New study showed spawning frequency regulates species population networks on coral reefs

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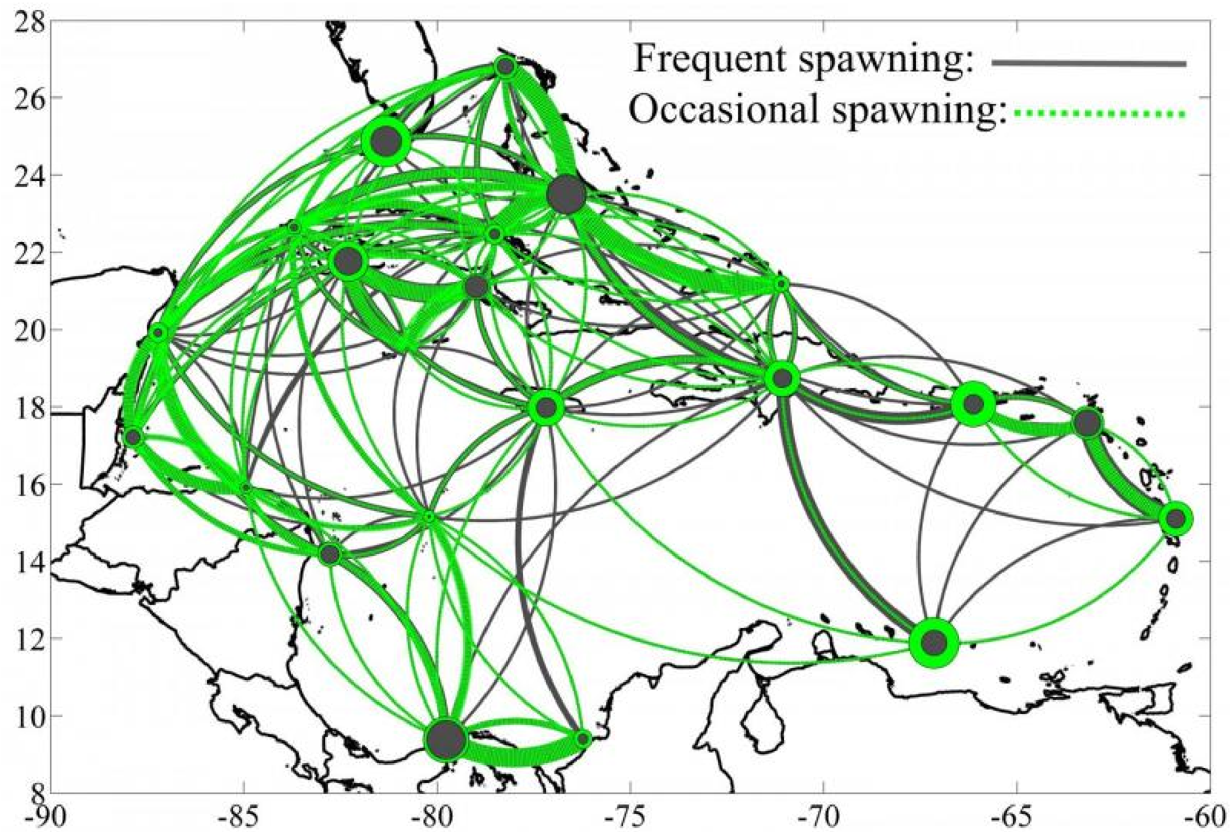

The larval connectivity network of the bicolor damselfish (Stegastes partitus) shows that spawning more often (gray lines) increases dispersion and in some routes, even strengthens the connections (direction of connectivity is clockwise). However, connectivity nodes (circles) become more central in keeping the integrity of the network when spawning is less frequent (i.e., grey circles are generally smaller than green). Credit: Andrew Kough, Ph.D.

New research on tropical coral reef ecosystems showed that releasing larvae more often is beneficial for a species' network. The study on reproductive strategies is critical to assess the conservation of coral reef ecosystems worldwide.

Researchers from the University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science used a computer model developed by UM Rosenstiel School scientist Claire Paris, known as the Connectivity Modeling System to track larval movements of three distinct reef species - the Carribean sea plume (*Anthiellogorgia elisebeathae*), the bicolor damselfish (Stegastes partitus) and the Caribbean spiny lobster (*Panulirus argus*). The three species, which have varying larval dispersal strategies, were simulated in a dynamic natural marine system over time to determine whether dispersal was driven by environmental or biological factors for the modeled species.

Many coral reef species live on separate habitat patches on coral reefs that are linked through larval dispersal into a larger population network. As a parent population spawns, the eggs and larvae are transported in the currents from their native location to another, more distant location. This exchange of larvae by currents between geographically separated populations create a network of connections, which is known as a connectivity network. The authors suggest that the more often an animal reproduces, the greater the variability in the ocean currents that larvae can experience, and the more potential habitats that a dispersing animal could be connected to.

Juvenile bicolor damselfish (*Stegastes partitus*). Credit: Evan D'Alessandro, Ph.D.

"We found that the rate at which a species spawn drives the relatedness between distant populations," said Claire Paris, associate professor of ocean sciences at the UM Rosenstiel School. "Therefore more frequent spawning is more likely to stabilize the connectivity network."

"There is tremendous variability in how often reef animals reproduce and release eggs and larvae, yet they all find their way to coral reefs," said Andrew Kough, UM Rosenstiel School alumnus and lead author of the study. "Our study explored how changes in reproductive frequency shape an animal's connectivity network."

The researchers also found that larval behavior enhances the persistence of these network connections, when compared to passive transport by the ocean currents.

"For animals that reproduce infrequently, vertical swimming behavior during the larval stage helps control the dispersal network and is a vital part of marine ecology," said Kough.

The larval phase of a marine species is often the only time that coral reef inhabitants travel between habitat locations, an important early life history stage required to maintain healthy populations when environmental conditions fluctuate due to both natural and man-made factors.

"Our model has proved accurate enough to test important hypotheses in marine ecology, said Paris. "One hot topic has always been about the role of reproduction strategies on the structure of marine populations. We find a fine balance between spawning frequency and larval behavior in reef species."

More information: The study, titled "The influence of spawning periodicity on population connectivity," was published in the Online First section of the journal *Coral Reefs*. The co-authors are Andrew S. Kough and Claire B. Paris.

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