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Abstract

A crucial stage in several benthic marine invertebrate's development is the larval-juvenile transition, which depends heavily on identification of suitable substrate and subsequent intensive calcification, especially in calcifiers such as barnacles. The carbonate ion concentration ($[CO_3^{2-}]$) determines the ease with which calcification can take place. The decreasing pH (and decreasing $[CO_3^{2-}]$) due to increased global CO_2 emissions (ocean acidification) is therefore expected to affect the amount of energy that must be invested by larvae to build their shells and subsequent energetically expensive processes such as habitat selection and larval metamorphosis. In this study, using the barnacle *Balanus amphitrite* as a model, the relationship between pH (4 levels - pH 8.1, 7.9, 7.6, 7.3, representing CO_2 emission scenarios from present to 2300) and larval-juvenile transition process (naupliar development, cypris physiological condition, cypris metamorphic success and early juvenile growth and calcification) has been examined. Developmental rate was unchanged while physiological quality and metamorphic success showed a decreasing trend with decreasing pH. Surprisingly, calcification at the time of cypris metamorphosis increased with decreasing pH. However, early juvenile growth and shell weight appear to be insensitive to decreasing pH. This study suggests, for the first time, that ocean acidification could reduce larval metamorphic success through reducing larval physiological condition. However, cyprids appears to overcome such negative effects by enhancing their calcification rate at the time of metamorphosis. Nevertheless, it seems that the levels of ocean acidification likely to be experienced in the near future might, in isolation, significantly affect larval metamorphic success in barnacles.

Keywords: *Balanus amphitrite*, ocean acidification, cypris metamorphosis, larval calcification, cypris physiological quality, energy reserves.