Texas General Land Office

2023 Water Resources Program Update

By Jason Pinchback
Manager, Water Resources program

GLO
Water Resources

The GLO Water Resources program consists of Texas Beach Watch (Beach Watch), Texas Coastal Ocean Observation Network (TCOON), and the Coastal Nonpoint Source or Clean Coast Texas program. These programs are inextricably linked through a collection of highly complementary data, by their focus on the connection between land, rivers and coastal waters, and by their integration of community engagement practices.

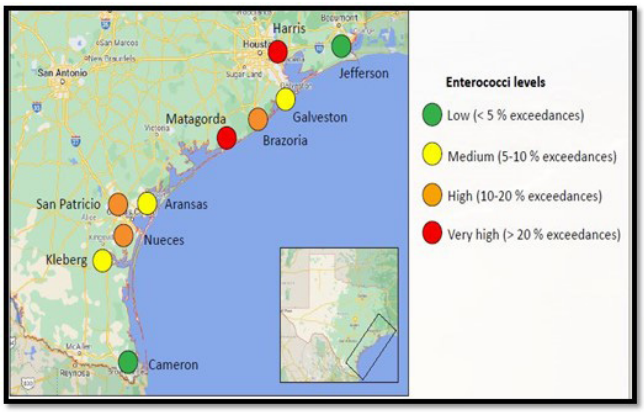
Texas Beach Watch Project Manager Lucy Flores is documenting a recent field quality control site visit with field staff.

Beach Watch was initiated at the GLO as a Coastal Management Program (CMP) project in the 1990s. Originally a modest program, Beach Watch has grown over time and is now one of the premiere beach bacteria monitoring networks in the U.S. This network provides weekly and biweekly fecal indicator bacteria (FIB) information at 172 sites from Sea Rim State Park to Boca Chica near the Rio Grande. The network's focus is to provide accurate and timely notifications regarding potential health risks associated with contact recreation. When Enterococcus bacteria levels in the water exceed acceptable levels, the GLO works with local governments to issue beach advisories warning the public of potential health risks associated with contact recreation. Each year 7,000-9,000 monitoring events occur.

Texas Beach Watch field staff attend the classroom portion of their annual training refresher

CMP's **Clean Coast Texas** program was launched in 2021, when it was approved by NOAA and the EPA after a multidecade development process. Coastal nonpoint source (NPS) pollution management measures have been required by all Coastal Management Programs since the passage of U.S. Congress' Protecting Coastal Waters Act in 1990 (Coastal Zone Act Reauthorization Amendments Section 6217g). The main mission of this program is to work with local jurisdictions to enhance NPS management through local ordinance development, provision of technical resources, implementation of best management practices, and other complimentary actions.

The **TCOON** program is a network of 32 water monitoring systems that provide the public and state and federal coastal managers with real-time data on tides and environmental parameters along the Texas Coast from Sabine Pass to Port Isabel. Established by legislative mandate, the monitoring network is important to the safety and well-being of Texans by providing the real-time data on weather and potential coastal hazards. TCOON is managed through cooperative agreements among the GLO, Texas Water Development Board, U.S. Army Corps of Engineers, and NOAA.



Peering through the lens of a watershed practitioner, Beach Watch, Clean Coast Texas, and TCOON programs have integrated their operations to gain insights into changing coastal near-shore water quality.

Partnership Beginnings

In 2019, two coastal counties found themselves in the epicenter of 60 miles of coastline where elevated FIB levels were observed during predominantly dry periods for most of the summer. GLO Water Resources led an investigation to determine what could be the driving forces of the elevated bacteria levels, but realized the task was too big for just one agency to address. The GLO formed an ad-hoc task force consisting of state agencies, researchers, counties, and councils of government to investigate the phenomenon. After reviewing internal quality control and ruling out laboratory and field staff procedures, the task force focused on probable FIB sources such as nearby wastewater treatment plants, NPS from major streams and rivers, and illicit discharges.

An exhaustive search discovered issues associated with wastewater treatment plants, sewage conveyance systems, and malfunctioning septic systems. Although these issues are problematic and in the same geographic proximity, it seemed improbable that these FIB sources could stay densely confined to the shoreline for a 60-mile expanse. To explore this

theory, GLO Water Resources used GLO and Texas Water Development Board (TWDB) oil spill response models that employ a petroleum product that best mimics bacteria transport in marine waters. TWDB staff modeled numerous scenarios but none of the results showed contaminants spreading from single source(s) and then encompassing a vast area of coastline.

On their own, elevated Enterococci levels receded four months later in September 2019 after peak beach visitation ended. Through the process of elimination and analysis of all available information, only one type of source was left as potentially viable – even if it has never been observed before in Texas. It was determined that the likely sources of the contaminants were cumulative impacts from a subset of the 60,000+ on-site septic facilities or septic systems, many of which are located in close proximity to beaches. Soon after this event, GLO partnered with the Harte Research Institute for Gulf of Mexico Studies (HRI) at Texas A&M Corpus Christi (TAMUCC) and published the first of its kind long-term trends study in Marine Pollution Bulletin in 2021. Although some beaches showed remarkably fantastic water quality for contact recreation, other areas did not. Overall, FIB trends increased over time at all monitored areas except Cameron County. Cameron County beaches showed slight reductions of bacteria over time.

Texas Beach Watch field staff and GLO pause for a group photo during their annual training refresher

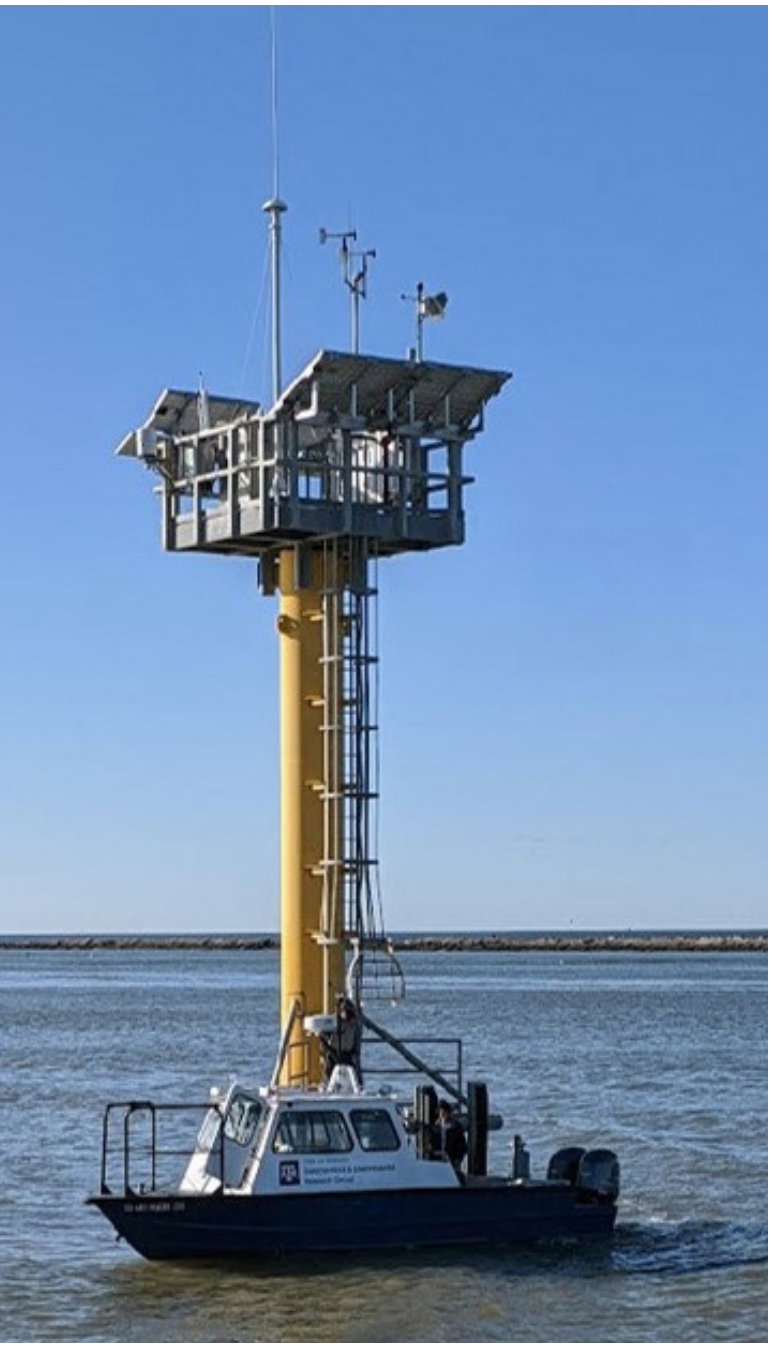
Teams of Teams

On the heels of the 2021 study, Clean Coast Texas received feedback from discussions with coastal community managers that highlighted waste treatment and bacteria issues in their areas. Based on this feedback, GLO Water Resources took steps to utilize coastal partnerships to enhance their understanding of the driving forces causing elevated FIB levels and to characterize the who-what-why-when-wherehow questions.

Dr. Dorina Murgulet, Associate Professor of Hydrogeology at TAMUCC's Center for Water Supply Study and 2021 study collaborator, formed a multi-disciplinary team consisting of microbiologists, chemists, hydrogeologists, and others and received a CMP Project of Special Merit grant. The preliminary results of the ongoing project are novel for Texas and provide insights into the dynamic connections between nearshore septic systems, groundwater, and Gulf beaches.

Beach Watch began collaborating with two scientific teams headed by (1) Dr. Anish Jantrania, Associate Professor at Texas A&M University's Department of Biological and Agricultural Engineering; and (2) Dr. Jeff Brady, Assistant Professor at Texas A&M University's Department of Soil and Crop Sciences. Both teams' research target Galveston, Brazoria, Matagorda, and Nueces counties. Aware that Beach Watch sampling days and times do not always occur during peak contact recreation times, researchers have pursued enhanced data analysis to reduce FIB loading and beach advisories. Their research focuses on bacteria source tracking, enhanced data mining and analysis, connectivity to waste conveyance infrastructure, and identifying longterm bacteria "hot spots". Preliminary results continue to be refined, though the analyses have located specific areas of interest. Interestingly, the initial investigation recently identified a probable concentrated bacteria outflow at a popular Gulf beach. Although this research is ongoing, these efforts highlight the difficulty of identifying bacteria sources due to the millions of confounding variables impacting beach contact recreational water quality.

The Clean Coast Texas program has partnered with Texas State University's Meadows Center, AgriLife's Texas Community Watershed Partners, and Texas Sea Grant. This team brings extensive expertise in green stormwater infrastructure, local ordinance development, NPS management, and community engagement. Team resources are being utilized to translate complex scientific findings into usable information that could lead to action at the local level.



Texas Coastal Ocean Observation Network data station located in the Freeport Channel

Tying It All Together:
GLO Water Resources programs at-a-glance

On-going:

Conducting routine TCOON and Beach Watch data collection operations; Clean Coast Texas conducting community engagement

Annually:

Conducting systematic data analysis

If warranted:

Conduct bacteria source tracking studies and related analysis

In progress:

GLO and Clean Coast Texas community engagement, site investigation, and problem solving to reduce pollutants along the Texas coast

Desired outcomes:

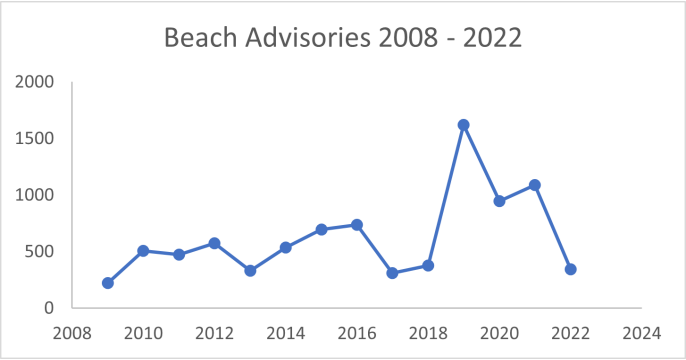
Resilient coastal economies through reduced bacteria loading, beach advisories, shellfish closures, and improved quality for contact recreation and ecosystems

The Texas coast attracts many new residents and visitors. A recently published long-term trends study shows that fecal indicator bacteria are increasing over time and with population growth.

Epilogue – The Future of Texas Beach Watch

All GLO's Water Resources programs share a common goal – to see less bacteria loading and pathogens, fewer beach advisories, and a more resilient blue coastal economy. Texas Beach Watch is proud to be a leader in Texas and the nation for demonstrating how to bring holistic watershed-based perspectives to resolve real-world problems. To this end, GLO Water Resources is constantly looking at how Beach Watch can be improved by using cutting edge research and actionable science-based information. Over the coming year, Beach Watch has several exciting initiatives to help refine the program to meet the needs of Texas coastal communities.

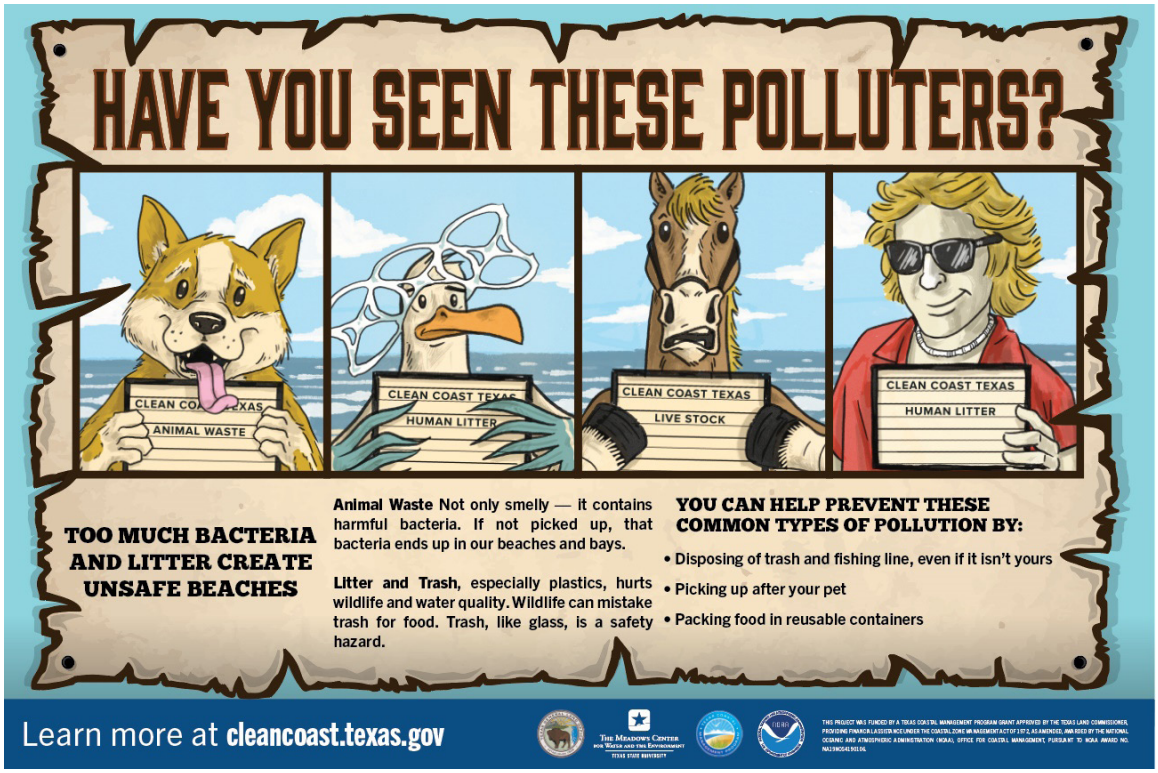
Beach Watch staff have been working on modernizing program operations, data management systems, notification systems, and a public facing data viewer. This effort started three years ago with the seeking and obtaining of funding. The program's supporting technology will be updated to modern standards and will include new amenities and services for stakeholders who access data and the dataviewer. The anticipated release date of the new system is 2024.



The program has also been investigating new fecal indicators, such as qPCR, digital qPCR, and other DNA-based methods to obtain more rapid and accurate beach advisory information. While promising, these methods bring higher costs, limitations due to technology transfer with current coastal practitioners and expertise, and limitations for data use by the State's annual 305b and 303d water quality use attainability assessments. There could be a limited, targeted use of these applications in the coming years, but no determinations have been made yet.

The future is now! Earlier this year, Beach Watch launched an artificial intelligence (AI)-driven beach bacteria predictor/ forecaster project, with HRI's extraordinaire Felimon Gayanilo leading the effort. In the pilot project, Beach Watch is testing AI's capabilities of making accurate predictions of beach water quality. Results will be ready to share in 2024. Additionally, a public beach use survey project will start in summer 2023. This project will survey Texas beaches to determine where the busiest public beaches are located. This information will be used to fine-tune the Beach Watch monitoring program sampling locations and to make sure peak use beaches are being sampled.

Texas Beach Watch has been criticized by a few stakeholders regarding the day of the week and timing of sampling, as well as the Enterococci FIB used by the program. There is always



Clean Coast Texas sign to engage the public in learning about coastal water quality

room for improvement but there are also real-world limitations for operating a coastwide network of 172+ monitoring stations that span 367 miles of Texas beaches. Implementation of new methods and weekend sampling may occur in the future, but fiscal and technological limitations are constraining expansion of services. If Beach Watch expands now, the geospatial and temporal coverage would shrink the network by 20%. Given these limitations, the program has expanded its data analysis services, as noted above. This shift in strategy is already providing key insights to priority FIB issues needing to be addressed. Recent in-depth analysis identified a popular beach segment with long-term elevated FIB and a follow up GLO investigation found a "hot spot" and unattributed outfall to a Gulf beach. That investigation continues.

A Final Comment

Imagine yourself living in a Texas coastal community 25 or 50 years from now. You might look back to 2023 and reminisce about the vast open space and undeveloped areas of our Coastal Zone in wonderment. We are fortunate that Texas does not suffer from chronic harmful algal blooms, long-lasting hypoxia events, or extensive beach advisories. Generally, Texas has good water quality in the Coastal Zone. True, this is due to some of our communities' management practices and policies, but the real benefactor is likely the immense ecosystem services and "filtering" ability provided by the land that is still in its natural state, somewhat undisturbed. People love the Texas coast, and our coastal communities will continue to grow over time. The story revealed from the resulting land use change will be self-evident through our coastal streams, wetlands, bays, and beaches. GLO Water Resources aims to seize this opportunity to create more meaningful science and dialogue and collectively act to ensure future Texas generations have the same wonderful water quality, aesthetics, and quality of life that is enjoyed today. Through collaboration and teamwork, anything is possible!

To get involved with the GLO's Water Resources programs, contact Jason Pinchback (Jason.pinchback@glo.texas.gov).

THANK YOU TO
THE TEAMS OF TEAMS
WHO MAKE THIS WORK POSSIBLE:

Lucy Flores who works tirelessly to operate Beach Watch, TCOON, and too many other aspects to include; David Green, Angie Sunley, Natalie Bell, and Julie McEntire who provide excellent leadership and vision for Coastal Resources; CMP staff Jessica Chappell, Meghan Martinez, Jacquelyn Boutwell, Melissa McCutcheon and Andrea Walmus; Beach Watch field techs and lab staff Jon Burns, Mark Ruiz, Christian Laffey Katie Wilson, Jennifer Robertson, Ronnie Schultz, Hudson Deyoe, Bert Presas, Maria Infante, Shelby Bessette, Angela Flores, Stephanie Rivera, Raymond Martinez, Andrea Ferry, Arthur Nguyen, Rachel Rios, Valerie Requenez, Susan Cogar-Daniels, Daniel Bowen, Wendy Wilson, Cassie Tarron, Jessica Baggett, Chris Wirzberg, Tiffany Bush, Justin Marion, Tracy Taylor, and Lou Galusha who meticulously follow quality controls measures thousands of times each year; Anish Jantrania, Gabrielle Bonatti, Terry Gentry, Karalee Corbeil, Ben Klein, Jeff Brady, Stephanie Brady, Kristin Sefcik, Dave Felix, Cody Lopez, Nicole Powers, and Mike Wetz whose analysis deciphers the complex; Tom Hegemier; Charriss York, Celina Lowry, Ashley Bennis, Christina Lopez, Nick Dornak, Jenna Walker; GLO staff Allison Fischer, Tara Whittle, Laura Wisdom, Adrian Loucks, Amy Nunez, Rene Garcia, Gloria Maynard, Johanna Volente, Brian De Santi, Brent Koza, Santana Ramirez, Mark Choo, Lance Plumer, Derek Klein, Ashley Hall, David Gibbs, Ramiro Alaniz, Kevin Truong, Carrie Wofford, Haley Kaul, Christie Vanhorn, Sean Peterson, Amanda Grantham, Paul Russell, Dylan Coover, Nikki Johnson, Christopher Weiland, and GLO IT, Jeff Perkins, Mark Conway and the Geospatial team; Lance White, Clay Sebeck, Katie Lawrence, Shelia Kirk, Linh Phan, Jeff Caudle, Jamone Fields, Jesse Ruiz, Edward Orozco, Gabriela Johnson, Roland Torres, Eric Perales, Julie Neaville the amazing Todd Running and his great team, and Brian Sims may he rest in peace; Caimee Schoenbaechler and her remarkable team of scientists; and the extensive network of coastal managers and leaders who's efforts are never ending, on-going, and always needed to solve issues and build resilient communities for tomorrow's prosperity...**THANK YOU!**