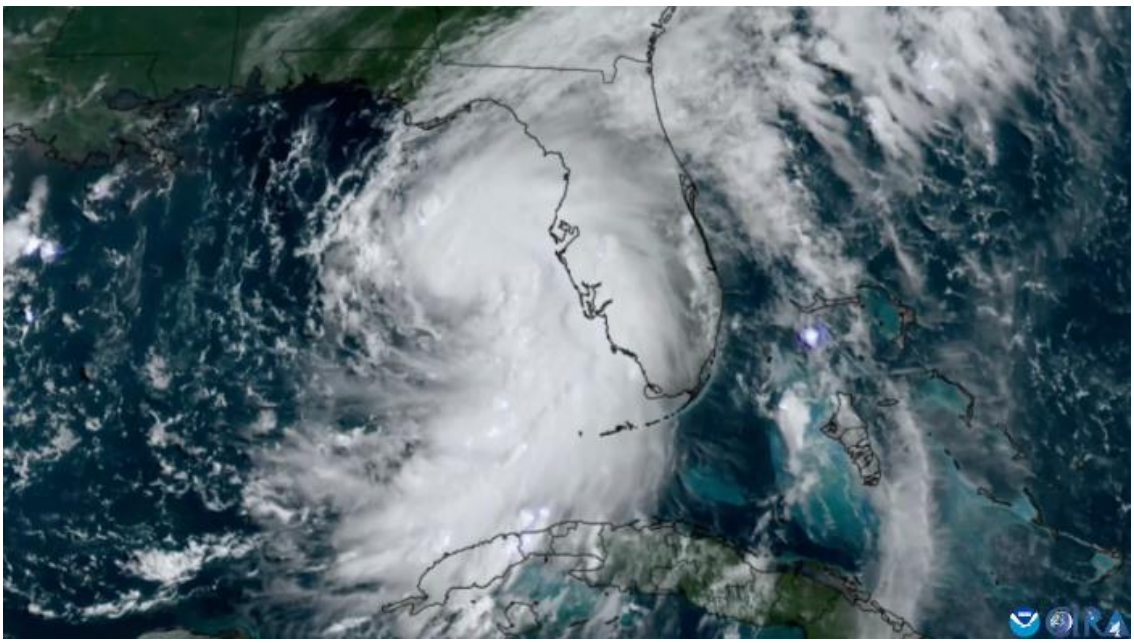
MOTE MARINE LABORATORY & AQUARIUM

Mote Marine Laboratory's Post-Debby Analysis: Multidisciplinary findings one month after the storm



CREDIT: NOAA
More photos and videos can be found here.

Tropical Storm Debby's recent passage through the Gulf of Mexico had a significant ecological impact on Sarasota Bay and the associated coastal environment. However, the question remains as to whether the immediate impacts over days to weeks will have longer-term ramifications for these ecosystems over months to years. Mote Marine Laboratory is committed to utilizing advanced technology and science, coupled with community engagement via volunteer citizen scientists, to serve at the forefront of assessing the storm's effects.

Water Quality Impact

Mote has, for decades, conducted comprehensive water sampling throughout Sarasota Bay through the National Environmental Laboratory Accreditation Program. As a result, it was able to implement rapid response water quality sampling to assess Tropical Storm (TS) Debby's impact on the bay's delicate ecosystem. Initial analyses have revealed the following key findings of immediate water quality impact:

- **Turbidity and Water Color:** Measurements of turbidity and true color of Bay waters were elevated. Elevated true color indicates an increase in substances such as dissolved organic matter in water, while elevated turbidity indicates increased particulate matter in the water—both of which were likely caused by massive amounts of stormwater resulting from the intense rainfall of TS Debby in the Sarasota Bay watershed. Elevated turbidity and true color led directly to reduced penetration of sunlight (light attenuation) into Bay waters.
- **Nitrate and Ammonia Concentrations:** Post-TS Debby, Mote scientists recorded a significant spike in Sarasota Bay concentrations of nitrate and ammonia, which may serve as an increased source of nutrients for aquatic bacteria and algae.
- **Dissolved Oxygen Concentrations:** Mote water samples immediately following the storm also indicated a drop in dissolved oxygen levels at certain sites in Sarasota Bay. Dissolved oxygen fell below 3 mg/L, which is dangerously low, in North Sarasota Bay and near Stickney Point Bridge.

"Storm events like Debby can have profound effects on our coastal environments," said Dr. Emily Hall, Manager of Mote's Ocean Acidification and Chemical and Physical Ecology Research Programs. "These preliminary findings suggest that the storm has had a significant impact on water quality in Sarasota Bay. We are particularly concerned about the high nutrient and low dissolved oxygen concentrations, which could have serious implications for marine life in the affected areas."

What This Impact Means

Higher than normal nitrate and ammonia concentrations may lead to increased bacteria and algal blooms that can make the water murky and potentially lead to low oxygen concentrations in specific locations. If any potential bacteria and/or algae blooms are composed of toxin-producing species, such toxins may harm marine life and potentially pose health risks to humans and pets who come into contact with the water.

Reduced light attenuation can be problematic for benthic organisms like seagrass, which require sunlight for growth. When bacteria levels are also high, the breakdown of organic matter uses up oxygen, releases carbon dioxide (reducing pH), and releases nutrients into the water. The combination of low pH, elevated nutrients, and low oxygen concentrations can disrupt the balance of the ecosystem and further stress marine life. Dissolved oxygen is vital for fish and other aquatic life to survive. When oxygen levels are as low as some Mote water samples indicate, it can stress or even kill marine life, which could lead to fish die-offs and other ecological impacts.

Mote's Beach Conditions Reporting System (BCRS) engages community members in scientific observation and is a valuable tool for communicating the presence of dead fish, respiratory irritation, water color, and wind direction at over 100 coastal sites in Florida, as well as in each state from South Carolina to Texas, plus California. BCRS

(visitbeaches.org) is a free downloadable application that allows the public to view coastal conditions reports submitted by trained volunteers, and users can also contribute their own observations through the Community Science Portal on the BCRS. During the week following TS Debby, BCRS observations for individual sites in the Sarasota Bay area reported an increase from 0-2 dead fish observed at a site to over 2 dead fish per site. However, reports of dead fish declined back to 0-2 observations per site after that time. Overall, prior to TS Debby, only 6 BCRS sites in Sarasota County reported dead fish, while 31 BCRS sites in Sarasota County reported dead fish following TS Debby.

Mote will continue to monitor and analyze the water quality in Sarasota Bay utilizing advanced technologies, nationally certified laboratory analyses of water samples, and the engagement of BCRS volunteer citizen scientists. Long-term water quality analyses will be vital for elucidating the storm's full impact and guiding any necessary mitigation efforts.

Sea Turtle Nesting Impact

In addition to its impact on water quality, TS Debby significantly affected sea turtle nests that were still active in the area. Before TS Debby's arrival, Mote's Sea Turtle Patrol had documented 4,353 nests along Sarasota County's beaches, with 2,958 still active. The storm's powerful waves and high tides led to the overwash and washout of many of the still active nests. It is estimated that 79% of the 2,332 still active nests were impacted to varying degrees, with a total washout presumed on 1,231 nests (42%). As of the end of August, 1,131 active nests remain on the beach.

"Tropical Storm Debby was initially tracking to miss Sarasota, but storm surge from the right side of the storm was the main concern for nests. Debby was expected to bring 3-5 ft of storm surge and, coupled with the new moon, tidal influence would be higher. Each storm is different, but the data from NOAA suggested a significant impact for the beaches in the region, regardless of storm severity," said Dr. Jake Lasala, Staff Scientist & Program Manager of Mote's Sea Turtle Conservation & Research Program.

Surge from the storm changed the beach profiles, including adding sand to some areas (accretion). Nests remaining after the storm that do hatch may have to dig out from deeper nests. Despite these setbacks, Mote remains hopeful that some of the temperature data loggers buried with the remaining research nests can be recovered, potentially providing valuable insights into the storm's impact on incubation conditions. In addition, Mote's weather stations persevered through the storm and continued to provide pertinent data for the team.

"Sea turtles have long navigated the challenges posed by natural events such as storms. Their evolutionary adaptations to these dynamic conditions are a testament to their enduring survival," said Melissa Macksey, Senior Biologist and Conservation Manager of Mote's Sea Turtle Conservation & Research Program. "Tropical Storm Debby is a reminder of the ongoing need to understand and protect these remarkable creatures as they continue to adapt to their ever-changing environment."

Mote Marine Laboratory's multidisciplinary science and technology approach to assessing the impact of TS Debby, combined with direct engagement of the broader community, underscores the organization's dedication to protecting Florida's coastal ecosystems. Whether through the rigorous analysis of water quality or the tireless efforts of the Sea Turtle Patrol and BCRS-trained volunteer citizen scientists, Mote remains committed to

advancing marine science for the restoration, sustainable use, and conservation of species, habitats, and ecosystems in the face of both natural and human-induced challenges.