ICES CM 2016/D:216

Human-induced changes in the functioning of marine food webs: towards less productive and more unstable ecosystems?

Aurore Maureaud[1], Didier Gascuel[1], Mathieu Colléter[2], Deng Palomares[2], William W.L. Cheung[2]

The development of fisheries in the oceans, together with other natural and human drivers such as climate change, have led to changes in species abundance, composition, trophic interactions, and ultimately in the functioning of marine food webs such as their productivity, stability and resilience. Here, using a trophodynamic approach and global databases of catches and life history traits of marine species, we tested the hypothesis that human-induced ecological changes might have led to less productive and more unstable ecosystems, with potential adverse effects on top predators. We analyzed a set of Large Marine Ecosystems (LMEs) with contrasting trophic functioning, latitude and fishing intensity. We evaluated the changes in two types of trophic spectra: (1) the speed of the biomass flow, surging up the food web from low to high trophic levels, and (2) the respiration rate assumed to be a proxy of the (inverse of the) trophic transfers efficiency, from 1950 to 2010. We show that marine ecosystems have generally become dominated by short-living and less energetically efficient species. Such changes may have impacted the whole functioning of marine food webs, affecting their overall productivity, especially in the intensively fished LMEs of the North Atlantic. Consequences on high trophic-level species and the potential interactions with climate-related impacts, are discussed.

Keywords: fishing and climate change impacts, transfer efficiency, food webs functioning, ecosystem productivity, trophodynamic approach

[1]Université de Bretagne Loire, Agrocampus Ouest, UMR 985 Ecologie et Santé des Ecosystèmes, 65, rue de Saint Brieuc, CS 84215, 35042, Rennes cedex, France
[2]Institute for the Oceans and Fisheries, The University of British Colombia, Faculty of Science, AERL, 2202 Main Mall, Vancouver, BC Canada V6T 1Z4

Contact author: didier.gascuel@agrocampus-ouest.fr