



Gray's Reef Bytes...

An Educators Guide to Gray's Reef National Marine Sanctuary, marine science news, reviews, opportunities and inspiration from the South Atlantic Bight.



Climate Milestone as Earth's CO₂ Passes 400ppm

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An instrument near the summit of Mauna Loa in Hawaii has recorded a long-awaited climate milestone: the amount of carbon dioxide in the atmosphere there has exceeded 400 parts per million (ppm) for the first time in 55 years of measurement—and probably more than 3 million years of Earth history.

The last time the concentration of Earth's main greenhouse gas reached this mark, horses and camels lived in the high Arctic. Seas were at least 30 feet higher—at a level that today would inundate major cities around the world.

The planet was about 2 to 3 degrees Celsius (3.6 to 5.4 degrees Fahrenheit) warm-

er. But the Earth then was in the final stage of a prolonged greenhouse epoch, and CO₂ concentrations were on their way down. This time, 400 ppm is a milepost on a far more rapid uphill climb toward an uncertain climate future.

[National Geographic](#) reported this news from the Mauna Loa monitoring station which is one of a few observatories managed under NOAA that are observing long-term climate data. The data are housed on the [Earth System Research Laboratory](#) website along with a CO₂ movie depicting time history of atmospheric carbon from 800,000 years ago to 2013.

At Gray's Reef, our CO₂ data reflects the reality of this trending climate debacle. The NOAA Pacific Marine Environmental Lab (PMEL), The University of Georgia (UGA), and [GRNMS](#) have been monitoring pCO₂ offshore Georgia since 2006. The [PMEL station](#) currently collects pCO₂ at the air-sea interface and in the atmosphere, surface seawater temperature, and salinity. Data are also being collected in the research area during this **year's expedition**. Follow the adventures and scientific work conducted aboard the [NOAA ship Nancy Foster](#) through the daily logs and images posted by the research scientists, going on right now!

Coastal Connections at Ships of the Sea

Gray's Reef is pleased to collaborate with [Ships of the Sea Maritime Museum](#) and the [Skidaway Institute of Oceanography](#) on "Coastal Connections," a five-part speaker series connecting culture, science, and history on the Georgia Coast.

Join us Thursday July 18 at 7:30 PM as Cathy Sakas leads us on a journey **From Rivers to Reefs**, connections from sea to shore. Find us at the Ships of the Sea Maritime Museum North Garden, located one block West of City Market in the Historic

Downtown Savannah, GA. **FREE to the public!** You can also follow the adventures of 16 intrepid teachers as they are immersed in the Altamaha River Watershed through their logs and images after **each day's activities**. [Click here to explore more!](#)





Read more about the Flipper-Bot in this [Smithsonian Magazine article](#)

'FlipperBot' Almost as Cute as the Baby Sea Turtles It Mimics

Baby sea turtles are an impressive example of **nature's engineering prowess**. The beaches on which they are born are plagued with predators looking to snatch up a quick turtle snack, and when the tiny turtles scramble out of their underground nests, their ability to hustle

across the sand to the relative safety of the ocean determines if they live or die. But anyone who has ever tried jogging through sand knows that moving on the shifting ground can be challenging. To make their way, sea turtles evolved a flexible flipper wrist that allows them to skim along

without displacing too much sand. Inspired by this ability and curious about why some sea turtles perform better than others, researchers from Georgia Tech and Northwestern University [have built the FlipperBot](#), a bio-inspired robot that can navigate through sand.

The Beautiful Math of Coral - Ted Talks

Snowflakes, fractals, the patterns on a leaf -- there's beauty to be found at the intersection of nature and physics, beauty and math. Science writer Margaret Wertheim founded the Institute for Figuring to advance the aesthetic appreciation of scientific concepts. The IFF's latest project is perhaps its most beguilingly strange -- a coral reef constructed entirely

by crochet hook, a project that takes advantage of the happy congruence between the mathematical phenomena modeled perfectly by the creatures of the reef, and repetitive tasks such as crocheting -- which, as it turns out, is perfectly adapted to model hyperbolic space. It is easy to sink into the kaleidoscopic, dripping beauty of the yarn-modeled reef, but the aim

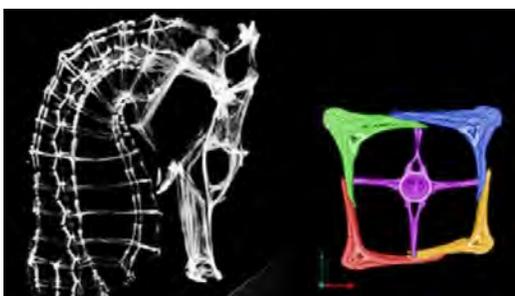


A woolly taxonomy of crochet 'organisms'

of the reef project is two-fold: to draw attention to distressed coral reefs around the world, dying in droves from changing ocean saline levels, over-fishing, and a myriad of threats; and to display a flavor of math that was previously almost impossi-

ble to picture.

[Watch this inspiring Ted Talks video of Margaret Wertheim](#) who hopes to bring some of the most complicated mathematical models embodied in our universe into the minds (and hands) of the masses.



Mysterious Seahorse Astounds Scientists

The curious seahorse, a tiny fish that swims in a vertical position and looks a lot like a miniature horse, has astounded researchers by its ability to withstand crushing forces that would destroy nearly every other living creature. And it just may help the researchers borrow from the world of biology to solve some really tough problems in the world of engineering.

The curious seahorse, a tiny fish that swims in a vertical position and

The seahorse is the latest in a growing list of organisms in the relatively new field of biomimetics. If you are trying to solve an engineering problem, find something in nature that has already done it, then steal its secrets. Engineers at the Jacobs School of Engineering at the University of Cal-

ifornia, San Diego, have been studying several animals to see how they protect themselves. Their goal is to develop a device that can grab an object, even something deep under the sea, while withstanding the forces of nature and the threats from predators. [Read more from ABCNews](#)

Underwater Robot Helps Study Atlantic Sturgeon

More than a century ago, an estimated 180,000 female Atlantic sturgeon arrived from the coast in the spring to spawn in the Delaware River and fishermen sought their caviar as a lucrative export to Europe. Overfishing contributed to steep population declines and today numbers have dwindled to fewer than 300 adults.

Researchers at the University of Delaware and Delaware State University

are using satellites, acoustic transmitters, an underwater robot and historical records to pinpoint the ocean conditions that the fish prefer during migrations — and potentially help fishermen avoid spots where they might unintentionally catch this endangered species.

“There are specific, observable waters in the ocean that we hypothesize are more associated with this species,” said Matthew

Oliver, assistant professor of oceanography in UD’s College of Earth, Ocean, and Environment. [More](#)

Gray’s Reef acoustic receivers have confirmed the [presence of this endangered species](#) in the Sanctuary. Based on these preliminary observations, it appears that Gray’s Reef and other “live-bottom” reefs are an important habitat for Atlantic Sturgeon, and they travel great distances to get there.



The OTIS glider waiting on deck while an Atlantic Sturgeon gets tagged and released

Additional Web Resources:

[Ocean Acidification - "Time to Change" \(feat. Ryan Yoo\)](#)

[GTM Research Reserve Teacher Resources](#)

[Discover Your Changing World with NOAA](#)

GRAY'S REEF NATIONAL MARINE SANCTUARY

Gray's Reef National Marine Sanctuary is one of the largest near-shore live-bottom reefs of the southeastern United States. It's just one of the 14 national marine protected areas that make up the National Marine Sanctuary System and is governed by the National Marine Sanctuaries Act. It is managed by the National Oceanic and Atmospheric Administration (NOAA).

Gray's Reef was designated as a sanctuary on January 16, 1981, and is the only protected natural reef area on the continental shelf off the Georgia coast. The 22 square miles of Gray's Reef protects an area that is recognized nationally and internationally.

<http://graysreef.noaa.gov/>

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National Marine Sanctuaries.....America's underwater treasures!