PALAIOS, 2010, v. 25, p. 000–000
Research Article
DOI: 10.2110/palo.2009.p09-149r

Could a stalked crinoid swim? A biomechanical model and characteristics of swimming crinoids

G. Alex Janevski* and Tomasz K. Baumiller

University of Michigan, Department of Geology, Ann Arbor, Michigan 48109, USA
e-mail: galexski@umich.edu
**Corresponding author.*

Keywords: echinoderm, comatulid, biomechanics, functional morphology, predator-prey interaction

ABSTRACT

Modern stalked crinoids represent a relict fauna of once considerably higher diversity, as seen in their extensive fossil record. Comatulid crinoids, which lack a stalk and dominate modern crinoid diversity, have been interpreted as an evolutionary success story due to the increased mobility afforded by stalk loss. This mobility includes effective crawling and also swimming, often interpreted as anti-predatory escape strategies. Until recently it was assumed that stalked crinoids were incapable of active locomotion, but observations of an extant isocrinid have demonstrated that some can crawl relatively rapidly, perhaps in order to escape from benthic predators. Because the mechanics of crawling in stalked crinoids resemble the mechanics of swimming in comatulids, it is worth investigating whether a stalked crinoid would be capable of swimming. The feasibility of this scenario is tested using a biomechanical model of swimming in a stalkless crinoid and by applying the model to a stalked crinoid. The model demonstrates that the stalk imposes a heavy burden that limits the ability of a stalked crinoid to swim. Evolutionarily this might suggest that stalk loss was a key innovation that facilitated swimming; however, stalk loss alone is not sufficient to allow a crinoid to swim. Swimming would have allowed greater capability for escape from benthic predators than crawling. An evolutionary scenario is considered in which swimming evolved in a stalked crinoid to allow more effective escape from benthic predators subsequent to evolution of rapid crawling, precipitating eventual stalk loss.