida, and most of those cases were attributed to fishery interactions—meaning ALS could be extremely valuable by detecting skin damage caused by lines and nets.

Lovewell and colleagues at the Florida Fish and Wildlife Conservation Commission (FWC), Sarasota Dolphin Research Program (SDRP)\* and Blue World Research Institute successfully obtained two ALS forensics kits thanks to a competitive grant awarded in 2021 by the National Oceanic and Atmospheric Administration (NOAA) John H. Prescott Marine Mammal Rescue Assistance Grant Program.



**AMBIENT LIGHT**

Signs of damage on the fluke of a deceased dolphin examined by Mote staff in 2020

PHOTO: MOTE MARINE LABORATORY



**ALTERNATE LIGHT SOURCE (ALS)**

Certain markings become more visible, including a crisscross consistent with net entanglement

PHOTO: SARASOTA COUNTY SHERIFF'S OFFICE

In the past year, Mote scientists have worked with FWC and the Sarasota County Sheriff's Office on five dolphin forensics cases.

"It's a lot of trial and error because no one has used this on cetaceans before," Lovewell said. "Sometimes it can give us a better sense of the extent of an injury, for example, helping us to see the extent of fluid under the skin. We also think it might help us identify dolphin freeze brands that have faded over time or are indistinguishable due to decomposition."

A freeze brand is an identifying mark scientists may place on a dolphin's dorsal fin for conservation-focused research. For instance, SDRP scientists use a freeze brand as a "medical ID

bracelet" to clearly identify wild dolphins that were captured and released for health assessments.

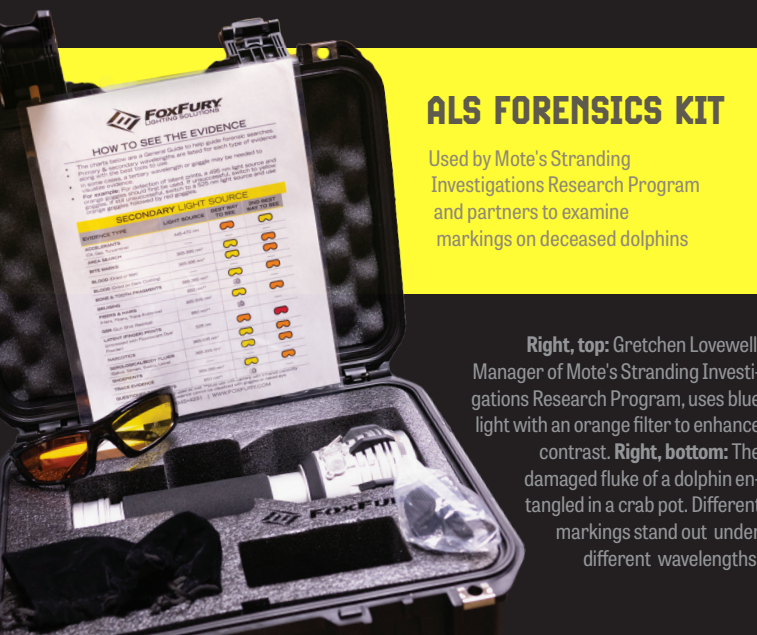
Many new applications of ALS could open up thanks to teamwork and shared knowledge. "The Sheriff's Office has been so accommodating," Lovewell said. "They've been exceedingly welcoming and willing to help."

Walls and her colleagues have a wealth of experience using ALS for cases involving people and certain animals, such as pets and livestock. For example, ALS can help detect natural substances like blood, other bodily fluids or undyed hair against synthetic fabrics, such as carpets and clothing. It can also help identify counterfeit money. Walls is excited to work on wildlife cases and believes there's a connection between how people treat animals and how they treat each other.

"These cases are challenging and make me think outside of the box—I didn't know how dolphin skin would react to the ALS," said Walls. "I also might be able to take things I learned from Mote and apply them to other cases. When Gretchen was explaining the net, I was like, 'I see it.' A weapon can be anything, even a net."

Lovewell and her partners look forward to sharing what they learn with others who, like Mote, are partners in the NOAA-led Marine Mammal Health and Stranding Response Program. "Our partners have already been reaching out to learn more." ■

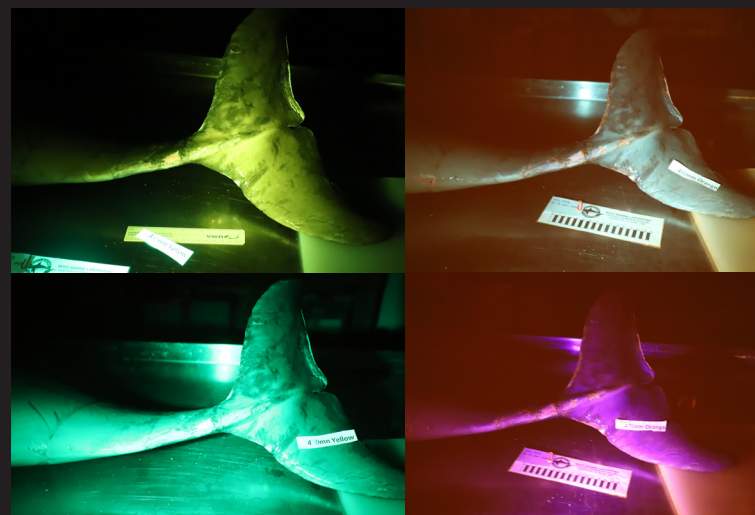
\*SDRP is a Chicago Zoological Society Program in collaboration with Mote.



**ALS FORENSICS KIT**

Used by Mote's Stranding Investigations Research Program and partners to examine markings on deceased dolphins

**Right, top:** Gretchen Lovewell, Manager of Mote's Stranding Investigations Research Program, uses blue light with an orange filter to enhance contrast. **Right, bottom:** The damaged fluke of a dolphin entangled in a crab pot. Different markings stand out under different wavelengths.





# FANTASTICAL DEPTHS

Real stories of deep-diving science and a new exhibit straight from the legendary pages of "20,000 Leagues Under the Sea"

DIVE IN ▶

# A DEEP FASCINATION

Visitors to Mote Aquarium are discovering the deep ocean through the legendary lens of Jules Verne's "20,000 Leagues under the Sea," thanks to the limited-time exhibit "Voyage to the Deep" ([mote.org/voyage](http://mote.org/voyage)). For Mote Marine Laboratory scientists, deep exploration is a never-ending obsession.

BY JAIME FOGEL

**F**rom the mythology of Poseidon and mermaids to the science fiction of Jules Verne, people have long been fascinated with what's below the surface of the ocean. For Mote Marine Laboratory scientists, deep ocean exploration is more than science fiction—it's a vital mission that helps us understand and protect our oceans.

Mote scientists have dived hundreds of feet deep using scuba gear and explored deeper than 10,000 feet by traveling in submersible vehicles or operating them remotely. Their mission: investigate extreme ocean environments and the remarkable living things found there.

Here are their adventures.

## DEEP SEA SHARKS ▶

Mote's founding "Shark Lady," Dr. Eugenie Clark, completed more than 80 submersible vehicle dives in her career, observing marine life such as deep-sea sharks difficult to observe through other methods. During her submersible dives, Clark observed a greater variety of deep sea sharks—including sleeper sharks, gulper sharks, sixgill sharks and ghost catsharks—than would otherwise be possible. In 2018, a new species of deep-sea shark was discovered and named in her honor: *Squalus clarkae*, "Genie's dogfish."



## BLUE HOLES ▶

Mote scientists Jim Culter and Dr. Emily Hall dive deep into mysterious underwater caves, springs and sinkholes called "blue holes." Conditions within a blue hole can differ significantly from the surrounding ocean, particularly temperature, light, oxygen and pH. Blue holes are lower pH (more acidic) than ambient ocean water. Their conditions mimic the pH levels predicted for our oceans in approximately 100 years. The rims of blue holes tend to host diverse wildlife, but diversity decreases as you descend inside the hole. Some blue holes have a hypoxic (oxygen poor) layer where nothing but microscopic life can survive. Blue holes could be important places for discovering microscopic organisms new to science and understanding how they thrive amid low oxygen and other conditions hostile to most living things.

## ◀ HYDROTHERMAL VENTS

Before coming to Mote, staff chemist Jessica Frankle participated in research expeditions using Woods Hole Oceanographic Institution's submersible ROV (remote operated vehicle) "Jason" to study deep sea hydrothermal vents. These geyser-like openings in the sea floor are unique environments for research on different types of rock, chemistry and microscopic life. Scientists hypothesize that hydrothermal structures might occur on the moons Europa (Jupiter) and Enceladus (Saturn), and certain types of hydrothermal structures may even be able to support life on other worlds.



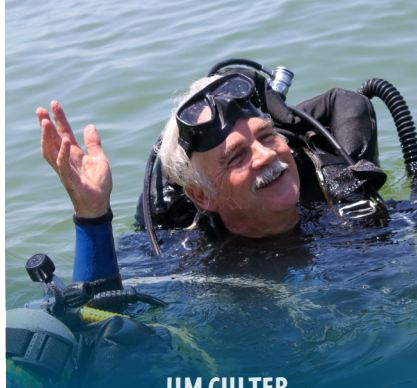
### DR. EMILY HALL

Senior Scientist

**First dive:** A spring in north Florida, while studying as a graduate student at the University of Florida

**Latest dive:** A blue hole—a deep opening in the limestone bottom offshore of Florida—known as “Green Banana”

**Deepest dive so far:** Scuba, 170 feet, to Green Banana



### JIM CULTER

Senior Scientist

**First dive:** Age 15 in a rock quarry in Ohio where the water temperature was 45 degrees!

**Latest dive:** Exploring Captiva Blue Hole off Sanibel Island, Florida

**Deepest dive so far:** Scuba, 365 feet, in a cave off Sarasota



### DR. EUGENIE “GENIE” CLARK (1922–2015)

Mote’s Founding Director

**First dive:** Wearing a dive helmet in the early 1940s in La Jolla, California

**Last dive:** Solomon Islands, 2014 (age 91)

**Deepest dive:** In a submersible to Monterey Canyon, 12,000 feet. Scuba, Papua New Guinea, 267 feet

## BLUE ABYSS

“These blue holes have probably been some of my number one spots to go to,” said Mote Senior Scientist Dr. Emily Hall. “Because of the depth, because of how far [offshore]... there’s a lot that goes into preparing for it. But then you get in the water and it’s all blue around you, and remoras are sticking to you, and other things are checking you out. You dive down and you keep going and you keep going and you keep going and then all of a sudden this hole just opens up, and it’s just so eerie and so otherworldly. It looks like this dark abyss that you’re about to get to, because you can see the bottom of the Gulf around it. You’ve just opened up this whole new world down here at these depths. So every time I get to one of these holes I get super excited. I kind of have to calm down for a sec because I’m here to do work, but I do get that excited feeling every time I see it.”

## BIG FISH TALE

“In one of the blue holes we were diving in, you could look up and we saw circling around this really, really big fish,” said Mote Senior Scientist Jim Culter. “Sat there for a minute and realized it was a whale shark (Earth’s largest species of fish!). We were coming up the line and he came down to observe us. We had 20 minutes or so of staged decompression stops to go through, and he stayed with us and would just swim around us. It was really interesting; he would come in and look you right in the face. Just beyond arm’s reach. I didn’t want to chase him away; I was more interested in just watching. He stayed with us the whole decompression and then cut out when we left. It was pretty neat.”

**Left to right:**  
Whale shark, hooded octopus

## SEA MONSTER

“My deepest dive was 12,000 feet,” said Mote Founding Director Dr. Eugenie Clark. “And when I got down there I knew that there was a beautiful octopus that lived in the deep sea and I hoped that I would see one. And as soon as I looked out my window, I did see this creature. It’s the hooded octopus of the deep sea—that can hardly be considered a monster unless you can also say that monsters are beautiful. They only live below 6,000 feet and are really beautiful monsters.”







**JESSICA FRANKLE**

Staff Chemist

**First dive:** Key Largo, Florida

**Latest dive:** Sarasota, completing rescue diver certification

**Deepest dive so far:** Scuba, 100 feet. Worked with a team piloting the remote operated vehicle (ROV) "Jason" to about 16,000 feet.

**ROCKING THE BOAT**

Aboard the vessel that deployed the deep remote operated vehicle "Jason":  
 "We felt an earthquake on the boat," said Mote Staff Chemist Jessica Frankle. "So if you didn't know that you can feel an earthquake on a boat—you can feel an earthquake on a boat! We thought it was a really weird engine test. Everything was shaking. The very big one, the first one, the ROV didn't capture. But after an earthquake sometimes you can feel aftershocks, and the ROV captured one of those aftershocks. The ROV was filming this hydrothermal vent and it watched all of the shrimp on the vent just jump off all at once. And everyone was like, 'that's weird,' and then—phwomp—and that was the earthquake energy hitting the boat. It was delayed from the time the shrimp jumped to the time we felt it on the boat. It was crazy that we had recorded that on camera." ■



TOP PHOTO BY CAPT. ALBERT E. THERBERGE, NOAA CORPS (RET.) - NOAA PHOTO LIBRARY.  
 BOTTOM PHOTO BY J. SEEWALD, WHOI / CARBON AT CAYMAN / NSF / ROV JASON / 2020 © WOODS HOLE OCEANOGRAPHIC INSTITUTION

**Top:** Woods Hole Oceanographic Institution's submersible ROV (remote operated vehicle) "Jason," used for studying deep sea hydrothermal vents. **Bottom:** Shrimp cluster on a hydrothermal vent.

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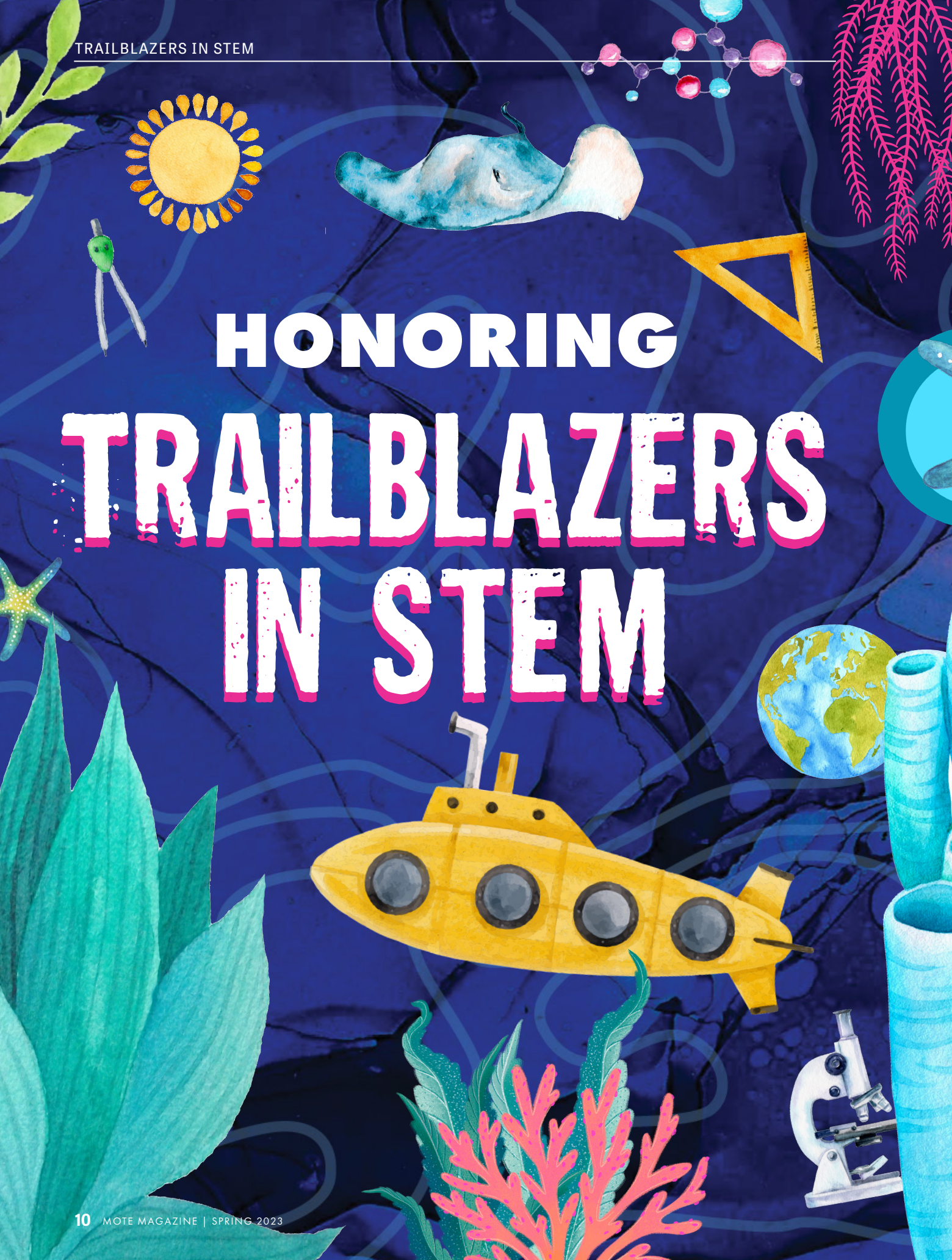
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# HONORING TRAILBLAZERS IN STEM





**In February, Mote Aquarium visitors got their first look at a new interactive display and website featuring “Trailblazers in STEM” throughout history, and Mote Marine Laboratory & Aquarium convened a panel of current trailblazers to discuss the critical importance of diversity for the future of STEM (science, technology, engineering and math).**

BY KEVIN COOPER

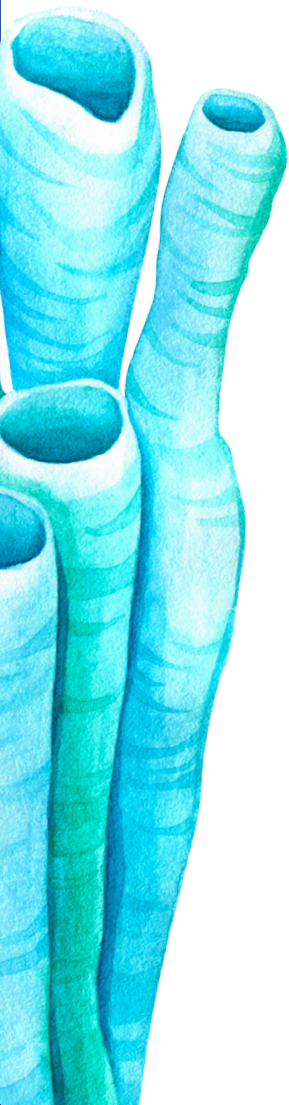
**M**ote’s “Trailblazers in STEM” digital display and website, developed in partnership with Yocum African American History Association (YAAHA), highlights diverse pioneers in STEM whose ingenuity and fortitude have revolutionized every facet of our lives. These amazing trailblazers include Mote’s own sea star, Founding Director Dr. Eugenie “Genie” Clark. The display was unveiled by Mote and YAAHA staff and trustees during a Feb. 8 ribbon-cutting ceremony.

By developing and featuring “Trailblazers in STEM” at its Aquarium, with its launch during Black History Month, Mote continues its future-leaning efforts to expand the participation of historically underrepresented groups in marine STEM. In 2019, Mote Marine Laboratory was selected by the National Science Foundation to lead the Marine Science Laboratory Alliance Center of Excellence (MarSci-LACE), a Louis Stokes Alliance for Minority Participation program. Mote’s MarSci-LACE is a nexus training, resource, and supporting partner to other independent marine research institutions, universities, LSAMP students, and STEM mentors and faculty. The central focus and purpose of MarSci-LACE and its partners is to increase the number and preparedness of students from historically underrepresented groups earning undergraduate degrees in marine sciences and related natural resources fields.

To further broaden the successful impacts of MarSci-LACE, in February 2023, Mote announced the appointment of Amanda Felix to the position of Diversity and Inclusion Advisor to the President & CEO. In her newly established position, Felix will be responsible for developing, managing, recruiting for, and expanding programs that increase historically underrepresented groups’ participation in the Aquarium population of undergraduate interns, staff and volunteers through experiential learning and training opportunities.



**Photo:** Ribbon cutting for the “Trailblazers in STEM” digital display. Left to right: Lisa M. Charles, YAAHA Board Member; Amanda Felix, Mote Aquarium Biologist and Diversity & Inclusion Advisor to the President & CEO; Dr. Michael P. Crosby, President & CEO of Mote; LTC (ret.) Frances Presley Rice, Mote Trustee & YAAHA Board Member; Aly Busse, Mote’s Associate Vice President for Education; Sandi Stuart, Vice Chairman of Mote’s Board of Trustees



Dr. Michael P. Crosby, Mote President & CEO and Principal Investigator for MarSci-LACE, said: "For years Mote has been a leader in recruiting and nurturing historically underrepresented groups in our REU programs as well as establishing innovative approaches to study, identify, demonstrate and articulate the need for broadening the participation of historically underrepresented individuals in marine STEM fields." He added, "Our 'Trailblazers in STEM' collaboration is a continuance of Mote's very own trailblazing endeavors to establish research-based best practices that will broaden underrepresented participation in marine and ocean science STEM."

Aly Busse, Mote's Associate Vice President of Education and Co-Principal Investigator for MarSci-LACE, said that "Trailblazers in STEM" is a "welcome addition and natural fit to our internationally recognized efforts to diversify the participation of historically underrepresented groups in marine science." She added, "Our focus is on pioneering an aspirational approach to the future of STEM identity; part of our success will rest in demonstrating to tomorrow's leaders that these trailblazers have forged a path that is now theirs to carry forward."

The partnership with YAAHA accelerated efforts to expand Mote's reach beyond partners, students and practitioners. Lieutenant Colonel Frances Presley Rice, a board member for both Mote and YAAHA, adds, "We're proud to work alongside Mote in support of an aligned mission to bring out the powerful stories of African American heroes and leaders who made a difference. As we seek to further educate the public that black history and American history are one and the same, it's important to recognize and honor the diversity in STEM fields already historically documented. Launching Trailblazers in STEM with Mote was a tremendous way to celebrate Black History Month this year." ■

### PHOTO: Panelists discuss diversity in STEM to celebrate the new 'Trailblazers' display at Mote. About the panelists:

- Dr. Warren Washington (participating remotely), Distinguished Scholar and 2nd African American ever to obtain a Ph.D. in meteorology. Honored with the National Medal of Science in 2010 for his work at the National Center for Atmospheric Research and for his efforts to increase diversity in the workforce.
- Amanda Felix (left), Mote Aquarium Biologist III, and Diversity & Inclusion Advisor to the President & CEO at Mote Marine Laboratory.
- Dr. Ashanti Johnson (center), who received a U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, among other awards, and is a current member of the U.S. Defense Science Board, was the first African American to receive a Ph.D. in oceanography at Texas A & M.
- Aly Busse (right), Associate Vice President for Education at Mote Marine Laboratory and Co-Principal Investigator and Project Director for the LSAMP/MarSci-LACE at Mote.

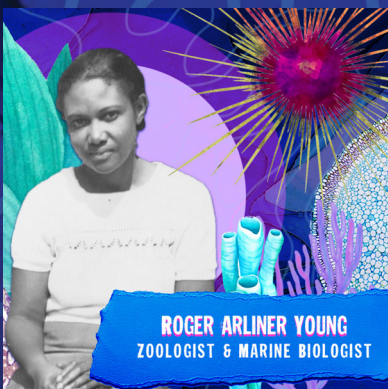


## MEET THE TRAILBLAZERS

DISCOVER THE STORIES OF THESE SCIENTISTS AND MANY MORE AT:

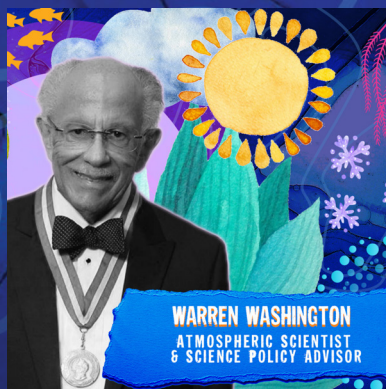


[MOTE.ORG/TRAILBLAZERS](https://mote.org/trailblazers)



**ROGER ARLINER YOUNG**  
ZOOLOGIST & MARINE BIOLOGIST

First Black woman published in the scholarly journal *Science*



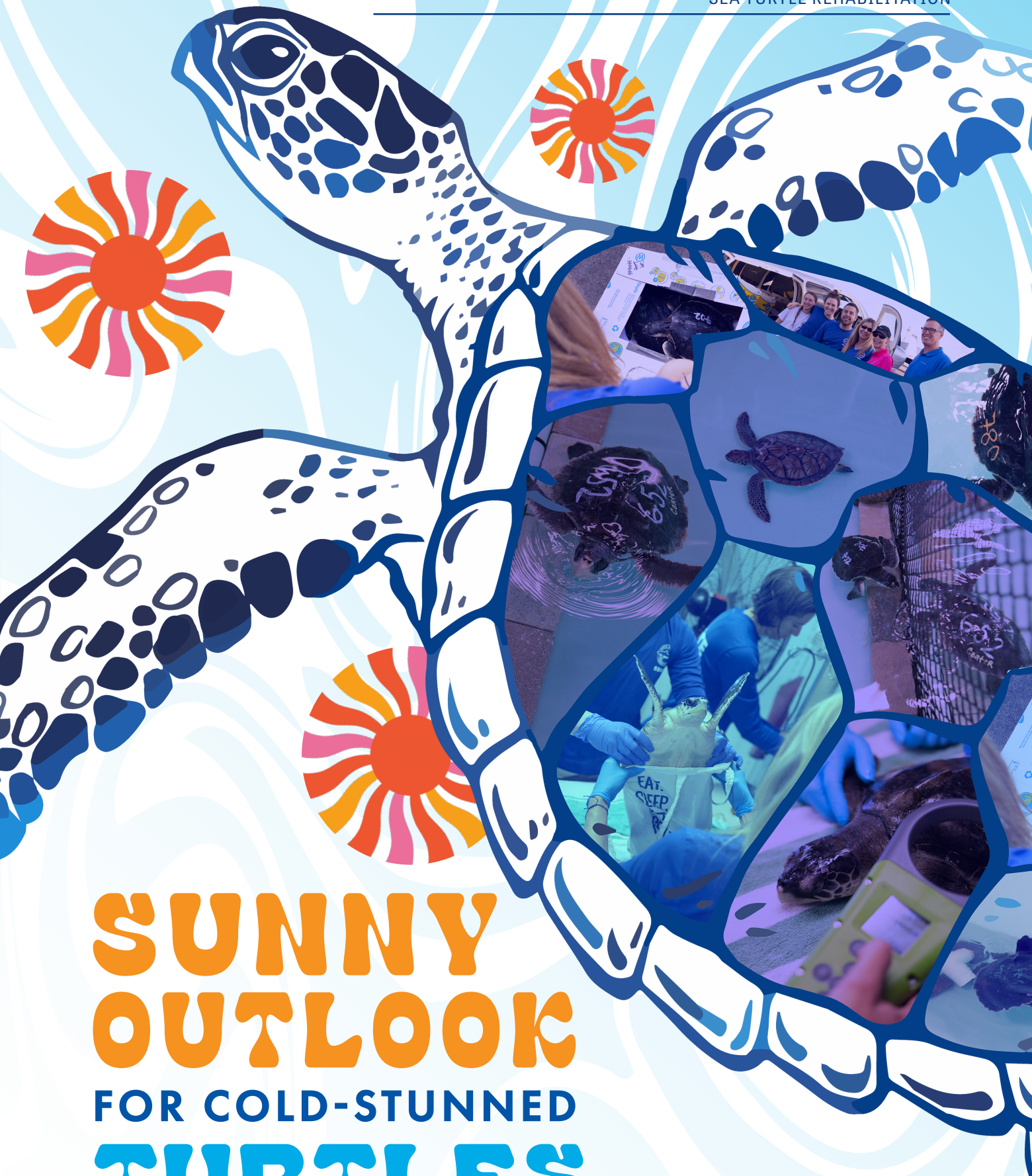
**WARREN WASHINGTON**  
ATMOSPHERIC SCIENTIST  
& SCIENCE POLICY ADVISOR

Co-developed one of the first computer models to predict atmospheric conditions



**EVAN B. FORDE**  
OCEANOGRAPHER

First Black scientist to conduct deep sea research in a submersible



# SUNNY OUTLOOK FOR COLD-STUNNED TURTLES



**Top to bottom:** A Kemp's ridley sea turtle in Mote's Sea Turtle Rehabilitation Hospital; Lynne Byrd, Mote's Rehabilitation & Medical Care Manager, examines a radiograph (X-ray) of a turtle patient; Mote staff scan a newly installed ID tag (which functions like a pet microchip) in a sea turtle about to be released; volunteer pilots who flew 12 cold-stunned turtles to Florida in cardboard banana boxes hand them off to Mote's hospital team.

**BY SEAN STOVER**

About 800 sea turtles needed hospital care after becoming cold-stunned in Cape Cod, Massachusetts—and 12 Kemp's ridley turtles from that group were flown to sunny Florida to finish their rehab at Mote Marine Laboratory's Sea Turtle Rehabilitation Hospital.

Cold-stunning is a condition in which sea turtles can become weak, inactive and lethargic due to extreme low temperatures.

"Hundreds of cold-stunned sea turtles wash up on the beaches of Cape Cod each year because with the rapidly-changing water temperature and wind pattern, many turtles cannot escape the hook-like area of Cape Cod Bay before becoming hypothermic," said Lynne Byrd, Mote's Rehabilitation & Medical Care Manager.

The turtles now at Mote were found stranded on the beach on Dec. 15, 2022. A few had secondary pneumonia and a fungal infection, both fairly common in cold-stun patients. They spent a few weeks in the New England Aquarium being triaged and slowly warmed back up. All received subcutaneous fluids and injected vitamins and antibiotics. Once stable enough, the 12 turtles were flown to Dolphin Aviation Inc. in Sarasota by a volunteer pilot coordinated by Turtles Fly Too.

Once at Mote, they were examined, weighed and situated in rehab pools in shallow water. After a few days of care, all 12 turtles ate small amounts of capelin, shrimp and squid. As they recovered in Mote's care, they gained weight and became more active in swimming, requiring deeper water in their rehab pools. Once their blood work was cleared, they were weaned off antibiotics.

Kemp's ridley sea turtles (*Lepidochelys kempii*) are the smallest, rarest and most critically endangered of Earth's seven sea turtle species, making these 12 turtles extremely important to their population. "Every animal matters," Byrd said. "We look to these animals as an indication of the health of our oceans."

That truth continues to guide Mote's animal caregivers as we approach a major milestone: treating our 1,000th sea turtle patient.

Five of the 12 turtles were cleared for release by the Florida Fish and Wildlife Conservation Commission and were sent back to the big blue off Ormond Beach, Florida, on Feb. 10. Before release, the turtles were outfitted with passive integrated transponder (PIT) tags: If they ever strand again, caregivers can scan the PIT tag to look up their history. The other seven will remain at Mote until they are also cleared.

"These efforts couldn't have happened without all the wonderful people involved," Byrd said, "starting with the volunteers who recovered the stranded turtles, to the staff at the New England Aquarium who began their rehab process, and then Turtles Fly Too. These turtles were in good hands all the way through." ■

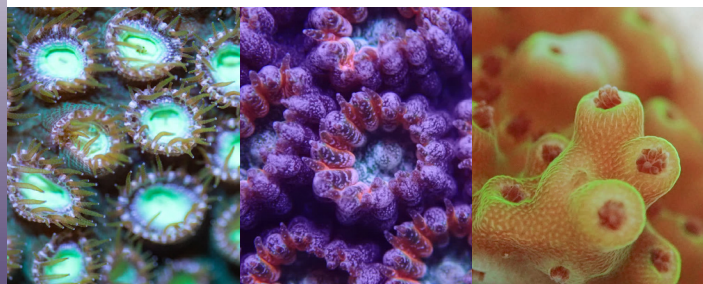


# A coral GROWTH spurt

BY HAYLEY RUTGER

Thirty years ago, Mote Marine Laboratory established its first lab in the Florida Keys, a satellite of our southwest Florida home. That lab, on Pigeon Key, succumbed to Hurricane Georges in 1998—but Mote wasn't going anywhere. Our Keys operations settled on Summerland Key, where we dedicated ourselves to saving a precious, threatened ecosystem: coral reefs.

Now, Mote is celebrating its 30th year in the Keys—where our current footprint spans from Key Largo to Key West—and our coral research and restoration is expanding rapidly, right when the world needs it most.



Global climate change and other stressors continue to ravage coral reefs—the rainforests of the sea that support fisheries, wildlife, economies and coastal resilience to storms worldwide. Florida's Coral Reef remains a hotspot in this crisis. There, corals cover less than 5% of their historical habitat, and coral disease, climate change, coastal development, pollution and more have brought some coral populations to the brink of functional extinction.

To date, Mote has restored more than 190,000 corals to Florida's Coral Reef and brought many exciting, science-based solutions to fruition.

Here are highlights from our past year of coral reef science—made possible by three decades of discovery in the Keys.

## BRANCHING OUT

Mote scientists restored 38,260 corals to Florida's Coral Reef in the past year, and we expanded the horizons of coral science and restoration with critical new infrastructure and successful efforts to breed, raise, study and restore naturally resilient and genetically diverse corals, monitor restored reefs and adapt restoration strategies to maximize success.

In summer 2022, Mote opened the first and only land-based coral nursery in Key Largo, Florida, extending Mote's coral restoration footprint from Key Largo to Key West. Based at Reefhouse Resort & Marina, the Key Largo nursery will produce 6,000–10,000 fragments for restoration per year.

The Key Largo Coral Nursery, developed with support from the National Marine Sanctuary Foundation, joins Mote's other satellite nursery in Islamorada, Mote's Elizabeth Moore International Center for Coral Reef Research & Restoration on Summerland Key, and Mote's underwater nurseries near Key West, Looe Key, Islamorada and Key Largo.

Northward along Florida's Gulf Coast, Sarasota County is home to Mote's primary research campus and Mote Aquaculture Research Park, which features Mote's International Coral Gene Bank.



## GAME OF GENES

Mote's International Coral Gene Bank is a "Noah's Ark" protecting coral genetic diversity from around the world to empower restoration and research. Mote facilities, including the Gene Bank, currently hold more than 6,000 coral genotypes (genetic varieties)—the largest single holding other than Mother Nature herself.

In a landmark moment last year, two symmetrical brain corals (*Pseudodiploria strigosa*) and one mountainous star coral (*Orbicella faveolata*) spawned—began sexually reproducing—inside the Gene Bank's state-of-the-art spawning system, contributing to a total of 2,553 new coral babies with fresh genetics produced within the Gene Bank for Mote's restoration pipeline.

Across all Mote campuses, managing thousands of genotypes requires many

decisions: Which genotypes should be kept in which nurseries? Which should be planted on a given reef? Which are compatible as parents? Which are too closely related to be bred or restored close together?

Those questions—the chess moves of science-based coral restoration—are the focus of something truly cutting-edge: Mote's new Coral Genetic Management Plan.

"To our knowledge, we are the only group that has developed an organization-level genetic management plan related to restoring Florida's Coral Reef," said Mote Associate Vice President for Research and Senior Scientist Dr. Erinn Muller. "It describes the decision trees associated with new corals that come in, and it helps guide where they are retained, where they go among our campuses and how we plan to outplant them."



## FIGHTING ALGAE WITH CRABS

As a core partner in *Mission: Iconic Reefs (M:IR)*—the NOAA-led collaboration restoring seven Iconic Reef sites in Florida—Mote began recruiting new helpers to the cause during the past year: Caribbean king crabs (*Maguimithrax spinosissimus*). These crabs help keep reefs healthy by grazing on algae (seaweeds) that are expected to overtake more coral reefs with continued climate change.

In January through fall 2022, Mote scientists hatched 67 clutches of crab larvae, with funding in part from the National Marine Sanctuary Foundation, and established their research and production pipeline for the species to prepare for introducing crabs to *M:IR* sites.

Specifically, Mote is constructing new, recirculating aquaculture systems at Mote Aquaculture Research Park in southwest Florida capable of producing ~250,000 crabs annually and 2.8 million crabs in 10 years.

Caribbean king crabs seem tough enough for their future on restored reefs, suggested a recent study by Mote scientists and partners in *Marine Biology* titled, “Caribbean king crab larvae and juveniles show tolerance to ocean acidification and ocean warming.”

“We looked at these crabs under climate change conditions they may experience on reefs in the future and found that they don’t mind low pH and high temperatures much, and they’re likely to be winners,” said Dr. Jason Spadaro, Manager of Mote’s Coral Reef Restoration Program.

## THERAPY FOR DISEASE

Another Mote-led research paper, “A highly effective therapeutic ointment for treating corals with black band disease,” published in late 2022 in the peer-reviewed journal *PLOS ONE*, shared a simple treatment that eliminated the appearance of the lethal black band disease in 100% of the corals tested. “This treatment can be used to preserve iconic corals, prevent the loss of corals within highly valued reef sites, and mitigate disease outbreaks within restoration sites,” Muller said.

This was the first-ever study to show that a treatment for a worldwide coral disease has the potential to be 100% effective.



## YOU CAN DRIVE US FORWARD

Florida residents: Support Florida’s Coral Reef by purchasing a Protect Our Reefs specialty license plate from your local tax collector—each sale provides a \$25 donation to Mote for coral reef research, restoration, education and outreach. [motereefplate.com](http://motereefplate.com) ■

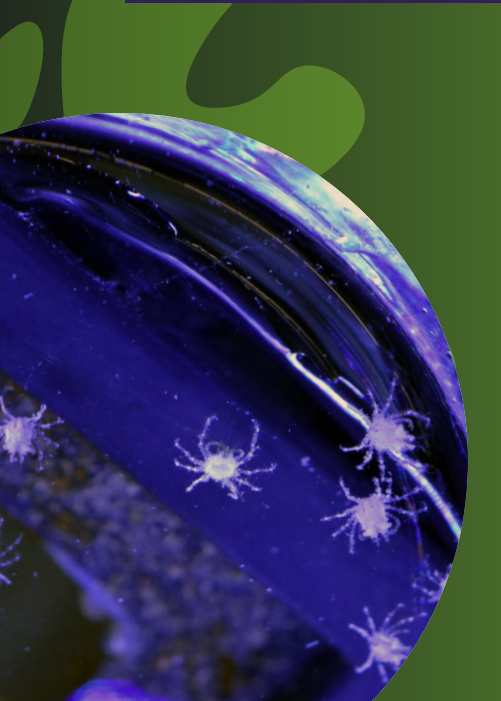


**Left:** Caribbean king crabs in Mote’s care

**Right, top:** Mote’s Dr. Jason Spadaro with a Caribbean king crab.

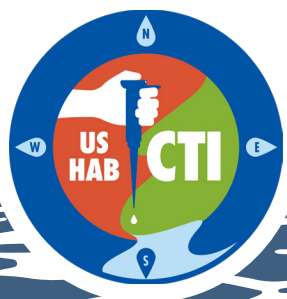
**Right, bottom:** Louis Schlecker works with corals in Mote’s Key Largo Coral Nursery.

BOTTOM PHOTO BY  
MARY D. GRIFFIN  
PHOTOGRAPHY



# TACKLING HARMFUL ALGAE

*from sea to shining sea*



BY KEVIN COOPER

**Mote Marine Laboratory & Aquarium recently announced a groundbreaking partnership with the University of Maryland Center for Environmental Science (UMCES) to lead a new U.S. Harmful Algal Bloom Control Technologies Incubator (US HAB-CTI) to advance innovative ways to control harmful algal blooms in both salt and fresh water.**

HABs are a widespread problem in coastal and Great Lakes waters around the U.S. They occur when algae—simple, plant-like organisms—grow out of control while producing toxic or harmful effects on people, fish, shellfish, marine mammals and birds—leading to environmental, economic and human-health issues.

The growing frequency and magnitude of HABs has created a pressing need to control them and mitigate their impacts. Finding effective, feasible control technologies demands rigorous research.

UMCES' Institute of Marine and Environmental Technology (IMET) in Baltimore, Maryland, has the capability to perform lab-based experiments with freshwater HABs, and Mote has extensive experience with saltwater-dwelling red tide in the Gulf of Mexico, including our lab-based testing of red tide

mitigation strategies at our inland Mote Aquaculture Research Park and our facilitation of pilot field tests during past active red tide blooms.

The new US HAB-CTI will help Mote and IMET combine their strengths and support HAB control development by other innovators, powered by a \$7.5-million grant from the National Oceanic and Atmospheric Administration (NOAA).

“We know firsthand how devastating HABs can be,” said Dr. Michael P. Crosby, Mote President & CEO and a Principal Investigator on the project. “NOAA recognized the important role that our innovative Mote-UMCES collaboration will have in effectively and efficiently bringing together many diverse partners from industry, academia and non-profit organizations with a laser focus on utilizing past research and existing knowledge to develop new technologies and approaches for

**Right:** Mote Senior Scientist Dr. Emily Hall sets up equipment for red tide mitigation research conducted in partnership with the University of Central Florida.

RESEARCH PERMITS: FLORIDA DEP 0202410-006 EE  
AND USACE SAJ-2022-01604.



mitigating the impacts of HABs to the environment, economy and quality of life in communities across the U.S.”

The US HAB-CTI builds upon the early success and momentum of Mote's Florida Red Tide Mitigation & Technology Development Initiative. Alongside UMCES' IMET, Mote will develop this first-of-its-kind center to solicit, fund and assist the development of innovative harmful algal bloom control technology projects.

As Mote Magazine went to press, the US HAB-CTI team was accepting its first round of project proposals from candidates near and far, with more calls for proposals expected annually.

As scientists, governments, and agencies have worked to assess HAB control methods, there has been an increasing need to incorporate environmental compliance, risk assessments, and other permitting in the decision-making process to use a control agent or approach.

The US HAB-CTI will not only support feasibility testing for HAB control and mitigation methods—it will also provide guidance to end users on navigating the relevant state and federal licensing and permitting processes (e.g., state requirements, National Protection Act, and Federal Insecticide, Fungicide, and Rodenticide

Act requirements). The US HAB-CTI goal is the development and implementation of scalable, environmentally acceptable, cost-effective HAB control strategies. Additionally, the US HAB-CTI will archive tool and technology project data for sharing with the broader HAB and resource-management community.

Science has significantly advanced our understanding of the dynamics that lead to HAB formation and spread; now, the US HAB-CTI is bringing us closer to an elusive goal: finding effective means to control and mitigate HABs at multiple geographic scales.

“Field demonstration of harmful algal bloom control techniques is needed to fill the gap between laboratory research and larger scale implementation,” said Peter Goodwin, president of the University of Maryland Center for Environmental Science. “This is an ideal partnership to address a concerning global issue.”

“In Florida, we've demonstrated that partnerships between research institutions, government agencies, private businesses, and other stakeholders can result in effective research that can rapidly identify potential, scalable solutions,” said Kevin Claridge, Vice President for Sponsored Research and Coastal Policy Programs at Mote. “We're looking forward to the opportunity to expand that model even further with a national focus that includes many types of HABs.” ■

# BREATH

# HURRICANE?

**Hurricane Ian left Florida's coastal seawater looking "bruised"—stirred up and colored by rain-swollen river outflows. Mote Marine Laboratory scientists are using this huge storm to study whether hurricanes, predicted to strengthen with climate change, could make west Florida's coastal waters lower in oxygen and less hospitable to marine life.**

BY HAYLEY RUTGER

In September 2022, Category 4 Hurricane Ian damaged or destroyed tens of thousands of homes when it made landfall near Florida's Charlotte Harbor estuary.

As essential recovery efforts progressed, marine scientists turned their focus to a stunning impact off the coast. Satellite images after the storm showed dark plumes of estuary water stretching more than 10 miles into the Gulf of Mexico.

"I'd never seen plumes like that from the Peace River," said Mote Senior Scientist Dr. Cynthia Heil. These plumes—fueled by rainfall funneled by land and rivers through Charlotte Harbor—carried nutrients, dissolved organic matter, algae, bacteria and suspended sediments. Excess nutrients can support harmful algal blooms. Dissolved organic matter can support bacteria that can acidify water and deplete oxygen. Sediments and water color can deprive seagrasses of sunlight. In short, this sudden influx was probably tough on the ecosystem, at least in the short term.

What about the long term? Human-driven climate change is projected to increase hurricanes' strength and rainfall—increasing their odds of being like Ian. "Ian was huge, and it stalled and rained everywhere—a big pulse across the entire watershed," Heil said.

Heil and fellow Mote Senior Scientist Dr. Emily Hall are learning all they can about this unusual storm's impacts on west Florida waters through a new Mote study in partnership with University of Maryland Center for Environmental Science (UMCES) and supported by a Rapid Response Research (RAPID) grant from the National Science Foundation (NSF).

Uniquely, study partners will use their findings about Ian to power predictive models designed to help natural resource managers better anticipate hurricane impacts on ecologically and economically important estuaries in our changing climate.

## IAN

### FLORIDA LANDFALL

Sept. 28, 2022

**RAIN** 10–20 inches over 4 days in many Florida cities

**INTENSITY** Fourth strongest landfalling hurricane in Florida since 1851, tied with Florida Keys Hurricane (1919) and Charley (2004)—but about twice as big as Charley

**Left:** Hurricane Ian crosses Florida.

**Right background and inset:** Water color along Florida's Gulf of Mexico Coast after Ian, including plumes of dark water from Charlotte Harbor  
NASA EARTH OBSERVATORY IMAGES  
BY JOSHUA STEVENS

# TAKING

## AFTER IAN

### NEW STUDY BY MOTE & UMCES

How did Ian affect coastal water quality, and the microscopic life that impacts water quality, in and offshore of Charlotte Harbor, Florida? How do Ian's effects change, recede or persist over time? Can studying Ian help us predict and describe the coastal ocean impacts of future hurricanes strengthened by climate change?

**DARK-COLORED WATER PLUMES** flow from Florida's west coast into the Gulf of Mexico on Oct. 1, 2022.



### 'X' MARKS THE SAMPLE

✕ Mote scientists will collect water samples & data for the new study at these sites in February, May, July and September 2023—helping us see how this natural system responds to Ian in the shorter term and longer term.

↕ Many other sampling efforts by Mote and state and federal agencies started before the storm and will add data to the new project.

**WHAT WAS IN THE PLUME FLOWING OUT OF CHARLOTTE HARBOR?**

sediments • dissolved organic carbon • nutrients • microscopic life • less oxygen • lower pH

10 KILOMETERS  
(6.21 MILES)

### CHARLOTTE HARBOR, FLORIDA

An estuary renowned for its fish, wildlife and relatively intact Florida ecosystems. The estuary feeds the Gulf of Mexico naturally brown water from Florida rivers rich in colored dissolved organic matter. Hurricane Ian flushed an unusually large plume of dark water out from rivers into the Gulf, carrying more "cargo" than usual—substances washed from the land by rain and stirred up by water movement.

### WEST FLORIDA SHELF

Waters farther from shore are generally lower in nutrients. Intense rain washes nutrients to sea, which might drive nuisance algal blooms or worsen existing blooms of native red tide algae that began offshore and drifted toward shore.

## CONCERNS ABOUT OXYGEN & MORE

With the substances flushed to sea by Ian—dissolved organic carbon along with nutrients from nature and from human sources, such as wastewater spills—declines in oxygen and pH (acidification) were reported in estuary waters. That's not surprising, but Mote and UMCES scientists are concerned that Ian, or future storms could create a tipping point—making these symptoms more chronic. Low oxygen can stress, deter or kill marine life, and acidification can harm shellfish and corals, impeding the formation of their shells and skeletons. Low oxygen appeared to become a more chronic, summer problem in another coastal system, Chesapeake Bay, after Tropical Storm Agnes brought record rain in 1972—a hard hit on top of preexisting stressors. While scientists are still investigating Chesapeake Bay's history, and they note many differences between the Bay and Florida's Gulf Coast estuaries, one lesson is clear: There is potential that Ian may have ecological impacts for decades to come.



## Aquaculture champion becomes senior scientist emeritus

Dr. Kevan Main, a world-renowned aquaculture scientist at Mote Marine Laboratory, was recently celebrated by her Mote family and the scientific community as she retired from her long-held leadership positions and became a Mote Senior Scientist Emeritus.

Main, whose central role was Director of Mote Aquaculture Research Park, has led aquaculture research programs at Mote since 2001, developing new innovations to farm animals and plants in water sustainably.

In February 2023, she won the National Aquaculture Association (NAA) Joseph P. McCraren Award for outstanding contributions in promoting aquaculture growth. She was nominated for the award—the NAA's most prestigious honor—by peers across the nation.

Her work in developing sustainable aquaculture methods to produce marine fish, sturgeon, shrimp, abalone and corals earned her recognition as a “White House Champion of Change for Sustainable Seafood” in 2016. She also received the Research Innovation Award from Florida Sea Grant in 2015 for her innovative marine aquaponics science funded by Florida Sea Grant.

Main has worked throughout her career to support the World Aquaculture Society (WAS), serving as its president in 2012. She worked closely with leaders in WAS and the African aquaculture community to form the African Chapter of WAS, which was ratified in 2018. With more than 35 years of experience in the aquaculture of tropical and subtropical species from around the world, Main's research has produced more than 98 peer-reviewed publications and seven books!

"Our entire Mote family offers very best wishes to Dr. Kevan Main as she has retired after decades of leading incredible advances in sustainable aquaculture research on a global scale," said Mote President & CEO Dr. Michael P. Crosby. "In her new role as Mote Senior Scientist Emeritus, we are very fortunate that Dr. Main will continue to be engaged on a voluntary basis in helping to mentor the next generation of scientists at Mote and around the world."

The innovations that Main pioneered will continue with Mote's Dr. Nicole Rhody at the helm of Mote's Marine & Freshwater Aquaculture Research Program. ■



## A SEAworthy tradition

In February 2023, construction teams began pouring concrete to form the foundation of the largest focal point at Mote Science Education Aquarium (Mote SEA)—the Gulf of Mexico exhibit.

Before the first pour, Mote staff joined donors Gary and Margo Jamieson to celebrate the construction progress with a long-held nautical tradition: a mast-stepping ceremony—placing a coin beneath the mast being raised on a ship to bring good luck. Updating this tradition for Mote SEA, the Jamiesons placed a silver dollar from 1922—the birth year of Mote's founding “Shark Lady,” Dr. Eugenie Clark—into the Gulf exhibit foundation.

Mote's Gulf of Mexico exhibit will feature amazing sharks and other large fishes, with a huge, curved window providing visitors a sweeping view and immersive experience. The Gulf of Mexico has been Mote Marine Laboratory's home and a central focus of our research since Clark founded the Lab in 1955. By placing a coin from Clark's birth year into the foundation of Mote SEA, Mote staff and supporters honored Clark's legacy—the foundation of Mote's scientific mission

and the wonders that await our community at Mote SEA. ■

## Good catches

Mote scientists are celebrating fin-tastic milestones in their research with commercial fishermen in the Gulf of Mexico. In the past year, Mote deployed electronic monitoring (EM) gear on more than 100 fishing trips to improve data for Gulf fisheries management.

All together, the Center for Fisheries EM at Mote has collected six years of data thanks to 22 participating vessels, producing 164,663 annotated records rich with data.

Mote's data have real-world impacts. For example, in a project supported by a recent grant from the Sustainable Ocean Alliance, Mote scientists are producing and automating “bycatch hotspot maps” to help Gulf fishermen avoid bycatch (unwanted or prohibited animals) to help them achieve their goals of efficient, sustainable fishing. ■

## Events calendar

Registration is required for all.  
More events: [mote.org/events](https://mote.org/events)

### SPRING 2023

#### APRIL 12

##### SEAsonal Tasting at Nathan Benderson Park

Food and fun celebrating restaurants of University Town Center and benefiting Mote Science Education Aquarium (Mote SEA). 6–8:30 p.m. \$125.  
[mote.org/seasonaltasting](https://mote.org/seasonaltasting)

#### APRIL 18

##### Coffee with a Scientist (Boca Grande)

In-person or virtual lectures from Mote scientists. Topic: Sound in the ocean. 10 a.m. Free. [mote.org/coffee](https://mote.org/coffee)

## MAY 13

### Breakfast with the Sharks

Enjoy breakfast with Mote's resident sharks, see a live feeding & have your shark questions answered. 8-9:30 a.m. Ticket prices online. [mote.org/breakfast](https://mote.org/breakfast)

## MAY 21

### Last day of Voyage to the Deep exhibition

Included with Mote Aquarium admission. [mote.org/voyage](https://mote.org/voyage)

## SUMMER 2023

### MAY - AUGUST

#### Mote Day Camp

Single-day sessions with STEM activities, water exploration, Aquarium tours and more for ages 5-10. 9 a.m.-1 p.m. on select dates. \$54/day for Mote members, \$60/day for non-members. [mote.org/summercamp](https://mote.org/summercamp)

### JUNE 03

#### Sensory Saturday

Guests with sensory processing differences or autism spectrum disorders can access Mote Aquarium an hour early for a calmer environment. 8:30-9:30 a.m. Tickets: [mote.org/tickets](https://mote.org/tickets). Details: [mote.org/sensory](https://mote.org/sensory)

### JUNE - AUGUST

#### Summer Camp

Marine science-themed, hands-on activities for ages 5-13. Each Monday-Friday camp is \$270 per week for members, \$300 for non-members. [mote.org/summercamp](https://mote.org/summercamp)

## FALL 2023

### OCT. 14

#### Sharktoberfest

Sample local and regional brewery selections and enjoy live entertainment, food stations and more. Tickets & sponsorships online. [mote.org/sharktoberfest](https://mote.org/sharktoberfest)

### OCT. 28

#### Oceanic Evening

Mote's signature annual black-tie gala. 6 p.m. Tickets & sponsorships online. [mote.org/oceanicevening](https://mote.org/oceanicevening)

## LEGACY SOCIETY SPOTLIGHT

# Virginia K. Walsh

## An unforgettable legacy

BY LESLIE WALSH

Virginia K. Walsh, a stellar volunteer at Mote Marine Laboratory & Aquarium, devoted herself to Mote's mission for 21 years. She passed away on Nov. 30, 2022, leaving a vital legacy for the future of Mote and our oceans.

Ginny, as she was known, served as an informative guide to Mote visitors and a devoted caregiver to marine animals, particularly sea turtles recovering at Mote's Sea Turtle Rehabilitation Hospital. Her unique bond with a resident sea turtle named Edgar has entered into Mote lore. Whenever Ginny appeared, Edgar responded by swimming across the pool and rising to greet her. Their unique relationship earned Ginny the moniker of "the turtle whisperer."

Ginny touched the lives of everyone who had the pleasure to meet her. Her limitless energy, her pride in her volunteer work, the mentorship she provided as shift leader to both her Thursday and Saturday afternoon teams and interns, and the engaging interest

she showed in Mote's mission knew no bounds. Her colleagues, family and friends benefited from having known this kind, thoughtful and giving woman.

Ginny's generosity also knew no bounds. She deepened her positive impact by joining Mote's Legacy Society—a visionary group of people who support Mote through their wills and estate planning.

Because of her planned gift through Mote's Legacy Society, Ginny's impact will continue to be felt throughout the organization for years to come.

If you'd like to like to honor Ginny's memory, please make a gift to the memorial fund set up by her family, benefiting Mote's Sea Turtle Rehabilitation Hospital: [mote.org/virginiawalsh](https://mote.org/virginiawalsh) ■

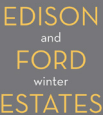
### Learn more about Mote's Legacy Society:



Go to [mote.org/legacy](https://mote.org/legacy) and contact us at [plannedgiving@mote.org](mailto:plannedgiving@mote.org) or (941) 388-4441 ext. 352.



## Did you know?



## Mote members can visit the following Florida attractions for FREE this summer\*:

The Florida Holocaust Museum • Free admission in April

The Ringling Museum • Free admission in May

The Dalí Museum • Free admission in June

The Peace River Botanical & Sculpture Gardens • Free admission in July & August

Edison & Ford Winter Estates • Free admission in September

## Don't live in Florida? Traveling this summer?

Mote members also have reciprocal benefits  
at over 100 attractions across the U.S.

For more information, and to see a full list of reciprocal attractions, scan this QR code or visit:



**MOTE.ORG/MEMBERSHIP**

*\*Some restrictions apply. Please see website for details.*