

Trophic modeling for integrated ecosystem assessment: from diagnosis to ecosystem-based advice for fisheries management

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Trophic modeling is a well-known tool to better understand the functioning of marine ecosystems and to diagnose their health using ecological indicators. Using the Celtic Sea ecosystem as case study, we show (1) how tropho-dynamic models can be used to undertake Integrated Trend Analysis and (2) how results can inform ecosystem-based fisheries management (EBFM). We built Ecopath models for 1950, 1980 and 2013, based on outputs from ICES stock assessments and long term biomass production models. The derived EcoTroph models helped to diagnose fishing impacts on the food web and estimate various ecosystem indicators. Our results suggest that the Celtic Sea ecosystem has been highly impacted by the tremendous increase in fishing effort which occurred from the 1950s to the 1990s. However, while fishing effort decreased over the last two decades, ecosystem health did not improve significantly. We used an Ecosim model fitted over the 1950-2013 period to simulate several fishing management scenarios. We specifically studied the effects of the Landing Obligation enforced by the CFP, with or without enhancement in the fishing gear selectivity, compared to single MSY or status quo situation. The Landing Obligation might have a negative effect on some discards feeders such as seabirds, while others trophic groups do not seem affected. If selectivity is assumed to improve, this rule appears beneficial to certain target groups. Through simulations of different management strategies, trophic modeling proves to be crucial to provide scientific advice on complex ecosystem in the context of an EBFM.

Keywords: Fishing impact, Ecosystem-based fisheries management, Trophic modeling, Ecopath with Ecosim, EcoTroph, Scenarios simulation, Landing Obligation

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