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Effects of deep bottom trawling in sedimentary organic matter during different trawling seasons on the flanks of La Fonera Canyon, NW Mediterranean

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Bottom trawling is one of the main mechanisms inducing sediment resuspension in deep-sea environments, leading to erosion and depletion of sedimentary organic matter. Trawling grounds are often located in the vicinities of submarine canyons, since they constitute important nursery areas for commercial species. The flanks of La Fonera Canyon (NW Mediterranean) have been trawled at around 400-800 m water depth for decades, targeting the deep-sea shrimp *Aristeus antennatus*. A recent management plan of this species established a yearly 60-day closure (no-trawling) to allow maturation of juveniles from January to early March.

The aim of this study is to assess the seasonal impacts of bottom trawling on sedimentary organic matter, and whether the no-trawling period allows the recovery of organic matter on trawling grounds. These impacts were addressed by comparing sedimentological characteristics (dry bulk density and grain size), natural short-lived radioisotopes (excess ^{234}Th and excess ^{210}Pb), organic carbon (OC), total nitrogen (TN), and several organic compounds yielded from CuO oxidation (lignin phenols, cutin acids, fatty acids, dicarboxylic acids, and amino acids) in trawled and untrawled sediment cores. Coring was conducted in three periods: during the trawling season in June and October 2017, as well as just before the end of the trawling closure in early March 2018.

Sediment cores collected from trawling grounds presented signs of erosion, evidenced from the lower inventories of both excess ^{234}Th and excess ^{210}Pb, as well as winnowing of fine particles during all seasons in comparison to the untrawled cores. Overall, even after correcting for sand content, bottom trawling grounds had 22% less OC and TN during all seasons and were depleted in the biomarkers analysed. Differences between trawled and untrawled sites were greater for the more labile fatty acids, dicarboxylic acids, amino acids and cutin acids (40-65%), than for the more refractory lignin phenols (15%), indicating that bottom trawling not only depletes organic matter through erosion, but also enhances remineralization of the more labile compounds. Although surface organic matter was always lower in the trawled site than in the untrawled site, it slightly increased in the trawled site in both June 2017 and March 2018. These results highlight that, even if bottom trawling substantially depletes sedimentary organic matter, there is a slight seasonal recovery of surface organic matter on trawling grounds during the trawling closure as well as during springtime, when trawling coexists with enhanced primary productivity in the water column.