Title: Measuring Structural Complexity on Coral Reefs.

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Abstract: Structural complexity on coral reefs has been shown to positively influence several measures of biodiversity, and is thus an important ecological variable. The dominant field method used by reef scientists to measure structural complexity is the chain-and-tape method, which produces a measure of rugosity calculated as the ratio of contour–following vs. straight distance between two points on the reef. Expanding on this method, we developed simple and easy-to-use tools to measure rugosity at four spatial scales for a range of typical coral reef structures, and also used the data to calculate fractal dimensions at three intermediate scales. We show that measures of structural complexity change unpredictably across spatial scales, and illustrate that typical coral reef structures are too complex for any single measure to function as a comprehensive index of structure over a range of scales. This illustrates that considerations of spatial scale are important when measuring structural complexity, and that the smallest scale obtainable with current remote sensing technology and methods is not directly related to

the scale used in most studies of fish ecology. We also illustrate that the fractal dimension measure is more closely related to human intuitive perception of structural complexity than is rugosity, though we are unable to test its value in fish ecology with our current dataset. Future research will relate fish body size to the scale of reef structural complexity, and develop remote sensing-based methods to map structural complexity over large spatial extents.

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