

Effects of Flow Speed and Direction on the Frequency and Speed of Sea Star *Asterias forbesi* Oscillatory Gait

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hundreds of small tube feet (podia) that are controlled by a dispersed, decentralized nervous system. Sea stars can crawl by striding relatively uncoordinated podia in a similar direction with each foot. Sea stars can also coordinate via mechanical coupling to make sea stars vault up and forward in a faster bounce like movement called an oscillatory gait [1,2]. Sea star oscillatory gaits have characteristic frequencies and speeds, which have been studied in still water but in flow. Effects of flow may be negligible at slow flows, disruptive at high flows, and may either slow or speed up sea star locomotion depending on the speed of flow and the relative directions of flow and sea star movement. To understand the interaction of sea star locomotion and flow, we quantified the frequency and speed of the oscillatory gait of the sea star *A. forbesi* at three flow speeds and two locomotion directions. We hypothesized that *A. forbesi* would move faster with flow in the same direction as its first step than in no flow and more slowly with flow opposite to sea star movement.

We collected 14 *Asterias forbesi* (33-85 g) from the local intertidal/shallow subtidal and acclimated a filming

sea stars
and order of flow conditions for a given sea star on a given day were determined randomly. Time and position data were extracted from 2-6 films of each sea star each flow condition using DeepLabCut from which frequency and maximum speed of the oscillatory gait were determined using Mathematica programs written by O. Ellers. Statistical analyses on those variables were conducted using SPSS software and graphed using GraphPad Prism. Preliminary results show that the highest flow speed frequency and maximum speed differed when locomoting against flow and increased when locomoting with flow (Fig. 1; RM ANOVA: each $p < 0.01$, d.f. = 1,52). Thus, choice of locomotion direction relative to flow direction can alter the ability of sea stars to move at their fastest speeds.

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References

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