# Supplementary Information:

# *Parasites shape community structure and dynamics in freshwater crustaceans*

*Supplementary Results*

*Host population dynamics*

The sex ratio in *P. fluviatilis* differed between low exposure and high exposure treatments at week 3 and 9, but not week 6 (Table 1). The ratio of males to females in *P. excavatum* did not differ between low and high exposure treatments on any sampling date (Table 1). However, since we did not see any recruitment and individual sex could not be determined as we set up the mesocosms, these ratios are just as likely due to the set-up of the experiment.

Sex ratio in *A. annectens* differed between treatments in week 3 and 9, but not in week 6 (Table 1). The number of juveniles was higher in low exposure treatment mesocosms during week 6 and week 9 (Table 1). The proportion of males to females to juveniles in *A. lacustris* did not differ between treatments throughout all three sampling periods (Table 1).

*Host fecundity*

The proportion of female *P. fluviatilis* carrying young did not differ between low and high exposure treatments in any of the three sampling periods (Table 2). Infected females were more likely to be carrying young than uninfected ones throughout all sampling periods (Week 3, χ2 = 3.1, *P* = 0.073; Week 6, χ2 = 23, *P* < 0.0001; Week 9, χ2 = 14, *P* = 0.0003). The relationship between infection status and the probability of carrying eggs held true in the low exposure treatment (Week 3, χ2 = 4.1, *P* = 0.04; Week 6, χ2 = 15.7, *P* < 0.0001; Week 9, χ2 = 15.7, *P* = 0.0001), but not consistently in the high exposure treatment (Week 3, χ2 = 0.07, *P* = 0.80; Week 6, χ2 = 7.6, *P* = 0.006; Week 9, χ2 = 1.5, *P* = 0.22).

Only two female *P. excavatum* were carrying eggs, one in each treatment, and both were carrying the same number of eggs (three each). Both females were found during the week 3 sampling period. No *A. annectens* egg or pair was found in either treatment. The fecundity of *A. lacustris* did not differ in week 6, but the proportion of paired individuals tended to be higher in low treatment tanks (Table 2). Similar trends were present in week 9 (Table 2). No pair or young were found in *A. lacustris* during week 3 sampling.

*Parasite infection patterns*

The mean abundance and prevalence of *M. poulini* in *P. fluviatilis* decreased over time in the low exposure treatment (abundance, F2,2999 = 4.6, *P* = 0.0097; prevalence, χ2 = 17.9, *P* = 0.0001) and high exposure treatment (abundance, F2, 861 = 11.5, *P* < 0.0001; prevalence, χ2 = 33.9, *P* < 0.0001; Fig. 3). The mean abundance and prevalence of *C. parvum* decreased over time in both the low (abundance, F2,2999 = 5.0, *P* = 0.007; prevalence, χ2 = 13.8, *P* = 0.001) and high exposure treatments (abundance, F2, 861 = 24.7, *P* < 0.0001; prevalence, χ2 = 37.5, *P* < 0.0001; Supplementary material Appendix 1, Fig. A1). No juveniles (individuals < 1.5 mm) were infected in any treatment.

The prevalence and abundance of *M. poulini* in *P. excavatum* did not vary over time in either the low (abundance, F2, 85 = 1.0, *P* = 0.36; prevalence, χ2 = 5.5, *P* = 0.08; Fig. 3) or high exposure treatment (abundance, F2, 83 = 0.80, *P* = 0.45; prevalence, χ2 = 2.5, *P* = 0.29; Fig. 3), although the prevalence tended to decrease in the low exposure treatment. The mean abundance of *C. parvum* did not vary between weeks in the low exposure treatment (F2,85 = 0.044, *P* = 0.96) but it varied in the high exposure treatment (F2,83 = 4.0, *P* = 0.022), with the abundance being the highest in week 3 and lowest in week 6 (Supplementary material Appendix 1, Fig. A1). The prevalence showed similar trends with no difference observed in the low exposure treatment (χ2 = 0.59, *P* = 0.75) but a trend towards some variation in the high exposure treatment (χ2 = 5.0, *P* = 0.08).

The abundance and prevalence of *M. poulini* in *A. annectens* remained consistent in the low exposure treatment (abundance, F2, 126 = 3.0, *P* = 0.06; prevalence, χ2 = 4.2, *P* = 0.12; Fig. 3). In the high exposure treatment, the abundance and prevalence of *M. poulini* increased over time (abundance, F2, 93 = 4.3, *P* = 0.02; prevalence, χ2 = 14.5, *P* = 0.007; Fig. 3).

*Multispecies infections*

Multiple infections were found in both amphipod species; *C. parvum* and *M. poulini* co-infecting 1.0% of *P. fluviatilis* and 13% of *P. excavatum* across all three sampling dates. Co-infections of *A. galaxii* and *M. poulini* occurred in 0.1% of *P. fluviatilis* whereas co-infections of *A. galaxii* and *C. parvum* only were seen in 0.03% of individuals. *Maritrema poulini* and *H. spinigera* were found co-infecting one of *P. excavatum* (0.6%)*.* Additionally, one *P. excavatum* (0.6%) was infected with three parasite species (*C. parvum,* *M. poulini,* and *H. spinigera*).

The prevalence of co-infection by both *M. poulini* and *C. parvum* in *P. fluviatilis* decreased over time in the high exposure treatment (Contingency analysis, χ2 = 35.3, *P* < 0.0001), but stayed consistent in the low exposure treatment (χ2 = 4.1, *P* = 0.13). The number of multispecies infections in *P. fluviatilis* was higher in the high exposure treatment during week 3 and 6, but they did not differ in week 9 (Table 2).

Co-infections by *M. poulini* and *C. parvum* in *P. excavatum* was highest in the high exposure treatment in week 3 but decreased in week 6 and week 9 (Contingency analysis, χ2 = 5.8, *P* = 0.046). Conversely, infections by both species stayed consistent across sampling weeks in the low exposure treatment (Contingency analysis, χ2 = 0.59, *P* = 0.74). Multiple species infections did not differ between low and high exposure treatments at any sampling period (Table 2).



**Supplementary Figure S1**. Mean abundance of *Coitocaecum parvum* in two host species, *Paracalliope fluviatilis,* and *Paracorophium excavatum,* in both low and high treatments through the sampling periods (a) week 3, (b) week 6, and (c) week 9. Stars represent a significant difference (*P* < 0.05) between the two treatment groups. Sample size of 6 mesocosms per treatment per sampling period.