Variation in offspring investment within and among populations of *Gammarus minus* SAY (Crustacea: Amphipoda) in ten mid-Appalachian springs (U.S.A.)

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With 5 figures and 6 tables

Abstract: Amphipod crustaceans in freshwater springs offer excellent opportunities for testing hypotheses of life-history ecology and evolution. In this study, several hypotheses were tested regarding variation in brood mass, brood size (number of embryos per brood) and individual embryo mass within and among populations of *Gammarus minus* in ten cold springs in central Pennsylvania, U.S.A. Brood mass and brood size showed strong relationships with maternal body mass both within and among populations. Most of the relationships between brood mass and maternal mass were isometric or nearly so, as predicted by the hypothesis that available body volume within a confining exoskeleton is the major factor causing body-size scaling of reproductive investment in amphipods. However, as expected from optimal offspring-investment theory, embryo mass was usually unrelated to maternal mass and its variation was much less than that of brood mass and brood size. The effects of other factors were assessed by adjusting each reproductive trait to maternal mass (designated by the term “relative”). As predicted by life-history theory, relative embryo mass and number were negatively correlated among populations. However, such trade-offs were usually absent within populations. Relative embryo mass was significantly greater during winter than summer in all four populations sampled, though varied seasonal effects occurred on relative brood mass and brood size. This seasonal variation in offspring size was unexpected, because in other amphipods it has usually been attributed to changes in water temperature, which varied little during the year in the study springs. Other potential causes of this variation are seasonal changes in food availability and watercress coverage. Relative brood mass, brood size and embryo mass varied significantly among the ten populations sampled. This variation was independent of differences in water chemistry among the springs. However, predation and wa-