Climate mitigation averts critical acidification and habitat loss in the ocean’s upper twilight zone

The invasion of anthropogenic carbon into the global ocean poses an existential threat to marine habitats and marine ecosystems. Marine calcifiers are particularly vulnerable, as calcification depends on the abundance of the carbonate ion, which is rapidly being depleted as it reacts with anthropogenic carbon. This is rendering increasing volumes of the global ocean corrosive to the shells of calcifying marine organisms. In this work, we evaluate a suite of projections of an Earth System Model to assess the benefits of climate mitigation efforts for averting habitat compression and delaying the onset and progression of corrosive conditions at the time-varying upper boundary of the ocean’s twilight zone, the depth horizon inhabited by ecologically important species of marine calcifiers. We find that without mitigation (RCP8.5), more than 40% of the upper boundary of the global ocean’s twilight zone experiences conditions corrosive to aragonite shells by year 2100, representing wide-spread habitat loss for many marine calcifiers. With moderate mitigation (RCP4.5), this is reduced to 20%, and with aggressive mitigation (RCP2.6), to 10%. Mitigation averts the onset of corrosive conditions in many of the ocean’s Large Marine Ecosystems, including the California Current and the Gulf of Alaska. Mitigation slows the pace of transition, providing longer opportunity for acaptation, migration and ecosystem adjustments to loss of marine calcifiers. This work underscores the efficacy of climate mitigation efforts in protecting the habitats of marine calcifiers and the ecosystems in which they are embedded.

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