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Investigation of the Role of Planform Shape and Swimming Gait in Cetacean Propulsion[1] FATMA AYANCIK, Lehigh University, FRANK E. FISH, West Chester University, KEITH W. MOORED, Lehigh University — Dolphins and whales, known as cetaceans, have morphological characteristics associated with enhanced thrust production, high propulsive efficiency and reduced drag. These animals oscillate their moderate aspect ratio flukes in a heaving and pitching motion to propel themselves through the water. Surprisingly, these animals display a large variation in their fluke shape and swimming gait. The present study aims to probe the connection between the fluke shape and swimming gait in high performance swimming. The planform shape of cetacean flukes is parameterized with a NACA-inspired function where the coefficients are fit to several species. An unsteady three-dimensional boundary element method is used to identify the thrust production, energetics and wake structure of free-swimming flukes with an added virtual body drag. The shape and gait parameters of the different species are exchanged to gain a broader understanding of the connection between shape and gait. The numerical results are compared with lunate tail theory to assess the limitations of the theory and its predictions of force and energetic scalings.

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