Quantification of larval traits driving connectivity: the case of *Corallium rubrum* (L. 1758).

Marine Biology

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Deriving a motility behavior model for larval dispersal simulations from larval motility behavior experiments

Guizien et al. (2006) propose modeling larval dispersal by combining flow and larval velocities generated stochastically from a cumulative frequency distribution (CFD). The method of implementing larval velocities in a Lagrangian dispersal model (varying along tracks or in different tracks) will depend on the main source of variability in motility behavior (intra- or inter-individual). As larval velocity is expected to vary with age (due to ontogenic changes) and/or according to environmental conditions (i.e., light, depth or food) along the same track, intra-individual variability cannot be neglected. However, larval velocity may also vary as a result of different intrinsic abilities (bet-hedging hypothesis; Stearns 1976), but accounting for such variability is not necessary as long as it is lower than intra-individual variability.

Whatever the variability sources, larval velocity CFD used in the model should describe the larval motility behavior at sea which could differ from that quantified in laboratory due to biases linked to two limitations: 1) duration of the experiments, and 2) size of the experimental containers.

As behavioral experiments are limited to durations of hours, intra- and inter-individual variability in swimming activity frequency cannot be separated: Although some larvae could display 100% activity during the experiment, it is, unrealistic to extrapolate from this that 100% activity could be maintained over days. To avoid this bias, intra-individual larval velocity CFD is reconstructed from motility behavior experiments performed on a group of larvae by summing the swimming velocity CFD (computed on tracks of swimming larvae) weighted by the swimming activity frequency and the free drift velocity weighed by the swimming inactivity frequency (Fig S1). By definition, the sum of the activity and inactivity frequency is 1. Furthermore, in small-sized containers, directional drift (downward or upward) may lead to the accumulation of larvae either on the bottom or at the surface. In these cases, larvae escaping from tracking will be considered inactive, while the interpretation of the behavior depends on buoyancy. If negatively buoyant, for instance, larvae on the bottom of containers can reasonably be assumed to be free falling in an unbounded medium, while larvae at the surface should be considered upward swimming. Hence, larval velocity CFD at sea is a composite

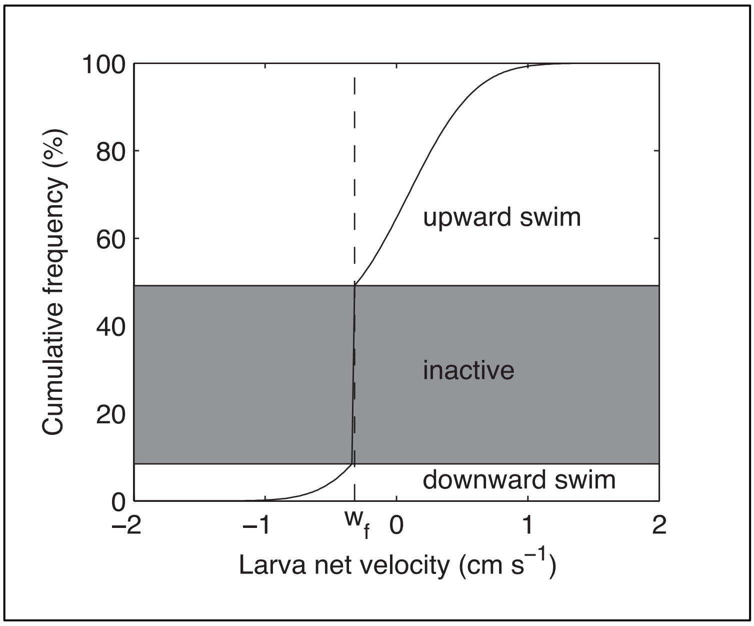

Fig S1: Generic model of cumulative frequency distribution (CFD) of larval swimming velocities for negatively buoyant larvae: The grey area represents CFD during periods of inactivity characterized by free fall speed (dashed line). White areas represent CFD during upward and downward swim. W_f= free fall speed.

function reconstructed from experiments with unavoidable biases. In the case of negatively buoyant larvae, this composite CFD is the weighted sum of three contributions and is written as:

$$CFD(age) = (A\ CFD_A(age) + B\ CFD_B(age) + C\ CFD_C(age))/(A+B+C) \quad (1)$$

where CFD_A is the free fall CFD, CFD_B is the net swim velocity CFD, CFD_C is the upward net swim velocity CFD for negatively buoyant larvae, A is the time the larvae spend on the bottom or free falling in the water column, B is the time spent in the water column not free falling, and C is the time spent at the free surface in the experimental containers.