Sinking behavior of gastropod larvae (Ilyanassa obsoleta) in turbulence

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Limnol. Oceanogr., 49(6), 2004, 1937-1948 | DOI: 10.4319/lo.2004.49.6.1937

ABSTRACT: Larvae of coastal gastropods sink in turbulence and may use nearshore turbulence as an initial settlement cue. Our objective was to quantify the relationship between turbulence and the proportion of sinking larvae for competent mud snail veligers (*Ilyanassa obsoleta*). We exposed larvae to a range of field-relevant turbulence conditions (ε = 8.1 x 10^{-3} to 2.7 x 10^{0} cm^2 s^{-3}) in a grid-stirred tank, holding other factors constant. We used a video plankton recorder to record larval movements in still water and in turbulence. Larval trajectories and velocity measurements were extracted using video-image analysis. We also measured turbulent flow velocities independently, using laser Doppler velocimetry. To interpret empirical measurements in terms of larval behavior, we developed a threecomponent, normal mixture model for vertical velocity distributions of larvae in turbulence. The model was fitted to observed larval velocities by maximum likelihood, to estimate the proportions of sinking, hovering, and swimming larvae. Over the range of turbulence intensities found in typical coastal habitats, the proportion of sinking larvae increased exponentially (r^2 = 0.89) with the log of the turbulence dissipation rate. The net mean behavioral velocity of the larvae shifted from positive to negative when the dissipation rate reached ~10^{-1} cm^2 s^{-3}. By sinking when they enter turbulent, shallow water, competent larvae could improve their chances of settling in favorable coastal habitats.