Fractal dimension as a means of quantifying and modeling the branching complexity of the brown macroalga, *Fucus vesiculosus*, growing in different wave exposures

Nature is driven by chaotic processes that cannot be predicted. Fractal geometry is a mathematical framework that allows for the characterization of the ordered patterns resulting from chaotic processes. The fractal nature of branching in the brown macroalga, *Fucus vesiculosus*, was characterized using the chaotic process of wave exposure to which the organisms were exposed during ontogeny. The hypothesis tested was that this algal species would vary branching complexity toward more branching in high wave exposures to compensate for frequency of injury. No link was found between wave exposure and branching complexity, or genotypic frequency and branching complexity. However, fractal geometry allowed for the characterization of the branching in these complex organisms. The outcome of this study suggests that *Fucus vesiculosus* is exposed to multiple chaotic processes during ontogeny that influence its branching complexity; all of these processes cannot be measured, but the resulting patterns of chaos can be modeled.