SUPPLEMENT 1

Selection of released particle number

Methodology

We selected a particle number for which the Fraction of Unexplained Variance (FUV) was smaller than 0.05. In our case study, the FUV informed on the similarities between two gridded larval dispersals.

For selecting a number n_i of released particles: *i)* We released a maximum number of N=200,000 passive particles released at 24 sites with observed oyster population in the Galway region, with release conditions similar to the ones described in the manuscript (Section 2.3). *ii)* At the tracking time *t*=30 days, we computed the spatial N particle density *D* in a grid *G. iii)* At a tracking time *t*=30 days, we randomly sampled the position of *ni* particles out of the *N* particles and computing their spatial density *di* in the grid *G*. *iv)* We computed the Pearson coefficient of correlation *r* between *D* and *di*, and then the *FUV* with FUV = 1 - r^2. v) We repeated points iii) and iv) 100 times and computed the average and standard deviation values of the 100 FUV for n_i particles.

We computed the FUV for n_i = 100, 500, 1000, 2500, 5000, 7500, 10000, and 15000.

Results

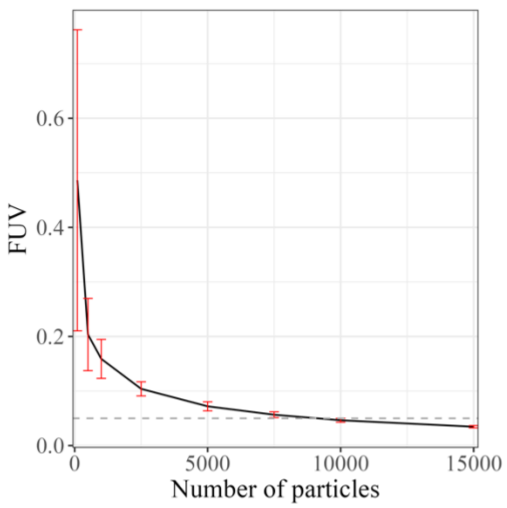

Figure S1. Fraction of Unexplained Variance (FUV) across number of particles.

The FUV was lower than 0.05 when n_i =10 000 particles, meaning than if the total of released particle was equal or upper than 10 0000 particles, at least 95% of the dispersal variability will be represented.

In the case of Galway, 1077 sites were localized for particles released, so, 9.34 particles per sites for reaching 10000 particles in total. We ceiled the value at 10. To further demonstrate that 10 released particles per sites were an adequate number, we estimated the FUV between the spatial density of the passive particles released at the 1077 sites (i.e., the simulations of the main study) and the spatial density of the N passive particles released at the 24 sites (i.e., the simulation to define n_i). FUV was 1.1%, meaning that 10 particles were enough.

In the case of Bantry, 273 sites were localised for particles released, therefore, 36.6 particles per sites for reaching 10000 particles in total. Nonetheless, the scale of the release site domain was 1.89 times bigger in the Bantry region than in the Galway regions. For securing a good representativity of the dispersal, we rounded up the number of particles to 100 per sites.

Selection of diffusivity coefficients

Methodology

First, we looked at oceanographic manuscripts mentioning diffusivity in tidal systems (e.g., Guillam et al, 2020; Simons et al., 2013, Nagai and Hibiya, 2011) and set a range of possible amplitudes of vertical and horizontal coefficient diffusivity.

Second, we approached values of diffusivity coefficients (K) using equations (eq. 4) and (2) in Okubo (1971) study.

- Using Okubo's empirical equation, $K=0.0103*L^{1.15}$ (eq. 4) with $L = 200*10^{-2}$ cm, i.e., the spatial resolution of the regional ROMS on the horizontal dimension, resulting in $K_h \sim 0.1$ m^2/s.
- Using the 4/3 power law of oceanic diffusion, K_h would be around 0.5 m^2/s.
- K_v can be much more variable in function of the depth discretization of the ROMS. From the 20 sigma-layers of the ROMS for the Galway region and using Okubo's empirical equation, 75% of K_v values were below 0.001 m^2/s.

Then, we ran several simulations of particle transport in the Galway region (Table S1). Each simulation was run with passively advected particles and accounted for diffusivity through random walk schemes with value combinations of the two diffusivity coefficients. We compared the results of the linear model relationship of the mean squared displacement (MSD) with time and Okubo's relationship (eq. 3) $MSD(t)=0.0108.t^{2.34}$ and selected the combination of coefficients that best approached this equation using the root mean square error (RMSE). $\text{MSD} = \sum \frac{d^2}{n}$, with *d* the distance between a particle position and the average position of the whole particle pool and n the quantity of particle

Results

A summary of the simulations and the results from the linear model analyses is showed in Table S1. *A* is the coefficient of the linear model and should be close to 0.0108. *B* is the power component of the linear model and should be close to 2.34.

Table S1. Linear model results (A and B) according to combinations of the diffusivity coefficients K_h and K_v, and comparison with Okubo's empirical relationship

K_h	K_v	A	B	RMSE ($*10^8$)
0.1	10^{-4}	$1.75*10^{-4}$	1.81	4.29
0.1	K_v from ROMS	$2.26*10^{-3}$	1.60	4.44
0.1	10^{-6}	$1.45*10^{-6}$	1.98	4.61
0.5	10^{-4}	$1.75*10^{-3}$	1.62	4.41

We picked up $K_h = 0.1$ m^2/s and $K_v = 0.0001$ m^2/s as the RMSE with Okubo was the lowest.

Supplementary references

Guillam M, Bessin C, Blanchet-Aurigny A, Cugier P, Nicolle A, Thiébaut E, Comtet T (2020) Vertical distribution of brittle star larva in two contrasting coastal embayments : implications for larval transport. Scientific Reports 10:12033. doi: 10.1038/s41598-020-68750-4

Nagai T, Hibiya T (2011) The processes of semi-enclsed basin-ocean water exchange across a tidal mixing zone. Journal of Oceanography 67:533-539. doi: 10.1007/s10872-011-0045-0

Simons RD, Siegel DA, Brown KS (2013) Model sensitivity and robustness in the estimation of larval transport: a study of particle tracking parameters. J Mar Syst 119−120: 19−29