Coping with the double whammy of low oxygen and high carbon dioxide in estuarine crustaceans

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The incidence of hypoxia in coastal waters has increased dramatically world-wide due to growth in human populations, causing adverse impacts to many estuarine organisms. In coastal estuaries of the southeastern and southwestern US, high CO₂ (hypercapnia) frequently co-occurs with hypoxia, causing acidification. We have studied the effects of high CO₂, low O₂ conditions (hypercapnic hypoxia) on the physiology and performance of highly active crustaceans. Our experiments indicate that, in some cases, concurrent exposure to high CO₂ can reduce or reverse acclimatory responses of crustaceans to hypoxia alone, with supporting evidence from transcript profiles of hepatopancreas tissue, oxygen-binding properties of the crustacean respiratory pigment hemocyanin, and performance of crabs walking on an underwater treadmill. Our studies have revealed some unexpected effects of high CO₂/lOW pH on hypoxia acclimation in crustaceans, with both positive and negative implications for their survival in the face of coastal development and climate change.