

Supplementary Material

Dispersal syndromes can impact ecosystem functioning in spatially structured freshwater populations

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Supplementary method description

Length of dispersal phase. The length of the dispersal phase for the two species was determined in a pilot experiment. The DispNet protocol aimed for a 20% dispersal rate in the “control” (normal food, no predator cues) treatment.

Length of consumption experiment. The consumption experiments were stopped when a visual assessment estimated that leaf litter was half consumed (by area) in the fastest-consumed mesocosms. This was not an exact measure and corresponded to the following mass loss percentages: 55% of leaf mass remained in the most-depleted *G. fossarum* mesocosm, and 62% leaf mass remained in the most-depleted *D. villosus* mesocosm at the end of the respective experiments.

Leaf litter in consumption experiment. Leaf litter was collected just after leaf drop from a single tree in Dübendorf, Switzerland, in 2016, then air-dried and stored loose in cardboard boxes.

Microbial contribution to decomposition. Alder leaves were conditioned in a mix of tap water and stream water (from the Chriesbach stream next to the experimental facility in Dübendorf, Switzerland) for six days before the experiment began. Thus, leaves in all mesocosms had identical conditioning for each experiment (*G. fossarum* and *D. villosus*; the microbial community in the stream water may have differed between the two experiments due to taking place at different times of year).

We did not explicitly adjust for microbial and fungal decomposition in our estimates of consumption rates. This was because a previous experiment in the same facility (Little and Altermatt 2018) showed that microbial decomposition of alder leaves was minimal over the course of a 28-day experiment, which was 67–133% longer than the duration of the two experiments presented in this manuscript. While higher total consumption rates by amphipods could potentially increase the

contribution of the microbial community by increasing particulates or otherwise changing conditions, we did not have space to design an additional test of this hypothesis.

Amphipod weight in mesocosms. Leaf consumption rates by amphipods was calculated per mg of amphipod dry weight. All amphipods surviving until the end of the experiment were sacrificed, dried in an oven for 48 hours at 60°C, and weighed. The consumption rate was then calculated using the following steps:

- (i) Amphipod survival in each experimental replicate had been checked every 2-3 days. From these counts, a total number of “amphipod days” per replicate was calculated, with any mortality between survival checks assumed to occur at the midpoint between the two dates for simplicity. Thus, 100% survival would result in be $n_{\text{start}} * 19$ or $n_{\text{start}} * 12$ amphipod days for *G. fossarum* and *D. villosus* respectively, due to the 19- and 12-day length of the respective experiments, and any mortality would lead to lower numbers of amphipod days.
- (ii) The “weight days” for surviving amphipods was calculated by summing the dry weights of all surviving amphipods from a replicate and multiplying this biomass by 19 or 12 days for *G. fossarum* or *D. villosus* replicates, respectively.
- (iii) If survival was less than 100% in a replicate, then the missing number of “amphipod days” was calculating by subtracting $n_{\text{surviving}} * 12$ or $n_{\text{surviving}} * 19$ from the total number of “amphipod days”. These missing “amphipod days” were converted to “weight days” by multiplying by the mean global dry weight of individuals of the respective species. While this is making an assumption – individuals which died could have been smaller or larger than the global average – we have no other information with which to justify another assumption, thus we decided that using the average weight was most defensible.

(iv) These missing “weight days” were added to the “weight days” of the surviving amphipods to get a total “weight days” for the replicate, and the total mass loss over the course of the experiment was divided by the “weight days”.

References

Little, C. J., and F. Altermatt. 2018. Species turnover and invasion of dominant freshwater invertebrates alter biodiversity-ecosystem-function relationship. *Ecological Monographs* 88:461–480.

Figures

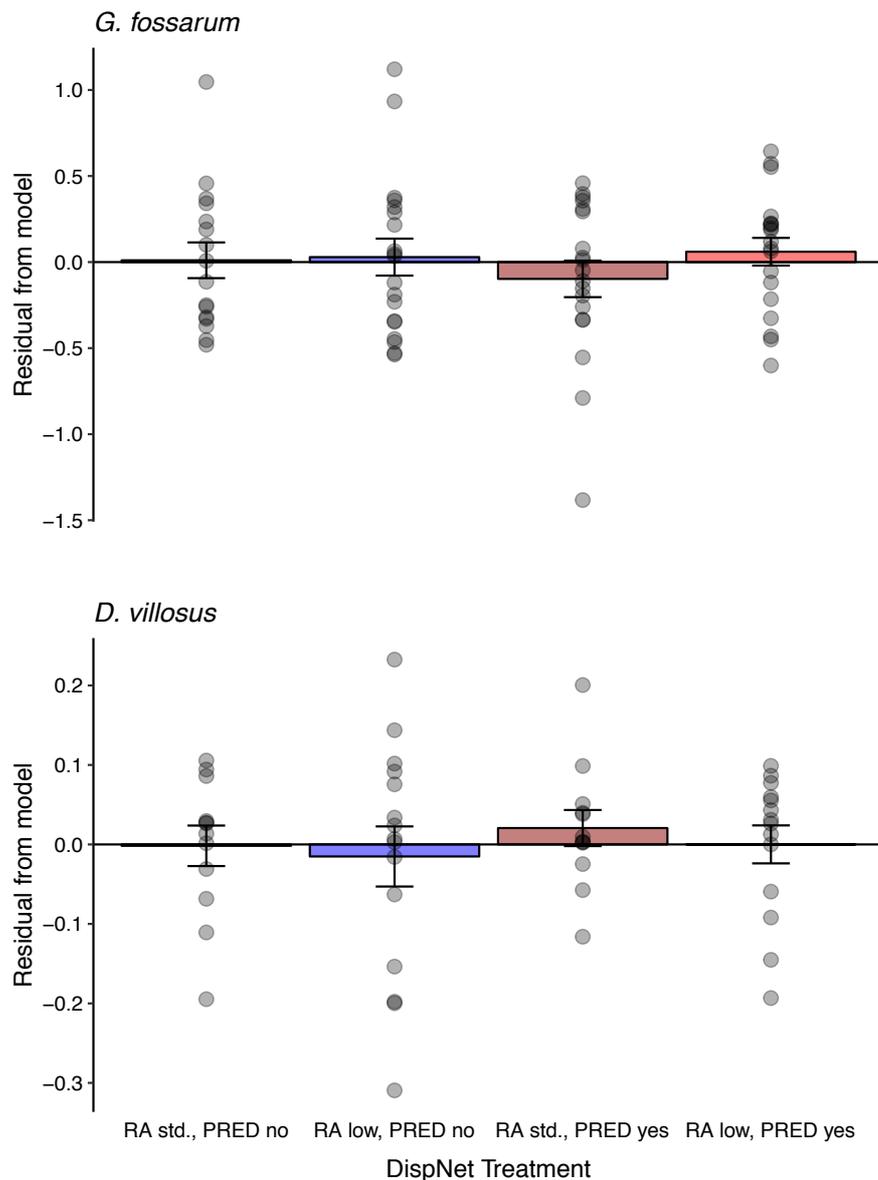


Figure S1. Model residuals from the mixed-effect models (transformed consumption rate ~ dispersal status + (1|replicate block)) plotted against treatments from the dispersal experiment: RA = resource availability (standard or low), PRED = predator cues (no or yes). Linear models of residuals as a response of dispersal experiment treatment showed no significant effects (*G. fossarum*: $F_{3,69} = 0.49$, $p = 0.69$; *D. villosus*: $F_{3,49} = 0.25$, $p = 0.86$). Error bars show standard error of the mean, and gray points show residuals from individual experimental replicates.

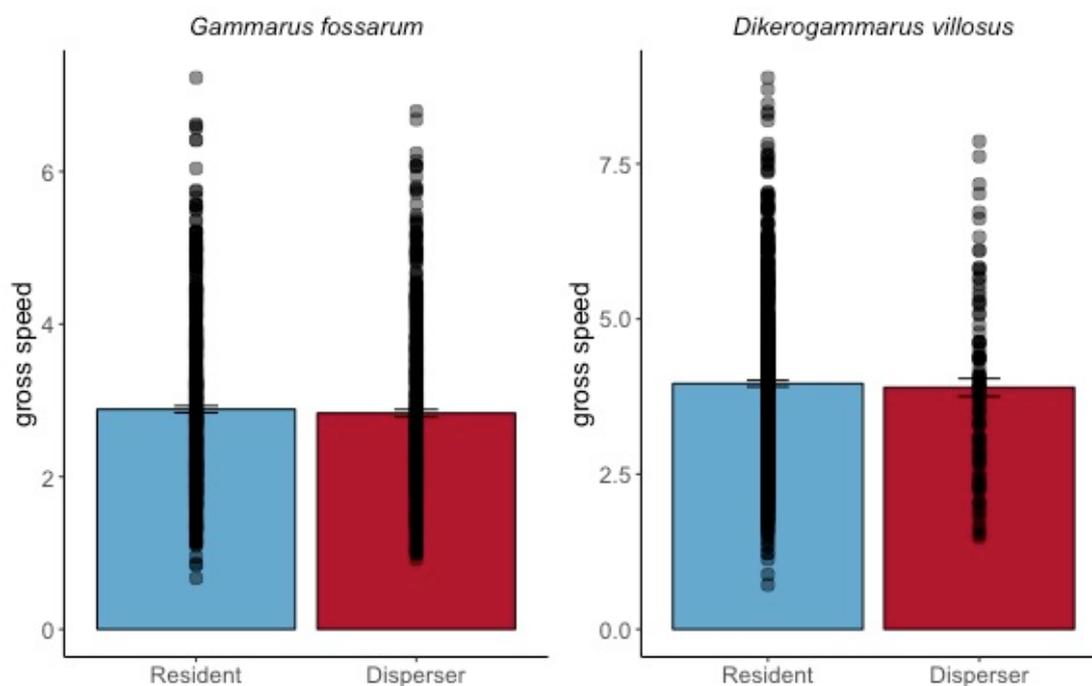


Figure S2. Gross swimming speed of residents and dispersers, from video analysis using the ‘BEMOVI’ package in R. Before being placed into the consumption mesocosms, residents and dispersers were (separately) placed into an experimental arena and allowed to move freely for three minutes. Each time an amphipod moved it was detected it was given an object identifier and the movement was described; gray dots in the figure represent each movement, and error bars show the standard error of speed for residents and dispersers. There were no significant differences in swimming speed between residents and dispersers based on simple linear models in either *G. fossarum* ($F_{1,1109} = 0.57$, $p = 0.44$) or *D. villosus* ($F_{1,824} = 0.17$, $p = 0.68$).