

Abstract Submitted
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Spatial organization and Synchronization in collective swimming of *Hemigrammus bleheri*¹ INTESA AF ASHRAF, THANH-TUNG HA, RAMIRO GODOY-DIANA, BENJAMIN THIRIA, PMMH, CNRS, PSL-ESPCI, Paris 06, Paris 07, JOSE HALLOY, BERTRAND COLLIGNON, LIED, CNRS, Paris 07, LABORATOIRE DE PHYSIQUE ET MECANIQUE DES MILIEUX HETEROGENES (PMMH) TEAM, LABORATOIRE INTERDISCIPLINAIRE DES ENERGIES DE DEMAIN (LIED) TEAM — In this work, we study the collective swimming of *Hemigrammus bleheri* fish using experiments in a shallow swimming channel. We use high-speed video recordings to track the midline kinematics and the spatial organization of fish pairs and triads. Synchronizations are characterized by observance of "out of phase" and "in phase" configurations. We show that the synchronization state is highly correlated to swimming speed. The increase in synchronization led to efficient swimming based on Strouhal number. In case of fish pairs, the collective swimming is 2D and the spatial organization is characterized by two characteristic lengths: the lateral and longitudinal separation distances between fish pairs. For fish triads, different swimming patterns or configurations are observed having three dimensional structures. We performed 3D kinematic analysis by employing 3D reconstruction using the Direct Linear Transformation (DLT). We show that fish still keep their nearest neighbor distance (NND) constant irrespective of swimming speeds and configuration. We also point out characteristic angles between neighbors, hence imposing preferred patterns. At last we will give some perspectives on spatial organization for larger population.

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