Title
A simple unsupervised echoes classification to detect different types of sound scattering layers in multispecific ecosystems.

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Abstract
Zooplankton populations fluctuations have been studied and sampled since centuries. However the discrete and common use of nets generally result in a sparse information of their dynamics. Acoustic data are collected by hull-mounted echosounders over large geographical areas in a reduced sampling time. Worldwide, the echograms display extended structures often comprised of zooplanktonic communities: the so-called sound scattering layers (SSLs). To differenciate the echotraces and mainly to better extract the fish schools echoes and estimate their biomass, automatic classification methods have been developed based on *a priori* knowledge of the backscatterers present in the sampled water column. However in multispecific ecosystems, the observed acoustic response is a combination of several kinds of backscatterers response. In the Bay of Biscay in spring, ubiquitous and diverse SSLs are observed during recurrent ecosystemic surveys. In this study we present an unsupervised echoes classification method based on multifrequency acoustic information to distinguish between the types of observed SSLs. The method is not based on *a priori* knowledge of the present targets and is applicable on any multifrequency dataset. Acoustic data have been collected in springs 2013, 2014 and 2015 by 6 split-beam Simrad EK60 echosounders (18, 38, 70, 120, 200 and 333 kHz). Results provide groups of echo-integration cells displaying similar frequency responses which spatial distribution show real "echo-scapes" with coherent patterns in the Bay of Biscay. The "echo-scapes" patterns have been related to concurrently collected environmental data and their temporal dynamics have been analysed.

Keywords: multifrequency, sound scattering layers, bay of biscay, unsupervised, classification.

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