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TITLE: Ocean currents and herbivory drive macroalgae-to-coral community shift under climate warming

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ABSTRACT:

Coral and macroalgal communities are threatened by global stressors. However, recently reported community shifts from temperate macroalgae to tropical corals offer conservation potential for corals at the expense of macroalgae under climate warming. Although such community shifts are expanding geographically, our understanding of the driving processes is still limited. Here, we reconstruct long-term climate-driven range shifts in 45 species of macroalgae, corals, and herbivorous fishes from over 60 years of records (mainly 1950-2015), stretching across 3,000 km of the Japanese archipelago from tropical to subarctic zones. Based on a revised coastal version of climate velocity trajectories, we found that prediction models combining the effects of climate and ocean currents consistently explained observed community shifts significantly better than those relying on climate alone. Corals and herbivorous fishes performed better at exploiting opportunities offered by this interaction. The contrasting range dynamics for these taxa suggest that ocean warming is promoting macroalgal-to-coral shifts both directly by increased competition from the expansion of tropical corals into the contracting temperate macroalgae, and indirectly via deforestation by the expansion of tropical herbivorous fish. Beyond individual species' effects, our results provide evidence on the important role that the interaction between climate warming and external forces conditioning the dispersal of organisms, such as ocean currents, can have in shaping community-level responses, with concomitant changes to ecosystem structure and functioning. Furthermore, we found that community shifts from macroalgae to corals might accelerate with future climate warming, highlighting the complexity of managing these evolving communities under future climate change.

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