

# Georgia's 'Live Bottom' Jewel:

## Gray's Reef National Marine Sanctuary

By Michelle Riley

**W**hile Georgia's picturesque salt marshes are well-known to artists, photographers, travelers, naturalists and coastal residents, many consider Gray's Reef National Marine Sanctuary a hidden jewel. Safely tucked away in the Atlantic Ocean, the 22-square-mile (57 sq km) sanctuary is cared for and treasured by divers, conservationists and fishermen, along with sanctuary staff.

Located 40 miles (64 km) southeast of historic Savannah, Georgia, Gray's Reef's scattered outcroppings and ledges provide homes for an abundance of diverse marine life. Crabs, sea stars, soft corals, octopuses, sponges, urchins and thousands of other creatures blanket the nooks and crannies of Gray's Reef, giving it the name "live bottom." Most are invertebrates — animals without backbones — which hide inside caves and under ledges, or live permanently attached to the rocky slopes.







## Whose Reef? – History and Designation

In 1953, the University of Georgia opened its Marine Institute on Sapelo Island, which is the closest landmass to Gray's Reef. Milton "Sam" Gray, a biological collector and curator at the institute, conducted extensive biological surveys of the ocean floor off the Georgia coast. By 1961, Gray had identified a spectacular near-shore, hard-bottom reef 17 nautical miles (31 km) off the coast of Sapelo. Today, the Smithsonian Institution's National Museum of Natural History houses more than 200 lots of Gray's invertebrate collections taken from Georgia waters.

In 1974, Jesse Hunt, a graduate student, was the first geologist to study the reef, then known by the locals as "Sapelo Live Bottom." He proposed the new name, "Gray's Reef," to recognize Gray's valuable contribution to the understanding of offshore habitats and marine life, especially those of the near-shore continental shelf of Georgia. In 1978, the Georgia Department of Natural Resources sub-

mitted a nomination to the Secretary of Commerce, recommending that Gray's Reef be designated as a national marine sanctuary. With enthusiastic encouragement from noted Georgia environmental activist Jane Yarn, President Jimmy Carter, a native of Georgia, approved the designation of Gray's Reef National Marine Sanctuary on January 16, 1981.

The Office of National Marine Sanctuaries is part of the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce. Currently, the sanctuary system includes 13 national marine sanctuaries and two marine national monuments. Gray's Reef National Marine Sanctuary (NMS) and the other entities protect America's iconic natural and cultural marine resources, promoting responsible, sustainable ocean uses that ensure the health of these most valued ocean places. A healthy ocean is the basis for thriving recreation, tourism and commercial activities that drive coastal economies. In fact, in communities across the sanctuary system, about \$8

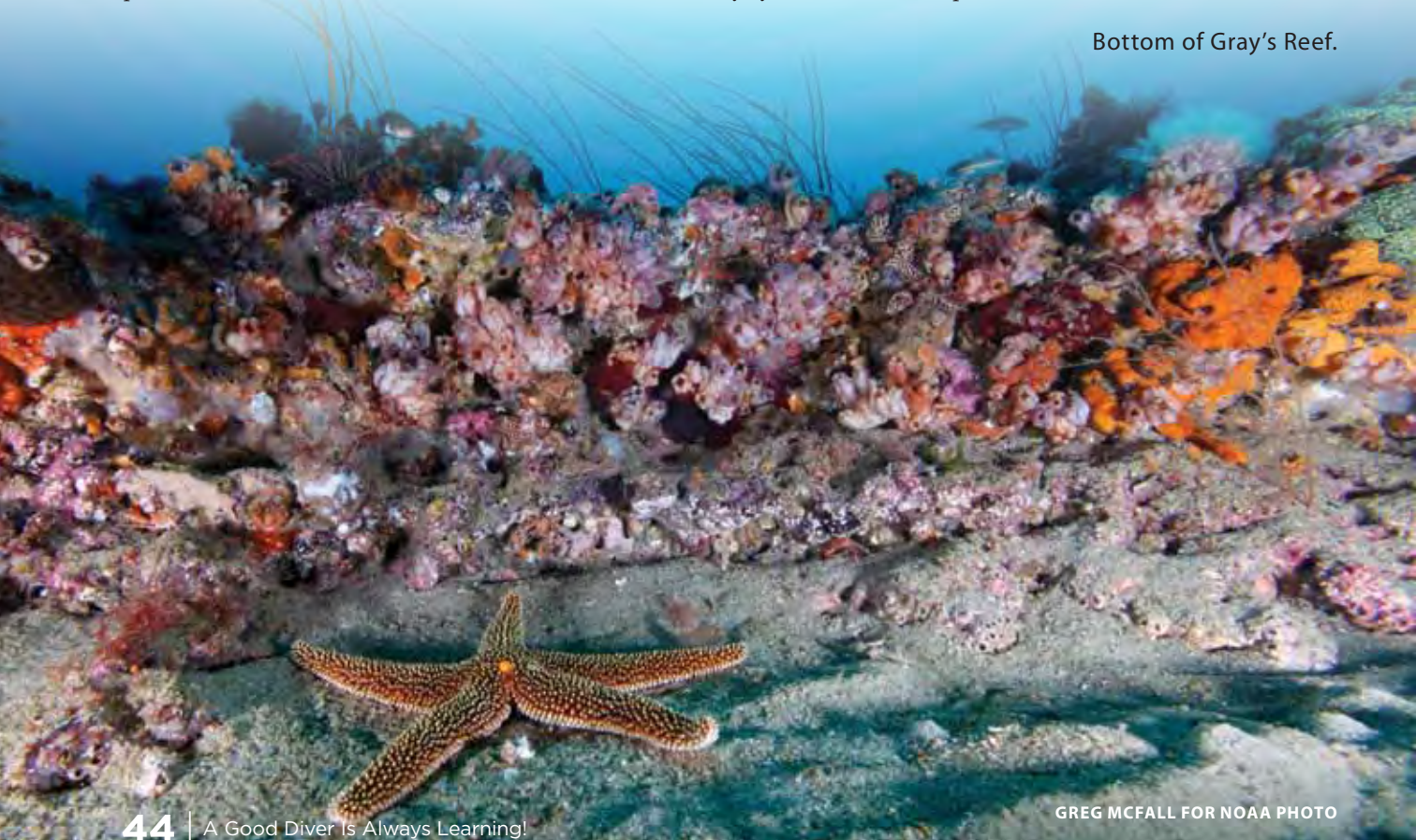
billion annually is generated in local, coastal and ocean-dependent economies from pursuits like recreational diving, fishing and boating, research, education and commercial fishing.

## What's It Made Of? – The Structure of Gray's Reef

Overhanging rock ledges and sandy, flat-bottomed areas characterize Gray's Reef, unlike tropical coral reefs that are formed by living hard corals. As recently as 25,000 years ago, Gray's Reef was dry land and the Georgia coastline was about 80 miles (128 km) farther east than it is today.

The hard bottom of Gray's Reef was created by the consolidation of ocean and terrestrial sediments (sand, shell and mud) that were laid down as loose aggregate between 6 million and 2 million years ago. Some of these sediments were probably carried by rivers that drained into the Atlantic Ocean, and others were delivered by ocean currents from other locations. The sediments continued to accumulate until a dramatic change began to take place on Earth between 2 million and

Bottom of Gray's Reef.







Black sea bass.

GREG MCFALL FOR NOAA PHOTO

## Gray's Reef Chapter of the National Marine Sanctuary Foundation

In addition to donating their valuable time and expertise as volunteers, some ocean-loving residents of Georgia and the South Carolina coast are interested in financially supporting the work of the sanctuary. In 2014, the Gray's Reef National Marine Sanctuary Foundation was established as a chapter of the nonprofit National Marine Sanctuary Foundation, which is headquartered in Silver Spring, Maryland, just outside Washington, D.C.

Based in Savannah, Georgia, the local chapter's mission is to support and strengthen Gray's Reef National Marine Sanctuary as a unique and vital landmark for the community through charitable and educational activities.

Incorporated as a nonprofit in 2000, the National Marine Sanctuary Foundation (NMSF) has evolved into a dynamic force in ocean stewardship. As the marine sanctuary system's chief national charitable partner, NMSF supports a wide-ranging slate of sanctuary programs and initiatives in science, conservation, education and public outreach. In 2005, it established the Ernest F. Hollings Ocean Awareness Grants, which are dedicated to increasing awareness for national marine sanctuaries. To date, nearly \$1.5 million has been awarded to scholars, nonprofits, start-ups and others with great ideas.

As a chapter of the National Marine Sanctuary Foundation, the Gray's Reef National Marine Sanctuary Foundation promotes its sanctuary's initiatives, raises funds on behalf of Gray's Reef, makes grants to Gray's Reef, and stages events to raise awareness for ocean conservation in close collaboration with the Gray's Reef management team.

Next on the foundation's agenda is the 14th Annual Gray's Reef Ocean Film Festival on February 3-4 in Savannah. The foundation partners with the sanctuary to present this annual event. 3-D movies, children's films and a contest for emerging filmmakers mark some highlights of this fun-filled family event.

To learn more about the foundation and the film festival, visit the website at [graysreefnmsf.org/](http://graysreefnmsf.org/) and follow on Facebook at [facebook.com/GraysReefNMSF](https://www.facebook.com/GraysReefNMSF).

10,000 years ago. During that time, the area that is now Gray's Reef was periodically exposed land, as sea levels rose and fell at least seven times. As the glacial ice melted for the last time starting 18,000 years ago, the water flowed back into the sea, filling the ocean basins and covering Gray's Reef.

Gray's Reef contains sandstone rock outcroppings that are scattered about and rise up to 6 feet (1.8 m) above the hard bottom of the nearly flat continental shelf. In addition to invertebrates like sea stars and sponges, the reef also supports soft corals and non-reef-building hard corals.

The hard bottom of Gray's Reef provides a foundation on which benthic (bottom-dwelling) invertebrates can colonize. These animals form a dense carpet of living creatures that in places completely covers the rock. Gray's Reef is composed of four main bottom types: flat sand, rippled sand, sparsely colonized live bottom, and densely colonized live bottom (ledges). The four bottom types have distinct physical and biological features, which divers can explore at numerous sites.

### Underwater – Marine Life In Gray's Reef

Gray's Reef was designated as a national marine sanctuary to preserve the extraordinary beauty of the area and to protect the habitat of its diverse marine life. Many divers have never seen a natural live-bottom reef before and are awestruck by the panoramic views and vivid colors.

Scientists have documented more than 200 fish species in the relatively small sanctuary. Visitors to Gray's Reef regularly swim with blue angelfish, cocoa damselfish, painted wrasse, seaweed blenny, spotfin butterflyfish, cobia and other colorful inhabitants. Sharks are commonly sighted and can be seen at all levels of the water column. Large scalloped hammerhead sharks swim along the surface, while sandbar, nurse and lemon sharks are plentiful on the bottom of the reef. Divers can see tiger, bull and white sharks at all levels, from the surface to the bottom.

Of course, the bottom of the reef is a divers' delight. There, tiny sea horses wrap around sea fans, loggerhead sea turtles rub against the rocky ledges to scratch their backs and nurse sharks lie almost motionless under the outcroppings. At every turn, something new comes into focus: At one glance, a diver sees a batfish "walking" along the bottom of the reef, at another, a great barracuda shoots past a diver's mask, while an octopus quickly hides in a cave near a reticulate moray eel. Along the slopes of the reef, sea anemones and bright orange tunicates vie for space with sponges and sea whips that sway in the current. Sea stars are everywhere, as are several species of crab. At night, spiny lobsters leave their rock crevices to find meals of snails, clams or sea urchins.

Looking up, a diver might see a giant manta ray casting its shadow, or perhaps a bottlenose dolphin chasing a tasty treat. Not yet seen by divers, but always a possibility, is the beloved and critically endangered North Atlantic right whale. Gray's Reef is within the habitat and only known winter calving ground of this elegant and elusive creature. As protection efforts continue, hopefully divers one day will see a mother and her calf in Gray's Reef National Marine Sanctuary.

### **Seriously, It Was This Big! — Recreational Fishing at Gray's Reef**

Spring and summer in coastal Georgia are fishing tournament seasons, and anglers frequently make a beeline to Gray's Reef in hopes of catching the winning king mackerel. The largest king mackerel ever caught in Georgia was reeled in there in 2004, weighing more than 75 pounds (34 kg). Black sea bass, amberjack, cobia, gag and scamp grouper, white-bone porgy and gray triggerfish also attract fishermen to the sanctuary, which is only accessible by boat.

Georgia's coastal community takes pride in preserving Gray's Reef National Marine Sanctuary for current and future generations, and fishing regulations play an essential role. Generally,

two of the most widely known fishing regulations are that only rod and reel and handline fishing gear can be used at Gray's Reef, and anchoring is not allowed anywhere inside the sanctuary. Fishermen are allowed to keep fish they catch as long as they meet state and federal regulations; however, anglers must return prohibited species and sizes of fish to the water if they are accidentally caught. Spearfishing is prohibited. For more information about fishing in the sanctuary, go to [graysreef.noaa.gov/visit/fishing/welcome.html](http://graysreef.noaa.gov/visit/fishing/welcome.html).

### **The Right Stuff — Recreational Diving at Gray's Reef**

Advanced divers are encouraged to dive Gray's Reef, where they are treated to 20-30 dive sites. Divers often comment that the unexpected makes Gray's Reef particularly exciting. The sanctuary is so far offshore that divers cannot see the bottom when they are at the surface of the water. As they descend 60-70 feet (18-21 m) with visibility ranging from 5 to 30 feet (1.5 to 9 m), marine life emerges from all around them and a new world unfolds. In 2006, researchers found a 36,000-year-old whale jawbone just north of Gray's Reef, and in 2010 a second jawbone was found, this one 46,000 years old. Any discoveries should be relayed immediately to sanctuary staff and left where they are found.

Divers must always be alert and aware, because they may encounter strong currents, cold water at depth and occasional limited visibility. Although anchoring is not permitted, divers may use a weighted marker buoy to locate their dive site.

### **Making a Difference — Team Ocean Divers and Other Volunteers**

The small staff at Gray's Reef NMS depends on a strong, committed volunteer corps to execute many facets of research, education and outreach on behalf of the sanctuary. One of the most exciting volunteer positions is that of Team Ocean

diver. The Team Ocean volunteer program engages community divers in the research and monitoring of the sanctuary. Once they become NOAA-certified divers, these volunteers work side by side with marine scientists at Gray's Reef. Gray's Reef only offers the training occasionally and it is intense, including pool trainings, instruction in working with scientific and photographic equipment, and hours of practice, but the volunteers' hard work is vital to their safety and to increasing knowledge of the habitat and the creatures that live there.

Another essential volunteer position is that of Sanctuary Advisory Council member. The council is a community-based advisory group that provides advice to the sanctuary superintendent on a host of issues, from protecting Gray's Reef's natural resources to assisting in outreach efforts that increase public awareness of the value and purpose of the sanctuary. One of the council's most important strengths comes from the diversity of its membership. Gray's Reef's Sanctuary Advisory Council consists of 19 members representing recreational diving, recreational fishing, charter/commercial fishing, education, research, conservation, law enforcement and other government agencies.

Trained volunteers of all ages, from teens to seniors, help Gray's Reef become more visible in the coastal Georgia community by manning booths at local festivals and boat shows, or assisting at the annual Gray's Reef Ocean Film Festival or lending a hand with numerous administrative tasks in the office. Some volunteers help build the Gray's Reef float for Savannah's St. Patrick's Day parade — regularly ranked as one of top 10 in the United States — and then ride among thousands of spectators on March 17. Others lend their valuable diving, engineering and science expertise to the Gray's Reef Southeast Regional ROV Competition, working with students who build underwater robots.



## What's It All About, Anyway? — Research and Monitoring

Gray's Reef National Marine Sanctuary was established to conserve, protect and enhance the biodiversity, ecological integrity and cultural legacy of Gray's Reef. To manage effectively, the superintendent and staff at the sanctuary need to understand the biological and ecological components of Gray's Reef. In 2011, a research area was created in the southern third of the sanctuary — about 8 square miles (21 sq km) in total — where scientists can study the effect of human activities on the sanctuary's marine resources. No fishing or diving is allowed in the research area and boats are not allowed

to stop, although they may transit through the area without stopping.

During 2016, NOAA carried out a number of research projects across the sanctuary with the help of Gray's Reef staff, Team Ocean divers and college and postdoctoral students. For example, in September, four large, yellow torpedo-shaped gliders were deployed outside and within Gray's Reef to collect data on temperature, salinity, density, chlorophyll and oxygen. Gray's Reef staff worked with University of Georgia's Skidaway Institute of Oceanography to launch the gliders from a NOAA research boat. The gliders are part of larger efforts with the Southeast Coastal Ocean Observing Regional Association to

gather oceanographic data on conditions along America's southeast coast.

In July, scientists from several organizations, including NOAA's National Ocean Service, NOAA Fisheries, Valdosta State University, the University of Connecticut, Georgia Southern University, and Gray's Reef National Marine Sanctuary, used the NOAA ship *Nancy Foster* and research vessel *Sand Tiger* to conduct ongoing studies and observations in the sanctuary. Dive teams studied fish, sea urchins, sea stars and other marine animals at 66 different sites in Gray's Reef. For the first time in memory, some research dives took place at night to examine relationships between large predatory fish and their smaller prey.



Nondiving scientists aboard the *Nancy Foster* used the ship's acoustic instruments to scan for fish at different times during the day and night. One team of scientists collected sea urchins that they brought back to the lab at Valdosta State University to see if they can carry acoustic transmitters. If successful in lab experiments, the scientists hope to attach transmitters to urchins and study their movements on Gray's Reef.

All the projects undertaken during the research cruise included observations from inside and outside the sanctuary's research area. As part of their experiments, scientists are careful to monitor organisms from both areas of the sanctuary and can note if human activities outside the research area result in outcomes that are

A diver observes seafloor sensors.



GREG MCFALL FOR NOAA PHOTO

different from changes inside the research area. This meticulous, long-term science will help provide the staff of Gray's Reef National Marine Sanctuary with vital information to keep the sanctuary healthy. It is this type of slow but steady scientific research that adds to the world's knowledge and understanding of the ocean.

### What's That Doing Here? – Invasive Species and Marine Visitors

One of the most effective observation methods Gray's Reef NMS uses is acoustic telemetry, implemented to track the movements of black sea bass, snapper and grouper in the sanctuary. This involves divers surgically implanting some fish with acoustic tags that emit a unique signal. Acoustic receivers located in the sanctuary listen for the tags. When a fish is detected, the receiver records the date and time that the fish was near the receiver.

Several surprising results added a layer of valuable information to the tagging project. For instance, endangered Atlantic sturgeons that were tagged north of Cape Hatteras, North Carolina, have been detected in Gray's Reef, a distance of several hundred nautical miles. Other regular visitors revealed by acoustic telemetry are white sharks and lemon sharks. Additionally, some tiger sharks and bull sharks that showed up were found not to be Gray's Reef residents, but had traveled from other areas of the ocean.

Unlike benign visitors to Gray's Reef, invasive species such as lionfish are a direct threat to the health of the sanctuary. The lionfish is an invasive species from the Indian and Pacific oceans that have no natural predators on the East Coast and can grow and multiply quickly.

Lionfish are voracious carnivores that eat fish and invertebrates, such as small shrimp and crabs. They can eat prey as large as half their size and they consume fish at an unsustainable rate, making them one of the top predators in many reefs in the Atlantic. With a life span of about 15 years and the ability to reproduce every four days, lionfish can increase their numbers

rapidly. By eating so many native fish, they may negatively affect recreational and commercial fishing and tourism.

To date, only a small number of lionfish have been discovered at Gray's Reef, but hundreds of thousands of the predators are known to live in the South Atlantic. The foundation that supports Gray's Reef NMS hosts a dinner each September, "A Fishy Affair: Malicious but Delicious," to promote the idea of lionfish consumption as a method of controlling the population. (See sidebar for more on the GRNMS Foundation.)

### I Want to Know More About Gray's Reef! – Outreach and Education

Since Gray's Reef National Marine Sanctuary is hard to reach, many people learn about it from magazines, festivals, boat shows, community events, websites and social media. Divers and ocean lovers around the world follow Gray's Reef on Facebook and Twitter and develop an appreciation of the fascinating undersea world the sanctuary offers. Many partner organizations along the Georgia coast invite Gray's Reef to participate in fairs and festivals that attract as many as 10,000 attendees.

In 2017, Gray's Reef will celebrate the 14th year of the Gray's Reef Ocean Film Festival. Always a crowd pleaser, the film festival includes fascinating video of the sanctuary, in addition to exciting ocean-themed movies from award-winning filmmakers worldwide. Since Gray's Reef is too deep for most people to visit, the film festival helps bring the reef to them. Ocean movies can inspire, engage and connect people to the ocean and to each other as responsible ocean stewards.

Two programs are of note: the remotely operated vehicle (ROV) competition and the Rivers to Reefs program. Each spring, Gray's Reef NMS conducts ROV-building workshops and then hosts hundreds of students at the Gray's Reef Southeast Regional MATE ROV Competition. The program provides an excellent opportunity for teachers and their students to engage



## Diving Gray's Reef – the Logistics

**A**dvanced divers are welcome at Gray's Reef National Marine Sanctuary. There are no regularly scheduled dive charters to Gray's Reef, but local dive operators can assist in finding charters and requesting a dive trip. The reef is 60-70 feet (18-21 m) below the surface, where divers may encounter strong currents, cold water and unpredictable visibility. Average visibility is 15-25 feet (4.5 to 7.5 m), with extremes from 5 feet (1.5 m) or less to greater than 50 feet (15 m). For optimal conditions, ask the dive operator to provide suggestions on the best time of year and moon phase to schedule trips.

## Sanctuary Dive Area Coordinates

Northwest: 31°25.264'N (31.421064°N)  
80°55.272'W (80.921200°W)

Northeast: 31°25.264'N (31.421064°N)  
80°49.689'W (80.828145°N)

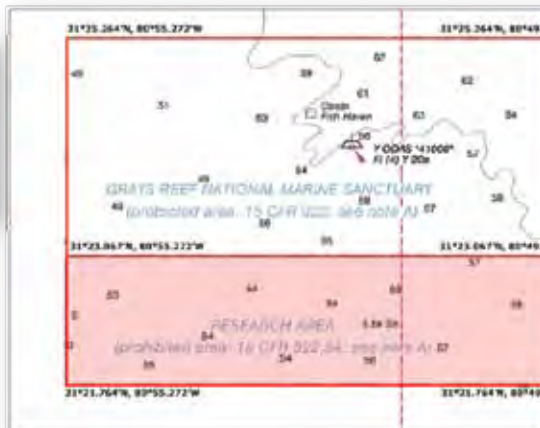
Southwest: 31°23.067'N (31.384444°N)  
80°55.272'W (80.921200°W)

Southeast: 31°23.067'N (31.384444°N)  
80°49.689'W (80.828145°W)



The white area seen at right is open to divers and anglers.

Diving or fishing in the red-shaded research area is prohibited.



**T**he Gray's Reef NMS data buoy is the only permanent object in the sanctuary. It provides near real-time oceanographic and meteorological data, which can be found at [go.usa.gov/xKtmM](http://go.usa.gov/xKtmM).

Anchoring is not permitted, but divers may use a weighted marker buoy as reference to locate their dive site. Marker buoys can weigh up to 10 pounds (4.5 kg) with a buoy line up to a quarter inch. For a complete list of regulations, go to [graysreef.noaa.gov/protect/regulations/welcome.html](http://graysreef.noaa.gov/protect/regulations/welcome.html).

Divers should bring a line reel and inflatable surface marker buoy for ascent.

You can share video and photos using #GraysReef and tell everyone about diving Gray's Reef National Marine Sanctuary.

## Mark Your Calendars – Looking Forward to 2017

### February 3-4, 2017

Gray's Reef Ocean Film Festival – For only the second time, the film festival will include a special 3-D ocean movie night, which was a big hit in 2016. Almost 1,000 people donned their 3-D glasses to explore marine life along with Jean-Michel Cousteau and other ocean filmmakers. Other sessions include children's movies and a contest and viewing session for emerging ocean filmmakers, held at the Savannah College of Art & Design. Follow Gray's Reef on Facebook to see the schedule as it is confirmed.

### April 22, 2017

Gray's Reef Southeast Regional MATE ROV Competition. Team Ocean divers assist dozens of middle and high school teams as they compete for the opportunity to continue to the International Finals of this global underwater robotics contest. More than 100 students pilot their remotely operated vehicles or ROVs in an Olympic-size pool in Savannah.

### August 2017

Get Into Your Sanctuary. All the country's national marine sanctuaries host events to encourage Americans to visit and "dive in" to the 13-site sanctuary system that spans the United States and its territories from Boston to America Samoa. Watch the sanctuary Facebook page for more information.

### For more information

about Gray's Reef National Marine Sanctuary, visit the website at [graysreef.noaa.gov](http://graysreef.noaa.gov) or [facebook.com/graysreefsanctuary](http://facebook.com/graysreefsanctuary) and Twitter @GraysReefNMS.


Researcher Peter Auster observing and recording a school of spadefish.



in science, technology, engineering and math by building underwater ROV models that operate much like actual ROVs used in ocean exploration and research. The winning team goes to the international finals, which was held in 2016 at NASA Johnson Space Center's enormous Neutral Buoyancy Lab pool.

Rivers to Reefs is an educational program for K-12 teachers. Each June, Gray's Reef NMS partners with Georgia Aquarium — the largest aquarium in the world — and Gordon State College to immerse 16 teachers in a week-long expedition that begins by wading in a creek in suburban Atlanta and culminates in canoeing and exploring the Altamaha watershed as the mighty Altamaha River flows into a massive salt marsh and then into the Atlantic Ocean, 17 miles (27 km) from Gray's Reef National Marine Sanctuary. The group then boards a working research ship and travels to the sanctuary, where cameras are dropped so that they see the abundant marine life and understand the deep connections between the Earth's waterways and the ocean.

## Dive Into Your National Marine Sanctuary

Savannah is known worldwide for its warm hospitality, beautiful squares and parks, elegant antebellum architecture and charming horse-drawn carriages. The city is proud to serve as the gateway to Gray's Reef National Marine Sanctuary and welcomes all Americans and international visitors to this hard-to-reach but very special place. 

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## For More Info

**Invaders From Inner Space:  
Revealing Nemo's True Colors**

[dtmag.com/thelibrary/invaders-from-inner-space-revealing-nemos-true-colors/](http://dtmag.com/thelibrary/invaders-from-inner-space-revealing-nemos-true-colors/)

**Diving That Counts:  
On Becoming a Citizen Scientist**

[dtmag.com/thelibrary/diving-counts-becoming-citizen-scientist/](http://dtmag.com/thelibrary/diving-counts-becoming-citizen-scientist/)



Carrollton Junior High School team called Marine Operations - 2016 preparing to compete.

BRIAN GREER PHOTO



M. RILEY FOR GRNMS PHOTO