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The effects of body properties on sand-swimming[1] SARAH SHARPE, ROBYN KUCKUK, Georgia Tech, STEPHAN KOEHLER, Harvard, DANIEL GOLDMAN, Georgia Tech — Numerous animals locomote effectively within sand, yet few studies have investigated how body properties and kinematics contribute to subsurface performance. We compare the movement strategies of two desert dwelling subsurface sand-swimmers exhibiting disparate body forms: the long-slender limbless shovel-nosed snake (*C. occipitalis*) and the relatively shorter sandfish lizard (*S. scincus*). Both animals "swim" subsurface using a head-to-tail propagating wave of body curvature. We use a previously developed granular resistive force theory to successfully predict locomotion of performance of both animals; the agreement with theory implies that both animal's swim within a self-generated frictional fluid. We use theory to show that the snake's shape (body length to body radius ratio), low friction and undulatory gait are close to optimal for sand-swimming. In contrast, we find that the sandfish's shape and higher friction are farther from optimal and prevent the sandfish from achieving the same performance as the shovel-nosed snake during sand-swimming. However, the sandfish's kinematics allows it to operate at the highest performance possible given its body properties.

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