Ocean acidification and hypoxia alter organic carbon fluxes in marine soft sediments

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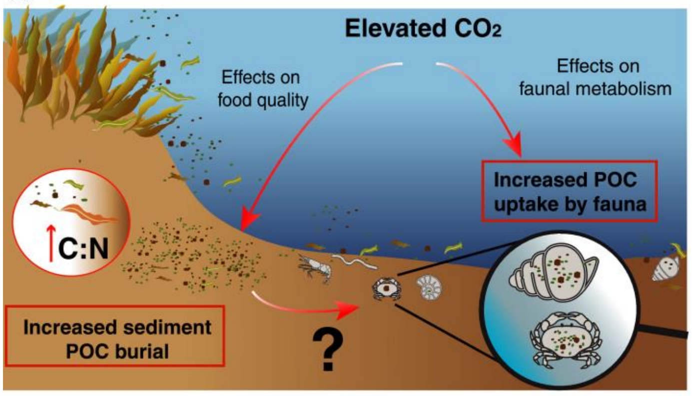
Context: Climate-related stressors can alter the structure and functioning of infaunal communities, which are key drivers of the carbon cycle in marine soft sediments. However, the compounded effects of single and multiple stressors on sedimentary carbon fluxes remain largely unknown.

Ambition & methods: we use mesocosm experiments to investigate the cumulative effects of ocean acidification (OA) and hypoxia on the organic carbon fate in marine sediments. Isotopically labelled macroalgal detritus (^{13}C) was used to trace carbon incorporation in faunal tissue and in sediments under acidified and hypoxic conditions. Labelled macroalgae were also used to assess the organic carbon uptake by fauna and sediments, when both sources and consumers were exposed to elevated CO_2.

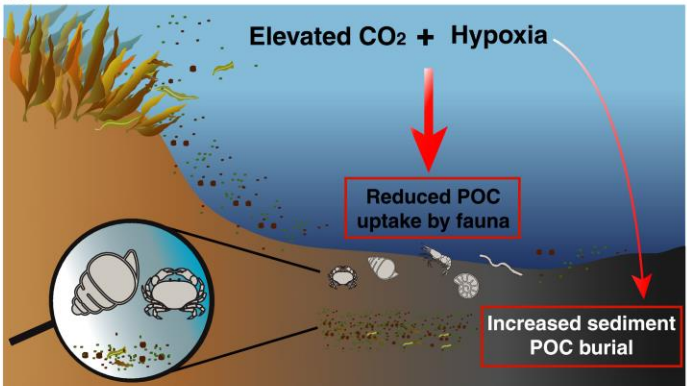
Findings:

(a)



(a) Increased particulate organic carbon (POC) uptake by fauna, when consumers were exposed to elevated CO_2 (direct effects of elevated CO_2 on faunal metabolism); enhanced POC burial in the sediment and high variability (question mark) in POC uptake by fauna, when both consumers and resources (algae) were exposed to elevated CO_2.

(b)



(b) Hypoxia hindered POC uptake by fauna under elevated CO_2, and increased POC burial in the sediment when consumers were exposed to the combined effects of elevated CO_2 and low oxygen.

Conclusions: Both (globally relevant) climate-related stressors have measurable effects on faunal and sedimentary POC uptake, suggesting they have the potential to impact sedimentary carbon cycling in the ocean. Almost no studies have assessed such impacts.

Higher variability in results when both resource and consumers were exposed to acidification highlights implications for experimental design as we grow this evidence base.

Management actions towards limiting hypoxic event drivers (e.g. eutrophication in coastal areas) may thus help mitigate the impacts of global change on marine biogeochemical cycling.

Natural Environment Research Council