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Mechanical Properties, Vibrational Response and Flow-Field Analysis of Staghorn Coral Skeleton, Acropora cervicornis

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Abstract : The results of studies of microstructure, mechanical behavior, vibrational response, and flow field analysis of critically endangered staghorn coral (Acropora cervicornis) skeletons are reported. The $CaCO_3$ aragonite structure of a chemically-cleaned coral skeleton of A. cervicornis was studied by optical microscopy and computer tomography. The mechanical behavior was studied using uniaxial compression and Vickers hardness technique. The average maximum stress measured during skeleton uniaxial compression was 10.7 ± 2.24 MPa and Vickers hardness was 3.56 ± 0.31 GPa. The vibrational response of the aragonite structure was studied by micro-Raman spectroscopy, which showed a substantial dependence of the structure on applied compressive stress. The flow-field around a single coral skeleton forming vortices in the wake of the moving skeleton was measured using Particle Image Velocimetry (PIV). The results are important for further analysis of time-dependent mechanical fatigue behavior and predicting the lifetime of staghorn corals.

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