Larval fish feeding and turbulence: A case for the downside

MacKenzie, Brian R., Thomas Kiørboe

Limnol. Oceanogr., 45(1), 2000, 1-10 | DOI: 10.4319/lo.2000.45.1.0001

ABSTRACT: Theory states that small-scale turbulence decreases pursuit success of planktonic predators by advecting the encountered prey from the reactive zone of the predator during the pursuit event. We tested the quantitative predictions of a previously published model describing this phenomenon in larval cod by videorecording particle motion and feeding behavior of larval cod (8.7-12.3 mm) preying on copepods in a laboratory tank. Fluid motion shared characteristics with that in the ocean, i.e., intermittent, logarithmically distributed, average particle-particle velocity difference proportional to separation distance$^{1/3}$. Estimated bulk dissipation rates were 0-2 x 10^{-4} m^2 s^{-3} and similar to those commonly experienced by larval cod in nature (e.g., located at 30 m during winds of ca.7 m s^{-1}). Owing to the intermittent nature of turbulence, we related individual predation events to local, instantaneous relative velocities instead of bulk averages. Pursuit success decreased significantly with relative velocity and the observations approximated the predicted effect of turbulence on pursuit success. Nonlinear and counteracting effects of turbulence on pursuit success and encounter may partly explain the contradictory observations of how turbulence affects larval fish feeding, growth, and survival in the sea.