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Exploring the fluid dynamics of collective pulsing behaviour in xeniid corals using the immersed boundary method

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Xeniid corals, a family of soft corals (*Alcyonacea*), include species displaying a unique pulsing behaviour. Within a colony, each individual polyp pulses by actively contracting and passively expanding eight tentacles, increasing the local mixing and enhancing nutrient and gas exchange. Using the immersed boundary method with finite elements (IBFE), we constructed a 3D model of a pulsing polyp. The motion of the polyp tentacles is based on actual motion data tracked from videos of real polyps. We find that individual polyps pull water in radially, mix it between their tentacles, and expel the fluid volume in an upward jet. After validating this 3D IBFE model against experimentally measured flow fields, we are now using the model to numerically simulate small groups of polyps and to quantify the effects of collective pulsing behaviour on the local fluid dynamics. Here, we simulate pairs of polyps and vary the pulsing patterns (in-phase and different degrees of out-of-phase) and distance between polyps to better understand how differences in collective pulsing behaviour affect local flow and mixing.

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