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TITLE: Biomass changes and trophic amplification of plankton in a warmer ocean

AUTHOR: ['Guillem Chust', 'J. Icarus Allen', 'Laurent Bopp', 'Corinna Schrum', 'Jason Holt', 'Kostas Tsiaras', 'Marco Zavatarelli', 'Marina Chifflet', 'Heather Cannaby', 'Isabelle Dadou', 'Ute Daewel', 'Sarah Wakelin', 'Éric Machu', 'Dhanya Pushpadas', 'Momme Butenschön', 'Yuri Artioli', 'G. Petihakis', 'C.J. Smith', 'Véronique Garçon', 'Katerina Goubanova', 'Briac Le Vu', 'Bettina Fach', 'Bar?? Saliho?lu', 'Emanuela Clementi', 'Xabier Irigoien']

ABSTRACT:

Abstract Ocean warming can modify the ecophysiology and distribution of marine organisms, and relationships between species, with nonlinear interactions between ecosystem components potentially resulting in trophic amplification. Trophic amplification (or attenuation) describe the propagation of a hydroclimatic signal up the food web, causing magnification (or depression) of biomass values along one or more trophic pathways. We have employed 3?D coupled physical?biogeochemical models to explore ecosystem responses to climate change with a focus on trophic amplification. The response of phytoplankton and zooplankton to global climate?change projections, carried out with the IPSL Earth System Model by the end of the century, is analysed at global and regional basis, including European seas (NE A tlantic, B arents S ea, B altic S ea, B lack S ea, B ay of B iscay, A driatic S ea, A egean S ea) and the Eastern Boundary Upwelling System (Benguela). Results indicate that globally and in A tlantic M argin and N orth S ea, increased ocean stratification causes primary production and zooplankton biomass to decrease in response to a warming climate, whilst in the B arents, B altic and B lack S eas, primary production and zooplankton biomass increase. Projected warming characterized by an increase in sea surface temperature of 2.29 ± 0.05 °C leads to a reduction in zooplankton and phytoplankton biomasses of 11% and 6%, respectively. This suggests negative amplification of climate driven modifications of trophic level biomass through bottom?up control, leading to a reduced capacity of oceans to regulate climate through the biological carbon pump. Simulations suggest negative amplification is the dominant response across 47% of the ocean surface and prevails in the tropical oceans; whilst positive trophic amplification prevails in the A rctic and A ntarctic oceans. Trophic attenuation is projected in temperate seas. Uncertainties in ocean plankton projections, associated to the use of single global and regional models, imply the need for caution when extending these considerations into higher trophic levels.

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