

## **Reproductive patterns of cold-seep mussels in the western Atlantic and Gulf of Mexico: effects of depth and detritus**

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Continuous or semi-continuous reproduction is the norm in deep-sea animals, with exceptions often relying on seasonal pulses of surface-derived phytodetritus. Chemosynthesis-based ecosystems such as cold seeps have an independent food supply and can be thought of as decoupled from the surface. However, if surface production provides a supplemental food source, then reproductive patterns in chemosynthesis-based habitats could be expected to vary across depth and region. We explored patterns in the reproduction of Bathymodiolin mussels from 14 known cold-seeps in the Gulf of Mexico and the Western Atlantic in 2014 and 2015. Collection sites for four species ranged in depth from 320 m to 3300 m. Using paraffin histology, we determined sex, maturity stage, and oocyte size (for female mussels). All species at all sites reproduced periodically and synchronously, with apparent geographic synchrony among sites. This suggests that mussels rely on a site-independent cue such as seasonal variations in phytodetrital flux to synchronize reproduction. Mature oocytes were of similar size for all species at all depths, suggesting that egg size is phylogenetically constrained. Deeper sites showed some evidence of an extended gametogenic cycle, which may be tied to lower temperatures and lower detrital food supply. Our data suggest a stronger coupling between surface production and reproduction than previously expected for chemosynthesis-based cold-seep fauna.