

Encadrement :

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Qualité : Postdoctorants

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Titre du stage :

Comparative study of suction inflow dynamics in two species of fish

Mots clés :

Fish morphology, suction feeding, fluid dynamics, 3D X-ray Particle Tracking Velocimetry, X- ray reconstruction of moving morphology

Résumé :

To capture prey by suction, fishes generate a high velocity flow of water entering the mouth and exiting at the back of the head. Although the hydrodynamics associated with suction feeding is prominent to catch food successfully, difficult optical access to the buccal cavity makes it still poorly understood. Here, we want to test the influence of morphology and kinematics on the inflow of water in the buccal cavity associated with suction feeding. To do so, we acquired data based on a technic called three- dimensional X- ray particle tracking velocimetry (3D XPTV), which requires the use of at least two X- ray sources and radio-opaque particles of densities close to that of the fluid medium. We specifically designed small, neutrally buoyant radio-opaque particles composed of 1.4 mm diameter polystyrene foam spheres with an insert of an X-ray absorbing metal marker. Two individuals of Carp (*Cyprinus carpio*) and two individuals of Tilapia (*Oreochromis niloticus*) were implanted with 0.35 mm diameter radio-opaque markers on the head bones in order to link the quantified water motions with skeletal kinematics, using XROMM methods. Fishes were filmed during suction and intra-oral manipulation of food and surrounding XPTV-particles. We plan to compare the suction feeding strategies and manipulation between these two species and to link the results to the ecology of the animals. The candidate must have a background in biology and an interest for 3D modelling and 3D data analyses. A knowledge in 3D softwares is not mandatory but the student must be eager to learn, motivated and well-organized. R programming background could be a plus.

Références bibliographiques :

Camp, A. L., & Brainerd, E. L. (2014). Role of axial muscles in powering mouth expansion during suction feeding in largemouth bass (*Micropterus salmoides*). *Journal of Experimental Biology*, 217(8), 1333-1345.

Seeger, A., Kertzscher, U., Affeld, K., & Wellenhofer, E. (2003). Measurement of the local velocity of the solid phase and the local solid hold-up in a three-phase flow by X-ray based particle tracking velocimetry (XPTV). *Chemical Engineering Science*, 58(9), 1721-1729.

Techniques mises en œuvre :

X-ray cineradiography, XmaLab, Avizo, Autodesk Maya, R, TecPlot.