
Balanced harvesting implications for fishing yields, conservation and fish size evolution

Théo Villain^{*1,2}

¹Institut d'écologie et des sciences de l'environnement de Paris – Institut de Recherche pour le Développement, Sorbonne Université, Université Paris-Est Créteil Val-de-Marne - Paris 12, Centre National de la Recherche Scientifique, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement – France

²Institut méditerranéen d'océanologie – Institut de Recherche pour le Développement, Aix Marseille Université, Centre National de la Recherche Scientifique – France

Abstract

Current fisheries management is largely based on species-by-species regulations and often ignores ecosystem aspects (changes in the interaction network) or the selection forces that arise from different exploitation strategies applied on a community (evolutionary aspects). Through the study of a simplified model, we demonstrate that distributing the fishing effort across various trophic levels allows for reconciling economic yields, system resilience and limiting the risks associated with estimation errors. While changes in fish size are often considered to result from strong selectivity on size (type of net, specific selection on stocks), our evolutionary analysis suggests that ecological variations in densities among trophic levels play a dominant role in body size selection. Since size structures the architecture of food webs, not taking these changes into account could lead to major ecological and economic disruptions. Balancing the harvesting on the community distributes the selective forces, which limits these potential changes. Finally, simulating networks based on the size of individuals allows us to test the first analytical predictions.

Keywords: multispecific fisheries management, balanced harvesting, maximum economic yield, ecological networks, adaptive dynamics, size evolution, theoretical modeling

*Speaker