

Abstract Submitted
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From Tadpoles to Trout: Scale-invariant features of optimally efficient swimming ALEXANDER WIENS, ANETTE HOSOI, Massachusetts Institute of Technology — The Strouhal number (St) was thought to be an invariant feature of efficient inertial swimming, however, recent studies by Eloy and Gazzola have shown that St actually varies throughout nature based on animal size, shape, and speed. This finding leads us to ask whether there is any truly invariant property of efficient inertial swimming. Using Lighthill's large-amplitude elongated-body theory, we show that there is. Lighthill's model predicts that efficient swimmers must tune their gait such that the unsteady motions of their body generate uniform steady thrust. Mathematically, we show that this behavior can be fully quantified through a single variable which should be constant for all inertial swimmers. Comparison with data from existing literature shows that animals ranging in size from tadpoles to trout adhere to the optimum value predicted by Lighthill's model.

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