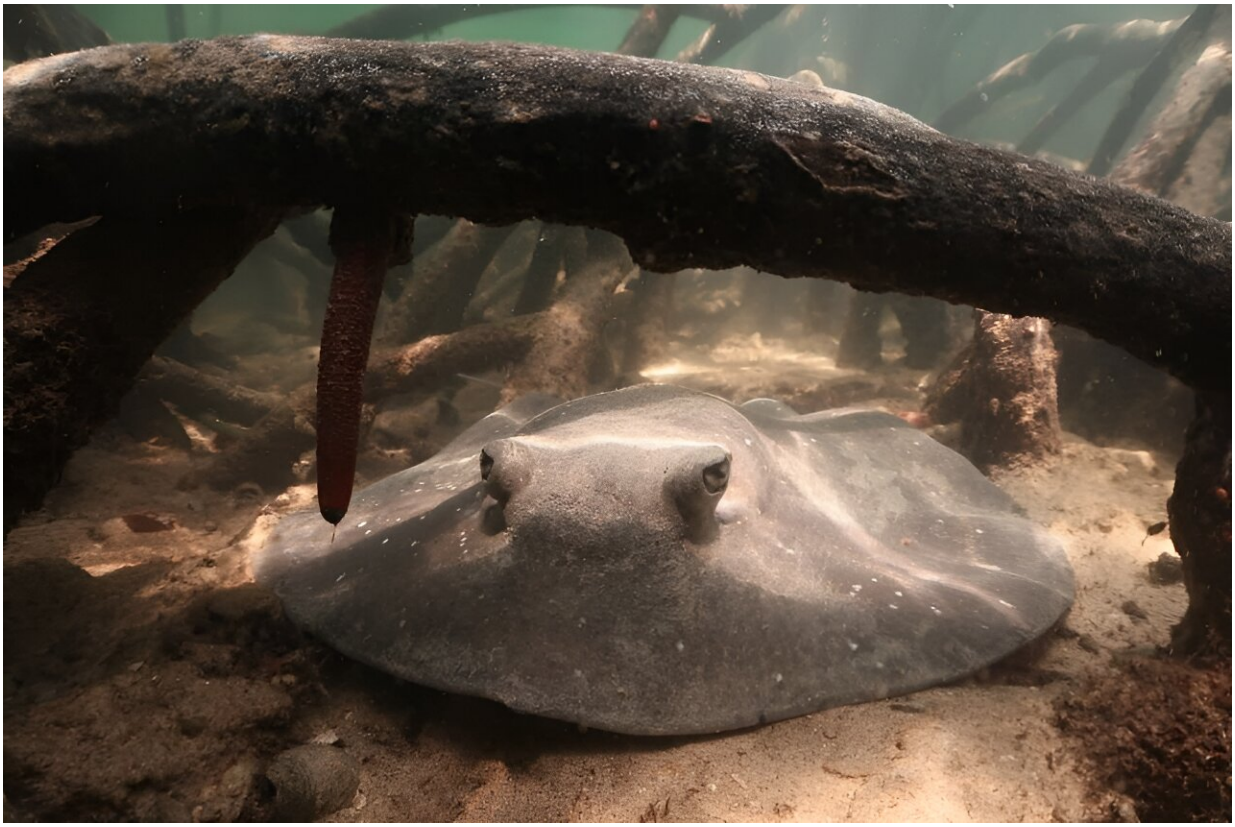
'Sauna' mangrove sanctuaries pose risk for stingrays

August 29 2024



A mangrove whipray in the mangroves in Pioneer Bay off Orpheus Island. Credit: Colin Simpfendorfer

A new study from James Cook University has revealed that mangrove habitats may serve as temporary sanctuaries for stingrays, but scientists

fear the "saunas" could become too hot to handle with climate change accelerating. The study is published in the *Journal of Thermal Biology*.

JCU scientists have discovered that juvenile mangrove whiprays in Orpheus Island's Pioneer Bay are actively selecting temperature zones within mangroves that range between 24°C and 37°C, even as the surrounding waters fluctuate dramatically from about 21°C to 43°C.

"The great thing about this project is that we were able to get some really high-resolution temperature data, not just from the environment, but we also tracked the body temperatures of the rays themselves," said Dr. Jodie Rummer, Professor of Marine Biology at JCU. "The rays showed thermotaxic behavior, meaning they are deliberately choosing the temperature at which they wanted to reside."

The findings shed light on the underappreciated role mangroves play as critical habitats for various species of sharks, rays, and other marine species. However, Prof Rummer cautioned that these coastal ecosystems may not be safe havens for much longer.

"We know that sharks and rays are already considered one of the most threatened groups of animals in the ocean," she said. "By relying on coastal habitats, like mangroves, they are even more in jeopardy due to human interaction and development. With climate change driving up temperatures, these shallow, extremely productive areas could become dangerously warm during heat waves with dramatic impacts on oxygen and pH levels."

To understand how these rays cope with such extreme conditions, the research team attached temperature tags to juvenile mangrove whiprays to track their preferred thermal ranges and compared those temperatures to recorded temperatures within the mangrove.

The team also analyzed 12 juvenile mangrove whiprays at the Orpheus Island Research Station, where they tested the rays' temperature tolerance and oxygen uptake rates at different temperatures.

"We expected that, like most cold-blooded animals, such as other fish species, the rays would require more oxygen at higher temperatures because they are burning more calories as their bodies become hotter," said University of British Columbia Postdoctoral Fellow Dr. Ian Bouyoucos, who co-led the study.

"But, to our surprise, the rays' oxygen uptake rates didn't increase as the water warmed. This suggests that these rays have adapted to regulate their metabolism in a way that conserves energy, even in their already warm environment."

Dr. Bouyoucos and the team also found that while mangrove whiprays have a poor tolerance for cold temperatures compared to other species of rays, they exhibit complex thermal preferences in different habitats.

"In their 'namesake' habitat, the mangroves, whiprays spend most of their time at their average body temperature, but on reef flats, they sought out either warmer or cooler temperatures, possibly to optimize physiological processes like digestion," he said.

While the juvenile whiprays' ability to cope with high temperature environments is promising, Dr. Rummer warned that the species' long generation times may prevent them from evolving quickly enough to keep up with the rapid pace of climate change.

"Sharks and rays take many years, even decades, to go through even just a couple generations," Dr. Rummer said.

"This means that the genetic adaptations—changes in DNA—necessary

to survive in changing environments happen very slowly. With the rate at which we humans are altering their habitats, they may not be able to adapt quickly enough," she said. "That's what is really alarming. Their basic biology puts them at a disadvantage—they simply don't reproduce fast enough to keep pace with these environmental changes."

Looking ahead, Prof Rummer and her team plan to expand their research to other mangrove estuaries to see if juvenile whiprays elsewhere exhibit similar thermal preferences, offering broader insights into the species' resilience.

More information: Emily Higgins et al, How hot is too hot? Thermal tolerance, performance, and preference in juvenile mangrove whiprays, Urogymnus granulatus, *Journal of Thermal Biology* (2024). DOI: 10.1016/j.jtherbio.2024.103943

Provided by James Cook University