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Morphospecies and taxonomic sufficiency of benthic megafauna in scientific bottom trawl surveys

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ABSTRACT

Scientific fisheries surveys routinely identify a large diversity of commercial and non-commercial benthic megainvertebrates that could provide useful information for Marine Strategy Framework Directive (MSFD) descriptors. Species is obviously the basic taxonomic level to which most ecological studies and theories refer. Identification at this level of organization is indeed always preferred over any other taxonomic level. Nevertheless, aggregation of species to higher taxonomic levels may be unavoidable sometimes, since errors of identification are known or suspected to occur in many surveys. Using analyses of taxonomic sufficiency (identification of organisms at various taxonomic resolutions) and groups of morphospecies (taxa identified easily by non-experts on the basis of evident morphological traits), this study aims to quantify the loss of ecological information incurred by partial identification of benthic megafauna in bottom trawl surveys in order to put such data to good use. The analyses were conducted on five scientific surveys representing a large range of geographical areas (from 150 km^2 to 150 000 km^2) and environmental conditions. Results show that genus, family and, particularly, morphospecies are good surrogates for species identification in community analyses. We suggest that bottom trawl surveys can provide reliable megafauna data that may usefully complete those obtained by grab surveys. The use of morphospecies could lead to new strategies, combining different datasets to provide indicators for MSFD descriptors (e.g. D6).

1. Introduction

The main objective of the Marine Strategy Framework Directive (MSFD; European Commission, 2008) is to achieve or maintain good environmental status (GES) by 2020. To fulfil MSFD requirements, 11 qualitative descriptors and a suite of indicators associated with each descriptor have been selected (Rice et al., 2012). European Member States have already initiated the reviews required to provide information for these descriptors and the estimation of the related indicators that will be used to assess the GES (Borja et al., 2011; Rombouts et al., 2013). Among the MSFD descriptors, D6, which concerns Sea Floor Integrity, and three others (D1, D2 and D4) include indicators that refer directly or indirectly to macro- and megainvertebrates (European Commission, 2010).

In a recent report on the Sea Floor Integrity descriptor (D6), Rice et al. (2010) underlined that most time series and established monitoring programs of benthos are conducted relatively nearshore and have restricted spatial coverage. These authors called for new strategies to assess environmental status of the sea floor integrity at regional or sea-wide scales. Scientific bottom trawl surveys dedicated to stock assessment of bentho-demersal fish populations routinely identify commercial and non-commercial benthic macro- and mega-invertebrates. These annual surveys often cover large geographic areas (e.g. the North Sea) and could thus be used as a complement to grab surveys in order provide more complete information for MSFD descriptors. Data collected from bottom trawl surveys are available rapidly, as the sizes of the invertebrates collected allow a rapid identification that can be mostly done at sea. This is a considerable advantage over grab samples, which are usually washed through 1 or 2 mm mesh screens and then require a large amount of laboratory time for sorting and identification. Ground fish surveys, particularly those conducted using beam trawls, have already proved efficient for sampling and studying the functional components of the benthic megainvertebrate communities, from filter feeders to detritivores and scavengers (Brind'Amour et al., 2009; Kopp et al., 2013; Tillin et al., 2006).

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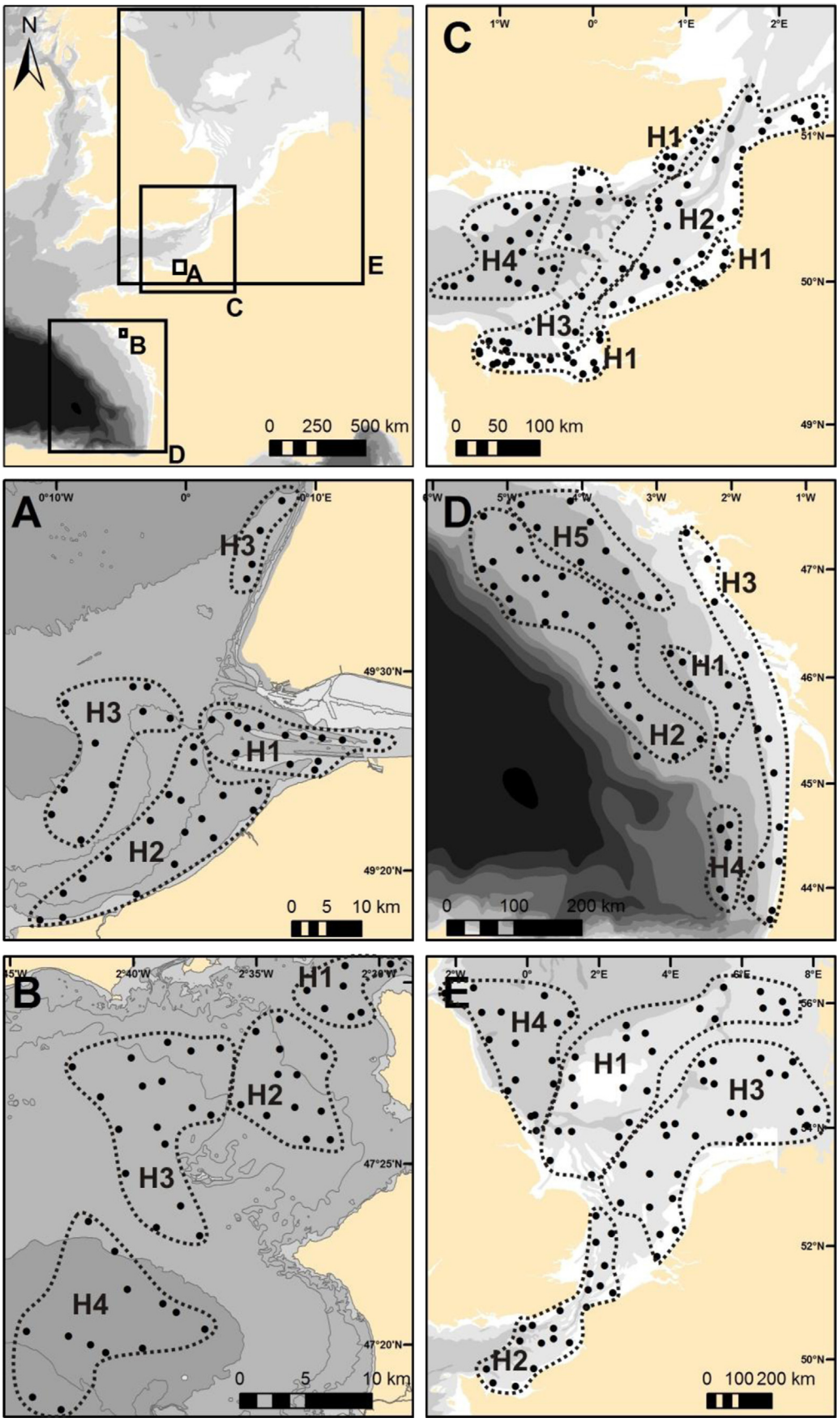

Fig. 1. Map of geographic areas and sampling stations for each of the five French datasets: Bay of Seine (A), Bay of Vilaine (B), Eastern English Channel basin (C), Bay of Biscay (D), North Sea (E). The dotted lines delineate the habitats found in the present study using cluster analyses (see Section 2 for details). The habitats described here (H1 to H5) are a schematic view of the macro- and megabenthic communities in the studied ecosystems. These are described in detail for each ecosystem in Table 4.