Changes to Florida's climate threaten oyster reefs, researchers warn

August 30 2022

Credit: University of South Florida

With temperatures rising globally, cold weather extremes and freezes in Florida are diminishing—an indicator that Florida's climate is shifting from subtropical to tropical. Tropicalization has had a cascading effect

on Florida ecosystems. In Tampa Bay and along the Gulf Coast, University of South Florida researchers found evidence of homogenization of estuarine ecosystems.

While conducting fieldwork in Tampa Bay, lead author Stephen Hesterberg, a recent graduate of USF's integrative biology doctoral program, noticed mangroves were overtaking most oyster reefs—a change that threatens species dependent on oyster reef habitats. That includes the American oystercatcher, a bird that the Florida Fish and Wildlife Conservation Commission has already classified as "threatened."

Working alongside doctoral student Kendal Jackson and Susan Bell, distinguished university professor of integrative biology, Hesterberg explored how many mangrove islands were previously oyster reefs and the cause of the habitat conversion.

The interdisciplinary USF team found the decrease in freezes allowed mangrove islands to replace the previously dominant salt marsh vegetation. For centuries in Tampa Bay, remnant shorelines and shallow coastal waters supported typical subtropical marine habitats, such as salt marshes, seagrass beds, oyster reefs and mud flats. When mangroves along the shoreline replaced the salt marsh vegetation, they abruptly took over oyster reef habitats that existed for centuries.

"Rapid global change is now a constant, but the extent to which ecosystems will change and what exactly the future will look like in a warmer world is still unclear," Hesterberg said. "Our research gives a glimpse of what our subtropical estuaries might look like as they become increasingly 'tropical' with climate change."

The study, published in the *Proceedings of the National Academy of Sciences*, shows how climate-driven changes in one ecosystem can lead to

shifts in another.

Documenting a mangrove overtaking an oyster reef in Tampa Bay. Credit: University of South Florida

Using aerial images from 1938 to 2020, the team found 83% of tracked oyster reefs in Tampa Bay fully converted to mangrove islands and the rate of conversion accelerated throughout the 20th century. After 1986, Tampa Bay experienced a noticeable decrease in freezes—a factor that previously would kill mangroves naturally.

"As we change our climate, we see evidence of tropicalization—areas that once had temperate types of organisms and environments are becoming more tropical in nature," Bell said. She said this study provides a unique opportunity to examine changes in adjacent coastal ecosystems and generate predictions of future oyster reef conversions.

While the transition to mangrove islands is well-advanced in the Tampa Bay estuary and estuaries to the south, Bell said Florida ecosystem managers in northern coastal settings will face tropicalization within decades.

"The outcome from this study poses an interesting predicament for coastal managers, as both oyster reefs and mangrove habitats are considered important foundation species in estuaries," Bell said.

Oyster reefs improve water quality and simultaneously provide coastal protection by reducing the impact of waves. Although mangroves also provide benefits, such as habitat for birds and carbon sequestration, other ecosystem functions unique to oyster reefs will diminish or be lost altogether as reefs transition to mangrove islands. Loss of oyster reef habitats will directly threaten wild oyster fisheries and reef-dependent species.

Although tropicalization will make it increasingly difficult to maintain oyster reefs, human intervention through reef restoration or active removal of mangrove seedlings could slow or prevent homogenization of subtropical landscapes—allowing both oyster reefs and mangrove tidal

wetlands to co-exist.

Hesterberg plans to continue examining the implications of such habitat transition on shellfisheries in his new role as executive director of the Gulf Shellfish Institute, a non-profit scientific research organization. He is expanding his research to investigate how to design oyster reef restoration that will prolong ecosystem lifespan or avoid mangrove conversion altogether.

More information: Stephen G. Hesterberg et al, Climate drives coupled regime shifts across subtropical estuarine ecosystems, *Proceedings of the National Academy of Sciences* (2022). DOI: 10.1073/pnas.2121654119

Provided by University of South Florida