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Aquatic prey capture in snakes: the link between morphology, behavior and hydrodynamics[1] MARION SEGALL, PMMH (ESPCI/CNRS), MECADEV (MNHN/CNRS), ANTHONY HERREL, MECADEV (MNHN/CNRS), RAMIRO GODOY-DIANA, PMMH (ESPCI/CNRS), FUNEVOL TEAM, PMMH TEAM — Natural selection favors animals that are the most successful in their fitness-related behaviors, such as foraging. Secondary adaptations pose the problem of re-adapting an already 'hypothetically optimized' phenotype to new constraints. When animals forage underwater, they face strong physical constraints, particularly when capturing a prey. The capture requires the predator to be fast and to generate a high acceleration to catch the prey. This involves two main constraints due to the surrounding fluid: drag and added mass. Both of these constraints are related to the shape of the animal. We experimentally explore the relationship between shape and performance in the context of an aquatic strike. As a model, we use 3D-printed snake heads of different shapes and frontal strike kinematics based on in vivo observations. By using direct force measurements, we compare the drag and added mass generated by aquatic and non-aquatic snake models during a strike. Our results show that drag is optimized in aquatic snakes. Added mass appears less important than drag for snakes during an aquatic strike. The flow features associated to the hydrodynamic forces measured allows us to propose a mechanism rendering the shape of the head of aquatic snakes well adapted to catch prey underwater.

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