

Spawning coral monitored for effects of climate change

As waters warm, researchers keep a wary eye on reef life cycles.

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The divers' lights pierce the night-time darkness 18 metres below the rolling waves of the Gulf of Mexico. As the beams pan across a coral reef, they illuminate whitish spheres nestled in the pale yellow ridges of female coral mounds. Triggered by some unknown signal, these eggs start to rise, a few at a time, like little helium balloons. Male corals nearby begin to release sperm, which resembles drifting smoke, or milk stirred into black coffee. Dispersed by currents, the gametes gradually ascend towards a reproductive rendezvous at the surface.

"It's a marvellous sight of nature that most people will never see," says Larry McKinney, director of the Harte Research Institute for Gulf of Mexico Studies in Corpus Christi, Texas. McKinney was part of a team of scientists who spent four nights last week scuba-diving and observing the annual coral spawning at the Flower Garden Banks National Marine Sanctuary, located in the Gulf about 175 kilometres southeast of Galveston, Texas.

For McKinney, the event is not only a natural wonder, but also a key indicator of reef health. "Spawning events are sort of the canary in the coal mine for reefs," he says. Environmental stressors that can affect spawning include overfishing and coastal development and — to a degree that has become an increasing concern in the Gulf — water temperature.

Sexual reproduction through spawning is also crucial to reef health in a more long term sense, says Peter Vize, a biologist at the University of Calgary in Canada, because it mixes up genes to produce combinations that may help corals to adapt to climate change. Vize has studied spawning at the sanctuary, but was not present for this year's event. "If pollution or other elements, including higher than normal water temperatures, stopped corals from spawning, no new genetic diversity would be generated," he says.

In hot water

The 21 species of reef-building coral living in the sanctuary, which make up the most northerly reefs in North America, are adapted to live in sea water at temperatures of 20–30 °C. But in recent years, the waters of the Gulf have been experiencing above-average temperatures with increasing frequency.

If the waters get above 30 °C for much of the season, corals may 'bleach', expelling the symbiotic algae that give them their colour. Bleached corals can recover if conditions return to normal fairly quickly, but otherwise they die.

On 2 August, just before this year's spawn, the US National Oceanic and Atmospheric Administration reported higher than normal water temperatures in the Gulf and issued a coral-bleaching warning for the sanctuary. Sure enough, during last week's dives, surface temperatures ranged from 30.2 °C to 30.5 °C.

Apart from the bleaching, no one is quite sure how warming in the Gulf will affect the spawning. Water temperature is known to be among the environmental signals that influence the exact timing of the event, but researchers have yet to tease out how various triggers — which also include the phase of the Moon and diurnal cycles — operate and interrelate. "It's possible higher water temperatures could shift or disrupt the spawn," says McKinney.

Moonlight magic

Predicting the time of spawning was tricky this year, says Emma Hickerson, research coordinator at the Flower Garden Banks sanctuary. Spawning occurs between seven and ten days after the first full Moon in August, but this year the full Moon fell between 1 and 2 August, so Hickerson had to make a judgement call on which day to start the count.

"In general, it was a decent spawning event, although a bit confused," said Hickerson afterwards. "The star and brain corals typically spawn on the same night, but the star corals went off on the eighth [night] and the brain corals primarily on the ninth."

Observers commented that the spawning was not as prolific as it has been in previous years. On some occasions, the sheer volume of gametes has reduced visibility in these normally clear waters to less than a metre. However, the differences this year could be within the boundaries of natural variation. And because divers can remain underwater for only an hour or so at a time, the team might have missed the period of greatest activity.

Sanctuary scientists have been monitoring the spawning since 1991. They haven't observed any significant changes over the years, but measurements have so far been qualitative rather than quantitative. However, that is set to change: Hickerson and other researchers are working with the US Naval Research Laboratory to develop the capacity to take quantitative measurements of the amount of material released. They hope to have a system in place by next year. Eventually the data will help to illuminate the impact of factors such as temperature changes on coral reproduction.

"I think the jury is still out in regards to coral spawning in warming seas," says Hickerson after the dive. With rising temperatures likely to become the new normal, much could rest on the eventual verdict.

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