



Mate finding, mating, and population dynamics in a planktonic copepod *Oithona davisae*: There are too few males

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ABSTRACT: Three-dimensional (3D) video observations of free-swimming copepods revealed the mechanisms of mate finding in the cyclopoid copepod *Oithona davisae* (cephalothorax length 0.33 mm). The females are ambush feeders and spend almost all of their time sinking slowly through the water, interrupted by 0.5-1-mm-long jumps every few seconds. The sink-jump behavior distributes produced pheromones along an intermittent trail. Males spend about half of their time ambush feeding, and half of their time cruising rapidly (50 body lengths s^{-1}), searching for female signals. On encountering a pheromone patch, the male starts circling rapidly (up to >100 body lengths s^{-1}) around the patch, apparently to find subsequent patches and, eventually, the female. The pursuit may last several tens of seconds, and ends by the male capturing the female or losing the track. Observed reaction distances and male motility patterns were combined with a simple encounter model to estimate a matesearch volume rate of $4.4 L d^{-1}$. The males have a rather limited mating capacity, 0.9 females $male^{-1} d^{-1}$, even when mate-encounter rate is not limiting. Field observations of abundances, combined with estimates of mortality and mate-search and mating capacities, predict that only approximately one-third of the females should be fertilized. This is consistent with field observations, and suggests that population growth in this species is severely constrained by fertilization limitation. Fertilization limitation may apply more generally to populations of pelagic copepods, and may partly account for the frequent observation that female copepods produce sterile eggs, even during periods of a plentiful food supply.

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