

Trophic amplification of ocean productivity trends under climate change

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Pronounced projected 21st century trends in regional oceanic net primary production (NPP) raise the prospect of significant redistributions of marine resources. Recent results further suggest that NPP changes may be amplified at higher trophic levels. Here, we use the Geophysical Fluid Dynamics Laboratory's Earth System Model coupled with the COBALT (Carbon, Ocean Biogeochemistry and Lower Trophics) plankton ecosystem model (ESM2M-COBALT) to assess the extent of trophic amplification and the mechanisms underlying it. We focus on projected changes in mesozooplankton production – a key prey item for forage fish and the larval stages of larger fish. Globally, mesozooplankton production was projected to decline by 7.9%, but changes in some regions approached 50% and were twice the size of projected NPP changes. Changes in three planktonic food web properties – zooplankton growth efficiency (ZGE), the trophic level of mesozooplankton (MESOTL), and the fraction of NPP consumed by zooplankton (zooplankton-phytoplankton coupling, ZPC), explain the projected amplification. We will also describe preliminary results relating projected changes mesozooplankton production to potential changes in fish catch.

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