

# Going 'back to the future' to forecast the fate of a dead Florida coral reef

March 28 2024

---



A closeup of a well-preserved Late Holocene hard pillar coral (*Dendrogyra cylindrus*), now genetically extinct along the Florida reef tract due to a disease outbreak in 2014. Credit: Florida Atlantic University

Rising temperatures and disease outbreaks are decimating coral reefs

throughout the tropics. Evidence suggests that higher latitude marine environments may provide crucial refuges for many at-risk, temperature-sensitive coral species. However, how coral populations expand into new areas and sustain themselves over time is constrained by the limited scope of modern observations.

What can thousands of years of history tell us about what lies ahead for coral reef communities? A lot. In a new study, Florida Atlantic University researchers and collaborators provide geological insights into coral range expansions by reconstructing the composition of a Late Holocene-aged subfossil coral death assemblage in an unusual location in Southeast Florida and comparing it to modern reefs throughout the region.

Located off one of the most densely populated and urbanized coastlines in the continental United States, the Late Holocene coral death assemblage known as "Pompano Ridge" records a northward range expansion of tropical coral communities that occurred during a period of regional climate warming more than 2,000 years ago.

Could this happen again in the face of climate change? Going "back to the future," this study offers a unique glimpse into what was once a vibrant coral reef assemblage and explores if history can repeat itself.

Results of the study, published in the journal [\*Communications Earth & Environment\*](#), reveal significant differences in coral composition between Late Holocene and modern assemblages, suggesting that ongoing environmental stressors that were not present during the Late Holocene will likely limit the ability of modern higher latitude reefs in Florida to function as long-term climate refuges

"Today's [environmental conditions](#) and ecology have substantially deviated from long-term Holocene baselines that occurred over

millennial timescales," said Anton E. Oleinik, Ph.D., co-author and an associate professor of geology, Department of Geosciences, FAU Charles E. Schmidt College of Science.

"Based on the findings from our study, we are not overly optimistic that Florida's subtropical reefs will be able to support range expansions of reef-building coral species reminiscent of the Late Holocene any time soon."

Findings show that Late Holocene coral assemblages were dominated by now critically endangered *Acropora* species (stony coral) between 1,800 and 3,500 years ago, mirroring classic zonation patterns characteristic of healthy pre-1970s Caribbean reefs.

"What's really remarkable is that we didn't find these subfossil corals in the middle of the Caribbean like Belize or Bonaire. We found them right here in South Florida well beyond their present-day core range," said Alexander B. Modys, Ph.D., first author and a recent doctoral graduate in FAU's Department of Geosciences. "What existed here thousands of years ago is similar to what we would have seen in Jamaica in the 1950s and 1960s."



Anton Oleinik, Ph.D., (left) holds a well-preserved subfossil of a Late Holocene hard pillar coral (*Dendrogyra cylindrus*), now genetically extinct along the Florida reef tract due to a disease outbreak in 2014, and Alex Modys, Ph.D., holds a Late Holocene subfossil of an elkhorn coral (*Acropora palmata*). Credit: Florida Atlantic University

In contrast, the modern reefs off Southeast Florida are becoming increasingly dominated by stress-tolerant species like *Porites astreoides* (mustard hill coral) and *Siderastrea siderea* (round starlet coral), partly due to their resistance to thermal stress, sedimentation, and, more recently, stony coral tissue loss disease.

Researchers conducted surveys along 16 transects across the full extent of the coral rubble zone in the study area and identified 21 unique coral groups. To determine how current assemblages at the study site compared with the Late Holocene assemblages, they collected live coral abundance data along the same 16 transects in the summer and fall of 2018.

They also compared the composition of the Late Holocene assemblages to publicly available data for the entire reef tract off Southeast Florida from the Southeast Florida Coral Reef Evaluation and Monitoring program, allowing for a comprehensive analysis that spans the full extent of the region's coral communities.

A total of 1,949 coral skeletons were identified and qualitatively evaluated based on their overall preservation in terms of abrasion, presence of original corallite material, and encruster communities. Researchers used Uranium-Thorium dating to determine their age, which ranged from 900 to 4,500 years old.



Alex Modys, Ph.D., diving at the coral death assemblage in Pompano Ridge digging up a subfossil coral is *Orbicella annularis*.. Credit: Anton Oleinik, Ph.D., Florida Atlantic University



The Late Holocene coral death assemblage in Pompano Ridge. Credit: Alex Modys, Ph.D.

Subfossil samples included well-preserved Late Holocene-aged elkhorn coral (*A. palmata*), which made up nearly 50 percent of the samples, mountainous star coral (*Orbicella* spp.) and pillar coral (*Dendrogyra cylindrus*), a hard coral that is now genetically extinct along the Florida reef tract due to a disease outbreak in 2014.

The author's research suggests Southeast Florida could offer a haven for corals that are being devastated by climate warming in the tropics. However, they caution that the range expansions observed in the past are unlikely to happen today without direct human intervention.

"The rapid decline of southern source populations and the added anthropogenic stressors that weren't present during the Holocene are likely inhibiting the natural expansion of tropical corals we'd expect to see with climate warming," said Modys. "They aren't going to get there on their own, so more aggressive conservation strategies like assisted migration may be needed."

The Late Holocene record from Pompano Ridge provides a foundation for not only identifying areas that could serve as critical climate refuges for corals in the future but also for developing comprehensive restoration and management strategies that aim to replicate the successful ecological attributes of historical coral communities, ensuring their long-term sustainability. However, climate change remains a major obstacle even on higher latitude reefs.

"It is important to emphasize that the long-term sustainability of these restoration activities will ultimately depend on the rate and magnitude of present-day climate warming," said Oleinik. "If climate warming continues at its present rate, it will become too warm even at historically cooler, higher latitude locations like Southeast Florida, and sadly, these restoration programs won't be enough."

**More information:** Alexander B. Modys et al, Modern coral range expansion off southeast Florida falls short of Late Holocene baseline, *Communications Earth & Environment* (2024). [DOI: 10.1038/s43247-024-01283-0](https://doi.org/10.1038/s43247-024-01283-0)

Provided by Florida Atlantic University



Citation: Going 'back to the future' to forecast the fate of a dead Florida coral reef (2024, March 28) retrieved 27 April 2024 from <https://phys.org/news/2024-03-future-fate-dead-florida-coral.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.