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The Center for Marine Sciences and Technology

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Diving Deep Down Into History

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CMAST Helps Discover 18th Century Shipwreck

Scanning sonar from a scientific expedition has revealed the remains of a previously unknown shipwreck more than a mile deep off the North Carolina coast. Artifacts on the wreck indicate it might date to the American Revolution.

Marine scientists from NC State University, Duke University and the University of Oregon discovered the wreck on July 12 during a research expedition aboard the Woods Hole Oceanographic Institution (WHOI) research ship Atlantis. They spotted the wreck while using WHOI's robotic autonomous underwater vehicle (AUV) Sentry and the manned submersible Alvin. The team had been searching for a mooring that was deployed on a previous research trip in the area in 2012.

ALVIN prepares to deply on its voyage to 6,500 feet under the sea. (Photo: Woods Hole Oceanographic Institution)

Among the artifacts discovered amid the shipwreck's broken remains are an iron anchor chain, a pile of wooden ship timbers, ballast stones, red bricks (possibly from the ship cook's hearth), glass bottles, an unglazed pottery jug, and a wooden navigational instrument that might be an octant or sextant.

The wreck appears to date back to the late 18th or early 19th century, a time when a young United States was expanding its trade with the rest of the world by sea.

FROM THE DIRECTOR

One of the fun things about doing science is the unanticipated surprise that often accompanies laboratory and field hypothesis testing. Amazing discoveries are often made through study results that had never been considered when setting-up the original hypothesis.

In this issue of the CMAST Newsletter, we highlight a different type of unanticipated surprise, when our team of deep-sea biologists stumbled across an undocumented, 18th century shipwreck while using acoustic sonar to search the seafloor at a depth of 6,500 feet off the Carolinas for a scientific mooring.

We also highlight ocean discoveries closer to home as graduate student Brendan Runde conducts a tag-recapture study to quantify the survival of recreationally and commercially important Triggerfish after they have been caught by hook and line, and subsequently released. We also congratulate the latest achievements of people at CMAST, from our latest crop of Summer Fellows all the way up to grad student and faculty awards and grants.

I invite you to view our Facebook page and website, follow us on Twitter, visit our facility located on Bogue Sound in Morehead City, or contact any of our faculty, staff or students with questions.

With best wishes,

Dave Eggleston

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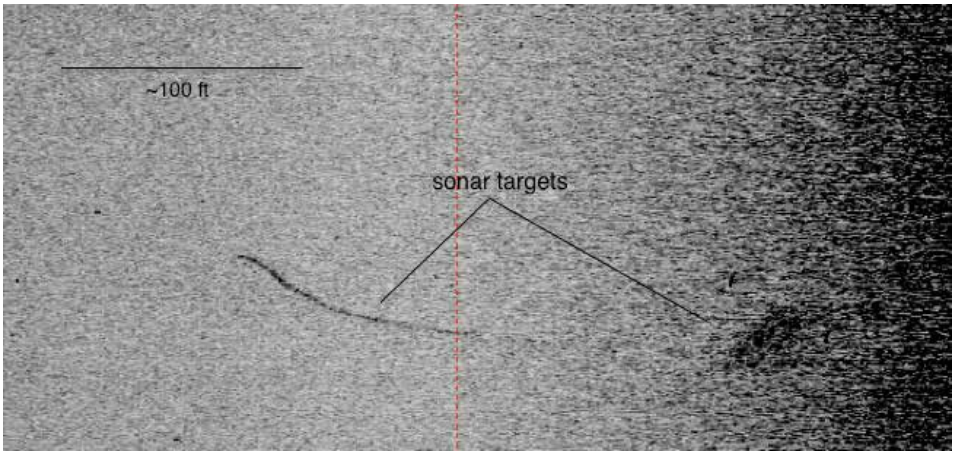
Alvin Strikes Gold, continued from p. 1



Side-scan sonar image from the autonomous underwater vehicle SENTRY. The sonar target on the left represents what was thought to be a deep-sea mooring, but turned out to be the anchor chain of a shipwreck. (Photo: Woods Hole Oceanographic Institution)

"This is an exciting find, and a vivid reminder that even with major advances in our ability to access and explore the ocean, the deep sea holds its secrets close," said expedition leader Cindy Van Dover, director of the Duke University Marine Laboratory.

"I have led four previous expeditions to this site, each aided by submersible research technology to explore the sea floor — including a 2012 expedition where we used SENTRY to saturate adjacent areas with sonar and photo images," Van Dover said. "It's ironic to think we were exploring within 100 meters of the wreck site without an inkling it was there."

"This discovery underscores that new technologies we're developing to explore the deep-sea floor yield not only vital information about the oceans, but also about our history," said David Eggleston, director of the Center for Marine Sciences and Technology (CMAST) at NC State and one of the principal investigators of the science project.

After discovering the shipwreck, Eggleston and Van Dover alerted NOAA's Marine Heritage Program of their find. The NOAA program will now attempt to date and identify the lost ship.

Bruce Terrell, chief archaeologist at the Marine Heritage Program, says it should be possible to determine a date and country of origin for the wrecked ship by examining the ceramics, bottles and other artifacts.

"Lying more than a mile down in near-freezing temperatures, the site is undisturbed and well preserved," Terrell said. "Careful archaeological study in the future could definitely tell us more."

James Delgado, director of the Marine Heritage Program, notes that the wreck rests along the path of the Gulf Stream, which mariners have used for centuries as a maritime highway to North American ports, the Caribbean, the Gulf of Mexico and South America.

"The find is exciting, but not unexpected," he said. "Violent storms sent down large numbers of vessels off the Carolina coasts, but few have been located because of the difficulties of depth and working in an offshore environment."

Bob Waters of WHOI piloted ALVIN to the site of the newly discovered shipwreck after SENTRY's sonar-scanning system detected a dark line and a diffuse, dark area which

Alvin Strikes Gold, continued on p. 3

Alvin Strikes Gold, continued from p. 2

Pile of bricks on the sea floor from the cooking hearth of the ship's galley. (Photo: Woods Hole Oceanographic Institution)

they thought could be the missing scientific mooring. Bernie Ball of Duke and Austin Todd of NC State were aboard Alvin as science observers.

The expedition has been focused on exploring the ecology of deep-sea methane seeps along the East Coast. Van Dover is a specialist in the ecology of deep-sea ecosystems that are powered by chemistry rather than sunlight, and Eggleston studies the ecology of organisms that live on the seafloor.

"Our accidental find illustrates the rewards — and the challenge and uncertainty — of working in the deep ocean," Van Dover said. "We discovered a shipwreck but, ironically, the lost mooring was never found."

An 18th century wine or beer bottle, likely made in England or France. (Photo: Woods Hole Oceanographic Institution)

Funding for the research expedition and for the development of SENTRY came from National Science Foundation grants #OCE-1036843, #OCE-1030453 and #OCE-1031050. NOAA's Marine Heritage Program is part of its Office of National Marine Sanctuaries.

CMAST IN THE FIELD

TAG, YOU'RE IT!

How a tagging study conducted by researchers at CMAST can help us understand what happens when a small fish gets thrown back, and how that affects the species population at large

"So, a gray triggerfish that's caught and then thrown back for whatever reason, what sort of shot does that fish have of making it?" This is a question CMAST's Brendan Runde asked hypothetically as he sat working on dozens of tags spread out in front of him, tags that will end up inside of fish as part of his study. Runde is doing his master's thesis on the gray triggerfish, one of the most popular recreationally and commercially caught fish from North Carolina to Florida.

The tagging program attempts to test the hypothesis that fish which undergo this barotrauma when caught and then thrown back don't have as great a chance to survive the experience as if they had not undergone the catch and discard process.

Testing this hypothesis will lead to an expanded understanding of the triggerfish population and is a project that involves extensive surface tagging of fish, deep-sea scuba work, cooperative efforts between CMAST researchers and a local commercial fisherman, and lots and lots of fishing. The approach is to bring these fish up, tag them, throw them back and, in classic message in a bottle fashion, hope they return to researchers with data that leads to answers.

The gray triggerfish lives in water depths of 100 feet or more. When they are brought to the surface by being caught, they typically suffer barotrauma, which is injury due to extreme and rapid pressure changes. In gray triggerfish, common forms of barotrauma include bloating of the abdominal cavity, and intestinal prolapse. If a fish is caught and then discarded, it may have sustained injuries that end its life before it can grow big enough to end up in a fisherman's cooler another day.

Data on how many of these "catch and discard" specimens grow and thrive to reach legal limits for later catches is critical to setting sustainable catch limits.

Tracking the lives of individual fish would seem at first glance to be a needle-in-a-haystack proposition. However, there are a few factors that make the gray triggerfish a likely candidate for this study. First and foremost, they exhibit what is called "high site fidelity," which means they tend to live their lives in one spot. Males in particular form a 'harem' and then stick close to home. Most fish are recaught in the same spot they were originally tagged, and if not, usually within a one mile radius. This high site fidelity helps ensure that a fish that was not recaptured was lost due to mortality rather than simply migrating from the area.

How the tagging process works

Researchers use hook and line fishing methods for triggerfish in waters approximately 130 feet deep. When a triggerfish is caught, a small incision is made under the skin and an internal-anchor wire-core tag is inserted. On the tag are the fish ID number and the phone number to call if a tagged fish is caught; anyone catching a tagged fish can contact the researchers for a reward. Once inserted, the tag looks very much like a yellow plastic bread-tie poking a bit outside the fish's skin.

After tagging, the fish is examined for outward signs of barotrauma. This information is recorded, and the fish is then released. The fish's response once it hits the water is also carefully recorded. Some take off for the bottom vigorously, apparently none the worse for wear by the experience. Others have more trouble, and, rarely, some die at

the surface. The data recorded at the time of catch and tagging will be referenced if the fish is recaught.

However, that's only half the story. A control group of fish who have not undergone the barotrauma of being caught at the surface are also being tagged and tracked. Tagging these fish is a little trickier. Fish traps are set on the bottom at these same fishing sites where scientists are catching and tagging fish at the surface. Scuba divers, who have only about fifteen minutes of bottom time per session, go down to the traps to perform the incision and tagging procedures on the fish in the traps, which are then released.

With an equal number of surface-caught fish and control group fish tagged, researchers can then develop a formula to calculate how many of the caught and discarded fish died as a result of barotrauma. As a simplified example, if 50% of the control group fish are caught, and there is a 25% return rate for fish caught at the surface, it can be concluded that roughly half of the fish caught at the surface die as a result of barotrauma. Because of the characteristics of the gray triggerfish, the number which simply leave the area is surprisingly small.

Tagging and more tagging

A study such as this one is very labor intensive. The tagging process began in May of 2015 and will continue through 2016. There are 1,500 tags to be deployed. That's a lot of fishing, and a lot of diving, but at the end of the study, there should also be a lot of data, and that's what it will take to answer questions about what's happening with this

Tagging gray triggerfish, continued on p.6

CMAST researchers bottom-fish for gray triggerfish, which live in waters about 130 feet deep. Fish will be caught, tagged, catalogued, and released. (Photo by Ray Mroch)

Gray triggerfish, continued from p. 5

population of fish.

The number of gray triggerfish caught and released every year seems to be on an upward trend. Some states have recently implemented minimum size requirements where there were none before. Other states have put quota systems into effect, so there is more motivation for throwing back a fish under the limit. Catch and discard rates are increasing as a result, and any gray triggerfish released are then subjected to the gauntlet of potential causes of mortality. A tagging study such as this one will help determine how discard rates are affecting the species population as a whole, and may allow scientists to predict how this trend will continue.

Divers perform quick underwater surgery to tag gray triggerfish at 130 feet. The tag can be seen in the foreground, while the other diver makes the small incision with a scalpel. The fish will then be released. These fish tagged at depth comprise a control group of fish which have never suffered barotrauma, as opposed to fish caught at the surface.

A group effort

This tagging project is funded by a grant from NOAA, under the Cooperative Research Program. It is a yearly grant made available to scientists who want to cooperate with the fishing community to promote knowledge and provide outreach, combining commerce, recreation, and science. The CMAST tagging team is made up of principal investigator Dr. Jeff Buckel, assisted by Paul Rudershausen, and Brendan Runde. Runde will come out the other side of this project with a master's thesis that will provide important clues to federal agencies who are gathering this and other data to sustainably manage triggerfish.

Local commercial fisherman Tom Burgess of Sneads Ferry is another important participant in this study. He is part of the original grant, and much of the bottom fishing and tagging is done on his vessel. Runde was enthusiastic in discussing the collaborative aspect of the project. "This is the interface between fishermen and scientists, so that everybody understands each other a little bit better. Communicating scientific findings to those outside of the scientific community is such an important part of the big picture."

CMAST Congratulates its 2015 Summer Fellows

CMAST's 2015 Summer Fellows gave presentations on their projects to a packed room on Aug. 7, 2015. From left to right: Brent Griffin, "Oyster Reefs as Essential Fish Habitat." Johanna Woods, "Bottlenose Dolphin (*Tursiops truncatus*) Diet Diversity with Growth." Emily Barnett, "Effects of Culvert Presence and Habitat Change on Community Composition and Fish Movement in Tidal Creeks." Lauren Huffstetler, "Usage of North Carolina Tidal Creeks by the American Eel, *Anguilla rostrata*.

Paul Rudershausen Recognized for Research Excellence by NOAA

Paul Rudershausen, a doctoral candidate working with Jeff Buckel and Joe Hightower in the Fisheries, Wildlife, and Conservation Biology program, received the 2014 National Oceanic and Atmospheric Administration's Walter B. Jones Sr. Memorial Award for Coastal and Ocean Resource Management.

This award recognizes excellence in graduate study that contributes materially to the development of new or improved approaches to coastal or ocean management. Rudershausen is examining the effects of anthropogenic activities on biota within salt marsh tidal creeks using novel tagging technology.

He is conducting research on the movement and survival rates of a small saltwater fish, the mummichog, in a salt marsh creek using a unique antenna array situated in the water column. Using this technology, he is demonstrating the validity of a continuously operating system that may be useful for tracking fish in environments that are not conducive to active fish-sampling gear.

In 1990, as part of the reauthorization of the Coastal Zone Management Act (CZMA), the late Congressman Walter B. Jones provided NOAA with the authority to honor the people and organizations of America for their dedication and outstanding contributions in helping the nation maintain healthy coastal and ocean resources and balance the needs of these resources with human use.

CMAST's Paul Rudershausen giving a helping hand to a sea turtle in the field. Rudershausen received the Walter B. Jones Sr. Memorial Award for Coastal and Ocean Resource Management.

At that time, Congressman Jones identified three award categories as particularly important—excellence in local government, excellence in marine and coastal graduate study, and coastal steward of the year. NOAA later added additional categories to recognize the broad spectrum of contributions made by this country's many motivated, caring individuals and organizations.

Michael Stoskopf Awarded NCBiotech Grant to Expand Equipment

CMAST's Michael Stoskopf, NC State professor of aquatics, wildlife and zoologic medicine and of molecular and environmental toxicology, has been awarded an Institutional Development Grant from the North Carolina Biotechnology Center (NCBiotech) to fund new lab equipment.

Dr. Stoskopf will receive $72,500 for a recycling system that will reduce by at least 90 percent the use of liquid helium and nitrogen in the imaging and spectroscopy magnet at the Marine Magnetic Resonance Facility at CMAST.

These grants are among 33 awards totaling $2.4 million that NCBiotech awarded to companies, universities and other organizations across the state in the first three months of 2015.

Dr. Michael Stoskopf (left) shares his expertise with CVM students

COLLEGE OF VETERINARY MEDICINE @ CMAST

SEA TURTLE ASSIST

CMAST veterinarians Dr. Craig Harms and Dr. Brianne Phillips use an endoscope to attempt to locate a hook swallowed by this Kemp's ridley sea turtle incidentally caught by a fisherman. Hook removal is often simple by a skilled hand when the hook can be seen in the mouth.

However, sometimes more in-depth measures are required to visualize and access the hook. This turtle, treated on Aug. 12 2015, is expected to make a full recovery and be released. If you encounter a hooked sea turtle, call the NC Sea Turtle Stranding Hotline for assistance: 252-241-7367

Photo by Heather Broadhurst

COMING IN OUR NOVEMBER ISSUE...

Our next issue will highlight educational outreach at CMAST. Here, our own Sam Binion-Rock conducts a seining activity in our own backyard with visiting students from Baltimore

Where Are They Now?

Former MS student **Jason Peters** was recently promoted to head of the NC Division of Marine Fisheries Artificial Reef Program. Jason is based at the Division's headquarters in Morehead City, NC.

Former MS student **Robert Dunn** is working on his PhD in a joint program between University of California-Davis and San Diego State University. He is studying the ecology of nearshore kelp forests in California.

Former PhD student and post-doc **Ashlee Lillis** is a post-doctoral scholar at Woods Hole Oceanographic Institution. Ashlee is working on the ecology of underwater soundscapes, and invertebrate organisms that produce sound