Marine Science News
Issue 34

Marine Science News

The University of Texas at Austin Marine Science Institute Activities and Events (July - December 2024)

Winter 2025

DISCOVERY STARTS HERE

Discoveries & News

Weathering Scratches the Surface of Plastic

Plastics might be more resilient than you think—new research shows they can survive in the ocean for decades. A study released in *Environmental Science & Technology* documents how commercially available macroplastics (>5mm) can withstand decades of exposure in marine environments with minimal degradation. With the influx of plastic waste into the world's oceans, it is imperative to understand the environmental degradation of plastics and their potential impacts on marine ecosystems.

When plastics are exposed to environmental stressors and mechanical forces, they undergo a process called weathering. This process typically involves the gradual degradation of plastic debris at the surface, leading to increasingly smaller particles until they become nanoplastics. The breakdown of these plastics is known to wreak havoc on marine ecosystems and may also pose risks to human health.

To determine how plastics degrade, researchers at The University of Texas Marine Science Institute along with their colleagues at Ocean Coastal Vision and Marine Biological Laboratory in Woods Hole simulated natural weathering conditions by exposing various types of commercially available macroplastics in seawater to UVA radiation equivalent to 25-75 years of sunlight. Plastics are composed of synthetic polymers, long chains of carbon atoms intertwined with other elements, forming a complex structure. When plastic is exposed to UVA radiation, photodegradation takes place by breaking down the chemical bonds in the polymer. Altering the molecular structure of the polymers can cause cracking, color changes, and loss of physical properties. However, not all plastics respond the same under environmental conditions due to differences in composition.

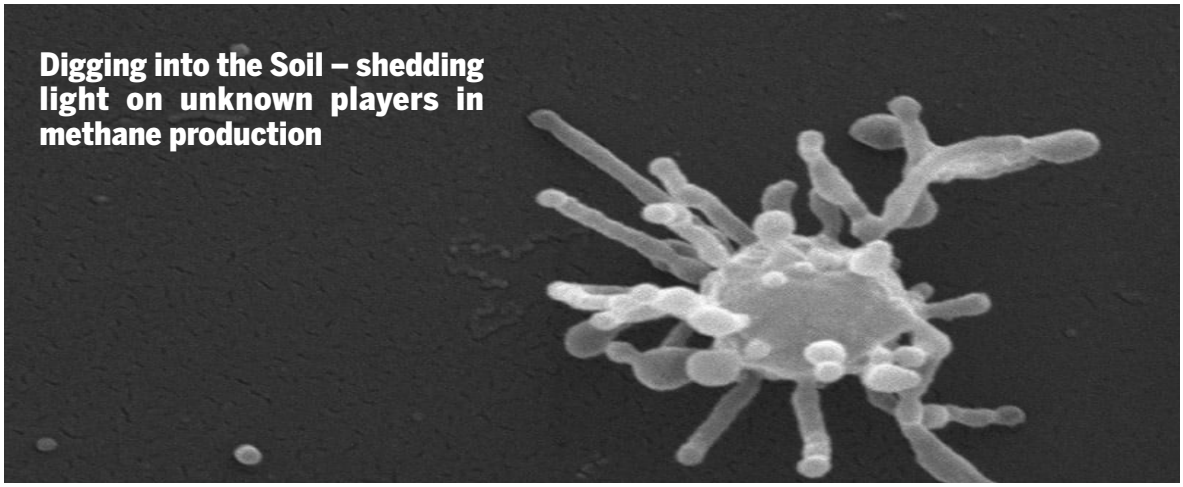
Various analytical tools were used to characterize the surface chemistry, morphology, thermal stability, and additive composition of plastics. The researchers found that the surface layer of the plastic was highly oxidized and eroded after 9 months of accelerated weathering. Despite this prolonged exposure and surface layer degradation, the plastics showed little change, retaining both their composition and thermal stability.

Researchers discovered that when the plastics are

in the ocean, oxygen-containing compounds will start to form on the surface of plastics. These compounds initiate the degradation process, leading to their breakdown over time. The compounds are formed through reactions with environmental factors like sunlight and oxygen, compromising the structural integrity of the plastics by starting the initial breaking of polymer bonds. However, in some plastics, the presence of antioxidant additives, which are designed to enhance the material's durability, can inhibit this breakdown. These additives effectively slow down the oxidative degradation process, allowing the plastics to retain their structural integrity for longer periods, even in harsh environmental conditions.

The findings of this study underscore the resilience of macroplastics in marine environments, potentially persisting far longer than previously estimated. This is largely due to the chemical composition of the plastic, the small surface area of macroplastics. These factors contribute to the complex interplay between environmental stressors and plastic composition, influencing the degradation processes. The implications of these findings are significant, suggesting that the long-term impact of plastics on marine ecosystems could be more profound than we currently understand. This research highlights the need for further studies to better understand the fate of plastics in marine ecosystems.

The research was supported by the National Science Foundation and the Simons Foundation. Researchers that conducted the study include Xiangtao Jiang from The University of Texas Marine Science Institute (UTMSI), Scott Gallager from Coastal Ocean Vision, Rut Pedrosa Pàmies from Marine Biological Laboratory (MBL), Emil Ruff from MBL and Zhanfei Liu from UTMSI.



Digging into the Soil – shedding light on unknown players in methane production

Wetlands are known to produce and contribute a substantial amount of methane that is released into the atmosphere. Most of that methane gets produced from microbes in rich, and sometimes smelly, soil lacking oxygen. Researchers from Brett Baker's laboratory at the University of Texas Marine Science Institute in Port Aransas, have experience in studying saltwater wetland soils. They lent that expertise in a new study released in *Nature Communications* that looked at the previously understudied microbes called Asgard archaea in the soils of freshwater wetlands.

The researchers focused on Asgard archaea because previous research suggested this pivotal evolutionary group can grow on various carbon compounds and use them for energy. The authors of the study reconstructed the full genomes of two types of Asgards, Atabeyarchaeia and Freyarchaeia, to examine the gene content and understand how they impact methane metabolism in wetlands.

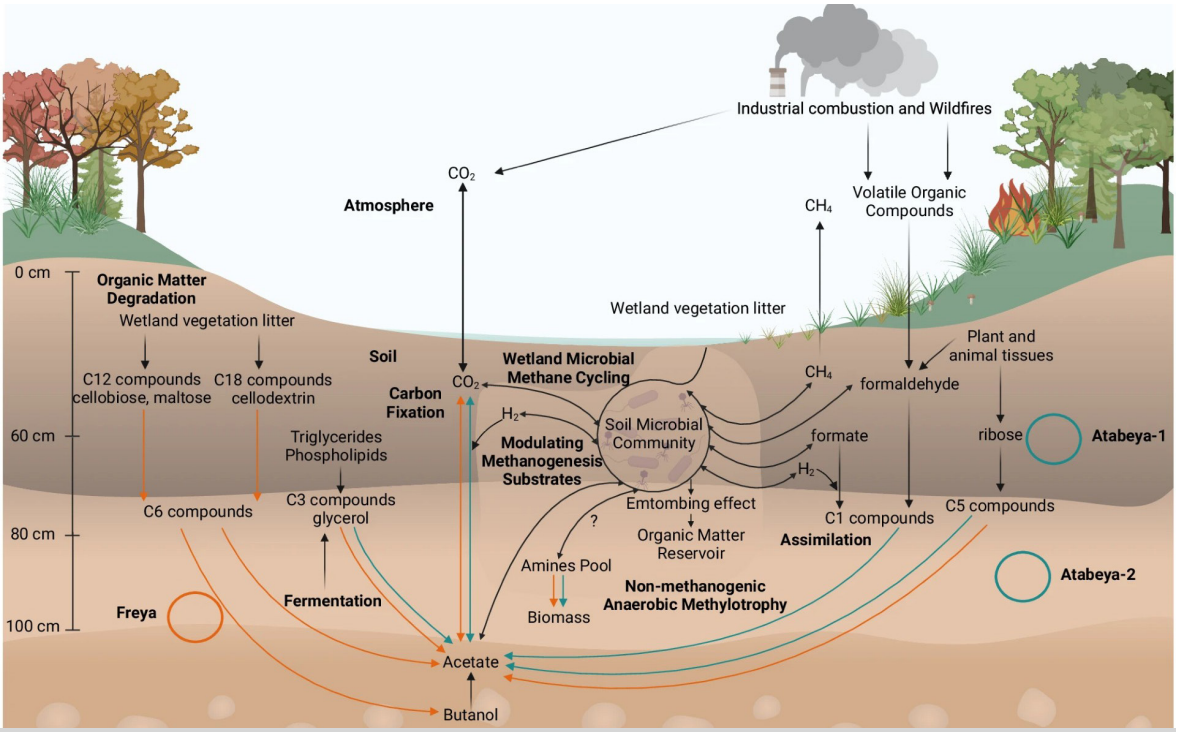
The research revealed that the two groups of Asgards do impact methane cycling. They both produce and consume methane precursors, making their previously unknown activity important in understanding methane cycling. While their abundance in wetland soils is relatively rare, they may have an important role in methane processing. The genetic analysis done in this research discovered

that they have the capacity to degrade aldehydes from various sources, such as volatile organic compounds left by California wildfires.

In addition, the authors identified Atabeyarchaeia sequences in freshwater sediment, peat, and wetland environments from previous studies and Freyarchaeia has been found in a wide diversity of environments —suggesting this metabolism is likely more widespread through archaea.

What makes the research even more impactful was that this was the first study to reconstruct a full genome for environmental Asgards from these groups. This is important because with partial reconstructions it is more difficult to describe metabolic processes without confirmation of potential artifacts or errors. The complete genomes allowed the authors to provide the first detailed metabolic description of these archaeal groups.

This research not only provides the first full reconstructed genome of Atabeyarchaeia and Freyarchaeia for future work but the detailed metabolic analysis highlights a previously underappreciated and overlooked player in methane and aldehyde cycling.



Complete genomes for Atabeyarchaeia (green) and Freyarchaeia (orange) are shown. Isolated from wetland soil (60-100 cm), these anaerobic lineages encode the Wood-Ljungdahl and EMP Pathways for CO_2 fixation, supporting chemolithotrophy and heterotrophy to produce acetate. Their metabolic versatility may give these soil Asgardarchaeota a competitive edge, similar to their marine counterparts.

This research was supported by the Bill & Melinda Gates Foundation, University of California Dissertation-Year Fellowship, Stengl-Wyer Graduate Fellowship and University of Texas at Austin Graduate Continuing Fellowship, Innovative Genomics, Simons Foundation and the U. S. Department of Energy. The study's co-first authors are Kathryn E. Appler and Luis E. Valentin-Alvarado with co-corresponding authors Brett Baker and Jill Banfield from The University of Texas at Austin and Marine Science Institute and University of California, Berkeley. The other authors are Valerie De Anda from The University of Texas at Austin and Marine Science Institute; Marie Schoelmerich, Jacob West-Roberts, Veronika Kivenson, Alexander Crits-Christoph, Rohan Sachdeva, and David Savage from University of California, Berkeley; Lynn Ly from Oxford Nanopore Technologies Inc; and Chris Greening from Monash University.

TEXAS GULF COAST RESEARCH CENTER

The Texas Gulf Coast Research Center, established by the 88th Texas Legislature and based at The University of Texas Marine Science Institute, is driving innovation to support the Gulf Coast region. Collaborating with UT scientists and local and state partners, the Center focuses on applied research that addresses critical issues while promoting progress and resilience for Texas coastal communities and ecosystems. Since its inception, the Center has launched 25 impactful research projects across key areas:

Marine and Coastal Ecosystem:

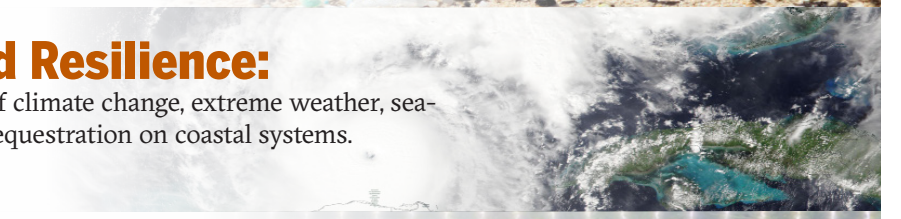
Exploring species distributions, plankton food webs, and habitat roles for fisheries.

Plastic Pollution:

Addressing environmental degradation through microplastic assessment and innovative microbial solutions for plastic degradation.

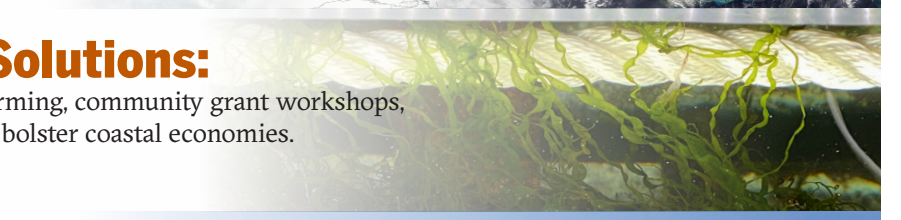
Weather and Resilience:

Studying the impacts of climate change, extreme weather, sea-level rise, and carbon sequestration on coastal systems.



Innovative Solutions:

Supporting seaweed farming, community grant workshops, and market analyses to bolster coastal economies.

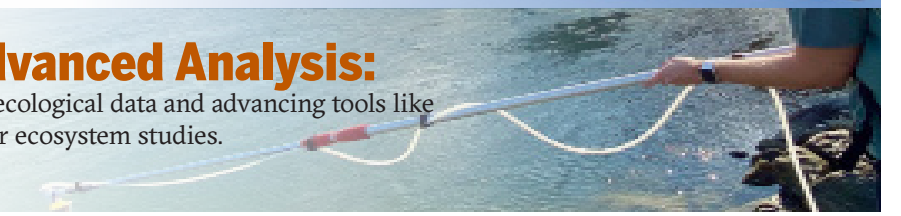


Wildlife and Habitat:

Investigating bird migration, fish behavior, and critical coastal habitats.

Data and Advanced Analysis:

Integrating decades of ecological data and advancing tools like DNA metabarcoding for ecosystem studies.



New Faculty

The University of Texas Marine Science Institute (UTMSI) is pleased to welcome three new faculty members. Get to know our newest faculty members and discover the contributions they'll be making to Texas Science.

Kelly Dorgan, Associate Professor: Kelly Dorgan's research focuses on animal-sediment interactions at the intersection of sediment ecology, invertebrate biology, and sediment processes. She uses engineering tools to study burrowing animals and their impact on sediment structure, collaborating with engineers to explore how animals alter the geoacoustic and geotechnical properties of sediments. Her work has broad applications, including seafloor stability, bio-inspired robots, and understanding invertebrate evolution. Kelly earned her Ph.D. in Oceanography from the University of Maine and completed postdoctoral training at UC Berkeley and Scripps Institution of Oceanography. She previously taught at Dauphin Island Sea Lab for over 10 years.

Robert Joseph Griffitt, Professor: Robert Joseph Griffitt's research centers around the study of the effect of anthropogenic contaminants on aquatic organisms. He focuses on molecular approaches, aimed at identifying the precise cellular and molecular pathways that are affected by different contaminants. His previous research projects have examined the effects of oil spills in the Gulf of Mexico. Griffitt earned his Ph.D. from the University of South Carolina and was previously a professor at the University of Southern Mississippi.

Xinping Hu, Professor: Xinping Hu specializes in carbon-cycle science in estuarine and coastal environments. His team uses state-of-the-art techniques to quantify seawater carbonate system parameters and investigate their variability and the factors that control these changes. Hu's research aims to understand the effects of climate change on estuarine biogeochemistry, the coastal ocean carbon cycle and ocean acidification. Before joining UT Austin, he served as the Endowed Chair for Ecosystem Science and Modeling at the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi. Hu earned his B.S. in chemistry from Peking University and his Ph.D. in oceanography from Old Dominion University. He is also a recipient of the NSF CAREER Award.

Congratulations to Our New Graduates!

Xiangtao Jiang, Ph.D. "Evaluating the abundance, associated pollutants, and environmental fate of microplastics in marine environments" with advisor: Zhanfei Liu.

Philip M. Souza, Jr., Ph.D. "Examining the Biodiversity and Functioning of a Dynamic Estuary Through Bioacoustics and Cryptobenthic Communities" with advisor: Simon Brandl.

Kathryn E. Appler, Ph.D. "Expanding the Tree of Life and Altering Models of Eukaryogenesis" with advisor: Brett Baker.

Awards

Dr. Simon Brandl, Assistant Professor at UTMSI, has been selected as an Early-Career Research Fellow in the Environmental Protection and Stewardship track by the Gulf Research Program.

Dr. Brandl leads the Fish & Functions Lab at UTMSI, where his research focuses on the roles fishes play in energy and nutrient fluxes within coastal habitats like coral and oyster reefs. With over 75 peer-reviewed publications and awards such as the NSF CAREER and NOAA RESTORE, his work advances understanding of marine ecosystems, particularly in the Gulf of Mexico region.

This fellowship will support Dr. Brandl as he continues his innovative research to address environmental challenges and protect coastal ecosystems.

Administrative Services

Where We've Been

July 2024-December 2024, researchers, students, and staff presented at and/or attended the 2024 Ecological Society of America annual meeting in Long Beach, CA; Field Campaigns for NSF-sponsored Beaufort Lagoon Ecosystems (BLE) and Long-Term Ecological Research (LTER) project in connection with Dunton lab in Alaska; fieldwork and research at the Smithsonian Tropical Research Station in Bocas del Toro, Panama, Carrie Bow Cay, Belize, Moorea, French Polynesia, and Natal, Brazil; attended and presented at the 2024 PSA-ISOP-ISEP Joint Meeting at the University of Washington in Seattle, WA; Attended and presented at the 19th International Symposium on Microbial Ecology in Cape Town, South Africa; 2024 Goldschmidt Conference in Chicago, IL; 2024 iBOL Conference in Brazil; 154th Meeting of the American Fisheries Society in Honolulu, HI; DUMAC Field Station visit in Celestun, Mexico to collaborate for undergraduate study abroad; 2024 Restore America's Estuaries Coastal and Estuarine Summit in Arlington, VA; NERRS Annual Meeting at Wells Reserve in Kennebunkport, ME; 12th US Symposium on Harmful Algae in Portland, ME; 2024 SETAC North America Annual Meeting in Fort Worth, TX; 2024 American Geophysical Union Annual Meeting in Washington, DC; Gulf Estuarine Research Society Meeting 2024 in Fairhope, AL.

Island Science Day Draws 500+ Visitors

We're pleased to announce the return of Island Science Day, formerly Open House, to keep celebrating the natural wonder of Port Aransas and the Gulf of Mexico for future generations. On October 12th, UTMSI welcomed over 500 visitors for a day filled with boat rides, interactive field trips, and engaging demonstrations showcasing the groundbreaking work of UTMSI scientists.

The event offered a unique opportunity for attendees of all ages to experience hands-on learning, behind-the-scenes tours, and a deeper understanding of UTMSI's ongoing research, education, and outreach efforts.

From its humble beginnings in 1941 as a small shack on the Gulf shores, UTMSI has grown into a leading center for marine science. Now in its 84th year, UTMSI remains dedicated to inspiring curiosity, fostering community connections, and celebrating the rich marine ecosystems of the Texas Gulf Coast.

Are Parrotfishes Friends or Foes to Coral Reefs?

For many years, parrotfishes have been considered an essential tool for coral reef management as they are known for helping corals grow and survive by grazing on algae and cyanobacteria that can otherwise smother corals. However, some parrotfish species can also eat coral and a new study in *Marine Ecology Progress Series* examined how changes in coral and parrotfish populations across the Greater Caribbean can influence the impact of this dual behavior that can be helpful, yet sometimes detrimental, to coral reefs.

The study, conducted across diverse reef sites in Panamá, Florida, St. Croix, and Bonaire, found that while there was more intense coral predation on reefs with more abundant parrotfishes, there was less predation in areas with lower coral diversity and fewer of their preferred coral prey species. Since parrotfishes generally only prefer a few types of corals, this selective predation suggests that coral diversity and the presence of these specific species influence the intensity of coral predation.

This is important for reef managers since it suggests that parrotfishes may scale back their coral predation intensity on more degraded reefs. They also found that, with the exceptions of a few preferred coral prey, most Caribbean corals are not intensively preyed upon by parrotfishes.

"The findings underscore the importance of considering the dynamic interactions between parrotfishes and coral communities to effectively manage reef resilience under changing conditions. Research suggests that the benefits of parrotfish algae grazing likely outweigh the consequences of their occasional coral predation. However, in the face of widespread decline in coral cover across the Caribbean, it's important to understand what factors influence the intensity of parrotfish coral predation–especially for frequently targeted coral species.," said lead author Hannah Rempel, a Ph.D. student at The University of Texas Marine Science Institute in Port Aransas, Texas. Understanding the nuanced impact of parrotfishes on coral reefs

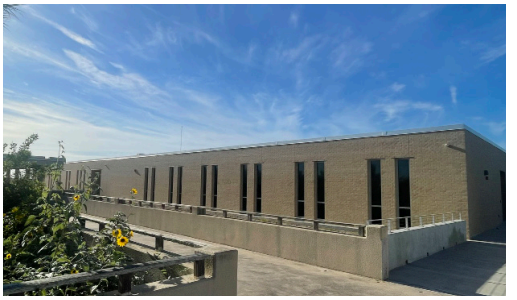
can help inform strategies to balance their beneficial algae-grazing activities with their coral predation behavior. By monitoring the specific coral species targeted by parrotfishes, reef managers can better predict and mitigate potential declines in coral diversity.

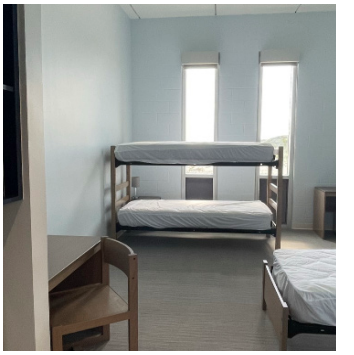
This study's insights will play a pivotal role in the ongoing debate about the net impact of parrotfish on coral reef ecosystems. While research suggests that parrotfishes likely have overall net positive impacts on coral reefs, a deeper understanding of their dual roles can facilitate more effective management practices that can enhance coral reef resilience.

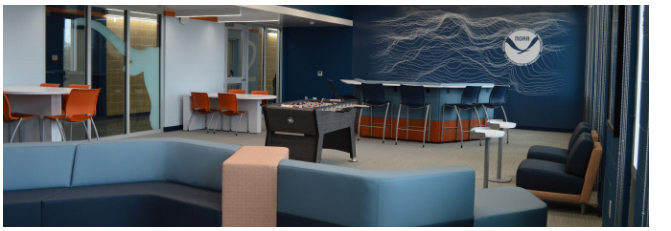
Hannah Rempel is joined by coauthors Kelly Bodwin, Peter VanderBloomer, Benjamin Ruttenberg, Tara O'Rourke, Maurice Goodman, Marilla Lippert, Rachael Lamore, Emma Barton at California Polytechnic State University; Deron Burkepile, Thomas Adam at University of California at Santa Barbara; Andrew Altieri at University of Florida; Roxanne-Liana Francisca at Stichting Nationale Parken Bonaire; and Marietta Marroquín at ECOspiral. The research was supported by the NOAA Coral Reef Conservation Program, Smithsonian Tropical Research Institute, California Polytechnic State University Frost Fund, and California State University Council on Ocean Affairs, Science & Technology, Dr. Earl H. Myers & Ethel M. Myers Oceanographic & Marine Biology Trust, Harvard Travellers Club Permanent Fund, and American Museum of Natural History Lerner-Gray Fund for Marine Research.

Unveiling Our New Spaces

Estuarine Research Center Dormitory Construction is now complete, and the dormitory is officially housing students. This facility provides accommodations for visiting K-12 and undergraduate students, with the project officially wrapped up in time for the new term.







Amos Rehabilitation Keep Rescue Center We're excited to announce the opening of the Amos Rehabilitation Keep Rescue Center in late September! This new facility provides rehabilitation for shorebirds, birds of prey, and sea turtles, featuring spaces for veterinary care, animal housing, food prep, office space, and two walk-in freezers to support the ARK's mission.

Under Construction

- Wilson Cottage Expansion
- Seawater supply system at Channel View campus
- Fisheries and Mariculture Laboratory Upgrades

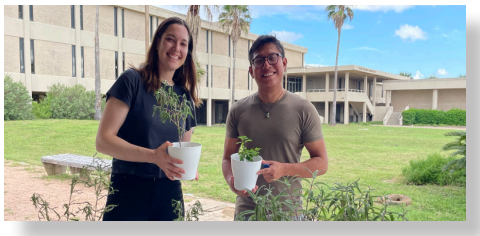
Around Campus

It's been a busy time around campus, with exciting events and achievements. We recently hosted a blood drive where we exceeded our goal, collecting 14 units!

Our videographer has been hard at work capturing the essence of our department, filming a new video that highlights the incredible work happening here. You can check it out at https://youtu.be/ETjGOiN-WC8.

Our monthly "Campus Community" event brought together students, staff, and faculty for a native plant planting, enhancing the area and supporting local biodiversity. These events are a wonderful opportunity to connect and build a stronger sense of community.

Our upcoming projects and initiatives promise even more ways for everyone to get involved and make a difference. It's been a season of giving, creating, and growing, and we're excited for what's to come!



Connecting with us: Introducing Our New Websites

We're happy to share the launch of two brand-new websites, designed to better serve our diverse community. Both websites reflect UTMSI's commitment to providing accessible, informative, and engaging digital spaces for all audiences—whether you're a student, researcher, or visitor eager to learn more about marine science.

Institutional

https://utmsi.utexas.edu/

UTMSI introduces an updated institutional website that highlights our world-class research, educational programs, and outreach efforts. Whether you're planning a visit, learning about our scientific initiatives, or exploring the rich ecosystems of the Gulf Coast, this site offers a user-friendly experience to engage with the institute's work and its impact on the community.

Departmental

https://marinescience.utexas.edu/

The new departmental site offers a comprehensive digital hub with resources, tools, and information to support academic and research endeavors. From access to labs and faculty research to student resources and opportunities, this site connects our marine science community to the latest resources and updates.

MISSION ★ ARANSAS
NATIONAL ESTUARINE RESEARCH RESERVE

Highlights

K-12 Field Trips

Public Lectures

Turtle Releases

Teachers on the Estuary

Volunteer Appreciation

Workshops

and much more...

Workshops Held

- Shoreline Restoration Techniques
- Gulf Tree Workshop
- Living Shorelines Workshop
- TNC/WAM Workshop
- Grant Writing Workshop
- Facilitation Basics for Coastal Managers Workshop

This year, **122 birds**, **53 sea turtles**, and **10 other reptiles** (pond turtles) were rehabilitated at **The Amos Rehabilitation Keep (ARK)**, serving the coastal zones of Mustang Island and St. Joseph Island.

What's on the Horizon for UTMSI?

Conferences

- Seaweed Symposium, April 3, 2025
- Advances in Stable Isotope Techniques and Applications (ASITA) Conference, May 18-21, 2025

Outreach

- STEM Girl Day at UT Austin, February 22, 2025
- UT Summer Science, June

Workshops

- Eat the Invasives with the CWMA
- Texas Bays and Estuaries Meeting
- Gulf TREE Training Workshop
- NOAA's Social Science Basics for Coastal Managers Workshop
- Texas Plastic Pollution Symposium

Public Lecture Series

The public lecture series features in-person presentations by scientists on their research and programs, free for everyone to attend.

Patton Center 855 E. Cotter Avenue | Port Aransas | Door's open at 6:30pm, lecture starts at 7:00pm

- Andrew Orgill - January 9th
- Ed Buskey - January 16th
- Kelly Dorgan - January 23rd
- Kelley Savage - January 30th
- Simon Brandl - February 6th
- Victoria Congdon - February 13th
- George Archibald - February 20th
- Randy Bissell and Jim Moloney - February 27th

Bay Education Center 121 Seabreeze Drive | Rockport| Lecture starts at 2:00pm

- Jace Tunnell - January 15th
- Ellis Chapman, Jr. - January 22nd
- Paityn Macko - January 29th
- Kody Barone - February 5th
- Tess Kelly - February 12th
- Sofia Armada-Tapia - February 19th
- Kimber Montanye - February 26th

UTMSI professors, staff and students continued the tradition of running the weigh station at the 88th Deep Sea Roundup — the longest running fishing tournament in Texas. Its also a great opportunity to collect research samples. Pictured here is Bailey Bonham, doctoral student in Simon Brandl's Lab.

Human Resources

New Employees

Welcome to our newest team members: Xinping Hu, Kelly Dorgan, and Robert Griffitt (Faculty); Leonardo Fonseca Reginato (Research Engineering/Scientist Assistant, Brandl Lab); Rodnyel Arosemena (Laboratory Research Assistant I, Casey Lab); Kylan Petty (Animal Attendant I); Kadee Loyd (Laboratory Research Assistant I, Liu Lab); Eric Ehrlich (Communications & Outreach Specialist); Philip Munoz (Aquarist); Courtney Bass and Mary Finch (Laboratory Research Assistants I, Dunton Lab); Nathan Bludworth (Mechanic/Tech); Laura Sisk-Hackworth (Postdoc, Fuiman Lab); Emilie Tagle (Building Monitor); Miguel Vera (Education Assistant, BEC); Quyhn Hoang (Research Engineering/Scientist Assistant II, Hu Lab); Hang Yin (Research Associate, Hu Lab); Caitlin Neill (Laboratory Research Assistant IV, Nielsen Lab); and Austin Willson (Laboratory Research Assistant II, Dorgan Lab).

The University of Texas at Austin
Marine Science Institute

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P.8, 9: Hannah Rempel
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P.13: Mission-Aransas NERR
P.14: Eric Erlich
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The University of Texas at Austin Marine Science Institute advances knowledge of coastal and blue water oceans with exceptional research, innovative teaching, and diverse public outreach programs.

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