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Elevated ocean temperature influences the early development stages of spawning corals more than acidified oceans

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Abstract: The 'double trouble' scenario of elevated ocean temperature and acidity is becoming of increasing interest in the field of climate change research. Calcifying organisms, such as corals, are of central interest, because they are the major contributor to the establishment of coral reefs. Interestingly, events early in the life history of corals, prior to the initiation of calcification, such as fertilization, embryogenesis, larval survival and settlement are not overly affected by high acidity. However the possible synergistic effects of temperature and acidity have not been widely explored. Here, we tested the effects ocean acidification in combination with elevated temperature on fertilization, development, survivorship and metamorphosis of two spawning acroporids from the Great Barrier Reef. We used four treatment: control, elevated temperature (+2°C), elevated acidity (750ppm) and a combination of elevated temperature and acidity. These values correspond to the current values and the predicted values of atmospheric pCO_2 within this century. Rates of fertilization did not vary among treatments. The rate of embryogenesis was more rapid in temperature treatments (e.g.: elevated temperature only and elevated temperature and acidity). Survivorship and metamorphosis were lower in temperature treatments. These results suggest that elevated temperature has a more detrimental effect on the early life history stages of corals when compared to elevated acidity Furthermore, there was little evidence of an additive effect of these factors when in combination.

Keywords: coral reefs, early life stages, elevated ocean temperature, embryogenesis metamorphosis, ocean acidification, survivorship.