On the observed tight range of Strouhal number (0.2<St<0.4) among the swimming species in nature

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- Flapping is the most common method of propulsion in nature.
- Flying and swimming animals share a common aspect of propulsion characterized by Strouhal number (Taylor et al. 2003, nature).
- Our focus is on swimming

\[
    St = \frac{fA}{U}
\]

- \( f \) = frequency of flapping
- \( A \) = amplitude of flapping
- \( U \) = forward speed

A well-known hypothesis by Triantafyllou & Triantafyllou 1995 and Taylor et al. 2003 suggests that the narrow range of St (0.2-0.4) indicates efficiency of the motion.

Did you know that nature is a great source of inspiration for hydrodynamicists to improve the performance of their Autonomous Underwater Vehicles (AUVs)?

- Did you know that the hydrodynamic performance exhibited by myliobatoids is superior to that of state of the art AUVs to date?
  - Low noise signature.
  - High propulsive efficiency
  - Superior maneuverability

Did you know that flying and swimming species share a common aspect of locomotion characterized by a narrow range of Strouhal number (St)?

Elucidating the reasons behind the tight range of Strouhal number seen in nature is essential to design more efficient AUVs.

In the current research, using computational fluid dynamics (CFD) and some linear theory, we challenge the well-known hypothesis by (Triantafyllou & Triantafyllou 1995, Taylor et al. 2003) and explore whether the narrow range of Strouhal number, 0.2-0.4, causes the optimality of motion or whether it is merely an effect of some other characteristic, such as simply the act of free-swimming, without any regard for optimality.