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Bottom trawl impacts on Mediterranean demersal fish diversity: not so obvious or are we too late?

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Abstract

Measures of biodiversity change may be useful as indicators if they are responsive to manageable drivers of biodiversity loss. However, there are many candidate indicators that are considered to be robust to survey artifacts and sensitive to manageable impacts. Using extensive survey data on demersal fish assemblages around the Balearic Islands (western Mediterranean) we analyze relationships among 'traditional', taxonomic and functional diversity indices, to identify a minimum set of indices that provide a good representation of the different aspects of diversity. Secondly we model the responses of the demersal fish community diversity to bottom trawl fishing pressure. To do so, we used two different approaches: i) considering fishing effort and depth as continuous explanatory variables; and ii) grouping samples according to bathymetric sampling strata and contrasting levels of fishing effort. The results show that diversity can be described using different complementary aspects such as species richness, evenness, and the taxonomic and functional breadth of the species present in a given community, displaying different responses to fishing pressure. However, the changes in diversity in response to fishing may only be detectable in those communities where the levels of fishing pressure have remained relatively low. When communities have been exposed to high levels of fishing pressure for a long period, the relevant changes in diversity may have happened long before the onset of monitoring of the fishery, and hence it may be too late to detect differences between levels of fishing effort. This seems to be the case on the middle slope of the Balearic Islands, where vulnerable species have disappeared or are very infrequent, and have been replaced by species better-adapted to fishing impacts.

Keywords: biodiversity; taxonomic diversity; functional diversity; fish; bottom trawling; fishing effort; Balearic Islands; western Mediterranean.

1. Introduction

Within the context of the Ecosystem Approach to Fisheries (EAF; Pikitch et al., 2004), indicators of biodiversity are used to assess fisheries and to monitor